E D S - *EXPERT DIAGNOSTIC SYSTEM*

OVERALL ONLINE CONDITION MONITORING
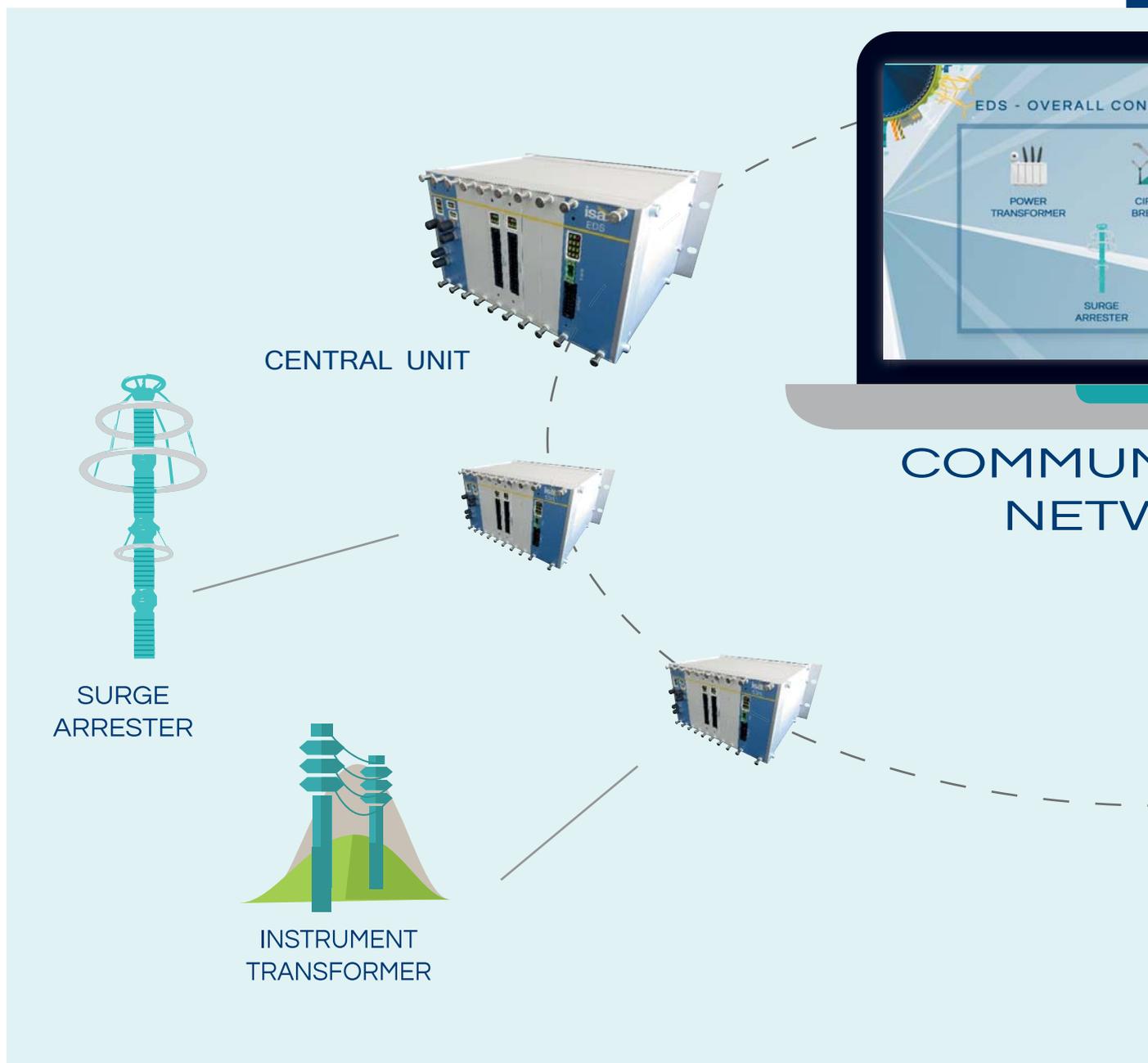
Expert diagnostic system - overall substation assets condition monitoring

- Overall condition diagnostic system is designed to monitor the main substation assets: current transformer, voltage transformer, power transformers, circuit breakers, surge arresters and GIS switchgear.

- It is a reliable and accurate system to perform a "condition based maintenance approach".

- Easy to install and non intrusive, suitable also for existing substastion, as it can be customized according to the substation layout.

- It can be connected in an existing data collection system or used as stand-alone option, thanks to a dedicated web application.

- The unit is fully configurable, it can be used as central unit, remote unit or slave unit.

- EDS software provides an easy and user friendly interface to acquire and analyze data.

- Two main configurations for TP are available: standard and advanced.

- A dedicated device for CT, VT, CB, GIS, SA is available and it can be connected through a fiber optical loop to the other devices.

CENTRAL UNIT

EDS - OVERALL CON

POWER
TRANSFORMER

CIR
BRE

SURGE
ARRESTER

COMMUN
NETV

SURGE
ARRESTER

INSTRUMENT
TRANSFORMER

INTRODUCTION

The up-to-dated players are moving from a "routine based maintenance approach" to an "online condition monitoring" in order to optimize the efficiency of their networks and substations.

Overall on line condition monitoring allows the optimization of performance by extending lifecycle and reliability of products, reducing costs of maintenance, preventing sudden failures, lowering risks of failure, diversifying costs of asset replacement and minimizing the downtime of assets.

EDS - Expert Diagnostic System - is an Overall Condition Monitoring System that integrates all the real time conditions from all relevant substation assets in a single system.

EDS provides in one solution the monitoring of several assets, according to the requirements of each distribution, transmission or generation application: Circuit Breakers (both AIS or GIS), Current Transformers, Voltage Transformers, Power Transformers (Bushing, Tap Changers, Tanks, Cooling System, DGA, alarms, etc), Surge Arresters, Batteries and other auxiliary assets, etc. Partial Discharge monitoring can be integrated in the proposal as complementary demand.

CIRCUIT BREAKER

GIS

POWER TRANSFORMER
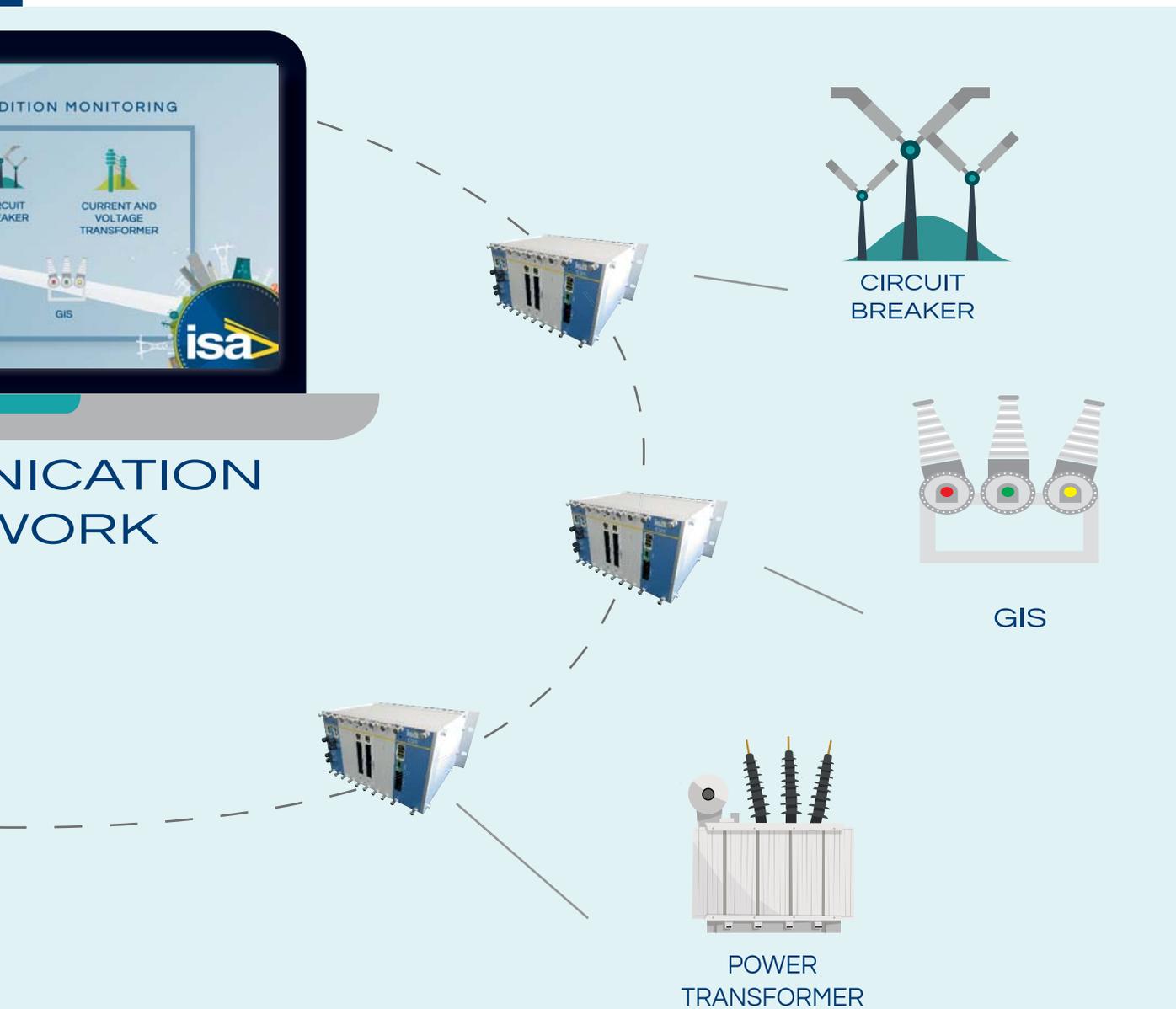
EDS - FRONT PANEL

EDS can monitor simultaneously the condition of:
• **Circuit Breaker**
. Auxiliary contact opening and close time
. Auxiliary contacts bouncing times
. Arc extinction time: I^2T
. Opening and close coils current profiles
. Mechanism operating time
. Continuity of coils
. Battery voltage DC

• **Gas Insulated Switchgears**
. SF6 Density and Trend
. SF6 Temperature
. Auxiliary contact opening and close time
. Arc extinction time: I^2T
. Opening and close current profiles
. Continuity of coils
. Auxiliary voltage

• **Power Transformer**
. Transformer operating hours
. Transformer thermal aging
. Winding temperature
. Cooling diagnostic
. DGA (single or multi gases)

. Moisture, dielectric oil
. Binary events
. Bushing monitoring
. Tap Changer (Condition, OLTC, etc)

• **CT Transformer**
. SF6 Density and Trend
. SF6 Temperature

• **VTC Transformer**
. Accuracy
. Contacts

• **Surge Arrester**
. 3rd harmonic current
. True RMS current value
. Total current flow
. Discharges counter

• **MV Switchgears**
. Opening and closing operations
. I^2T
. Number of operations
. SF6 gas Density and Trend
. SF6 Temperature

SYSTEM DESCRIPTION

EDS Condition Monitoring System is composed by several units; each one has dedicated electronic boards and sensors to perform the requested measurements.

The units are connected toghether through a bidirectional fiber optical loop. The HV loop is normally separated from the MV ones.

A central unit collects all the data processed by the other Condition Monitor Units through the optical fiber. In many cases, one of the remote unit could also be parameterized as central unit, in this case it has a dual fuction: remote and central unit.

The configuration of the system could also be adapted by using slave units connected with remote units.

• Central Unit
. Data collation and computing

• Remote Unit for monitoring
. Circuit Breaker AIS/ GIS
. Surge arrester
. Power Transformer
. CT and VT
. MV Switchgears

• EDS Condition Monitoring Software

CENTRAL UNIT

The **Central Unit of Monitoring System** is the unit that convey all the signals, coming from all assets, in a single diagnostic module. The Central Unit includes: power supply and Ethernet switch, optical fiber data collection to avoid interferences, input channels with parallel electronics to provide reliable data quality, data analysis with the generation of dedicated alarms, data ac-

cess through web HMI or data access using IEC 60870-5-101 or 104 protocol.

The central unit elaborates and stores data from all the sensors installed or supplied externally by third parties.

It could be installed in the more appropriate existing cabinet in the station or in a dedicated cabinet.

The Central Unit is equipped with a PC card and a microprocessor which compute all the raw data coming from the other units installed in each asset. The electronic card is also used to store the data, providing time synchronization and communication over protocol. Additionally it is designed with a web user interface in order to communicate with the substation network.

Main features are:
. Supply voltage: 110 V CC nominal; voltage range from 93,5 to 121 V CC
. Absorption: about 50 W
. Communication: Ethernet port, with TCP/IP protocol, for the configuration of the monitoring system, and in general for the maintenance and querying of the system itself
. Inputs connection: by means of clamps
. Output connection: by means of connector for optical fiber type ST multimodal 62.5 / 125 micron
. Malfunction signaling: fault on the internal supply; transmitted via optical fiber
. Weight: about 2 kg
. Indoor installation: panel size may vary to accommodate system selection. Dimensions: 3U x 14" or 19" rack module - IP 20.
. Outdoor installation: galvanized steel cabinet for external application IP 54. Dimensions: 400x500x 350 mm
Cabinet could be supplied as option in stainless steel version.

Note: the customization is according to customer's requirements and substation layout.

TECHNICAL SPECIFICATION

POWER TRANSFORMER MONITORING UNIT

With the use of sensors and diagnostic functions, **EDS PT** unit helps to detect in advance potential failure of all the main components of a power transformer, avoiding the risk of destructive shutdown. It also allows the operator to use the Power Transformer at a maximum power load, without accelerating the aging of the transformer itself.

The **EDS PT** unit functionalities (in the Advance Option) include the condition monitoring of several sub-functions: Transformer operating status, temperature monitoring, cooling monitoring, DGA(*), Oil moisture, TC condition, Bushing Monitoring(*), Partial Discharge(*).

The monitoring modules are installed close to each monitored sub-system, in their own cabinet or in an exhisting ones and they are designed for indoor and outdoor installation.

EDS PT monitoring system acquires the following data:
• Load current on HV side
• Over currents and short circuit currents on HV side
• Top oil temperature
• Gas in oil content
• Relative moisture of oil (water %)
• Operating voltage on HV bushing
• Bushing Capacitance
• Ambient temperature
• Circuit state of each fan and pump
• TC position
• Active power consumption of TC motor drive

The condition monitoring system for power transformer has two main configurations, with different functionalities: basic and advanced.

Basic configuration

DATA	INPUT
Top oil temperature	PT100
Ambient temperature	PT 100
Current HV	±20mA
Single gas in oil	4 – 20mA
Relative moisture in oil	4 – 20mA
Cooling group 1 temp In/Out	PT100
Cote Temperature	PT100
Gas max variation	Digital
Watchdog DGA	Digital

Advanced configuration

DATA	INPUT
Top and bottom oil Temperature	PT100
Ambient temperature	PT100
Housing Temperature	PT100
Current HV	±20 mA
Bushing capacities	Modbus RS485
Bushing Tan Delta	Modbus RS485
Bushing capacitive displacement current	Modbus RS485
Multiple gas in oil	Modbus RS485
Relative moisture in oil	Modbus RS485
Fault contact of single gas sensor	Modbus RS485
TC position	Resistor read
TC temperature	PT100
Current LV	±20 mA
TC electrical/mechanical operation	Digital
Voltage LV	±200 V
TC motor drive power	4 – 20mA
TC protective relay	Digital
Cooling group 1 temp In/Out	PT100
TC tank min/max oil level	Digital
Transformer tank min/max oil level	Digital
Transformer pressure relief device	Digital
Transformer relay trip/alarm	Digital

Thermal Monitoring
The unit can be customized for condition monitoring of the following features:
. Bottom oil temperature
. Hot spot temperature, according with the IEC 60354
. Top oil temperature
. Outside temperature - Sunlight temperature
. Outside temperature - Ambient temperature

Several alarms can be customized:
. High Top Oil Temp
. High-high Top Oil Temp
. High winding Hot Spot Temp
. High-high Winding Hot Spot Temp

Cooling Monitoring model
The Unit can be customized with the status of the cooler groups. Different colored symbols represent different rotating status (starting/stop). It is also displayed the number of operating hours and the thermal resistance.
. Operating times of fans and pumps
. Cooling efficiency (Thermal resistance Rth)

Ageing Model

The calculation is based on the hot spot temperature in the hottest winding. The Ageing calculation is computed according to IEC 60076-7 for non thermally upgraded paper. The expected service life will only be used for reference purposes.

Tap Changer Model (*)

The unit can be customized for monitoring the Tap changer. The features monitored are:
. TC position (last and actual)
. Last TC operation
. Number of switching operations of TC
. Sum of switching load current of TC
. Diverter switching current during switching operation
. Number of TC operation until service
. Power consumption of motor drive
. Time of inrush current
. Switching time
. Maximum power consumption of sector 1, 2 and 3
. Contact erosion (wear) of main contacts
. Contact erosion (wear) of auxiliary contacts.

Several alarms can be settled according to the existing sub-system configuration.

DGA Dissolved Gas Analysis in PT (*)

The EDS PT monitoring unit can be configured to collect data from DGA system. The **Basic Option** has a dedicated input for 1 DGA measure (4-20 mA) for PT. Normally hydrogen is monitored. The **Advanced Option** manages up to 8 DGA measures on PT through a RS485 connector and 2 Digital inputs for DGA in the Bushing. In this option the inputs are used also for the moisture measurements.
The DGA System is supplied upon request and according to customer specifications. All the computation analysis will be integrated in the central unit and displayed in the web HMI interfaces.

References and alarms could be set and customized in the EDS PT unit before the installation, following the customer specification or the DGA manufacturer instructions.

Bushing Capacitance and Tan Delta measures (*)

The Bushing Capacitance and Tan Delta measures are performed with a dedicated system that is not included in the standard unit. The system is provided upon request accordong to customer's specifications. All the computation analyses will be integrated in the central unit and displayed in the web HMI interfaces.

Partial Discharge System

The Partial Discharge system is a dedicated system that is not included in the standard unit. The system is provided upon request according to customer's specifications. The PD system will be integrated in the Advanced option adding a dedicated HW.

General Characteristics

. Indoor installation: 3U x 14" or 19" rack module - IP 2 Panel size may vary to accommodate system selection.
. Outdoor installation: 400x500x 350 mm - Galvanized steel cabinet for external application IP 54. Option: stainless steel cabinet solution IP 54. Panel size may vary to accommodate system selection.

(*) Note: signals from these devices are provided by dedicate systems integrated inside EDS.

CIRCUIT BREAKER MONITORING UNIT

This remote unit could be installed with non-invasive solution in an external cabinet and it includes the following functionalities:
. Monitoring of the auxiliary contacts
. SF6 gas – Gas monitoring: density, trend and temperature (Option)
. Monitoring and computing I2T measurement.

Monitoring of the auxiliary contacts

Circuits for monitoring of auxiliary contacts
. Number of inputs: 16
. Type of monitored inputs: wet
. Inputs voltage: from 93,5 to 121 V CC
. Threshold voltage: 77 V ± 5 V
. Recognition criteria: an input is acknowledged as closed if it passes the threshold for a time longer than 200 µs
. Precision of the timing measure: ± 100 µs
. Input circuits are isolated; voltage withstand 500 V AC
. Absorbed current by the input circuits: 2 mA nominal
. Input impedance: greater than 20 kOhm
. In case of fault of one component of the measuring circuit, the minimum impedance of the input is 10 kOhm. The resulting current does not further damage the circuit.

General Characteristics of monitoring of auxiliary contacts:

. Supply voltage: 110 V CC nominal; voltage range from 93,5 to 121 V CC
. Absorption: about 10 W
. Supply protection: In case of fault supply is protected by a fuse, 0,2 A
. Inputs connection:
    .. Commands and breaker contacts: by means of clamps
    .. SF6 gas density: by means of clamps.
. Output connection: By means of connector for optical fiber type ST multimodal 62.5 / 125 micron
. Malfunction signaling:
    .. Fault on the SF6 transducers supply; transmitted via optical fiber
    .. Fault on the internal supply; transmitted via optical fiber.
. Installation: Unit to be mounted inside the breaker control box
. Weight: About 2 kg

. Dimensions:

    .. Indoor installation: 3U x 14" or 19" rack module - IP 20 Panel size may vary to accommodate system selection

    .. Outdoor installation: 400x500x 350 mm - Galvanized steel cabinet for external application IP 54. Option: stainless steel cabinet solution IP 54. Panel size may vary to accommodate system selection.

SF6 Gas monitoring: Density, trend and temperature

In case of Circuit Breakers gas insulated, the Condition Monitor System has to be equipped with the gas leakage monitor functions, to control the density, trends and temperature.
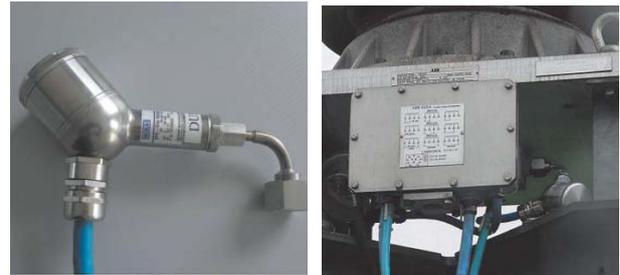
Circuit for monitor of SF6 gas density, trend and temperature

. Number of inputs: 3

. Type of transducers: density meters WIKA GD-10 , or equivalent

. Range of densities to be measured: from 0 to 60 kg/m3, or from 30 to 60 kg/m3

. Transducer output: DC current on the supply, useful to be measured by the monitoring circuit, with a fireproof cable respecting standard CEI 20-22, with maximum length 20 m

. Precision of the density measure: ± 2% of the measure ± 2% of the full range.

General Characteristics of monitoring of auxiliary contacts and SF6

. Supply voltage: 110 V CC nominal; voltage range from 93,5 to 121 V CC

. Absorption: 10 W

. Supply protection: in case of fault supply is protected by a fuse, 0,2 A

. Inputs connection:

    .. Commands and breaker contacts: by means of clamps

        .. SF6 gas density: by means of clamps.

. Output connection: by means of connector for optical fiber type ST multimodal 62.5 / 125 micron

. Malfunction signaling:

    .. Fault on the SF6 transducers supply; transmitted via optical fiber

    .. Fault on the internal supply; transmitted via optical fiber.

. Installation: unit to be mounted inside the breaker control box

. Weight: about 2 kg

. Dimensions:

    .. Indoor installation: 3U x 14" or 19" rack module - IP 20 Panel size may vary to accommodate system selection

    ..Outdoor installation: 400x500x 350 mm - Galvanized steel cabinet for external application IP 54. Option: stain still cabinet solution IP 54. Panel size may vary to accommodate system selection

Monitoring and computing of I2T

The value of I2T is a very good proxy of the arc extinction time and the integration of all the data in the years give an indication of the residual life cycle of the circuit breakers. The measure of the I2T is a remote unit stand-alone. For the correct evaluation it is necessary to collect the data also from the A/B bars.

Circuits for the measurement of the current

. Number of inputs: 3.
. Measure connections: toroidal transformers placed on the CT secondary sides.
. Toroidal transformers characteristics:

  .. Description: Resin coated toroidal transformer, to be screwed on a base, with output connector.
  .. Internal hole: 12 mm diameter
  .. Transformer ratio: 1000//1.
  .. Primary current: 5 A; surge 150 A (30*IN) for 1 s, 2*IN to time indefinite
  .. Global precision: transformer, converter, rms measure: ± 5% of measure ± 2% of range

Circuits for the monitoring of A/B Bars

. Number of inputs: 2
. Type of monitored inputs: wet
. Inputs voltage: from 93,5 to 121 V CC
. Threshold voltage: 77 V ± 5 V
. Recognition criteria: an input is acknowledged as closed if it passes the threshold for a time longer than 200 μs
. Precision of the timing measure: ± 100 μs
. Input circuits are isolated; voltage withstand 500 V ac
. Absorbed current by the input circuits: 2 mA nominal
. Input impedance: greater than 20 kOhm
. In case of fault of one component of the measuring circuit, the minimum impedance of the input is 10 kOhm. The resulting current does not further damage the circuit.

Computation of the I2T

The module receives the actual open command raised by the breaker unit, from the central unit, and such command orders the unit to start the measurement.
. The sampling frequency for each phase is 1 kHz.
. On the measured currents, the module will compute the following functions:

  .. Verifies if the current is higher than the programmed threshold
  .. Calculates I2T by integration of the current values of the last part of the phenomenon, corresponding to the arc extinction time Te programmed (average arc time).

. The I2T computed value is transmitted to the central unit for further processing. The total error on the measure of I2T is less than 10% for currents greater than 15 IN.
. The module detects and transfers the A/B bar selection, which will be used by the MRE system for the monitoring of the PT.

General Characteristics of monitoring I2T

. Supply voltage: 110 V CC nominal; voltage range from 93,5 to 121 V CC
. Absorption: 5 W
. Supply protection: in case of fault supply is protected by a fuse, 0,1 A
. Inputs connection: from the transformer, via connectors or clamps
. Output connection: via connector to the central unit
. Malfunction signaling: fault on the internal supply; transmitted via optical fiber.
. Installation: unit to be mounted inside the line cubicle
. Dimensions:

  .. Indoor installation: 3U x 14" or 19" rack module - IP 20 Panel size may vary to accommodate system selection
  .. Outdoor installation: 400x500x 250 mm - Galvanized steel cabinet for external application IP 54. Option: stainless steel cabinet solution IP 54. Panel size may vary to accommodate system selection

. Weight: about 2 kg

SURGE ARRESTER MONITORING UNIT

The module serves the purpose of verifying the discharger efficiency of the metal oxide surge arresters installed on the HV transport lines, according to IEC standards 60099-5 A1 ED. 1.0 Section 6: Diagnostic indicators of metal-oxide surge arresters in service (method B1). The control is executed with the surge arrester in service, by analyzing through a current transformer the current discharged in the grounding connection. This current normally has values in the range between fractions of mA and a few mA, and is characterized by a deformation of the 3rd harmonic, whose value is an indication of the degradation of the surge arrester itself.

Measure of the currents

. Number of inputs: 3
. Connection: on the surge arrester grounding cable
. Characteristics of the measuring transformers:

  ..Description: Resin coated toroidal transformer, with output connector
  .. Transformer ratio: 1000//1
  .. Ratio error from 0,1 mA to 10 mA: 5%　0,05 uA
  .. Internal hole diameter: 50 mm
  .. Connection: with connector
  .. Connection cable: shielded, 5 pins, maximum length 10 meters.

. Measure performed on the current measured by the clamp:

  .. True rms value of the total current
  .. 3rd harmonic rms value
  .. Digital conversion of these voltages for the transmission on optical fibre.

.. Range of the total current: 19,99 mA.

.. Range of the 3rd harmonic: 1999 uA.

.. 3rd harmonic filter response: < - 60 dB at 50 Hz; 0 dB at 150 Hz; < - 20 dB at 250 Hz and greater frequencies.

. Errors:

.. Measure at 50 Hz, rms value: ± 5 % of the measure ± 1 % of the range.

.. Measure at 150 Hz, rms value: ± 10 % of the measure ± 2 % of the range.

. External field insensitivity. In presence of the following disturbances:

.. Electric field: < 10 kV/m.

.. Uniform magnetic field: < 50 uT.

.. Non-Uniform magnetic field, create by the circulation of a 20A current in a conductor placed 50 mm away from the current transformer, the measure will be maximum 2 mA rms at 50 Hz.

Surge Arrester Remote Unit

Measure of the number of discharge

. Number of inputs: 3.

. Connection: on the surge arrester grounding cable.

. The number of discharges will be increased if the current value is greater than the programmed threshold (500 A, 2000A, 5000A, > 5000A).

. Error on the measure of the current pulse amplitude:< 30%.

General Characteristics of surge arrester unit

. Supply voltage: 110 V CC nominal; voltage range from 93,5 to 121 V CC.

. Absorption: about 5 W.

. Supply protection: In case of fault supply is protected by a fuse, 0,1 A

. Inputs connection: From the transformers and discharge sensors, via connectors or clamps.

. Output connection: by means of connector for optical fiber type ST multimodal 62.5 / 125 micron.

. Malfunction signaling: fault on the internal supply; transmitted via optical fiber.

. Dimensions:

.. Indoor installation: 3U x 14" or 19" rack module - IP 20 Panel size may vary to accommodate system selection

.. Outdoor installation: 400x500x 350 mm - Galvanized steel cabinet for external application IP 54.

Option: stainless steel cabinet solution IP 54.

Panel size may vary to accommodate system selection.

. Weight: about 2 kg plus internal components.

VOLTAGE TRANSFORMER MONITORING UNIT

The purpose of this unit is to provide an accurate measure of the VTC secondary voltage and to highlight anomalies in the functioning of the transformer itself by confronting the value at the secondary side of other VTC.

Each module includes:

. Digital inputs for the voltage measures: 8 or 16 .

. Acquisition microprocessor electronic board.

. Optical communication board, equipped with status led

. Power supplier unit.

. USB connector local control and communication during commissioning.

. 2 Rotary selectors for the set up of logic address (from 1 to 154).

CVT Module

Circuits for the voltage measure

. Number of digital inputs: 8 or 16, optical insulated.

. Connection: on the VTC secondary side, by means of isolation transformer.

. Input Range intension: from 93,5 to 121 VDC. Max pick is 250 VDC

. Global precision: transformer, measure true rms and converter, from 65 V ± 5V.

.. Temperature from 25 °C: ± 0,1% of the measure ± 0,02% of the range.

.. Complete range of temperatures (from -25°C to + 60

°C): ± 0,5% of the measure ± 0,1% of the range.

.. Differences between two units, whose temperature difference is lower than 10 °C: ± 0,2% of the measure ± 0,04% of the range.

. Connectors on TVC side: compliant at CEI EN 60947-7-1 and 60947-7-2.

General characteristics of VT

. Supply voltage: from the secondary side of the VTC; voltage range from 40,0 to 110 V DC tolerances -30%/+10%.
. Load: Max 30W.
. Fault: in case of fault of a component in the measuring circuit, the minimum impedance of the input becomes 1 kOhm (load on PT of 3,3 VA). The subsequent current does not further damage the circuit.
. Inputs connection: fom the transformers by means of connectors of clamps.
. Output connection: by means of connector for optical fiber type ST multimodal 62.5 / 125 micron.
. Malfunction signaling: fault on the internal supply; transmitted via optical fiber
. Dimensions:
  .. Indoor installation: 3U x 14" or 19" rack module - IP 20 Panel size may vary to accommodate system selection
  .. Outdoor installation: 400x500x 350 mm - Galvanized steel cabinet for external application IP 54.
  Option: stainless steel cabinet can be supplied IP 54 Panel size may vary to accommodate system selection
. Weight: about 2 kg plus internal components.

CURRENT TRANSFORMER MONITORING UNIT

GAS INSULATED SF6

The unit includes three circuits for the measure of the SF6 gas density.

Circuit for monitor SF6 gas density, trend and temperature

. Number of inputs: 3.
. Type of transducers: density meters WIKA GD-10,or equivalent.
. Range of densities to be measured: from 0 to 60 kg/m3, from 15 to 45 kg/m3 or from 30 to 60 kg/m3, depending on the installed transducer.
. Transducer output: DC current on the supply, useful to be measured by the monitoring circuit, with a fireproof cable respecting standard CEI 20-22, with maximum length 20 m.
. Precision of the density measure: ± 2% of the measure ± 2% of the full range.

General characteristics of monitoring SF6 Gas insulated

. Supply voltage: 110 V CC nominal; voltage range from 93,5 to 121 V CC.
. Absorption: 10 W.
. Supply protection: In case of fault supply is protected by a fuse, 0,2 A

. Inputs connection: SF6 gas density, by means of clamps.
. Output connection: By means of connector for optical fiber type ST multimodal 62.5 / 125 micron.
. Malfunction signaling:
  .. Fault on the SF6 transducers supply; transmitted via optical fiber.
  .. Fault on the internal supply; transmitted via optical fiber.
. Dimensions:
  .. Indoor installation: 3U x 14" or 19" rack module - IP 20 Panel size may vary to accommodate system selection.
  .. Outdoor installation: 400x500x 350 mm - Galvanized steel cabinet for external application IP 54.
  Option: stainless steel cabinet can be supplied IP 54. Panel size may vary to accommodate system selection.
. Weight: about 2 kg.

MV SWITCHGEAR MONITORING UNIT

MV Switchgear is one of the most reliable components within substation assets. A constant Monitoring allows a longer lifetime of assets and reduce costs of routine maintenance. Condition monitoring will improve the efficiency of these systems anywhere there are severe environmental conditions. This remote unit incorporates the condition monitoring options in a single rack unit. Easy to install while the system is working . The coil current monitoring signals are collected from dedicated CTs without any interruption of installed set up.

Each EDS unit can monitor up to 10 breakers.

Data are collected, stored and analyzed in a PC card. The system double-checks the measurements by parallel electronic inputs. A set up web HMI allows to work through a dedicated browser. The system could also be equipped with the IEC 60870-5-104 protocol to communicate with a remote control center (i.e. Scada). The communication of the system is provided via bi directional fiber optic cables.

The Unit can also manage data of density, trend and temperature provided by dedicated SF6 gas sensors, in case of SF6 gas insulated switchgears.

To increase the number of digital inputs, the unit could be configured as main unit or slave unit.

MV switchgear monitoring unit - example of front panel

Main features of MV Switchgear conditioning monitor unit

. Acquisition of all the signals in a single diagnostic module.
. Compact size of the unit and peripherals.
. All hardware concentrated in one enclosure, including power supply and Ethernet switch.
. Optical fiber data connection to avoid interferences.
. Input channels with parallel electronics to provide reliable data quality.
. Data analysis with the generation of dedicated alarms.
. Visualization of the acquired data on a web HMI.
. Ddata access using IEC 60870-5-104 protocol.
. Free parameterization by the end user administrators.

Diagnostic functionalities of MV Switchgear conditioning monitor unit

. Operating times
. I2t during breaking operations
. Circuit breaker position
. Operation counter
. Fault currents summation
. Waveforms recording & processing
. Auxiliary Voltage monitoring
. Coil continuity check
. SF6 density monitoring

## General Characteristics of MV Switchgear conditioning monitor unit

. Supply voltage: 110 V DC tolerances -30%/+10%.
. Load: Max 30W.
. Fault: in case of fault of a component in the measuring circuit, the minimum impedance of the input becomes 1 kOhm (load on PT of 3,3 VA). The subsequent current does not further damage the circuit.
. Inputs connection: from the switchgears by means of connectors
. Output connection: by means of connector for optical fiber type ST multimodal 62.5 / 125 micron
. Malfunction signaling: fault on the internal supply, transmitted via optical fiber.
. Unit is assembled inside the breaker central box.
. Weight: about 2 kg.

EDS SOFTWARE AND MONITORING

EDS software allows to check the status of the apparatus under condition monitoring, according to the customer specifications and installation. It is a **web HMI** application and it can be activated by pinging the defined customer IP.
The software provides the user with information to optimize the operations and the planned maintenance activities of the assets under monitoring. The Software provides also automatic report with the status information about the assets. In case of the values will exceed the limits, the system generates alarms record which is also saved in the database. Optionally the alarm signals can be sent to the control room by standard protocols. The web based application can be personalized according to the customer needs and requests. As an option it can be possible to communicate with a SCADA by means od standard protocols such IEC 60870-5-104.
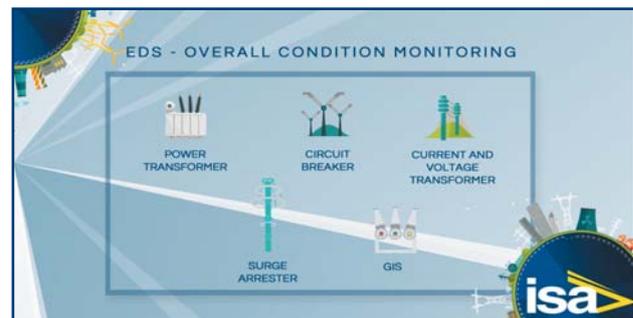
EDS software

ORDERING INFORMATION

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