CONDIS®

Reference Sheet

Grid Control

Development of a monitoring system for the aggregation and analysis of fault data

In collaboration with Netceler and Amprion GMBH

Objectives

- Fast remote readout of fault records
- Interoperability for all IEDs used
- Use of software for automated fault analysis
- Recommendation of manual restart after unsuccessful automatic restart

System architecture

The implemented system is divided into a data collection area and an application area. Fault records are aggregated by the protection devices and fault recorders at station level and stored on a central server in the process network. This server forwards the data to an application server in the office network. Network management, operating personnel or protection engineers can work directly with the application server. There is also a data connection to additional services such as a Blitz database.

IED and IEC 61850 communication

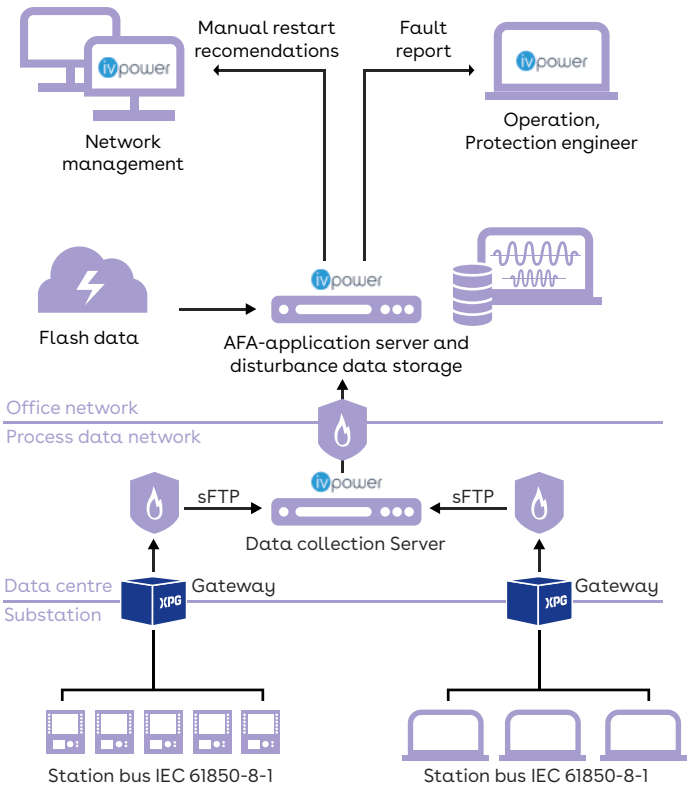
The IEDs store the fault records (COMTRADE files) on the internal memory. Preconfigured virtual machines (virtual appliances) running gateway software are located in the substations. This retrieves the fault records via the station bus (IEC 61850) and stores them in the cache in the folder structure with unique file names.

Gateway and communication towards data collector server

The fault records with folder structure are sent from the gateway to the data collector server via sFTP.

Coupling system/Data centre and IT/OT

Beyond the classic network decoupling through firewalls, the synchronisation procedure via sFTP (FTP with SSH encryption) enables one-way communication: system to data collector and then data collector to application server. The application server is in the office network. It can connect to other information systems and provides a web HMI.



CONDIS®

Reference Sheet

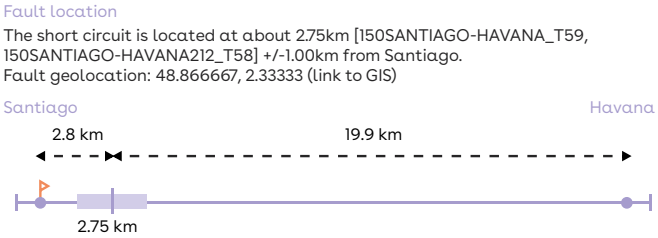
Grid Control

Configuration

For the configuration of the gateway no SCD file is required, only the IP addresses of the IEDs are relevant. The data collector works with configurable device profiles.

Application

The application server carries out the automatic diagnosis of network events by time-correlating fault records and lightning data. It is used to determine the sequence of the fault. The server can notify users by e-mail and offers a web interface for evaluation.



The AFA system supports

- Fault evaluation of signal curves, messages lists, impedance values, etc.
- Fault location (single or multi-sided) with tolerance range where the fault is to be searched for
- Recommendation for manual restart after unsuccessful automatic restart

Conclusions and lessons learned

IT/OT and security

Coupling of process and office networks requires additional review of IT security and compliance with all relevant guidelines (e.g. according to the BDEW white paper).

Scalability and operating costs

The system should be easy to expand and integrate into existing substation control technology.
The connection of the devices via IEC 61850 proved to be very helpful

Advantages

- With the implemented system, the operating personnel can be deployed more efficiently: Faster response on site in the event of faults, support for switching decisions and remote reading of fault records
- Fault location quality and accuracy can be improved in many cases
- An archive with many fault records can be used for further analysis

Network data management

The issue of network data maintenance for the fault location software proves to be an additional expense. A standardised interface in a CIM format is being used here, which will automate the data maintenance process in the future.