Operating Instructions /

for

ANALYST 3Q

Power Quality Analyzer

CE

Please read this instruction manual carefully before initial operation!

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DRANETZ BMI

LEM

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The manufacturer reserves the right to change any information without notice.

Table of Contents

1. General

1.1 Power Quality Analysis

With this analyzer you have acquired one of our high quality, efficient and durable multiple purpose test instruments. We thank you for your confidence.
By monitoring the voltage quality criteria, the final customer receives important information about the quality of his power network as provided by the electricity producer. With this Analyzer you obtain the certainty that the power quality corresponds to the EN50160 standard, a recognised international power quality standard.

It is necessary to check the supply voltage regularly in order to ensure the perfect functioning and working of the growing number of electronic devices. In connection with the liberalisation of the energy market "Voltage Quality" is also becoming more important for energy producers and final customers.

This device has been optimised for the fast identification of disturbances in the power network.

With the help of the clear representation of all relevant parameters, it becomes simple to detect systematic network problems.

Therefore the analyzer was developed in particular for plant electricians and electrical installers, who have an important role during the recovery of disturbances of the power distribution system.

1.2 Safety Instructions

Please read this section carefully. It will familiarise users with the most important safety instructions for handling the instrument.

Warning

Open the instrument only to replace the accumulator package (see chapter 4.1). Opening the instrument can lead to electric shock. Therefore the instrument should be separated from all live circuits before opening. Disconnect all test leads before using the RS232 interface. Qualified service personnel may only carry out servicing of this equipment.

Warning

Current probes used with this equipment must comply to IEC 61010-2-032 category A and must be designed for 600V CAT III. If flexible current probes are used, the conductor to be enclosed by the probe and the adjacent conductor must be connected strain-free, or suitable protective gloves must be worn.

Important

This power quality analyzer may only be used and handled by qualified personnel.
Protect the device against wetness and humidity, so that the device does not suffer damage.
The plug and socket connection for the voltage input is designed for 600V CAT III. The maximum voltage between outer conductor and earth potential must not exceed 600V. With multi-phase connections, the voltage between the outer conductors of the system to be measured may not exceed 800V.

WARNING

Death, serious injury, or fire hazard could result from improper connection of this instrument. Read and understand this manual before connecting this instrument.
Follow all installation and operating instructions while using this instrument. Connection of this instrument must be performed in compliance with the National Electrical Code (ANSI/NFPA 70-2002) of USA and any additional safety requirements applicable to your installation. Installation, operation, and maintenance of this instrument must be performed by qualified personnel only. The National Electrical Code defines a qualified person as "one who has the skills and knowledge related to the construction and operation of the electrical equipment and installations, and who has received safety training on the hazards involved."
Qualified personnel who work on or near exposed energized electrical conductors must follow applicable safety related work practices and procedures including appropriate personal protective equipment in compliance with the Standard for Electrical Safety Requirements for Employee Workplaces (ANSI/NFPA 70E-2000) of USA and any additional workplace safety requirements applicable to your installation.

Safety Summary

Definitions

WARNING statements inform the user that certain conditions or practices could result in loss of life or physical harm.

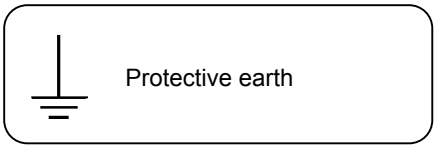
CAUTION statements identify conditions or practices that could harm the
Power Platform, its data, other equipment, or property.

NOTE statements call attention to specific information.

QUALIFIED
These persons have the special know-how about the manufacturing, assembly, connections and operation concerning these instruments. Adequate qualifications are the following:

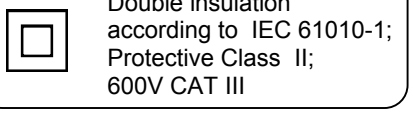
- Having received training and authorization to switch on/off, earth and mark circuits and devices in accordance with the safety standards of electrical engineering.
- Training or instruction in accordance with the standards of the safety engineering in maintenance and use of appropriate safety equipment.
- Training in first aid.

Symbols:


Protective earth


CE Certificate


Warning of danger (read the documentation)


Double insulation according to IEC 61010-1; Protective Class II; 600V CAT III


DC voltage

1.3 Standard and Optional Accessories

Contents of delivery	Order number
ANALYZER Set 4-phase: ANALYZER Basic + LEM~flex Set 4- phase + carrying case	EP0602A
LEM~flex Set 4-phase (L1, L2, L3, N)15/150/1500A	EP0604A
Voltage measuring cable 3-phase 2 m long	E438080005
NiMH - 2700mAh / 7.2V (analyzer-integrated)	EP0610A
Carrying case for transportation and protection (included with ANALYZER Set only)	EP0611A
Operating instructions English + German	EO 0600G

Accessories continued on next page

Accessories and services	
Description	**Order number**
Voltage test leads 3-phase, 2 m long, USA-colours	E438080018
LEM-flex 3 phase 15/150/1500A with 7 pin plug	EP0603A
LEM~flex Set 4-phase (L1, L2, L3, N) 15/150/1500A	EP0604A
Set of current clamps 10A 3-phase	EP0450A
Set of current clamps 10A 4-phase	EP0451A
Set of current clamps 50A / 5A 3-phase	EP0452A
Set of current clamps 50A / 5A 4-phase	EP0453A
Set of current clamps 200A 3-phase	EP0455A
Set of current clamps 200A 4-phase	EP0456A
Dolphin clamp, blue	EO325Z
Dolphin clamp, red	EO326Z
Dolphin clamp, black	EO327Z
Minigripp, black, insulated	EP0312Z
Battery pack NiMH – 2700mAh 7,2V	EP0610A
Power adapter US	EP0612U
Operating manual English & German	EO0600G
Carrying case	EP0611A

Please pay attention upon delivery. Should the analyzer have been damaged during transport the deliverer should be contacted immediately. The damage must also be noted in the delivery documents.

In case of damage, please send the device back to us but only with the original packaging. Please check all the accessories for completeness according to the previous table.

2. Putting the Analyzer into Operation

Note:

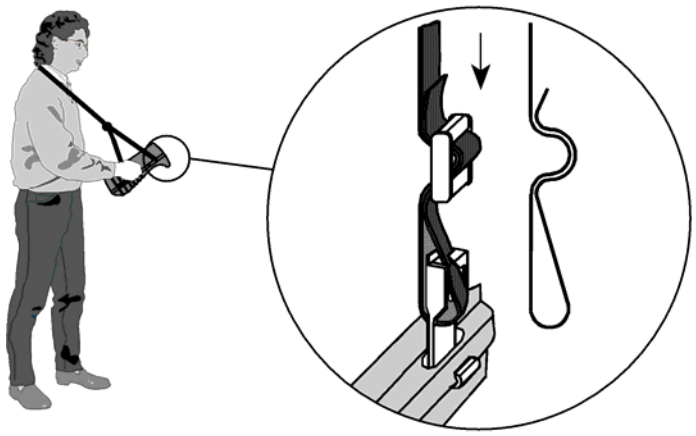
The analyzer is delivered with an empty battery pack. Please charge the battery before the first operation or use the provided charging adapter at the beginning. (for more Information see section “Power Supply and Replacing the Battery Pack”).

2.1 Accessories

Optional accessories like LEM-Flex or current clamps will be detected by the device via an auto-detection feature, which is activated once the device is turned on.
It is **important** to turn the device on once accessories have been changed to avoid possible discrepancies between the set accessories and the newly connected accessories.

2.2 Carrying Belt

If it is required to use the analyzer in a portable mode, the carrying belt may be used. The following figure shows how to fasten it to the device and adapt the length.

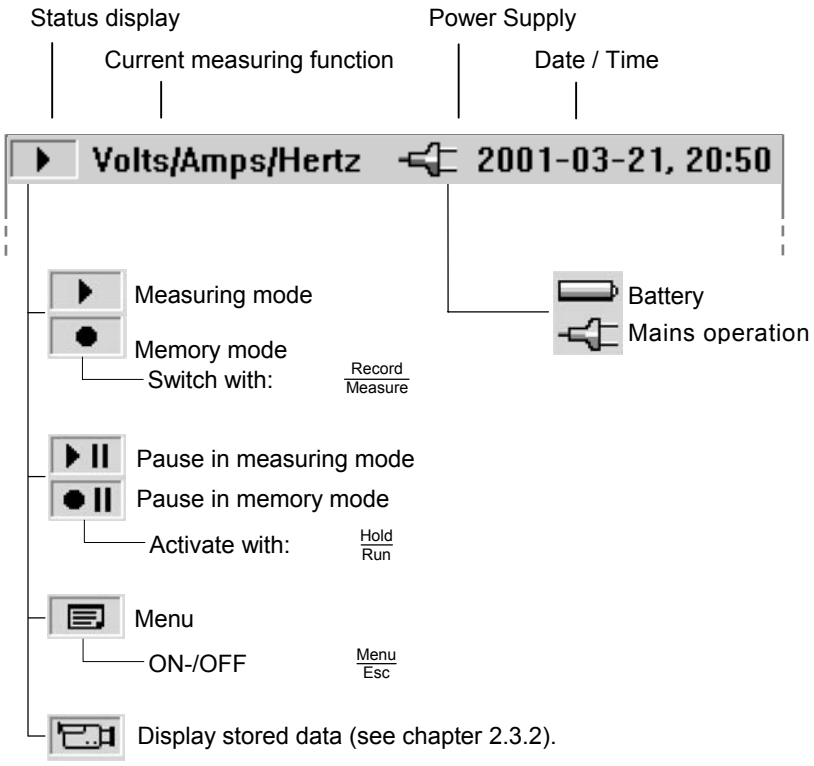


2.3 Control Elements, Display

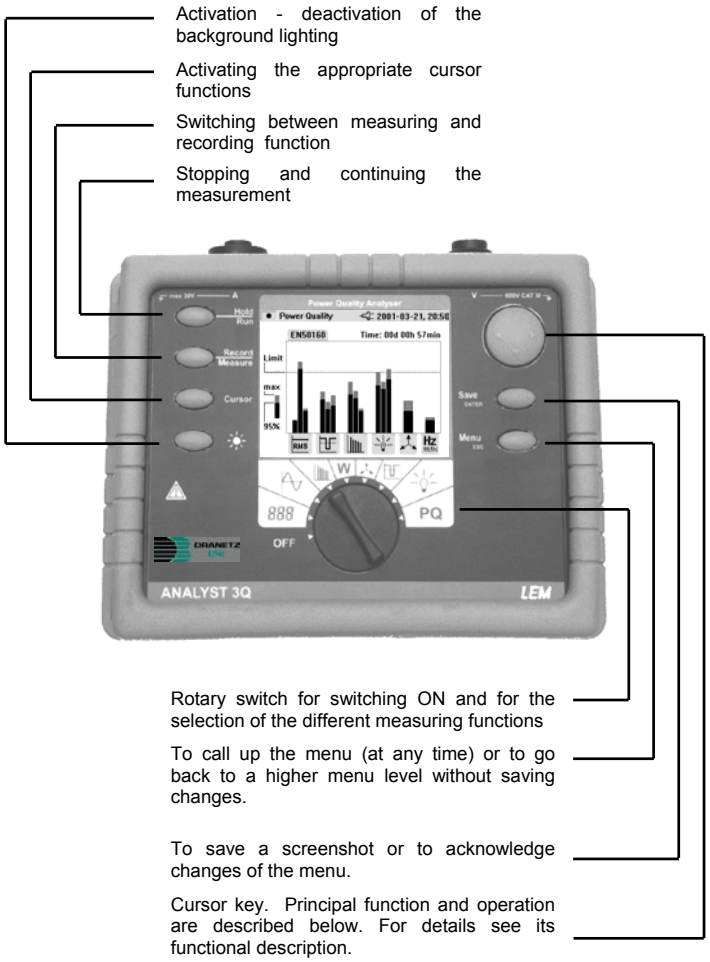
In this section we will make you familiar with some basic control elements, like the display and the connections of your measuring instrument before the first measurement.

Put the device into operation by turning the rotary switch in clockwise direction. In the LC display (function display) it is possible to read the selected measuring function for each case.

Display Symbols



Description of the Control Elements:



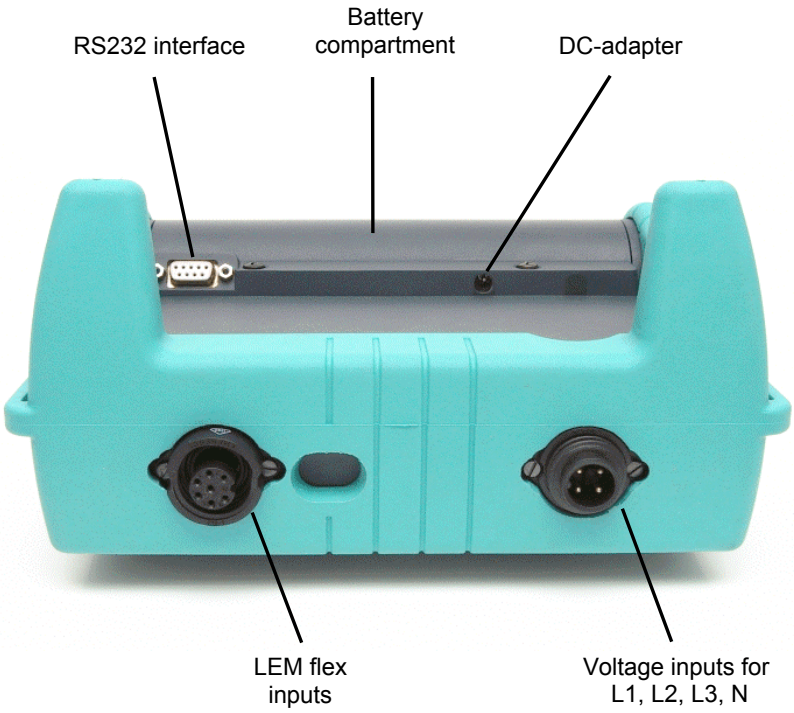
Note:

The symbols occurring in this operating instruction ´⇳´ and ´⇔´ correspond to the respective directions of the cursor keys.

Using the SAVE and CURSOR keys :

The SAVE and CURSOR keys are activated once in *HOLD mode*.
Pressing the *SAVE* key will save the current picture as a screenshot.
Since it is a screenshot, a saved picture cannot be modified or edited with the cursor.
Pressing the *CURSOR* key will go into cursor mode.
Pressing the key ⇔ will move the cursor and the current values can be read on the display.
Pressing the *CURSOR* key in the recording mode will set a reference cursor.
Screenshots can also be taken in cursor mode.
Pressing ESC will exit the cursor mode and return to the hold mode.

Connections:



RS-232 Interface:

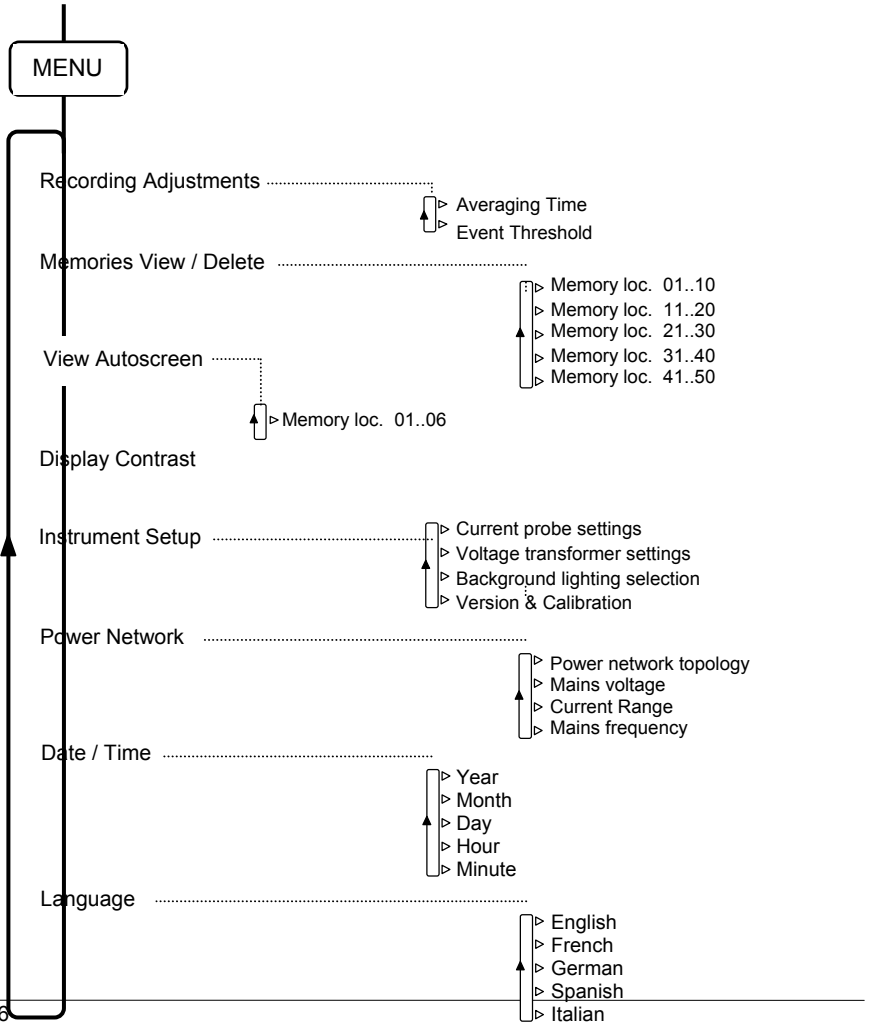
The serial RS232 interface is used for communication with an external PC. The stored measurement data can be read in and analysed via software, Dran-View is recommended for this analysis. Through this interface a firmware update may also be executed.

2.4 Basic Adjustments (Menu)

2.4.1 Menu Structuring

All basic adjustments of the measuring instrument are to be made via the main menu. This can be recalled at any time with the key: [Menu / Esc] . If the key is pushedt again the previous display will be shown.

Short overview of the Menu:

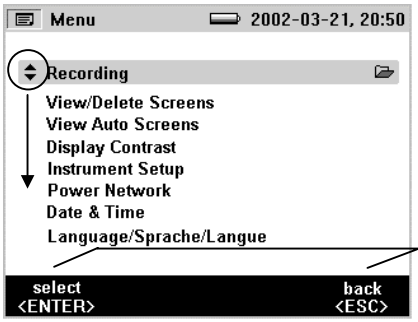


Basic Operation:

The following examples show how to select parameters in the menu.

- Entering the main menu: Menu / Esc

- Selecting menu options with the cursor keys: ⇳



<Enter> go to marked submenu
<ESC> back to the previous menu level

Changing parameters:

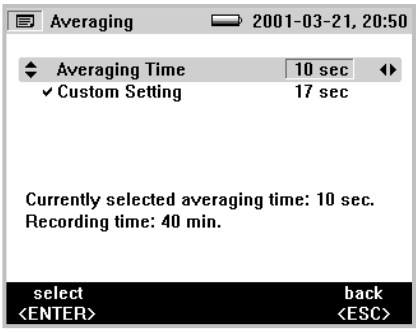
- The displayed parameters can be modified with the arrow keys (in levels of the preset values).

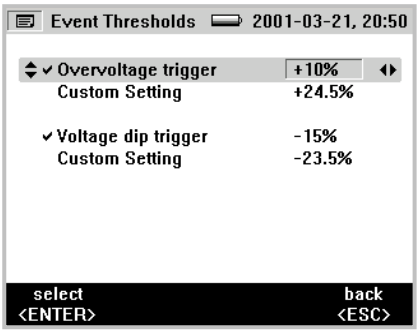
- If values are not preset they can be modifed by using the cursor keys. With ´⇔´ the decimal place may be selected and with ⇳ ´ the number may be modified.

Note:
Selected parameters are stored in the memory with <Enter>. With <ESC> the adjusted value can be discarded at any time.

2.4.2 Parameter Configuration

- Recording Parameters (available in Hold mode only)



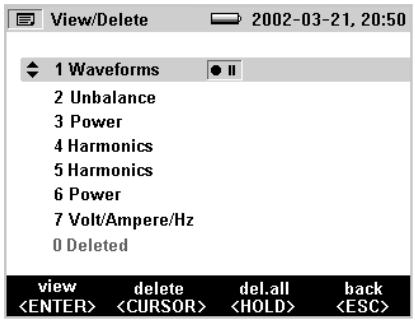


If the recording menu is selected, two further submenus may be selected: Menu for adjusting the averaging time (figure above) and for adjusting the event threshold (figure below) in recording parameters.

In the menu “Averaging Time” select the time over which the measuring data are to be averaged. These values may also be selected from the predefined values for averaging time.
With “Custom Setting” choose any averaging time value. Depending upon the selected averaging time, maximum available recording time is indicated in the display at the same time. Up to 1440 averaging intervals can be recorded with the record function.

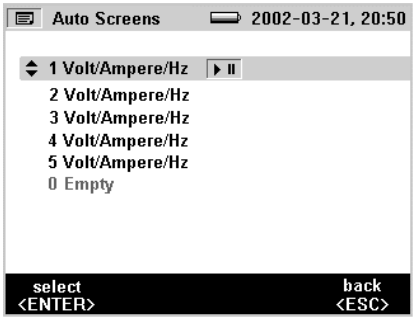
By selecting the menu “Event Thresholds” the threshold voltage at which the recording is to be started may be selected (see also chapter 3.6).

- View/Delete Screenshots



Select one of the saved screenshots. Press ENTER to view it. All screenshots include the date and time and the measuring mode, in which they were saved. Each page lists 10 events. Use the ‘ ⇳ ‘ to turn the page.

- View Auto Screenshots



With this menu item, the recorded screenshots may be viewed, these are saved in the Save mode. 6 screenshots are available (01...06). Select one of the pictures with the cursor key and press ENTER to view it.
Note: Saved Auto Screenshots always show the currently displayed parameters.

Example: If phase L2 is selected in the Volt/Ampere/Hertz function and the recording reaches the margin of the picture, a screenshot of the current picture, i.e., phase L2, is saved.

- Display Contrast

Select the display optimum contrast with ´⇳´.

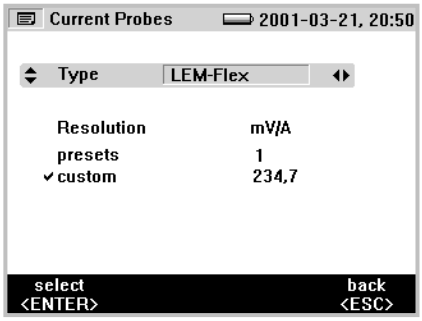
- Instrument Set-Up

In this menu option adjustments may be made in the submenu for:

- Current probes
- Voltage probes
- Version number
- Background lighting

These are described individually in the following:

Current Probes



If standard accessories are not used, which are automatically detected during start-up, the necessary adjustments may be made here. Select one of the given transducer types with “Type”. Enter the transducer factor, through selection of a given value or by input of a customized value, e.g.: for a current probe displaying 0.5V per 5A this equals 100mV/1A.
Therefore, 100 should be entered.

Note: We recommend the use of standard accessories since it makes the operation easier and clearer.

Voltage Transformers

If voltage transformers are used, select transducer factors with ENTER. Press the ' ⇔ ' key and enter the transformer factor with '⇳ ' .
For transducer factor details see information on the voltage transformer.

Backlight

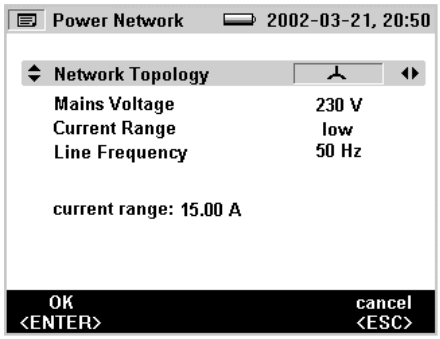
Here, it is possible to select whether the background lighting is deactivated automatically after 30 seconds or whether it is deactivated manually after switching it on with the ´☼´ key.

Note:
If the battery is in use, use the backlight only if necessary. This will ensure a longer battery lifetime.

Version & Calibration

This menu displays system information. No adjustments can be made. The displayed data give information of type and version of the device.

- Power Network



Select the used power network topology (Y or ∆) here. The nominal phase voltage of the power network, its nominal frequency and the current range may also be selected.

- Date & Time

Enter the current date and the current time.

- Language

Select the language required for operation.

3. Measuring Functions

3.1 Overview

This is a short overview of the different measuring procedures for the exact analysis of the power system, which is to be examined.

Power Quality

In this mode, a simple, clear diagram showing an overview of the voltage quality is displayed. A simple summary indicates where there are high deviations, furthermore these can be analysed in details analysed with individual measurement parameters.

Volts / Amps / Hertz

This function displays the voltage and current values simultaneously, in addition, the frequency and the neutral-conductor current is measured and displayed. This measuring function may be used to capture an overview of these values, before the analysis of the signal in detail by means of the other available functions.

Waveforms

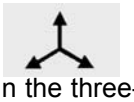
This measuring function shows the voltages, currents and the φ angle (phase shift) in "oscilloscope representation“ as well as their instantaneous values at the cursor position. With this function a clear representation of current and voltage waveforms and their distortions is shown.

Harmonics

Harmonics are sinusoidal voltages with a frequency, which corresponds to an integer multiple of the fundamental of the mains voltage.
Every signal can be split into an infinite number of sine waves of different frequency and amplitude. The contribution of each of these individual sine waves is represented in a bar chart up to the 40th harmonic. The smaller the harmonics are (starting from the 2nd harmonic, the 1st is the fundamental) the better is the power network quality.

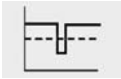
Power

This function indicates the values of the transferred power. At the same time it is possible to measure active power, reactive power, apparent power, distortion power and the appropriate power factor. It is also possible to view the active and reactive power energy.



Unbalance

In the three-phase power network there is normally a phase shift of 120° between the individual phases (3 x 120° = 360°). This measuring function gives the deviation of the phase angle of the phase voltages. For single-phase power networks this function is not applicable.



Events

Events are voltage dips, swells and interruptions. This measuring mode automatically records all events for later evaluation. The threshold values for starting the recording are freely configurable in the menu.

Flicker

Voltage fluctuations cause changes of the luminance of lamps that may create the visual phenomenon called Flicker. One distinguishes between Pst..short time flicker, which is averaged over 10 minutes, and Plt..long time flicker, which is averaged using 12 Pst values.
The Fl..instantaneous flicker describing the instantaneous value is also shown.

3.2 Connecting the Analyzer

When connecting to the current circuits, the corresponding measuring conductors must first be connected to the base unit and then to the current sensor to prevent the risk of electric shock in case of erroneous connection.
Use the original cables only for connecting the current probes and the voltages to the analyzer. If these are damaged do not use them. Make sure that all plugs are connected correctly and locked, in order to prevent contact with live parts.

Measurement in a Single-Phase Power Network

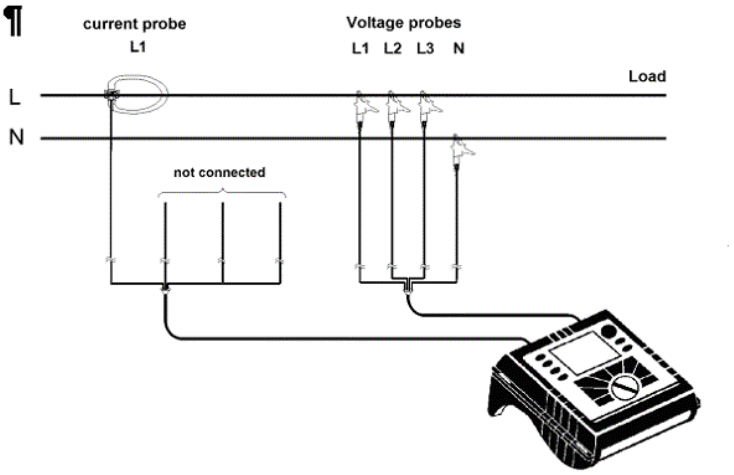
In order to measure in a single-phase power network, connect the device to the power network according to the following figure .
In order to analyse the measured values correctly, pay attention to the colour coding or the labels of the measuring wires:

Voltage:

Mains line	Test leads
L	L1
L	L2
L	L3
N	N

Current:

Mains line	Test leads
L1	L1
not connected	L2
not connected	L3
not connected	N



Measurement in a Three-Phase Power Network

In order to measure all phases in the three-phase power network with the Analyzer it should be attached to the measuring power network according to the following figure. If the network topology is changed to Δ under supply networks in the menu, the measurement is conducted in an Aron measuring circuit (2-wattmeter method).
See section **3.5 Power** for further details.

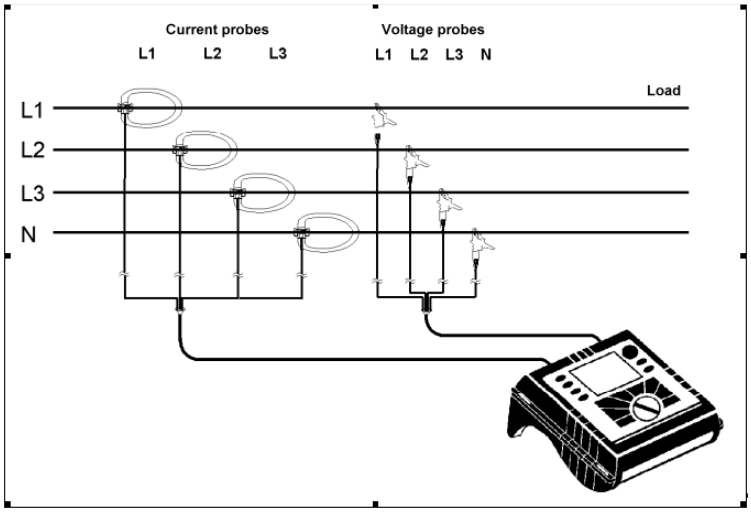
The following wiring diagram applies to star connections and delta connections. In order to analyse the measured values correctly, pay attention to the colour coding or the labels on the measuring wires:

Voltage:

Mains line	Test leads
L1	L1
L2	L2
L3	L3
N	N

Current:

Mains line	Test leads
L1	L1
L2	L2
L3	L3
N	N



3.3 Power Quality

Select 

with the rotary switch.

In this measuring mode an overview over the voltage quality of the measured power network is presented regarding the following:

- RMS values of the voltage
- Events
- Harmonics
- Flicker
- Unbalance
- Frequency

This measurement gives a first overview of the quality of the power network. If individual measurements are outside the permitted tolerance, they may be analysed in more detail with the other, different measuring functions.

Measurement

For this measuring function there are two representations at available:

- Quick View representation

  Here the measured values after a short time.

Recorder function

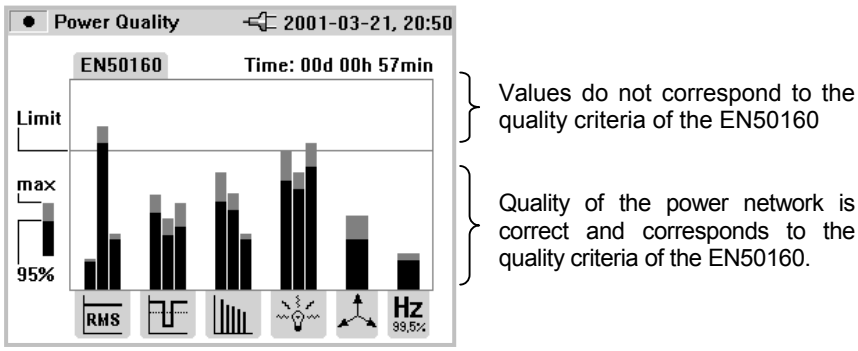
Activation with button <*Record/Measure*>.
Here, the values are averaged over a set averaging time. If an interval is set at 10 minutes, the measurement is taken according to EN50160 and will be shown on the display. An averaging time of 1 second (1sec*1440=24min) can record 24 minutes; this measurement does not comply with the EN50160 standard but gives a rigorous test to the supply being measured. In this mode Rec instead of EN50160 is

shown. Once the averaging time has elapsed, the first measurement results are displayed.

Recording

In this mode the averaging values of the following interval data are stored into memory:
Voltages (L1, L2, L3)
Currents (L1, L2, L3)
Frequency
Event counters (L1, L2, L3) sorted by event type
Pst, Plt, THD U, THD I, Unbalance (L1, L2, L3)
Power (L1, L2, L3): P, S, Q, and D
With 10-minute intervals a recording time of 10 days is possible.

- EN50160 Representation:



The individual bars in the display correspond to the phases from left to right: L1, L2, L3.

With <Hold/Run> the actual display “freezes” and the measurement is stopped or started again respectively.

What is EN 50160?

EN50160 is an agreed European Standard for Power Quality. Whilst it may not be directly applicable to your particular requirements it is an excellent way of gauging the overall power quality. The standard

normally measures all electrical parameters over a seven-day period and compares the measured values against the standard. The power quality overview can quickly indicate what type of power quality problem may be present on the system being measured. Many US utilities in Europe use this standard to great effect.

Cursor:

There is no cursor mode in this measurement function.

Save:

With <*Save/Enter*> a screenshot is captured and stored, the picture of the display in the memory location may subsequently be displayed.

Note:

For intervals other than 10 minutes the values are not compliant with the regulation EN50160.
Please note that the event threshold must be set to +/-10% to achieve an EN50160-compliant recording.

3.4 Volts / Amps / Hertz

Select  with the rotary switch.

In this mode is possible to measure values for each phase (L1, L2, L3) of

- Voltage (U)
- Current (I)
- Frequency (F)
- Neutral-conductor current (In)

The values are measured and may be and stored. It is also possible to record the values with the recorder function.
Measurement or calculation of the neutral-conductor current is optional.

Recording

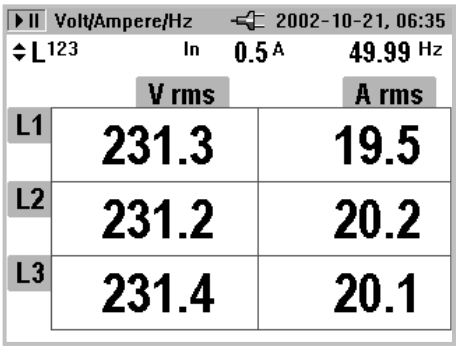
In Record mode, the following values are recorded for every phase (L1, L2, L3)

- Voltage (U) and
- Current (I) and the value of the
- Frequency (F)
- Neutral-conductor current (In)

These values can be exported with the WinA3Q software and further processed as a PQDIF file.

Measurement

If this measuring mode is selected the following display is shown:



Use this switch to get the following values

-minimum of values
-maximum of values and
-frequency or neutral-conductor current

With <Hold/Run> the actual values “freeze” and the measurement is stopped or started again.

Save:

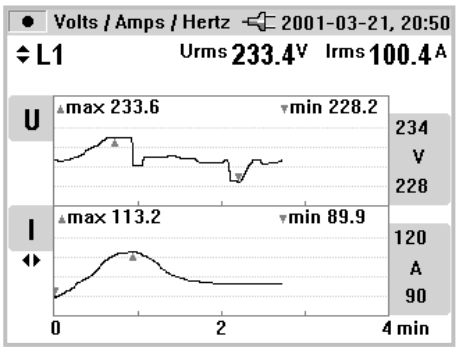
With <*Save/Enter*> a screenshot is captured and stored, the picture of the display in the memory location may subsequently be displayed.

Recorder Function:

With <Record/Measure> the recorder function may be initiated or the measuring mode may be selected. Before the start, the maximum recording time is indicated this value may be changed with <*Esc*> followed by entering using the <*Cursor*> key.

Changes in the averaging time, cause corresponding changes in the recording time of the measurement (double averaging time = double recording time).
When the recorder graphics reach the edge of the screen during recording, a picture of this screen is saved.
The display is then deleted and the recording is continued. Up to 6 auto screens are saved in the course of a recording. The saved screenshots can be retrieved via the "View Auto Screenshots" menu.

Note:
Do not forget to operate the device with the DC adapter during recording in order to prevent shutdown caused by low battery.



Select between the individual phases

Select between the two representation modes:
- U and I (see fig.)
- U and F
- U and In

Analysing the measured values of the recorder function:

Use of the key <cursor>. When the cursors are invoked it is possible to probe the graphs and display the associated values. With ´⇳ ´ the individual phases may be selected.

Note:
The Cursor functions are only available in the ”Hold“ mode.

3.5 Power

Select **W** with the rotary switch.

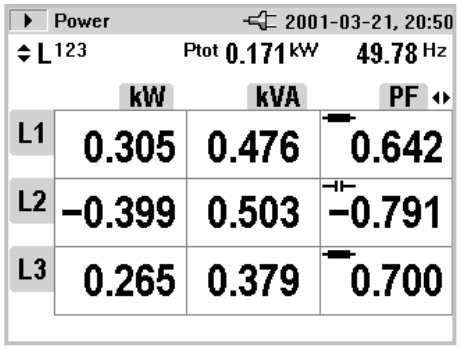
In this measuring mode the following values for each phase (L1, L2, L3) are obtained:

- Power (P) in *W* (for each phase and its sum P_{tot})
- Reactive power (Q) in *var*
- Apparent power (S) in *VA*
- Distortion power (D) in *VA*
- Power factor (PF)
- cosφ
- Active energy (EP) in kWh
- Reactive energy (EQ) in kvarh

Measurement:

It is possible to determine the instantaneous values and store them. Further it is also possible to record the values with the recorder function.

If this measurement mode is selected the following display is available:



Switch between the individual phases (detailed view: min- max- values and distorted power

Switch between the representation modes:
- P, S and PF
- P, S and Q
- P, S and D
- P, S and EP
- P, S and EQ
- P, S and cosφ

This function is also active in the detail view of the individual phases.

Capacitor or inductance symbols offer information about capacitive or inductive reactive power.

With <Hold/Run> the values displayed at the moment “freeze” and the measurement is stopped or started again.

Note: In the individual representation of L1 or L2 or L3, the active and reactive energy cannot be selected.

***Δ - Topology*:**

By switching the network topology from star to delta, the voltages and currents I_{L1}, I_{L3}, I_{L2} are calculated, measured and displayed.

When calculating the power, selecting the delta connection will use the Aron measuring circuit for the calculation.

The neutral conductor may be connected, however, it does not influence the measurement even in open state. If no neutral conductor is connected, a virtual star point is formed via a symmetrical resistor network.

In the Aron circuit, phase L2 becomes the return line for L1 and L3 causing the current I_{L2} to be obtained as the sum of the two negative currents I_{L1} I_{L3}.
i2(t)=-[i1(t)+ i3(t)]

In general, the instantaneous total power is:
➔ *Ptot(t)=u1(t) i1(t)+ u2(t) i2(t)+ u3(t) i3(t)*
➔ *Ptot(t)= u1(t) i1(t)- u2 [i1(t)+ i3(t)]+ u3(t)i3(t)=*
=[u1(t)- u2(t)] i1(t)+[u3(t)-u2(t)]i3(t)

However, since the voltages between the lines of a poly-phase are measured in the delta connection, the following formula results for the total power:
Ptot(t)= u12(t) i1(t)+u32 i3(t)

Integration via a period results in:
Ptot= U12 I1 cos(U12 ,I1)+U32 I3 cos(U32 ,I3)

Therefore, the total power corresponds to the total power of the star connection. For control purposes, it can be derived from the sum of the powers P_{12} and P_{31}.

Since I_{L2} is only calculated as an auxiliary value and is not measured, P_{23} must be set to zero (as per definition), because it does not exist in the Aron circuit.

The power factor PF has no physical meaning in the Aron circuit, because one would compare the current to the voltage between the lines of a poly-phase system. Reactive and apparent power should be understood as pure computing values and have no physical meaning.

The exact formulae for calculating the active power are given in the section Formulae.

Save:

With <Save/Enter> a screenshot is captured and stored the display in the memory location when requested.

Recorder Function:

With <Record/Measure> the recorder function may be initiated or the measuring mode may be selected. Before the start, maximum recording time is indicated and may be changed with <cursor>.

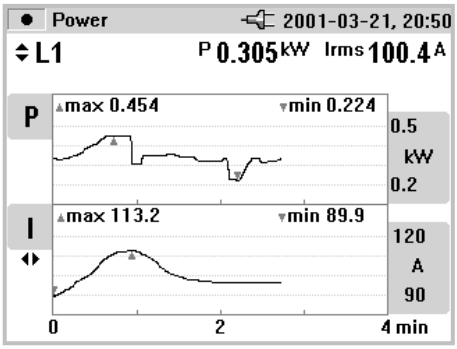
Changes in the averaging time, cause corresponding changes in the recording time of the measurement (double averaging time = double recording time).

When the recorder graphics reach the edge of the screen during recording, a picture of this screen is saved.

The display is then deleted and the recording is continued. Up to 6 auto screens are saved in the course of a recording. The saved screenshots can be retrieved via the "View Auto Screenshots" menu.

Note:

Do not forget to operate the device with the DC adapter during recording in order to prevent shutdown caused by low battery.
Active and reactive energy are not shown in the recorder function.



Switch between the individual phases

Switch between the representation modes:

- P and Q
- P and S
- P and PF
- P and cosφ
- P and D

Analysing the measured values of the recorder function:

Use of the key <cursor>. When the cursors are invoked the graphs may be interogated and the associated values displayed. With ´ ⇳ ´ it is possible to select the individual phases.

Recording

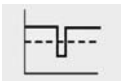
In Record mode, the following values are recorded for every phase (L1, L2, L3)

- Active power (P)
- Apparent power (S)
- Reactive power (Q)
- Power factor (PF)
- Cosine (cosφ)
- Power of distortion (D)

These values can be exported with the WinA3Q software and further processed as a PQDIF file for further analysis with Dran-View© software.

Note:
The cursor functions are only available in the ”Hold“ mode.

3.6 Events

Select  with the rotary switch.

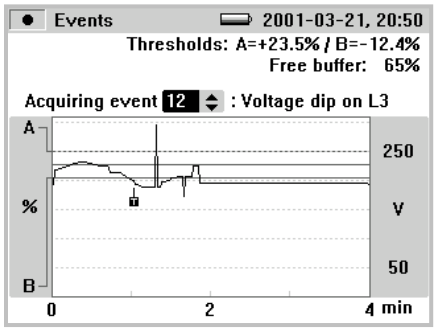
This measuring mode records the voltage of every phase (L_1, L_2, L_3) in the case of voltage dips, swells or interruptions (recorder function).

Measurement:

This function exclusively works with the recorder function.
Before the measurement is started, select the desired threshold value with <Menu/Esc> (under recording adjustments). After the measurement has started the following message appears on the display.

. . . waiting for events

The device is now in the trigger mode. If an event on one of the phases occurs, the recording is started automatically and lasts for 4 minutes. The MIN and MAX values of the half-cycle effective values are shown as waveforms. The screenshots recorded by this method are saved as individual pictures and can be viewed later, or the data may be exported as PQDIF for further use (see **Export of event files**). A total of 999 events can be recorded. In the display the phase and the number of recordings are displayed.



Switch between the individual events (if there is more than one)

This is also possible if the recording has been stopped and stored events are to be evaluated.

With <Hold/Run> stop/start the measurement is initiated or a new measurement may be started.

Save:

With <Save/Enter> a screenshot is captured and stored in the memory location and may be retrieved and displayed later.

Recording:

When exporting the event file as PQDIF, an ASCII test file is created for better clarity. It contains the number of the event, the type, phase, time and the new file name (see also **Export of event files**).

3.7 Flicker

Select  with the rotary switch

In this measuring mode the following values are determined for all phases (L1, L2, L3).

- Instantaneous flicker level (FL)
- Short time flicker level (P_{st}) . . . 10min mean value
- Long time flicker level (P_{lt}) . . . 2h mean value

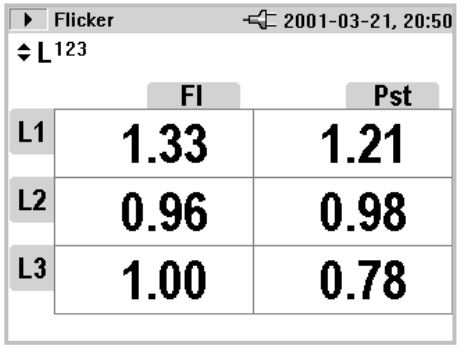
Note: In the RECORD mode P_{st} and P_{lt} are calculated on basis of the selected averaging time.

Measurement

Following the start of the measurement the value of the instantaneous flicker level is indicated immediately. The first short time flicker level (P_{st}) is indicated after 10min because of the mean value.

Note: It takes about 100 sec. to initialise the flicker filters after power on.

If this measuring mode is selected, the following display is shown:



Switch between the individual phases (detail view: min-max of values). After 10min of measuring the first P_{st} is displayed

With <Hold/Run> the values displayed at the moment “freeze” and the measurement is stopped or started again.

Save:

With <Save/Enter> a screenshot captured and stored in the memory location shown and may be retrieved and viewed later.

Record Function:

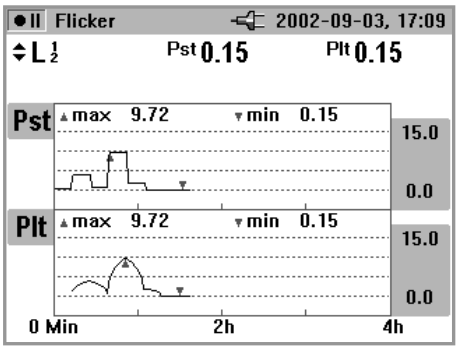
With <Record/Measure> the recorder function may be initiated or the measuring mode may be selected. In the record mode Pst and Plt are displayed based on the selected averaging time.
When the recorder graphics reach the edge of the screen during recording, a picture of this screen is saved.
The display is then deleted and the recording is continued. Up to 6 auto screens are saved in the course of a recording. The saved screenshots can be retrieved via the "View Auto Screenshots" menu.

Recording:
In Record mode, the following values are recorded for every phase (L1, L2, L3)

- Long time flicker (PLT) and
- Short time flicker (PST)

These values can be exported with the WinA3Q software and further processed as a PDQIF file in association with Dran-View®.

Note:
Do not forget to use the DC adapter during recording in order to prevent shutdown caused by low battery.



Switch between the individual phases

Analysing the measured values of the recorder function:

With the <cursor> keys, select a point on the graph and then display the associated value. With ⇳ ´ it is possible to select the individual phases.

Note:
The cursor functions are only available in the ”Hold“ mode.

3.8 Harmonics

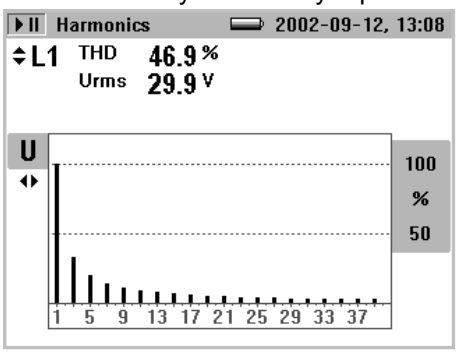
Select  with the rotary switch.

In this measuring mode it is possible to determine the Harmonics H1 to H40 for all phases (L1, L2, L3) of:

- Voltage (U)
- Current (I)

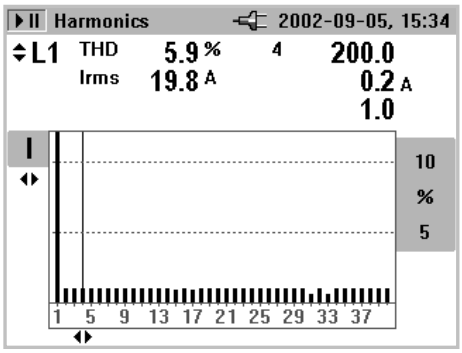
Measurement

When selecting this measuring mode with the rotary switch the harmonics are immediately and clearly represented on the display as follows.



Switch between the individual phases

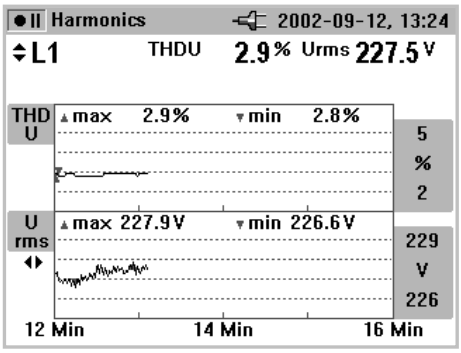
Switch between U and I



With <Hold/Run> the values displayed at the moment “freeze” and the measurement is stopped or started again. By pressing the <cursor> key, the cursor mode is selected, where it is possible to read additional values of the individual harmonics. With ´⇳´ it is possible to select the individual harmonics. Once the cursor mode is activated, the scale can be changed with the ' ⇔' from 100%-50% to 50%-25% or 10%-5%.

Recorder function:

<*Record/Measure*> starts the recorder function or goes from the recorder function back to the measurement mode, respectively.



Switching between individual phases

Switching between U and I

When the recorder graphics reach the edge of the screen during recording, a picture of this screen is saved.
The display is then deleted and the recording is continued. Up to 6 auto screens are saved in the course of a recording. The saved screenshots can be retrieved via the "View Auto Screenshots" menu.

It is possible to exit a measurement with HOLD, however, the measurement cannot be continued afterwards. In order to evaluate the measurement values of the recorder function:
Use the <*Cursor*> key. Using the cursors keys, select the respective time and read the corresponding measurement value. Repeated pressing of the cursor keys sets a reference cursor.

Recording:

In Record mode, the following values are recorded for every phase (L1, L2, L3)

- Voltages (U) and
- Currents (I)
- THD U
- THD I
- Values of uneven harmonics from 1-25 for U and I
- Frequency

These values can be exported with the WinA3Q software and further processed as a PDQIF file using Dran-View® software.

Save:

With <Save/Enter> a screenshot captured and stored in the memory location shown and may be retrieved and viewed later.

3.9 Unbalance

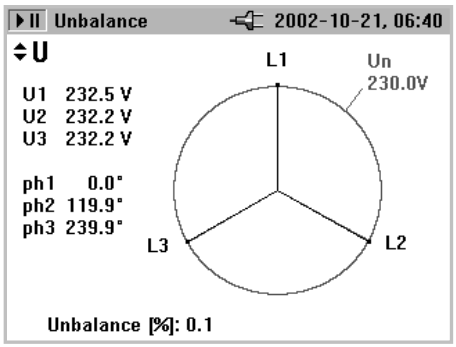
This function is only available in the 'Star' network topology.
The plug and socket connection for the voltage input is designed for 600V CAT III. The maximum voltage between outer conductor and earth potential must not exceed 600V. With multi-phase connections, the voltage between the outer conductors of the system to be measured may not exceed 800V.

Select  with the rotary switch.

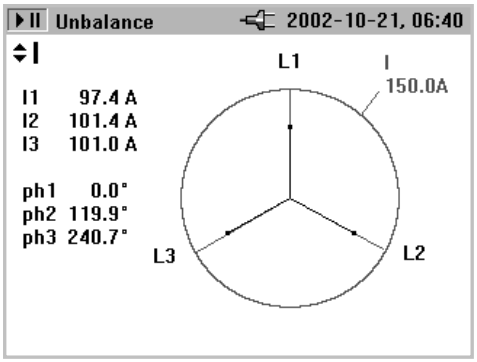
In this measuring mode the phase angles ($Ph_{1..3}$) and the RMS values (Root Mean Square) of the phase voltages and phase currents are determined for phases (L1, L2, L3) and represented in vector form.
In addition, the unbalance factor is shown.

Measurement

If this measuring mode is selected with the rotary switch the following figure appears on the display and the three phase voltages with their phase shift angles can be read immediately.



Switching between phase voltages and phase currents.



With <Hold/Run> the momentary values “freeze” and the measurement is stopped or started again.

Save:

With <Save/Enter> a screenshot captured and stored in the memory location shown and may be retrieved and viewed later.

Note:
In this mode the recorder function is not available.
($Ph_{1..3}$) angles between the phase voltages or in the case of the current between the phase currents. In a symmetrical 3-phase Ph_1 – Ph_3 are 120°.

3.10 Waveforms

Select  with the rotary switch.

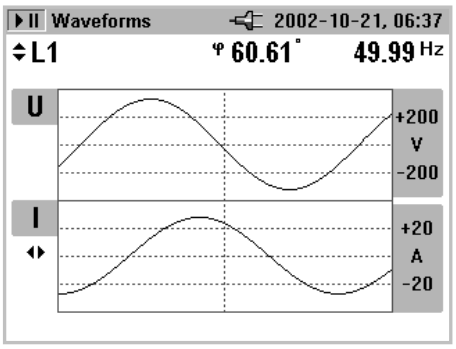
In this measuring mode an overview of the waveforms is presented of:

- Voltage (U)
- Current (I)
- Angle (φ)

for all three phases (L1, L2, L3).

Measurement

It is possible to select the measuring mode with the rotary switch the following figure appears on the display. The three phase voltages and current values are plotted for the time of one period.



Switch between the individual phases or total view of all phases (as shown in figure)

While viewing the individual phases, the cursor may be moved and the value at this location displayed.
In the individual view, the φ angle is also shown.

With <Hold/Run> the momentary values “freeze” and the measurement is stopped or started again.

Save:

With <Save/Enter> a screenshot captured and stored in the memory location shown and may be retrieved and viewed later.

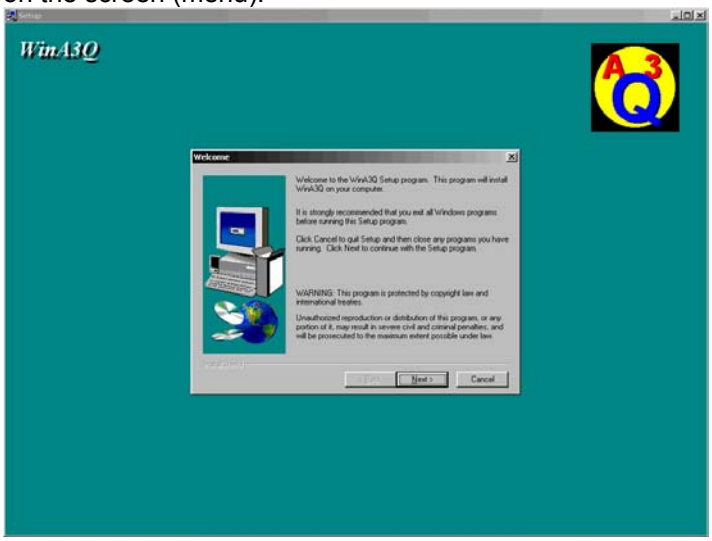
Note:

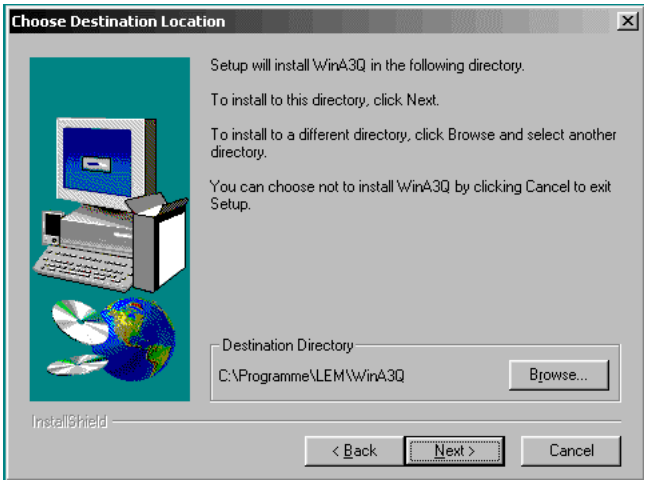
In this mode the recorder function is not available.
The angle (φ) describes the phase shift between first harmonic active power and first harmonic reactive power. See formula in the formula section for more details.

4. Operating instructions for WinA3Q software

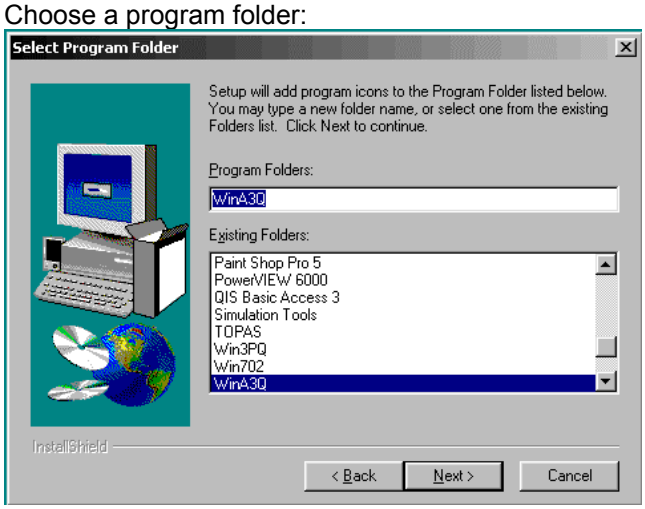
4.1 Installing WinA3Q

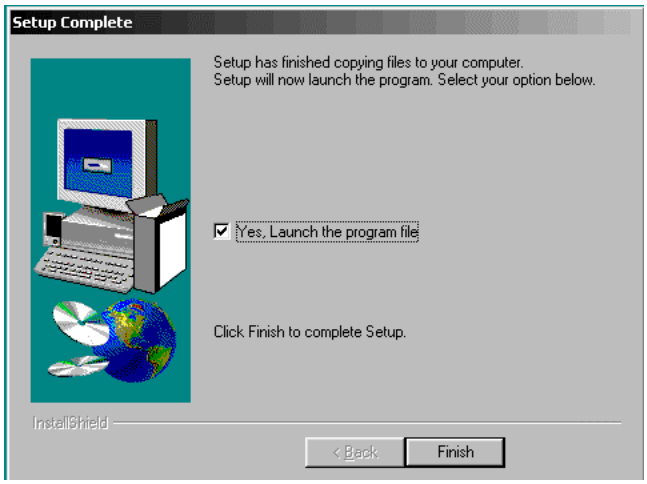
Insert the CD-Rom "WinA3Q“, double-click on "setup.exe“ and execute the program. Please follow the instructions appearing on the screen (menu):



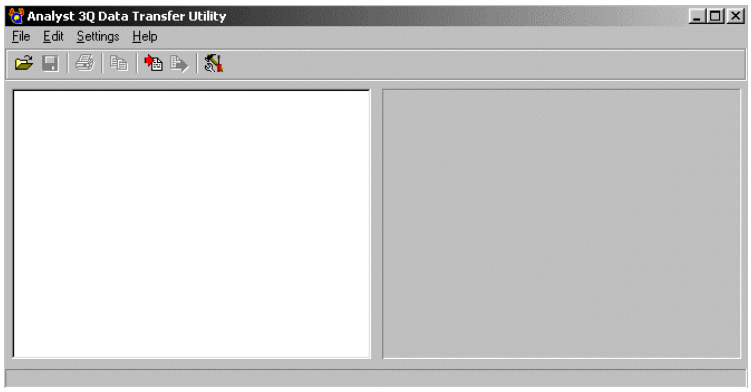


Choose a program folder:





The installation is complete and **WinA3Q** may be run :



Interaction with Dran-View® Software

Dran-View® application

Dran-View® is a Windows-compatible program that is used to access and retrieve data from data files on a memory card (requires PCMCIA slot or memory card reader) or from other disk media compatible with MS-Windows operating system. Following are the features and highlights of Dran-View® application:

- Two-pane browser (timeplots and waveforms simultaneously)
- Multiple ZOOM levels (up to 15 times)
- Advanced Harmonic analysis (DFT/FFT) featuring phasor diagrams and flexible data presentation
- Toolbar and Button support
- Drop-down Events list
- Multi-parameter time plots
- Time measurement tool (delta measurement)
- Saves data to .DNV (DRAN-VIEW compressed format) or converts to ASCII
- Status bar displays time, date and selected pane parameters
- Accelerator keys and right mouse button support
- Cut and paste to other applications
- Email .DNV data files directly from Dran-View

- File Append
- Harmonic and 3D timeplots
- Statistics Table with timeplots containing min, max, weighted median, standard deviation, 5%, 95%, and 99% figures.
- Report Writer (though the standard version of Dran-View may be upgraded to include Report Writer by installing a Report Writer Driver provided on a separate diskette)

For more information about Dran-View®, contact Dranetz-BMI Customer Service at (732) 287-3680 or 1-800-DRANTEC.

A separate users manual on Dran-View is available.

4.2 Recording measurement data with ANALYST 3Q

This section describes the recording with 'Record' using a PQ measurement. However, this is only an example, which can be run analogous to every Record measurement.
The export of events is an exception, which is described separately under 4.3.

- Connect **ANALYST 3Q** to the lines at the measurement location; select, e.g., the function "PQ" for power quality measurements.
- Wait until the flicker filter has been installed (approx. 2 minutes).
- Enter the desired averaging time with the Menu key, e.g., 10 minutes for measurements according to EN50160. The interval can be adjusted from 1 second to 10,000 seconds.
- Start the measurement by pressing "Record".
- In the PQ function, **ANALYST 3Q** can record up to 1440 intervals based on the preset interval time. The process can be cancelled by pressing "Record" at any time.

Maximum possible measuring periods:

Meas. function	Intervals max.	Maximum recording time			
		Averaging interval			
		1s	10min	15min	10,000s
V/A/Hz	1440	24min	10d	15d	166d 16h
W	1440	24min	10d	15d	166d 16h
Flicker	1440	24min	10d	15d	166d 16h
PQ	1440	24min	10d	15d	166d 16h

ANALYST 3Q records the following parameters for each interval and exports them as PQDIF

Measurement function	Saved parameters	PQDIF parameters in Top2000 Software
Volts/Amps/ Hertz		
	Voltages UL1, UL2, UL3, AVG, MIN, MAX rms values	VoltageU1 AN Volts&Amps VOLTAGE (AVG) VoltageU1 AN Volts&Amps VOLTAGE (MAX) VoltageU1 AN Volts&Amps VOLTAGE (MIN) VoltageU2 BN Volts&Amps VOLTAGE (AVG) VoltageU2 BN Volts&Amps VOLTAGE (MAX) VoltageU2 BN Volts&Amps VOLTAGE (MIN) VoltageU3 CN Volts&Amps VOLTAGE (AVG) VoltageU3 CN Volts&Amps VOLTAGE (MAX) VoltageU3 CN Volts&Amps VOLTAGE (MIN)
	Currents I1, I2, I3, AVG, MIN, MAX rms values	Current I1 AN Volts&Amps CURRENT (AVG) Current I1 AN Volts&Amps CURRENT (MAX) Current I1 AN Volts&Amps CURRENT (MIN) Current I2 BN Volts&Amps CURRENT (AVG) Current I2 BN Volts&Amps CURRENT (MAX) Current I2 BN Volts&Amps CURRENT (MIN) Current I3 CN Volts&Amps CURRENT (AVG) Current I3 CN Volts&Amps CURRENT (MAX) Current I3 CN Volts&Amps CURRENT (MIN)
	Frequency, AVG, MIN, MAX values	Frequency F TOTAL Volts&Amps VOLTAGE (AVG) Frequency F TOTAL Volts&Amps VOLTAGE (MAX) Frequency F TOTAL Volts&Amps VOLTAGE (MIN)
W - Power		
	Currents I1, I2, I3,In AVG, MIN, MAX rms values	Current I1 AN Power CURRENT (AVG) Current I1 AN Power CURRENT (MAX) Current I1 AN Power CURRENT (MIN) Current I2 BN Power CURRENT (AVG) Current I2 BN Power CURRENT (MAX) Current I2 BN Power CURRENT (MIN) Current I3 CN Power CURRENT (AVG) Current I3 CN Power CURRENT (MAX) Current I3 CN Power CURRENT (MIN) Current IN NG Power CURRENT (AVG) Current IN NG Power CURRENT (MAX) Current IN NG Power CURRENT (MIN)
	Real powers P1, P2, P3, AVG, MIN, MAX values	Real Power P1 AN Power POWER (AVG) Real Power P1 AN Power POWER (MAX) Real Power P1 AN Power POWER (MIN) Real Power P2 BN Power POWER (AVG) Real Power P2 BN Power POWER (MAX)

		Real Power P2 BN Power POWER (MIN) Real Power P3 CN Power POWER (AVG) Real Power P3 CN Power POWER (MAX) Real Power P3 CN Power POWER (MIN)
	Voltages UL1, UL2, UL3, AVG, MIN, MAX rms values	VoltageU1 AN Power VOLTAGE (AVG) VoltageU1 AN Power VOLTAGE (MAX) VoltageU1 AN Power VOLTAGE (MIN) VoltageU2 BN Power VOLTAGE (AVG) VoltageU2 BN Power VOLTAGE (MAX) VoltageU2 BN Power VOLTAGE (MIN) VoltageU3 CN Power VOLTAGE (AVG) VoltageU3 CN Power VOLTAGE (MAX) VoltageU3 CN Power VOLTAGE (MIN)
	Apparent powers S1, S2, S3, AVG, MIN, MAX values	Apparent Power S1 AN Power POWER (AVG) Apparent Power S1 AN Power POWER (MAX) Apparent Power S1 AN Power POWER (MIN) Apparent Power S2 BN Power POWER (AVG) Apparent Power S2 BN Power POWER (MAX) Apparent Power S2 BN Power POWER (MIN) Apparent Power S3 CN Power POWER (AVG) Apparent Power S3 CN Power POWER (MAX) Apparent Power S3 CN Power POWER (MIN)
	Reactive powers Q1, Q2, Q3, AVG, MIN, MAX values	Reactive Power Q1 AN Power POWER (AVG) Reactive Power Q1 AN Power POWER (MAX) Reactive Power Q1 AN Power POWER (MIN) Reactive Power Q2 BN Power POWER (AVG) Reactive Power Q2 BN Power POWER (MAX) Reactive Power Q2 BN Power POWER (MIN) Reactive Power Q3 CN Power POWER (AVG) Reactive Power Q3 CN Power POWER (MAX) Reactive Power Q3 CN Power POWER (MIN)
	Distortion powers D1, D2, D3, AVG, MIN, MAX values	Distortion Power D1 AN Power POWER (AVG) Distortion Power D1 AN Power POWER (MAX) Distortion Power D1 AN Power POWER (MIN) Distortion Power D2 BN Power POWER (AVG) Distortion Power D2 BN Power POWER (MAX) Distortion Power D2 BN Power POWER (MIN) Distortion Power D3 CN Power POWER (AVG) Distortion Power D3 CN Power POWER (MAX) Distortion Power D3 CN Power POWER (MIN)
	Frequency, AVG, MIN, MAX values	Frequency F TOTAL Power VOLTAGE (AVG) Frequency F TOTAL Power VOLTAGE (MAX) Frequency F TOTAL Power VOLTAGE (MIN

	Cosφ L1,L2, L3	
	Power factors PF1, PF2, PF3, AVG, MIN, MAX values	Power Factor PF1 AN Power POWER (AVG) Power Factor PF1 AN Power POWER (MAX) Power Factor PF1 AN Power POWER (MIN) Power Factor PF2 BN Power POWER (AVG) Power Factor PF2 BN Power POWER (MAX) Power Factor PF2 BN Power POWER (MIN) Power Factor PF3 CN Power POWER (AVG) Power Factor PF3 CN Power POWER (MAX) Power Factor PF3 CN Power POWER (MIN)
	Reactive energy EQ1, EQ2, EQ3 Averages only	Reactive Energy EQ1 AN Power ENERGY (AVG) Reactive Energy EQ2 BN Power ENERGY (AVG) Reactive Energy EQ3 CN Power ENERGY (AVG)
	Real energy EP1, EP2, EP3 Averages only	Real Energy EP1 AN Power ENERGY (AVG) Real Energy EP2 BN Power ENERGY (AVG) Real Energy EP3 CN Power ENERGY (AVG)
Events		
See point 4.3	Voltages UL1, UL2, UL3, MIN, MAX of 10-ms RMS values	DIP-Phase CN VALUELOG VOLTAGE MIN VOLTS RMS DIP-Phase CN VALUELOG VOLTAGE MAX VOLTS RMS BAND-Phase CN VALUELOG VOLTAGE MIN VOLTS RMS BAND-Phase CN VALUELOG VOLTAGE MAX VOLTS RMS INTER-Phase AN VALUELOG VOLTAGE MIN VOLTS RMS INTER-Phase AN VALUELOG VOLTAGE MAX VOLTS RMS SWELL-Phase BN VALUELOG VOLTAGE MIN VOLTS RMS SWELL-Phase BN VALUELOG VOLTAGE MAX VOLTS RMS
	Number of events per phase	
Flicker		
	Pst L1, L2, L3, AVG, MIN, MAX values	Flicker PST 1 AN Flicker VOLTAGE (AVG) Flicker PST 1 AN Flicker VOLTAGE (MAX) Flicker PST 1 AN Flicker VOLTAGE (MIN) Flicker PST 2 BN Flicker VOLTAGE (AVG) Flicker PST 2 BN Flicker VOLTAGE (MAX) Flicker PST 2 BN Flicker VOLTAGE (MIN) Flicker PST 3 CN Flicker VOLTAGE (AVG) Flicker PST 3 CN Flicker VOLTAGE (MAX) Flicker PST 3 CN Flicker VOLTAGE (MIN)

	Plt L1, L2, L3, AVG, MIN, MAX values	Flicker PLT 1 AN Flicker VOLTAGE (AVG) Flicker PLT 1 AN Flicker VOLTAGE (MAX) Flicker PLT 1 AN Flicker VOLTAGE (MIN) Flicker PLT 2 BN Flicker VOLTAGE (AVG) Flicker PLT 2 BN Flicker VOLTAGE (MAX) Flicker PLT 2 BN Flicker VOLTAGE (MIN) Flicker PLT 3 CN Flicker VOLTAGE (AVG) Flicker PLT 3 CN Flicker VOLTAGE (MAX) Flicker PLT 3 CN Flicker VOLTAGE (MIN)
PQ		
	Voltages UL1, UL2, UL3, Averages of RMS values	VoltageU1 AN Quality VOLTAGE (AVG) VoltageU2 BN Quality VOLTAGE (AVG) VoltageU3 CN Quality VOLTAGE (AVG)
	Currents I1, I2, I3, Averages of RMS values	Current I1 AN Quality CURRENT (AVG) Current I2 BN Quality CURRENT (AVG) Current I3 CN Quality CURRENT (AVG) Current IN NG Quality CURRENT (AVG)
	Frequency, Averages	Frequency F TOTAL Quality VOLTAGE (AVG)
Total Events: Number of events Interruptions: Number of voltage interruptions Voltage Dip: Number of voltage dips Voltage Swells: Number of voltage swells Return into Band: Number of returns to the selected voltage band	Events on L1, L2, L3, number per phase	Total Events L1 AN Quality NONE Total Events L2 AN Quality NONE Total Events L3 AN Quality NONE Interruptions L1 AN Quality NONE Interruptions L2 AN Quality NONE Interruptions L3 AN Quality NONE Voltage Dip L1 AN Quality NONE Voltage Dip L2 AN Quality NONE Voltage Dip L3 AN Quality NONE Voltage Swells L1 AN Quality NONE Voltage Swells L2 AN Quality NONE Voltage Swells L3 AN Quality NONE Return into Band L1 AN Quality NONE Return into Band L2 AN Quality NONE Return into Band L3 AN Quality NONE
	Unbalance, Averages	Unbalance TOTAL Quality VOLTAGE (AVG)
	Flicker Pst L1, L2, L3, Averages	Flicker PST 1 AN Quality VOLTAGE (AVG) Flicker PST 2 BN Quality VOLTAGE (AVG) Flicker PST 3 CN Quality VOLTAGE (AVG)
	Flicker Plt L1, L2, L3, Averages	Flicker PLT 1 AN Quality VOLTAGE (AVG) Flicker PLT 2 BN Quality VOLTAGE (AVG)

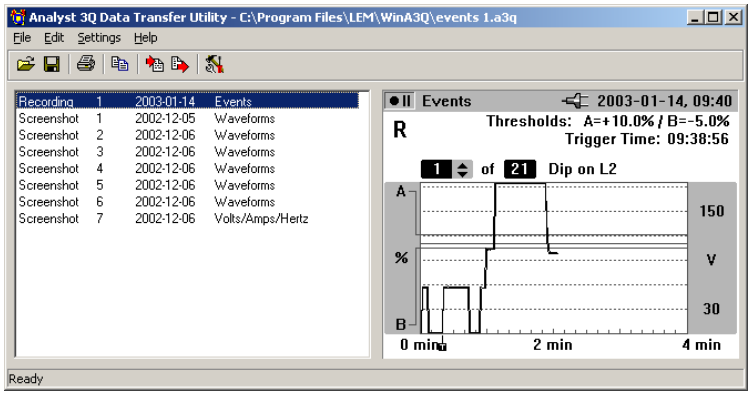
		Flicker PLT 3 CN Quality VOLTAGE (AVG)
	THD U L1, L2, L3, Averages	THD I1 AN Quality CURRENT (AVG) THD I2 BN Quality CURRENT (AVG) THD I3 CN Quality CURRENT (AVG)
	THD I L1, L2, L3,In Averages	THD U1 AN Quality VOLTAGE (AVG) THD U2 BN Quality VOLTAGE (AVG) THD U3 CN Quality VOLTAGE (AVG)
	Real powers P1, P2, P3, Averages	Real Power P1 AN Quality POWER (AVG) Real Power P2 BN Quality POWER (AVG) Real Power P3 CN Quality POWER (AVG)
	Apparent powers S1, S2, S3, Averages	Apparent Power S1 AN Quality POWER (AVG) Apparent Power S2 BN Quality POWER (AVG) Apparent Power S3 CN Quality POWER (AVG)
	Reactive powers Q1, Q2, Q3, Averages	Reactive Power Q1 AN Quality POWER (AVG) Reactive Power Q2 BN Quality POWER (AVG) Reactive Power Q3 CN Quality POWER (AVG)
	Distortion powers D1, D2, D3, Averages	Distortion Power D1 AN Quality POWER (AVG) Distortion Power D2 BN Quality POWER (AVG) Distortion Power D3 CN Quality POWER (AVG)
Harmonics		
	Voltages UL1, UL2, UL3, AVG, MIN, MAX rms values	VoltageU1 AN Harmonic VOLTAGE (AVG) VoltageU1 AN Harmonic VOLTAGE (MAX) VoltageU1 AN Harmonic VOLTAGE (MIN) VoltageU2 BN Harmonic VOLTAGE (AVG) VoltageU2 BN Harmonic VOLTAGE (MAX) VoltageU2 BN Harmonic VOLTAGE (MIN) VoltageU3 CN Harmonic VOLTAGE (AVG) VoltageU3 CN Harmonic VOLTAGE (MAX) VoltageU3 CN Harmonic VOLTAGE (MIN)
	Currents I1, I2, I3, In AVG, MIN, MAX rms values	Current I1 AN Harmonic CURRENT (AVG) Current I1 AN Harmonic CURRENT (MAX) Current I1 AN Harmonic CURRENT (MIN) Current I2 BN Harmonic CURRENT (AVG) Current I2 BN Harmonic CURRENT (MAX) Current I2 BN Harmonic CURRENT (MIN) Current I3 CN Harmonic CURRENT (AVG) Current I3 CN Harmonic CURRENT (MAX) Current I3 CN Harmonic CURRENT (MIN) Current IN NG Harmonic CURRENT (AVG) Current IN NG Harmonic CURRENT (MAX) Current IN NG Harmonic CURRENT (MIN)

	THD I L1, L2, L3, In, AVG, MIN, MAX rms values	THD I1 AN Harmonic CURRENT (AVG) THD I1 AN Harmonic CURRENT (MAX) THD I1 AN Harmonic CURRENT (MIN) THD I2 BN Harmonic CURRENT (AVG) THD I2 BN Harmonic CURRENT (MAX) THD I2 BN Harmonic CURRENT (MIN) THD I3 CN Harmonic CURRENT (AVG) THD I3 CN Harmonic CURRENT (MAX) THD I3 CN Harmonic CURRENT (MIN) THD IN NG Harmonic CURRENT (AVG) THD IN NG Harmonic CURRENT (MAX) THD IN NG Harmonic CURRENT (MIN)
	THD U L1, L2, L3, AVG, MIN, MAX rms values	THD U1 AN Harmonic VOLTAGE (AVG) THD U1 AN Harmonic VOLTAGE (MAX) THD U1 AN Harmonic VOLTAGE (MIN) THD U2 BN Harmonic VOLTAGE (AVG) THD U2 BN Harmonic VOLTAGE (MAX) THD U2 BN Harmonic VOLTAGE (MIN) THD U3 CN Harmonic VOLTAGE (AVG) THD U3 CN Harmonic VOLTAGE (MAX) THD U3 CN Harmonic VOLTAGE (MIN)
	Values of uneven harmonics from the 1^{st} -25^{th} order for U1, U2, U3, I1, I2, I3 ,In, AVG, MIN, MAX rms values	
	Frequency, AVG, MIN, MAX values	Frequency F TOTAL Harmonic VOLTAGE (AVG) Frequency F TOTAL Harmonic VOLTAGE (MAX) Frequency F TOTAL Harmonic VOLTAGE (MIN

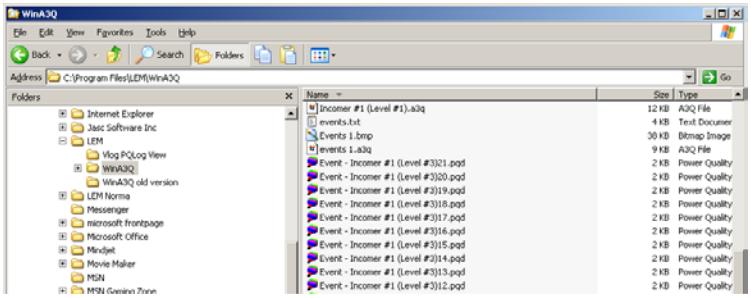
4.3 Export of event data

To export an event recording and to convert it into PQDIF format, follow the steps below.
Since a new file is created when an event recording is exported into PQDIF format, it is important to find a time allocation for the events.
Hence, in addition to the PQDIF files a text file is created during export for clarification.

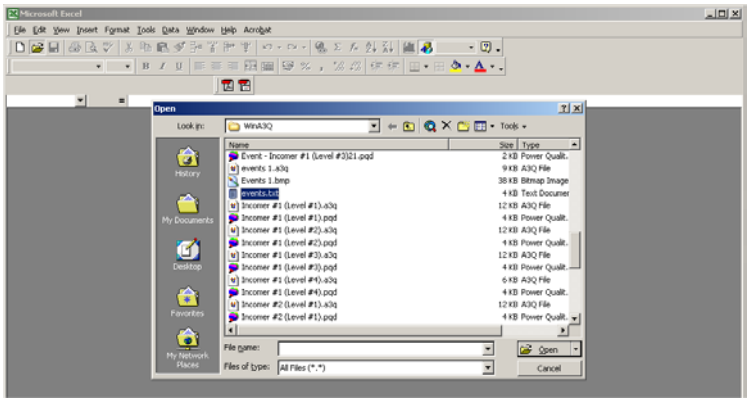
- Once an event file is recorder, this may be viewed via WinA3Q, the following may be viewed:



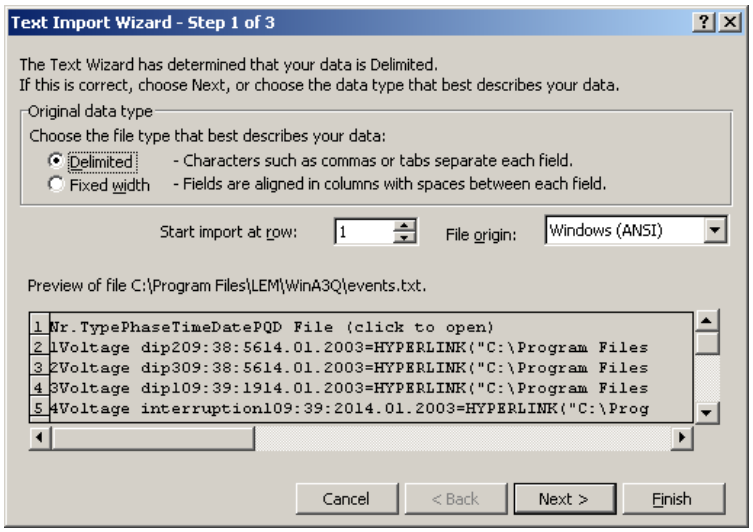
- The selected recording is now exported to PQDIF using the Export function.
- The program will transfer the Following Files with a user-selected name (e.g. events) to the folder selected by the user.

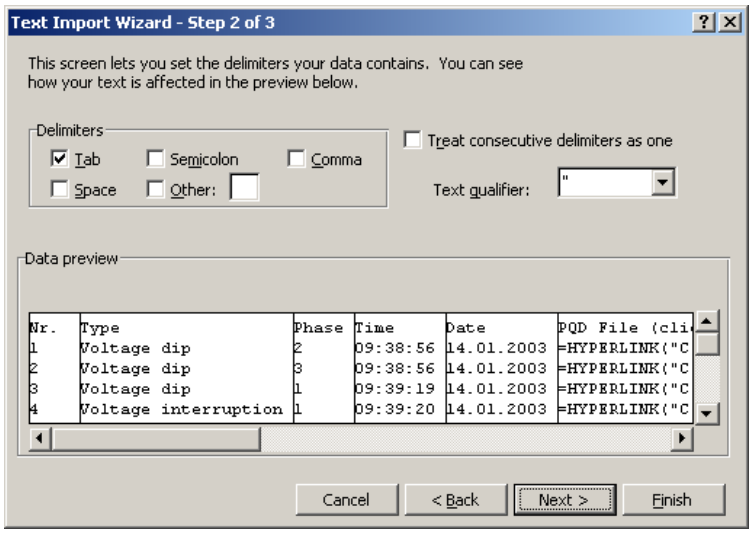


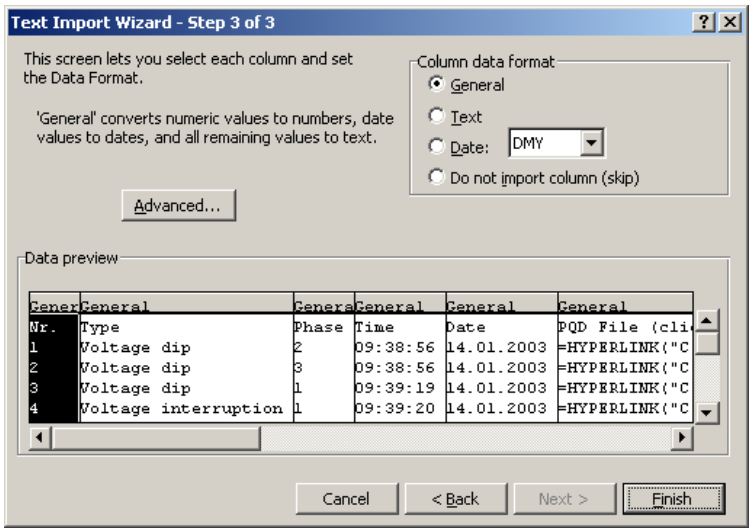
- It is most convenient to open the "events.txt" file in Microsoft EXCEL.
  Open Excel and select the folder containing the files with File Open.
  It is important that 'Files of type' is set to 'All files'.



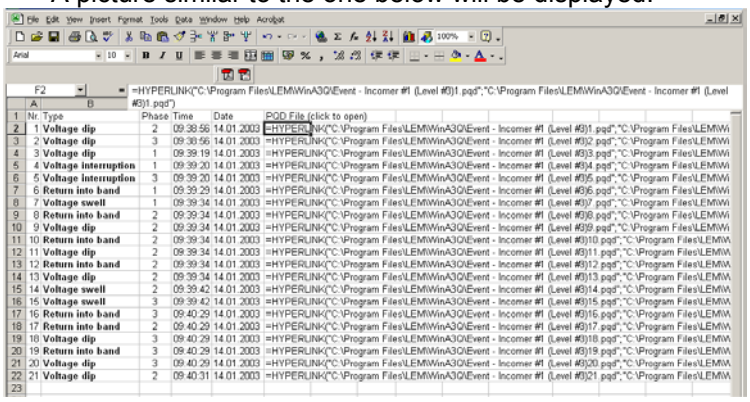
- To select the correct format, please follow the settings indicated in the next 3 pictures.


Text Import Wizard - Step 1 of 3
The Text Wizard has determined that your data is Delimited.
If this is correct, choose Next, or choose the data type that best describes your data.
Original data type
Choose the file type that best describes your data:
Delimited - Characters such as commas or tabs separate each field.
Fixed width - Fields are aligned in columns with spaces between each field.
Start import at row: 1
File origin: Windows (ANSI)
Preview of file C:\Program Files\LEM\WinA3Q\events.txt.
1 Nr. TypePhaseTimeDatePQD File (click to open)
2 1Voltage dip209:38:5614.01.2003=HYPERLINK("C:\Program Files
3 2Voltage dip309:38:5614.01.2003=HYPERLINK("C:\Program Files
4 3Voltage dip109:39:1914.01.2003=HYPERLINK("C:\Program Files
5 4Voltage interruption109:39:2014.01.2003=HYPERLINK("C:\Prog
Cancel
< Back
Next >
Finish


Text Import Wizard - Step 2 of 3
This screen lets you set the delimiters your data contains. You can see how your text is affected in the preview below.
Delimiters
Tab
Semicolon
Comma
Space
Other:
Treat consecutive delimiters as one
Text qualifier: "
Data preview
Nr. Type Phase Time Date PQD File (cli
1 Voltage dip 2 09:38:56 14.01.2003 =HYPERLINK("C
2 Voltage dip 3 09:38:56 14.01.2003 =HYPERLINK("C
3 Voltage dip 1 09:39:19 14.01.2003 =HYPERLINK("C
4 Voltage interruption 1 09:39:20 14.01.2003 =HYPERLINK("C
Cancel
< Back
Next >
Finish



- A picture similar to the one below will be displayed.

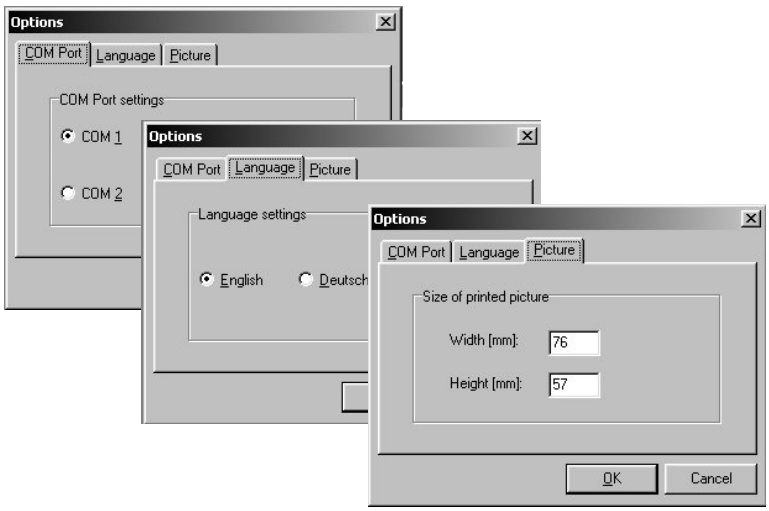


- It shows the number, type, phase, time and date of the events as well as a link to the corresponding file.
  If software to read PQDIF-Files is on the computer such as Dran-View®, clicking the link will open the corresponding event in the Software.

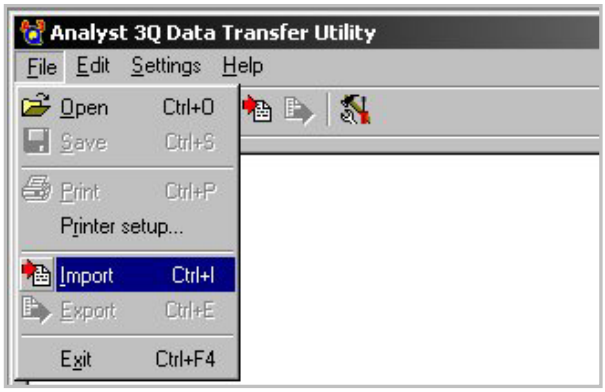
4.4 Read-out of saved measurement values

- Turn on **ANALYST 3Q. ANALYST 3Q** must be in **HOLD** mode (if not, press the $\frac{Hold}{Run}$ button on the device).
- Connect **ANALYST 3Q** to the serial port of the PC.
- Start the **WinA3Q** software

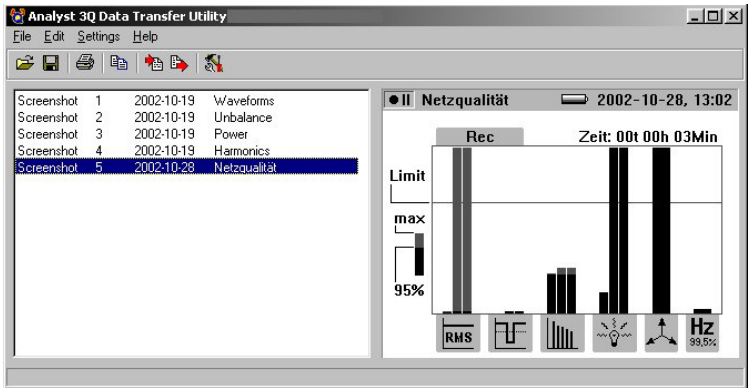
Select the COM port to which ANALYST 3Q is connected, the language and the size of the exported screenshots.



- Select Data import from the menu:

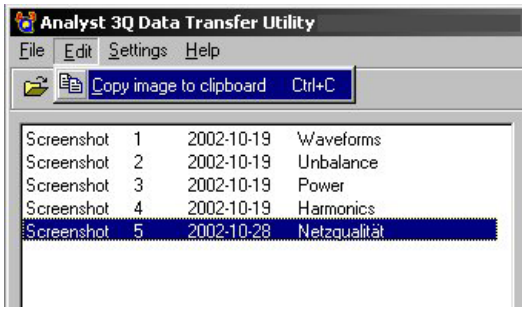


- **WinA3Q** shows an overview of all screenshots and the saved measurement value file ("Recording“):



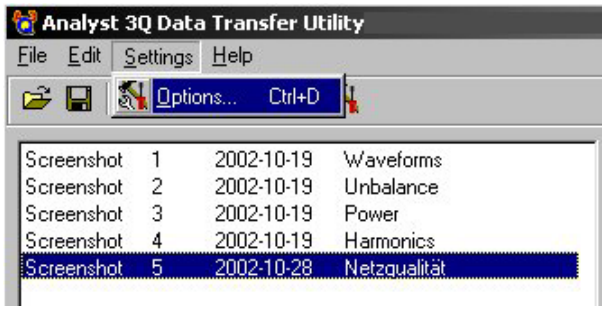
- **The File menu:**
    - **Open**: Opens any measurement file saved to the PC.
    - **Save**: Saves the current diagram (right half of screen) in a bitmap file (.bmp).
    - **Print:** Prints the current diagram on the system printer.
    - **Printer setup**: Opens the dialog box for the printer settings.
    - **Import**: Reads the measurement values from **ANALYST 3Q** into the PC.
    - **Export**: Exports the measurement value file into a PQDIF file, which can be evaluated later with evaluation software.
    - the file extension is .pqd.
    - **Exit:** Closes **WinA3Q**

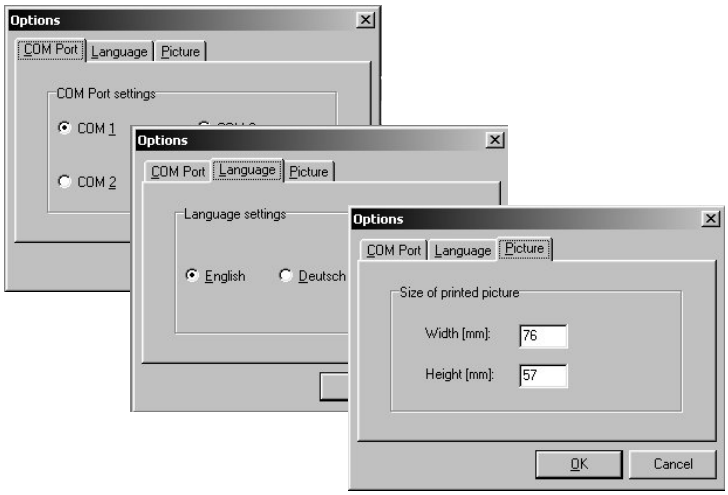
- **The Edit menu:**



Copies the selected diagram to the Windows® clipboard for evaluation in other applications.

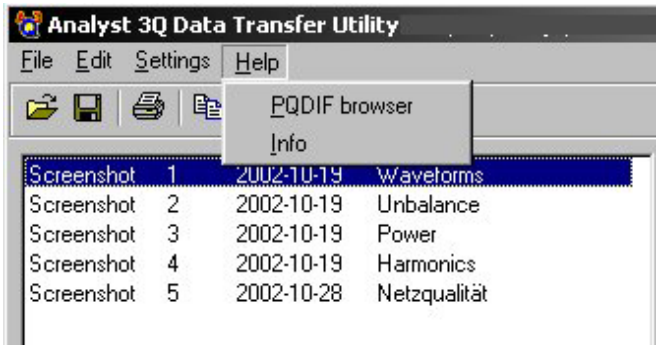
- **The Settings menu**





Select the COM port required for connection to the **ANALYST 3Q**, the language of **WinA3Q**, and the diagram dimensions required to save as a .bmp file.

- **The Help menu**



Info shows the current version of **WinA3Q**:

For evaluation of saved measurement value files, the screenshots must be copied to the Windows® clipboard and saved as .bmp graphic files. Measurement data series are exported into a PQDIF file, which can be evaluated with every PQDIF-browser.

5. Specific Data of the Analyzer

5.1 Power Supply and Replacing the Battery Pack

Power-line or Battery Mode

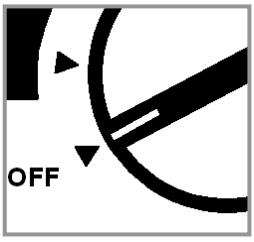
This Power Analyzer may be operated with the provided charging adapter or with the built in battery.
If operated with the charging adapter, the battery is charged automatically. On the LC display the symbol for the operating mode is displayed accordingly (see Chapter 2.2).
If the battery is completely discharged, it takes about 4 hours to charge it completely. It is impossible to overcharge the battery as the analyzer has an automatic load regulation.
When "LO-BAT“ is indicated, replace the batteries or recharge the accumulator.

Replacing the accumulator pack

If the accumulator capacity is noticeably low (see technical specification), then the accumulator pack has to be replaced. Please consider the following steps, which are described in the following figures:

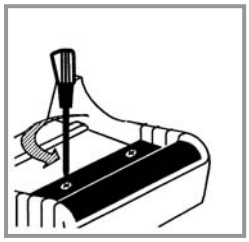
1. Turn off the device
2. **Disconnect all measuring leads**
3. Open the battery compartment (two cross-notched screws)
4. Unplug and replace the battery pack. Close the battery compartment again.

1

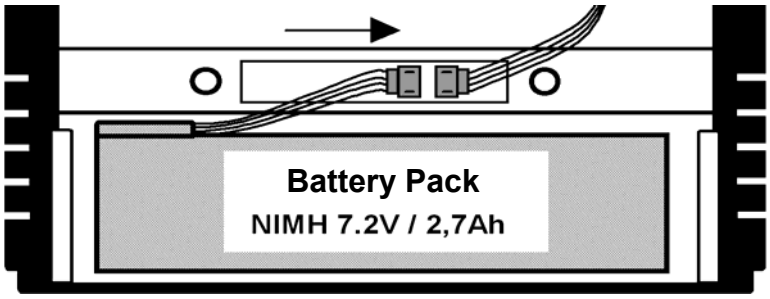


2

3



4



Note:

If the battery is replaced please use original spare parts only – see section “Standard and Optional Accessories”.

5.2 Maintenance and Warranty

Maintenance

If the Analyzer is used appropriately it does not require special maintenance or repair. If the device gets dirty wipe it off carefully with a damp cloth (without cleaning agents). Only trained and qualified personnel may execute maintenance work. This work may only be done at a company related workshop within the guarantee period.

Calibration

As an additional service we offer the regular examination and calibration of the instrument. On request calibration certificates to national or international standards may be issued

Storage

If the device is stored for longer time or is not in use for longer time, the battery should be charged at least once in six months.

Warranty

Statements and Notices

Statement of Warranty

All products of Dranetz-BMI are warranted to the original purchaser against defective material and workmanship for a period of one year from the date of delivery. Dranetz-BMI will repair or replace, at its option, all defective equipment that is returned, freight prepaid, during the warranty period. There will be no charge for repair provided there is no evidence that the equipment has been mishandled or abused. This warranty shall not apply to any defects resulting from improper or inadequate maintenance, buyer-supplied hardware/ software interfacing, unauthorized modification or misuse of the

equipment, operation outside of environmental specifications, or improper site preparation or maintenance.

Statement of reliability

The information in this manual has been reviewed and is believed to be entirely reliable, however, no responsibility is assumed for any inaccuracies. All material is for informational purposes only and is subject to change without prior notice.

Notice regarding FCC compliance

This device has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

Notice regarding proprietary rights

This publication contains information proprietary to Dranetz-BMI and LEM. By accepting and using this manual, you agree that the information contained herein will be used solely for the purpose of operating equipment of Dranetz-BMI.

Continued on next page

Statements and Notices, Continued

Note:

This manual does not contain all the detail information concerning the Analyzer. In order to keep the manual short and clear, not every case of application, operation or maintenance imaginable could be included.

5.3 Calculation of the Measured Variables

The following formulas are the basics of the measuring values:

Voltage and current measurement

$U_{RMS} = \sqrt{\frac{1}{T}\int u^2 dt}$	rms value of voltages
$I_{RMS} = \sqrt{\frac{1}{T}\int i^2 dt}$	rms value of currents
$I_N = I_1 + I_2 + I_3$	rms value of neutral-conductor current * Is calculated when not measured, i.e., no 4-phase LEM~flex is connected.

Waveform

The angle given in the waveform function is based on the following formula.

$\varphi = \arctan\left(\frac{P_1}{\sqrt{P_1^2 + Q_1^2}}\right)$	Angle between Q_1..reactive power of first harmonic P_1.. active power of first harmonic

Power measurements

$P = \sum_{k=1}^{40} U_k \times I_k \times \cos(\varphi_k)$	active power (200ms average values) U_k, I_k, φ_k .. values of harmonics
$P_M = \frac{1}{M} \sum_{i=1}^{M} P_i$	active power over average interval P_i ...single 200ms values M ...number of values
$P_{tot} = P_1 + P_2 + P_3$	total active power
$P_{tot} = P_1 + P_2 + P_3$	total active power Aron
$Q = \sum_{k=1}^{40} U_k \times I_k \times \sin(\varphi_k)$	reactive power (200ms average values) U_k, I_k, φ_k . . values of harmonics
$Q = \frac{1}{M} \sum_{i=1}^{M} Q_i$	reactive power over average time
$S = U \times I$	apparent power
$PF = \lambda = \frac{P}{S}$	power factor
$D = \sqrt{S^2 - P^2 - Q^2}$	distortion power
$\cos\varphi = \frac{P_1}{\sqrt{P_1^2 + Q_1^2}}$	cosine cosφ

Note:
The distortion power is > zero if the waveform of current is different from the voltage waveform.

Flicker

$$P_{lt} = \sqrt[3]{\left(\sum_{i=1}^{12} \frac{P_{sti}^{\ 3}}{12}\right)}$$

Long Time Flicker Severity
P_{sti} . . . short time flicker severity

Note: The instantaneous flicker FL is useful for quick assessment of the given flicker situation. The actual value can deviate significantly from the P_{st} .

Total harmonic distortion

$$THD = \frac{\sqrt{\sum_{h=2}^{40} (U_h)^2}}{U1} \times 100\%$$

Total Harmonic Distortion
U1 . . . RMS of the fundamental
Uh . . . RMS of the h-th harmonic

Unbalance as per IEC61000-4-30:

$$Uu = \frac{negative - Sequence}{positive - Sequence} * 100\%$$

$$Uu = \sqrt{\frac{1 - \sqrt{3 - 6\beta}}{1 + \sqrt{3 - 6\beta}}} * 100\% \text{ with}$$

$$\beta = \frac{U_{12\,fund.}^4 + U_{23\,fund..}^4 + U_{31\,fund.}^4}{\left(U_{12\,fund.}^2 + U_{23\,fund.}^2 + U_{31\,fund.}^2\right)^2}$$

5.4 Technical Specification

General Information:

Display:	¼ VGA Graphic LC Display 320 x 240 Pixel with additional background lighting and adjustable contrast, text and graphics in grey scales
Quality:	Developed, designed and manufactured according to DIN ISO 9001
Memory:	2 MB Flash memory, from this 1.5 MB for measuring data;
Interface:	RS 232 SUB-D socket; 115,2 kBaud, 8 data bits, no parity, 1 stop bit, firmware updates are possible with the RS 232 interface (9-pole extension cable)
Sampling rate:	10.24 kHz
Mains frequency:	50 Hz or 60 Hz with automatic synchronisation

Temperature ranges:

Working temperature range:	-10° C...+50° C
Storage temperature range:	-20° C...+60° C
Operating temperature range	0° C...+40° C
Reference temperature range:	+23° C ± 2K

Temperature coefficient:	± 0.1 % of the measured value per K.
Intrinsic error:	Refers to reference temperature, max. deviation is guaranteed for 2 years.
Operating error:	Refers to operating temperature range, max. deviation is guaranteed for 2 years.
Climatic class:	C1 (IEC 654-1) -5°C…+45°C, 5%...95% RH, no dew
Housing:	Cycoloy shock and scratch proof thermoplastic V0-type (not inflammable) with rubber protection holster
EMC	
Emission:	IEC/EN 61326-1:1997 class B
Immission:	IEC/EN 61326-1:1997 IEC/EN 61326-1, amendment 1: 1998
Power supply :	NiMH battery-pack, with mains adapter (15 V / 0.8 A)
Operation time with battery:	Typical > 24h without back light > 12h with back light
Dimensions:	240 x 180 x 110 mm
Weight:	1.7 kg (incl. battery)

Safety:

Safety:	IEC 61010-1 600V CAT III, double or enforced insulation, pollution degree 2
Protection:	IP65; EN60529 (refers only to the main housing without the accumulator compartment)

Specifications:

Rms values are measured with a 20-ms resolution.

V-rms Y *measurement*

Measuring range: 57 / 66 / 110 / 120 / 127 / 220 / 230/ 240 / 260 / 277 / 347 / 380 / 400 / 417 / 480 V AC
Intrinsic error : ±(0.2% of m. v. + 5 digit)
Operating error : ±(0.5% of m. v.+ 10 digit)
Resolution: 0.1 V

V-rms Δ *measurement*

Measuring range: 100 / 115 / 190 /208 / 220 / 380 / 400 / 415 / 450 / 480 / 600 / 660 / 690 / 720 / 830 V AC
Intrinsic error : ±(0.2% of m. v. + 5 digit)
Operating error : ±(0.5% of m. v.+ 10 digit)
Resolution: 0.1 V

A-rms measurement

LEM-flex and current probes with voltage output are supported.
All current probes must correspond to 600V / CAT III

LEM~flex I_N ranges: 15 / 150 / 3000 A rms (at sine)
Current clamp ranges: 50 / 500 mV AC
Resolution: 0.01 A
Ranges 150 / 3000 A and 50 / 500 mV
Intrinsic error : ±(0.5% of m. v. + 10 digit)
Operating error : ±(1% of m. v.+ 10 digit)
Range 15 A
Ranges 15 A and 5 mV
Intrinsic error : ±(0.5% of m. v. + 20 digit)
Operating error : ±(1% of m. v.+ 20 digit)

The errors of the current probes are not considered.

By using LEM~flex:
LEM~flex measuring error: ±(2% of m. v. + 10 digit)
Position influence: ±(3% of m. v. + 10 digit)
CF (typical): 2.83

Power measurement (P, Q, S, D)

Measuring range: see Vrms and Arms measurement
Power errors are calculated by adding the errors of voltage and current.
Additional error due to power factor PF:
Specified error x (1-IPFI)

Maximum Range with Voltage range 830V delta-connection and 3000A current range is 2.490MW

Intrinsic error:	± (0,7 % of m.v. +15 dig)
Resolution:	1 kW
Operating error:	± (1,5 % of m.v. + 20 dig)

Typical Range with Voltage range 230V star-connection and 150A current range is 34,50kW

Intrinsic error:	± (0,7 % of m.v. +15 dig)
Resolution:	1W…10W
Operating error:	± (1,5 % of m.v. + 20 dig)

The errors of the current sensors themselves have not been considered.

PF Power Factor

Range:	0,000 to 1,000
Resolution:	0,001
Accuracy:	±1% of full scale

Frequency measurement

Measuring range:	46 Hz – 54 Hz and 56 Hz – 64 Hz
Intrinsic error :	±(0.2% of m. v. + 5 digit)
Operating error :	±(0.5% of m. v.+ 10 digit)
Resolution:	0.01 Hz

Harmonics

Measuring range:	1...40th harmonic (< 50% von U_m)	
Accuracy:		
U_m, I_m, THDU, THDI:	according IEC 1000-4-7, class B	
U_m, I_m, THDU, THDI:	according IEC 1000-4-7, class B	
$U_m \geq 3\%\ U_N$	5% U_m	
$U_m < 3\%\ U_N$	0.15% U_N	
$I_m \geq 10\%\ I_N$	5% I_m	
$I_m < 10\%\ I_N$	0,5% I_N	
THDU	for THD <3%: < 0.15%	at U_N
	for THD ≥3%: < 5%	at U_N
THDI	for THD <10%: < 0.5 %	at I_N
	for THD ≥10%: < 5%	at I_N

Flicker

Measuring range: Flicker severity Pst according to IEC 1000-4-15

Specifications are valid 2 minutes after applying signals!

Intrinsic error : ±(3% of m. v. + 10 digit)
Operating error : ±(5% of m. v.+ 10 digit)
Resolution: 0.01

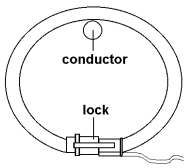
Events

Detection of voltage dips, voltage swells and voltage interruptions with a 10-ms resolution. Due to storage reasons, the maximum number of event recordings is 999.
Measuring error of the half-period sine wave of RMS:
Intrinsic error : ±(1% of m. v. + 10 digit)
Operating error : ±(2% of m. v.+ 10 digit)
Resolution: 0.1 V

Unbalance

rms errors see V-rms specification
Phase angle errors:
Intrinsic error : ±(0,5% of m. v. + 5 digit)
Operating error : ±(1% of m. v.+ 10 digit)
Resolution: 0.1 °

Note:
When using LEM~Flex current probes please make sure to position the conductor opposite to the LEM~flex-lock (see right).



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