



Grid Solutions
a GE and Alstom joint venture

MEASUREMENTS PRODUCT SOLUTIONS

iSTAT M355

Power quality analyser

The measurement of power quality is becoming very important and the M355 measures the required parameters to the highest defined standard.



IEC 61000-4-30 Class A

The M355 can be used by utilities (evaluation against standards) and industry (monitoring supplied power quality).

POWER QUALITY

Power Quality (PQ) is a very common expression; however it is not exactly in accordance with its actual meaning. PQ analysis actually deals with the quality of the supply voltage which is the responsibility of the utility companies and influences the behaviour of connected equipment and devices.

Current and power variations on the other hand are a consequence of varying loads and hence are the responsibility of the consumer. With proper filtering the influence of varying loads can be restricted to within the consumer's internal network or at worst within a single feeder. Whilst poor supply voltage quality influences a much wider area.

The iSTAT M355 has an important role in the permanent monitoring of power quality from its production (especially renewable) through transmission and distribution to the final consumers, especially those who are adversely affected by poor quality of the voltage supplied.

Lack of information about the supplied quality of voltage can lead to unexplained production problems and malfunction or even damage to equipment used in production processes. Therefore the M355 can be used for utility purposes (evaluation against standards) as well as for industrial purposes (monitoring supplied power quality).

M355 POWER QUALITY ANALYSER

The M355 is a power quality analyser that provides all of the measurements defined in IEC 61000-4-30: 2009 to Class A. Class A measurements are required where precise measurements are necessary, for example, for contractual applications that may require resolving disputes, verifying compliance with standards, etc.

The M355 also reports power quality compliance to the European standard EN 50160, but the default analysis periods and disturbance thresholds can be modified to meet other customer requirements.

The M355 is also a fully functioning communicating measurement centre, with 4 voltage and 4 current inputs, providing more than 150 measurement quantities and directional harmonic analysis on current and voltage inputs to the 63rd harmonic.

The M355 also includes a Trend recorder capable of recording up to 128 channels of analog measurement data and an alarm status recorder.

The M355 provides all of the power quality measurements required by EN 50160 including Flicker (EN61000-4-15) and Harmonics (EN61000-4-7 Class 1) and also calculates interharmonics.

FEATURES

Class A power quality accuracy in compliance with EN61000-4-30:2009
Evaluation of the electricity supply quality in compliance with EN 50160 with automatic report generation
Measurement of instantaneous values of 140+ quantities including harmonics, flicker, power line signalling voltage, unbalance
0.1% measurement accuracy, 0.2 S energy, true RMS
Automatic range selection of 4 current and 4 voltage channels (max 12.5 A and 1000 VRMS) with 31 kHz sampling rate
Recording up to 128 values, 32 adjustable alarms, anomalies and quality reports in the internal memory
Frequency range from 16 Hz to 400 Hz
Up to three independent communications ports, RS232/RS485 up to 115,200 bits/s, Ethernet or USB using MODBUS and DNP3 (level 1)
Support for GPS, IRIG-B (modulated and de-modulated) and NTP real time clock synchronisation
Up to 20 inputs and outputs (analog inputs / outputs, digital inputs, alarm / watchdog outputs, pulse outputs, tariff inputs)
Universal AC / DC power supply (2 voltage ranges)
User friendly setting and evaluation software QDSP2
Multilingual support
144 mm square panel mounting

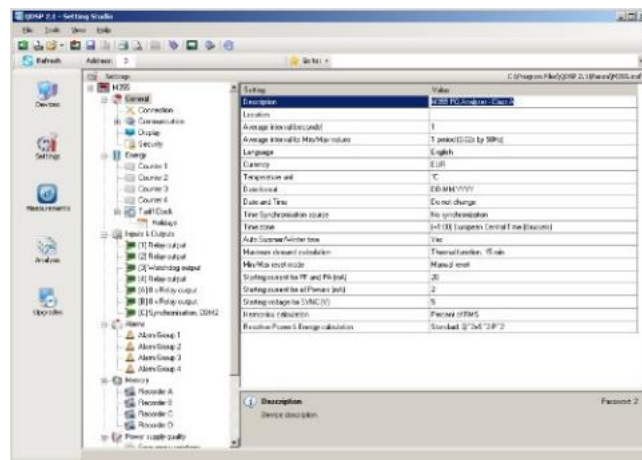
BENEFITS

Accuracy required for power quality measurement for regulatory compliance
European supply industry has a duty to meet EN50160 under EU legislation
Measurements available for a wide range of applications
Accurate measurements of any electrical network regardless of distortion
High accuracy wide range inputs for all voltages and currents of interest
All required measurement values can be recorded and periodically downloaded for analysis
Product can also be used in railway and airfield applications
Allows connection to most remote energy management, DCS and SCADA systems
Allows comparison of power quality data between different analysers across a system or for regulatory purposes
Allows a single multifunction product to be used in an application
Power supply suits most site requirements
Intuitive software interface that can be learnt quickly
Simple installation in multiple countries
Standard installation size

QDSP2 SOFTWARE

The QDSP2 software is used for the supervision of the M355 and many other iSTAT products from a PC. QDSP2 is used for defining device settings, the display of measured and stored values and the analysis of stored data from the devices. Data upload and download is possible via serial, Ethernet or USB communications.

The information obtained from the devices can be exported in standard Windows formats. QDSP2 operates on Windows XP and Windows 7 operating systems.



APPLICATION AND BENEFITS

The M355 power quality analyser can be used as a standalone monitoring device for detection of local PQ deviations. For this purpose it is normally positioned at the point-of-common-coupling (PCC) of small and medium sized industrial and commercial energy consumers to monitor the quality of the delivered supply voltage. Or at medium or low voltage feeders to monitor, detect and record possible disturbances caused by (unauthorised) operation by consumers.

Identifying the relevant fixed measuring points is the most important task prior to complete system installation. The system itself will not prevent disturbances in the network but it will help identify their origin and diagnose the effects. But this is possible only with a system approach by using time synchronised meters and predefined measuring parameters relevant for each individual measuring point.

The M355 stores the measurements and quality reports in internal memory for later analysis. Analysis of recorded measurements from multiple instruments installed in different locations provides an overall picture of the systems' behaviour. This can be achieved with respect to the M355 accurate internal real time clock (RTC) and the wide range of time synchronisation sources supported, which ensure accurate, time-stamped measurements from dispersed units.

COMPLIANCE WITH STANDARDS

Measurements and reports of power (voltage) quality (PQ) performance are only useful when they can be compared with measurements and reports from other PQ measuring devices in the supply network and evaluated against agreed limits for assessment of measured PQ parameters to establish an overall view about PQ issues in the network.

For this purpose it is essential to follow guidelines defined in international standards. PQ analysis depends on two levels of standardization:

Procedures for the proper acquisition of PQ parameters, their timed aggregation and required accuracy are described in a standard IEC 61000-4-30 and two supplementary standards IEC 61000-4-7 (harmonics), IEC 61000-4-15 (flickermeter).

Procedures for evaluation of the measured PQ parameters according to limit levels are defined in the European standard EN 50160.

The M355 power quality analyser follows the required methods and meets the precision requirements for Class A measuring device as described in standard IEC 61000-4-30. It uses acquired measurements to perform automatic evaluation of PQ according to EN 50160 and issues weekly reports. When certain PQ parameters fail to meet the required quality it also shows details of the specific measurements and the time of occurrence of the discrepancy.

IEC 61000-4-30 CLASS A COMPLIANCE

Phase voltage (rms)	Voltage swells
Phase-to-phase voltage (rms)	Voltage dips
Voltage negative sequence unbalance	Voltage interruptions
Voltage zero sequence unbalance	THDU
Voltage flicker	Voltage harmonics
Frequency	Voltage interharmonics
	Signalling voltage

M355 ACCURACY

Measures and	Accuracy	
Voltage L-N	± 0.1%	acc. to EN 61557-12
Current	± 0.1%	acc. to EN 61557-12
Active power (IN = 5A)	± 0.2%	acc. to EN 61557-12
Active power (IN = 1A)	± 0.5%	acc. to EN 61557-12
Active energy	Cl. 0.2S	acc. to EN 62053-22
Reactive energy	Cl.2	acc. to EN 62053-23
Frequency (f)	± 0.01Hz	
Power factor (PF)	± 0.1	acc. to EN 61557-12
THD (U)	± 0.3%	acc. to EN 61557-12
THD (I)	± 0.3%	acc. to EN 61557-12
Real time clock (RTC)	< ± 1s / day	acc. to EN 61000-4-30

VOLTAGE QUALITY

Voltage quality is a well defined term (sometimes also termed Power Quality – PQ) and is described by a selection of parameters, each of which represents certain phenomenon. They represent only the most common types of phenomena which can be used to describe the operation of the electrical network.

The M355 power quality analyser measures, detects, stores and evaluates parameters, which are defined in several standards. Evaluation is by default performed according to the limits set in the European standard EN50160. Users can also alter the parameter evaluation according to their own requirements according to the immunity of their equipment which operates within the analysed power network.

PQ REPORTS

PQ reports are issued on the basis of the chosen PQ parameters as well as information about a period of tracking and place of tracking (type of network).

Each record is internally stored for later analysis.

The QDSP2 software allows the user to quickly view the PQ report with limit lines and compliance results.

To analyse in detail which and when certain parameters are outside the limit lines, it is possible to view time stamped details and from that establish the true origin of the anomaly and its consequences.

INPUT / OUTPUT MODULES

The M355 quality analyser is equipped with two main I/O slots, two auxiliary I/O slots and a special time-synchronisation module.

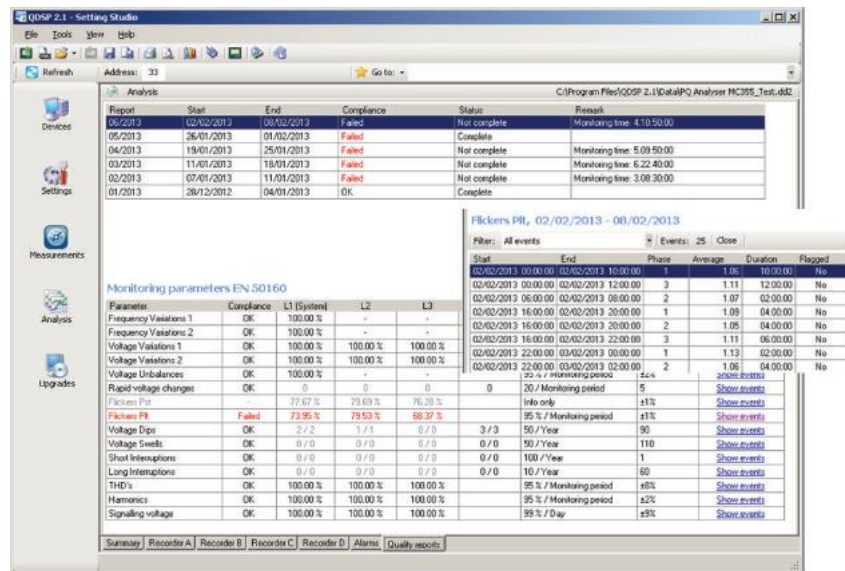
Main slot I/O OPTIONS

- 2 x energy contacts
- 2 x tariff inputs
- 2 x alarm contacts
- 2 x analog outputs
- 1 x Watchdog & 1x alarm contact
- 2 x digital inputs
- 2 x analog input

Auxiliary slot I/O OPTION

- 8 x alarm contacts
- 8 x digital inputs

Phenomena	PQ Parameters
Frequency variations	Frequency distortion
Voltage variations	Voltage fluctuation Voltage unbalance
Voltage changes	Rapid voltage changes Flicker
Voltage events	Voltage dips Voltage interruptions Voltage swells
Harmonics & THD	Harmonics Interharmonics Signalling voltage



Viewing power quality report parameters and log details with setting software QDSP2

Voltage quality parameters as defined in EN50160

MEASUREMENTS

Online measurements

Online measurements are available on the device display or they can be monitored with the QDSP2 software. Readings on the display are updated continuously with the refresh time dependent on the set average interval whereas the rate of readings monitored with QDSP2 is fixed and refreshed every couple of seconds.

For a better overview over numerous readings, the readings are divided into several groups, which contain basic measurements, minimum and maximum values, harmonics, PQ parameters and alarms.

Each group can be shown in either graphical or detailed tabular form. The tabular form allows the freezing of readings and/or copying of data into various report generation software tools.

Selection of available quantities

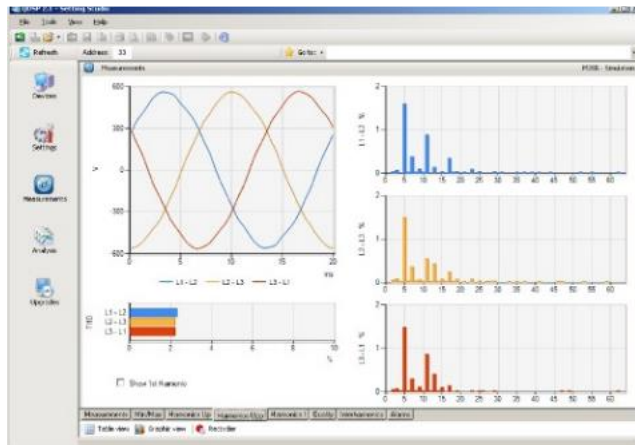
The available online measurement quantities and their appearance can vary according to the type of power network selected and other settings such as average interval, maximum demand mode, reactive power calculation method, etc.



Online measurements in graphical form

Group	U _{L1}	U _{L2}	U _{L3}	Total	Other
Basic measurements	229.37 V	229.24 V	228.96 V	229.19 V	U _g = 229.79 V
Current	101.07 A	101.44 A	101.44 A	303.95 A	I _T = 229.14 A
Real Power	36.89 kW	41.12 kW	38.53 kW	116.54 kW	154.15 kW
Reactive Power	0.80 kVar	0.80 kVar	0.80 kVar	2.40 kVar	19.73 kVar
Power Factor	0.9999	0.9999	0.9999	0.9999	0.9999
Power Angle	0.46°	0.31°	0.46°	0.41°	7.21°
U-C-Angle	2.47°	2.57°	2.42°	2.42°	
U-C-Angle	0.10°	0.10°	0.10°	0.10°	
Phase-to-phase voltage	390.48 V	386.78 V	396.13 V	391.13 V	U _g = 390.93 V
Angle	120.42°	119.93°	119.72°	119.72°	
U-C-Angle	2.05°	2.42°	2.41°	2.41°	
Maximum demand	Measured	Angle	Calculated	Sum	
Current	2.00 A	0.03°	2.00 A	30.30 mA	
Voltage	0.54 V	102.39°			
Energy	0.00 kWh	0.00 kWh	0.00 kWh	0.00 kWh	0.00 kWh
Total	22.96 kWh	1.44 kWh	99.31 kWh	123.71 kWh	20.48 kWh
Table 1	22.96 kWh	1.44 kWh	99.31 kWh	123.71 kWh	20.48 kWh
Table 2	0.00 kWh	0.00 kWh	0.00 kWh	0.00 kWh	0.00 kWh
Table 3	0.00 kWh	0.00 kWh	0.00 kWh	0.00 kWh	0.00 kWh
Table 4	0.00 kWh	0.00 kWh	0.00 kWh	0.00 kWh	0.00 kWh
Energy cost	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €
Maximum demand	Dynamic demand	Hour demand	Over MD	Time MD	Time into period
MD (over 1)	300.00 A	300.00 A	300.00 A	11.31 min	11.31 min

Online measurements in tabular form



Online harmonic measurements in graphical form

RECORDER

A built-in recorder (8 Mb) allows the storing of measurements, detected alarms and PQ reports with details. It supports recording of up to 128 different quantities in 4 configurable partitions. For each partition it is possible to set the storage interval and other recording parameters.

A fifth partition is used for recording alarms and auxiliary power interruptions. Each alarm triggered by a preset limit is stored as the alarm definition and its timestamp. A sixth partition is used for the PQ reports. Each report is identified by a monitoring interval (date).

The last partition is used for PQ report details. They represent time stamped PQ values that are outside the PQ limit lines.

The content of the recorder can be viewed with the QDSP2 software in detailed tabular or graphical form.

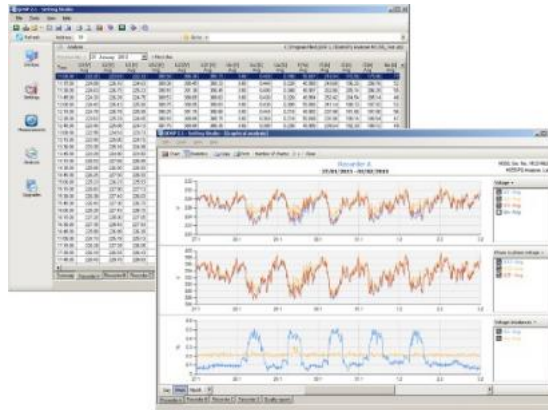
MEMORY CARD

The M355 power quality analyser is equipped with a front panel slot for a full size SD memory card that supports card capacity up to 2 GB. It is intended for downloading internally stored data, uploading setting files and performing firmware upgrades.

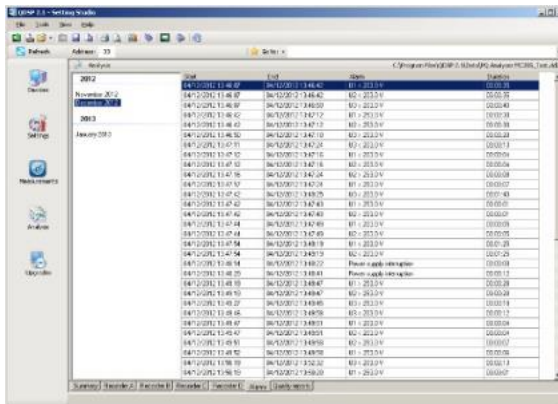
ALARMS

Alarms are a powerful part of the M355 control and supervision features, which allows the device's applications to reach beyond measuring and power network analysis.

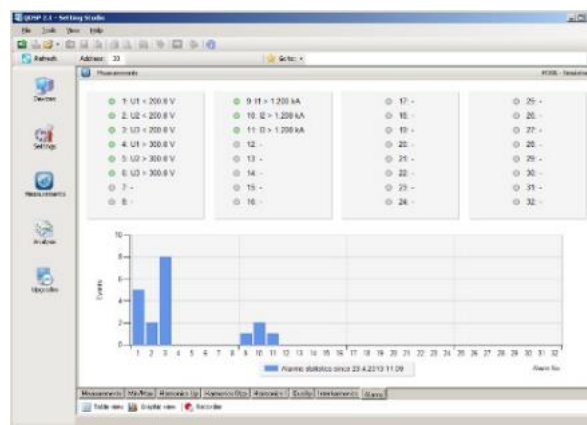
The M355 supports the generation and recording of 32 alarms in four groups. All alarms are also stored in internal memory for post-analysis.



Viewing recorder content in tabular and graphical form



Alarm recording



Viewing alarm settings, status and statistics

REAL TIME CLOCK

Synchronisation

A Synchronised real-time clock (RTC) is an essential part of any Class A analyser for proper chronological determination of events. Without RTC Synchronisation the M355 acts as a Class S device. To distinct cause from effect and to follow a certain event from its origin to manifestation in other parameters it is very important that each and every event and recorded measurement on one instrument can be compared with events and measurements on other devices. Even if the instruments are dispersed, which is normally the case in electrical distribution network, events have to be time-comparable with accuracy better than a single period.

For this purpose instruments normally support a highly accurate internal RTC. Still this is not enough, since temperature is location dependant and it influences RTC precision. For that reason it is required to implement periodical RTC synchronisation.

The M355 quality analyser supports three types of RTC Synchronisation.

GPS time synchronisation:

1PPS and serial RS232 communications with NMEA 0183 sentence support. The GPS interface is designed as 5 pole pluggable terminal (+5 V for receiver supply, 1pps input and standard RS232 communication interface). The proposed GPS receiver is the GARMIN GPS18x.

IRIG time code B (IRIG-B):

Un-modulated (DC 5 V level shift) and modulated (1 kHz) serial coded format with support for 1PPS, day of year, current year and straight seconds of day as described in standard IRIG-200-04. Supported serial time code formats are IRIG-B007 and IRIG-B127.

The interface for the modulated IRIG-B is designed as BNC-F terminal with 600 Ω input impedance. The interface for un-modulated IRIG-B is pluggable terminals.

Network time protocol (NTP):

Synchronisation via Ethernet requires access to an NTP server.

Note: NTP can usually maintain time to within tens of milliseconds over the public Internet, but the accuracy depends on the infrastructure properties - asymmetry in outgoing and incoming communication delay affects systematic bias. It is recommended that a dedicated network rather than a public network is used for NTP synchronisation purposes.

REAL TIME CLOCK

The built-in RTC is also very stable without external synchronisation when the device is connected to an auxiliary power supply. For handling short power interruptions without influence on the RTC, the M355 uses a high capacity capacitor. It ensures the auxiliary supply (for internal RTC only) for more than two days of operation.

COMMUNICATION

The M355 quality analyser has a number of communication options to suit specific demands. It is equipped with standard communication port COM1 and auxiliary communication port COM2. This allows two different users to access data from a device simultaneously and by using TCP/IP communication, data can be accessed worldwide.

The COM2 port is always present as a part of the synchronisation module C. It is available as a general purpose communication port when it is not used for time synchronisation purposes.

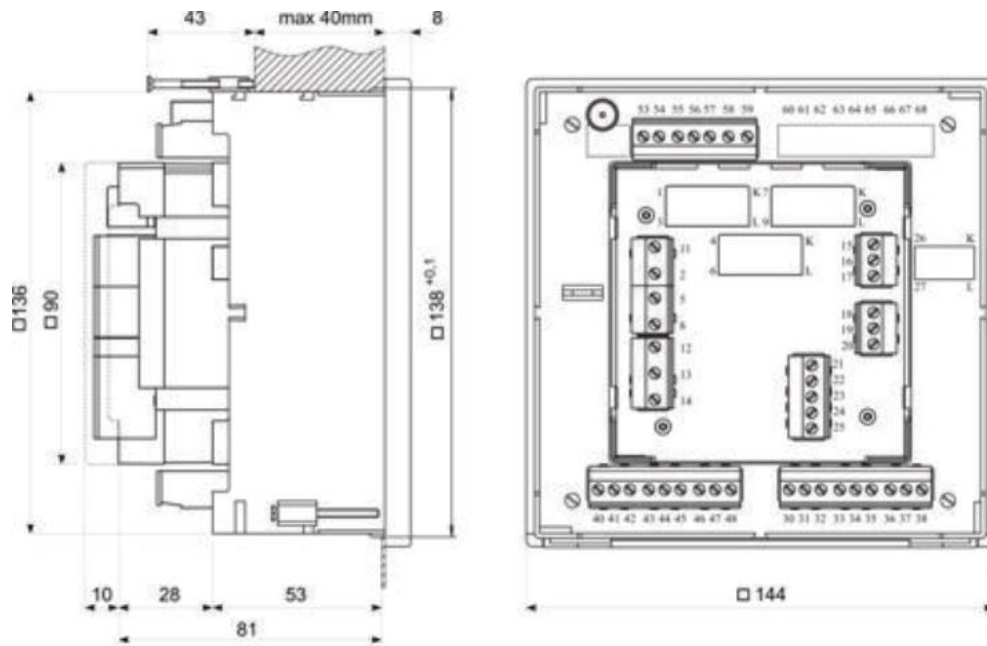
Different configurations are possible.

Conf.	COM1	COM2
1	RS232/485	-
2	RS232/485	RS232/485
3	USB	-
4	USB	RS232/485
5	Ethernet & USB	-
6	Ethernet & USB	RS232/485



IEC 61000-4-30 CLASS A POWER QUALITY ANALYSER

M355 enclosure and dimensions



For more information please contact
GE Grid Solutions

Worldwide Contact Center

Web: www.GEGridSolutions.com/contact
Phone: +44 (0) 1785 250 070

www.GEGridSolutions.com

