



PRODUCT SHEET

Electrification X

Distribution Grid Management

Distribution Grid Management made scalable
[siemens.com/electrificationx](https://www.siemens.com/electrificationx)

SIEMENS

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Overview

Distribution Grid Management enables a precise monitoring of all Distribution Grid stations and the street cabinets of the medium voltage (MV) and low voltage (LV) grid. Comprehensive load monitoring of each street cabinet terminal in the low voltage distribution gives insights about the power grid's utilization, the load of critical grid components and especially the identification of bottlenecks in the power supply. Furthermore limit violations of low voltage feeders can be mitigated by an autonomous feeder management to limit the consumption of flexible assets in the low voltage grid.

Benefits of Distribution Grid Management



Effectively handle bottlenecks and avoid power constraints



Proactively detect overload conditions in grid components long before they reach failure points



Utilize digitalization and effective data management as a foundation for strategy to redispatch or upgrade the grid where necessary



Reduce time for manual data collection and analysis, and optimize maintenance cycles



Provides valuable insights into the load pattern over time, allowing operators to better understand how power is being consumed and distributed throughout the system



Distribution Station KPIs serve as crucial metrics that enable comprehensive performance analysis of distribution stations across the power network. These indicators provide actionable insights for strategic decision-making and efficient load management, ultimately enhancing operational effectiveness and system reliability



Avoid limit violations in low-voltage grids with autonomous control of generation and load assets

Features

This chapter contains the packages, including features, that can be subscribed to within the feature set Distribution Grid Management.

Feature Distribution Grid Monitoring

The DSO station monitoring feature delivers comprehensive monitoring capabilities for power distribution infrastructure of secondary distribution automation system, for Distribution System Operators (DSOs). This solution enables real-time visualization of critical network components across Low-Voltage (LV) and Medium-Voltage (MV). Analysis of Key Performance Indicators provides real-time operational visibility, data-driven decision support, enhanced asset management with improved maintenance planning and resource allocation. Such monitoring can be applied to secondary distribution stations and cable cabinets.

DSO Station Monitoring feature – Low- & Medium-Voltage with SICAM EGS

Electrification X Distribution Grid Management leverages Siemens connected devices such as SICAM EGS, SICAM FCM / FCM Plus, and SICAM CP-801x, connected via SICAM 8-based GridEdge, to acquire measurement data from low-voltage and medium-voltage distribution stations and street cabinets.

The solution captures the following measurement categories:

- **Phase-resolved electrical base measurements**, including currents, voltages, frequency, harmonics, and temperatures
- **Electrical performance indicators**, such as active power, reactive power, apparent power, and power factor
- **Fault-related and operational measurements**, supporting the detection and analysis of abnormal grid conditions

DSO Station Monitoring feature – Low- & Medium-Voltage with SICAM CP-801x

Electrification X Distribution Grid Monitoring acquires operational and electrical data from medium-voltage distribution stations and feeders, including ring feeders (in/out), load feeders, and transformer feeders, via SICAM CP-801x connected through SICAM 8-based GridEdge.

The solution captures the following measurement categories:

- **Switching and status information**, including the status of load break switches (LBS) and earthing conditions, vacuum circuit breakers (VCB), breaker tripping, fault indicators, and voltage detecting devices
- **Electrical base and performance measurements**, including currents, voltages, frequency, power factor, active power, reactive power, and fault currents
- **Thermal condition measurements**, such as temperatures at cable terminals, supporting the detection of local overheating
- **Auxiliary and environmental alarms**, including signals from battery systems, UPS, and auxiliary sensors such as motion, temperature, and humidity sensors

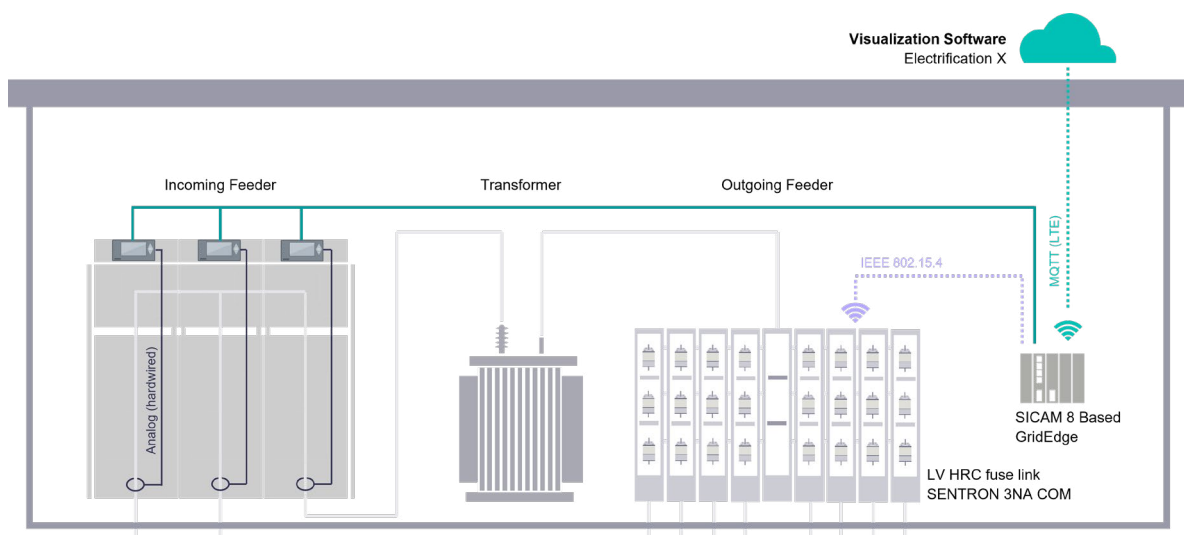
All data points are integrated and processed within Electrification X. Current and active power are visualized, for example, as heat maps, providing a clear overview of load distribution and load development over time.

In case of violation of load limit pre-set by the operator, the system will generate an alarm. The affected location will be shown in map / list views, and an alarm will be sent automatically to the operator and/or service crew according to configuration.

Distribution Station – Key Performance Indicator (KPI)

KPI analysis has been performed in Fleet Level and Station Level. Fleet Level refers complete install base in same partition of Electrification X. Station Level refers individual distribution station. Comparison has been done between similar types of assets.

- Assets – Incoming Feeder
- Assets – Transformer
- Assets – Outgoing Feeder



Different types of charts are selected during analysis. This chart is user selectable based on the assets, severity (normal, warning and critical) and total analysis period (date range selection up to 1 year).

Donut chart: This chart provides no. of assets compared with in particular asset type. Aggregation has been done over a duration of 15 mins (voltage deviation 5mins). In Aggregation duration, the algorithm calculates "Median" and select the pre-defined bin of severity. In total analysis period, if any values reach in highest bin, the algorithm consider this asset in that particular bin of the donut chart.

Horizontal bar chart: The chart presents a hierarchical visualization of assets, prioritized based on their critical bin duration periods. "View All" button provides all the assets ranked from top to down. The tooltip displays the relative duration as a percentage (%) of the total analysis period during which the asset experienced a specific severity level.

Table view: This provides analysis of the KPIs in more granular and comprehensive way. Additionally, user can select aggregation duration 5 minutes, 15 minutes and 30 minutes (voltage Deviation 5min only). The total sum of a row of any analysis timeframe will be 100% in ideal scenario (except measurement gap).

Additionally it shows the peak value and the time stamp per asset in the selected date range.

Percentage [%] Duration: It represents the proportional temporal distribution within predefined bins for each Key Performance Indicator (KPI) throughout the analysis time frame.

Congestion

The Congestion KPI supports operators in monitoring and interpreting congestion levels across substations and prevent service disruptions. By leveraging real-time and historical graphical displays of congestion data, operators can detect areas nearing capacity, facilitate timely interventions, and ensure sustained service reliability. All asset types are involved in this KPI.

Assets Incoming Feeder

Compute the congestion by analyzing the rating of outgoing transformer of the feeder. Subsequently, determine the temporal distribution by employing predefined classification bins, incorporating aggregated values obtained during the specified aggregation period.

Data point used: 3-phase Apparent Power.

Assets Transformer

Compute the congestion by analyzing the rating of Transformer of each phase. Subsequently, determine the temporal distribution by employing predefined classification bins, incorporating aggregated values obtained during the specified aggregation period. Consider the most affected phase in analysis.

Data point used: Aparent Power L1, Aparent Power L2, Aparent Power L3

Assets Outgoing Feeder

Compute the congestion by analyzing the rating of Fuse. Subsequently, determine the temporal distribution by employing predefined classification bins, incorporating aggregated values obtained during the specified aggregation period.

Data point used: Current L1, Current L2, Current L3.

Severity bins are designated as

- Normal: 0%-50% (Green)
- Warning: >50-80% (Yellow)
- Critical: >80% (Red)

Temporal distributions of congestions among all assets are further representing in more granular structure and compute based on pre-defined bin as

- 0% to 50%
- >50% to 60%
- >60% to 70%
- >70% to 80%
- >80% to 90%
- >90% to 100%
- >100%

Current Unbalance

The phase Current Unbalance KPI monitors the unbalance in current across the 3 phases of a distribution network. For balanced loads, it is ideal for all 3 phases to have equal current. However, variations can occur due to uneven loading, faulty equipment, or network issues. All asset types are involved in this KPI.

Assets Incoming Feeder, Transformer and Outgoing Feeder

Compute the Current Unbalance by analyzing current of each phase of asset. Subsequently, determine the temporal distribution by employing predefined classification bins, incorporating aggregated values obtained during the specified aggregation period.

Data point used: Current L1, Current L2, Current L3.

Severity bins are designated as

- Normal: 0%-5% (Green)
- Warning: >5-10% (Yellow)
- Critical: >10% (Red)

Temporal distributions of current unbalance among all assets are further representing in more granular structure and compute based on pre-defined bin as

- 0% to 5%
- >5% to 10%
- >10% to 15%
- >15% to 20%
- >20%

Power Factor

The Power Factor KPI helps operators monitor the efficiency of power usage across the network by indicating how effectively electrical power is being utilized. It offers both real-time and historical data on power factor variations at different substations or feeder points, facilitating the prompt detection of inefficiencies.

Severity bins are designated as

- Normal: 1- 0.95 (Green)
- Warning: <0.95 – 0.9 (Yellow)
- Critical: <0.9 (Red)

Assets Incoming Feeder

Determine the temporal distribution of power factor by employing predefined classification bins, incorporating aggregated values obtained during the specified aggregation period.

Data point used: 3-phase power factor.

Assets Transformer

Determine the temporal distribution of power factor by employing predefined classification bins, incorporating aggregated values obtained during the specified aggregation period. Consider most affected phase in analysis.

Data point used: PF L1, PF L2, PF L3.

Temporal distributions of power factor among all assets are further representing in more granular structure and computer based on pre-defined bin as

- 1 to 0.95
- <0.95 to 0.9
- <0.9 to 0.85
- <0.85 to 0.8
- <0.8

Voltage Deviation

The Voltage Deviation KPI helps operators monitor the voltage level and deviation against the rated voltages which are important operational targets. It offers analysis on voltage deviation variations at different substations or feeder points, facilitating the prompt detection of inefficiencies.

Severity bins are designated as

- Normal: 0-10% (Green)
- Warning: >10 - 25% (Yellow)
- Critical: >25% (Red)

Assets Incoming Feeder

Determine the temporal distribution of voltage distribution by employing predefined classification bins, incorporating aggregated values obtained during the specified aggregation period.

Data point used: Phase-to-phase A-B, Phase-to-phase B-C, Phase-to-phase C-A

Assets Transformer

Determine the temporal distribution of voltage distribution by employing predefined classification bins, incorporating aggregated values obtained during the specified aggregation period. Consider most affected phase in analysis.

Data point used: Phase A, Phase B, Phase C.

Temporal distributions of voltage deviation among all assets are further representing in more granular structure and compute based on pre-defined bin as

- 0 to 10 [%]
- >10 to 20 [%]
- >20 to 25 [%]
- >25 [%]

Infeed Detection

The KPI Infeed Detection provides crucial insights into reverse power flows (indicating generation, as opposed to positive power flow, which signifies consumption) occurring in outgoing feeders – a common challenge in distribution networks with high Distributed Energy Resources (DER) integration. By enabling precise detection and classification of these infeed conditions at the feeder level, this KPI empowers users to identify problematic areas, enabling prioritized operational optimization and proactive grid stability maintenance, ultimately ensuring a more resilient and efficient power distribution system.

Severity bins are designated as

- Normal: <0 - 50% (Green)
- Warning: >50 - 80% (Yellow)
- Critical: >80% (Red)

Assets Outgoing Feeder

Determine the temporal distribution of power factor by employing predefined classification bins, incorporating aggregated values obtained during the specified aggregation period.

Data point used: Currents of phases A, B and C.

Temporal distributions of infeed detection are further representing in more granular structure and compute based on pre-defined bin as

- | | |
|--------------|---------------|
| • No infeed | • 70% - <80% |
| • >0% - <50% | • 80% - <90% |
| • 50% - <60% | • 90% - <100% |
| • 60% - <70% | • >100% |

Feature

Autonomous Feeder Management

The Autonomous Feeder Management feature provides a model-free, curative control mechanism to prevent operational limit violations in low-voltage feeders and transformers. Measurements from feeders and transformers, acquired via the Distribution Grid Monitoring feature, are continuously evaluated against customer-configurable thresholds to identify critical grid conditions.

If a configured threshold is exceeded, a control case is automatically initiated. The feature quantifies the extent of the threshold violation and determines maximum permissible consumption setpoints for all configured controllable assets. The calculated setpoints are derived proportionally to the individual control ranges of the assets and are therefore applied in a non-discriminatory manner, independent of asset type or grid location. Only the controllable assets within the relevant grid area are considered.

During an active control case, grid measurements are continuously re-evaluated and the setpoints are dynamically adjusted to increase or decrease permissible consumption as required. The control case is automatically terminated once measurements remain sustainably below the configured thresholds and normal grid operation is restored.

Control setpoints are disseminated to controllable assets via the BDEW Web API. All control actions and setpoints are logged for audit and regulatory traceability purposes. Autonomous Feeder Management can be activated and deactivated by authorized users on a per-transformer basis.

Subscription

<u>Standard subscription plan</u>	<u>Electrification X - Distribution Grid Management</u>
Functions	All
Subscription metric	DSO Station Monitoring – LV & MV per station per month
Subscription term	Annually, auto-renewal
Billing term	Annually, payment in advance
Upscale	Effective immediately, pro-rated billing
Downscale/Cancellation	Effective with end of subscription term
Connected Devices	To be purchased separately
Permitted Users	Unlimited, Extended Use

The Electrification X – Distribution Grid Management feature set subscription plan is the regular, scalable offering for this cloud service. The subscription term is twelve (12) months with automatic renewal; the cloud service fee is paid in advance.

The subscription plan can be upscaled at any time and cloud service fees for upscales are calculated on a pro-rated basis. The customer can also scale down the cloud service effective with the end of the current subscription term. The subscription fee will be adjusted for the upcoming billing term. The cloud service can be cancelled any time, effective with the end of the current subscription term.

The subscription plan can be purchased in packages per DSO station monitoring feature – LV & MV per distribution grid stations or street cabinets. The subscription plan assumes a distribution grid stations or street cabinets is referring to one unique postal address or geo coordinates.

Extended Use entitles the customer to authorize its affiliates and third parties to access and use the cloud services in accordance with the rights set out in the Terms and Conditions.

Prerequisites

Electrification X tenant

The Electrification feature set is operated on an Electrification X tenant. Therefore, a tenant with an Electrification X Base Package is required. The Electrification X Base Package has a subscription term of 12 month and must be purchased together with the first DSO station monitoring feature – LV & MV per distribution grid stations or street cabinets feature, if not otherwise already available and in operation.

Supported connected devices

The cloud service is currently compatible with commercially available connected devices from Siemens. A description of the available connected devices is provided below.

A connected device must be purchased and installed on premises at a site specified by the customer as agreed between the customer and Siemens to use the cloud service. The customer is responsible for installing the connected device at the site and any associated costs to perform said cloud service in accordance with related documentation for the connected device.

List of supported connected devices: SICAM EGS, SICAM CP-801x

For order information, customer may contact its local sales representative.

Web browser and viewing devices

Google Chrome and Microsoft Edge browsers have been tested and are recommended to be used to access the cloud service. Other modern standard web browsers will likely be compatible. A screen resolution of 1920 x 1080 pixels or higher is recommended for best user experience.

Internet Connection

The bandwidth of customer's internet connection determines the performance of the cloud service.

Autonomous Feeder Management

Autonomous Feeder Management requires the configuration of controllable assets assigned to the correct feeders in the asset hierarchy of Electrification X and their integration into a customer-provided CLS service with BDEW Web API service. The integration of external systems and assets is not part of the scope of this feature. Customer must provide a BDEW-API compliant service for the market role "DSO" (Verteilnetzbetreiber).

Ordering

Ordering process for the subscription

To order the cloud service for the first time, customer must request a quote from its Siemens sales representative. Depending on the offering either with services, then customer will receive a link to his tenant, or without services, then the customer will receive a link to the shopping cart. In this case customer needs to (i) choose the payment options and (ii) accept the Terms and Conditions to start using the cloud service. The "Terms and Conditions" consist of the "Supplemental Terms Electrification & Automation", the Base Terms and the General Software and Cloud Supplemental Terms, the Acceptable Use Policy, the Siemens Data Processing Terms, this Product and Service Data Sheet and any other Supplemental Terms which may be referenced in either of the mentioned documents. Customer may upgrade, downgrade, and cancel the cloud services directly in the Subscription Manager store <https://subscribe.siemens.com>.

Ordering connected devices

To order connected devices the customer may request a quote from its Siemens sales representative.

Connected device

SIEMENS: SICAM EGS, SICAM CP-801x

Ordering

For order information, customer may contact its local sales representative.

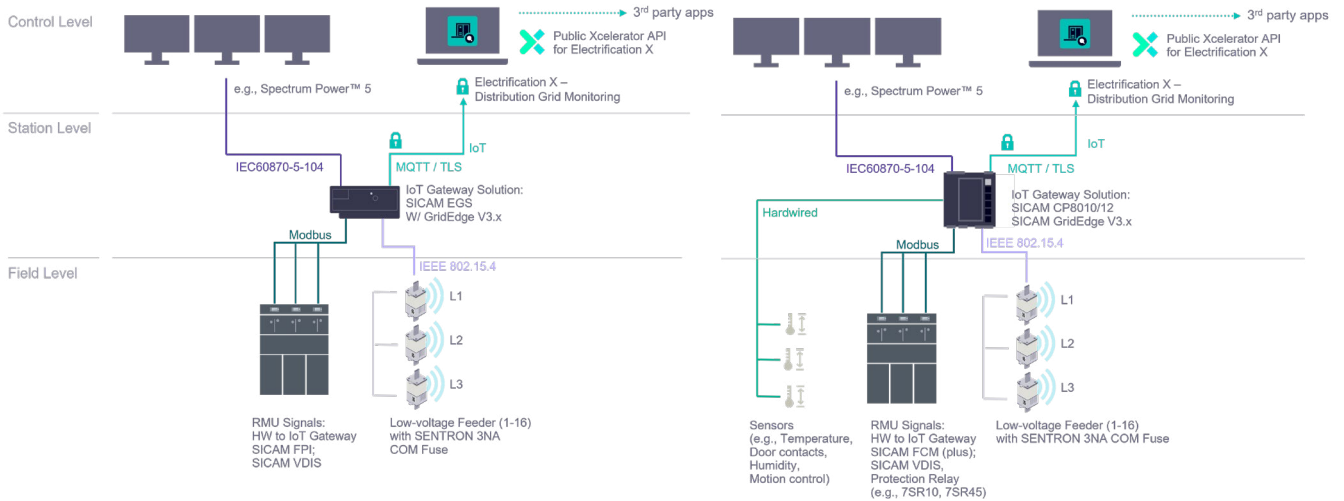
Product documentation

Technical documents	Document ID	Document ID German	Document ID English
Building X – Accounts User Guide	A6V12050070		
Building X – Devices User Guide	A6V12050067		
Electrification X – Base Package Operating Manual		E50417-H7500-C200-A5	E50417-H7540-C200-A5
Electrification X – Distribution Grid Monitoring Operating Manual		E50417-H7500-C206-A3	E50417-H7540-C206-A3
Electrification X – Engineering Guide		E50417-H7500-C203-A5	E50417-H7540-C203-A5
Electrification X – Security Manual		E50417-H7500-C204-A5	E50417-H7540-C204-A5

[↗ Technical documents can be downloaded here](#)

Topology

End-to-end cybersecurity



Data communication between the connected devices on premise and the cloud service requires internet connectivity SICAM EGS (to be provided by the customer)

Data communication between the connected devices on premise and the cloud service requires internet connectivity SICAM CP-801x (to be provided by the customer)

Both solutions for DSO Station Monitoring low- and medium-voltage offer key benefits whether with SICAM EGS or with CP-801x



Precise monitoring of all distribution grid stations and street cabinets



Instant, easy, remote access to any location any time



Insights into the power grid's utilization, the load of critical grid components

Customer support

Siemens offers helpdesk support.

Customer may contact its local Siemens representative for support requests.

<https://isp.portal.siemens.com/>

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