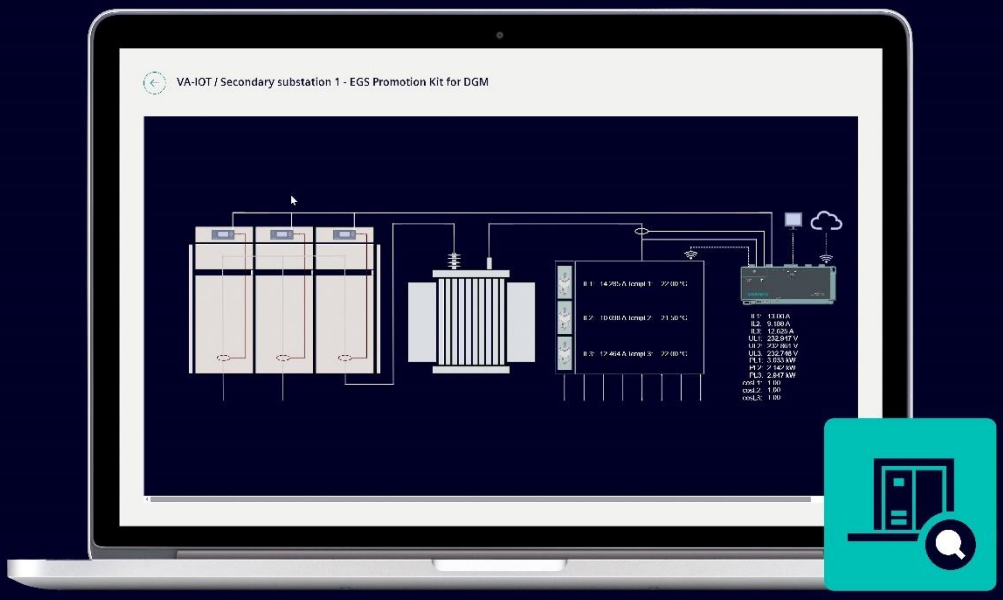


Electrification X

Distribution Grid Monitoring Feature set

Distribution Grid Transparency made scalable

SIEMENS

Contents

Overview

Distribution Grid Monitoring 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.

Customer Benefits:

- 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

Feature: DSO Station Monitoring Feature – LV & MV

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). Analyze of Key Performance Indicators provides real-time operational visibility, data-driven decision support, enhanced asset management with improved maintenance planning and resource allocation.

Functions – DSO Station Monitoring feature – LV & MV with SICAM EGS

SICAM EGS integrates seamlessly with LV HRC fuse link SENTRON 3NA COM to deliver low voltage feeder monitoring per phase in distribution grid stations and LV street cabinets. 3NA COM, communicates over Zigbee with SICAM EGS sends load current and temperature per phase. SICAM EGS is used to acquire, process and monitor currents, voltages and frequency in 50 Hz low-voltage networks and to calculate variables derived from them such as active power, reactive power and aparent power from Low Voltage transformer. SICAM FCM and FCM Plus communicates over Modbus, also process electrical parameters current, voltage, frequency, power factor, active power, reactive power and fault current information from Medium Voltage Load Feeders or Ring Feeders. All the data would be transferred to Electrification X from SICAM 8 based GridEdge for monitoring.

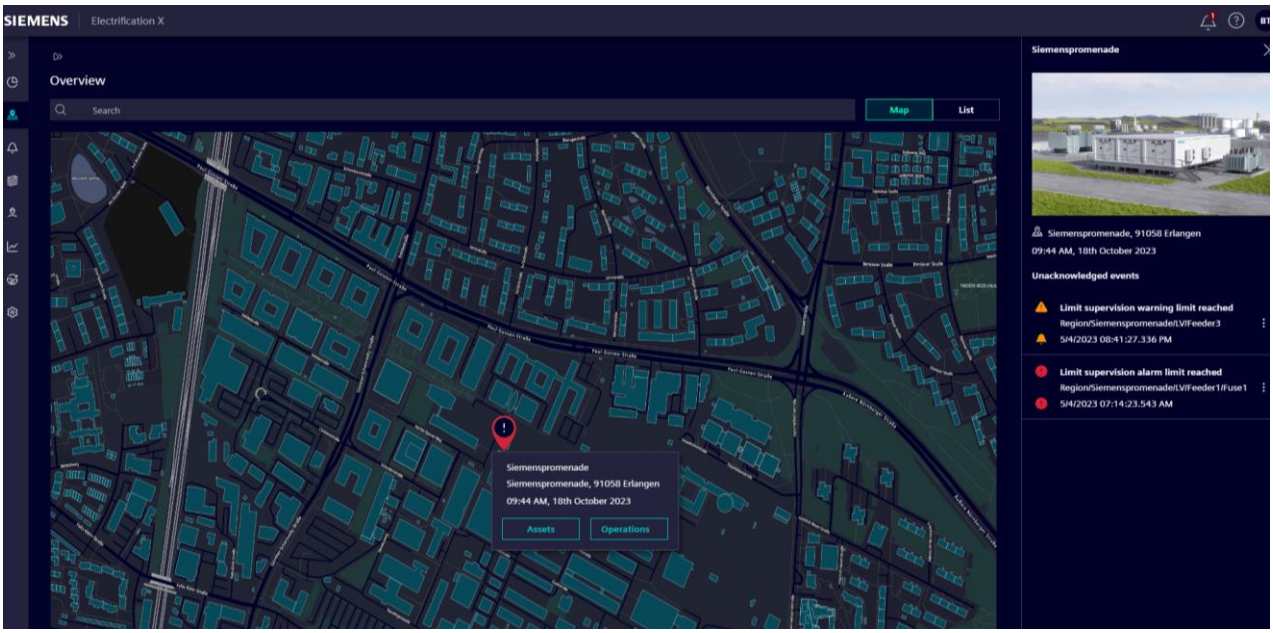
Functions – DSO Station Monitoring feature – LV & MV with SICAM CP-801x

Medium voltage distribution automations have different kinds of distribution feeders Ring Feeder In, Ring Feeder Out, Load Feeder, Transformer Feeder. SICAM CP-801x acquires information from Hardware Inputs of Load Break Switch (LBS) Status & Earthing Condition, Status of Vacuum Circuit Breaker (VCB), Tripping Status of Breaker, Status of Fault Indicating Device (i.e. SICAM FPI), Status of Voltage Detecting Device (i.e. SICAM VDIS/VDIS PRO). Critical electrical parameters from protection relays, low voltage metering or Feeder Condition Monitoring (i.e. SICAM FCM/ SICAM FCM Plus with SIBushing) devices process current, voltage, frequency, power factor, active power, reactive power and fault current information.

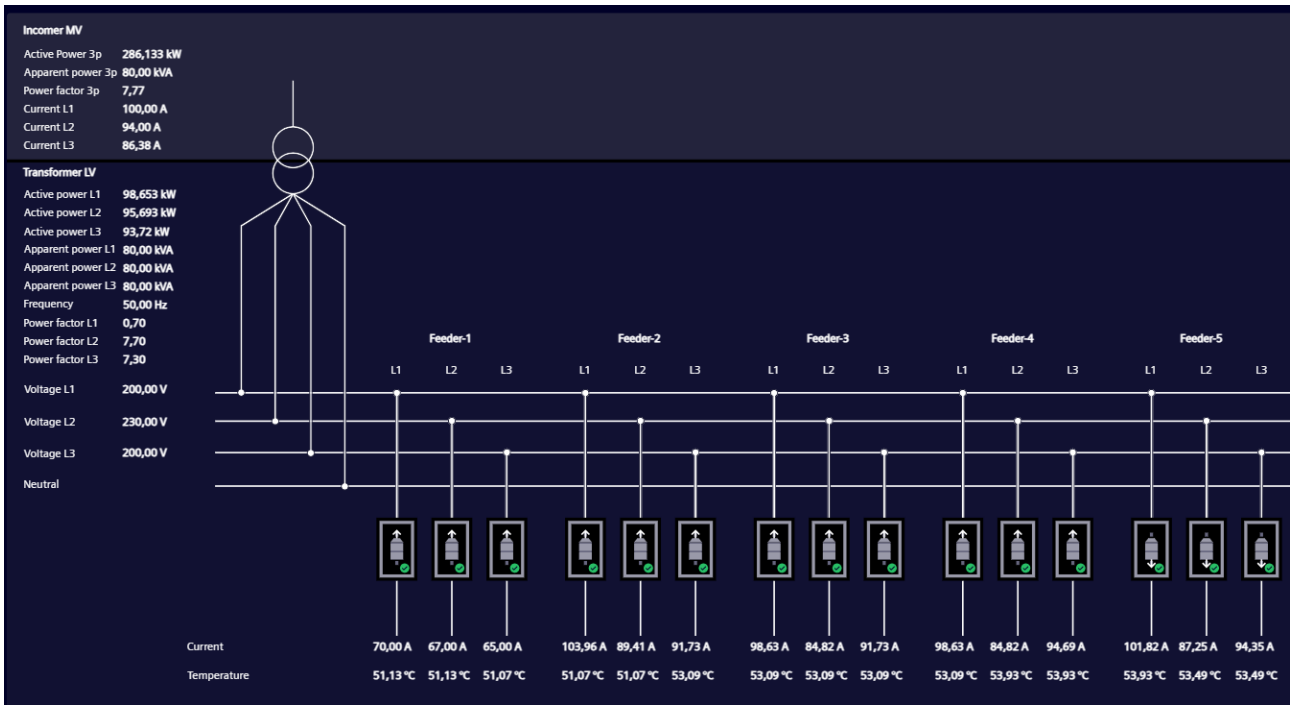
Connection with the temperature sensor in cable terminal identifies local overheating to prevent power outages.
Auxiliary alarms from Battery, UPS and other auxiliary devices like motion sensor, temperature and humidity sensor monitored effectively.
Integration with 3NA COM in same principle mentioned above.
Integration of these datapoints and functions realized with SICAM8 based Gateway CP-801x and SICAM8 based GridEdge.
Current and Active Power visualized as a heat map, providing a comprehensive overview of the load pattern over time.

This capability provides valuable insights into the load pattern over time, allowing operators to better understand how power is being consumed and distributed throughout the system. This comprehensive data allows for easy identification of areas experiencing high or fluctuating loads, enabling identification of proactive measures to optimize performance, balance loads, and prevent potential issues.

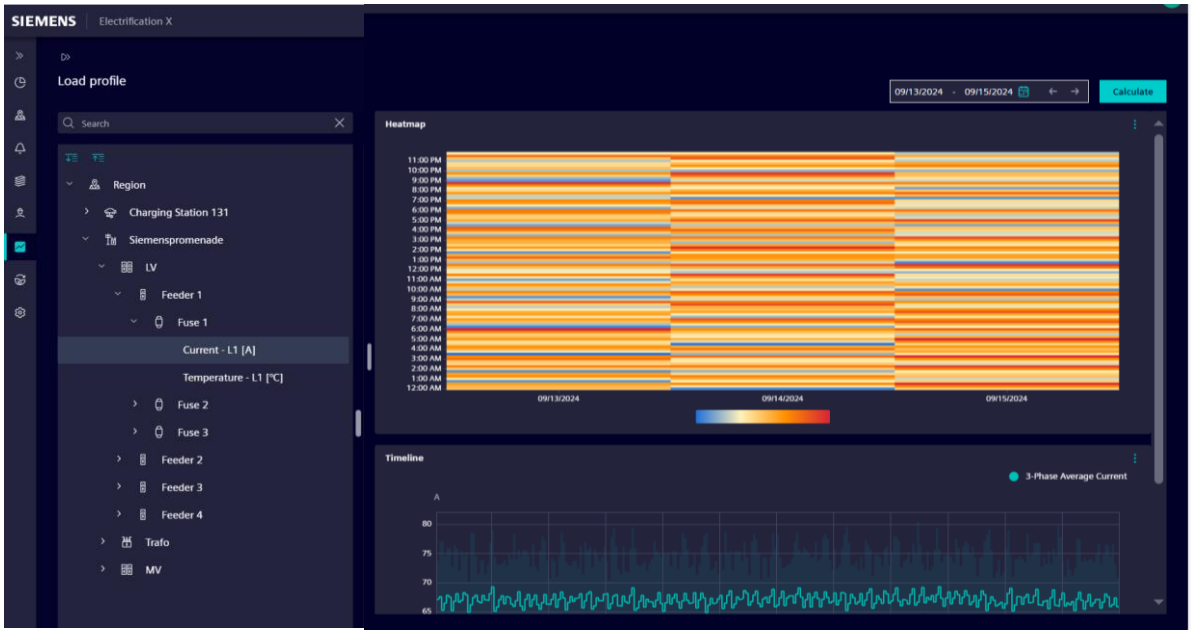
In case of violation of load limit pre-set by the operator, the system will generate an alarm. The affected location will be shown in map / list views, and an alarm will be sent automatically to the operator and/or service crew according to configuration.



Electrification X – Distribution Grid Monitoring: Map view on a Tablet



Electrification X – Distribution Grid Monitoring: Single Line Diagram

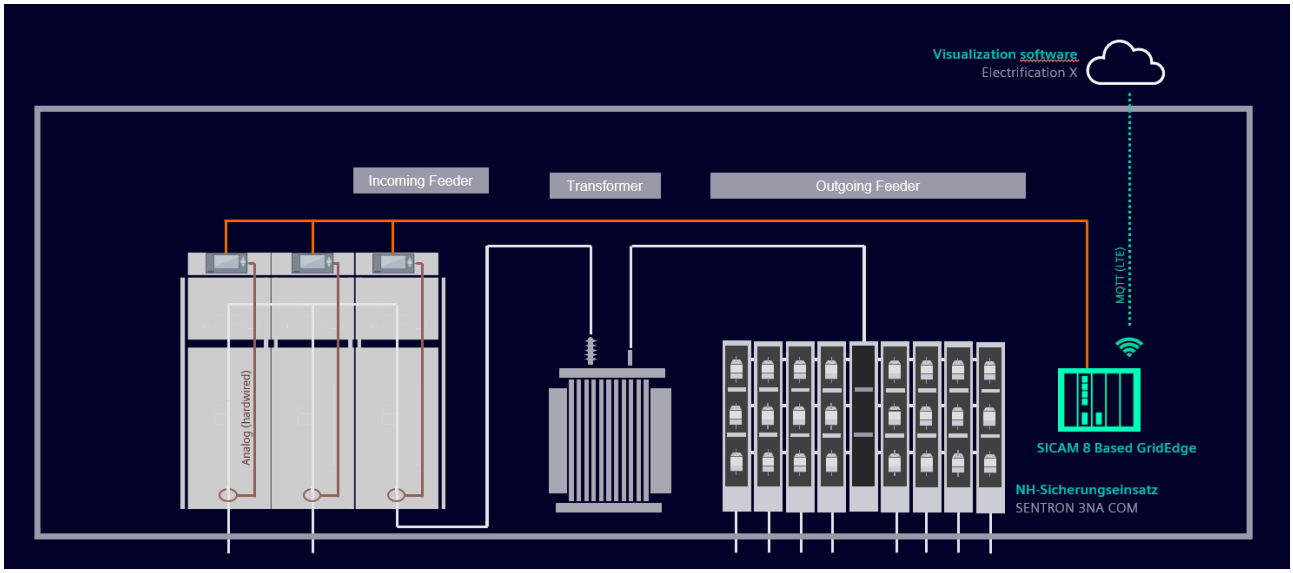


Electrification X – Distribution Grid Monitoring: Load pattern as heat map

Functions – 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 upto 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).

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

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.

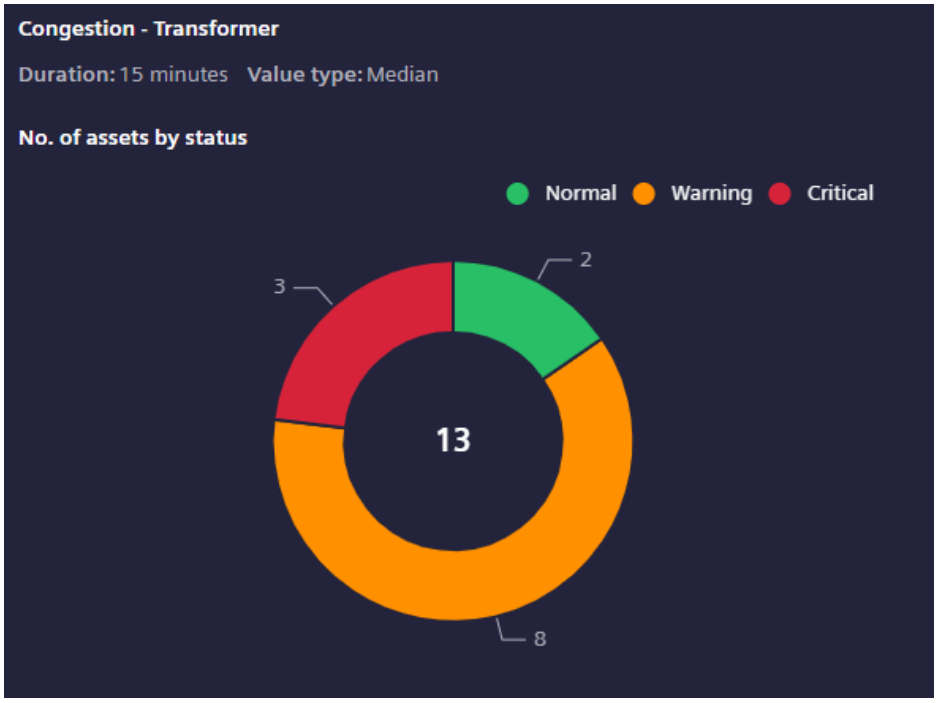
Assets Incoming Feeder:
Compute the congestion by analyzing the rating of Outgoing Transformer of the Feeder. Subsequently, determine the temporal distribution by employing predefined classification bins, incorporating aggregated values obtained during the specified aggregation period.
Data point used: 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

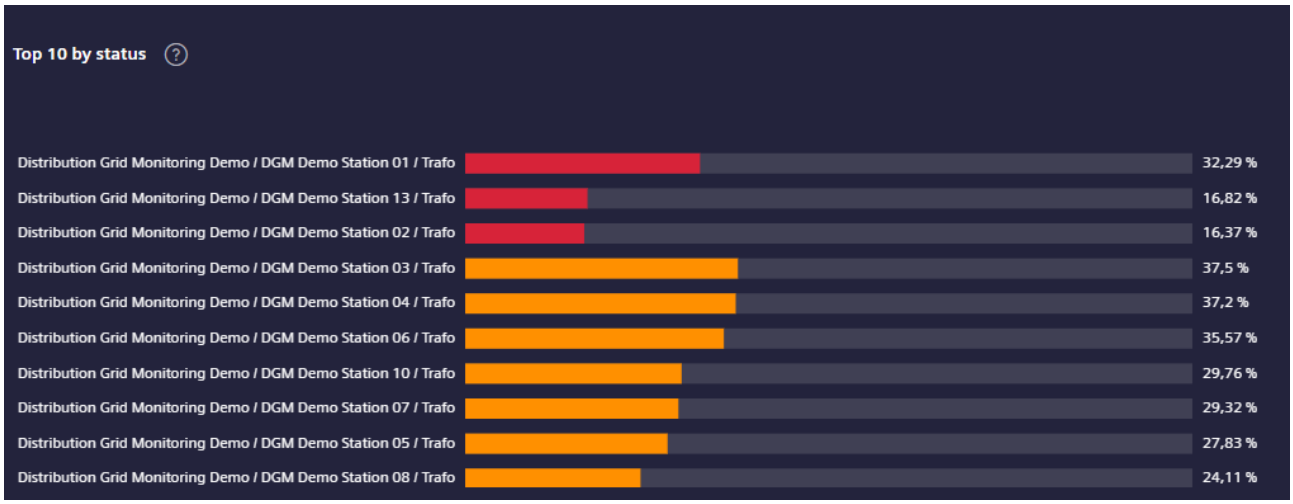
Assets Outgoing Feeder:
Compute the congestion by analyzing the rating of Fuse. Subsequently, determine the temporal distribution by employing predefined classification bins, incorporating aggregated values obtained during the specified aggregation period.
Data point used: Current L1, Current L2, Current L3.

Severity Bins are designated as

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



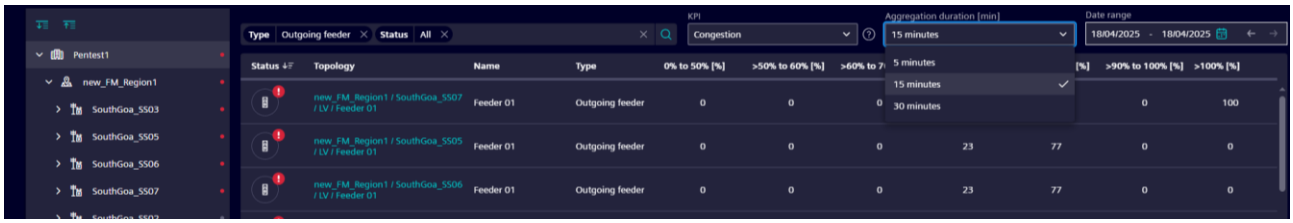
Electrification X – Distribution Grid Monitoring: Distribution Station KPIs, Congestion: DONUT Chart



Electrification X – Distribution Grid Monitoring: Distribution Station KPIs, Congestion: Horizontal Bar Chart

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%



Electrification X – Distribution Grid Monitoring: Distribution Station KPIs, Congestion: Table View

Current Unbalance

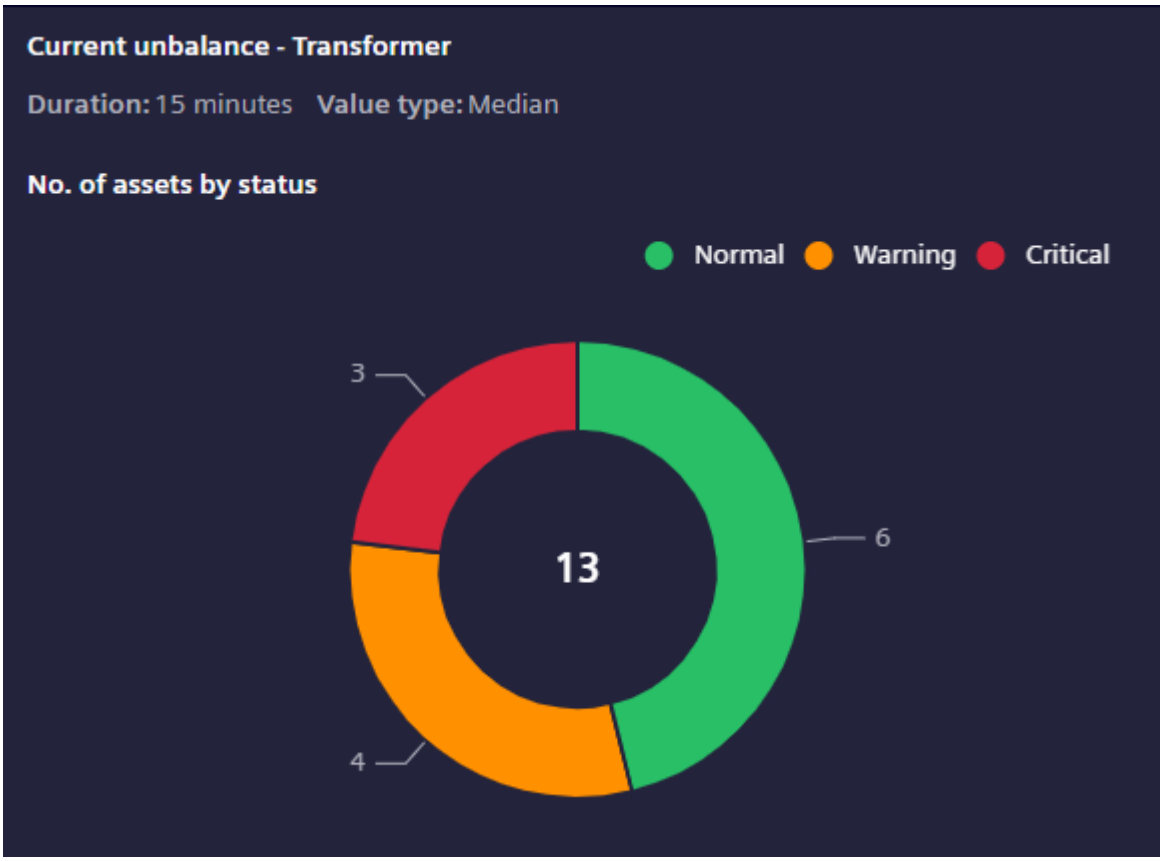
The phase Current unbalance KPI monitors the unbalance in current across the 3 phases of a distribution network. For balanced loads, it is ideal for all 3 phases to have equal current. However, variations can occur due to uneven loading, faulty equipment, or network issues. All asset types are involved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

Assets Incoming Feeder, Transformer and Outgoing Feeder:

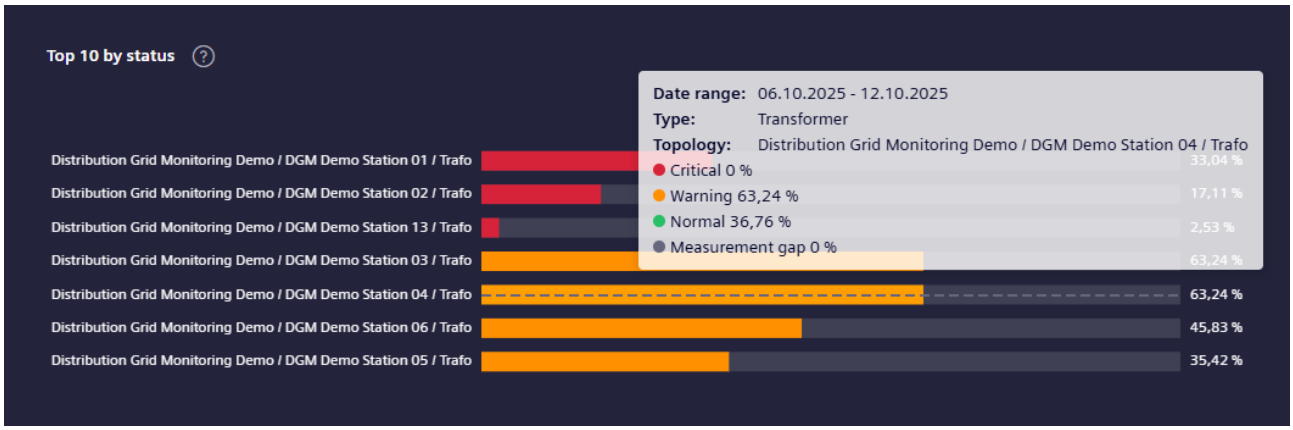
Compute the Current Unbalance by analyzing current of each phase of asset. Subsequently, determine the temporal distribution by employing predefined classification bins, incorporating aggregated values obtained during the specified aggregation period.
Data point used: Current L1, Current L2, Current L3.

Severity Bins are designated as

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



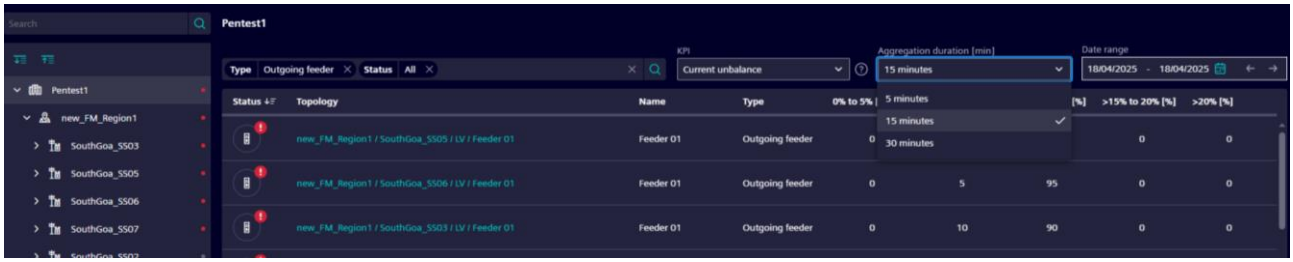
Electrification X – Distribution Grid Monitoring: Distribution Station KPIs, Current Unbalance: DONUT Chart



Electrification X – Distribution Grid Monitoring: Distribution Station KPIs, Current Unbalance: Horizontal Bar Chart

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%



Electrification X – Distribution Grid Monitoring: Distribution Station KPIs, Current Unbalance: Table View

Power Factor

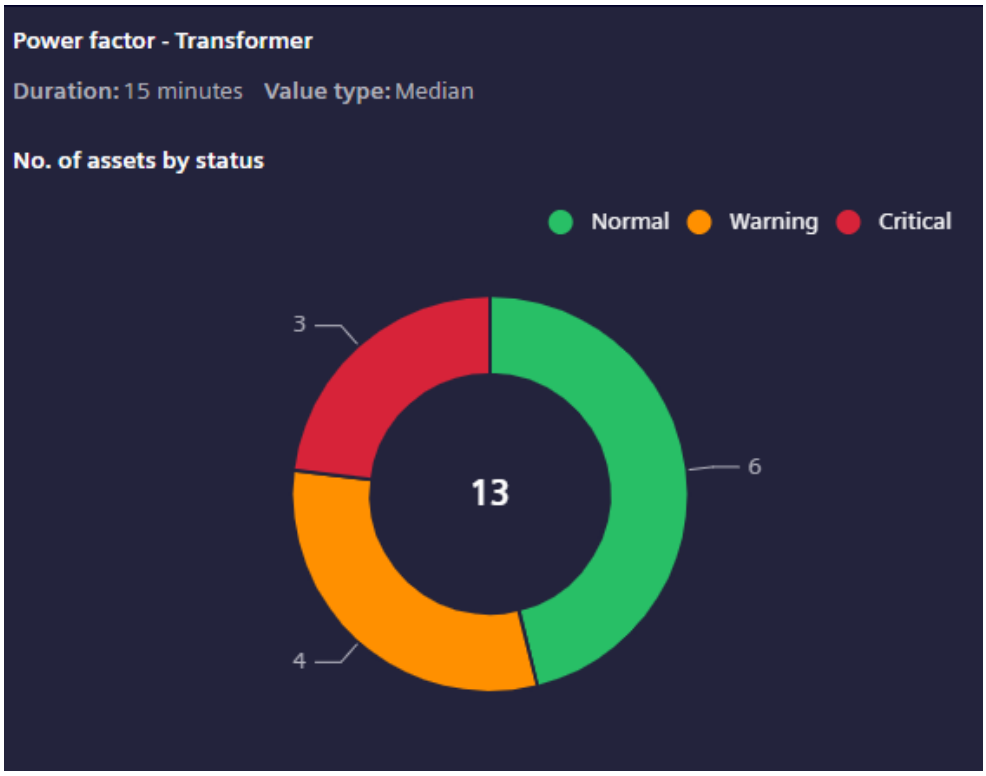
The Power factor KPI helps operators monitor the efficiency of power usage across the network by indicating how effectively electrical power is being utilized. It offers both real-time and historical data on power factor variations at different substations or feeder points, facilitating the prompt detection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

Severity Bins are designated as

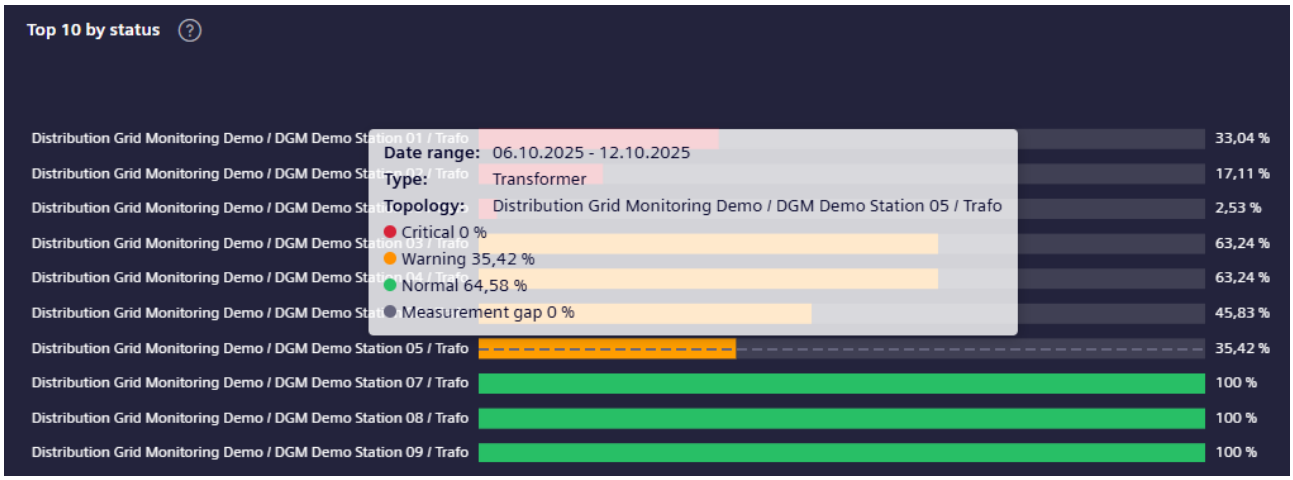
- Normal: 1- 0.95 (Green)
- Warning: <0.95 – 0.9 (Yellow)
- Critical: <0.9 (Red)

<u>Assets Incoming Feeder:</u>
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.

<u>Assets Transformer:</u>
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.



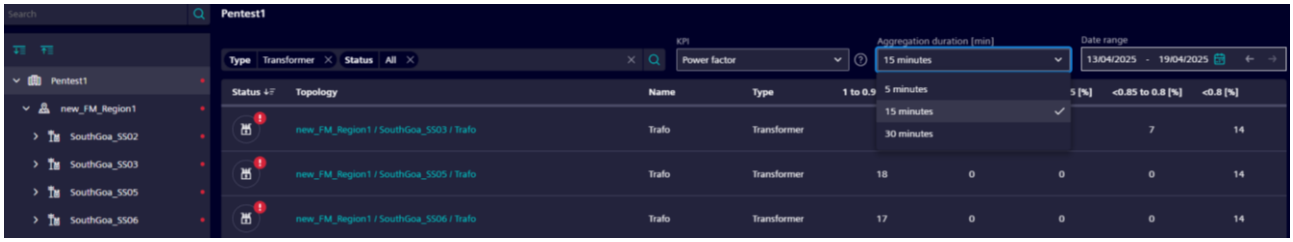
Electrification X – Distribution Grid Monitoring: Distribution Station KPIs, Power Factor: DONUT Chart



Electrification X – Distribution Grid Monitoring: Distribution Station KPIs, Power Factor: Horizontal Bar Chart

Temporal distributions of power factor among all assets are further representing in more granular structure and compute 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



Electrification X – Distribution Grid Monitoring: Distribution Station KPIs, Power Factor: Table View

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

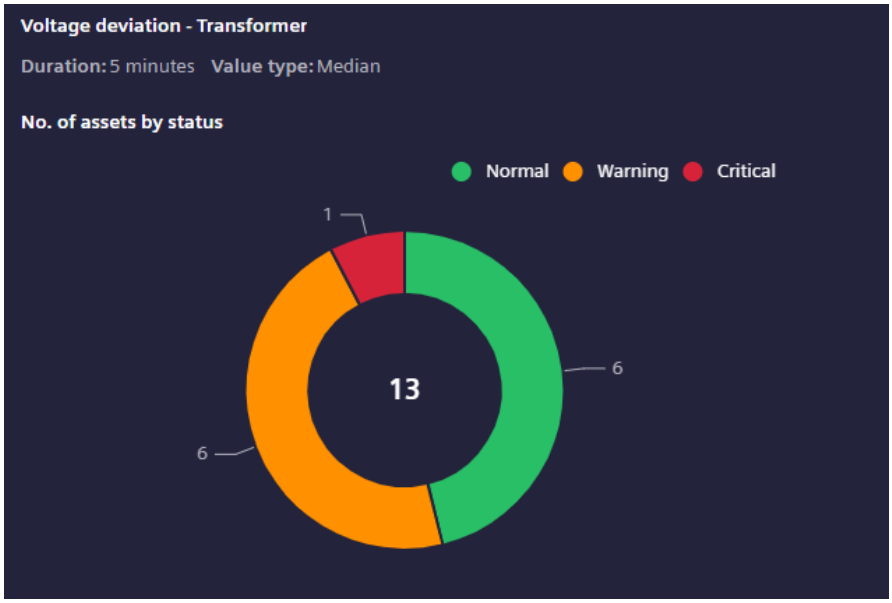
- Normal: 0-10% (Green)
- Warning: >10 - 25% (Yellow)
- Critical: >25% (Red)

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

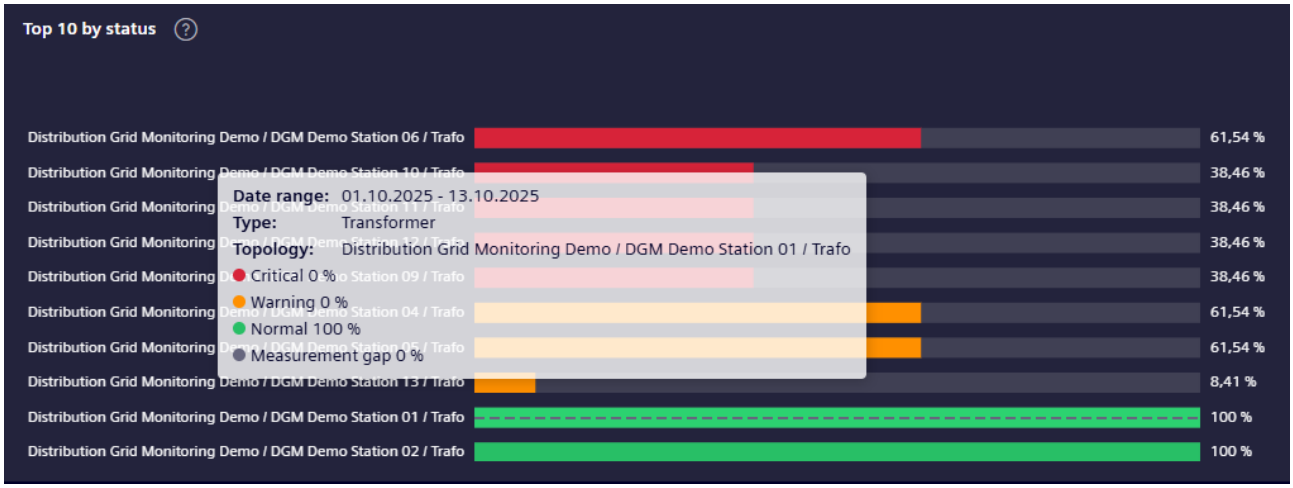
Assets Transformer:

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.



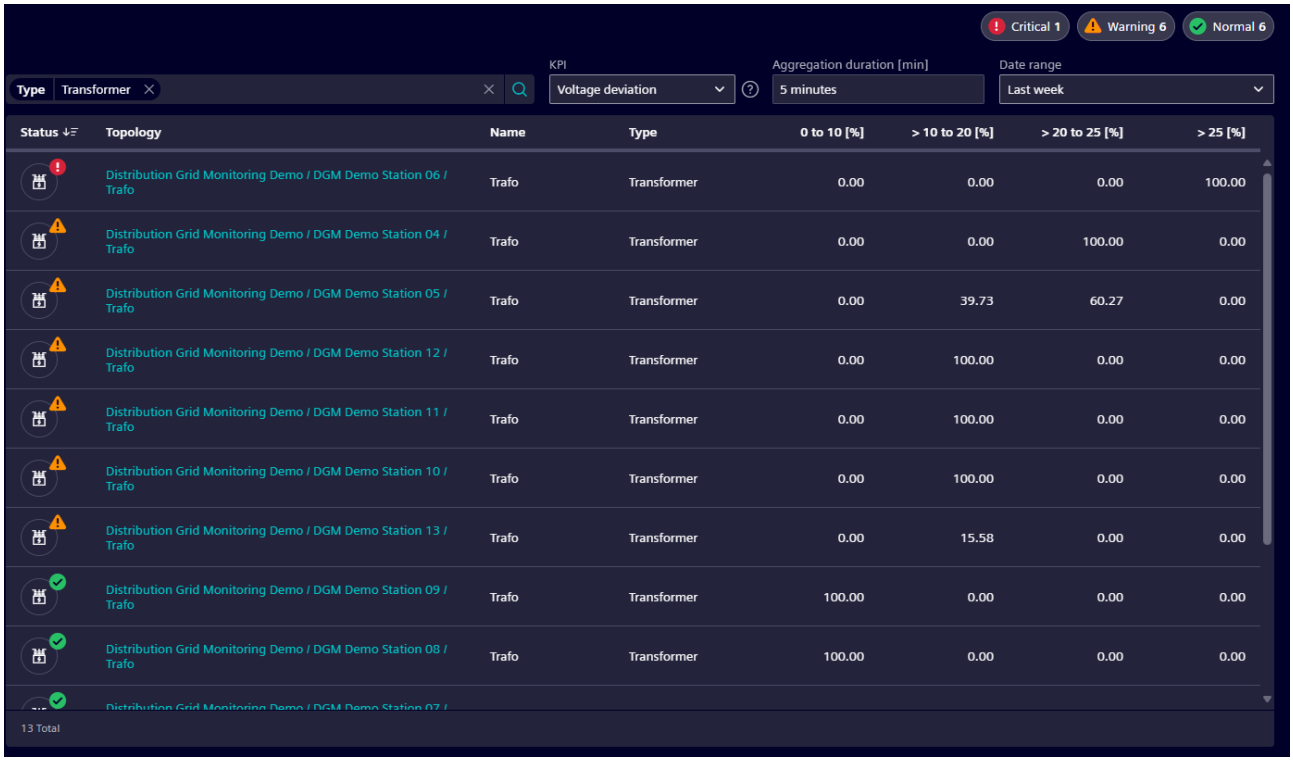
Electrification X – Distribution Grid Monitoring: Distribution Station KPIs, Voltage Deviation: DONUT Chart



Electrification X – Distribution Grid Monitoring: Distribution Station KPIs, Voltage Deviation: Horizontal Bar Chart

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[%]



Electrification X – Distribution Grid Monitoring: Distribution Station KPIs, Voltage Deviation: Table View

Subscription

Standard Subscription Plan	Electrification X Distribution Grid Monitoring
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 Monitoring 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	Chrome is recommended to use the Cloud Service, but other standard browsers might also serve this function. Screen resolution of 1920x1080 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.

Ordering

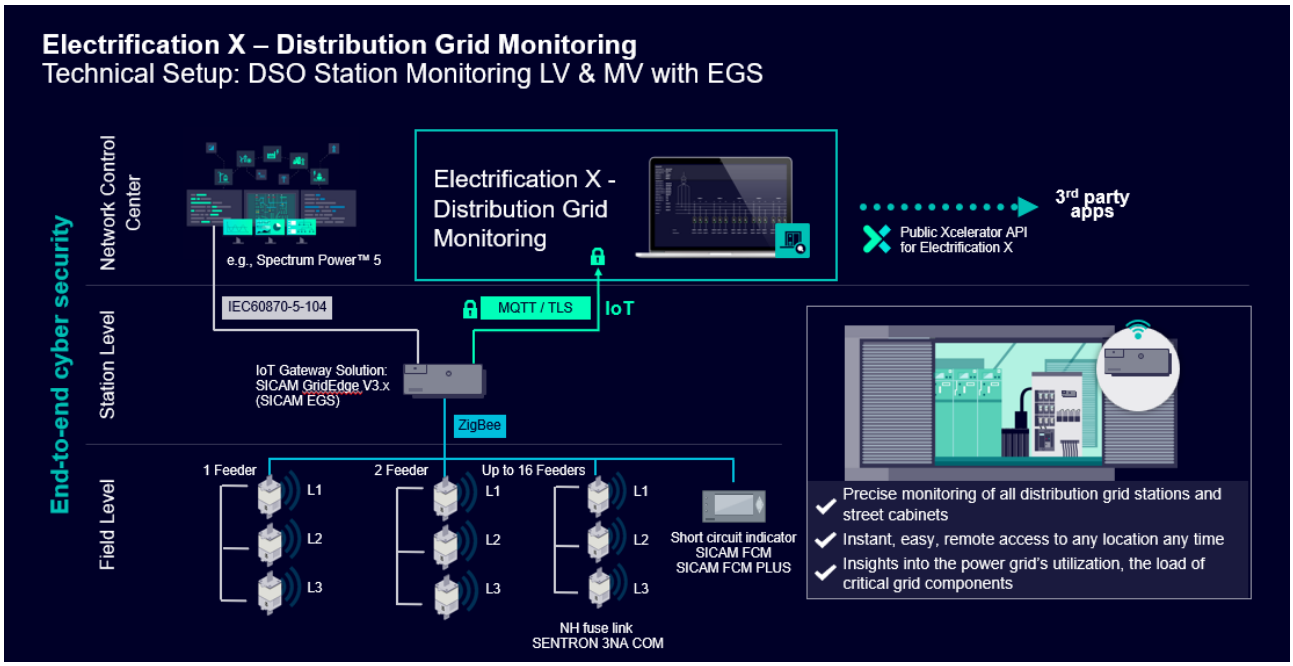
Ordering Process for the Subscription	To order the Cloud Service for the first time, Customer must request a quote from its Siemens sales representative. Depending on the offering either with Services, then customer will receive a link to his tenant, or without services, then the Customer will receive 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 "Electrification X Supplemental Terms", the Siemens Universal Customer Agreement, 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

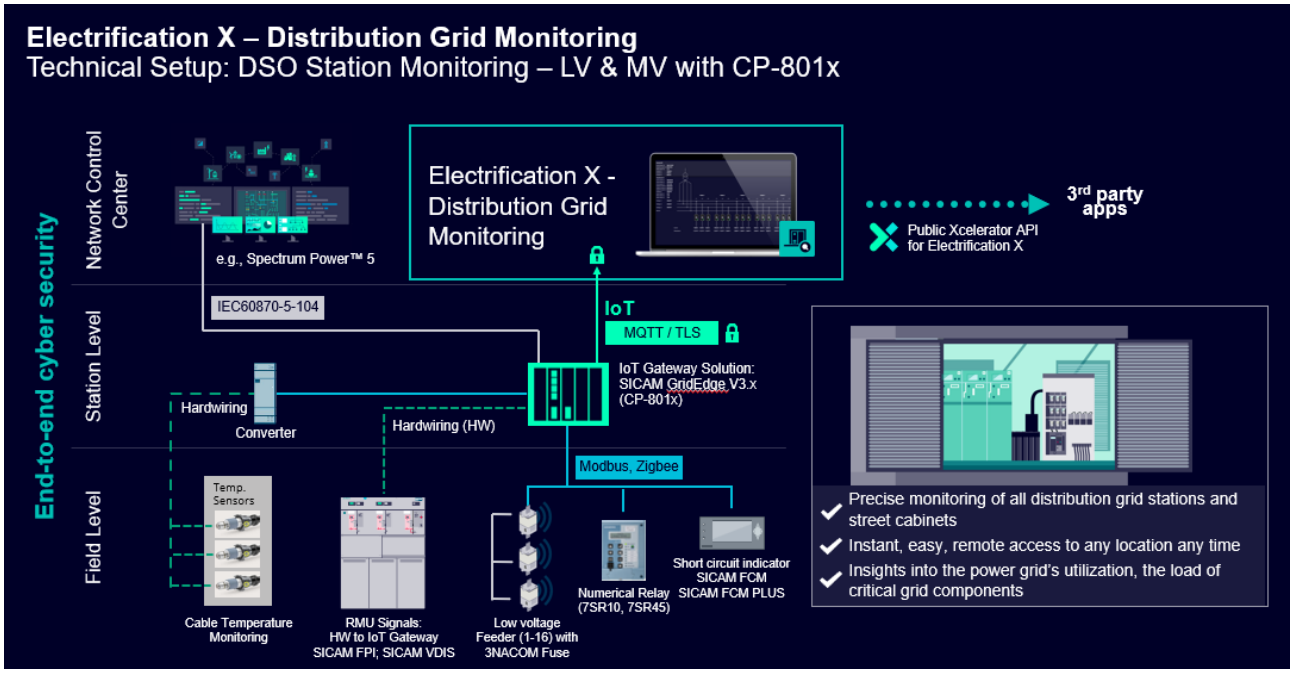
Technical Documents	Document ID	Document ID German	Document ID English
Building X – Accounts User Guide	A6V12050070		
Building X – Devices User Guide	A6V12050067		
Building X – Data Setup User Guide	A6V12481797		
Building X – Connect X200/300 Installation Guide	A6V13057554		
Building X – Connect Hub User Guide	A6V13471544		
Building X – Energy Manager Engineering Guide	A6V12576548		
Building X – Energy Manager User Guide	A6V12503191		
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:
https://support.industry.siemens.com/

Topology



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)

Specific Terms

Third Party Terms for Use of the Cloud Service	Software may contain third-party software, technology, and other materials, including open-source software, licensed by third parties under separate terms (“Third Party Terms”) which are specified in the “read me” files, header files, notice files, or similar files. Third Party Terms shall prevail with respect to the respective technology. If and to the extent required by Third Party Terms, Siemens will provide the source code for the respective technology upon written request and payment of any shipping charges by Customer.
Customer Support	Siemens offers helpdesk support. Customer may contact its local Siemens representative for support requests.

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