



Advanced Power Quality Monitor

UP-2210

UNIPOWER offers a wide range of products for power quality measurements and demand analysis. Our product line covers a full range from traditional portable PQ analysers to fully integrated, automated Power Quality Management systems. All UNIPOWER products are developed and manufactured in Sweden.

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UP-2210

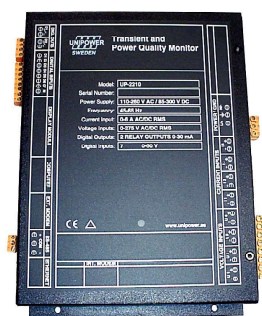
Advanced 3-phase Power Quality and Transient Monitor

- ✓ Norm-compliant,
IEC 61000-4-30 Class A
- ✓ Power Quality Monitoring
- ✓ Transient Monitoring
- ✓ Demand Monitoring
- ✓ Fault Recorder
- ✓ GPS Synchronisation
- ✓ Fully Simultaneous Operation
- ✓ PQ Secure Information System

The UP-2210 Power Quality Monitor is designed for permanent installation in any 50 / 60 Hz system. All voltage and current channels are differential, allowing the UP-2210 to be installed regardless of system configuration.

The unit has 12 voltage and 4 current channels which may either be connected directly or using PTs and CTs as required. The heart of the UP-2210 is a 32-bit digital signal processor (DSP) enabling all channels to be simultaneously monitored, thereby providing the most advanced features available anywhere.

The unit is designed to be fitted inside a switchboard or other equipment and to communicate to a conveniently located computer. Several units may be networked to a single computer, thus providing centralised monitoring to locations both local or distributed on a global basis.



Measure unit UP-2210



Measure unit UP-2210R

The standard unit is fitted with one RS-485, two RS-232 communication ports and one USB port. Other options available include internal modem, external GSM modem, ISDN modem and Ethernet.

The UP-2210 can also be fitted with digital inputs and digital outputs. These may be assigned for other monitoring purposes such as circuit breaker tripping, security alarms in substations etc, or providing local alarm or control outputs.

The UP-2210 can also be equipped with a fault recorder module, which activates the unit's digital inputs for supervision of the status of circuit breakers, relays and other external equipment. Whenever there is a disturbance in the electrical grid the unit records voltage and current deviations, together with information about the connected external equipment.



Power Quality Monitor (UP-2210)

The UP-2210 is a full-featured, norm-compliant (IEC 61000-4-30 Class A) power quality monitor capable of detecting any disturbances encountered in a network. It interfaces with the PQ Secure software package.



Measure unit (UP-2210)

The UP-2210 is based on a powerful digital signal processor (DSP) which makes it possible to monitor all parameters simultaneously with high accuracy.

The analogue sampling system is synchronised with the actual fundamental frequency, which ensures class A accuracy and precision as well as accurate event capturing.

Each and every cycle is analysed in accordance with IEC 61000-4-30 Class A. The UP-2210 can easily be set up to measure in accordance with EN 50160 or any other national or international standard, with automatic reporting to management or other any other interested receiver.



Measure unit UP-2210R

Graphical display

An optional graphical display is also available. The unit is equipped with Unipower's unique and user-friendly Turn&Click® interface, and can be connected to a PC on-site via a front panel connector.



Graphical Display Unit

Analogue inputs

The UP-2210 has 4 differential voltage and 4 differential voltage transient inputs. The bandwidth of each input is adapted to the appropriate application. When measuring harmonics a lower bandwidth is needed than when capturing transients.

The UP-2210 also has 4 differential current input channels. In low voltage networks the fourth current channel can be used to measure the neutral current.

Ground fault application

The fourth voltage channel can be used for earth point monitoring in order to find ground faults in impedance grounded networks.

Earth leakage

The UP-2210 is automatically detecting any earth leakage by summing the phase (and neutral) currents. If there is a ground fault some current will flow in a different path and the leakage is detected.

Digital Inputs and Fault Recording

The UP-2210 can be equipped with digital inputs that can interface with a variety of external equipment such as kWh-meters, water meters, protective relays, circuit breakers etc. By connecting signals from the protective relays, the UP-2210 can work like a fault recorder, recording all signals upon a trig signal at a digital input.

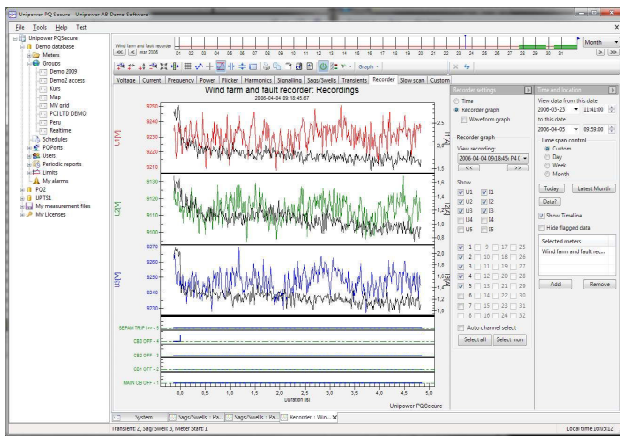
Digital Outputs

The UP-2210 can also be equipped with digital outputs that can be programmed to alarm when certain pre-set conditions are met. This in turn can alert other, external systems. The digital outputs can be used to synchronise other meters (or UP-2210) to record at an event.



Fault Recorder Module

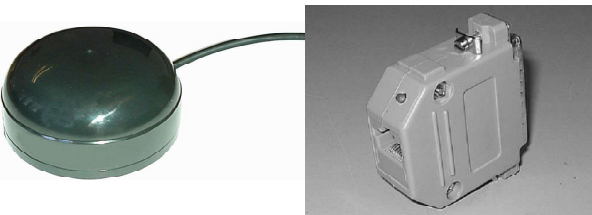
The UP-2210 can also be equipped with a fault recorder module, which activates the unit's digital inputs for supervision of the status of circuit breakers, relays and other external equipment. Whenever there is a disturbance in the electrical grid the unit records voltage and current deviations, together with information about the connected external equipment.



Fault Recorder window, displaying voltages, currents and digital input channels during a fault.

Time synchronization

GPS or NTP synchronization via server protocol.
Separate GPS module also available for meters.



Communication

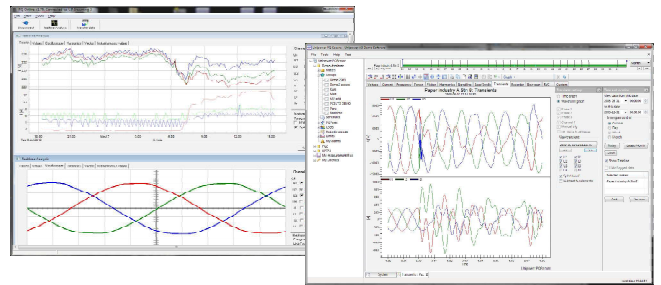
A central feature of UP-2210 is the flexibility and ease of communication between the workstation and the permanently installed monitor. Communication can be via a wire, phone connection, radio (and GSM), fibre/wire, etc. The monitor has built-in RS-232, RS-485, USB, Ethernet and also a modem.

The UP-2210 can also interface with other systems using either Modbus or PQDif (IEEE 1159.3).

Measured parameters

The UP-2210 has been developed as a full-featured power quality and transient monitor to simultaneously measure all events on all channels. Individual trigger levels can be set to enable an infinitely variable range of user-defined trigger conditions, either from the remote workstation or via a laptop directly connected to the monitor. If a disturbance occurs that exceeds the defined trigger levels the monitor will record the disturbance.

The internal memory has been chosen so that there are no moving parts. Problems with hard disks are a thing of the past. Instead, the analyser stores the events on its solid-state internal memory using a sophisticated data compression technique so that 8 MB represents typically 25 days storage. Remember that the key is the automatic download to the central database.



Waveforms and power quality parameters can be viewed in real-time with PQ Online or as historical data with the PQ Secure software (SQL database).

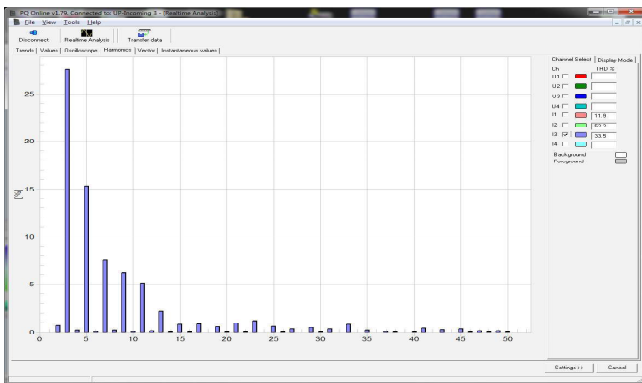
Basic parameters and demands

All basic power quality parameters are measured continuously and can be viewed in real-time with PQ Online, or as historical data with PQ Secure.

- ✓ Voltage (phase-phase, phase-neutral)
- ✓ Current (phase-phase, phase-neutral)
- ✓ Active, Reactive and Apparent Power
- ✓ Active, Reactive and Apparent Energy
- ✓ Power Factor and cos phi
- ✓ Frequency
- ✓ Rapid Voltage Changes, RVC
- ✓ Earth fault detection
- ✓ Frequency rate of change, dF/dt

Harmonics

Harmonic distortion is caused by non-linear generators or loads and can cause severe problems. For example, capacitor banks can easily be damaged and neutral connectors can overheat. To identify harmonic-related problems it is necessary to measure continuously. The UP-2210 unit measures harmonics, both amplitude and phase, up to the 50th harmonic. A large number of different THD parameters together with K-factor and harmonic power are calculated. All harmonics calculations are in accordance with IEC 61000-4-30 Class A (IEC 61000-4-7 Class I). The UP-2210 also has a module for studying interharmonics and signalling.



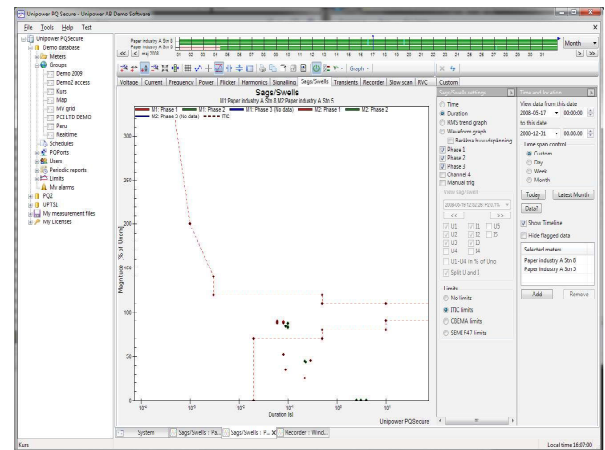
PQ Online: real-time evaluation of harmonics.

Transients, Sags and Swells

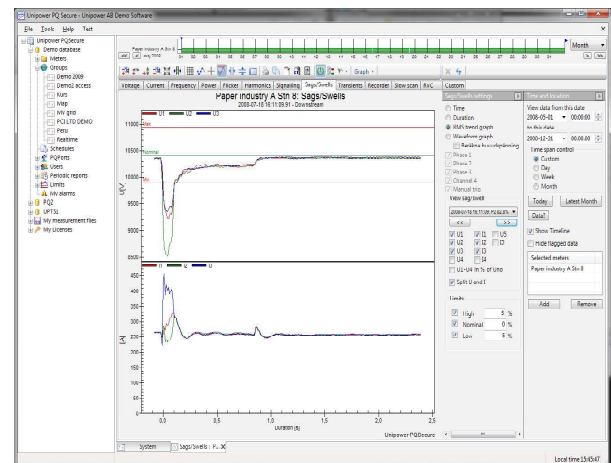
Disturbances in a power system are defined as voltage transients, sags or swells. Transients are fast disturbances originating from lightning, load switching etc. Voltage sags are short-duration low RMS-values generally caused by faults such as short circuits in the utility system. The reliability of a power system is critical to most businesses and is greatly affected by sags and swells.

The UP-2210 detects and categorises the type of disturbance, and helps to identify the source by determining the direction. It measures and calculates the RMS value for each half cycle and uses precision peak detectors to detect transients down to part of a microsecond duration. When a transient or a sag/swell occurs the UP-2210 records it and stores all necessary data in the built-in memory. It is then automatically transferred to the workstation with a seamless timebase for evaluation. Transients and sags & swell measurements are based on IEC 61000-4-30 Class A.

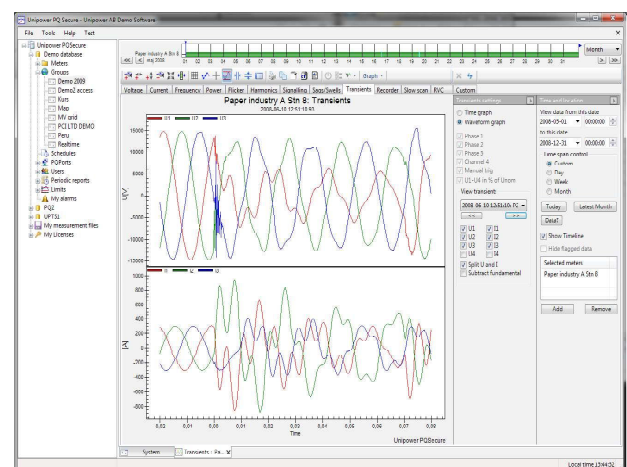
The Callback function ensures that a disturbance is immediately reported to the system.



PQ Secure, Sag&Swell duration diagram - ITIC



PQ Secure, Sag&Swell RMS evaluation window

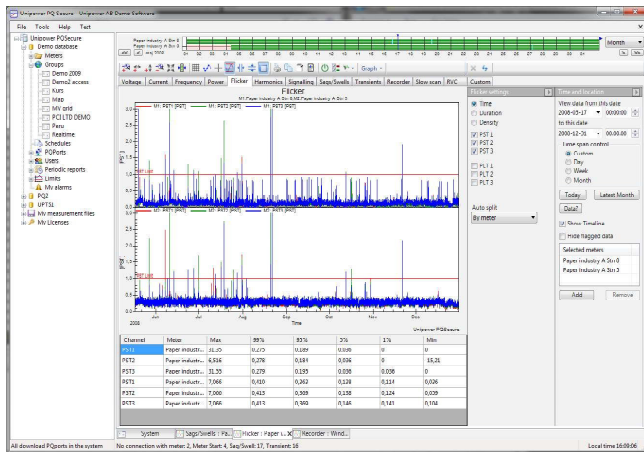


PQ Secure, Transient evaluation window



Flicker

Fluctuating loads cause voltage variations that are often referred to as flicker. Lamps connected to such a voltage produce a flickering light, very annoying to the human eye. The UP-2210 measures voltage flicker in accordance with IEC 61000-4-30 Class A (IEC 61000-4-15) and calculates flicker parameters such as IFL, PST and PLT.



PQ Secure, historical evaluation of PST, short-term flicker severity.

Unbalance

Unbalance is a condition where the three phases differ in amplitude. This unbalance is frequently expressed as the ratio of the negative phase sequence divided by the positive phase sequence, as a percentage. Even small amounts of voltage unbalance decrease the efficiency of a three-phase motor. Monitoring the unbalance can help to improve efficiency and increase the life length of a motor.

The UP-2210 measures and stores the positive-, negative- and zero-phase sequence and the unbalance for both voltage and current in accordance with IEC 61000-4-30 Class A.

Slowscan Recording

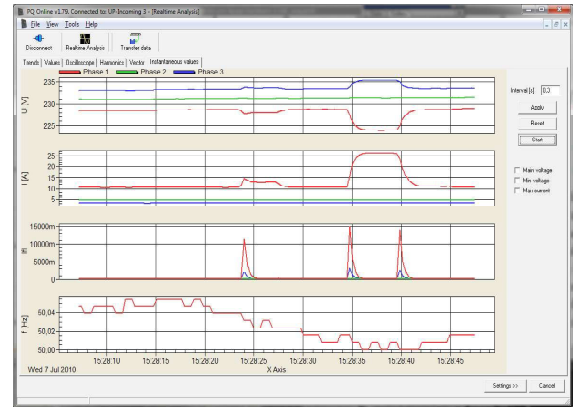
Module enables RMS recording up to 5 minutes. Multiple triggers available: Frequency threshold, Voltage threshold, dI/dt, dP/dt, dQ/dt and dF/dt.

Current Trigger

Set the instrument to trig on specified current threshold. Usable for monitoring inrush events such as motor starts etc.

Real-time and troubleshooting

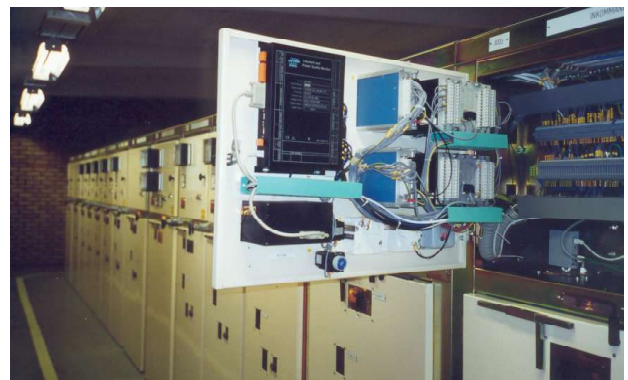
Without interrupting the logging of all parameters, the UP-2210 can show values in different real-time graphs. This makes a great tool that can be used when troubleshooting different problems on site as well as remote.



Voltage, current, instantaneous flicker level and frequency in real-time.

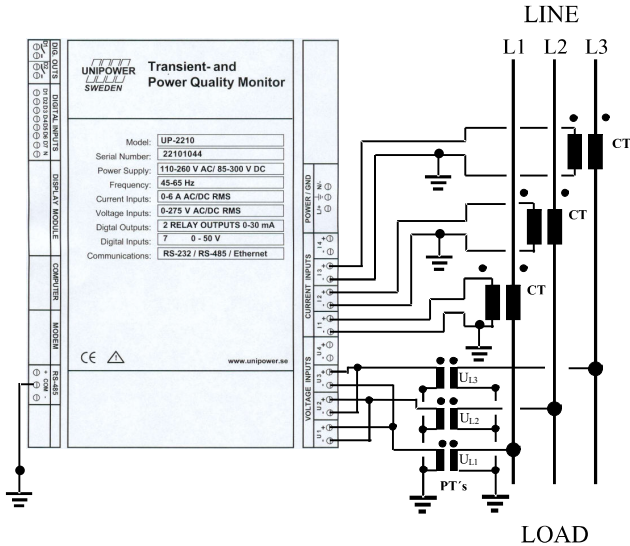
Mounting

The UP-2210 is a compact and rugged unit and is intended to be mounted permanently on site. The small size is ideal for mounting in any switchboard. An optional graphical display is also available for front panel monitoring on site. The display unit can be mounted remotely from the UP-2210 and is equipped with an extra front panel RS-232 communication port to which a portable computer easily can be connected to view real-time parameters on site.



UP-2210 and Display unit installed in a substation cabinet

Example of wiring diagram, 3-phase, 3-wire delta with 3 PT's and 3 CT's



Connections

The UP-2210 supports all power configurations as listed below.

- ✓ 3-wire system
- ✓ 4-wire system
- ✓ Phase-to-phase, wye and delta configurations

All calculations are based on the correct electrical configuration which is set from a drop-down menu.

Typical Substation Application

PT primary: 11 kV
PT secondary: 110 V
CT primary: 3000 A
CT secondary: 5 A

Digital In-/Outputs

Communication
(RS-485 in this case)



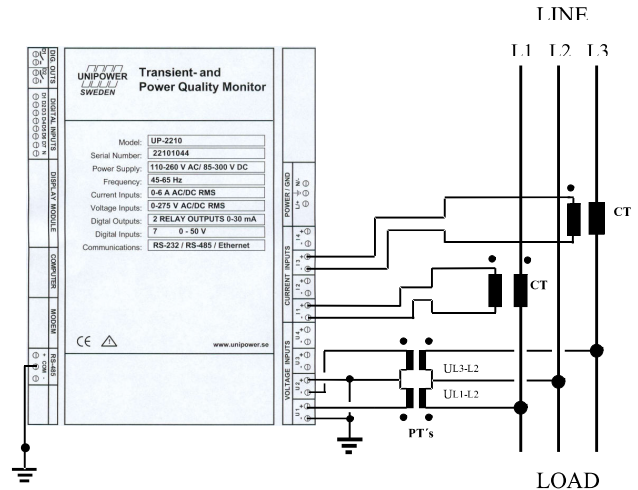
Power supply
(85-264 V AC /
110-375 V DC)

4 current inputs
(0-6 A TRMS)

4 voltage inputs
(0-275 V TRMS)

Connection box
(connected to PT's
and CT's)

Example of wiring diagram, 3-phase, 3-wire delta with 2 PT's and 2 CT's



Installation

- ✓ Fourth voltage input available for measurements in open delta configurations etc.
- ✓ Fourth current input available for neutral or ground current measurements
- ✓ 8 (32) digital inputs available for indication purposes such as circuit breaker tripping etc.
- ✓ 2 (4) digital outputs available for alarm purposes etc.



Technical Specification

Voltage inputs

Voltage channels	4 differential inputs
Channel input level	275 or 150 V RMS (custom range available)
Resolution	14 bit (84 dB)
Basic sampling rate	256 samples/cycle
Input impedance	2 Mohm
Bandwidth	3.2 kHz analogue anti-aliasing filters
Accuracy	IEC 61000-4-30 class A (0.1%)

For maximum accuracy, automatic synchronisation to the power frequency is ensured by a phase-locked loop (PLL).

Voltage transient inputs

Voltage transient channels	4 differential inputs
Channel input level	+/- 1500 V peak level
Resolution	14 bit (84 dB)
Transient detection	Fast transients (>0.5us), sag/swells, interruptions
Input impedance	2 Mohm
Bandwidth	3 MHz

Current inputs

Current channels	4 differential inputs
Channel input level	0-6 or 0-1.2 A RMS (voltage input optional)
Resolution	14 bit
Basic sampling rate	256 samples/cycle
Input impedance	<10 mohm
Bandwidth	3.2 kHz analogue anti-aliasing filters
Accuracy	0.1%

Digital inputs

8 opto-isolated digital inputs (0-250 VDC). 32 channels optional.

Digital outputs

2 solid state relays (0-110 VDC, 0-110 mA). 4 channels optional.

Time synchronisation

GPS or NTP synchronization via server protocol. Separate GPS module also available.

Selected calculated parameters

Power Quantities	All 3-phase configurations. Active power [kW], Reactive power [kVAR], Apparent power [kVA], Power Factor and $\cos\phi$ (displacement factor), Active Energy [kWh], Reactive energy [kVARh], Apparent energy [kVAh] Energy accuracy class 0.2S (IEC 62053-22)
Frequency	50 or 60 Hz according to IEC 61000-4-30 Class A.
Harmonics	0 - 50th individual harmonics of voltage and current in accordance with IEC 61000-4-30 Class A. THD factors (THD-R, THD-F, TDD, THD-I etc), K-factor, 3sec Max Harmonic power with direction
Power Harmonics (PFFT)	In accordance with IEC 61000-4-30 Class A.
Interharmonics	IFL, Pst, Plt calculated in accordance with standard IEC 61000-4-30 Class A (IEC 61000-4-15)
Voltage / Current Unbalance	Positive-, negative- and zero phase sequence plus unbalance value (%) according to standard IEC 61000-4-30 Class A
Signalling Voltage	In accordance with EN 50160 and IEC 61000-4-30 Class A
RVC	Rapid voltage changes in accordance with IEC 61000-3-7 and 61000-4-30 Class A
Current leakage and Voltage sum	Isum and Usum parameters

Memory capacity

8 MB (larger memory is optional) built-in flash memory for measure data. A unit with standard memory will be able to measure for at least 25 days with normal configuration.

Communication

Built-in RS-232, RS-485 and USB. Optional Ethernet and internal modem. Support for external modems, radio devices, ISDN- and GSM/GPRS-modems. The measure unit can also interface with other systems using either Modbus or PQDif (IEEE 1159.3).

Standards

Voltage Quality	EN 50160, IEC 61000-2-2, IEC 61000-2-12 and more
Harmonics Measurements	IEC 61000-4-30 Class A (IEC 61000-4-7)
Flicker Measurements	IEC 61000-4-30 Class A (IEC 61000-4-15)
Power Quality	IEC 61000-4-30 Class A (Testing and measurement techniques)

Mechanical data UP-2210

Size W x H x D	205x300x65 mm Display unit, cutout: 186x92mm, Depth 99mm
Operational temperature	-10 °C to +55 °C
Humidity	10% - 98% non-condensing
Weight	1.3 kg
Safety	IEC 61 010-1
EMC	IEC 61000-6-4 and IEC 61000-6-2 (EN 50 081-1,2; EN 50 082-1,2)

Calibration and self-test

The calibration of UP-2210 is software-based and is therefore easy to make directly on site without having to dismount the units. To assure maximum reliability the UP-2210 always performs an automatic self-test (AST) before measuring.

Power supply

Standard: 110/230 V AC or 100-375 V DC, Optional: 24 V DC or 48 V DC

UP-2210 main features:

Sampling frequency

High-speed sampling frequency (256 samples/cycle) gives a high accuracy of all measured parameters.

Transient high speed capture

High-speed transients down to 0.5 us are captured and the waveforms for all 8 channels are recorded and can easily be evaluated with pre- and post trig.

Sag & Swell long time recording

8-channel recording of sags/swells up to 30 seconds (every single cycle is recorded). Selectable pre- and post-trig.

Realtime graphs

Realtime values can be studied together with waveform, harmonics graph, vector diagram and unique realtime time graph of instantaneous flicker level and other parameters.

Historical Trend graph

Unique automatic historical trend graph that shows all important values 24 hours back in time in real-time mode. This can also be shown in the optional display unit that can be mounted in substations etc.

PLL Sampling Synchronisation

High accuracy of all measured parameters achieved by a synchronisation between the sampling of the input signals and the power frequency. The synchronisation is made possible by a built-in PLL (phase-locked loop).

Flash memory

Easy to upgrade with new software thanks to the built-in flash memory. No moving parts ensures total reliability.



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