

# CB MONITOR

## On Line Circuit Breaker Monitoring System

CB MONITOR is a **cost-effective on line diagnostic system** used to monitor MV and HV circuit breakers. CB MONITOR system can monitor **up to 10 circuit breakers at the same time**. The purpose of the Circuit Breaker Monitoring System is to highlight issues before these can cause an inefficiency in the system, thus allowing a far **better management of condition based maintenance**.

This system is designed not to be invasive and does not affect the substation reliability. All the measurements performed by the monitoring devices are delivered to the system using the IEC standard 60870-5-104 (IEC standard 60870-5-101 optional) and DNP3 communication protocol.

The analysis of the signals and the causes, that raised alarms, are performed by dedicated units, by reading data from the monitoring and telecontrol system. By means of a dedicated line, separate from the monitoring system, it is also possible to modify parameters of the monitoring devices, and to upgrade their firmware by remote control.

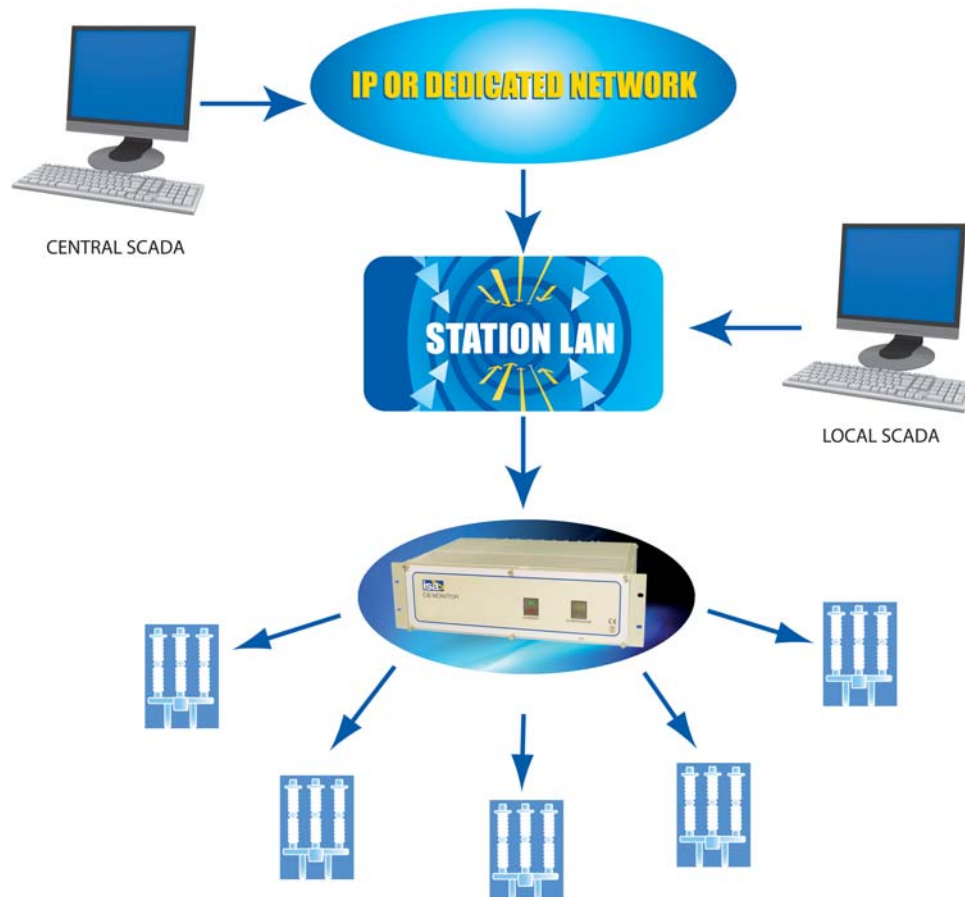
The CB MONITOR System is easy to install and, once configured, operates continuously.

### Expert analysis of circuit breaker

The CB MONITOR system can perform on line diagnostics on up to 10 circuit breakers simultaneously. CB MONITOR verifies continuously the following parameters:

- . Auxiliary contacts opening and closing time;
- . Auxiliary contacts bouncing times;
- . SF6 Density trend (optional);
- . Temperature (optional);
- . Accumulated fault current during arcing time (I<sup>2</sup>t);
- . Open and close current profiles;
- . Mechanism operating time (optional);
- . Battery voltage.

Then, the monitoring system through its software processes and manages the acquired data and automatically sends alarm messages to the central SCADA if thresholds are exceeded. The software can process and analyze the data and



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automatically can detect and report in details the origin of the problem (electrical, mechanical, aging or due to gas leakage), without the need of the operator's analysis.

Each CB MONITOR unit can monitor several circuit breakers (up to 10) at the same time. Auxiliary contacts and command coil currents are the parameters analyzed in every circuit breaker. The results are compared with the correspondent alarm threshold. Each CB MONITOR unit is connected to monitoring and telecontrol system, via standard IEC 60870-5-104 and 101-DNP 3 (optional) communication protocol. CB MONITOR units are mounted near to protection relays.

CB MONITOR units are designed to operate reliably under extreme weather conditions and electrical interference found in normal substation operations. In particular:

- Modules mounted outdoors are IP 65 and designed to work over an extended temperature range (from - 40°C to + 85°C).
- Self-diagnostics continuously tracks the condition of the CB MONITOR and issues alerts if an abnormality is detected in the system.
- By the continuous monitoring of the key parameters, CB MONITOR detects malfunctions in early stage and issues prioritized alarms communicating abnormal conditions and guiding maintenance decisions.

## CB MONITOR - CENTRAL UNIT

The CB MONITOR Central Unit controls the main function of the monitoring system. The main characteristics are:

- . Monitoring of the various peripheral units.
- . Storage of the results in daily/weekly/yearly database.
- . Trend analysis of the SF6 density (optional).
- . Possibility to modify the threshold parameters.
- . Possibility to remotely configure thresholds, erase old results, download results.
- . Firmware Upgrade of the various peripheral units.
- . Remote interrogation from another PC via static IP address (with password).
- . Transmission of the measurements and the alarms to the Scada system.
- . It can be synchronized by a substation GPS and it can synchronize all the peripherals connected.



## Specification

AMD® low power LX800 500MHz Processor

- 24-bit TFT LCD interface
- Dual 100 Base-T Fast Ethernet
- Four USB 2.0 ports
- Four COM ports
- 8 GB solid state hard disk
- GPS Synchronization: IRIGB input output for system synchronization
- Connections: by means of connectors for optical fibre type ST multimodal 62.5 / 125 microns
- Power supply: 93.5 ... 121 VDC
- Power consumption: 50W
- Physical realization: 3 U Rack 19"
- Remote Communication: Ethernet TCP/IP, RS232
- Protocol IEC60870-5-101 or DNP

## CB MONITOR - MONITORING UNIT

The main characteristics are:

- . Designed to easily fit into breaker control cabinets.
- . Analysis performed on every breaker operation.
- . Automatic fingerprint comparison of breaker characteristics.
- . All measurements are sent to the CB MONITOR Central Unit for analysis.

The Circuit Breaker Condition Monitor acquires the following information:

- . Auxiliary contacts opening and closing time.
- . Auxiliary contacts bouncing times.
- . SF6 Density trend (optional).
- . Temperature (optional).
- . Accumulated fault current during arcing time (I<sup>2</sup>t).

- . Open and close current profiles.
- . Mechanism operating time (optional).
- . Battery voltage.

## TIMING MEASUREMENT

- . Number of inputs: 5 for each circuit breaker; in total 50 contacts can be monitored.
- . Type of monitored inputs: wet.
- . Inputs voltage: from 93.5 to 121 V DC.
- . Threshold voltage: 77 V  $\pm$  5 V.
- . Recognition criteria: an input is acknowledged as closed if it passes the threshold for a time longer than 250  $\mu$ s.
- . Precision of the timing measure:  $\pm$  100  $\mu$ s.
- . Input circuits are isolated between them in 2 groups of 3 inputs each; voltage withstand 500 V AC between the inputs self and 2 kV referring to other sections inside the same unit.

## SF6 LEAKAGE MONITORING (OPTIONAL)

Rapid variation and Slow variation. The derivative measure is performed once a day, overnight, when the temperature is more stable, at the programmed time; the time is synchronized by means of the clock input. The derivative is calculated on the average of a programmable number of values, as a difference of the readings over two or more days.



- . Type of transducers: density meters WIKA GD-10 , or equivalent.
- . Range of densities to be measured: from 0 to 60 kg/m<sup>3</sup>, or from 30 to 60 kg/m<sup>3</sup> .
- . 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:  $\pm$  2% of the measure  $\pm$  2% of the full range.

## ACCUMULATED I<sup>2</sup>T

- . Number of inputs: maximum 2 for each circuit breaker, in total 20 inputs connected to terminals. Transducers must be connected to these terminals.
- . Transducers type: Hall effect transducers.
- . Current measuring range: from 0.1 A to 20 A DC.
- . Transducer output: DC voltage or current, enough to be measured by monitoring circuit.
- Current measuring accuracy:  $\pm$  5% of measure  $\pm$  2% of range.



## OPEN AND CLOSE COIL CURRENT PROFILE

- . Number of inputs: 2
- . Measuring connections: on terminals connected means cables to toroidal transformers inserted on secondary side of CTs.
- . Toroidal transformers characteristics:
  - .. Description: resined toroidal transformer, to be mounted on DIN guide.
  - .. Open core: 12 mm diameter.
  - .. Transformer ratio: 1000 / 1.
  - .. Primary current: 5 A; overload 150 A (30 I<sub>n</sub>) for 1 s, 2 I<sub>n</sub> for infinite.
- . Total accuracy (transformer + converter) effective value measure :  $\pm$  5% of measure  $\pm$  2% of range.

## BATTERY VOLTAGE MEASUREMENT

- . Number of inputs: 2.
- . Measuring connections: on terminals.
- . Maximum voltage on measuring inputs: 260 V DC.
- . Voltage measuring accuracy:  $\pm$  0.5%.

. Input circuits are isolated between them: voltage withstands 2000 V AC between them and 2 kV referring to other sections inside the same unit.

## SOFTWARE OF THE COMPUTING UNIT

The main features are:

- . Monitoring activity of the different circuit breakers.
  - . Communication with the Center using the IEC 60870-5-104 protocol.
  - . Setting parameters are received by local or by Center.
  - . The circuit breaker behaviour is save in a log file.
  - . A log file is managed for each circuit breaker.
  - . The saved log file is transferred to Center (download of all log files).
  - . Measures, events and alarms are transferred to the Center.
  - . Configuration is set according to different circuit breakers.
  - . The software defines an IP address for each unit.
  - . The upgrade of setting parameters is made according to the setting received by the Center.
  - . The upgrade of the firmware is made by the Center.
  - . Synchronization of internal clock with the Center one means SNTP system.
- The information report:
- . Timing measurements.

## WEIGHT AND DIMENSIONS

**CENTRAL UNIT:** 19" rack module; 3 U.

## APPLICABLE STANDARDS

### Electromagnetic Compatibility

Directive n. 2004/108/EC. Applicable Standard:  
EN61326 + A1 + A2.

### Low-voltage directive

- . Directive n. 2006/95/EC.
- . Applicable standard: CEI EN 61010-1.
- . Inputs and outputs protection: IP 2x, according to according to IEC EN 60529.
- . Temperature: from - 25°C to + 85°C.
- . Altitude: less than 2000 m.

## ORDERING INFORMATION

CODE	DESCRIPTION
10173	CB MONITOR - Central Unit 3 U - for up to 10 circuit breakers (including CT's and Hall effect sensors)
11173	CB MONITOR - Central unit 3 U - for 1 circuit breaker (including CT's and Hall effect sensors)
90173	CB MONITOR - 1 output for 1 circuit breaker (including CT's and Hall effect sensors)



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