Anti-Tamper Solution

Metering

System & Integration

HEXING

Foreword

Most utilities around the world lose their revenue due to Aggregate Technical, Commercial and Collection (ATC&C) losses. It is the main reason for revenue leakage in utilities that by nature should earn enough money to invest on their networks and increases quality of their services to their clients. The reality is that most of these losses are avoidable.

Hexing developed a solution to remove avoidable parts of these leakage points and increase utilities revenue. This solution includes the entire required systems and products those also tailor made to current situation of utility. The proposed solution can reduce (if not completely eliminate) tampering and theft, eliminate collection loss in LV distribution network.

Hexing has already proved herself as a leader in smart prepayment domain in developing countries. Hexing is one of rare companies those have enough technical and financial resources to provide tailor made solutions according to exact requirements of clients.

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Proposed Solution

Hexing integrated AMI (Smart Metering) systems into prepayment platform and added state-of-the-art designed anti-tamper meters to it. This platform is enriched by more than two decades of International experience of Hexing in metering industry including in smart metering and prepayment domains. To offer total solution for loss reduction and detection (so prevention) tampers, Hexing also offers transformer-monitoring units; these devices are integrated metering, monitoring and concentrator units those can be used as main meters of transformer as well as concentrators for collecting data of all meters installed under their transformers.

Hexing AMI is a super system that is developed to provide necessary tools to utilities to help them managing their consumers' demand, behavior and improving their very own processes. AMI system comprises IT infrastructure, application software, communication modules, meters and consumer side devices. Hexing AMI is used to measure electrical parameters, collect data in one point, and analyze consumers' data and finally generate meaningful and reasonable reports and graphs. Implementing AMI is considered as an important step toward realizing smart grid.

From the other hand, prepayment system provides necessary tools and facilities for cash collection prior to energy consumption, so using prepayment system helps utilities to eliminate cash collection problems.

Integrating AMI system into prepayment platform creates more benefit for utilities to decrease their losses. BY using this system collection loss is eliminate through prepayment functionality and tampering and theft losses are decreased through AMI functionalities.

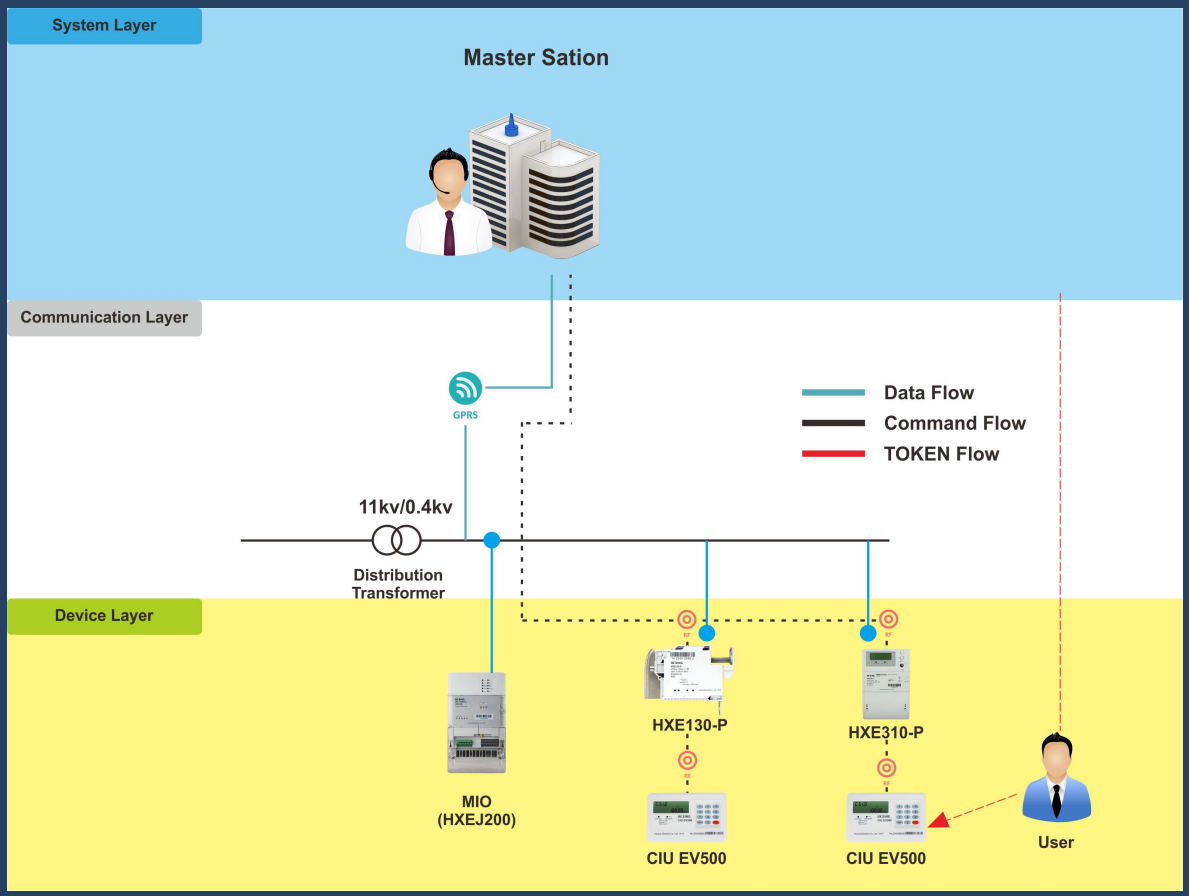
As it is demonstrated in opposite page picture, in Hexing's proposed solution, anti-tamper single & three phase meters are communicating with CIU (Customer Interface Unit). CIU is small display that is installed at customer side and usually inside home; it has 2-way communication with meter and can display consumption parameters on its display, also customer can enter tokens using it.

Smart meters also communicate with MIOs (special data concentrators usually installed at the secondary side of distribution transformers) through PLC or RF and send metered parameters to them.

MIO is an all in one multi-function device, which acts as data concentrator also has a full function C&I meter inside. This meter can be used for transformer metering.

MIO communicates with master station via GPRS/3G or Ethernet networks. It is also equipped with RS232 port for in site maintenance.

Solution Highlights



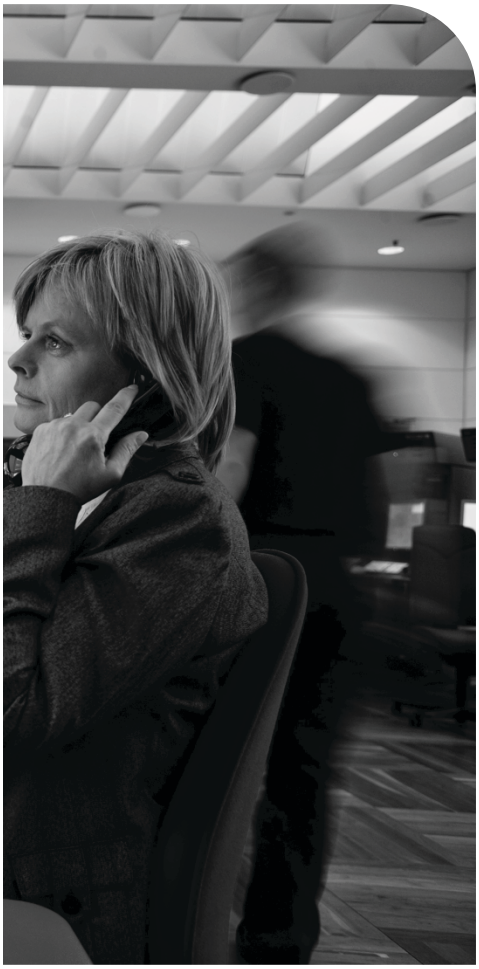
Highlights

The main goal of Hexing loss reduction solution is providing a set of comprehensive tools and interfaces to network operator to detect and block theft and tamper points in a smart and easy way, so operator can locate and calculate loss values per geographical location.

Solution Highlights

- Future proof technology:
  - Modular design which can ensure functional flexibility and fully meeting utility's present and future requirements;
  - Fully web-based user interface with user-friendly and cross-browser compatibility;
- Adopts and scales up from pilot to small scale projects to large scale applications;
- Integrates with third party systems via CIM based or ad-hoc interfaces;
- Security:
  - Multi-factor authentication;
  - Access control;
  - Security audit;
  - SSL (Secure Sockets Layer) secure connection;
  - AES/DES and RSA encryption;

Functional Specification



- Ultimately tamper-proof design:
  - Revolutionary out-of-reach design of single-phase meter with direct installation on over-head line;
  - Rich set of anti-tamper sensors those make meter able to detect and report any tamper situation;
- Enhanced automatic data collection:
  - Scheduled/on-demand data collection;
  - Scheduled missing data re-reading;
  - Automatic missing data re-reading when meter/terminal goes online;
  - Local data collection via HHU;
  - Data push to master station (only for GPRS/3G meter through DLSM/COSEM protocol);
- Head-end
  - Multi communication methods: Ethernet; GPRS, 3G, Fiber Optic, PLC, RF, RS485 and etc.;
  - Multi communication protocol: DLMS/COSEM, Q/GDW 376.1 and etc.;
- Device Management
  - Built-in device library;
  - Possibility to add new devices;
- Smart Operation:
  - Enhanced bulk operation;
  - Alarm & event subscription;
  - Communication diagnostic;
- Analysis:
  - Energy loss analysis;
  - Outage analysis;
  - Tamper detection and analysis;
  - Low power factor analysis
  - Abnormal consumption analysis;

Hexing New RF Technology

Hexing new RF technology is a micro power wireless communication system, which is developed independently by Hexing. It is designed based to form Personal Area Networks (PAN). It complies with all related international standards such as IEE802-15-4. Main features of this system are Auto Network Registering, Automatic Routing, Self-Healing, Long Distance Penetration, Low Power Consumption and Robust Communication. It is suitable for electricity, water and gas smart metering systems.

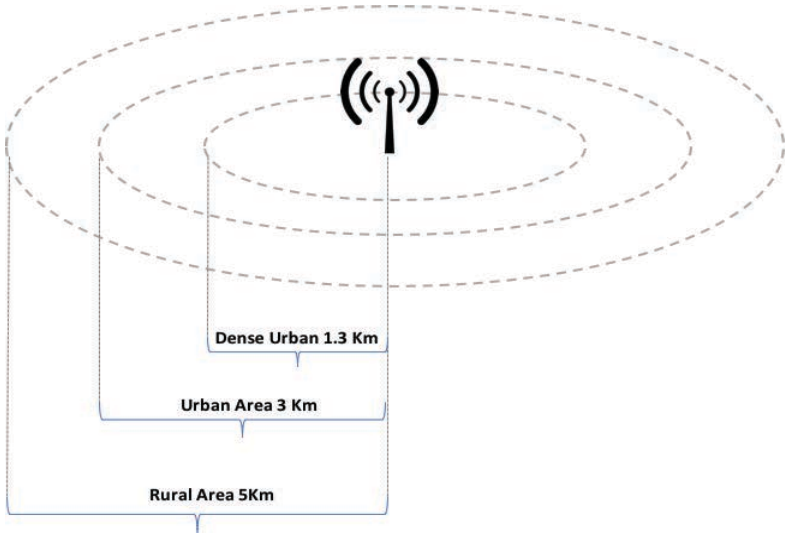
Technical Features

- Auto Networking: No operator configuration is needed;
- High Data Throughput:
  - Up link throughput of up to 22 Mb/day;
  - Down link throughput of up to 18 Mb/day;
- Time-slot Division Multiplexing: Timeslot competitive mechanism enabled, collision avoided, networking efficiency improved;
- High Link Budget[1];

Comparison of Hexing RF and Similar Competitive RF Technologies

Factors	Hexing Technology	Competitive RF Technology
Sensitivity	-135 dBm	-105 dBm
Transmit Power	+20 dBm	+20 dBm
Antenna Gain	+5dBi	+5dBi
Link Budget	+160 dBi	+130 dBi

- Long Penetration Depth: 1.3Km in dense urban area, and 5Km in rural area;

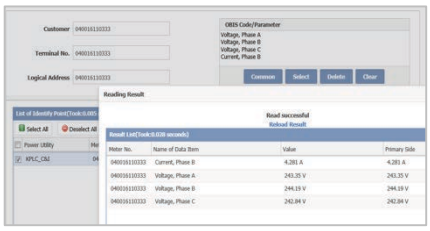


[1] Link budget is a measure of wireless network links indicating how much they can penetrate [beyond obstacles].

Main Functionalities

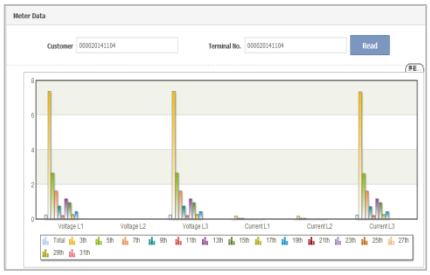
Scheduled and On Demand Reading

System supports both on demand and scheduled collection (reading) of metered data items at configurable time intervals. Detail information of consumption is collected and recorded in the system. It is convenient for operator to browse desired list of data items and related reports and graphs.



Power Quality

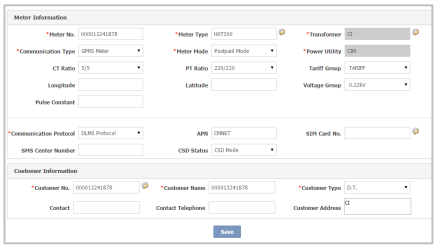
Power quality parameters for all three phases (harmonics, sag, swell and PF) are collected and monitored by the system.



Asset Management

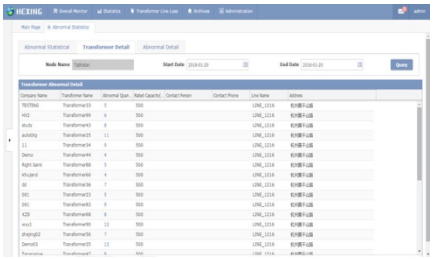
Flexible asset management sub-system covering all metering related devices and equipment:

- Rich built-in device library;
- Mapping devices to complex grid structures;
- Meter life time management;
- Terminal life time management: data concentrator and data collector;
- SIM card management;
- Archives import/export from/to Excel or CSV files;
- Archive statistics and reports;



Load Control

According to policies of utility, system administrator can configure load control mechanism of the system. Load control function can be done automatically or manually. In automatic mode, meter disconnects customer from the grid when his/her consumption exceeds pre-configured limit while in manual mode, just the excess event is reported to master station and network operator can make decision for possible disconnection.



GIS

On master station, based on Google map / open street map, smart meters locations and status are displayed on the map. By using GIS, it is more convenient for operators to manage the grid. Each meter is displayed on GIS map as an icon while different colors represent different status.

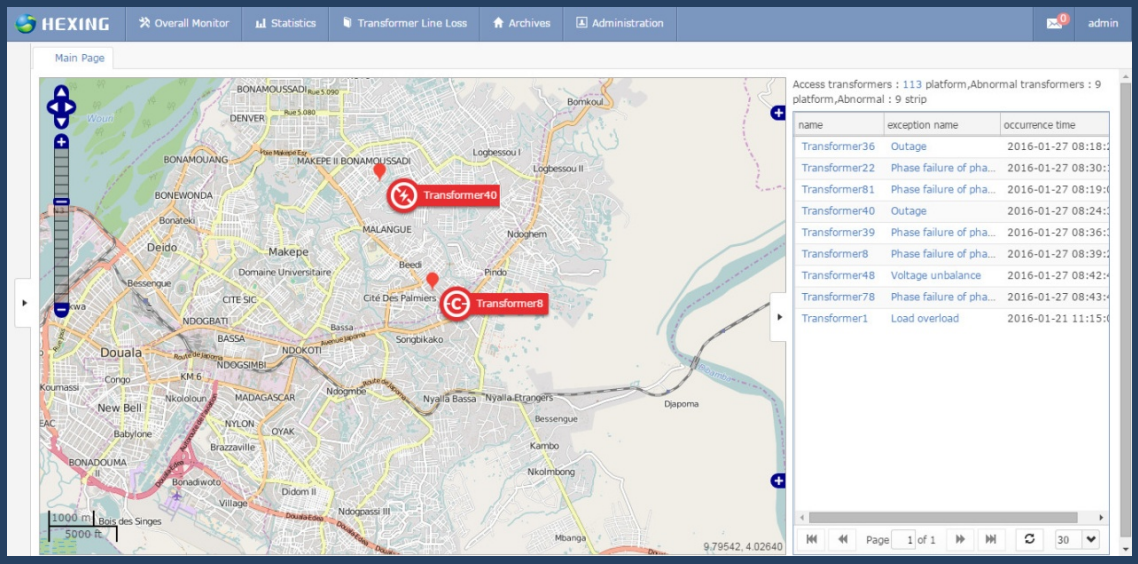


Figure 1, GIS Home Page, showing the entire devices and their status

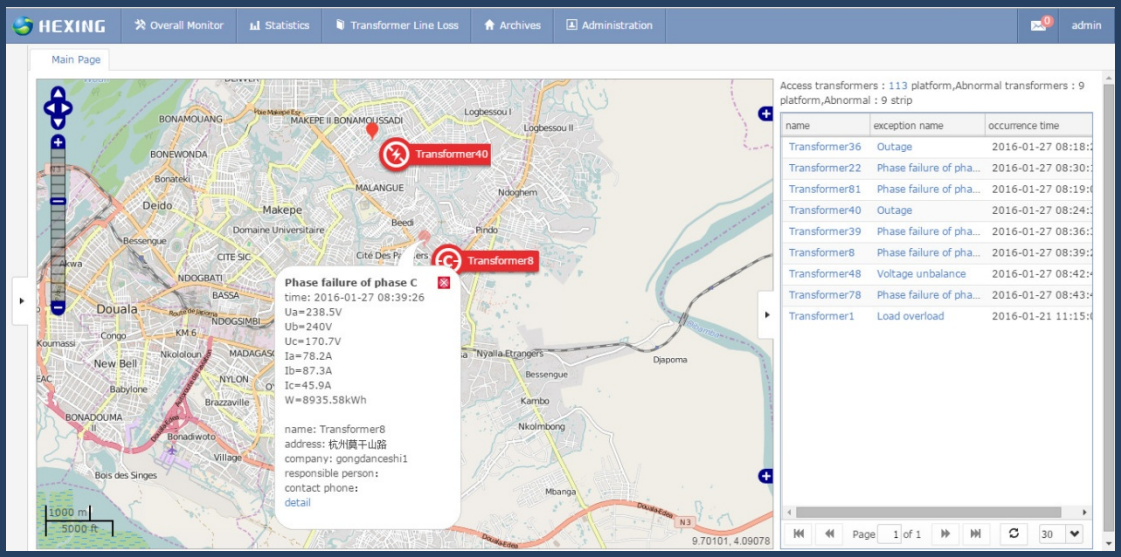


Figure 2, by clicking on each device all related data appears

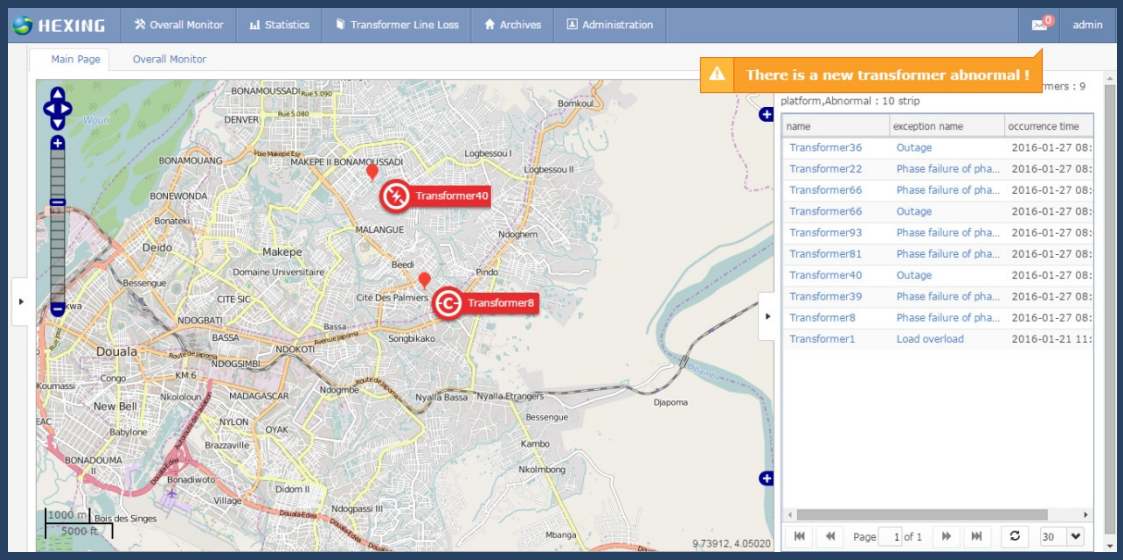


Figure 3, In case of any abnormal event, the message appears on top of the window

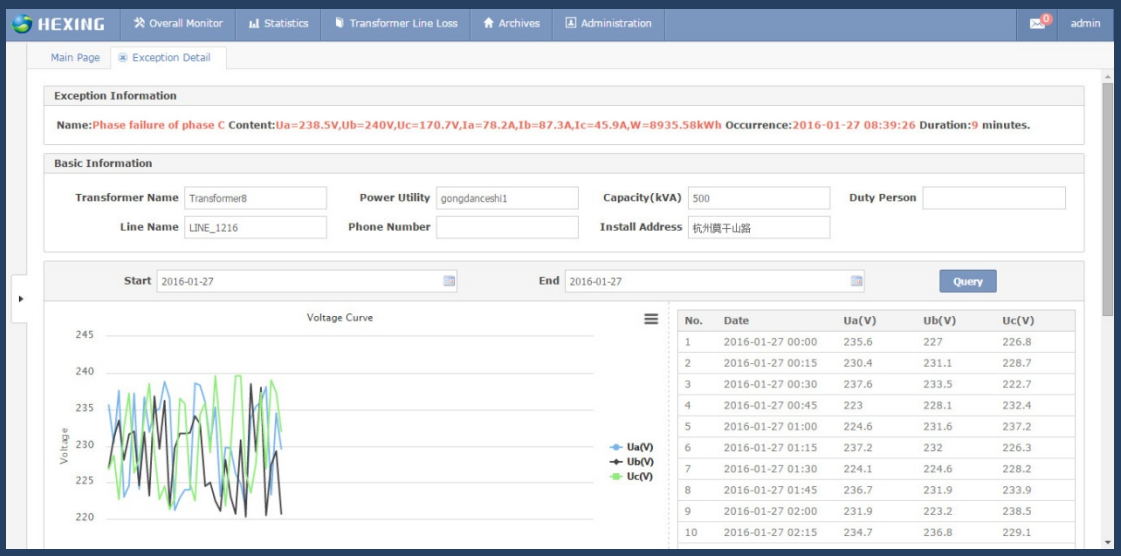


Figure 4, by clicking on each event operator can see detailed information about it

Alarm Statistics and Notification

System provides flexible way for administrator to configure alarms and events so the system can be easily adapted to different applications/scenarios. Alarms/events can be sorted by different parameters like load level, power quality and type of abnormality. Priority of events/alarms can be set as high, medium and low. System notifies responsible operators by SMS and/or email about happening of events/alarms.

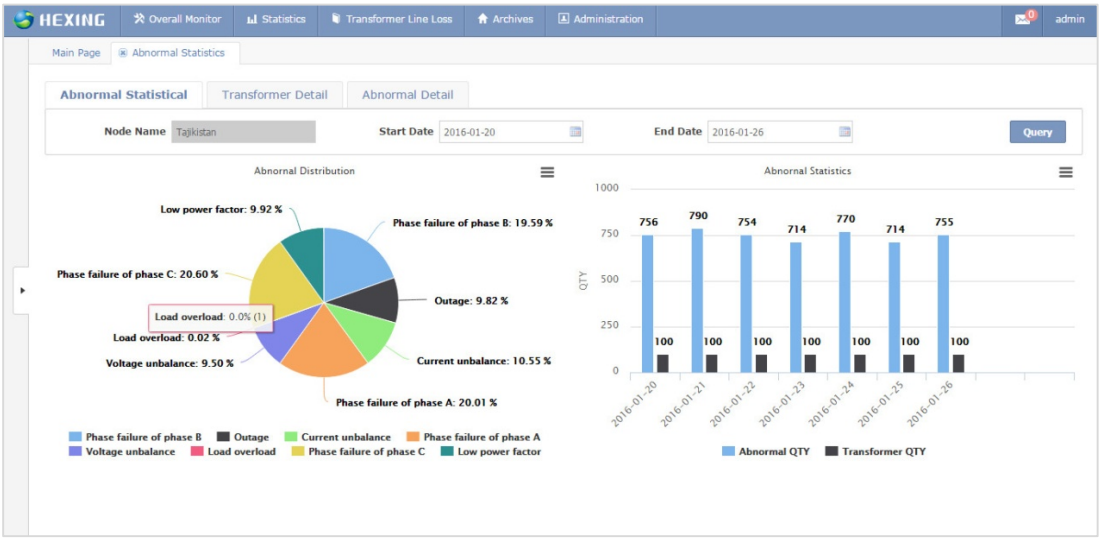
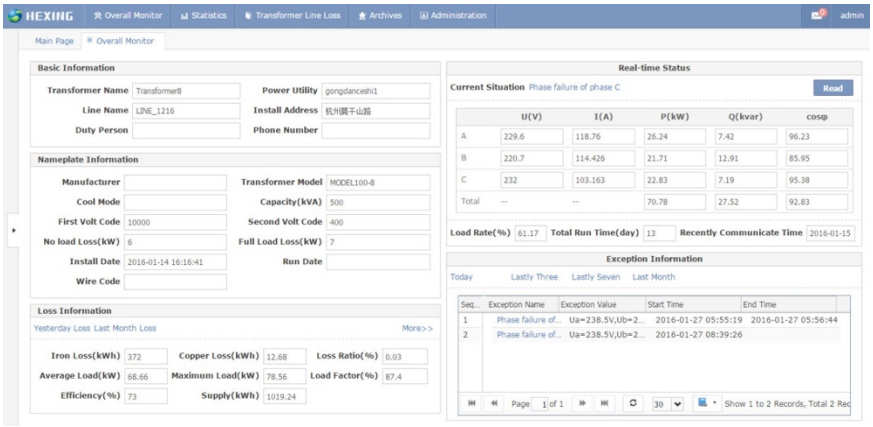


Figure 5, System Abnormal Monitoring Dashboard

Transformer Monitoring

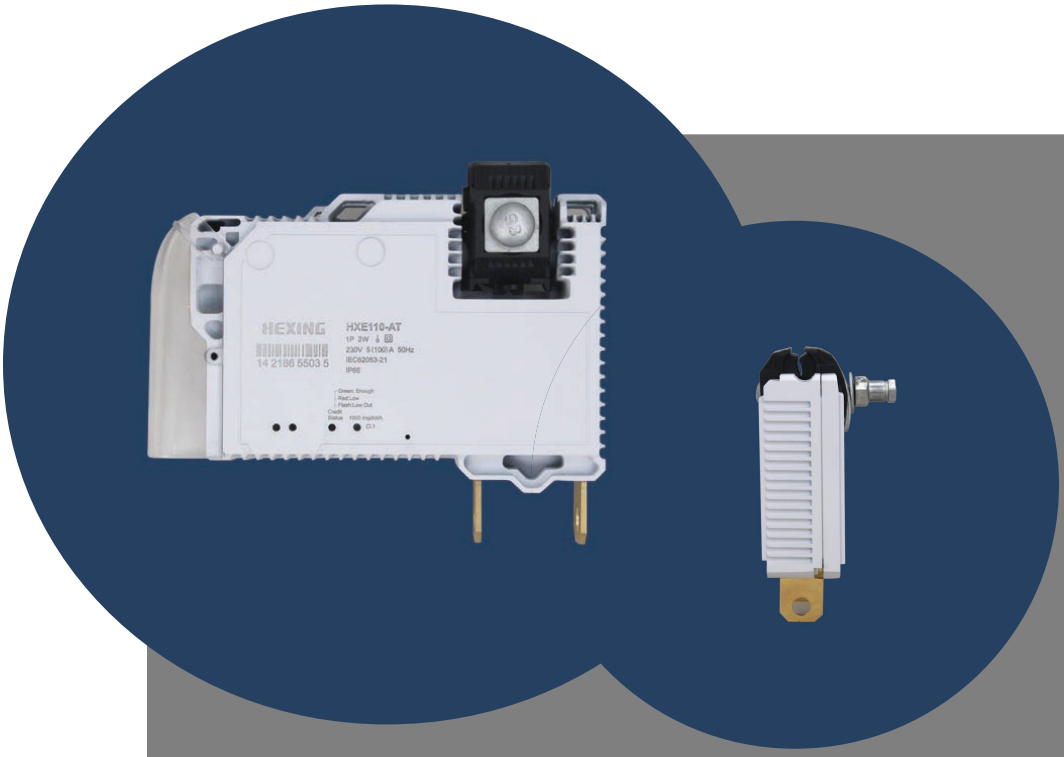
Operator can see status of transformer in this page, including:

- Transformer static information (as appear on name plate),
- Electrical parameters like voltage, current, power factor and actual power
- Loss information
- Events and alarms



Meters and Terminals

Hexing loss reduction solution relies on function of accurate, trustable, reliable and robust metering devices, which communicate with CIUs (Customer Interface Units) from one side and MIOs (special concentrators) from the other side.



HXE130-P the Ultimate Tamper-Proof Smart Prepayment Meter

HXE130-P; Single Phase Smart Prepaid Meter

HXE130-P is a single-phase two-wire residential anti-tamper split prepayment meter that is directly installed on self-supporting cable. It complies with STS standard; hence, it is supported by Hexing and third party vending systems. With RF communication, this meters communicates with CIU (downlink) and MIO/DCU (uplink).

Highlights

- Support of STS standard protocol ensures open and secure operation;
- Support of DLMS/COSEM protocol guarantees interoperability;
- Split type design, with high tamper-proof performance;
- Direct installation on power line, prevents meter's manipulation by users
- Easy and fast installation;
- High Ingress Protection (IP65), suitable for outdoor installation even in bad weather;
- Working ability both in prepayment and post-payment modes (switchable)
- RF communication with CIU;
- Ultrasonic welding of casing;

CIU: EV500

CIU EV500 is a customer interface unit with keypad for credit charging. It communicates with smart meters through RF. EV500 can be used to display metered parameters as well as entering tokens.

HXE310-P; Three Phase Smart Prepaid Meter

HXE310-P is a three-phase direct connected prepaid meter. It complies with STS standard and communicates with CIU through M-bus or RF port/channel.

Highlights

- Support of STS standard protocol ensures open and secure operation;
- Support of DLMS/COSEM protocol guarantees interoperability;
- Internal relay for load control; can be managed by internal logic of meter also by remote command;
- Working ability both in prepayment and post-payment modes (switchable)

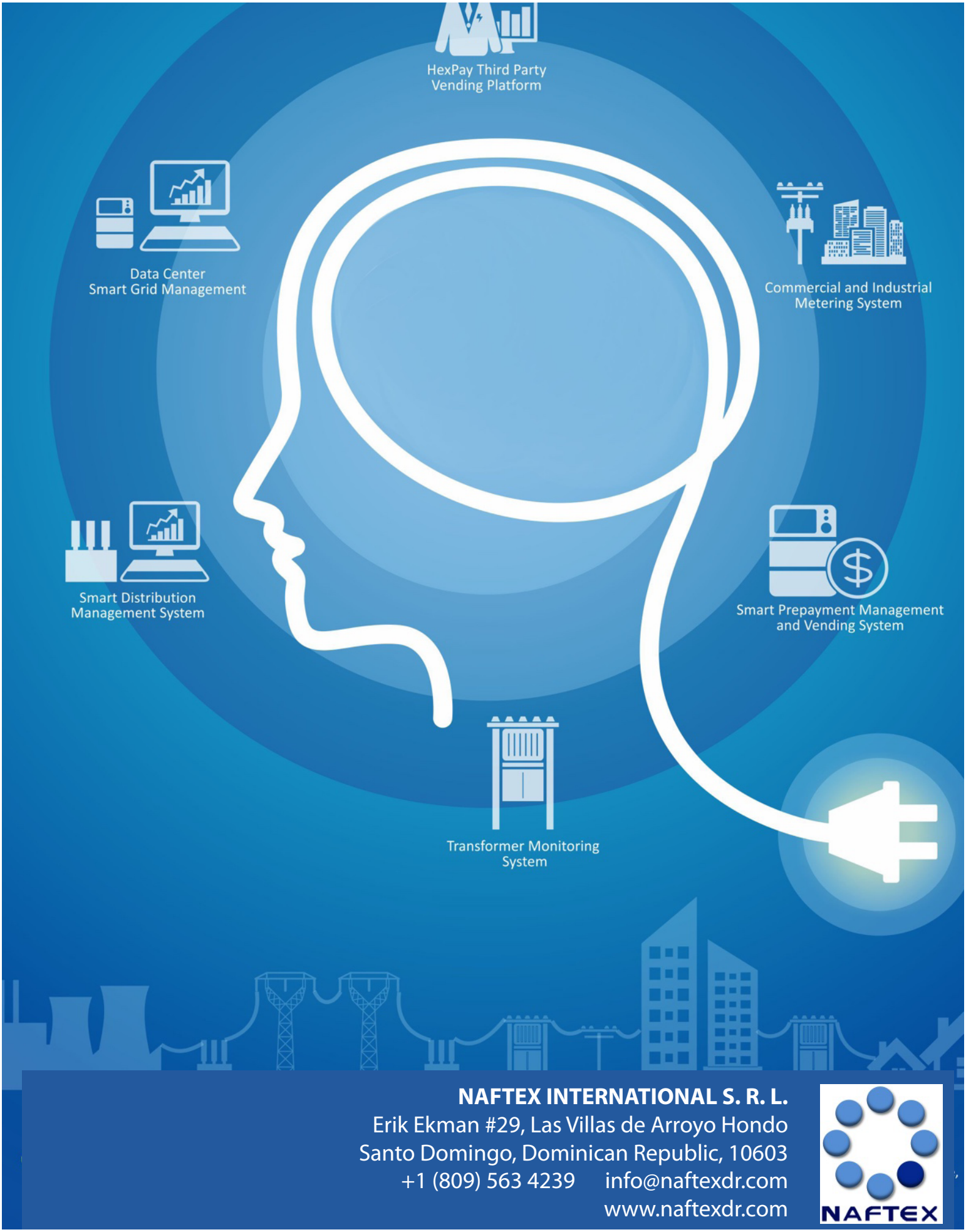
MIO: HXEJ200

HXEJ200 is an intelligent all-in-one unit, which plays critical role in loss reduction solution. It has a sophisticated design to preform multiple tasks in real time. It acts as a high accuracy three-phase smart meter and at the same time, it plays role of a data concentrator.

HXEJ200 can use different communication media to communicate with master station (up-Link) such as GPRS / Ethernet. For downlink communication, it can use PLC / ZigBee / RF and RS485. In addition, it is equipped with RS232 port for local maintenance.

Main Functionalities

- **Data concentrator functions**
  - Scheduled and on-demand collection of the entire information of meters;
  - Storage of collected information from meters and sending them to master station on configurable time schedule;
  - Managing meter inventory;
  - Monitoring and reporting events of meters;
  - Providing transparent link between master station and meters;
- **Metering functions**
  - Measuring and storing all energy parameters like active energy and reactive energy (for each phase, each quarter and in total);
  - Measuring and storing all electrical parameters like voltage, current, power, power factor;
  - Measuring and storing harmonic component;
- **Power quality monitoring function**
  - monitoring voltage quality (sag, swell);
  - monitoring phase unbalance;
  - monitoring power factor;
  - monitoring harmonics and THD;
  - monitoring power outages;



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