



GRIDSCALE X™

LV Management Product Sheet

LV Management is a modern low voltage management software that enables users to monitor and control their low voltage grids and supports workflows around outage management and grid-side flexibility management.

[siemens.com/lv-management](https://www.siemens.com/lv-management)

SIEMENS

LV Management Product Sheet

(Documentation)

General

Value Proposition

LV Management supports distribution system operators in three main areas:

1. **LV Grid Digitalization** – Digitalize fast and efficiently.
 - Choose the best spot for onboarding digital equipment and expand your grid insights & control capabilities.
 - Create and maintain an accurate grid model, in compliance with CIM standards.
 - Guided and automated RTU onboarding process
 - Integrate IoT & standard control protocols (IEC 61850, IEC 60870-5-104, DNP3i)
2. **LV Outage Resolution** – Resupply faster & raise customer satisfaction.
 - Improve quality indexes via faster outage identification and restoration.
 - Unplanned & Planned Outage workflows, guiding the operator in every step.
 - Automatic prediction of outage location and impact
 - Guided restoration with system validated switching proposals.
 - Active LV grid management with full grid transparency and awareness
3. **LV Grid Stabilization** – Operate the grid closer to its limits.
 - Defer grid investments and reduce OPEX by maximizing asset usage and avoiding transformer overloads.
 - Automated Transformer Overload identification & guided step by step resolution
 - Optimize grid topology and leverage controllable DERs to avoid constraint violations and balance demand during peak hours.
 - Automated identification and guided resolution of voltage violations

Prerequisites & Specific Terms

Operating systems and web browsers for users	LV Management is a SaaS with a web-based browser frontend for use on desktop computers or notebooks. LV Management requires a recent version of an HTML5 capable Internet Browser, e.g. Google Chrome
Use Restriction	You acknowledge that insights provided by LV Management are limited to the grid model based on the Asset Data, connectivity information, mapping of entities and telemetry provided by the Customer and results may not fully correspond to the real-world situation. The interpretation, implementation and utilization of reports, concepts and results is the sole responsibility of the Customer. Siemens does not assume any liability, warranty, or guarantee for the feasibility or usability of reports, concepts, and results, nor for actions or omissions based on the reports, concepts, proposals, or recommendations.
Onboarding Services	Onboarding services are required for the full use of LV Management and must be ordered separately.

Description & Functionalities

Grid model building	Grid model building module of LV Management provides the ability to visually build grid models for LV Management by leveraging relevant data sources (e.g. GIS, ERP), processing the data and directly verifying results using geographical user interface. The required data from relevant sources is combined and integrated in a Grid Model that is flexible and extendable to meet changing needs of LV Management over time. The electrical domain of data is leveraged to logically split the grid model in circuits, facilitating the user navigation and data analysis step. A robust and flexible grid model validation engine ensures data is validated before it reaches operations. Users can directly relate to erroneous grid segments on the same geographic interface highlighted according to severity. Selected examples of validation rules include • Connectivity • Completeness • Electrical properties • Consistency of voltage
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- Relationship (parent – child)

Once all data model prerequisites for LV Management are fulfilled and validated the datasets are serialized according to the requirements and structure of operational needs of LV Management. But still ensuring consistency regarding unique IDs and therefore guaranteeing interoperability.

Since grid models are subject to constant change, the grid model building module subscribes to and receives model changes from master systems, updates and re-validates the grid model and sends updates to LV Management.

Low Voltage Transparency

The low voltage transparency provides a visual grid model representation comprising medium and low voltage equipment. A live visualization of current topology and grid state is based on available measurements and (optional) manual updates of (non-remote-controlled) breaking equipment.

The combination of a geographical, schematic view and software-inherent understanding of the electrical circuit enables users to navigate within the grid and drill down into details, when necessary, based on smart topology highlighting.

Substations, cable cabinets and connection points are high-level elements in LV Management automatically aggregating underlying equipment to reduce cognitive load of users. The following aggregations are supported

- Connection points aggregate multiple service delivery points, that is defined as the point of delivery at which a utility service, in this case electricity, is supplied.
- Primary substations aggregate transformers and breaking equipment relevant to denote medium voltage feeders.
- Secondary substations aggregate transformers and breaking equipment relevant to denote low voltage feeders.
- Cable cabinets aggregate breaking equipment relevant to denote low voltage feeder (sub-)segments.

Visual representation and details depend on the available grid model for certain grid areas including equipment and

connectivity information from medium voltage down to low voltage service delivery points.

LV Grid Digitalization

The LV Grid Digitalization provides an automated, easily configurable, standardized and vendor independent field equipment (RTU) onboarding process, leveraging the Web of Things concepts.

A dedicated decreased cognitive load “environment” for the equipment onboarding process is provided, that supports the user with a guided step by step workflow for the equipment onboarding process.

- Clear distinguishment between equipment’s state and communication state
- Substation digitalization process visible by all electrical grid operators
- Configurable substation digitalization process steps
- In-system automated documentation of the substation digitalization processes

Telemetry Data

Any telemetry data from the field through a SCADA system or other systems (e.g. MDM or IoT headend) can be ingested in LV Management and is automatically mapped to the available equipment. Relevant attributes and IDs are mapped in the grid model builder module ensuring consistency and compatibility.

Telemetry data preview is provided on equipment level and automatically aggregated on connection point level including upper and lower limits to avoid misinterpretation. Detailed analysis can be conducted over historic data using the data analysis component providing time range selection to observe patterns.

Case Management

The case management enables you to save a context-specific view of the grid area with all selected objects. The software supports different types of cases with individual workflows. Each case has a start time and type specific information, e.g., concerning the equipment, the fault, and the operations performed for LV outages.

LV Management supports the following case types:

- LV Outage for unplanned outages
- LV Outage for planned outages
- Transformer overload
- Limit violation

- Maintenance case for RTU installation

All cases are accessible via the case library and can be searched, filtered, and managed in there. The list of cases is automatically sorted by priority. In addition, active cases are shown in the map and aggregated automatically depending on the zoom level showing the highest severity.

LV Outage Resolution

LV outage Resolution supports operators and relevant LV staff with workflows to handle unplanned and planned outages.

Unplanned LV outages are either automatically detected based on smart meter events, received as telemetry data, or manually tracked, e.g., based on trouble calls. During the outage management process, Temporary Network Elements (TNEs), i.e. mobile generators and cuts, can be incorporated. This includes detailed switching action logging for these TNEs. When TNEs are added or removed, the system that tracks the energization state of the grid is not being updated to reflect these changes.

A step-by-step guided workflow is provided, which reduces the cognitive load, limits the number of clicks, and makes the entire process faster and less prone to human errors.

Individual solution steps contain switching proposals for:

- faulty area isolation
- temporary restoration
- final network restoration

Abstract views are provided to visualize the impact of a switching proposal on the network.

If there are several proposals within a step, the ranking in terms of equipment loading or the remote controllability of switching devices helps the operator to select the most suitable proposal.

Automatic detection of low voltage outages requires availability of smart meter events (last gasp and first breath), energization information on medium voltage level, low voltage topology and optionally planned outage information including the affected equipment.

LV Grid Stabilization

The software is capable to identify potential equipment and elements in the grid close to their operational / predefined limits by analyzing historical telemetry data.

Once a violation has been identified, they are visualized on the geographical view and within the case management.

The following functions are supported:

- Real-time overload detection: transformer overload detection in real-time across all incoming data both from RTUs and external systems.
- Efficient load distribution solutions: the system supports the operator with solution proposals for load shifting & feeder reconfiguration options based on load assessment results.
- Proposal ranking based on nominal power flow: the proposal ranking system prioritizes solutions based on nominal power flow.
- Integrated flexibility options: solution proposals featuring integrated flexibility options.
- Curtailing flexible loads: control of the flexible loads with the set point control options for curtailing flexible loads.

Administration, and data access

Authentication and Access	Authentication and authorization are on User level based on the authentication method supported by the customer's identity and access provider (IDP) supporting openIDConnect.
Administrator	Permissions to administrate users of LV Management and access the Administrative Interface.
LV Management Standard User / LV/MV Service Manager	Permissions to access the geospatial data visualization. Typical user of LV Management with full access to all functionality besides administrative tasks.
Grid Model Building User / Grid Model Engineer	Permission to import, configure and adapt grid models using the grid model management feature of LV Management.
Administrative Interface	The administrative interface allows managing users, roles, groups, and the integration with identity providers. For every user, an individual login is required. Users are also permitted to access and utilize the user management. The administrative interface provides the ability to issue and manage client credentials that can be used to access data programmatically.

Outage Events Interface	The Outage Events interfaces can be used to query and write unplanned outage and work task information. The interface may be used for any synchronization with outage management systems (OMS) or other reporting systems. The interface has the following characteristics: • Data model based on IEC 61968-3 (CIM) • Event-based interface
Telemetry Interface	All measurements (analogs, smart meters readings) and information (e.g. switch states) coming from the field, or another system are treated as telemetry data. The telemetry interface is responsible for ingesting any type of telemetry data from various headend systems. The interface has the following characteristics: • Data format is based on IEC 61850, IEC 60870-5-104, or DNP3i • Event-based interface It is Customers responsibility to comply with the Telemetry Interface characteristics stated above. Agents are responsible provide the information to the telemetry interface. An agent is a software as part of a hardware device or in the form of an application provided by Siemens or a Third Party which can ingest data for one or more assets.
Client Credentials	The client credentials are used by clients to obtain an access token outside of the context of a user to utilize the provided interfaces.
SaaS Operational Environment and Services	
Security	Siemens implements and maintains a cyber security framework based on ISO/IEC 27001. Siemens will • handle security related incident identification, monitoring and remediation according to ISO/IEC 27001 ISMS policy framework of 'Detect; Respond; Remediate; Recover' by the operational team with highest priority • perform regular penetration testing of LV Management.

	• assure that data in transit and in rest are encrypted • optionally enable multifactor authentication for User Interface (UI) access via customer's IDP
Updates	Siemens is makes reasonable efforts to keep all customers on the latest available product release. Siemens will • apply operating system and other third-party security patches and updates as appropriate. • apply application software patches as necessary and perform periodic upgrades with latest application software releases (usually two upgrade releases a year). • maintain and troubleshoot third party software issues required for ongoing operations, work with third party provides to troubleshoot as required. • notify its customers of release schedule and availability of new upgrades, patches and service releases in a regular fashion. The schedule for installation will be mutually agreed upon. Customer has the obligation to approve and enable updates for the latest supported version within 6 months after release of the new version or until a mutually agreed date. Otherwise, Siemens may suspend product support and operations.
Monitoring and Maintenance	Siemens will • administer and monitor environments including utilization of Central Processing Unit (CPU), memory, Input/Output Operations (IOPs) and disk space • administer and maintain associated operating systems • manage and troubleshoot the infrastructure components and processes, software licenses and maintenance • develop, maintain and utilize standard operations procedures and daily checklists for Siemens operators and administrators
Testing Environment	Siemens uses a system for testing purposes that may be integrated with Customer's systems for delivery and testing

of updates before deployment in production environment. The testing environment does not adhere to the SLAs.

Data Retention

Siemens will provide

- one (1) month of hot storage
- up to one (1) year of cold storage
- upon termination data archival of data for up to three (3) months to permit transfer to customer

Training

Siemens will provide

- LV Management SaaS User Guides and onboarding material
- Instructor-led training (additional costs)

Onboarding

Siemens offers to the Customer to onboard LV Management into the customer IT/OT landscape for additional fees on time and material basis and under separately agreed terms and conditions.

Packages

Overview

The packages in the table below have limits that apply for the entire Subscription Term, unless expressly indicated as “monthly” limit.

Package	Tier 1	Tier 2	Tier 3
Included SDPs	300.000	600.000	1.200.000
Upgrade Packages			
Additional SDPs	50.000	50.000	50.000

Specific User Types

- LV Management Standard Users are entitled to use the capabilities (e.g. accessing the geospatial visualization, monitoring equipment and handling different workflows) provided by LV Management excluding grid model building capabilities and administrative tasks through the web-based interfaces.
- LV Management Administrator Users are entitled to use the administrative capabilities (e.g. managing user access) in addition to the LV Management Standard User entitlements.

- Grid Model Engineer Users are entitled to use the grid model building capabilities through the web-based interfaces.

A non-human operated device will not be counted as a named user in addition to all individuals authorized to use the services, if such devices can access the services

Service Delivery Points

Service delivery point is defined as the point of delivery at which a utility service, in this case electricity, is supplied.

API Limits

Overview of services and limits levels included in the LV Management Packages listed below:

Package	Tier 1	Tier 2	Tier 3
Telemetry Average Rate	25 MB/s	50 MB/s	210 MB/s
Telemetry Batch Rate (10% of the time in 12 h)	37,5 MB/s	75 MB/s	315 MB/s
Outage Event Interface	100 messages per minute	200 messages per minute	800 messages per minute
Token Management	20 requests per minute	40 requests per minute	60 requests per minute

All services are protected against Denial of Services attacks that may result in temporary limiting overall requests per client.

Concurrent User Limits

The number of concurrent users is limited as follows:

Package	Tier 1	Tier 2	Tier 3
Concurrent User	25	50	100

Siemens Grid Software

LV Management

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