Hexing Distribution Network Management Solution

HEXING

Foreword

Decades ago in the distribution industry, troubleshooting was done in simple way: waiting till events happen and then deploying teams to field and fixing the problem manually; in this age most of switch overs and changes in grid topology were done manually.

By increasing number of customers from one side and developing modern technologies from the other side, utilities started increasing quality of their services by using outage management and plenty of similar systems. Although by using these systems utilities reached to fair level of automation but most of these systems are developed for traditional distribution networks and based on related concepts.

As a headache free solution, Hexing offers a modern and integrated distribution network management platform. This platform not only fits in any traditional and modern distribution network but also fulfills a wide range of classic requirements as well as requirements raised in recent years.

Solution Overview

Hexing distribution management system is a new generation system based on more than twenty years of development and field operation experiences. This system is suitable for traditional grids as well as smart grids and hybrid networks, which are combination of smart grids and traditional ones. This system comprises multiple real-time subsystems, which offer functionalities like: dispatcher operation and management, data acquisition and control, state monitoring, fault identification, fault diagnosis, quick fault locating, fault isolation and power supply restoration for non-faulty area.

Solution Highlights:

Real-time Monitoring

One of the most important functionalities of this system is providing read-time monitoring ability to network operator. By providing network snapshots in different visual formats and giving operator option to customize the view, this tools radically helps utilities to control their distribution network.

Other important functionalities of the system are:

Network Outage Management

- Automatic fault detection;
- Automatic isolating faulty section of the network and disconnecting it from the grid;
- Minimizing outage area in case of events;

MV and LV Network Analysis

- Running analysis on events and parameters:
  - Three phase unbalance;
  - Harmonics;
  - Power factor;
  - Potential fault causes and places;

Distribution Network Optimizer

- Network reconfiguration;
- Feeder management;
- System restoration;
- Volt/VAR optimization;
- Load flow analyzing;
- Network planning management;

Switching Management

- Switching order management;
- Planned outage management;
- Network isolation management;

Network Operation Archiving

- Historical events and alarms;
- Historical operation reports;
- Outage reports;
- Historical load and demand;

Network Simulator

Hexing SDMS also provides comprehensive and intelligent tool for training operators and dispatchers.

System Specification

Heart of the "distribution network management system" is located in master station in utility office where several pieces of software are in operation. Communication backbone in master station is a data bus based on CIM standard complying with IEC61968 and IEC61970 standards, so all software sub-systems are connected to this bus and exchange data through this interface. This makes the system extremely interoperable and opens the system to third party software products to connect to bus and either receive information or inject data into it. Subsystems of the "distribution network management system" are SCADA subsystem, DPAS analysis subsystem, network expert warning subsystem, dispatcher simulation subsystem and distribution loss analysis subsystem. Some important components of the system can be listed as network SLD (Single Line Diagram) drawing tool, asset management, device management module, fault identification, fault diagnosis, fault locating, fault isolation and fault restoration for non-faulty area components. No doubt, this software is developed for distribution networks where the voltage level is considered below 35 KV.

Main Features:

- Message bus is based on IEC 61968 CIS interface. Information exchange mechanism is complying IEC 61970 CIM/IEC 61968 CIS.
- Rich support of SCADA and automation protocols including IEC60870-5-101, IEC60870-5-103, IEC60870-5-104, IEC60870-6-TASE.2, IEC61850, DNP3, SC1801, CDT and Modbus.
- All protocols are implemented in protocol library; it makes the system extension easy.

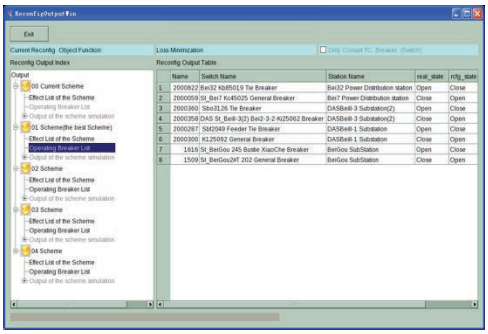
Main Features:

- Fast processing of fault messages so faults can be identified, located hence diagnosed and power supply can be restored for the non-faulty areas in shortest possible time.
- System supports distributed and hierarchical topology which means RTUs and telecommunication devices may communicate with master station directly or via other RTUs (hierarchical topology)
- SLD (Single Line Diagram) of the grid can be drawn by system administrator and then imported by the system. The software is enriched by components library that makes the design job as easy and as fast as possible.
- System has an advanced and reliable fault locating and fault processing function.
- Real-time information can be provided through WEB interface.
- System is truly platform independent. UNIX, LINUX, and WINDOWS are supported.
- Oracle, MySQL, Sybase and DB2 commercial database are supported.
- Popular telecommunication channels/media are supported.

Functionalities

Data Acquisition and Processing

Different type of data items are regularly and automatically collected from transducers and measurement devices. Most popular data items are active power, reactive power, voltage, current, oil temperature of transformer, state of circuit breaker and circuit isolator, OLTC tap step position, alarm signals and protection tripping signals. These data items are collected from different devices and from different locations and all are subjected to different kind of processing. Users may dig into raw data; also, they may see results of different kind of analysis and processing.



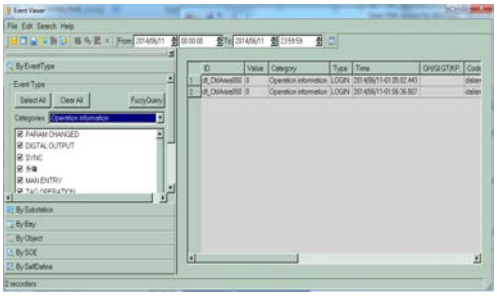
Supervisory Control Function

The systems lets operator to issue supervisory commands like opening and closing switches, adjustment of transformer taps, bringing compensation capacitor into operation or disconnecting them from the network. Command can be directly executed or can be issued and then executed in a 2-step procedure for added security.

Once commands are issued, they are sent to appropriate RTU/FTU/DTU/TTU units using preset SCADA protocol. The protocol is loaded from the protocol library.

Events and Alarms

Once any abnormality is sensed on the field by transducers or measurement devices, an alarm is generated and sent to master station. In the master station, because of severity of processing events and alarms, they are processes in out of order manner. Once events are received by master station, they can be monitored and the system can send SMS or audio alarm messages to predefined users. SOE (Sequence of Events) is preserved carefully in the whole system.



Feeder Automation:

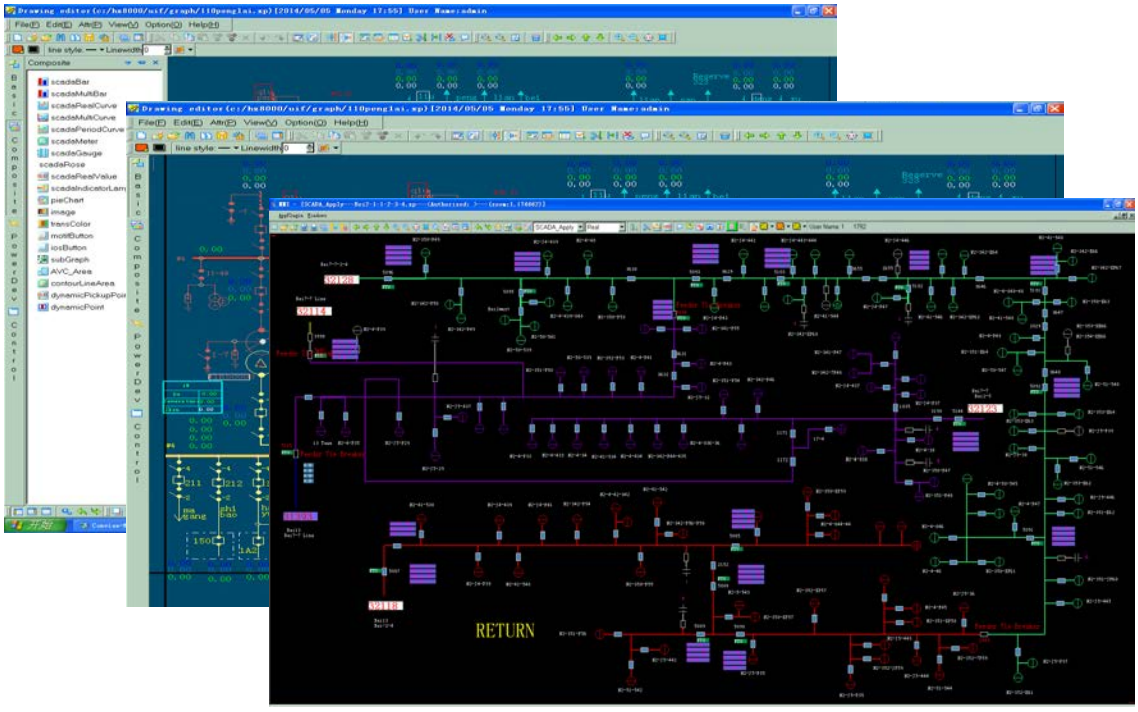
System is able to automatically diagnose and locate feeder faults, and then automatically or manually isolate faulty area. Based on its smart attitude the most optimized “power supply restoration scheme” is selected by the system due to output of different analysis.

Time Synchronization:

Clock of master station can be automatically adjusted by very accurate GPS clock or can be manually set by system operator. Once it is set, the system can synchronize time of other terminal units like RTUs, FTUs, DTUs and TTUs and these units may set time of other devices under them.

Communication:

The system can comprise up to 200,000 FTU/DTU/TTU units and this number of terminal units can be connected to only one master station. Communication with terminal units is a two-way communication: data can be collected from them and commands can be sent to them. Data here refers to both electrical and non-electrical parameters as well as to events and alarm signals.



Ring Network Switchgear

XGN-12 is modern switchgear unit that is designed for MV grids. This unit is suitable both for radial and ring networks. The entire live parts inside the switchgear are insulated and sealed inside an injection molded APG epoxy resin shell while the casing is metal-made. Insulation of bas bar and other live parts bring up several advantages including long lifetime of the unit and extra safety against electrical shock. This property makes the unit suitable to be operated in maintenance free and harsh environments like subway substations, distribution substations, big factory substations and substation of residential and commercial complexes.

No components of this unit are using SF_6 gas, so there is no risk of gas leakage problem, which makes the unit a real maintenance free device.

Technical Features

Environmental Friendly and Green Technology

- XGN-12 is complete environmental friendly product, using of modern material for solid insulation and other environmental considerations in this unit makes it a green product.

Vacuum Breaker

- Main circuit breaker is vacuum type breaker, which is newest in technology.

Fully Sealed, Fully Insulated

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Flexibility in Installation

- XGN-12 cabinets can be installed separately or can be attached to each other. Power cables can be attached to unit from both sides as well as from back or bottom.

Easy and Quick Monitoring

- XGN-12 has a big front panel equipped with multiple analogue and digital indicators as well as alarm signal lamps, so operator can monitor status of the unit in an easy way and in a quick way.

Fool Proof Operation

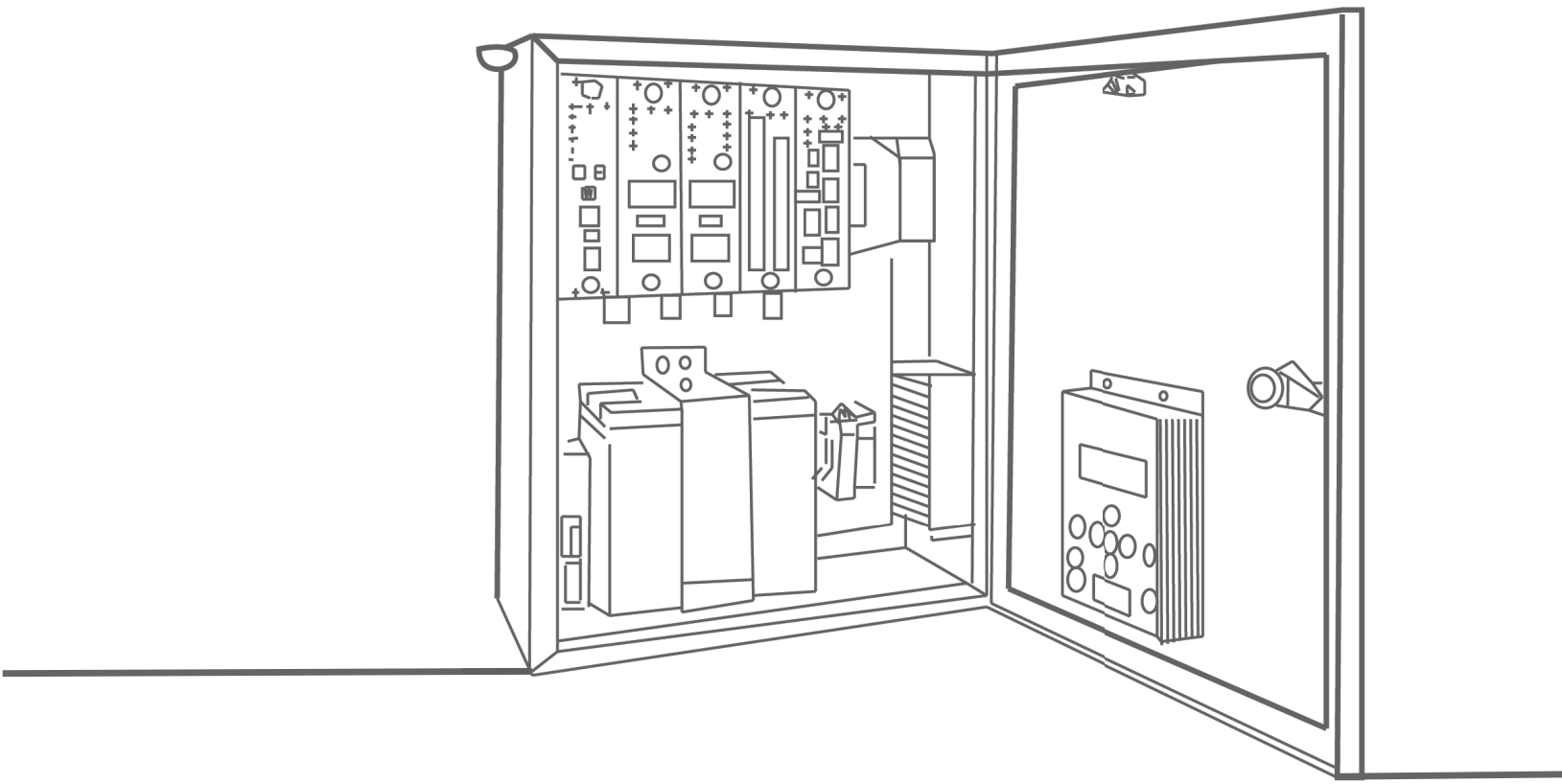
- The unit is equipped by mechanical interlocking system, so it does not let operator to issue wrong commands. This interlocking system guarantees safe and reliable operation of the system even in case of committing mistakes by the operator.

Automatic and Manual Operation

- XGN-12 unit can be operated manually or automatically, so for example the circuit breaker can be connected and disconnected manually by pushing a mechanical handle or automatically just by pushing a small button on the panel. System also accepts remote commands from master station for connection/disconnection or other operations. For added security, remote mode can be locally disabled.

Automation Equipment

Hexing is offering a full range of automation products; design of any of them is modular, so utilities can implement their desired scenarios by choosing the most suitable products and then configure them to fit to their desired scenarios/designs.

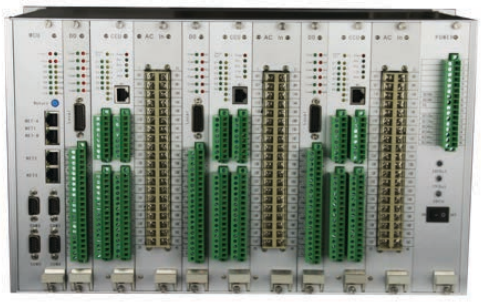


Feeder and Distribution Terminal Units

HX8651 and HX8600F series of terminal units are mainly designed for monitoring and control of MV distribution feeders. Their main functions are real-time data acquisition, line fault processing and feeder control. It can match up with "distribution automation master station system" also with slave station system to realize multi-line data acquisition, monitoring and control. Fault identification, fault diagnosis, fault locating, fault isolation and power supply restoration for non-faulty areas are other functionalities of this unit.

Main Features

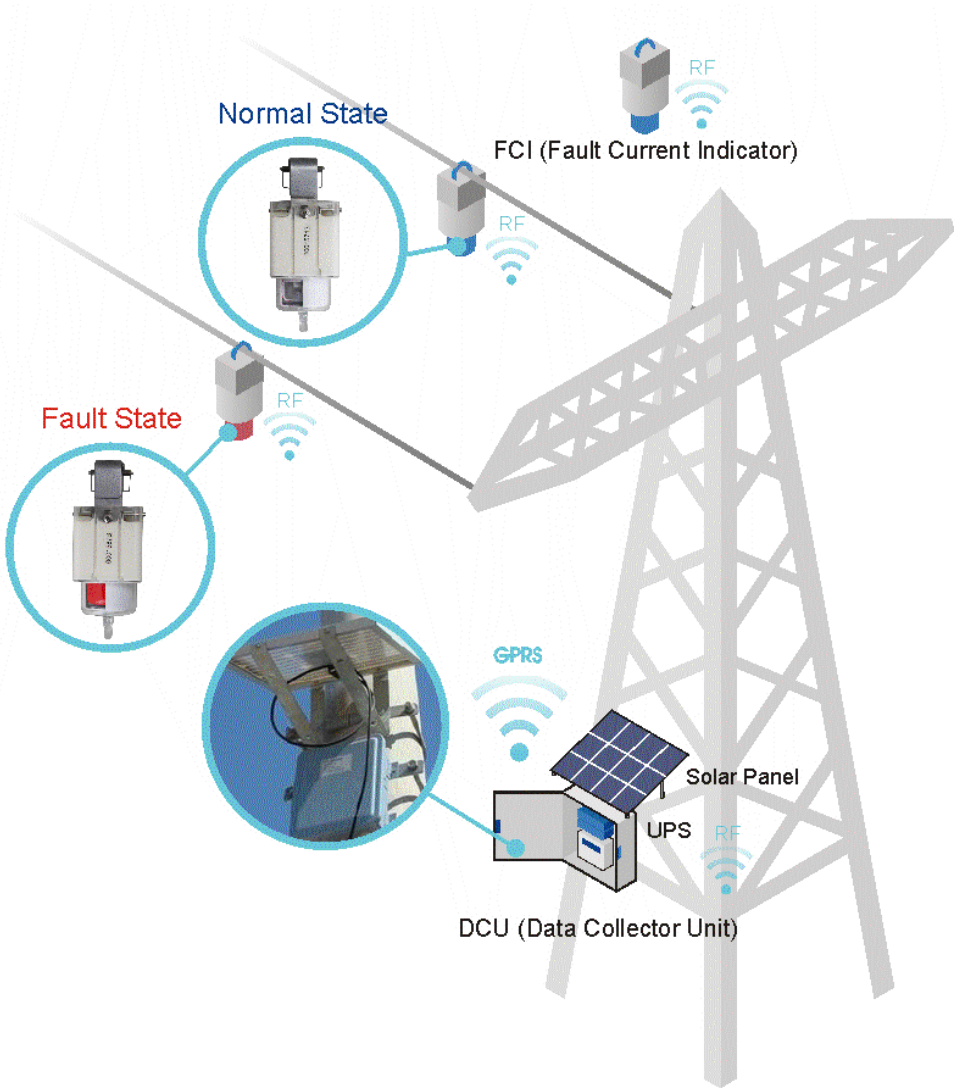
- The unit is capable of real-time monitor and data collection from digital and analog inputs as well as sending data and commands to both digital and analogue outputs.
- Both HX8651 and HX8600F units can quickly detect and record phase-to-phase short-circuits fault, single-phase earth fault and other commonly happening faults. Detected faults are also immediately reported to master station.
- The unit has a great capacity to save events and alarms considering SOE (Sequence of Events)
- Most popular supported protocols are IEC60870-5-101, IEC60870-5-104, DNP3.0 and IEC61850.



- The unit is equipped with these ports and telecommunication channels: RS485/RS232/RS422, Ethernet, GPRS and Bluetooth.
- For easy and quick maintenance and operation and the unit is equipped by a LCD display and bunch of keys. The LCD can display real-time data items, operational parameters and maintenance parameters.
- Like many other industrial class equipment, the device has a watchdog timer for self-recovery at any lockout situation.

Fault Current Indicator (FCI)

HXDT40 is small Circuit Fault Indicator (FCI) and reporting device. This device is easily mounted on overhead MV lines. FCI can detect two-phase and three-phase short circuit faults as well as single-phase earth fault. HXDT40 is used in conjunction with MV overhead line protection system; it transfers data to main unit through its internal short-range RF modem. In case the system is installed in rural area, it can be energized by an optional solar panel module.



HXDT 40-E has a same functionality as HXDT 40 but it uses for underground MV network. It is mounted on the three-phase cable The parameters of earth fault has two separate action zero-sequence current curves:

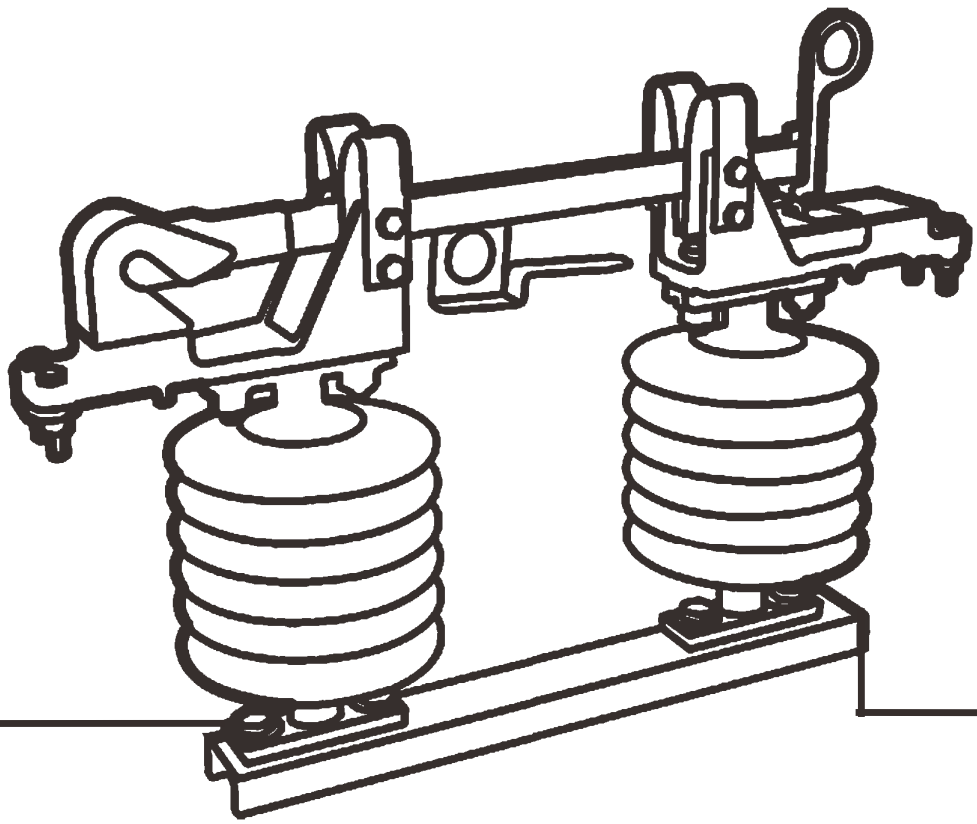
- fast curve;
- slow curve;

HXDT 40-E can monitor the changes of zero-sequence current and quick capture the first half-wave zero-sequence current for earth fault detecting. After earth fault occurs, it will flash three LEDs and send the alarm to collector immediately. In addition, HXDT40-E can monitor steady-state zero-sequence current, Transient zero-sequence current of the first half-wave and send these real-time data to collector spontaneously or at regular intervals.

At the same time, maintenance or operational team can use a USB interface's or wireless RF interface with local software to read the real-time data.

Outdoor Vacuum Circuit Breaker

Hexing provide best-in-class circuit breakers for both HV and MV networks. Range of products start from oil-operated breakers down to gas-isolated breakers and end up in vacuum C.B.s. The entire products can be ordered with pole mounting or structure mounting fittings.



ZW12-23/T

ZW12-23/T is outdoor vacuum circuit breaker designed for MV distribution networks with rated voltage of 11 KV up to 66 KV. ZW12-23/T is an on-load breaker, which can both connect and disconnect under rated load and by local or remote command of operator. This breaker is also equipped by internal CT, so in case of overloading or short-circuit events can act as protection device. In such cases, ZW12-23/T disconnects the circuit to protect the network.

Main Features

- Three-phase columnar-structure single-package product;
- Completely sealed structure;
- Vacuum type breaking mechanism brings best arc extinguishing when disconnecting under high loads;
- Reliable disconnecting and reconnecting, no risk of burning or blasting;
- The switchgear can be operated both locally (manually) and remotely throughout software systems;
- Operating mechanism is quite reliable and tested to connect/disconnect 10,000 times;
- In comparison to other similar products, this switchgear is both lighter and smaller in size;

ZW20-12/T

ZW20-12/T is pole mounted and SF_6 gas operated circuit breaker designed for distribution networks. Casing is designed using a technology from famous Japanese company of Toshiba. It is VSP5 gas sealed, and tested to be explosion-proof. Due to installation method, ZW20-12/T is designed in a way to occupy minimum space while operates in stable manner. Spring charging and operation mechanism is radically improved in comparison to similar products and designed to make operation of the unit more reliable.

FZW28-12F

FZW28-12F is outdoor vacuum circuit breaker designed for distribution networks. Its silicone rubber bushings provide sufficient isolation. This specially designed circuit breaker shows a great durability. It can disconnect the circuit up to 30 times under 25 KA short-circuit current.

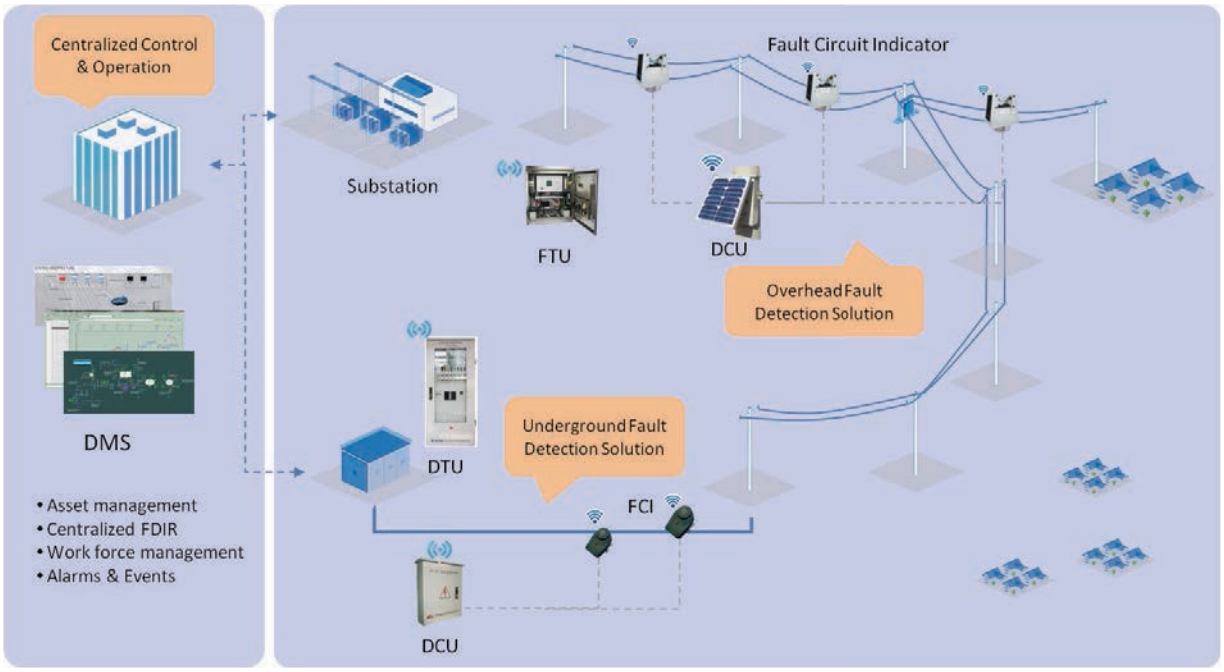
This circuit breaker can be operated both manually and remotely by a command from master station. Its local GPRS modem lets this switchgear to communicate with master station or any other software system hence the beaker can report its status; also it can receive commands and execute them.

Experiences and References

Hexing after long term working in electricity metering and protection industries, now has developed full portfolio of software and hardware systems to bring significant benefits to utilities all over the world. Our systems are under operation in multiple countries and counted as one of the world's best and most user-friendly systems in such a way to satisfy all utility requirements. Hexing systems are now under operation in ***South Africa***, ***Ghana***, ***Nigeria***, ***Senegal***, ***Iran***, ***Pakistan***, ***Jordan***, ***Tajikistan***, ***Dominican***, ***Panama***, ***Argentina***, ***Ecuador, Bangladesh*** and plenty of other countries.

Based on close collaboration with KE utility (Karachi Electric of Pakistan), Hexing successfully designed and implemented a DMS system for monitoring and controlling of feeders, substations and ring networks. Scope of the project was installation and commissioning of DMS central system and 387 units of FCIs (129 sets) for 89 overhead lines as well as 40 underground cables.

The project is started in 2014 and estimated be finished in 2016/6. The main driver for running this project was providing visibility on distribution feeders and substations as well as making the utility able to detect and locate faults in just several seconds. It makes outage duration shorter and brings labor costs down during remedy actions.



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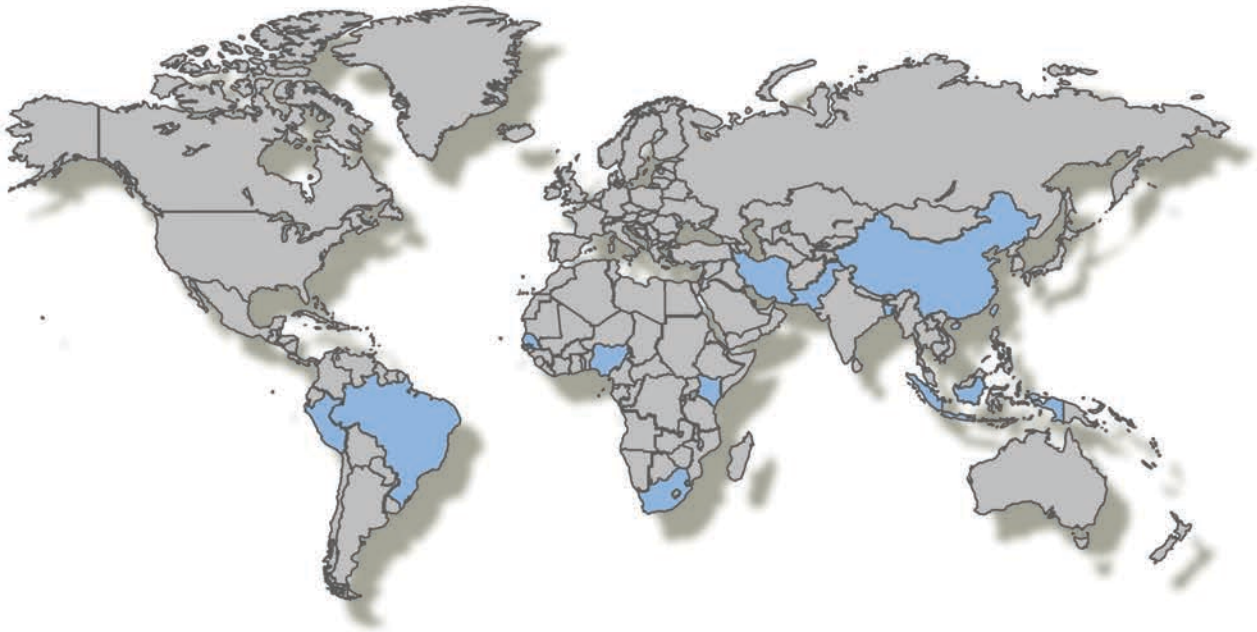

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East Africa
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South Africa
Johannesburg, South Africa

Middle East
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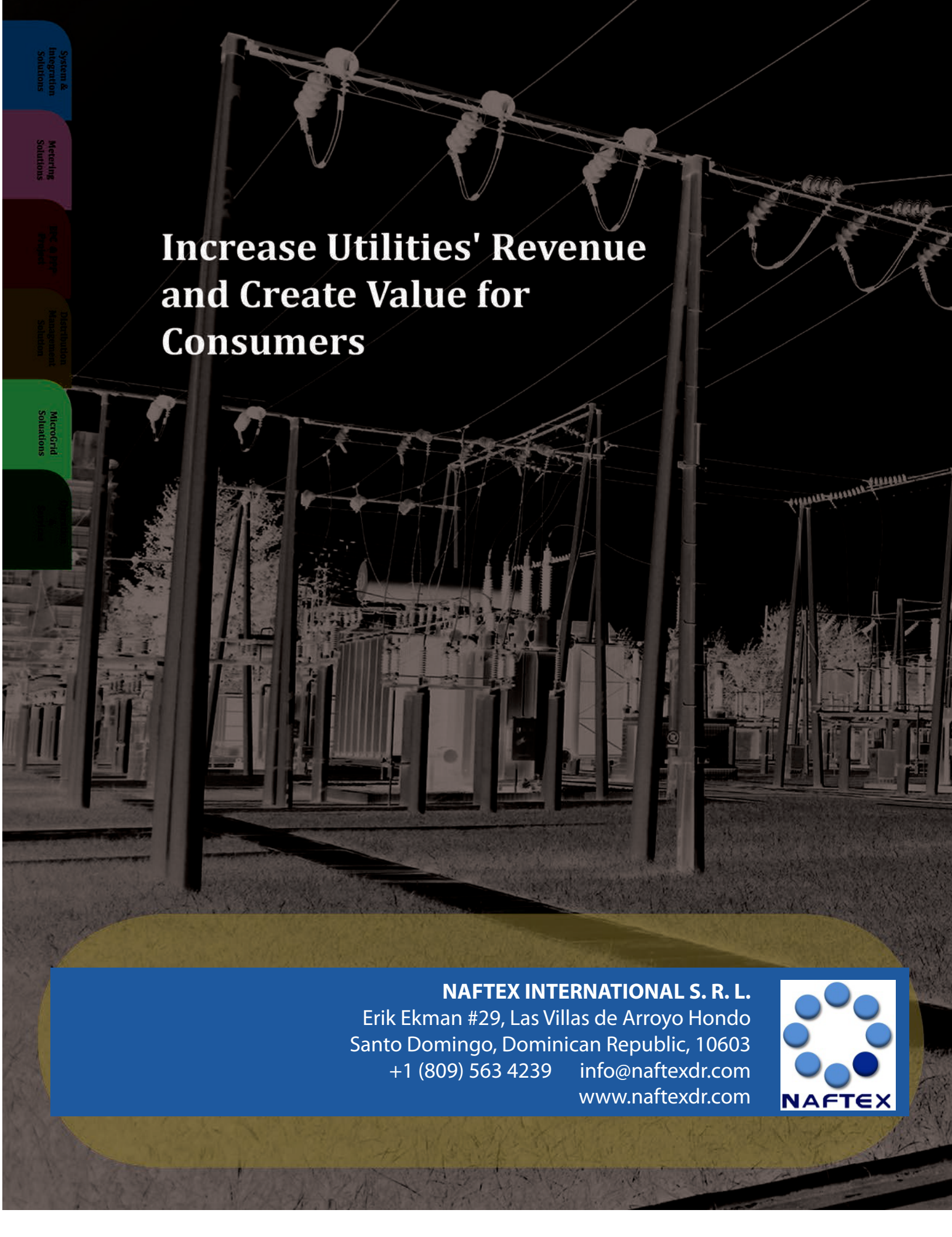

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