DlgsILENT

PowerFactory Monitor PFM300

INTEGRATED, MULTIFUNCTIONAL DATA ACQUISITION SYSTEM
FAULT RECORDER / DYNAMIC SYSTEM MONITOR / POWER QUALITY / GRID COMPLIANCE / PHASOR MEASUREMENT UNITS / POWER PLANT MONITOR
The DIgSILENT PowerFactory Monitor PFM300 provides an excellent overview of grid operation. The multi-timeframe recording mechanism captures all types of events (e.g. those caused by short circuits, switching actions or instability phenomena), mid-term transients and steady-state grid characteristics.

### MULTIFUNCTIONAL FAULT AND EVENT RECORDER

Transient fault recording facilitates the analysis of protection and circuit-breaker device operation.

- Digital Fault Recorder (DFR)
- Flexible channel configuration
- Up to 640 analogue and 2688 digital channels in one system
- Integrated Sequence of Events Recorder (SOE)
- Protection relay function and status supervision
- Different recording rates; fully-configurable
- Centralised Master Station software for convenient data analysis of all field-deployed PFM300 systems
- IEC 61850 compliant

### DYNAMIC SYSTEM & NETWORK PERFORMANCE MONITOR (DSM)

DSM performs the important tasks of power system stability supervision and determination and analysis of key system parameters.

- Voltage stability monitoring and steady-state instability supervision
- Generation outage, load rejection and system frequency response analysis
- Primary- and secondary response supervision
- Load-shedding tuning and optimisation
- Power System Stabiliser (PSS) effectiveness supervision
- Tie-line power exchange and network control characteristics
- Control performance supervision and identification
- Generator and load parameter identification
- Phase angle supervision
- Power oscillation detection and analysis
- Subsynchronous oscillation monitoring
- Supervision of super-synchronous control interactions
- Customised signal aggregation based on multiple input signals

### POWER PLANT MONITOR

Precise knowledge of grid response and plant characteristics is often required for solving stability problems, operating within stability margins and for the optimal tuning of grid and plant control systems.

- Generator, motor and general feeder load tests as well as parameter identification
- AVR/exciter performance supervision and identification
- Prime mover and associated controls supervision (boiler control, primary control, etc.)
- Optimal tuning of Power System Stabilisers (PSS)
- Supervision of shaft oscillations
GRID CODE COMPLIANCE

New rules and grid codes to connect generators to the grid are emerging worldwide. In every region, the operators responsible for the safety and reliability of the power system have established different requirements to connect renewable generation systems to transmission and distribution networks.

- Grid code compliance verification
- Low and High Voltage Ride Through (LVRT/HVRT)
- Verification of generator response during balanced and unbalanced voltage dips/swells
- Verification of voltage support requirements during dips/swells and after clearance
- Supervision of power plant non-disconnection
- Supervision of active and reactive power recovery according to the user-selected grid code
- Assessment of power quality requirements, flicker and harmonic levels according to IEC 61000-4-15, IEC 61000-4-7, IEC 61400-21 or TR3 (specific methods for renewables)
- Support of various grid code definitions including ENTSO-E, FERC, EEG/TRA, China BG/T, and that used in South Africa

PHASOR MEASUREMENT UNIT (PMU)

Wide area measurement (WAM) in regional transmission grids and very wide area super grids via PMUs is considered to be one of the most important measurement techniques in future power systems. PMUs increase grid reliability by early detection of faults and prevention of power outages.

- Real-time phasor measurement technology with high accuracy synchronised time stamping
- Multiple C37.118 inputs
- Aggregation of C73.118 inputs with analogue signal inputs
- C37.118 output

POWER QUALITY MONITOR

Poor power quality is a problem for all consumers. It contributes to high energy costs and production disturbances. Following the IEC 61000-4-30 standard it is possible to verify the power quality of the power supply.

- IEC 61000-4-30 Class A
- True RMS voltage and current, frequency, harmonics and inter-harmonics up to the 50th order according to IEC 61000-4-7, as well as unbalance, voltage dips, swells and interruptions
- Flickermeter according to IEC 61000-4-15
- Recording of all time frames from half-cycle stream up to 2 hours aggregated
- Statistical reports
PFM300 is an integrated, multifunctional data acquisition system that covers recording, monitoring and analysis of signals in all relevant timeframes. Flexible hardware and software components allow for the configuration of portable systems, standalone installations as well multiple distributed and linked installations.

**ARCHITECTURE**

- The PFM300 Smart Signal Unit (SSU) is an integrated, multifunction data acquisition system. Housing all components such as power supply, CPU, data storage and signal inputs with flexible channel configuration including interfaces for channel extension devices like Signal Units (SU) and Digital Units (DU)
- Centralised Master Station software for convenient data analysis supervision of all SSUs in the field
- Network connection of multiple SSUs to a Master Station
- Scalability of multiple SSUs including their extension devices
- Management of multiple linked slave-SSUs by the integrated Control Monitoring Unit (CMU) from an SSU. Two topologies are possible managed by one SSU: high numbers of channels with up to 640 analogue and 2688 digital channels; or distributed installation locations
- Slot-based components for easy upgrade or adaptation to different applications
- Availability of portable and rackmount versions as well as fully-configured cabinet according to customer specification

**SSU MULTI-TIMEFRAME DATA STREAMS**

**RAW DATA STREAM**

- Stream rate: 15,151kHz (303 samples/cycle @50Hz, 252 samples/ cycle @60Hz)
- Stream values: Instantaneous values from all signal inputs
- COMTRADE output: Recording based on trigger event
  - Pre-fault time: user-selectable (typical: 1 - 60s)
  - Post-fault time: user-selectable (typical: 1 - 120s)
  - Re-trigger: supported; various options

**FAST DATA STREAM**

- Stream rate: 1-2 samples/cycle (50-100 samples/sec. @50Hz, 60-120 samples/sec. @60Hz)
- Stream values: Voltages and currents RMS/phasor, frequency, power, PQ values, Di, etc. based on all signal inputs, C37.118 input values, user-defined signal aggregation based on multiple input signals via IEEE C37.118 or IEC 60870-5-101/104
- Protocol output: via IEEE C37.118 or IEC 60870-5-101/104
- COMTRADE output: Recording based on trigger event
  - Pre-fault time: user-selectable (typical: 1 - 120s)
  - Post-fault time: user-selectable (typical: 60 - 1200s)
  - Re-trigger: supported; various options

**SLOW DATA STREAM**

- Stream rate: Up to 10 samples/second
- Stream values: Same as for fast data stream
- Protocol output: via IEEE C37.118 or IEC 60870-5-101/104
- COMTRADE output: Continuous recording 24h; saved daily

**POWER QUALITY DATA STREAMS**

- Stream rate: Half-cycle stream, 10/12 cycle stream, 150/180 cycle aggregation stream, 10min aggregation stream, 2h aggregation stream according to IEC 61000-4-30
- Stream values: True RMS voltage and current, frequency, harmonics and interharmonics up to the 50th order according to IEC 61000-4-7, unbalance, voltage dips, swells and interruptions, Flickermeter according to IEC 61000-4-15
- COMTRADE output: Continuous recording, based on trigger event or timer-based
**SSU TRIGGER SUPERVISION**

- Triggering on all analogue and digital signal inputs as well as inputs via protocol
- Setup triggers on all values such as RMS, frequency, power, PQ values, oscillations or user-defined signals
- Threshold settings on maximum, minimum or gradients of analogue values
- Triggering on falling or rising edge
- Hysteresis and time filter options on all trigger monitors
- Synthetically-created trigger conditions based on logical combination of different trigger monitors via user-defined equations
- Timer triggers
- Multiple trigger monitors can be set on same signal values with different settings or logical combinations thereof
- Automatic re-triggering extending the recording
- Remote triggering of other PFM300 locations

**SSU WEB INTERFACE**

- Accessible on each Smart Signal Unit
- Display of live values, supports various display types
- Measurement operation control including manual triggering
- Easy configuration of signal assignment, trigger settings and recording parameters
- Including archive with up- and download functionality
- User management with multiple user accounts/groups having different access rights
- Firmware update via web browser

**MASTER STATION**

- Centralised Master Station software for convenient data analysis of all field-deployed PFM300 systems
- Master Station released as a module of DlgSILENT PowerFactory
- User-friendly interface with special toolbar, plot wizards and Master Station tool kit
- Data collection service to centralise recordings from all field SSUs to the Master Station via IEC 61850 or SMB Protocol via TCP/IP
- Database-based event viewer for PFM events such as triggers, warnings, alarms and SOE (sequence of events) with multiple screen arrangement, individual filter options and export functions
- Easy plot creation and data handling with various features including scaling, filtering, record scrolling, jumping, etc.
- Statistical functions such as local/global maxima/minima, average and histograms
- Individual post-creation of signalling, based on multiple recorded signals
- Recorded data can be exported to various file types including ASCII, Excel, etc.
- Full integration of recordings into PowerFactory simulations
- Optional Scripting and Automation package for customised reporting or add-on functionality
PFM300 VERSIONS

SMART SIGNAL UNIT SSU15-C

- **Specification**
  - 15 analogue input channels
  - 16 digital inputs channels
  - 7 digital output channels
  - Solid state storage 32GB
  - 19" standard, 4*HU
  - 15.15kHz, 16-bit sampling
  - Time synchronisation

- **Variants**
  - Rack mount
  - Portable

SMART SIGNAL UNIT SSU32-C/E

- **Specification**
  - 32 analogue input channels
  - 32 digital input channels
  - 7 digital output channels
  - Solid state storage 256GB
  - 19" standard, 7*HU
  - 15.15kHz, 20-bit sampling
  - Time synchronisation

- **Digital Unit DU128/256 (Extension)**
  - 128/256 digital input channels
  - 19" standard rack mount 3/6*HU
  - 1kHz sampling
  - LAN link to SSU32-CE
  - Power from SSU32-CE
  - Time synchronisation from SSU32-CE

- **General Characteristics**
  - All analogue and digital channels have galvanic isolation.

- **Time Synchronisation (Optional)**
  - GPS antenna
  - IRIG-B
  - IEEE 1588v2 Precision Time Protocol (PTP)
  - Network Time Protocol (NTP)

- **Communication Ports**
  - 1x front LAN Ethernet TCP/IP 10/100Mb/s
  - 2x back LAN Ethernet TCP/IP 10/100/1000Mb/s
  - Support of Redundant Network Interface PRP-1 and HSR according IEC 62439-3 incl. Port A, B failure supervision (optional)

  - Interface card for additional communication ports (optional)
    - 2x LAN Ethernet TCP/IP 10/100Mb/s
    - 4x COM RS-232 and RS-485

- **Protocols**
  - IEEE C37.118 /2005 /2011 (PMU input/output)
  - IEC 61850 edition 2
  - IEC 60870-5-101/104
  - Modbus TCP IEC 61158 (optional)

- **Digital Input**
  - 12V, 24V, 120V
  - Various additional signal input ranges are available, as are custom requests.
PRODUCT SUPPORT

- Up to 5 years hardware warranty
- Professional installation and product support via customer portal and hotline
- Detailed manuals and documentation
- PFM300 Firmware updates incl. new features
- PowerFactory Master Station service packs and new versions

SERVICES, CONSULTANCY AND TRAINING

- On-site commissioning services
- Training at DlgSILENT offices as well as at user’s site
- Power plant testing, including associated equipment such as steam, gas and hydraulic turbines, combustion engines, wind turbines, PV panels and their associated control systems (AVR/Exciter systems, Power System Stabilisers (PSS), prime mover controllers, etc.)
- Development of simulation models for dynamic analysis and parameter identification based on measurements, including models for certification processes of new generating units
- Verification of grid code compliance of power plants and generating units
- Supervision and evaluation of shaft oscillations due to torsional interaction with power system controllers and converters
- Testing and assessment of power quality performance of power plants and system consumers, incl. analysis of harmonic distortion, flicker, voltage dips and swells
- Performance testing of industrial systems, in particular those containing steam processes.

SALES CONTACT

DlgSILENT GmbH
Heinrich-Hertz-Straße 9
72810 Gomaringen
Germany

PHONE
+49 7072 9168-0 (Switchboard)
+49 7072 9168-23 (Sales)
+49 7072 9168-88 (Fax)

MAIL
mail@digsilent.de
www.digsilent.de
DIGSILENT is a consulting and software company providing engineering services in the field of electrical power systems for transmission, distribution, generation and industrial plants.

DIGSILENT was founded in 1985 and is a fully independent, privately owned company located in Gomaringen/Tübingen, Germany. DIGSILENT continued expansion by establishing offices in Australia, South Africa, Italy, Chile, Spain, France and the USA, thereby facilitating improved service following the world-wide increase in usage of its software products and services. DIGSILENT has established a strong partner network in many countries such as Mexico, Malaysia, UK, Switzerland, Colombia, Brazil, Peru, China and India. DIGSILENT services and software installations have been conducted in more than 130 countries.

DIGSILENT PowerFactory
DIGSILENT develops the leading integrated power system analysis software PowerFactory, which covers the full range of functionality from standard features to highly sophisticated and advanced applications including wind power, distributed generation, real-time simulation and performance monitoring for system testing and supervision. For wind power applications, PowerFactory has become the power industry’s de-facto standard tool, due to PowerFactory models and algorithms providing unrivalled accuracy and performance.

DIGSILENT StationWare is a reliable central protection settings database and management system, based on the latest .NET technology. StationWare stores and records all settings in a central database, allows modelling of relevant workflow sequences, provides quick access to relay manuals, interfaces with manufacturer-specific relay settings and integrates with PowerFactory software, allowing powerful and easy-to-use settings coordination studies.

PowerFactory Monitor is a flexible performance recording and monitoring system that copes easily and efficiently with the special requirements for system test implementation, system performance supervision and the determination and supervision of connection characteristics. Numerous monitoring systems installed at various grid locations can be integrated into a Wide-Area-Measurement-System (WAMS). PowerFactory Monitor can be fully integrated with PowerFactory software.

DIGSILENT Consulting
DIGSILENT GmbH is staffed with experts of various disciplines relevant for performing consulting services, research activities, user training, educational programs and software development. Highly specialised expertise is available in many fields of electrical engineering applicable to liberalised power markets and to the latest developments in power generation technologies such as wind power and distributed generation. DIGSILENT has provided expert consulting services to several prominent PV and wind grid integration studies.