



Systematic Information

Automated Metering and Information System AMIS

Answers for energy.

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Go on the offensive with AMIS



AMIS:

New solutions for new requirements

Due to changed legal framework conditions (such as EnWG in Germany, ELWOG in Austria, the Acceleration Directive, Energy Efficiency Directive, etc.) and new interest groups (such as bne, ...), liberalized energy markets pose serious challenges for the distribution network operators. The separation of generation, distribution network, and sales not only results in increased competition, but requires the provision of considerable quantities of additional data. In addition, in spite of tighter competition in subareas (such as consumption data acquisition), the usual security and quality of the supply must be maintained.

Distribution network operators seeking to ensure economical success and expand further under these framework conditions must optimize existing network operation processes and develop new fields of business. AMIS (Automated Metering and Information System) provides the ideal conditions for doing so. It combines metering and management of distribution networks in one system and was developed explicitly for the special requirements of the liberalized energy market. As a complete solution, AMIS acquires data and information of households, special contract customers and the distribution network infrastructure and transmits them to a control center. This allows network distribution operators to optimize essential key processes and offer new services and data to their customers, both on the supplier as well as the consumer side.



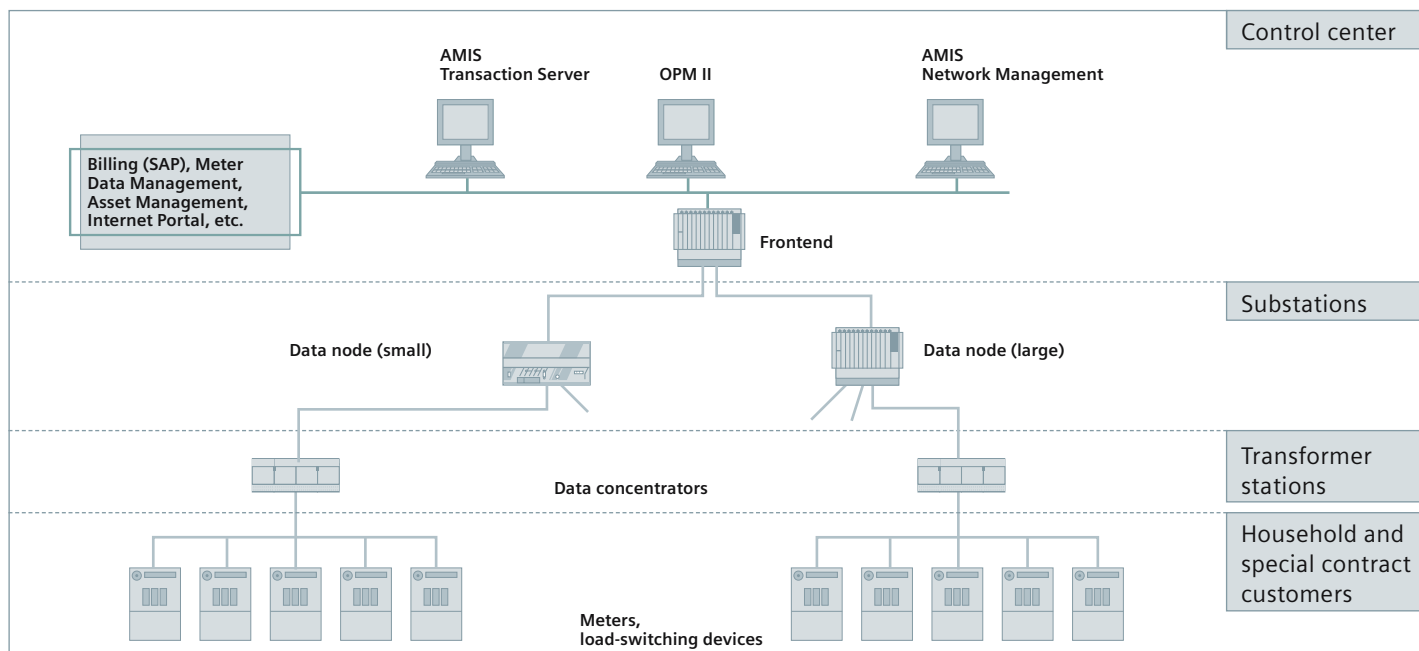
AMIS allows you to:

- Automate your customer processes (billing, change of tariff, blocking of customer installations, collection) to the greatest possible extent, bill related to actual consumption, and use short billing intervals.
- Implement various tariff models (several registers for active energy supplied/imported, time and/or load-dependent switchover) and acquire data on supplied/imported reactive energy. This ensures the greatest possible flexibility with regard to product design for an energy supplier. And you can optionally replace ripple control receivers with an independent load-switching device with integrated clock timer and two-way communication (changing of switching programs, spontaneous switching operations).
- Record the capacity utilization of individual line sections and transformers in order to optimize maintenance intervals, minimize line losses (e.g., by moving breaking points), and obtain additional data for planning expansion of the power network.
- Minimize down times by acquiring and diagnosing errors.
- Integrate small, decentralized energy generation plants into the distribution network for billing and automation purposes.
- Record and document the customer supply at the point of supply (in the meter) for the purpose of providing evidence and for planning the power network.
- Support crisis management in the event of a catastrophe through fast ascertainment of the network status and simple setup of power network islands with limited energy resources (individually interruptible customer groups and power consumption limit).

As a complete solution, AMIS comprises all necessary hardware and software components for the following applications:

- Acquisition of all consumption data for electrical energy for tariff customers and special contract customers
- Remote disconnection of customer connections (prepayment services, limitation of the maximum power consumption)
- Load-switching possibility for tariff and special contract customers
- Recording and documentation of the quality of supply (meter: voltage tolerances, short-term failures, long-term failures; Power Quality according to EN 50160 through data concentrators in the transformer stations)
- Creation of an open communications platform for the integration of meters for other energy carriers/media (gas, district heating, water) and additional services (Home Automation)
- Recording of unauthorized power tapping and manipulations on the terminal devices (such as meters)
- Telecontrol acquisition of the transformer stations and the distribution network infrastructure

AMIS is thus a complete system which is the basis for future smart grid solutions.



Control center: IEC 60870-5-104, IEC 60870-5-101

Substations: IEC 60870-5-104, IEC 60870-5-101, IEC 61334, IEC 62056, NSC, more than 160 third-party protocols

Transformer stations: IEC 60870-5-104, IEC 60870-5-101, NSC

Household and special contract customers: EN 50065, NSC, IEC 61334 and IEC 62056 possible

Comprehensive performance in the system – AMIS

Ideal components

Using sophisticated hardware and software, AMIS offers you perfect support at every level of the distribution network, from network management to the multifunction meter. All components match each other perfectly and can be ideally adapted to individual requirements.

AMIS terminal devices

The AMIS terminal devices work on the first network level to acquire the data directly from customers. The new fully electronic multifunction meter combines power and energy measurement, flexible tariff metering, and complete DLC* communication over the power supply network, and it is already prepared for value-added services. The load-switching device enables load switching based on a clock program or via command from the control center.

AMIS data concentrator for transformer stations

The data concentrators in the low-voltage transformer stations compile the data from the meters and load-switching devices and can be expanded in modular fashion with automation functionality. Both serial as well as LAN interfaces are provided for communications to the control center. For increased requirements (such as the standby transmission line concepts for communications) can also be realized at transformer station level.

AMIS data concentrator for substations

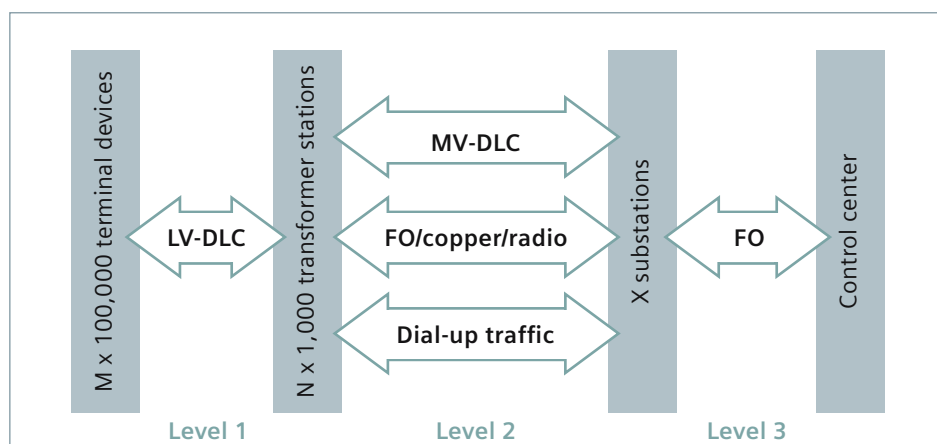
The data concentrators in the substations are based on reliable SICAM 1703 automation components. They collect and concentrate the data from the substations and convert them to the communication interfaces required in each case.

AMIS Transaction Server and AMIS Network Management System

The AMIS Transaction Server in the control center provides the entire acquired and prepared data from the terminal devices for various applications (billing, load profile data, ripple control, etc.). Automation data from the distribution network infrastructure is passed directly to a control system (SCADA). Using a central AMIS network management system enables considerably more efficient management of the AMIS system than would be possible with separate management systems for telecommunications equipment and data concentrators.

*DLC= Distribution Line Carrier

Make way for information – the AMIS communications network



- AMIS implements end-to-end communications, from the terminal device to the control center!
- Communications offered in AMIS via the medium-voltage network allows you to communicate
 - without fees
 - without dependencies on telecommunications providers
 - decoupled from the short-term innovation cycles of the telecom and IT industries

Use existing resources

For cost reasons an AMIS communications network mostly uses existing infrastructure (such as fiber optic cables and copper cables, cable TV networks, etc.) for complete consumption data acquisition. These must be expanded with the least expensive transmission equipment, such as medium-voltage DLC modems, radio modems, and in some cases even GSM or GPRS.

As a result, the low-voltage network is used at the primary level (connection of the terminal devices with the transformer stations). For this purpose, we developed our own narrow-band DLC communications technology based on spread-spectrum methods that allows highly available and secure communications via the power network. This communications technology supports meshed network structures with several feeding points and is a “self-learning” system with automatic recognition and registration of terminal devices. Therefore switching actions within the power network have no influence on the data communications. The corresponding DLC modems are a fixed part of the terminal devices and the data concentrators for the transformer stations.

The connection of the transformer stations with the substations (level 2) can basically be realized with any available communications medium, such as narrow-band radio, IP networks, fiber optics and all types of copper cables. The modems and IP components required for this are integrated in the AMIS Management via the data concentrator and can thus be completely monitored and parameterized remotely. As an alternative, a special medium-voltage DLC method can also be implemented, which masters the constantly changing line characteristics and, by means of its own routing-capable protocol, makes switchovers in the network invisible for the user.

In principle, all telephone networks (POTS, ISDN, GSM, GPRS, UMTS, etc.) can also be utilized for communications. However, they are not always available everywhere, cost money, and create dependency on third parties, which results in decreased investment security.

The connections of the substations with the control center form the third level of the communications network. Normally, the existing communications infrastructure is used. However, similar to the second network level, all communications paths can be used for individual solutions as needed.

The AMIS system components

The AMIS multifunction meter

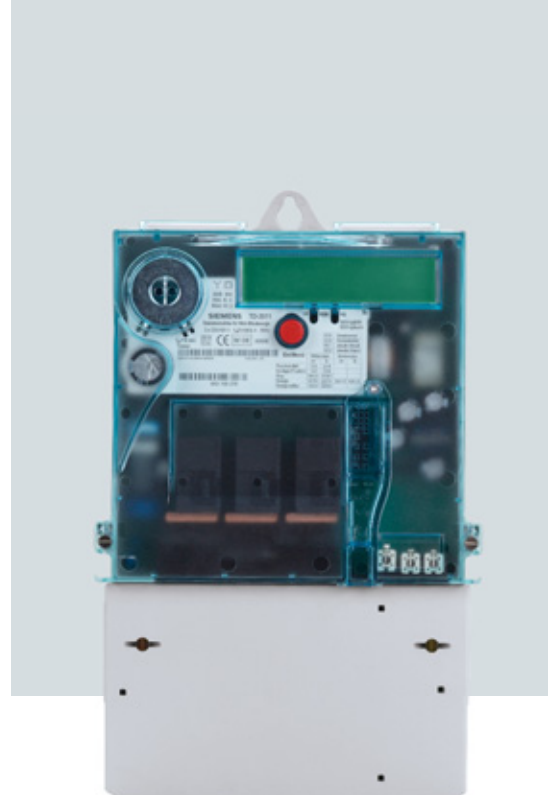
Optimal performance for all requirements

With the AMIS multifunction meter you need just one meter platform for all tariff models, because you can change them automatically from the control center. Thus there's no need to change the meter every time a new tariff goes into effect. In addition, the AMIS multifunction meter allows you to perform automated consumption data acquisition with customer-specific billing intervals according to actual consumption.

Changes in suppliers and the provision of consumption data for different balance groups are also automated. And the AMIS multifunction meter allows you to disconnect customer installations without local work (e.g., for change of tenant), automate collection and offer prepayment products, or limit power consumption. Moreover, with the AMIS multifunction meter you can document your supply quality (voltage level, short-term failures and long-term failures per phase) for each customer.

Performance data

- Electronic 4-quadrant meter for the acquisition of reactive and active energy
- Integrated DLC communication
- Generation of 4 load profiles corresponding to P+, P-, Q+, Q- with a memory depth of 60 days with generation of 1/4-hour values
- Meter types:
 - 3-phase: 5/60A and 10/100A
 - 1-phase: 5/60A
- Number of tariff registers:
 - 2x1 for reactive energy (supplied/imported)
 - 2x6 for active energy (supplied/imported)
- Summation registers for active energy (supplied/imported)
- Disconnection device for customer installation
- Accuracy: class 2 for active energy; class 3 for reactive energy
- Switchover between tariff registers time- and/or load-controlled
- Internal clock (synchronized with the AMIS system time, i.e., GPS-accuracy) and calendar with calculated and freely definable holidays
- IR interface for local readout and parameterization
- Expansion slot for expansion modules (e.g. communications via M-Bus wired or wireless, etc.)
- Manipulation contacts for terminal cover and calibrated range
- Voltage monitoring with over- and under-voltage registers (adjustable threshold values)





The AMIS load-switching device

More flexibility and reliability

When customer complaints arrive, the AMIS load-switching device with monitored relays (input and output voltage) allows you to immediately diagnose the complaint from the call center. You can determine whether a fault lies in the scope of the network operators or in the customer installation and quickly respond. In addition, the integrated two-way communication not only enables more secure transmission of switching commands compared with the existing ripple control system, but permits you to parameterize the devices completely remotely, and therefore to flexibly adapt them to the requirements of the energy supplier and the power network operator.

Performance data

- Load switching according to clock program or command from the control center (load shedding, reloading, etc.)
- Remote change of switching program
- Configurable with up to 5 relays
- 52 on/off switching pairs per relay
- Random generator for on/off switching delay to avoid peak loads in the network
- IR interface for local readout and parameterization via PDA (personal digital assistant) and Web browser
- Internal clock (synchronized with the AMIS system time, i.e., GPS accuracy) and calendar with calculated and freely definable holidays
- Monitoring of the input and output voltage of every relay
- Manipulation contact



The AMIS data concentrator for transformer stations

Greater transparency in the network

The AMIS data concentrator supports you in the diagnosis of network errors by integrating ground-fault and short-circuits indicators, measuring voltages and currents (per phase) in the transformer stations, and generating alarms when levels rise above or below defined limits. In addition, you can systematically bypass network faults because you can detect infrastructure failures (cables, transformers, overvoltage conductors, etc.) early, for example by measuring partial discharge, oil temperature, etc., and automatically isolate the faulty line sections.

At the same time, the AMIS data concentrator delivers valuable line and transformer-related load data that enable you to selectively utilize the capacity of the network infrastructure up to the maximum permissible load, and to monitor the power quality in the transformer stations according to EN 50160.

Performance data

- Master function for up to 1,000 terminal devices
- Integral LV-DLC modem for communication with the terminal devices
- 2 interfaces (serial/LAN or serial/serial) for communications with the control center
- Connected modems (radio, FO, copper cable, MV DLC, POTS, ISDN, GSM, GPRS) are parameterized via the AMIS data concentrator and integrated in the AMIS management system
- Parameter storage (also for modems) on flash card
- Configuration by means of preparameterized flash card or web browser
- Expandable with peripheral modules from the automation technology
- Communication standby transmission line concept can be implemented for important stations



The AMIS data concentrator for substations

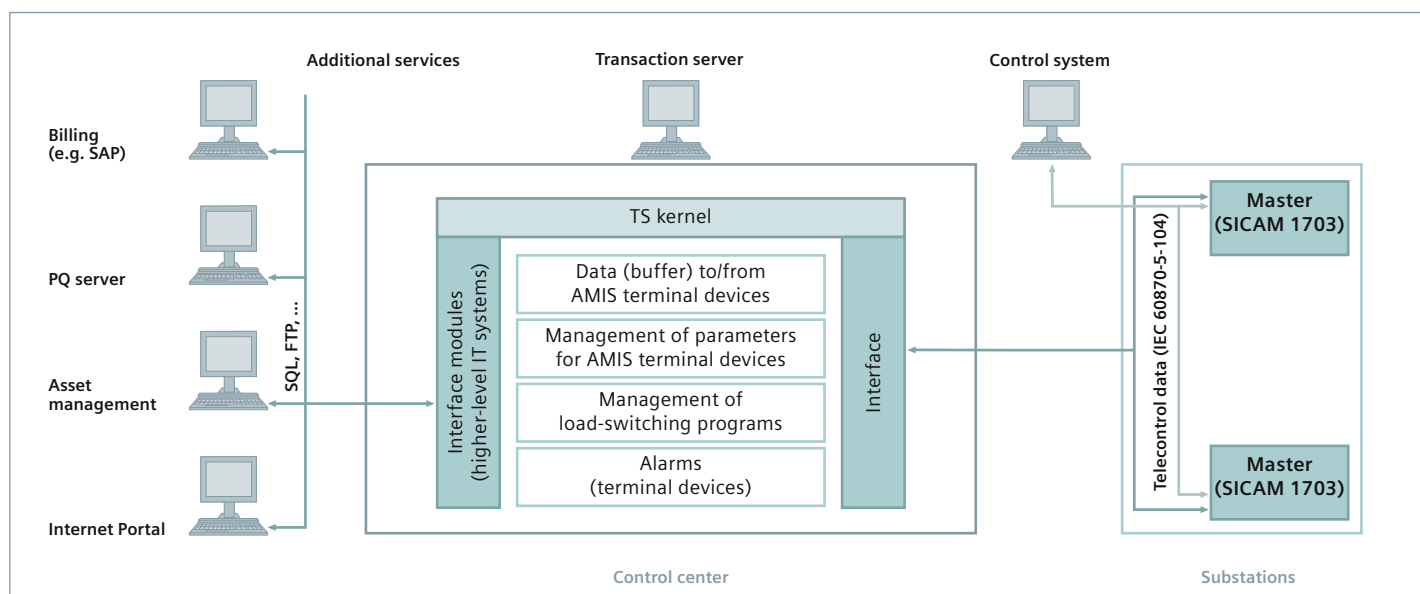
Customized and versatile

For small stations the AMIS data concentrator for substations can be built from TM 1703 components, and larger stations can be equipped with an appropriate number of AK 1703 ACP components. These can be equipped with serial or LAN interfaces depending on the requirements. If required, important transformer stations or the control center can be connected to the data concentrator in the substation via redundant communication paths. The node functionality in the substations necessary for an AMIS solution can be retrofitted in every existing SICAM 1703 component through simple configuration of the required interfaces.

Performance data

- Data concentrator and gateway functionality for the grouping of several transformer stations and conversion of the interfaces toward the control center to Ethernet
- Depending on data capacity, implementation with the reliable automation components AK 1703 ACP or TM 1703 ACP
- Expandable with peripheral modules from the telecontrol and automation technology
- Integration of AMIS into existing SICAM 1703 infrastructure possible

The AMIS transaction server



Groundbreaking performance

The AMIS transaction server in the control center processes the data of the terminal devices and adapts the data format to higher-level IT systems. Telecontrol and automation data from the AMIS data concentrators is transferred directly to a control system (SCADA). Thus the transaction server is the mediation device and gateway for higher-level IT systems such as billing systems, meter data management systems, asset management systems, Internet portals and the like. Moreover, it administers the terminal device parameters (meters, load-switching devices), which are created typified according to the requirements of the high-level IT systems. Export functions for mobile parameterization devices (PDAs) support the simple, quick paperless handling of installation orders without special training for installation personnel. Additional safety mechanisms guarantee the consistency of the terminal device functionality (i.e., the terminal device parameter settings), for example with the customer contract types stored in the billing system.

Optionally, the transaction server also offers the possibility of managing switching programs for the load-switching devices on a graphical user interface. The switching programs are displayed in the form of curves and can easily be checked for errors or compared with one another.

Support for meter and logistics processes

All terminal device parameters are created and managed centrally in parameter profiles, coordinated with the customer contract data and the requirements of the higher-level IT-systems. Installation, removal and conversion orders are also processed centrally and distributed electronically with the associated parameter profiles, thereby ensuring data consistency.

Operational reliability and security

The transaction server supports a "hot standby" concept in which the hardware and the software exist redundantly in two separate systems. If the active system fails, a switch to the redundant system can take place immediately. Moreover, all operation- and system-relevant data can be exported periodically and automatically to an external protected drive. Thus, in an emergency a transaction server can be set up and put into operation in a very short time. The combination of several measures ensures the security of the data in the AMIS system. For this purpose, the terminal devices are specially coded in the physical layer of the DLC communications procedure and always transmitted with encryption. The data concentrator in the transformer station is designed as a natural firewall to reliably prevent possible access to the higher-level process network. For the control center and the process network, customer-specific and scalable security and firewall concepts are available.



The AMIS network management system

Well equipped for the future

AMIS provides a wide range of data relevant to network operation as well as the consumption data of households and special-contract customers. In the future, there is certain to be a focus on finer chronological resolution of the precise energy consumption of individual customers and customer groups. This will be necessary as a basis for the creation of tariff and forecast models, and also because there seems to be a trend toward shorter billing intervals on the part of the EU Commission.

As a result, considerable quantities of data will have to be generated, transported and made available within defined time windows in the future. To efficiently ensure the necessary response times for a very large number of stations, the AMIS system requires a powerful management system consisting of AMIS NMS and OPM II.

Maintaining an overview

The AMIS NMS, implemented with a product from the control system family, enables the complete monitoring and diagnosis of all AMIS components and communications devices. In addition, individual departments, such as meter control, communica-

tions, network operation, etc., can be supplied with specifically designed overview images with the information relevant for them. And all information can be forwarded to a network control system (SCADA) via an IEC 60870-5-104 interface.

As a universal engineering and parameterization tool, the OPM II enables the uniform parameterization of all AMIS components from the transformer station to the control center, including the communications devices and the AMIS NMS. Moreover, all corresponding parameter data is managed in a central database in the OPM II. As a result, the part of an AMIS configuration close to the distribution network can be operated and maintained easily and inexpensively.

For operational reasons, the terminal devices are not represented in the OPM II, since their parameters can change "dynamically" depending on the customer contracts. They are therefore recorded in the transaction server.



AMIS system expansions

Built-in investment protection

Due to the high number of necessary terminal devices, these devices must provide broad functionality and allow for future expansions to make the investments usable over the long term. With AMIS, not only are your investments in terminal devices protected in the future, but hardware and software components in the entire system are designed today for future expansions.

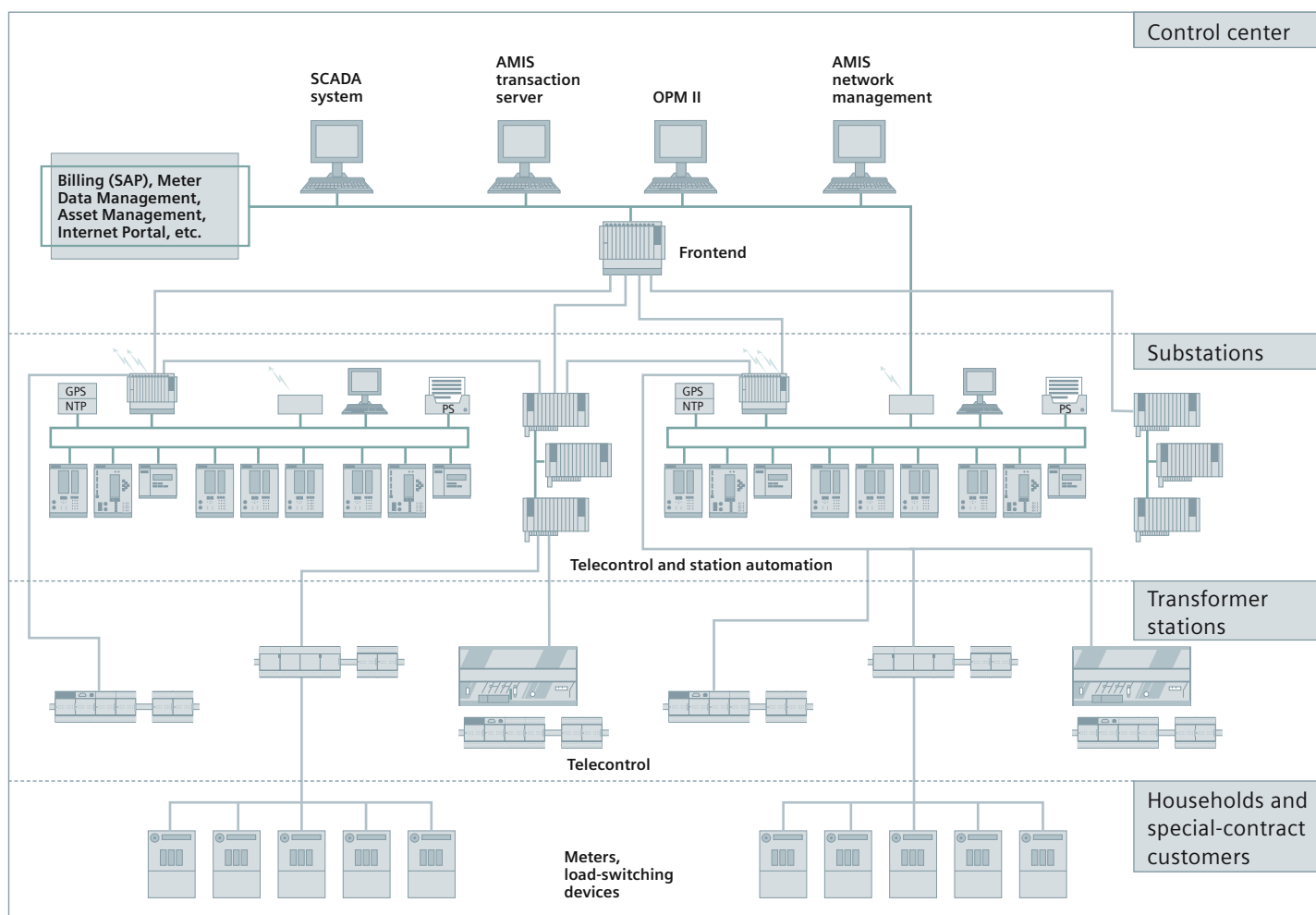
Synergies for success

If the environmental conditions for distribution network operators continue to change so rapidly, these changes are sure to affect the technical infrastructure and operating processes. As a result, issues such as "openness of systems for new demands and standards" and "total solutions for utilizing synergy effects" will take on a completely new meaning in the current discussion.

AMIS takes these factors into account through a modular expansion concept at every level of the system. Consequently, the meters with their interfaces for expansion modules represent an open communications platform over which both future home automation services as well as the integration of gas, water and district heating meters can be implemented. Furthermore, the DLC modem integrated in the terminal devices is realized entirely in the firmware, both with regard to the physical layer as well as the communication protocol. As a result, it can be simply adapted to future communications standards by means of firmware downloads.

Via an expansion interface, the AMIS data concentrators in the transformer stations can also be retrofitted for the telecontrol and automation functionality required today and in the future by means of corresponding expansion modules. Beginning at the substation level, the comprehensive flexibility of the SICAM 1703 product family is available. With its proven evolutionary development concept, it is designed to both accommodate the demands of the future and ensure compatibility with the past.

The special software design of the AMIS transaction server ensures a cost-effective expansion option with additional interfaces to higher-level IT systems. You can completely test these expansions with minimum effort.



Control center: IEC 60870-5-104, IEC 60870-5-101, more than 160 third-party protocols

Substations: IEC 60870-5-104, IEC 60870-5-101, IEC 61850, IEC 61334, IEC 62056, NSC, more than 160 third-party protocols

Transformer stations: IEC 60870-5-104, IEC 60870-5-101, NSC, third-party protocols

Households and special-contract customers: EN 50065, NSC, IEC 61334 and IEC 62056 possible

Integrated complete solution by Siemens

Our response to dynamic markets

As demands on network operation management change dynamically and the pressure on investments and operating costs grows, you need a complete solution that combines automation, telecontrol, ripple control and consumption data acquisition efficiently and with optimized technology. AMIS expands the total package of automation solutions into a complete solution which is the basis for future smart grid solutions.

The advantages of uniform system technology for the entire network operation management system are clear:

- Minimized training and engineering costs
- Consistent, end-to-end IEC communications concept
- Minimum time and effort for stockkeeping spare parts and logistics
- Reliable operation management
- The certainty that your system is equipped for future changes and expansions

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