



ES 398

March 2021

Integrated Retrofit HV Distribution Switchgear Remote Control Electricity Specification

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

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1. FOREWORD

This specification sets out the technical and performance requirements for an integrated system for retrofit remote control for application on distribution switchgear (retro-fit actuators with integrated control and communications facilities) for purchase by Electricity North West Ltd (hereafter referred to as Electricity North West) and for connection to its electrical network.

This specification is complementary to ES391 – Actuator requirements for distribution switchgear automation, covering general requirements for actuators used on the network.

2. INTRODUCTION

Electricity North West has implemented remote control and automation of its 11kV and 6.6kV Network switches. As well as increasing operator flexibility, remote control and automation reduces customer minutes lost and customer interruptions thereby improving the quality of supply to customers. In many instances, this can be achieved by the retro-fitting of actuators with integrated control and communications facilities to existing ring switches on ring main units (RMUs).

3. SCOPE

The purpose of this document is to specify Electricity North West's requirement for a low-cost and fully integrated product for retrofit automation and remote control on HV distribution switchgear.

Ideally, the product shall be compatible for use on the majority of Distribution Switchgear variants with preference given to a product compatible with the following switchgear types:

- Long and Crawford T3GF3
- Long and Crawford T4GF3
- Schneider Electric RN2C, RE2C
- Lucy Electric Sabre VRN2A, VRN2 and VRN
- Lucy Electric FRMU

In addition to the above, it shall be possible for the system, subject separate agreement and associated terms, to be made applicable for use on other switchgear types as appropriate.

The product will communicate by means of approved communication protocols to Electricity North West's Network Management System (NMS), whereby it can be remotely controlled as required in this Specification.

4. DEFINITIONS

Approval:	Sanction by the Electricity North West Plant Policy Manager that specified criteria have been satisfied.
Contract:	The agreement between Electricity North West and the Contractor for the execution of the Works including therein all documents to which reference may properly be made in order to ascertain the rights and obligations of the parties under the said agreement.
Contractor:	The person or person's firm or company, including personal representatives, successors and permitted assigns, whose tender has been accepted by Electricity North West.
Specification:	The Specifications and schedules (if any) agreed by the parties for the purpose of the Contract.
Sub-Contractor:	Any person (other than the Contractor) named in the Contract for any part of the Works or any person to whom any part of the Contract has been sub-let with the consent in writing of the Electricity North West Plant Policy Manager, and the legal representatives, successors and assigns of such person.
Supplier:	Any person or person's firm or company who supplies goods to Electricity North West or to its contractor.
Tender:	An offer in writing to execute work or supply goods at a fixed price.
Tenderer:	The person or person's firm or company, including personal representatives, successors and permitted assigns, invited by Electricity North West to submit a Tender.

5. GENERAL REQUIREMENTS FOR APPROVALS AND TESTING

5.1 Product not to be Changed

No change in the product, packaging or labelling shall be made after Approval has been granted without prior notice to the Electricity North West Plant Policy Manager, and receipt of a written agreement to the proposed change from the Electricity North West Plant Policy Manager.

5.2 Electricity North West Technical Approval

The Tenderer shall submit, with this Tender, proposals for testing which will demonstrate, to the satisfaction of the Electricity North West Plant Policy Manager, compliance with this Specification. Such tests shall be carried out without expense to Electricity North West.

Alternatively, the Tenderer may submit technical reports and other data that he considers will demonstrate, to the satisfaction of the Electricity North West Plant Policy Manager, compliance with this specification. Acceptance of this evidence shall be at the discretion of the Electricity North West Plant Policy Manager but will not be unreasonably withheld.

Approval shall be 'factory specific' and is not transferable to another factory without the written approval of the Electricity North West Plant Policy Manager.

The supplier and product shall comply with all the relevant requirements of Electricity North West documents EPD311 and CP311 in terms of approval of equipment.

Note: Technical approval shall only be granted to a pre-existing, deployment ready product that satisfies the requirements outlined in this specification and any other associated tender requirements, including lead times. As part of any future tender, the Tender will be required to submit a sample(s) of the full product (component parts are not acceptable as an alternative) to the Electricity North West Plant Policy Manager for inspection and be prepared to answer his questions regarding the suitability of the samples for immediate use on the network as required in this specification. Furthermore, at the discretion of the Plant Policy Manager, appropriate references obtained by the Tenderer from its previous customers may be requested alongside case studies detailing similar application of the product as that outlined in this specification on other UK DNO networks.

5.3 Quality Assurance

The Tenderer shall confirm whether approval is held in accordance with a Quality Assurance Scheme accredited under ISO 9000. If not, he shall submit a statement of the quality assurance procedures employed to control the quality of the product, including the performance of Suppliers and Sub-Contractors.

The right is reserved for the Electricity North West Plant Policy Manager to require, from time to time, the repeat of such tests as he may deem to be reasonably necessary to demonstrate continued compliance with the Specification.

The Tenderer shall submit, with this Tender, a list of tests and inspections which are carried out on the product prior to despatch which shall demonstrate, to the satisfaction of the Electricity North West Plant Policy Manager, fitness for installation and service.

The Tenderer shall provide free of charge to Electricity North West such samples as may, in the opinion of the Electricity North West Plant Policy Manager, be reasonably required for inspection

and/or retention as quality control samples. The Electricity North West Plant Policy Manager will confirm the requirement for samples at the time of Tendering.

The right is reserved for the Electricity North West Plant Policy Manager to make, from time to time, such inspections of the Tenderer's facilities as he/she may deem to be reasonably necessary to ensure compliance with this Specification and any Contract of which it forms a part.

The Tenderer shall submit, with this Tender, such details of product packaging disposal, as will enable Electricity North West to comply with the requirements of BS EN ISO 14001: 2004 - Environmental Management Systems.

5.4 Formulation

The Tenderer shall submit, with this Tender, such details of the formulation and use of the product and associated substances as will enable Electricity North West to comply with the obligations of the Health and Safety at Work Act 1974 and the Control of Substances Hazardous to Health Regulations 2002, in the use, storage and disposal of the product. The Tenderer may stipulate, prior to submission of such information, that he requires it to remain confidential and the Electricity North West Plant Policy Manager will, if requested, confirm his agreement to this prior to receipt of the information.

5.5 Identification Markings

The Tenderer shall submit, with this Tender, details of markings which it is proposed to apply to the product or packaging to identify manufacturing batches or items. The forms and content of such markings shall be subject to the Approval of the Electricity North West Plant Policy Manager and shall in all cases include the Electricity North West Approved Description and Commodity Code Number.

The Tenderer shall submit, with this Tender, such details of marking gross weight on components, assemblies and packages, as will enable Electricity North West to comply with the Health and Safety Manual Handling Operation Regulations 1992, for components, assemblies and packages supplied with a gross weight over 1kg. The forms and content of such markings shall be subject to the Approval of the Electricity North West Plant Policy Manager.

5.6 Minimum Life Expectancy

The minimum life expectancy of all products covered by this Specification is 10 years.

5.7 Product Conformity

Preference will be given to those suppliers who can provide suitable Product Conformity Certification to a recognised or specified standard, or an equivalent certification.

6. REQUIREMENTS FOR TYPE AND ROUTINE TESTING

The Electricity North West Plant Policy Manager shall set out the requirement of the following tests to be carried out by the Supplier at the Supplier's cost.

6.1 Requirement for Type Tests at the Supplier's Premises

These are a series of one-off type tests, which are carried out to ensure the satisfactory performance of the product design, under extremes of operating stresses, and of endurance, as may be appropriate, to be determined by the Electricity North West Plant Policy Manager.

These may or may not be destructive tests.

See section 13 for more information on type testing.

6.2 Requirement for Routine Tests at the Supplier's Premises

These tests may be required to be carried out on every individual unit or component, as specified, or at some regular frequency to be determined by the Electricity North West Plant Policy Manager.

The results of these tests may be required to be supplied to Electricity North West with each unit purchased or retained for inspection, at a period to be determined by the Electricity North West Plant Policy Manager.

7. GENERAL REQUIREMENTS

The product shall consist of an actuator, control electronics and communications equipment, with preference given to products that successfully integrate all of these elements into one low-cost, easy-to-fit unit. For two switch applications, a second, separate unit can be fitted to the second switch.

The product shall be mounted onto the switchgear and be capable of operating the switch repeatedly without manual intervention.

The unit or units shall be powered from a single phase LV AC supply obtained via the local system, and provided by Electricity North West; or, as appropriate, powered by a 24V DC supply, derived via the local LV, and provided by Electricity North West. This is the product's **primary power source**.

A rechargeable DC battery housed within the product will act as a **secondary power source**.

7.1 Response Times

The following requirements are subject to the communications path to NMS being available, and communications networks not introducing significant latency. This assumes an always on DNP3 connection is configured between the product and the NMS.

- 7.1.1 The target time is for the product to acknowledge commands from NMS is within 1 second of the command being received by the product. Assuming an optimal communication path.
- 7.1.2 The product shall issue the command to start the actuator moving (i.e. operating physically) within 1 second of the operate command outlined in 7.1.1 being acknowledged.
- 7.1.3 The switching operation shall be completed (i.e. switch opened / closed) within 10 seconds of the operate command outlined in 7.1.2 being issued to the actuator.
- 7.1.4 The product shall be capable of completing 10 such switching operations (i.e. those steps outlined in 7.1.1, 7.1.2 and 7.1.3 in combination) sequentially and without a pause longer than 5 seconds between each operation.
- 7.1.5 In the event of the primary power source being lost the product shall be able to complete as a minimum 10 sequential switching operations via its secondary power source (battery).
- 7.1.6 The product shall be ready to complete further operations once the primary power source is restored.
- 7.1.7 The product must be restored to nominal capacity and be able to perform another set of 10 sequential switching operations within 8 hours of the primary power source being restored.
- 7.1.8 When a binary input changes state, this shall be reported to NMS in no more than 10 seconds.

7.1.9 There shall be a minimum delay between switch operations of 3 seconds. The delay shall be measured between the completion of one switch operation and the start of the next.

7.2 Lifetime

7.2.1 The product shall have a minimum design life of 10 years (including batteries).

7.2.2 Each product shall have a design life of at least 1000 switching operations.

7.2.3 The product shall have a minimum site maintenance period of at least 5 years, with 10 years being preferred.

8. PHYSICAL REQUIREMENTS

8.1 The product shall be suitable for mounting on indoor and outdoor switchgear.

8.2 The product shall have an Ingress Protection rating of at least IP55.

8.3 The product shall have a minimum operating temperature range of -15 to +50°C in accordance with:

- IEC 60068-2-1: 2007 Cold
- IEC 60068-2-2: 2007 Dry Heat

8.4 The product shall operate in humid environments in accordance with IEC 60068-2-78: Damp heat, steady state.

8.5 The product shall be resistant to salt spray with no signs of rust after 72 hours in accordance with IEC 60068-2-11.

8.6 The product shall withstand rough handling in accordance with IEC 60068-2-31.

8.7 No dangerous voltages shall be present during operation of the product, with all covers in place.

9. SWITCHGEAR INTERFACE

As a minimum, variants of the product shall be available for retro-fitting to the following switchgear:

- Long and Crawford T3GF3
- Long and Crawford T4GF3
- Schneider Electric RN2C, RE2C
- Lucy Electric Sabre VRN2A, VRN2 and VRN
- Lucy Electric FRMU

- 9.1 It shall be possible for an experienced fitter to carry out the first-time installation of a product in less than 15 minutes (This assumes that the power supply is available and does not include commissioning time).
- 9.2 It shall be possible for a trained operator to remove and store safely, without damage, and without needing the services of a fitter, the product from the switchgear in less than 5 minutes.
- 9.3 It shall be possible for a trained operator to re-fit the product to the switchgear, and without needing the services of a fitter, in less than 5 minutes.

Note: Manual operation of the switch via the actuator is not mandatory. Manual operation is expected to require a trained operator to remove the product from the switchgear.

- 9.4 It shall be possible to isolate the product to prevent inadvertent local and remote operation.
- 9.5 The product shall monitor the position of the actuator (open/closed/DBI), and report this to the control system.
- 9.6 It is desirable for the product to include monitoring of it being mounted to the switchgear or not and report this to NMS as appropriate.
- 9.7 The product shall monitor for the presence of a stuck switch and/or actuator and report this to the control system.
- 9.8 The product shall be compatible with being installed on both left or right switches.
- 9.9 The limit of travel for the actuators shall be configurable on-site. This may be by mechanically altering the position of limit switches, or by software configuration.
- 9.10 The product shall be mounted on the switchgear using existing mounting points.
- 9.11 Where switchgear is fitted with covers, or otherwise situated within close-fitting kiosks (e.g. GRP housing), fitting of the product shall not prevent closing of the covers (i.e. close securely and be lockable) or any other normal operation or use of the switchgear.
- 9.12 Fitting the product shall not interfere with the operation of any padlocks and/or safety interlocks of the switchgear.
- 9.13 It shall be possible to move the position of the actuator when the product is removed from the switch.
- 9.14 The switchgear switch destination label shall be visible with the product installed.
- 9.15 Where fitted, VPIS terminals shall still be accessible with the product installed.

10. POWER SUPPLY

- 10.1 The primary power source of the product shall be 230V 50Hz AC or a 24V DC derived via the AC supply with a maximum current draw of 1.5A.
- 10.2 The product shall house a secondary power source that allows for up to 10 switching operations, and powers the control electronics and communications equipment for up to 8 hours, when the primary power source is unavailable.

- 10.3 The product shall accept polls from NMS for the first 8 hours after the primary power supply is unavailable.
- 10.4 The product shall monitor the health and state of charge of all batteries present within the product and report this state to the control system NMS.
- 10.5 The product shall monitor the state of the primary power supply (on/off) and report this to the control system NMS.
- 10.6 Whilst running on secondary power source the product shall monitor the state of charge of the battery, and when the battery reaches a configurable threshold, the product shall power off, to prevent damage to the battery occurring owing to deep discharge. The product shall automatically restart operation once the primary power source is restored.
- 10.7 Alternatively, the product may opt to keep the control electronics powered for a pre-determined period after the power has failed.
- 10.8 The product shall report to NMS when it shuts down to protect the battery.

11. COMMUNICATIONS

11.1 Communication Media

The product shall support LTE (4G) communications, with a fall back to GPRS (2G) communications at times and locations where 4G is not available.

The product shall have a field replaceable communications module that allows upgrade to newer communication technologies during the expected lifetime of the system.

It is desirable but not essential for the product to have an Ethernet interface to allow connection of external communication interfaces.

Any external antennae shall be of a vandal resistant design.

Any supplied antennae shall be field replaceable with antennae remotely located up to 15m from communications equipment.

Local communications diagnostics shall be available to assist support and maintenance staff in diagnosing communications issues.

The following LTE communications parameters shall be monitored and reported to NMS as string inputs:

- ICCID (SIM serial number)
- Network registration state
- Network Operator Name
- Network Type

Signal Strength (in dBm) shall be monitored and reported to NMS as an analogue input.

There shall be a local indication of the communications health (LEDs or similar).

11.2 Protocols

The product shall utilise DNP3.0 protocol for communications with NMS.

The DNP3.0 protocol implementation shall be compatible with NMS.

The DNP3.0 protocol implementation shall support 'always on' connections, or 'connect as required'.

The DNP3.0 protocol implementation shall support both server and dual-endpoint modes.

The DNP3.0 protocol implementation shall support unsolicited reporting of events.

Each DNP3.0 data point shall have a configurable DNP3.0 class (1/2/3).

Switch positions shall be reported as double bit binary indications.

It shall be possible to configure the product to accept either direct operate or select-execute controls.

Remote controls shall not be accepted whilst in local mode.

The product shall have a Dummy Switch to allow remote controls to be tested without operating a physical switch.

The product shall support clock synchronisation using DNP3.0 protocol.

11.3 Encryption

The product shall support the use of TLS1.2 to encrypt DNP3.0 traffic between the product and NMS.

It shall be possible to enable/disable TLS encryption.

TLS encryption shall use device certificates to allow the system to authenticate itself to NMS.

To validate the expiry date of certificates, the product must have a method of synchronising its clock, other than a message from NMS. (NTP or NITZ for example)

The product shall support remote upgrades to the encryption software suite.

The product shall support remote upgrades of device and trusted CA certificates.

11.4 Firmware and configuration updates

The product shall support over-the-air (remote) firmware upgrades.

The product shall support local firmware upgrades. No special programming cables shall be required, and it shall be possible to upgrade the unit without removing the cover or dismounting the product from the switchgear.

Upgrading the firmware (local or remote) shall preserve the configuration settings.

The firmware version shall be reported to NMS as analogue input.

The product shall check for firmware updates on a periodic basis (configurable). It shall be possible to disable this feature via configuration.

The product shall check for configuration updates on a periodic basis (configurable). It shall be possible to disable this feature via configuration.

It shall be possible to force the product to carry out an immediate check for new firmware by issuing a DNP3.0 control.

It shall be possible to force the product to carry out an immediate check for new configuration by issuing a DNP3.0 control.

The product shall report failures in firmware and configuration updates to NMS.

The product should use HTTPS and the Nortech iHost Device API to fetch firmware and configuration updates.

11.5 Data Points

The Tenderer shall supply a list of proposed data points.

11.6 Local Communications

The product shall provide a local communications interface, using a PC compatible interface. Any cabling and connectors shall be standard off-the-shelf components.

A local/remote mode selector shall allow users to prevent the remote control of the product. The product will provide a solution, technical or physical, to replicate the safety derived from the application of a safety lock.

The status of the local/remote mode shall be monitored and reported to NMS.

The status of the local/remote mode shall be preserved through a power cycle.

The local communications interface shall allow the switches to be controlled locally. The product will provide a solution, technical or physical, to replicate the safety derived from the application of a safety lock.

It shall be possible to carry out local control operations from a safe distance. Tenderer to provide details of how this is achieved with their solution.

The local communications interface shall be protected by a user configurable password. It shall also be possible to disable the password.

It shall be possible to remotely configure the local communications password.

Remote communications shall function as normal whilst the local communication interface is active.

If the product uses a wireless interface for local communications, this shall take steps to prevent unauthorised connections. Tenderer to supply details on how this is achieved.

11.7 Input for FPI(s)

It is desirable that the product will support integration of 2 FPIs. The product shall support the following DNP3.0 data mapping for each FPI:

- 2 binary Inputs (for fault indications)
- 1 binary output (for remote reset)

- 1 analogue input (for HV load reporting)

The connection to the FPI shall be opto-isolated RS-485 using the MODBUS protocol.

The system shall provide a 24V DC (100mA) power supply output for each FPI.

12. EMC TESTING

The product shall comply with the following standards:

- EN 55011 Class B mains terminal disturbance voltage
- EN 55011 radiated emissions 150 kHz to 30 MHz
- EN 55011 Class B electromagnetic radiation disturbance 30 MHz to 1 GHz
- EN 61000-4-2 electrostatic discharge +/-8kV air and +/-4kV contact
- EN 61000-4-3 electromagnetic field 80 MHz to 1 GHz @ 10 V/m
- EN 61000-4-4 fast transients
- EN 61000-4-5 surge
- EN 61000-4-6 conducted RF
- EN 61000-4-8 power frequency magnetic field
- EN 61000-4-11 voltage dip and short interruptions

13. TYPE TESTING

The manufacturer shall submit to Electricity North West all relevant equipment type testing certification. The actuator itself shall be type tested to a minimum of 500 OFF - ON – OFF operations each time confirming the operation is within the rated operating time. The manufacturer shall submit all relevant test documents to confirm the system complies with all required specification such as EMC test certificates.

14. DRAWINGS

General arrangement drawings shall be submitted with the Tender. These drawings shall include, as a minimum, overall dimensions of the product, headroom for erection and/or operation, space required for removal and positions of mains and multicore cables. On receipt of an order the Contractor shall submit drawings at an early stage in an AutoCAD (.dwg) and Adobe Acrobat (pdf) format and one paper print maximum size A1 of all diagrams to the Electricity North West Plant Policy Manager.

14.1 MAINTENANCE INSTRUCTIONS

A copy of all installation, operation and maintenance manuals shall be submitted with the tender. These manuals shall, preferably, be in Adobe Acrobat (pdf) format. If the product is of a type not

previously supplied to Electricity North West, one unit will be required to be delivered to the Electricity North West Training Centre, free of charge, for the purposes of training. The Tenderer will also be required to provide training for Electricity North West instructors on the operation of the unit.

An Operation, Installation and Maintenance Manual shall also be supplied with the Tender.

15. DISPOSAL OF AUTOMATION SOLUTION AND/OR ITS COMPONENTS

Tenderers shall provide details on how to dispose of the product and/or its components to ensure compliance with the various waste management regulations [Environmental Protection Act 1990 (Part II); Special Waste Regulations 1996; Waste Management Licensing Regulations 1994; Control of Pollution (Amendment) Act 1989]

16. MANUAL HANDLING

Tenderers shall supply a Risk Assessment on the manual handling required for installation and operation of the Actuator assembly.

17. FAILURE, MODES, EFFECT AND CAUSE ANALYSIS (FMECA)

Tenderers shall carry out a FMECA or equivalent study for each type of equipment offered. A copy of this study shall be provided with the tender documents.

18. DOCUMENTS REFERENCED

- Health and Safety at Work Act 1974
- Control of Substances Hazardous to Health Regulations 2002
- Manual Handling Operations Regulations 1992
- Environmental Protection Act 1990
- Special Waste Regulations 1996
- Waste Management Licensing Regulations 1994
- Control of Pollution (Amendment) Act 1989
- BS EN 60529:1992 Degrees of Protection provided by Enclosures (IP Code)
- ENA TS 41-36 Distribution Switchgear for Service up to 36kV (Cable and overhead conductor Connected)
- IEC 60068; Environmental testing of electrotechnical products
- BS EN 55011: radio disturbance characteristics for electromagnetic compatibility compliance

- BS EN 61000: Electromagnetic compatibility

19. KEYWORDS

Actuator; Automation; NMS; CI; CML; RTU; Remote Control