

Company Directive

POLICY DOCUMENT: SD11/2

Requirements for Load Management Schemes

Summary

This document specifies the requirements for Load Management Schemes (LMSs) including the Network Design requirements.

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Implementation Date: June 2023

Approved by



Carl Ketley-Lowe
Engineering Policy Manager

Date: 12th June 2023

Target Staff Group	Staff involved with the analysis, design, construction, maintenance, replacement, operation and control of National Grid Electricity Distribution's (NGED's) network
Impact of Change	Amber – This document specifies the requirements for the design and assessment of LMSs.
Planned Assurance checks	Engineering Policy will check that the assessments required under Section 11 have been completed and that any deficiencies have been addressed.

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IMPLEMENTATION PLAN

Introduction

POL: SD11 specifies the requirements for Load Management Schemes (LMSs). These requirements are applicable to all National Grid Electricity Distribution (NGED) networks, irrespective of voltage level.

Main Changes

Five fundamental (LMS functions have been identified and minimum requirements specified.

Requirements for Other Authorised Distributor's (OAD) connections, IT systems and communication systems have been clarified and a number of definitions have been added/modified.

References to ST: SD11C and ST: SD1D have also been included.

Impact of Changes

Target Staff Group	Staff involved with the analysis, design, construction, maintenance, replacement, operation and control of National Grid Electricity Distribution's (NGED's) network
Impact of Change	Amber – This document specifies the requirements for the design and assessment of LMSs.

Implementation Actions

Managers shall ensure that target staff group are aware of and follow the requirements of this document.

Retrospective action is required to modify or replace LMSs that do not meet the requirements of the original version of this Policy, POL: SD11.

[<SD11/2 Presentation>](#)

Implementation Timetable

This document is implemented on issue for new or modified LMSs.

Any existing LMSs that did not comply with the requirements of the original version of this policy should have been rectified by 31st December 2022.

REVISION HISTORY

DOCUMENT REVISION & REVIEW TABLE		
Date	Comments	Author
June 2023	<ul style="list-style-type: none"> • New Category Z schemes may not be installed but existing ones may be maintained. • The latest DCUSA requirements have been referenced • Five fundamental LMS functions have been identified and minimum requirements specified. • Requirements for OAD/IDNO networks have been added to the scope. • A number of definitions have been added • The term System Integrity has been replaced with System Frequency Integrity • Network Integrity requirements now explicitly consider Secured IT Outage, Secured Telecommunication Outage, IT Secured Next Fault and Telecommunication Secured Next Fault conditions. • System Frequency Integrity requirements explicitly consider Secured IT Outage, Secured Telecommunication Outage, IT Secured Next Fault and Telecommunication Secured Next Fault conditions. 	Andy Hood / Stephen Quinn / Sven Hoffmann
October 2020	<ul style="list-style-type: none"> • The document has been re-structured and modified to align with POL: SD2, POL: SD3 and POL: SD4. • Detailed requirements have been moved to STs in the SD11 series. • The deadline for retrospectively modifying or replacing LMSs is 31st December 2022. • References to overhead line ratings have been modified to align with ST: SD8A. 	Andy Hood
April 2019	<ul style="list-style-type: none"> • New Document 	Andy Hood / Stephen Quinn / Sven Hoffmann

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1.0 SCOPE

This document specifies the requirements for Load Management Schemes (LMSs). It shall be read in conjunction with POL: SD2, POL: SD3, POL: SD4 and POL: SD5 as applicable.

Detailed requirements for specific categories of LMSs are provided in the SD11 series of Standard Techniques.

At the time of issue of this document, the following STs are, at the time of issue of this document, in place:

- ST: SD11A: Requirements for Category A LMSs that utilise Protection Class Operational Intertripping
- ST: SD11B: Requirements for Category B LMSs; that utilise Full Pre-event Curtailment
- ST: SD11D: Requirements for Category D Load Management Schemes - Overload Protection
- ST: SD11Z: Requirements for Category Z LMSs that do not meet the Prerequisites for other LMS Categories

As other LMS categories are identified and their requirements determined additional Standard Techniques will be issued.

Category Z LMSs have historically been installed and accepted. These schemes may be maintained, however new Category Z LMSs shall not be commissioned. Where material changes are required to existing Category Z LMSs these schemes shall be replaced with LMS complying with other acceptable categories.

LMSs may be used to Curtail customer Load connected to OAD networks. Where this is the case NGED will issue Curtailment instructions to, and receive the relevant information from, the OAD at the point of connection. The IDNO is responsible for implementing the requirements of this document within their network and with their customers.

From the 1st April 2023 the process for handling Curtailment and Curtailable Connections changed. Some types of Load Management Scheme may be used to delay or indefinitely postpone network reinforcement and where this is the case connections applied for from this date shall comply with the Distribution Connection and Use of System Agreement (DCUSA).

At the time of issue of this document only Category A and Category B LMSs are approved for such applications.

Where any difficulty is encountered with the application of this policy, the Engineering Policy Manager shall be notified who will consider if a variation is appropriate.

2.0 DEFINITIONS

Name/Phase	Definition
Advanced Distribution Management System (ADMS)	A NGED system that provides Supervisory Control and Data Acquisition (SCADA), Distribution Management System (DMS) and Outage Management System (OMS) functionality.
Category A	<p>A category of Load Management Scheme that utilises protection class tripping or intertripping and that satisfies the prerequisites specified in ST: SD11A.</p> <p><i>Definition taken from ST: SD11A.</i></p>
Category B	<p>A category of Load Management Scheme that utilises full prevent Curtailment and that satisfies the requirements specified in ST: SD11B.</p> <p><i>Definition derived from ST: SD11B.</i></p>
Category D	<p>A category of LMS that utilises local overcurrent, overpower or thermal protection relays to disconnect load connected to items of plant and equipment.</p> <p><i>Definition taken from ST: SD11D.</i></p>
Category Z	<p>A category of Load Management Scheme that does not satisfy the requirements associated with any other category of Load Management Scheme.</p> <p><i>Definition derived from ST: SD11Z.</i></p>
Curtail, Curtailment or Curtailing	<p>Any action taken by NGED to restrict the flow of electricity at the customer's Connection Point (including a Connection Point within an IDNO or OAD network).</p> <p><i>Definition derived from POL: FD:3.</i></p>
Curtailable Connection	<p>[From DCUSA Schedule 2D]: means a connection to the Company's Distribution System which is made on the basis that it is expressly subject to Curtailment (and for which the Company's connection offer was made on or after 1 April 2023).</p> <p>This means a connection to NGED's system which is made on the basis that Curtailment is required in order to comply with NGED System Design policies POL:SD2, POL:SD3, POL:SD4 and associated STs as applicable and where:</p> <ul style="list-style-type: none"> • NGED received the customer's application on or after the 1st April 2023 and • The offered Minimum Scheme includes distribution network reinforcement and • A network benefit of applying Curtailment has been identified. <p><i>Definition taken from POL: FD:3.</i></p>

Name/Phase	Definition
Customer Security	<p>The requirement for Demand Security and Generation Security</p> <p><i>Note, the term Network Security was historically used instead of Customer Security and may still be found in other directives</i></p>
Demand Security	<p>The ability to meet customer demand under Intact Network and outage conditions.</p>
Generation Security	<p>The ability to accept customer export under Intact Network and outage conditions.</p>
Information Technology (IT) Secured Next Fault	<p>An IT fault outage after which Customer Security, Network Integrity and System Frequency Integrity requirements must be satisfied when operating the network.</p> <p>The following fault conditions starting from the prevailing running arrangement are applicable:</p> <ul style="list-style-type: none"> • Each FEP • Each firewall system • Each PowerOn server and associated database server etc. • Each network switch • Each ethernet circuit • Each independent source of electrical power <p>Outages in all relevant parts of the IT system shall be considered, including outages on third party systems and equipment, where applicable.</p>
Independent Distribution Network Operator (IDNO)	<p>A DNO that does not have a distribution services obligation area in its distribution licence and is not an ex public electricity supplier.</p> <p><i>Definition taken from the Distribution Code.</i></p>
Intact Network	<p>A network operating with open points in their normal position and without any outages that are material to the condition being considered or studied.</p>
Load	<p>The apparent power (e.g. kVA or MVA) associated with demand, generation and/or electrical energy storage.</p>
Load Management Scheme (LMS)	<p>Plant, equipment and software systems that together manage network loading and voltages by either controlling demand and/or generation connected to the network, operating switchgear to change the topology of the network and/or controlling the settings of tap-change controllers, reactive compensation equipment and flexible power links. Examples of Load Management Schemes include but are not limited to:</p>

Name/Phase	Definition
	<ul style="list-style-type: none"> • Operational Intertripping • Active Network Management (ANM) • Soft-intertripping • Overload protection • Auto-changeover • Voltage constraint systems • Remote control of switchgear or other plant and equipment <p>The following are not considered to be Load Management Schemes:</p> <ul style="list-style-type: none"> • Customer-owned limitation schemes • Conventional independent tap-change control schemes • Network protection for fault clearance • Loss-of-mains protection, including loss-of-mains intertripping • Timed Connections
Network Integrity	The ability of a network to operate within thermal, voltage and other technical limits, excluding frequency-related limits, under both Intact Network and outage conditions.
Operational Secured Next Fault	<p>A electrical network fault outage after which Customer Security, Network Integrity and System Frequency Integrity requirements must be satisfied when operating the network. The following fault conditions starting from the prevailing running arrangement are applicable:</p> <ul style="list-style-type: none"> • Each Circuit fault • Each busbar fault <p>Outages at all voltage levels in question shall be considered, including outages on the transmission system and other third party networks, where applicable.</p>
Other Authorised Distributor (OAD)	<p>A user of NGED's distribution system authorised by licence or exemption to distribute electricity and having a user distribution system connected to the NGED's distribution system.</p> <p style="text-align: center;"><i>Definition derived from the Distribution Code</i></p> <p style="text-align: center;"><i>Note, an IDNO is a type of OAD</i></p>

Name/Phase	Definition
Secured Outage	<p>An electricity network outage or combination of outages after which Customer Security, Network Integrity and System Frequency Integrity requirements must be satisfied in design studies.</p> <p>The following types and combinations of outages are considered when networks are designed:</p> <ul style="list-style-type: none"> • Each circuit fault outage* • Each busbar fault outage • Each circuit arranged outage* • Each circuit arranged outage followed by each circuit fault outage* • Each circuit arranged outage followed by each busbar fault outage • Each busbar arranged outage* • Each busbar arranged outage followed by each circuit fault outage* • Each busbar arranged outage followed by each busbar fault outage • Outages at all voltage levels relevant to the network in question shall be considered, so far as is possible, including outages on the transmission network and other third-party networks where applicable. <p>Customer Security requirements are set by EREC P2, bilateral agreements with customers, consideration of CIs and CMLs and consideration of vulnerable customer obligations, in accordance with Section 3.1. The outage types and combinations associated with Demand Security requirements in EREC P2 are marked with asterisks (*)</p>
Secured Information Technology (IT) Outage	<p>An IT outage or combination of outages after which Customer Security, Network Integrity and System Frequency Integrity requirements must be satisfied in design studies. These requirements must be satisfied for an arranged outage followed by a fault outage of any combination of the following components:</p> <ul style="list-style-type: none"> • Each FEP • Each firewall system • Each PowerOn server and associated database server etc. • Each network switch • Each ethernet circuit

Name/Phase	Definition
	<ul style="list-style-type: none"> • Each independent source of electrical power <p>Outages in all parts of the IT system shall be considered, so far as is possible, including outages in third-party networks, where applicable.</p> <p>Network Integrity and System Frequency Integrity requirements apply to all Secured IT Outages.</p> <p>Customer Security requirements are set by EREC P2, bilateral agreements with customers, consideration of CIs and CMLs and consideration of vulnerable customer obligations, in accordance with Section 3.0.</p>
Secured Telecommunications Outage	<p>A telecommunication network outage or combination of outages after which Customer Security, Network Integrity and System Frequency Integrity requirements must be satisfied in design studies. These requirements must be satisfied for an arranged outage followed by a fault outage of any combination of the following components:</p> <ul style="list-style-type: none"> • Each communication circuit • Each communication mast / tower • Each cable / waveguide? • Each multi-drop facility • Each multiplexer • Each network switch • Each independent source of electrical power <p>Outages in all parts of the IT system shall be considered, so far as is possible, including outages in third-party networks, where applicable.</p> <p>Network Integrity and System Frequency Integrity requirements apply to all Secured Telecommunications Outages.</p> <p>Customer Security requirements are set by EREC P2, bilateral agreements with customers, consideration of CIs and CMLs and consideration of vulnerable customer obligations, in accordance with Section 3.0.</p>
Sequence Scheme	A pre-defined logical set of checks and control actions performed by ADMS.
System Frequency Integrity	<p>The ability of the GB system to operate within acceptable frequency-related technical limits under both Intact Network and outage conditions.</p> <p>System Frequency Integrity is primarily managed by NGESO, but it can be affected by the operation of NGED's network and customers. This includes but is not limited to:</p> <ul style="list-style-type: none"> • Low Frequency Demand Disconnection

Name/Phase	Definition
	<ul style="list-style-type: none"> • Interface Protection associated with Power Generating Modules • Changes in net Load caused by protection operation, manual intervention or the operation of Load Management Schemes.
Telecommunication Secured Next Fault	<p>A telecommunication fault outage after which Customer Security, Network Integrity and System Frequency Integrity requirements must be satisfied when operating the network.</p> <p>The following fault conditions starting from the prevailing running arrangement are applicable:</p> <ul style="list-style-type: none"> • Each FEP • Each firewall system • Each PowerOn server and associated database server etc. • Each network switch • Each ethernet circuit • Each independent source of electrical power <p>Outages in all relevant parts of the IT system shall be considered, including outages on third party systems and equipment, where applicable.</p>
Unsecured Outage	<p>An outage condition that is beyond the scope of a Secured Outage.</p> <ul style="list-style-type: none"> • Unsecured Outages are not normally considered when designing the network. Examples include: • Multiple concurrent arranged outages • Circuit breaker failure fault outages • Multiple concurrent fault outages • The concurrent fault outage of multiple circuits sharing the same structure, such as double circuit tower lines.

3.0 GENERAL REQUIREMENTS

Load Management Schemes (LMSs) shall fulfil each of the following functions:

3.1 Detection

LMSs shall include inputs that enable the scheme to determine when load management is required. These inputs may include:

- Analogue information
- Data sets
- Network topology information

3.2 Calculation

LMSs shall process the input information to determine the level of Curtailment that is required. This may be achieved by:

- A logic scheme. This could be implemented by discrete protection class relays to respond to simple inputs or by using programmable logic, e.g. as part of an AMDS Sequence Scheme or within a programmable logic controller or relay
- An Active Network Management calculation engine
- A human, e.g. a Control Engineer or Operational engineer

3.3 Instruction

LMSs shall be capable of communicating the required network or boundary conditions to customer/s, OAD's or to NGED substations/systems, as applicable. This may be implemented using:

- Fixed clauses/conditions specified in a contract (e.g. connection agreement or flexibility service contract)
- Pre-determined conditions in a contract (e.g. timed connection)
- Internet or Application Programming Interface (API)
- SCADA or Connection Control Panel (CCP) interface, e.g. using binary or analogue signals.
- Protection signalling / volt-free contacts

3.4 Actuation

This is the method used by the customer, OAD or NGED substation/system to implement the required network or boundary conditions. The specific details are the responsibility of the relevant party.

NGED shall ensure, as far as is reasonably practicable, the customer and/or OAD installations are designed, operated and maintained to satisfy the requirements of the LMS.

Actuation methods may include:

- Adjusting variable set points of plant and equipment
- Operating switchgear

3.5 Recording

LMSs shall record their actions in a location and format which enables further processing and use for purposes including:

- Regulatory reporting
- Assessment of technical and economic performance
- KPIs

Where an LMS enacts Curtailment, the requirements of the relevant DSO series company directives shall also be met.

4.0 CUSTOMER SECURITY REQUIREMENTS

LMSs and the associated networks shall be designed to satisfy the requirements specified in POL: SD2, POL: SD3, POL: SD4 and POL: SD5, including:

- EREC P2 for Demand Security
- Bilateral connection agreements with customers and OADs for both Generation Security and Demand Security

Due consideration shall also be given to Customer Interruptions (CIs), Customer Minutes Lost (CMLs) and vulnerable customer obligations.

5.0 NETWORK INTEGRITY REQUIREMENTS

LMSs shall be designed to enable Network Integrity to be maintained under Intact Network, Secured Outage, Secured IT Outage and Secured Telecommunication Outage conditions, for Operational Secured Next Faults, IT Secured Next Faults and Telecommunication Secured Next Faults. Further guidance is included in POL: SD2, POL: SD3 and POL: SD4.

Second circuit outages of IT components (e.g. FEPs, firewalls, servers, network switches, Ethernet switches etc.) are typically mitigated by providing 3 independent instances of each component and by only taking an arranged outage on one item at a time. Where this is the case each component is designed to carry the full load and fail over instantaneously.

6.0 SYSTEM FREQUENCY INTEGRITY REQUIREMENTS

LMSs shall be designed to enable System Frequency Integrity to be maintained under Intact Network, Secured Outage, Secured IT Outage and Secured Telecommunication Outage conditions for Operational Secured Next Fault, IT Secured Next Fault and Telecommunication Secured Next Fault conditions taking into account credible step changes in Load.

In this context, the change of Load across all license areas and all voltage levels shall not exceed 300MW unless explicitly agreed with NGENSO.

It is recognised that Primary System Design (PSD) engineers do not currently have access to design tools that are capable of automatically assessing every Operational Secured Next Fault under all relevant network loading conditions. In the absence of such design tools PSD engineers may study a limited number of scenarios that, to the best of their knowledge, represent the most onerous cases.

7.0 FAILURE MITIGATION

Detectable LMS scheme failures including, but not limited to, communications failure alarms, relay/controller watchdog alarms and battery system alarms shall be presented to Control as high priority alarms.

8.0 LOAD MANAGEMENT SCHEME INTERACTION

Where an area of network is subject to control by or affects the behaviour of more than one LMS the interaction between those load management schemes shall be assessed to ensure that it does not result in incorrect operation.

Where more than one LMS is used to manage the same network constraint, e.g. where a number of LMSs are used to prevent the reverse power limits of a group of super grid transformers from being breached, the most onerous over-commitment limitation clauses from each of the relevant SD11 series standard techniques shall be applied, neglecting the behaviour of all applicable LMSs.

9.0 THERMAL RATINGS

When selecting ratings for the assessment of networks managed by LMSs consideration should be given to the applicability of ratings that rely on assumed daily or long-term loading patterns. These include:

- Cyclic and distribution ratings for cables
- Transformer ratings which rely on assumed ageing rates
- Overhead line ratings greater than the Sustained Load Pre-Fault

10.0 SCHEME CATEGORISATION

Every LMS shall be allocated a category in accordance with the STs in SD11 series.

Each category of LMS, includes a number of requirements. Any LMS that does not meet the relevant requirements for one of the other categories has historically been assigned to Category Z however, from the issue of this document, new Category Z schemes shall not be commissioned or substantially modified.

The LMSs category shall be recorded as part of the LMS scheme settings.

11.0 SCHEME RECORDS

LMS scheme records including a brief description of the scheme, the design assessment, CROWN asset records, drawings and diagrams, test records and settings shall be produced and recorded in accordance with POL: TP10. A copy of the scheme description and settings shall be sent to Control using the email addresses provided above.

12.0 ASSESSMENT AND RECTIFICATION OF DEFECTS

12.1 New and Substantially Modified LMSs

All new and substantially modified LMSs shall be assessed against the requirements of this Policy and the associated Standard Techniques by the Primary System Design Engineer or Planner that is responsible for the scheme, as applicable. An assessment form shall be completed and saved with the scheme records.

Assessment forms and guides are available via the following link:

[LMS Assessment Information](#)

12.2 Retrospective Assessment of Existing LMSs

In accordance with the original issue of POL: SD11, every existing LMS should have been retrospectively assessed against the requirements this document by 1st May 2020. Assessment forms and guides are available from the preceding link.

As part of these assessments LMSs should have been allocated a category and a report issued to the relevant Primary System Design Manager identifying any deficiencies and costs associated with rectifying these issues.

Where it is found that assessments have not been completed then these shall be completed as a matter of urgency.

12.3 Rectification of Deficiencies

The Primary System Design Managers should have arranged for all deficiencies to be rectified by 31st December 2022. If further deficiencies are identified these shall be rectified as a matter of urgency.

APPENDIX A: SUPERSEDED DOCUMENTATION

This document supersedes POL: SD11/1 dated October 2020 which has now been withdrawn

APPENDIX B: RECORD OF COMMENT DURING CONSULTATION

[POL: SD11/2 – Comments](#)

APPENDIX C: ANCILLARY DOCUMENTATION

POL: SD2 *132kV Network System Design*

POL: SD3 *66kV and 33kV Network System Design*

POL: SD4 *11kV and 6.6kV Network System Design*

POL: SD5 *LV Network Design*

POL: TP10 *Protection, Alarm, Control Scheme and Load management Scheme Records*

EE SPEC: 98 *Approved Protection, Voltage Control and Alarm Relays and Test Access Blocks*

EE SPEC: 136 *Ancillary Electrical Equipment for Use in Conjunction with Switchgear and Protection/Control Panels*

EE SPEC: 143 *Functional Specification for Western Power distribution's Connection Control Panels (CCPs)*

ST: SD1B *Management of P2 Non-compliance*

ST: SD11A *Requirements for Type A Load Management Schemes that utilise Protection Class Operational Intertripping*

ST: SD11B *Requirements for Type B Load Management Schemes that utilise Full Pre-event Curtailment*

ST: SD11D *Requirements for Type D Load Management Schemes - Overload Protection*

ST: SD11Z *Requirements for Type Z Load Management Schemes that do not comply with the prerequisites for other Load Management Scheme categories*

ST: TP10E *Requesting, Issuing and Recording Settings for Connection Control Panels*

POL: TP20 *Protection Class Communication Links*

EREC P2 *Security of Supply*

APPENDIX D: KEYWORDS

ANM, Category A, Category B, Category D, Category Z, design, intertrip, soft intertrip, Load Management Scheme, network, system, planning, network analysis