

SHERLOG CRX

New multi-functional measuring system for professional power system and event analysis

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The integration of renewables and the rapid development of smart grids call for major restructuring in many areas of electrical supply systems. At low and medium voltage levels in particular, the rise in the amount of distributed power fed in from renewables poses new challenges for automation, protection and measurement concepts which are difficult to plan for, not least because of the unpredictability of the weather.

The growing dynamism of electricity supply systems is accompanied by a steady increase in the importance of constant and reliable power systems monitoring.

A multitude of parameters have to be monitored in order to assess the quality of an electrical power system with regard to security of supply, power quality, stability and capacity utilisation. These parameters must provide vital information for the fast and effective restoration of system operation when a fault occurs, as well as serving as the basis for the extension of power systems and the optimisation of primary and secondary technology.

The wide-ranging requirements to be met by efficient power systems monitoring and the cost pressures acting on the installation and operation of supply equipment call for the use of multi-functional measurement and analysis systems which can be readily adapted in response to new conditions and can grow in pace with requirements.

During the planning and construction of complex plants in particular, such as power plants, wind parks or transformer substations, the demands placed on the measurement technol-

ogy to be used change repeatedly. It is not unusual for configurations to be finalized only shortly before commissioning and sometimes not until shortly afterwards.

The number of measurement channels required for the measurement of voltage, current and auxiliary signals and their respective measuring ranges are changed most frequently of all. Corrections concerning current measurement in the protection transformer circuit in particular are often necessary, either because the type of transformer is changed at short notice or because the overcurrent to be measured in the case of a fault has been miscalculated. On other occasions on-site requirements may change in respect of the data link or type of time synchronisation. An optical Ethernet interface may be required instead of the electrical RJ45 interface ordered initially, for example. Or the time reference provided „speaks“ the wrong protocol or is not equipped with the expected interface.

This means that modern measuring systems need to have a modular structure and be flexible enough for all the necessary changes and modifications to be made quickly and easily directly on site, without having to replace existing hardware. Customers or those responsible for commissioning a plant for the construction company should of course be able to make these kinds of adjustments themselves.

KoCoS Messtechnik AG has developed a new measuring system named SHERLOG CRX to meet every facet of these requirements. Particular care has been taken to ensure that the new system is quick and convenient to install on-site, while clarity and ergonomics are the guiding principles behind the operating concept.

Multi-functional measurement and analysis system

SHERLOG CRX is a multi-functional measurement and analysis system for comprehensively monitoring and assessing equipment in electricity supply systems. It can be used as a centralized or decentralized monitoring system and unites the following functions in one device:

- High-resolution fault recorder for transient processes with sampling rates up to 30 kHz
- RMS recorder
- Continuous data recorder
- Event recorder
- Power quality analyser to IEC61000-4-30 class A
- Fault locator
- Phasor measurement unit
- Sequence of events recorder
- Integration in substation control and protection systems to IEC 61850

Fig. 1: SHERLOG CRX front view



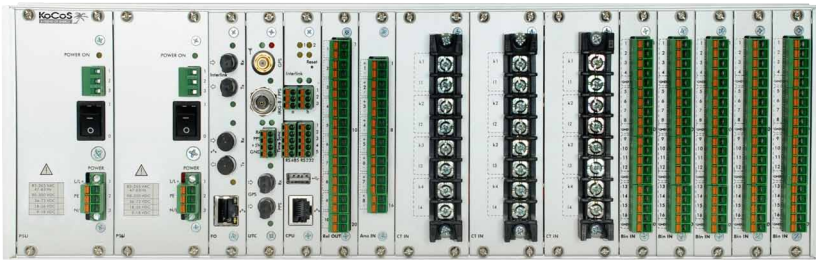


Fig. 2: SHERLOG CRX back view

Made-to-measure, compact and flexible

A single SHERLOG CRX device can accommodate up to 32 analog and up to 128 binary inputs. The network capability of the individual devices allows the creation of measuring systems which are practically unlimited in size. All the analog inputs can be used as needed for current measurement, voltage measurement or for the measurement of low-level signals from measuring transducers, such as temperature sensors or pyranometers for measuring solar radiation, for example. It is easy for customers to select the appropriate measuring ranges on site.

A special feature of the current measurement capability is the ability to connect SHERLOG directly to instrument and protection transformers using the high-current inputs or alternatively to use external sensors, such as measuring shunts, current clamps or Rogowski current transducers. It is also perfectly possible

to mix the different types of connection as required when operating the measuring system.

Plug & play technology for easy servicing

Thanks to plug & play technology, systems can be extended or modified quickly and easily on-site. Even when existing modules are replaced or new modules are added, there is no need for time-consuming and costly calibration.

Time synchronisation

Power system monitoring and fault analysis with full area coverage call for precise time synchronisation. Only when measured values are recorded by a number of devices absolutely simultaneously is it possible to compare them with one another and evaluate them correctly. Which method of synchronisation is most suitable from a technical and economic point of view depends on the specific conditions at the individual location.

In order to provide the optimum solution in every situation, the SHERLOG synchronisation module is equipped with all common interfaces as well as a built-in GPS receiver. The required synchronisation interface can be selected in the SHERLOG operating software; the following interfaces are available:

- Internal GPS receiver
- Optical or electrical GPS telegram and time pulse input
- DCF77 pulse telegram input
- Seconds/minutes pulse input (PPS/PPM)
- IRIG-B input
- NTP/SNTP synchronisation via the communication network

The user can select or change the type of synchronisation on site without having to make any changes to the hardware of the device.

Data link

SHERLOG CRX is equipped with all common interfaces, such as RS232, RS485, USB and Ethernet. Integration in fibre-optic networks is achieved by means of an optional plug-in submodule which is easy to retrofit on site.

IEC 61850 || Modbus

For integration in substation control and protection or for the exchange of data with systems from other manufacturers, SHERLOG CRX can use a range of data protocols, including IEC 61850 and Modbus. Access to the measurement data can be afforded to a number of different users or systems simultaneously. This means that SHERLOG can be integrated within an IEC 61850 host system, for example,



Fig. 3: Pylons

and use another network at the same time to deliver data to a dedicated database and monitoring system which is provided by the SHERLOG software. The integrated web server also allows access via any web browser.

Examples of applications for SHERLOG CRX

- Digital fault recorder with a high sampling frequency for detailed analysis of transient faults
- Determination of fault location
- Generator monitoring in power plants
- Recording and identification of power swings
- Capture of dynamic power system states
- Power quality analysis, e.g. to EN 50160
- Load and frequency recording
- Analysis of power consumption
- Assessment of the capacity utilisation and stability of supply systems
- Capture of influences resulting from a constantly fluctuating generator and load structure
- Monitoring of individually agreed connection conditions for compliance with limit values
- Documentation system for commissioning and service tests
- Chronological event recording and logging of binary status signals

RECORDING FUNCTIONS

Fast fault recording for power system faults

When a limit value violation occurs, all analog and binary signals are recorded with a configurable sampling rate of 100 Hz to 30 kHz. The recording comprises configurable time windows for the pre-fault, fault and post-fault periods. The fault recording duration can either be set to a fixed length or can be controlled by the actual duration of the event. These recordings make it possible to carry out comprehensive and detailed analyses of power system faults, including determination of fault location.

Slow fault recording

In addition to the analog and digital signals which are measured directly, the RMS recorder can also record all the quantities calculated on the basis of these signals, such as frequency, unbalance, positive sequence system, negative sequence system and zero sequence system, active power, reactive power and apparent power, harmonics etc. The sampling rate can be set between 1 Hz and double the system frequency (100 Hz/120 Hz). The recording is ideal for detecting and assessing slow processes, such as power swings, or for generator monitoring.

Uninterrupted data recording with continuous recorder

The continuous recorder records measurement data nonstop. The recorded data can be downloaded to a central computer/database at regular intervals without interrupting the measure-

ment. This enables continuous recording for a practically unlimited period of time. The averaging intervals can be set freely. The mean value for the interval time and the highest and lowest single RMS values are recorded for each averaging interval. These long-term recordings provide comprehensive information on the whole power system, expose slow and fast changes, show switch-on peaks and reveal potential for energy savings.

Event recording with dynamic sampling rates

Event recording provides information on the time, level and duration of limit value violations and a classification of events to EN50160, UNIPEDA, CBEMA or ITIC, for example. RMS value event signatures can also be recorded if desired. To keep memory requirements to a minimum, the sampling rate can be controlled dynamically. This means that fast signal changes are recorded with a higher resolution than slow signal changes.

Power quality analysis

The continuous recording of all power system parameters allows comprehensive power quality analysis to DIN EN 50160 or quality criteria defined by the individual user. Characteristic values are captured and calculated to IEC 61000-4-30 class A, IEC 61000-4-7 and IEC 61000-4-15.

Because quality reports can be created automatically as PDF files as well, it is easy to provide proof of quality whenever required, even without specialist knowledge.

Recording of digital events and states

Binary inputs are primarily used to read in signals from protection relays and circuit breaker positions which are of decisive importance for the analysis of fault records. Event classes with and without an acknowledgement obligation and message texts which can be listed or printed out chronologically can be assigned to the binary inputs for the continuous recording of binary signals (SER function).

Advantages over digital protection relays

- Because comprehensive trigger criteria can be set independently of the protection function, it is possible to record even very slight anomalies in the supply system
- Unadulterated signal recording thanks to the broad bandwidth from DC to 15 kHz
- Identification of malfunctioning transducers, bad switching contacts or ferroresonance
- Simultaneous recording with fast sampling for detailed fault analysis and slow sampling for the identification of power swings and for the performance of stability evaluations
- Recordings include information on all plant components and their impact chain

- By recording data continuously in order to monitor power system operation comprehensively, proof of how a power system is operating can be provided at any time, even if no disturbances were detected during the period in question
- Exhaustive evaluation of power quality, including harmonic and flicker analysis to IEC 61000-4-30 class A, IEC 61000-4-7, IEC61000-4-15

SHERLOG operating software

The ergonomic graphical user interface, designed according to the Windows® Fluent concept, is geared to meet real-world requirements and provides a wide range of functions, including the following:

- Flexible configuration for optimum customisation to measurement tasks with due consideration of the network model
- Fully automatic operation of the measuring system with:
 - Long-distance data transmission
 - Determination of fault type and fault location
 - Printout or dispatch of fault reports or quality reports
 - Records are archived in a database
 - Online monitoring
 - Self-monitoring

- Easy-to-use manual functions for data evaluation and report creation
- Remote configuration
- Can be used with several screens (optimum overview, a wealth of information at a glance)

Evaluation of fault records

The software contains a comprehensive range of powerful analysis tools for the assessment of recorded data:

- Useful zoom functions and variable scaling
- Simultaneous display, superimposition and synchronisation of more than one fault record
- Vector displays
- Harmonic analysis on the basis of full waves or to IEC 61000-4-7 with interharmonics
- Nyquist plot
- Determination of fault location
- Freely configurable absolute and delta measurement cursors
- Formulary and formula editor for the calculation of further power system quantities
- Individual report creation using the clipboard
- Automatic report creation



Fig 4: Vector analysis and harmonic analysis



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