

Chroma

**Power Analyzer
6630
User's Manual**

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P/N A11 000021

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Material Contents Declaration

A regulatory requirement of The People’s Republic of China defined by specification SJ/T 11364-2006 mandates that manufacturers provide material contents declaration of electronic products, and for Chroma products are as below:

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls	Polybromodiphenyl Ethers
	Pb	Hg	Cd	Cr ⁶⁺	PBB	PBDE
PCBA	×	○	○	○	○	○
CHASSIS	×	○	○	○	○	○
ACCESSORY	×	○	○	○	○	○
PACKAGE	○	○	○	○	○	○

“○” indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

“×” indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

1. Chroma is not fully transitioned to lead-free solder assembly at this moment; however, most of the components used are RoHS compliant.
2. The environment-friendly usage period of the product is assumed under the operating environment specified in each product’s specification.

Disposal

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new one, the retailer is legally obligated to take back your old appliances for disposal at least for free of charge.



Revision History

The following lists the additions, deletions and modifications in this manual at each revision.

Date	Version	Revised Sections
May 2003	1.0	Complete this manual.
June 2005	1.1	Change the address and phone no. of Chroma ATE Inc.
Mar. 2007	1.2	Add " <i>Material Contents Declaration</i> ".

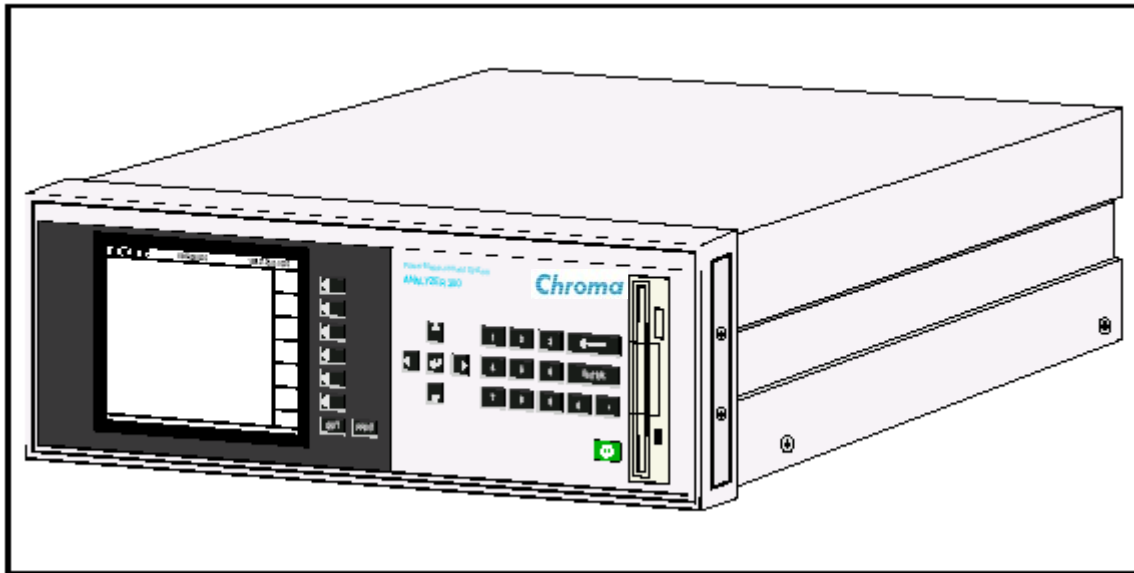
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1. Introduction

1.1 The Instrument – Power Analyzer 6630



Thank you for choosing the POWER ANALYZER 6630!

Our intention when we designed this instrument was to simplify design and verification of mains connected equipment according to EN 60 555-2, EN 60 555-3, EN 61000-3-2 and EN 61000-3-3.

The unique combination of programmable AC power sources and the POWER ANALYZER 6630 makes it possible to perform complex tests with ease.

POWER ANALYZER 6630 is more than an EN standard test instrument; you can make accurate measurements of voltage, current, real power, reactive power, apparent power and more.

The Recorder makes it easy to find power faults such as voltage surges and dropouts.

In this manual you will find all information you need to use the instrument standalone, together with an AC source, connected to a computer via GPIB and more so please read this manual carefully before using the instrument!

If you purchased an AC source for use together with the POWER ANALYZER 6630, please read section 6 and the AC source manual before attempting to connect the two units together.

1.2 CHROMA – the Company Behind the Product

The POWER ANALYZER 6630 has been developed by Chroma, who is also responsible for manufacturing, marketing and central after-sales service of the product.

It is a member of a growing family of power analyzing and sourcing equipment which also includes:

- * 6100 Series Programmable AC SOURCE
- * 6400 Series Programmable AC SOURCE
- * 6500 Series Programmable AC SOURCE
- * 6200 Series Programmable DC SOURCE
- * 6203 Series Programmable DC SOURCE
- * 6206 Series Programmable DC SOURCE
- * 6210K Series Programmable DC SOURCE
- * 6230K Series Programmable DC SOURCE
- * 6201F Series Programmable DC SOURCE
- * 6202F Series Programmable DC SOURCE
- * 6805 Switching Mode Rectifier/Battery Charger
- * 6000 Switching Power Supply Auto Test System
- * 6000E Switching Power Supply Auto Test System

In addition to the instrument product line Chroma also works as development partner for Swedish and international customers covering a broad area of technical development.

The principle areas of technical expertise are:

- instrument development
- measurement solutions and technical trouble shooting
- design and production of special manufacturing equipment.

The depth and wide range of technical expertise in the company makes it possible to handle all stages of product development.

2. General Information

2.1 About this Manual

This manual describes a POWER ANALYZER 6630 with all options installed. Certain parts of the manual may be irrelevant depending on which options your instrument was delivered with.

SAFETY FIRST!

For your and your instruments protection please read this manual before making any connections to the rear panel connectors!

On the instrument you will find the symbol.

This symbol informs you that you should consult this manual before using or modifying any parts in its close proximity.

Below is a short description of the contents of each following section:

Chapter 3:

Contains a description of the instrument design principles and instrument hardware such as keypads, display and connectors.

Chapter 4:

Description of instrument operation such as maneuvering through the display pages and entering parameters, connecting your measurement object and doing measurements, handling of results in the way of printing or saving to floppy disk and updating the instrument software.

Chapter 5:

Contains information about remote controlling the POWER ANALYZER 6630.

Chapter 6:

Contains information about using an AC source together with the POWER ANALYZER 6630.

Chapter 7:

Contains a technical specification of the POWER ANALYZER 6630.

2.2 Unpacking and Inspection

Inspect the instrument box for any damages caused during transit. If damage has occurred, please contact the shipping company that delivered your instrument.

Carefully unpack the instrument.

Your instruments standard accessories are:

- This manual.
- A power cord.

If your delivery does not match the packing list, contact your local dealer. Refer to part 2.3 for information about additional accessories and instrument options.

Please save the original packing material should it be necessary to return the instrument.

If damage has occurred to the instrument or accessories, contact your local dealer for advice and Return Authorization before returning any equipment. The added repair cost of inadequately packaged goods will be invoiced separately so please use the original packing material.

Instrument Storage

The POWER ANALYZER 6630 should be stored in its original container in a clean, dry environment. Protect the instrument from high humidity and extreme temperatures.

2.3 Instrument Options and Accessories

Below is a list of available instrument options and accessories. Please contact your local dealer for an up to date list of available products.

Instrument options available:

9 66301000 High performance POWER ANALYZER 6630 measurement module. The high performance module is needed to perform fluctuating harmonics measurements according to EN 60555-2.am.2 and EN 61000-3-2. It will also make steady state harmonics faster.

Instrument accessories available:

W31 635000 60 centimeters GPIB cable for connecting an AC Source.

W31 545000 2 meters GPIB cable for connecting the peripheral instruments.

A21 001000 Spare current measurement input fuse.
WARNING! Always use a fuse with the correct ratings!

G35 000300 Rack mounting kit containing brackets and rails enabling the instrument to be mounted in a standard 19" rack.

L00 000275 Measurement inputs cable kit. Use these insulated connectors to avoid electrical shock hazard when making cables for your measurement objects.

9 66300999 Measurement connection box. Ready to use for signal phase measurements. For POWER ANALYZER 6630 *together* with AC SOURCE 6530.

9 66301099 High performance measurement connection box for single phase measurements. For POWER ANALYZER 6630 only.

See Chapter 7 for technical data.

2.4 Product Assistance

The purpose of this manual is to provide enough information about the POWER ANALYZER 6630 instrument for normal use. We believe that most of what you need to know is in here so keep on reading!

However, after a while questions may arise so if you need assistance, please contact your local dealer for advice. They will be happy to answer your questions and in the case where they don't have the immediate answer, they will forward the questions to the proper persons.

2.5 Maintenance

The following maintenance procedures can/should be made at regular intervals or when needed:

- Cleaning,
- Dusting,
- Checking for damaged cables,
- Checking for damaged connectors,
- Checking for loose screws,
- Changing fuses

For cleaning, use a soap-water damped cotton cloth. Never use other detergents or chemicals.

Refer to Chapter 7 - *Specifications* for information about fuses. Always use a fuse of the correct rating and type. Failure to do so may cause personal injury.

There are no user serviceable components inside the instrument. Do not open the cover unless instructed to by your dealer.

3. Instrument Description

3.1 Instrument Features

The POWER ANALYZER 6630 is a module based instrument using the latest digital electronics to make it a reliable tool for long term use. The use of modules makes it possible to upgrade the instrument hardware in the future without replacing the entire instrument.

POWER ANALYZER 6630 uses a multiprocessor architecture with one central processor taking care of measurement results post-processing, display, communication, printing and a processor in each measurement module that continuously makes several different calculations on the input signals and delivers the results to the central processor.

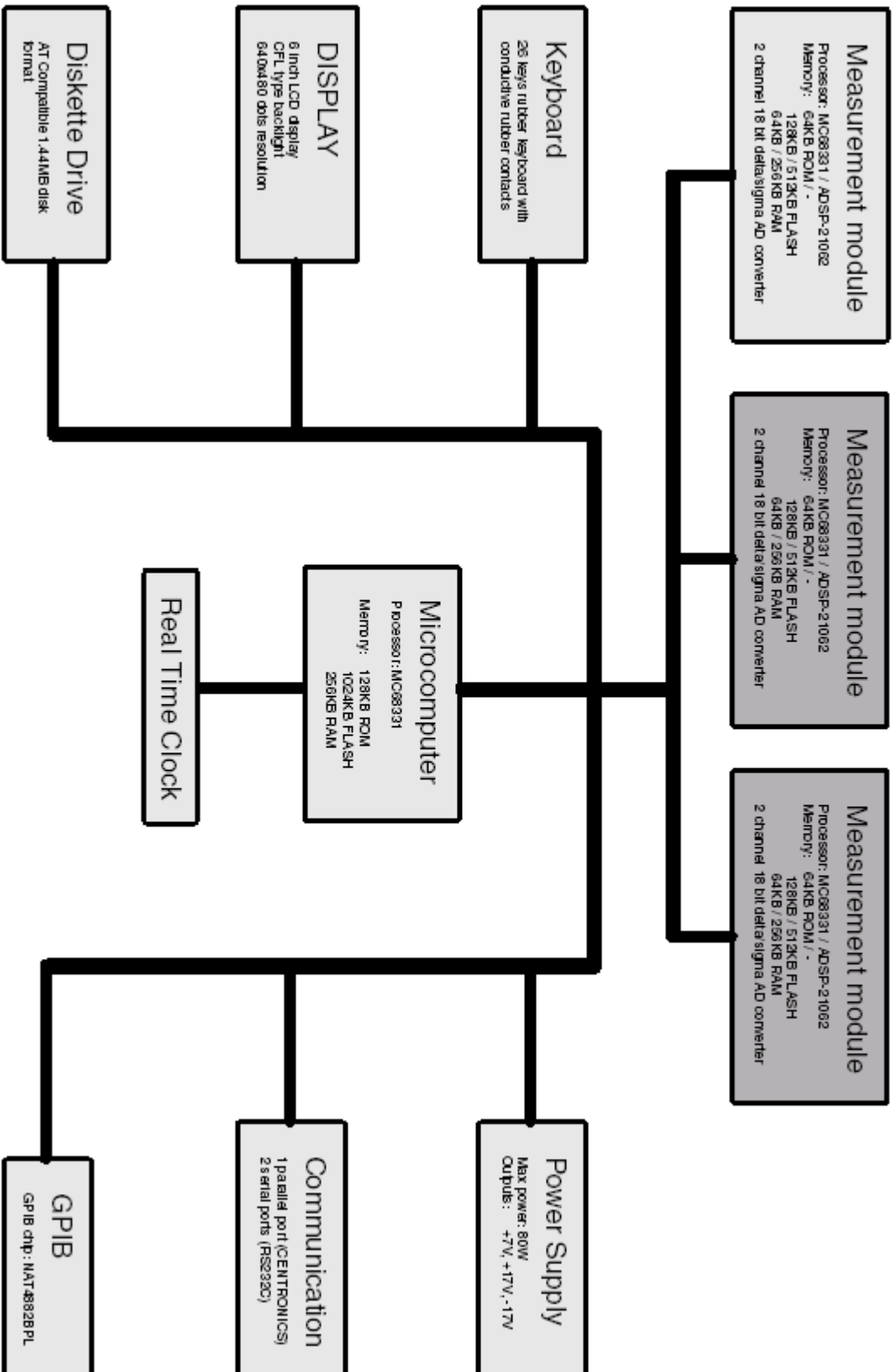
The central and measurement module processors have their system software loaded in FLASH (erasable ROM) memories. This makes it possible to upgrade the system software without returning or disassembling the instrument. A diskette with the new software will be sent to you and is then simply loaded by the instrument into the FLASH memories. This guarantees that your instrument will never become obsolete due to changing test standards.

POWER ANALYZER 6630 is equipped with extensive communication hardware such as: one GPIB port, two RS-232C serial ports and one CENTRONICS compatible parallel port. This gives you great freedom of choice when building your measurement setup.

The GPIB port is needed if you want the POWER ANALYZER 6630 to remote control an AC source. It will also give you access to extensive remote control functions using the industry standard IEEE 488.2 and SCPI command languages.

The diskette station reads, writes and formats standard PC compatible 1.44MBytes disks. In addition to upgrading instrument software, you can use it to save display dumps or transfer measurement results in the widely used DBF file format for direct loading into any database or spreadsheet software.

Figure 3.1 shows a block diagram of the instrument. The dark shaded blocks indicate instrument options.



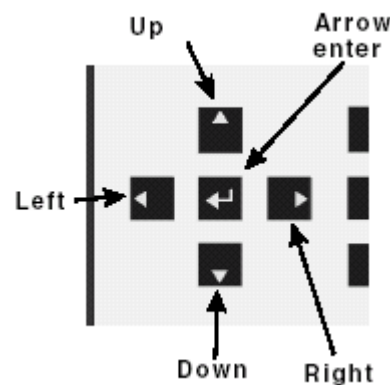
POWER ANALYZER 6630 Block Diagram

3.2 Front Panel

Figure 3-2 shows the front panel with its components grouped in function families. It consists of the display, keyboard groups, power switch and the diskette drive.

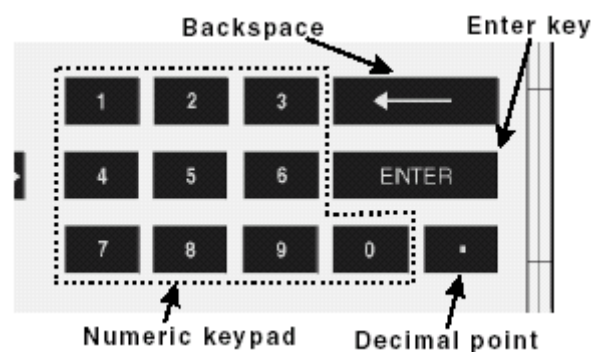
1: The arrow key group.

The arrow key group contains four arrow keys and an enter key. It is used for stepping through input fields on a display page and predefined choices on input fields (as opposed to entering numeric data with the numeric keyboard, see paragraph 3.4 for a detailed description of the display).



2: The numeric keypad.

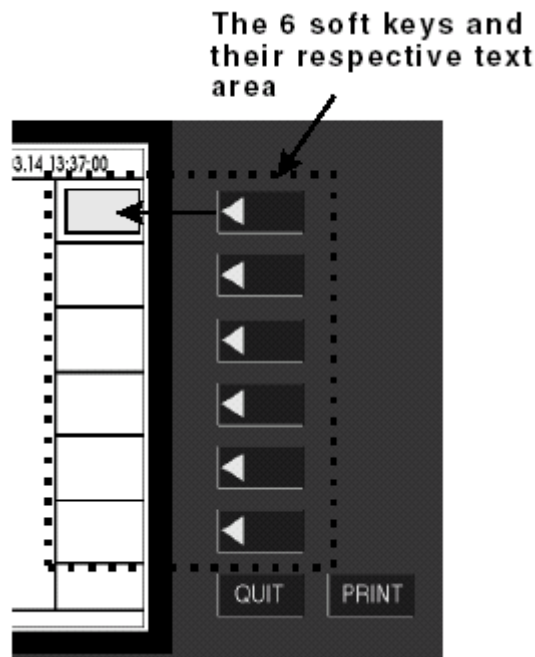
It is used for inputting numeric data as opposed to selecting predefined fields with the arrow keypad. In addition to the numeric keys, 0 - 9, there is a decimal point, a backspace key for deleting and an enter key.



3: The softkey group.

POWER ANALYZER 6630 uses a technique called 'softkeys' as a way to keep down the number of needed keys. This makes the instrument easier to use since the front panel will not be cluttered with details that makes it hard to find and learn each function. Instead, only the needed functions at each menu level will be available.

The 6 softkeys each have a text area on the display that defines its function. The softkey functions changes with the current menu level.



4: The graphic LCD display.
See paragraph 3.4 for a detailed description.

5: The diskette drive.
A 3.5" diskette drive that reads, writes and formats standard PC-AT compatible 1.44 MB disks.

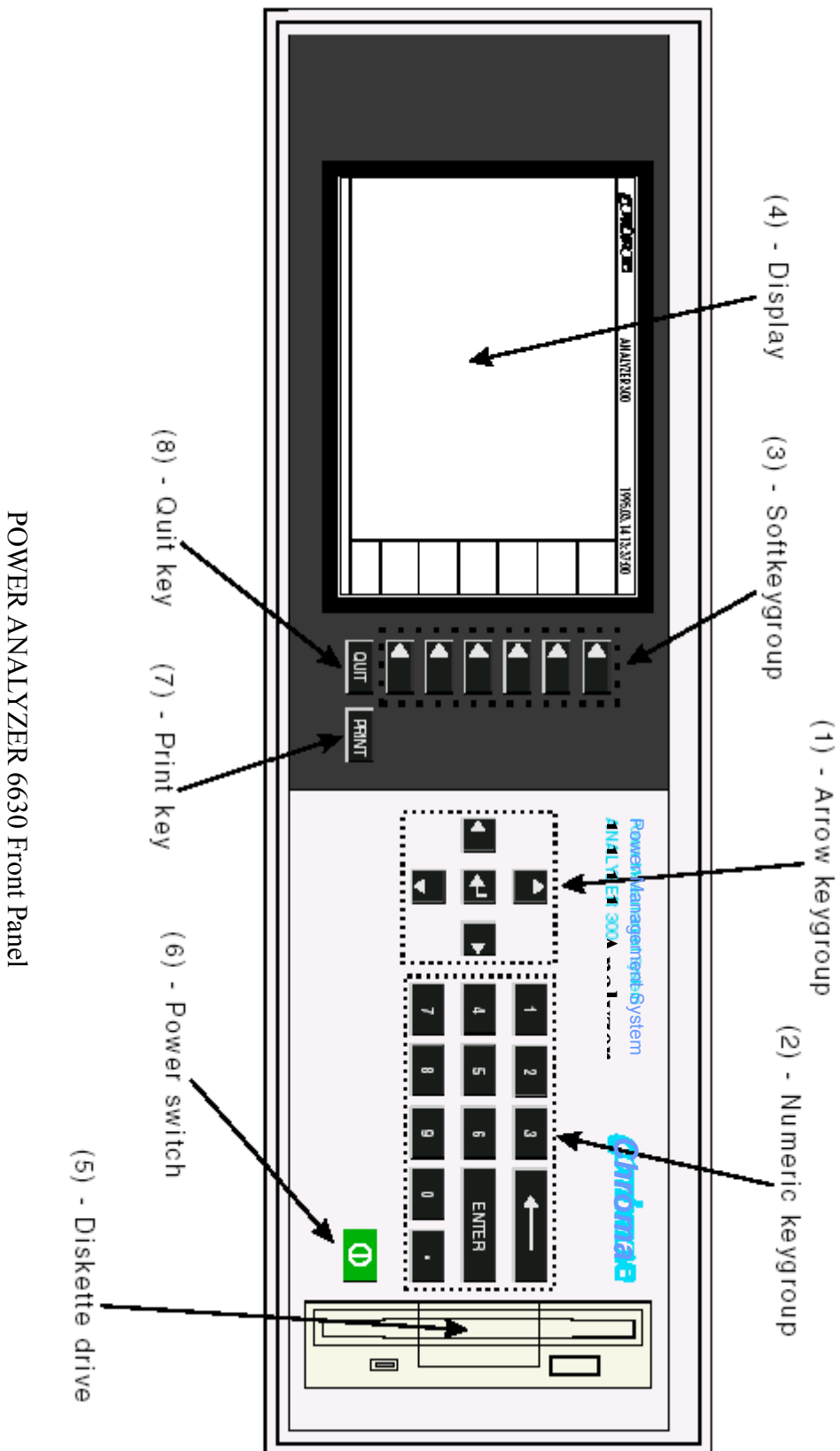
6: The instruments power on /off switch.

7: The PRINT key.
This key is used to print or to save the current display contents to diskette. Press this key to start the printout. This key also has a double function. By pressing the PRINT and keeping it depressed for 1 second, an options menu appears where all print target options become available. Press the appropriate key to start the printing. The main purpose of this function is to alternate between printing to paper and to disk without having to change the instrument settings. Be sure to press the correct printer type, pressing the wrong type will produce large number of pages with printer controller codes, not the display image.

See Chapter 4 for more information about setting the print options.

8: The QUIT key.
The quit key is used to go back one level in the instruments menu level tree or to stop an instrument function.

For a detailed description of POWER ANALYZER 6630's menu tree, see Chapter 4.



3.3 Rear Panel

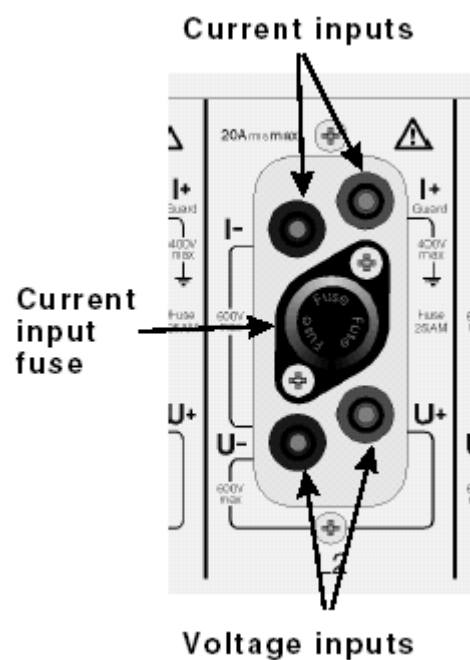
Figure 3-3 shows the rear panel. The callouts are as follows:

1: Measurement inputs

These are the measurement modules input connectors and current measurement input fuses. See specifications about fuses!

Your instrument may have less modules than shown in figure 3-3 but at least one is present in the rightmost slot. Empty measurement modules slots will be covered with a blind panel.

Additional modules are installed right to left. POWER ANALYZER 6630 can have a maximum of three installed measurement modules.



2:

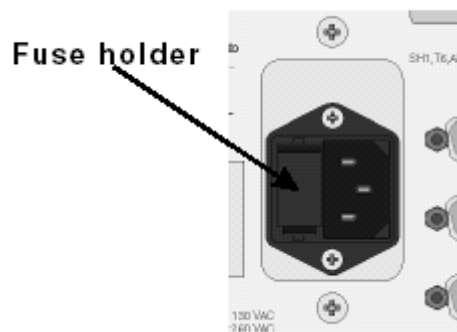
This spare module slot is reserved for instrument options such as future expansion of the instrument.

3: The GPIB interface connector.

POWER ANALYZER 6630 is equipped with an extensive GPIB implementation for remote control of the instrument. It is also used for controlling an AC source.

4: The power input connector and fuse holder.

See specifications about fuses!



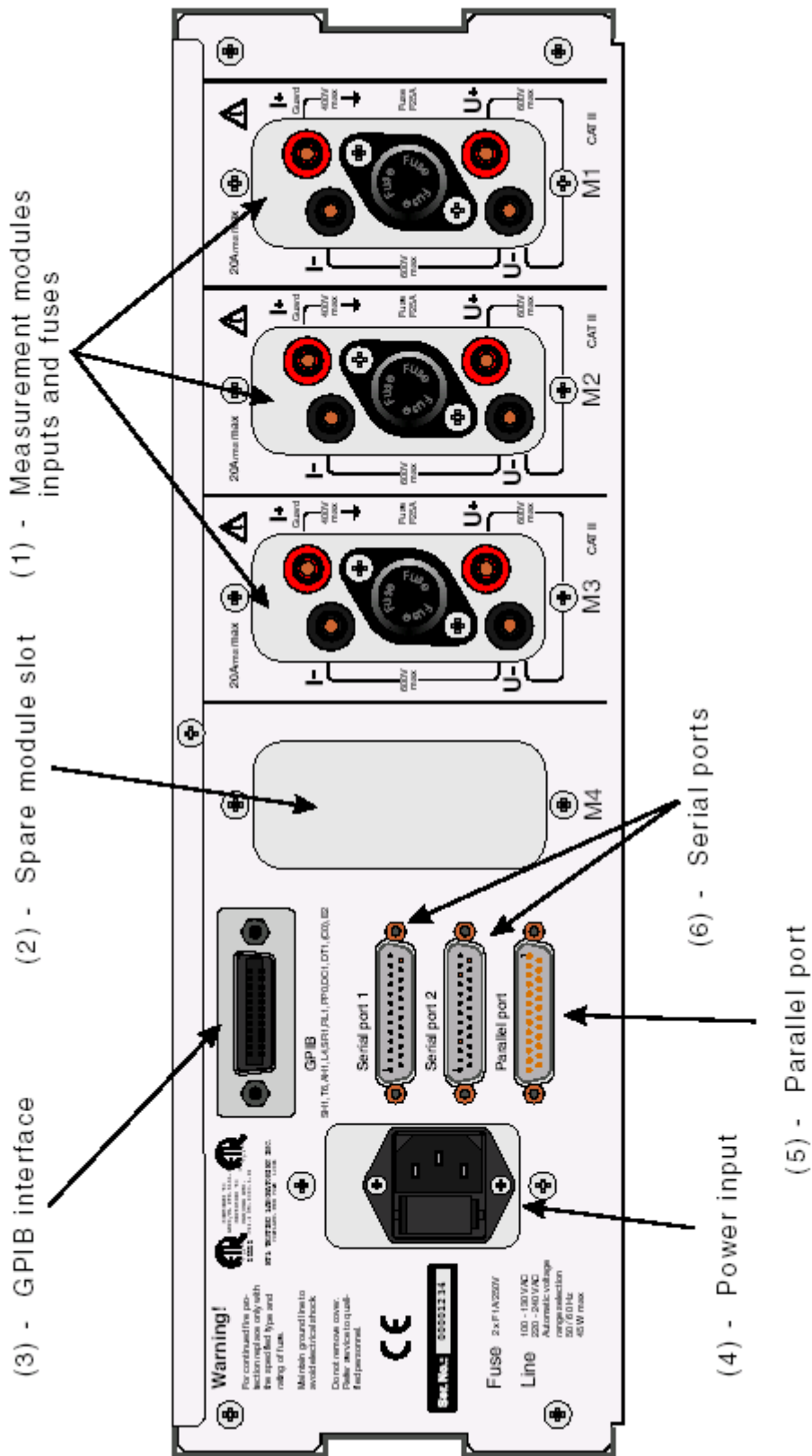
The connector accepts a standard IEC type apparatus power cord. No voltage range selection need be done, the instrument does this automatically.

5: The parallel port.

This is a Centronic compatible parallel port for connecting a hard copy device such as a printer or plotter to the POWER ANALYZER 6630. Dumps of the screen contents can be made at almost any time by pressing the **PRINT** key. See section 4 for information about using the parallel port.

6: The serial ports.

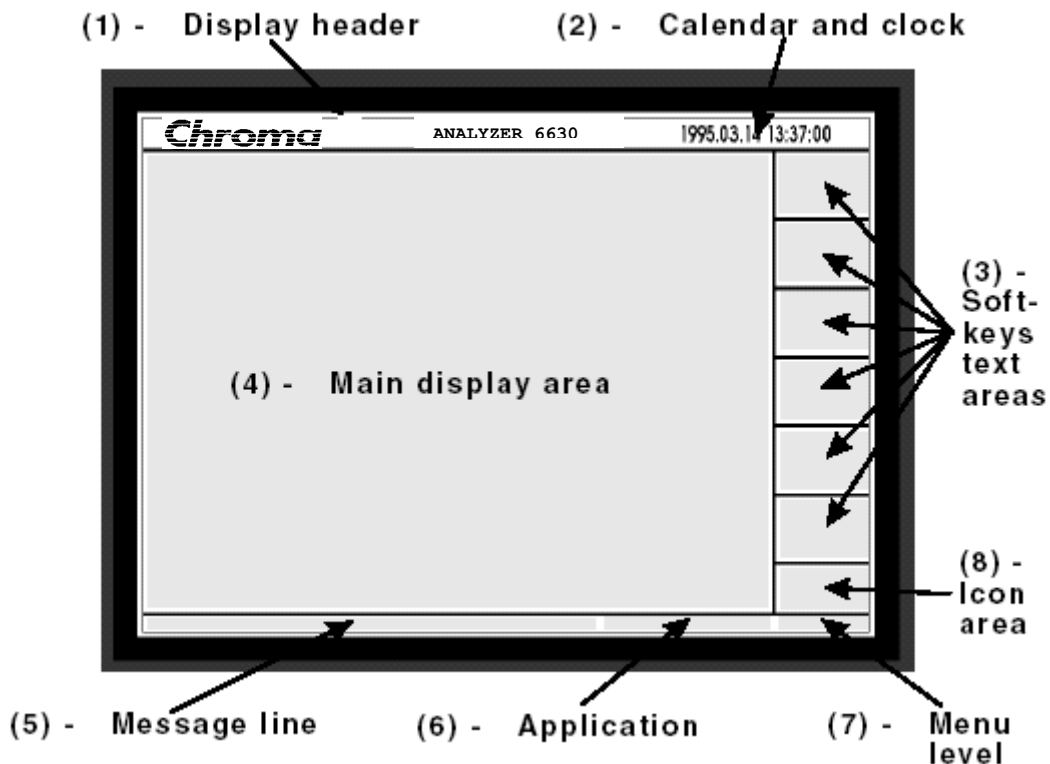
These two RS-232C compatible serial ports can be used to remote control the instrument in the case where remote controlling via GPIB is not preferable. See Chapter 4 for a description about using the serial ports and section 5 for a description of remote control.



POWER ANALYZER 6630 Rear Panel

3.4 The Display

Figure 3-4 shows the POWER ANALYZER 6630 display layout.



1 and 2: The display header, calendar and clock

Contains manufacturer logo, instrument name, a calendar and a 24 hour clock. See Chapter 4 for information about setting the clock.

3: Soft key text areas

These six text areas will have text or be empty depending on the current menu level. A blank area indicates that the corresponding softkey does not have any function; otherwise the text in the text area defines the softkeys function.

4: Main display area

The main display area is where nearly all information will be presented.

5: Message line

The message line is used to output information such as hints, limitation information and error messages.

6: Application

Displays the current instrument application (setup).

7: Menu level

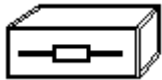
Displays the number of the current menu level. This is useful when requesting technical support, just refer to the menu level number.

8: Icon area

This area will show an icon that indicates ongoing events that may not be apparent to the user. Following shows the explanation of different icons.



The instrument is in remote mode. No keys except the QUIT key are operational. The only way to exit this state is by the IEEE 488.2 *GTL common command, the QUIT key which acts as a Go To Local key or by a power off-on.



The instrument is executing diskette operations.



The instrument is printing.

3.5 The Diskette Drive

POWER ANALYZER 6630 is equipped with a 3.5" diskette drive. Its primary use is for result and application storage but an equally important feature is the possibility to upgrade the instrument software. You received one or more disks together with the instrument and you will probably receive diskettes with updated instrument software sometime in the future. Section 4 explains how to load the instrument software from diskettes.

You should keep at least two releases of instrument software, the one recently received and the one it is replacing. The reason is that if there is any problem with the new software, you can always revert to the old one while the problem is being solved.

The diskette drive is a High Density PC compatible 1.44MB disk format. Results stored on the disk can easily be archived or transferred to a PC for post processing.

IMPORTANT!

The diskette drive is PC compatible and will read and write disks formatted on any PC compatible computer but for maximum performance, disks to be used with the POWER ANALYZER 6630 should be formatted by the POWER ANALYZER 6630. This is due to internal hardware reasons. Disks not formatted by the instrument will have drastically reduced performance. As an example, comparing load times of the instrument software with an POWER ANALYZER 6630 formatted disk and a PC formatted disks shows that the PC formatted disk takes about 4 times longer to load! This performance degradation is of course most apparent with large files such as the instrument software. Loading and saving applications uses files of small size, so the performance loss is less apparent.

Recommendation:

Always use POWER ANALYZER 6630 formatted disks with the instrument. Disk operations

will be much smoother. Disks formatted by the POWER ANALYZER 6630 can be used by PC without performance loss.

4. Operation

4.1 Installation

Warning:

The use of this instrument in any other manner than described in this manual may result in personal injury and/or property damage. Always use a grounded power cord connected to a grounded outlet to avoid electrical shock hazard. This equipment contains a lithium battery. Battery explosion and/or leakage may be the result of improper handling. Devices connected to this instrument should have applicable electrical safety approvals such as IEC 950 for computers and computer accessories and IEC 1010-1 for other measurement and controlling equipment to maintain safety.

The POWER ANALYZER 6630 is primarily for bench use. The instrument is equipped with tilt feet enabling it to be elevated for increased accessibility and display visibility.


The power supply automatically selects the correct voltage range as indicated on the rear panel.


Keep the area around the rear panel of the instrument clear of objects that may cause the measurement connectors to unplug or be damaged.

The POWER ANALYZER 6630 does not have a cooling fan. The reason has to do with several things, manufacturing cost, lack of internal space and environment. To compensate for this, the enclosure is designed to act as a heat sink, which places some restrictions on its installation:

- Keep the instrument clear of any objects that may degrade cooling such as manuals or clothes. This is especially important if the instrument is equipped with more than one measurement module and/or used with maximum measurement current for a long time
- If the instrument is to be rack mounted, a 1 HU (44mm/2") air space must be maintained below and above the casing for ventilation purposes.

POWER ANALYZER 6630 is designed to meet the EC rules for electromagnetic

susceptibility and emission; the  mark found on the rear panel instrument label is a confirmation that the POWER ANALYZER 6630 complies with the applicable EC directives.

Having a  mark on an instrument doesn't mean that its fool proof when it comes to interference. Normal 'sense' should still be used, don't use the POWER ANALYZER 6630 close to large interference sources such as actuators or motors since it may degrade performance.

4.2 The User Interface

This section describes how to maneuver through the instrument, view and change parameters. The figures will show the instrument with its default configuration as delivered. If the instrument has been used the figures may not be exactly what is shown on the instrument. This is not a problem; all techniques described are still valid.

Turn on the instrument; continue past the initialization screen to the Main Menu.

As mentioned in section 3, POWER ANALYZER 6630 uses a system called softkeys to keep down the number of keys on the front panel. Figure 4-1 shows the main menu. The screen will display the 'Available applications' which are setups stored in the instrument. DEFAULT is the default setup stored at manufacturing. Section 4.3 will describe in detail how setups are used. The status line shows hints or messages relating to the current action, in this case it hints us to use the System Functions soft key to reach the applications setup menus. The Appl: field will always show the selected application as a reminder when working with the instrument. There is also the 1 digit in the field after the application name field. This field shows a menu page number indication, pressing a softkey to reach another page will be reflected in this field. The number 1 tells us that we are at the top level of the menu system. Additional levels will be separated by punctuation's such as 1 . 2 . 2 . 1. You may already have noticed that there is no character keyboard on the POWER ANALYZER 6630 yet the applications name is using characters. This is one of the data input types that are used in the POWER ANALYZER 6630, the character data type. We will describe later how it is used but for now, press the Check Waveform softkey....

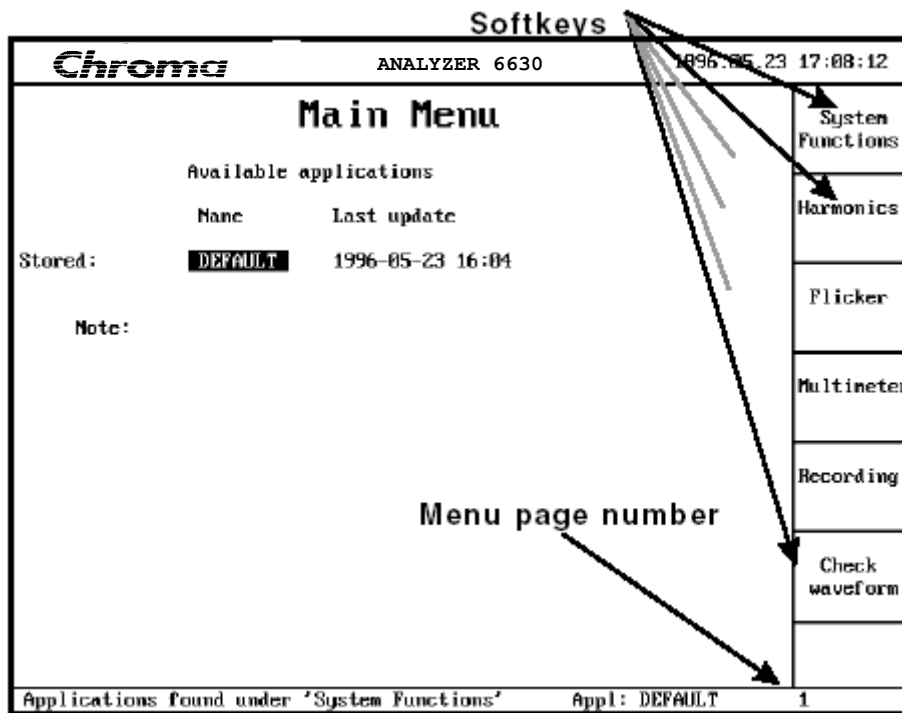


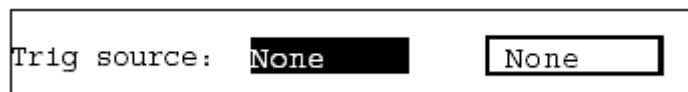
Figure 4-1 The Main Menu

Pressing Check Waveform will get us to page 1 . 6. The actual contents of the different

pages will be described in section 4.4 so continue by pressing the Setup key followed by the Modify key. You should now be on page 1.6.2.2, Modify Waveform Setup page as shown in figure 4-2. If you are not, press the **QUIT** key until you return to the main menu and try again. The **QUIT** key is always used to leave a level or function and return to the previous one. The Modify Waveform Setup page illustrates the four available data input methods, pan windows, select, numeric and character input.

Pan Window Input

We will now examine the pan window field. This data entry method is more or less the same as the select input field but this method is used when the parameter choices are more than can be shown on one line. Press the arrow-down key until you reach the Trig source parameter. Notice how a box is shown to the right of the highlighted value. The box will show the currently selected value.



This box is a 'window' into a string of parameters. Use the arrow-left and right and watch how the parameter window contents changes to match the string below. Similar to the select field method, the arrow-enter key is used to set the selected value.

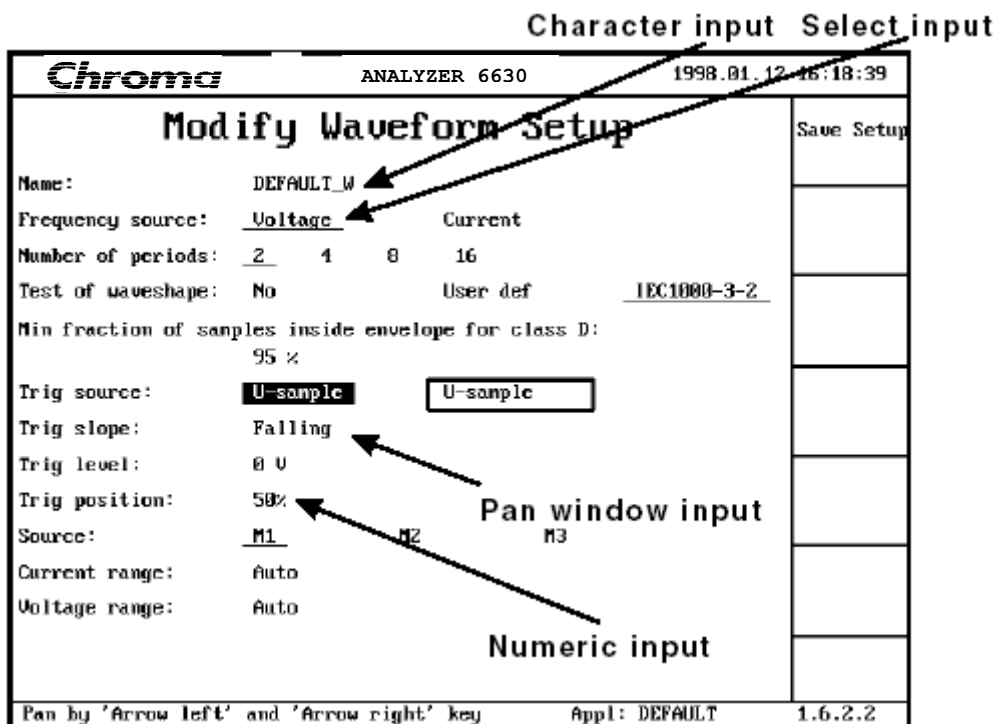
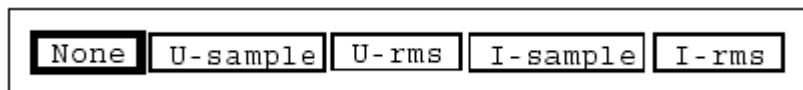


Figure 4-2 Modify Waveform Setup

Use the arrow-right key to get to U-Sample. Press arrow-enter to select it. The display should now look like figure 4-2.

This has shown how the pan input field is used. Now we shall see how the select input field is used.

Select Input

Press arrow-up until you reach the Number of period parameter. As you can see, the input choices are shown on the display and the currently selected value is underlined.



The select input field is used with parameters that have few choices and that can all be shown on the display on a single line. Use the arrow-left and right keys to move the highlighted area between the different choices. When the preferred choice is highlighted, press arrow-enter to select it. The underline has now moved to reflect the new setting.

This is the simplest input field in the POWER ANALYZER 6630, move to the desired parameter, use left-right keys to select value and press arrow-enter to set.

Numeric Input

Press the arrow-down key until the Trig level parameter is highlighted. Immediately to the right of the parameter is an empty box displayed. Use the numeric keypad to enter three, four digits. Do not press ENTER. Observe how the input field is updated as the digits are pressed. To input a fraction, use the dot key.

Erase the input field with the backspace key. When the input field is empty, press the backspace key one more time. A minus sign appears. This is the method to input negative values. Pressing backspace, not the left arrow key, in an empty numerical input field will display the minus sign.

Erase the minus sign by pressing backspace again, input 3000 and press ENTER. The instrument refuses to accept the value and informs you at the hint/status line that the maximum value is 2000.00. All numerical input parameters are protected in this way, entering an out of range value will be refused and the max.-min. limit is shown on the hint/status line. After entering a valid value, press enter to set it. The value will be shown on the display.

Character Input

We have now reached the last input field type, the character input field. Use the arrow-up key until the Name parameter has been reached. The hint/status line shows Alpha-numeric is activated by 'Arrow enter'. Do as the hint tells you, press arrow-enter. This brings up the character keyboard as shown in figure 4-3. An input box is displayed at the top left of the character keyboard. Character selections will be updated here, effectively forming a string. Move around using the arrow keys. Enter the word TEST by moving to T, press arrow-enter, move to E, press arrow-enter a.s.o. When finished, move to Enter and press arrow-enter. The character keyboard will disappear and the word TEST appears at the Name parameter.

This concludes the description of how to view and alter parameters in the POWER ANALYZER 6630. Press the **QUIT** key until the main menu is reached, do not press Save Setup. Move on to section 4.3 to learn about the setup system.

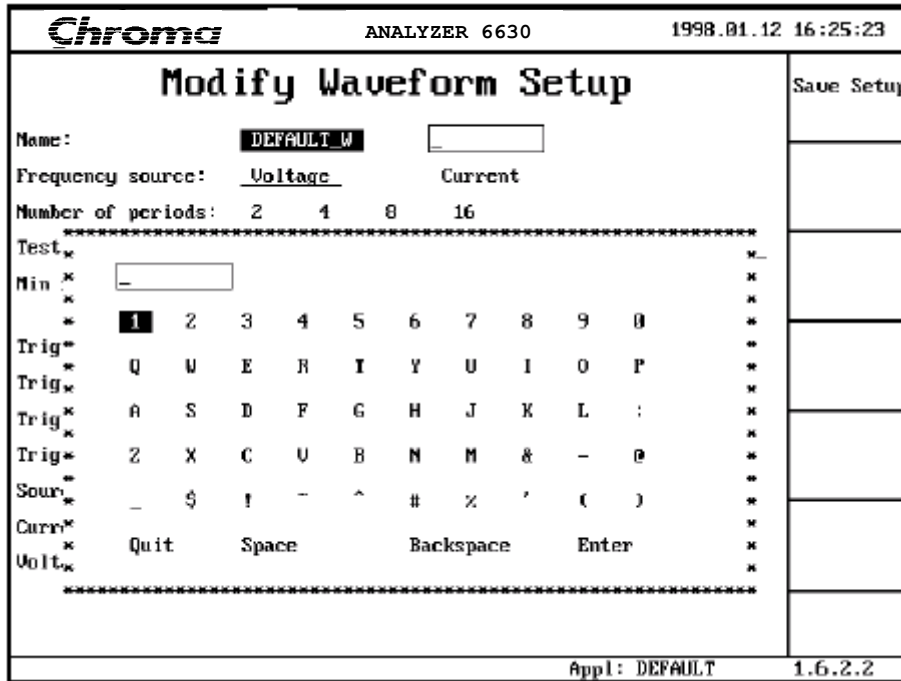


Figure 4-3 The Character Keyboard

4.3 Understand the Setup System

The complexity of an instrument such as the POWER ANALYZER 6630 automatically creates a need for versatility. Browsing through the pages of the instrument can initially be quite intimidating; a host of parameters with cryptically names meets the new user. It's always hard to strike a balance between making the instrument simple (inflexible for the power user) and versatile (hard to use for the beginner). The POWER ANALYZER 6630 is primarily designed to simplify measurements according to several EC standards, which means that most parameters really are required.

To make it easier for the user to use the instrument in different measurement configurations, the POWER ANALYZER 6630 has a setup system where parameters can be stored in so called 'Applications', see figure 4-4. An application is a folder of measurement function configurations and is reached through System Functions, Application Setup, Modify. Here the folder name is set, global parameters such as language, hard copy device and type, measurement modules configuration and more is specified. There can be a total of four applications stored in the instrument, each containing up to 6 measurement function configurations. The 6 measurement configurations can be a mix of any functions, for example one of each measurement function or just 6 multimeter configurations.

There is also a system setup. This is a single instrument setup not related to the application folders. It is used to store hardware related parameters such as calendar and clock, AC generator brand, GPIB and RS-232 interface configuration and remote control configuration.

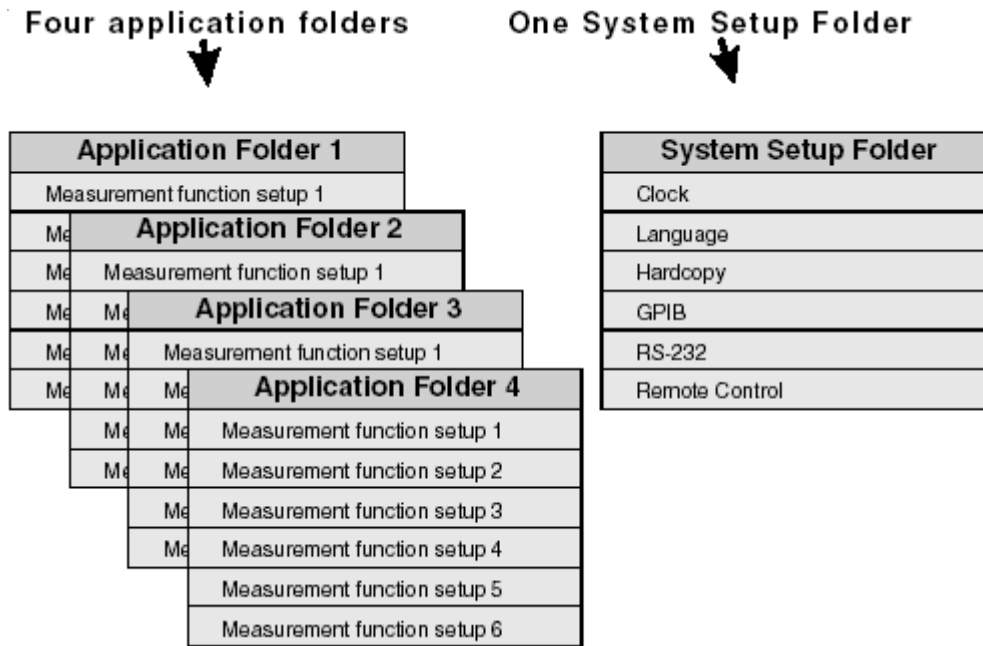


Figure 4-4 The Setup System

All these setup capabilities add up to quite a lot of data. The parameters are stored in an EEPROM (Electrically Erasable Programmable Read Only Memory), which retains the data after power off. To recall an application, use the arrow-up and down keys in the Main Menu shown in figure 4-1 to highlight the desired application and press arrow-enter. The selected application is loaded into the instrument, ready to be used.

The diskette drive may also be used to store applications. This ultimately makes the number of stored applications unlimited!

We will now see how a new application is created. Return to the Main Menu and press **System Functions, Applications Setup**. You should now be on page 1.1.2, Application Setup. Choose here which application that should be used as a template by selecting it with the arrow keys and arrow-enter. Since only the DEFAULT application is available, it will be used as the template. Press **New Setup**. The 1.1.2.1, New Application page appears. Enter the name TEST by using the character keyboard as described in section 4-2. Then press **Save Setup**.

The Application Setup page reappears and the new TEST application is added to the list of applications. It automatically becomes the selected application. Press **QUIT** until the Main Menu is reached. A new application has been added. The application is created with DEFAULT as template:

<u>Folder pos.</u>	<u>Function</u>	<u>Name</u>
1	Multimeter	DEFAULT_M
2	Harmonics	DEFAULT_H
3		
4	Recording	DEFAULT_R
5	Flicker	DEFAULT_F
6	Waveform	DEFAULT_W

As you can see, the new application contains a setup for each measurement function, leaving one folder entry unused. (The selected application folder contents can be inspected on page 1.1.2.2, *Modify Applications*. Press arrow-down more than 1 second to turn to the second page).

All measurement functions have setup management. A function setup can be created, modified and deleted. Check this from the *Main Menu* by pressing the *Harmonics* key, a screen like figure 4-5 will appear:

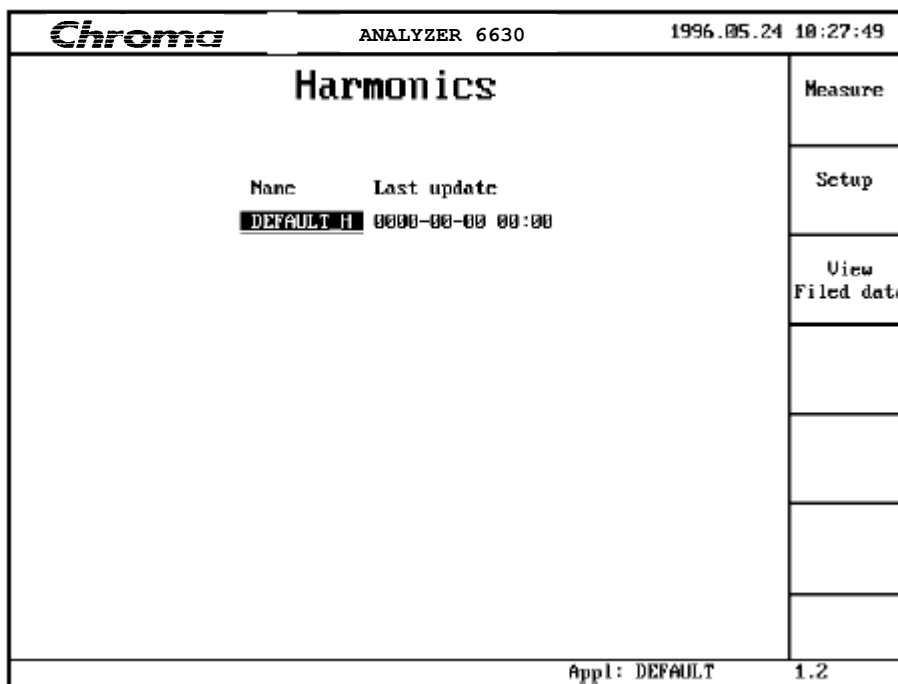


Figure 4-5 Measurement Function Access Page

This is the function access page, from here measurements can be started or its setup can be changed.

Press the *Setup* key to access the setup management screen. Figure 4-6 shows the setup management page:

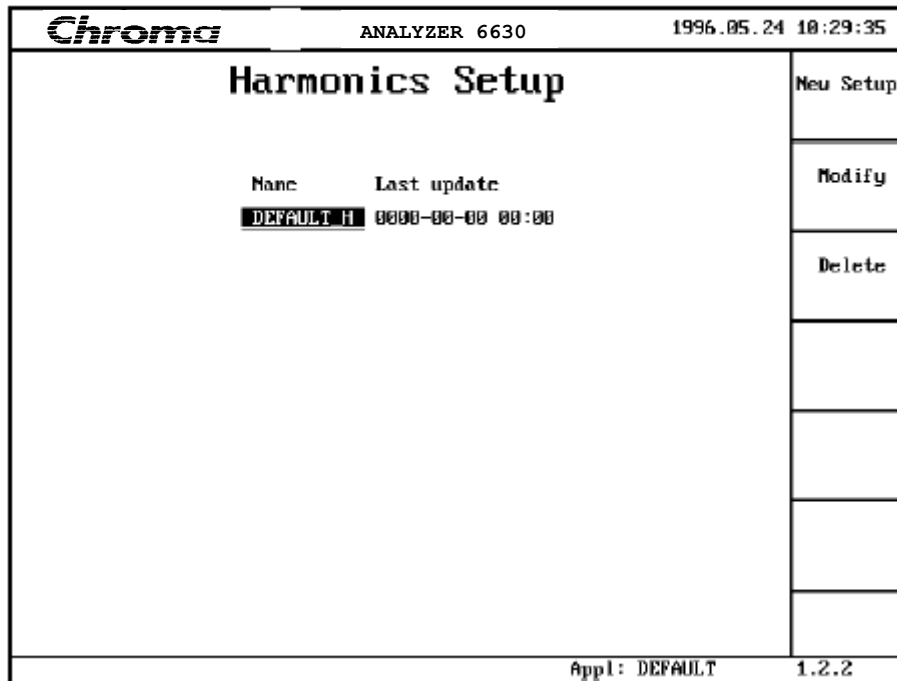


Figure 4-6 Function Setup Management Page

The `New Setup` key is used to add a function setup to the currently selected application folder. This key will only be shown as long as there are free folder entry's available. The `Modify` key is used to edit an existing function setup. The `Delete` key is used to, you guessed it, remove a function setup.

IMPORTANT!

The `Modify` and `Delete` keys refer to the currently selected setup, moving the highlight to another setup entry and pressing delete will not erase the highlighted entry. To edit or erase a setup, move the highlight with the arrow keys and select with arrow-enter before continuing.

Return to the Main Menu and try the other measurement function keys. Observe the similarity of the access and management screens.

Go back to the Harmonics Setup management screen on page 1.2.2. Press the `New Setup` key. This is similar to when we created the TEST application; a `New Setup Harmonics` screen appears where we start by naming the new harmonics setup using the character keyboard. Enter the name `NEW_HARM` and press `Save Setup`. The new setup appears at the setup management screen and automatically gets selected.

Notice that the `New Setup` key is gray because we used the last available application folder entry. Press the `Modify` key to access the setup parameters. Feel free to move around among the parameters and alter them, no harm will be done.

Press `QUIT` to return to the management screen. Delete the newly created setup by pressing `Delete`. A confirmation screen appears giving you a chance to change your mind. Press the `Delete` key. The management screen reappears and the `NEW_HARM` setup has disappeared. As a consequence of the delete, the `New Setup` key has returned.

As mentioned earlier, applications can be written to and read from diskette. This is done from Application Setup, page 1.1.2, shown in figure 4-7:

Chroma		ANALYZER 6630	1996.05.24 10:31:43
Application Setup			New Setup
Available applications			
	Name	Last update	Modify
Stored:	DEFAULT	1996-05-24 09:57	Delete
	TEST	1996-05-24 10:31	
Selected item will be used as template in 'New'			Write to disk
			Read from disk
Appl: TEST			1.1.2

Figure 4-7 Application setup Management Page

Select the application that you want to save by using the arrow keys. Insert a formatted diskette in the disk station and press the `Write to disk` key. A list of application files already stored on the disk, if any, is shown as in figure 4-8. Use the arrow keys and arrow enter to select an existing file or enter a new file name with the on-screen keyboard and press `Write`.

Reading an application is very straight forward, press `Read from disk` and the screen in figure 4-9 appears.

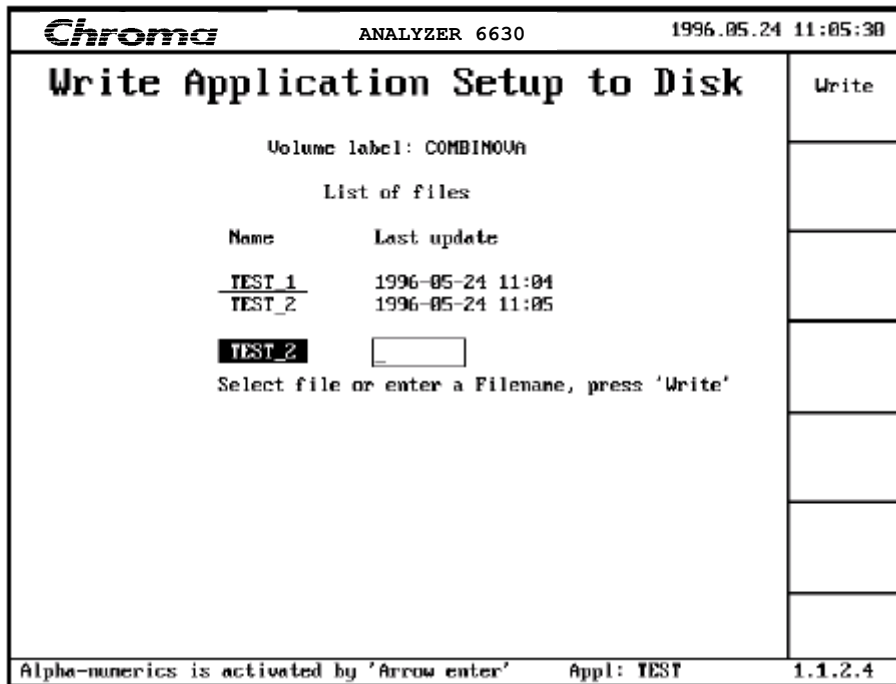


Figure 4-8 Write Applications to Disk

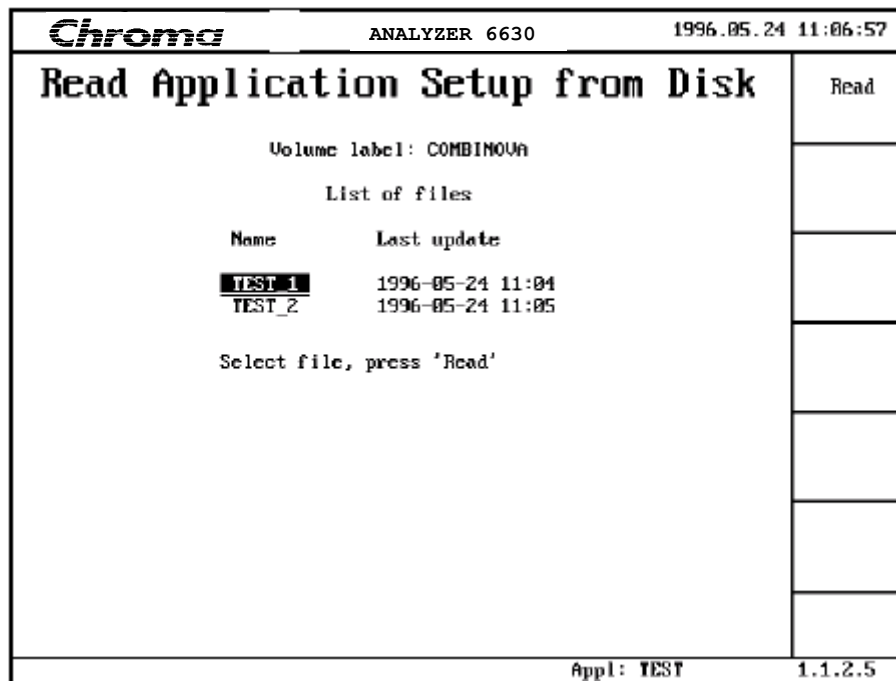


Figure 4-9 Read Application from Disk

Use the arrow keys to select the desired application and press arrow-enter followed by the Read key. A choice is now made about how you want to store the read application as shown in figure 4-10. Pressing Volatile will create a non-permanent application stored in RAM, a volatile application. The Application Setup screen reappears when the load is ready and the loaded application automatically becomes selected. Notice that the loaded application does not show up in the Stored field but in a new field called Volatile, see figure 4-11.

The `Volatile` field is used to indicate that the currently selected application was not retrieved from the instrument EEPROM but from an external media. It was mentioned earlier that selecting an application from the `Stored` list loads the application. You can think of the internal EEPROM as a small disk drive capable of storing four 'files'. Applications are loaded into a working copy, stored in the instrument RAM (Random Access Memory). The RAM is volatile which means it will lose its contents when the power is turned off hence the `Volatile` field. The `Volatile` application may be deleted or overwritten by loading a new application from diskette or the EEPROM.

Also note that there is no connection between the application name and the file name. The application name is stored in the file and will be shown when loaded.

Pressing **Non-volatile** at the display in figure 4-10 will load the application into a free EEPROM folder. If no folders are free, the Non-volatile choice in figure 4-10 will not be available.

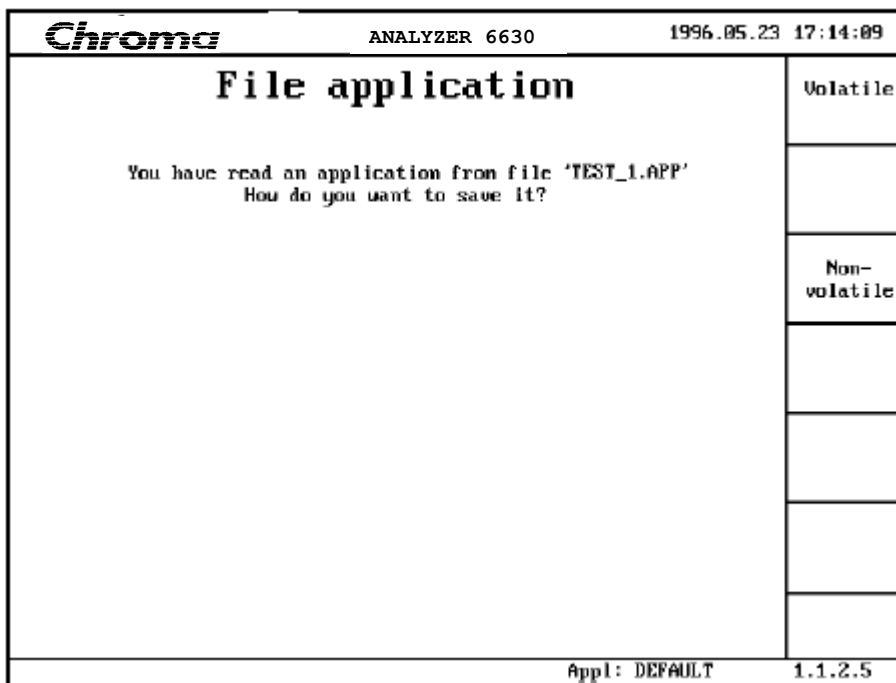


Figure 4-10 Selecting Storage of a Loaded Application

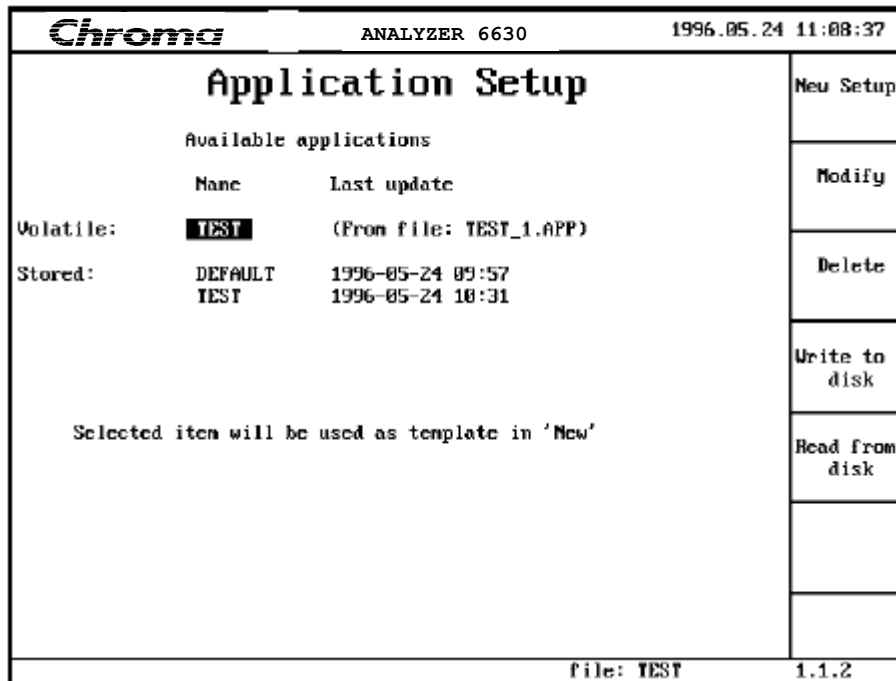


Figure 4-11 Application Setup Screen after Loading a Volatile Application

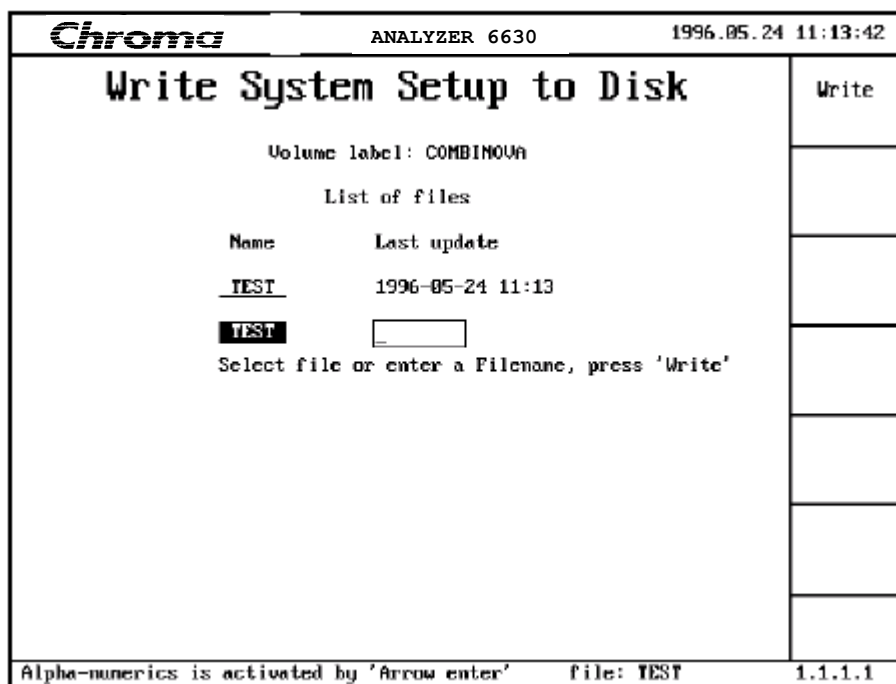


Figure 4-12 Writing System Setup to Diskette

The system setup can also be written to and read from a diskette. Go to the **System Setup** menu on page 1.1.1. There are two keys available, **Write to disk** and **Read from disk**. Insert a disk and press **Write to disk**. A filename entry/selection screen will appear as in figure 4-12. Use the arrow keys and arrow-enter to select an existing file which will overwrite it or use the on-screen alpha numerical keyboard to enter a new file name. When finished, press **Write** to save the system setup.

Stored system setups can of course be read back. Pressing the **Read from disk** key will

show a menu similar to figure 4-9. Select file with arrow keys as usual and press Read to load. The setup is loaded into RAM and is consequently volatile. There is however one important difference between volatile applications and volatile system setups, there is no indication on the display that the current system setup is volatile so use with care!

This concludes section 4.3.

You should now be able to create and remove an application, create, edit and remove measurement function setups. You should also be able to store and retrieve applications from a diskette and understand the difference between `Stored` and `Volatile` applications.

Move on to section 4.4 for an in-depth description of configuration, utilities and measurement functions.

4.4 Using the Instrument

IMPORTANT!

Before starting any measurements, please read section 4.1 *Installation* and section 4.5 *Connecting a Measurement Object* before proceeding. These sections contain important safety information.

When the POWER ANALYZER 6630 is switched on the instrument performs a series of self-tests and initializations before reaching the display shown in figure 4-13:

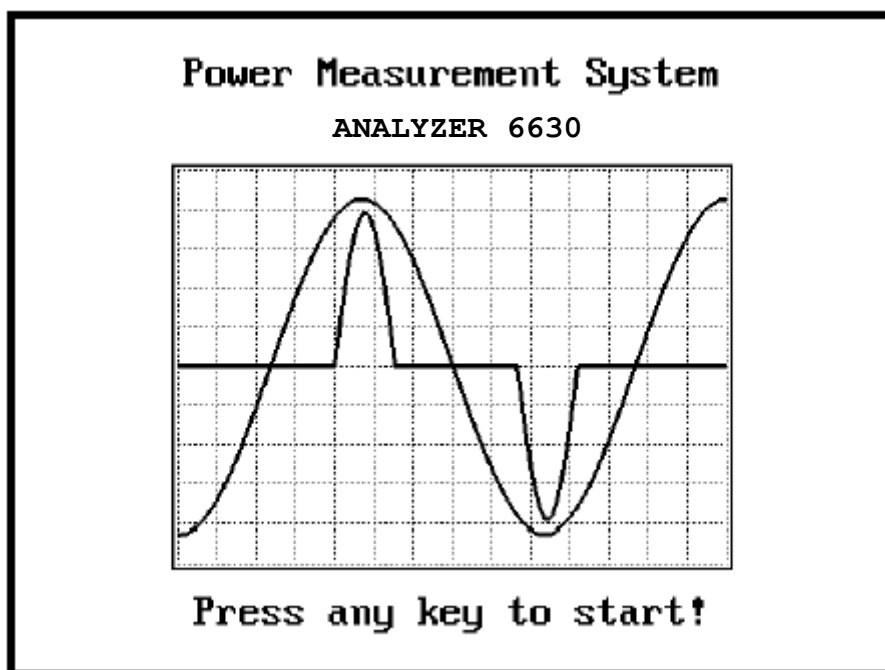


Figure 4-13 Power Analyzer 6630 Power On Display

Press any of the front panel keys to start the POWER ANALYZER 6630 system or wait for 5 seconds for the instrument to start automatically. A display similar to the one in figure 4-14 is shown. This is the instruments main menu and top level of the menu tree.

The display components are described in section 3.4 THE DISPLAY.

The six softkeys are used to enter new levels of the menu tree or execute instrument functions as described in its related softkey text. After entering a new menu or executing a function, the **QUIT** key is always used to exit a menu level to the previous one or for aborting functions. If you for some reason should find yourself lost in the menu structure, just continue to press **QUIT** until you reach the main menu. If you have completed a measurement and press **QUIT** to leave the function, the instrument will prompt you for a confirmation of that you really want to leave. This is to prevent the loss of valuable measurement results by accidentally pressing the **QUIT** key.

The PRINT key is used to dump the screen contents to a printer. POWER ANALYZER 6630 supports the most common laser and ink jet printers on the market. The type of printer must be specified before making a screen dump. Section 4.4.1.2 Application Setup and 4.6 *Connecting a Hardcopy Device* provides more information about setting up a printer. The PRINT key also has a double function by keeping it depressed for more than one second as described in section 3.2 *Front Panel*.

The main contents of the main menu is a list of available applications. Section 4.3 *Understanding the Setup System* contains a description of the instruments setup system. In addition to the information in section 4.3, the main menu is the place where applications are selected. Use the arrow keys to highlight the desired application and press arrow-enter. The currently selected application will be underlined.

Each application has a related note field where a short description of the application can be entered. Select the desired application and move to the note field. Press arrow-enter to activate the alpha-numeric keyboard where the text is entered. The description will then be included in all printouts. Only the selected applications note text will be shown in the main menu. To see another applications note, select it with arrow-enter. The note will be shown in all measurement result displays for the application. This note is not permanently stored and will be lost when power is turned off.

Use the softkeys to access the preferred instrument function. Each function available from the main menu will be described in the following sections.

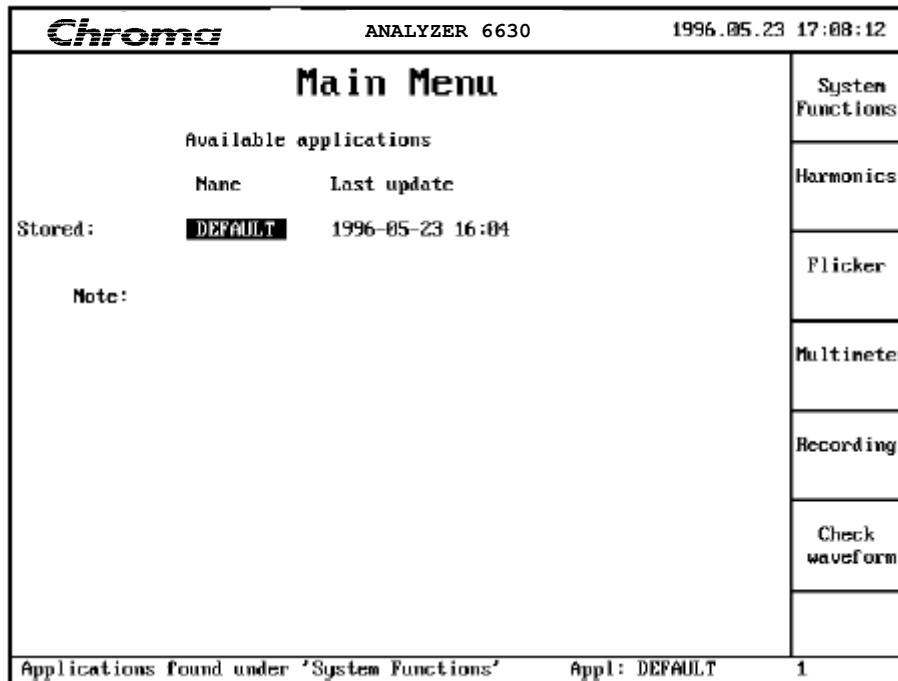


Figure 4-14 The Main Menu

4.4.1 System Functions

After pressing **System Functions** from the main menu the System Functions access page is displayed. The main display area shows information about the instrument such as BIOS and System software versions and serial numbers for the mainframe and each installed measurement module:

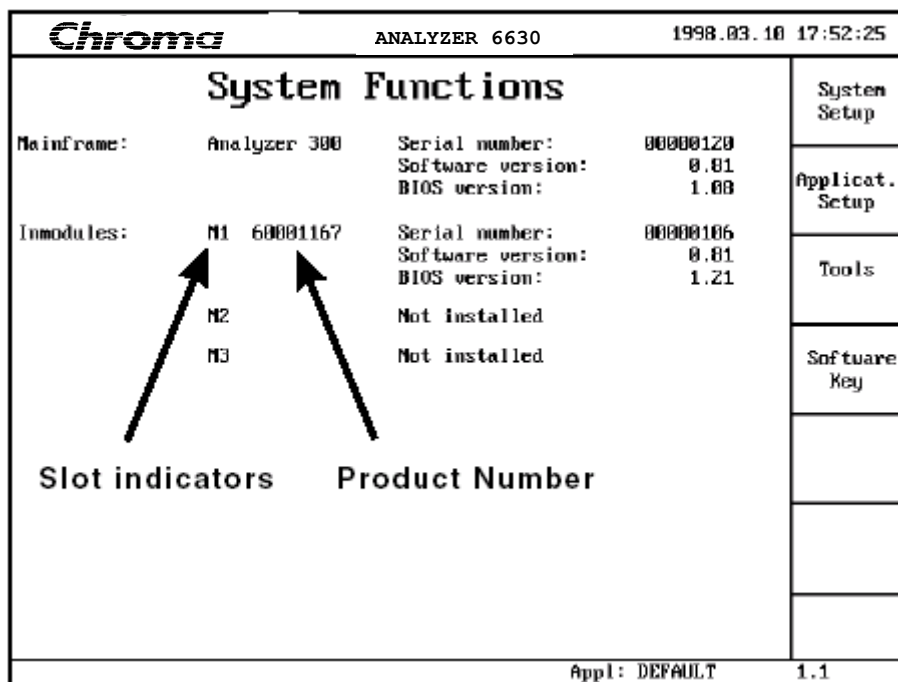


Figure 4-15 System Functions Access Page

The **Mainframe** area shows the instrument name, POWER ANALYZER 6630, together with the mainframe software versions and serial number. This serial number is the same as on the rear panel instrument label.

The **Inmodules** area displays information about the installed modules. Up to 3 modules can be installed simultaneously hence the module slot indicator M1, M2 and M3. The number after the slot indicator is the module product number. The last area contains the modules serial number and software versions.

IMPORTANT!

Please have the information in this display available if you contact the dealer for technical support.

Software Key - 

This function is used for enabling the instruments measurement functions. The instrument software disk delivered with the instrument contains a file called xxxxxxxx.TXT where xxxxxxxx is the instruments serial number. In this file you will find a 17-digit software key code. Press **Software Key** and the following display will show:

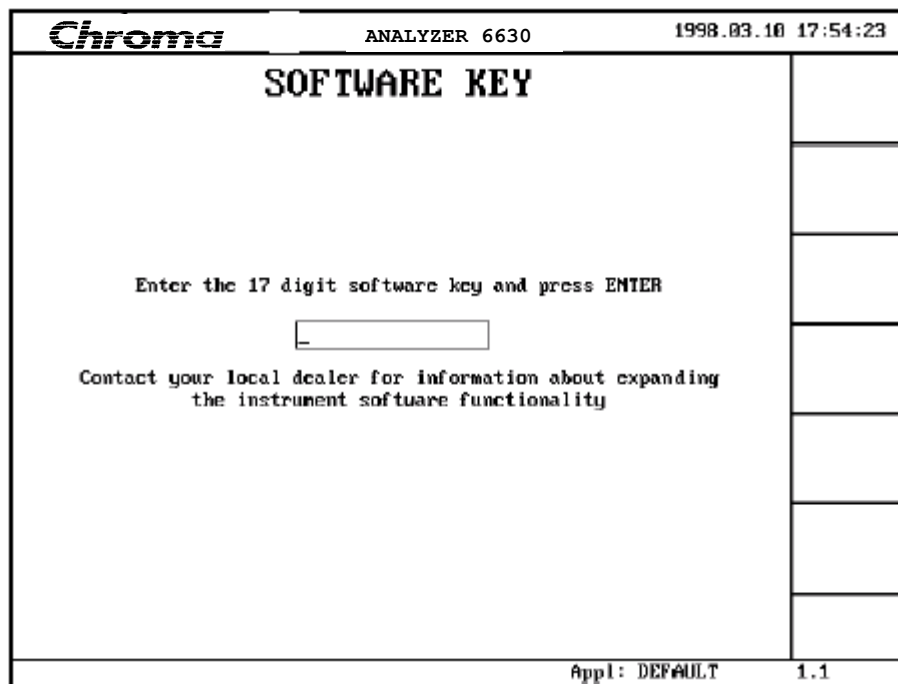


Figure 4-16 Entering the Software Key code

Enter the 17 digit code and press ENTER. The instrument functions specified when ordering the instrument will now be enabled.

The 17 digit software key code can also be found on the Software Key Code document delivered with the instrument.

IMPORTANT!

Do not loose the software key code! It will be needed to re-enable the measurement functions every time the main software is loaded.

4.4.1.1 System Setup

Pressing the **System Setup** softkey from menu page 1.1 will display the System Setup page 1.1.1:

Chroma		ANALYZER 6630		1996.06.20 12:34:44	
System Setup					Save Setup
Date:	Year	1996	<input type="text"/>		
	Month	06			
	Day	20			
Time:	Hour	12			
	Minute	34			
	Second	32			
Generator brand:	Combinova				
Generator type:	AC 304				
GPIB:	Analyzer address	12			
	AC Source address	30			
	Analyzer is controller	Yes	No		
	Interface timeout	1.3 s	2.6 s		
Remote port:	<u>No</u>	GPIB	COM1	COM2	
Com port 1:	Baudrate	9600			
	Format	8 data bits, 2 stop bits, even parity			
Com port 2:	Baudrate	9600			
	Format	8 data bits, 2 stop bits, even parity			
Appl: DEFAULT					1.1.1

Figure 4-17 System Setup

Date, Time

These parameters are used to set the instruments calendar and clock. Note that the new date and time is set only when Save Setup is pressed.

Generator type

Selects which brand of AC source that is supposed to be controlled by the instrument. This is needed since different AC sources have different remote control procedures. See **ACsource online** in the Modify Application page 1.1.2.2 and Chapter 6 *Using an AC Source* for more information.

GPIB: Analyzer address

Selects the POWER ANALYZER 6630's GPIB port address. Can be set between 0 and 30. Default address is 12. This is the instruments bus address when remote controlling through GPIB. When remote controlling through RS-232 this address has no effect.

GPIB: AC Source address

Sets the selected AC source's GPIB bus address. Can be set between 0 and 30. Default is 30. This address is where the POWER ANALYZER 6630 will try to communicate with an attached AC source (optional). Make sure that this address matches the setting in the AC source.

GPIB: Analyzer is controller

Sets the instruments GPIB bus active controller state. Select **No** if you intend to remote

control the POWER ANALYZER 6630 through the GPIB port. Must be set to **Yes** if the POWER ANALYZER 6630 is supposed to remote control an AC source. Default is **Yes**.

Only one device on a GPIB bus can be active controller at one time. If you want the instrument to control an AC source, remote controlling the POWER ANALYZER 6630 through the GPIB port is unfortunately impossible. Select one of the two RS-232 ports for remote control.

NOTE

If POWER ANALYZER 6630 is active controller, do not connect any other controller such as a computer to the instruments GPIB port.

GPIB: Interface time-out

Selects the GPIB port activity time-out. This parameter should normally be of little interest. If you experience GPIB bus time-outs when remote controlling the instrument, set this parameter to the next higher choice and try again.

Remote port

Selects which port on the POWER ANALYZER 6630 that should be used for remote control.

If the **Analyzer is controller** parameter is set to **Yes**, the following choices are available:

- No** - Disabled.
- COM 1** - Through serial port COM 1.
- COM 2** - Through serial port COM 2.

If the Analyzer is controller parameter is set to No, the following choices are available:

- No** - Disabled.
- GPIB** - Through the GPIB port.
- COM 1** - Through serial port COM 1.
- COM 2** - Through serial port COM 2.

Setting the **Analyzer is controller** parameter to **Yes** with this parameter set to **GPIB** will reset this parameter automatically to No. See the **Analyzer is controller** parameter.

All changes are made volatile. Press **Save Setup** to save the changes or **QUIT** to exit without saving.

The System Setup can be written to and read from disk using the **Write to disk** and **Read from disk** softkeys. See section 4.3 *Understanding the Setup System* for more information.

4.4.1.2 Application Setup

Pressing the **System Setup** softkey from menu page 1.1 will display the Application Setup page 1.1.2:

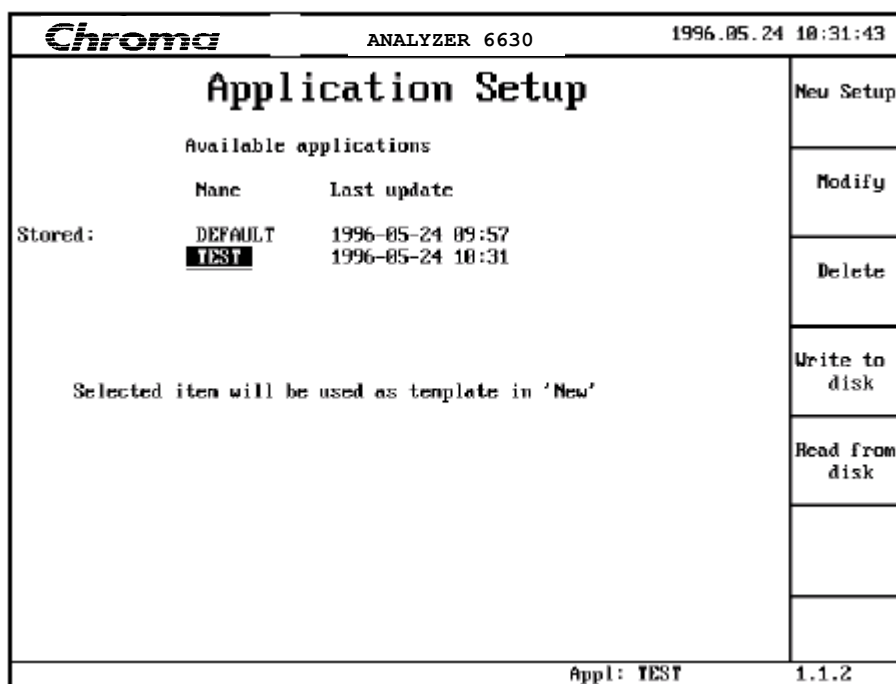


Figure 4-18 Application Setup

Here applications can be created, modified and deleted. See section 4.3 *Understanding the Setup System* for a description of creating, modifying, saving and reading applications.

Figure 4-19 shows the first page of the two Application parameter pages.

Name

Sets the name of the application. The selected applications name is shown in the **App1 :** field on the displays status line and is the main name of the application. An application contains up to six function setups. See section 4.3 *Understanding the Setup System*.

Language

Selects the instrument language.

Hardcopy device

Selects the type of device to make a screen dump to when the **PRINT** key is pressed. The **PRINT** key is used to make a screen dump in any menu page. The **PRINT** key has a double function by keeping it depressed for more than one second as described in section 3.2 *Front Panel*.

The available choices are:

HP Laserjet, PCL 5

Selects printers supporting the PCL 5 printer language. Tested printers are:

- HP Laserjet III
 - HP Laserjet IIID
 - HP Laserjet IIISi
- We have experienced problems with memory shortage on some early models.

- HP Laserjet IIIP
- HP Laserjet 4, M, Si, SiMx, L, ML
- HP Laserjet 5
- OKI 410ex with HP III emulation

Generally, printers that support the PCL 5 language should work but no guarantees are made.

HP Deskjet, PCL 3

Select printers that support the PCL 3 printer language. Tested printers are:

- HP Deskjet 500
- HP Deskjet 500C
- HP Deskjet 520
- HP Deskjet 540 • Supports 150 DPI only
- HP Deskjet 550C
- HP Deskjet 560C
- HP Deskjet 660
- HP Deskjet 660C
- HP Deskjet 850C • Supports 150 DPI only

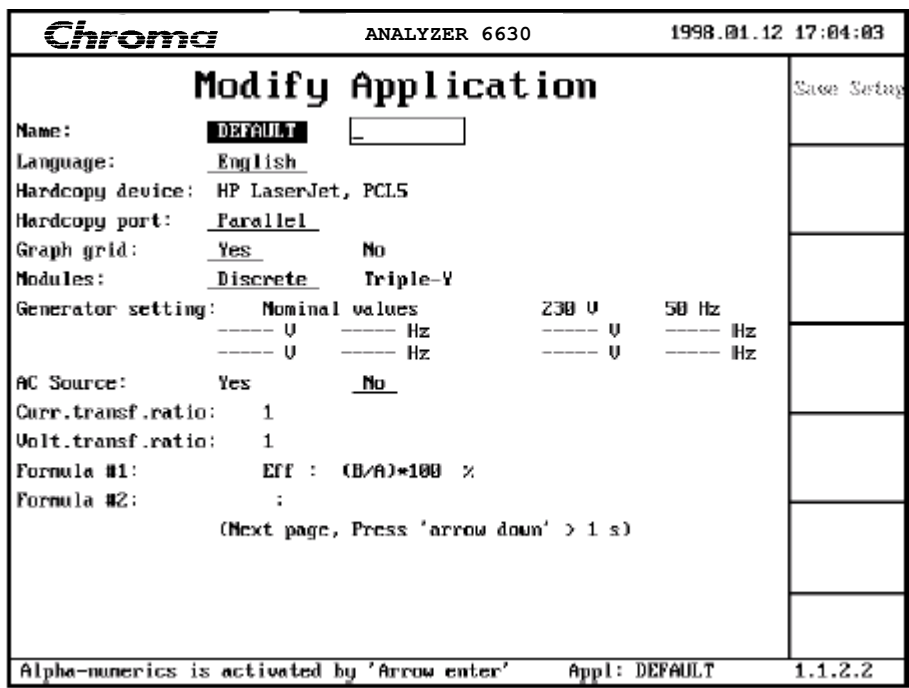


Figure 4-19 Modify Application, Page 1

Generally, printers that support the PCL 3 language should work but no guarantees are made.

Canon BubbleJet

Supports the following printers:

- BJ-30
- BJ-100
- BJ-200/230
- BJ-200e

- BJ-200ex
- BJC-70
- BJC-600
- BJC-600e
- BJC-800/820
- BJC-4000

BMP File

The screen contents will be written to a diskette in a standard windows bitmap, BMP, file format. This is ideal for importing measurement result displays directly into word processing documents. Remember to insert a diskette before pressing **PRINT**. Files will be named using the display page number. For example, the display shown in figure 4-19 is written as 1122_00.BMP. If the same display is dumped twice to the same disk, a filename counter is increased so the second dump of the display in figure 4-19 will be written as 1122_01.BMP.

IMPORTANT!

Printers are by nature a big source of frustration. If you have problems when printing, please make sure your printer is configured according to the instructions in this section. Technical support will only be provided for listed printers.

Hardcopy port

Information line only. Shows which port a hardcopy will be made to. LPT 1 for printers and diskette for bitmap files.

Graph grid

Selects whether a grid should be added when presenting result graphs. A grid can enhance the readability of a graph. Select **Yes** to use a grid or **No** to not use a grid.

Modules

Selects the use of multiple measurement modules. If one or two modules are installed, this parameter will be **Discrete** only. If three modules are installed, an additional choice of **Triple-Y** is given. Selecting **Triple-Y** will make it possible to perform simultaneous measurements on all three modules. See section 4.5 and the respective measurement functions for details.

Generator setting

List of AC source voltages and frequencies. When the POWER ANALYZER 6630 is configured to control an external AC source, a list of voltages and frequencies can be specified which will be stepped through in sequence. If an AC source is on-line, the first entry pair is used as nominal voltage and frequency, when starting a measurement, the AC-source will be set to the nominal voltage and frequency. Adding more voltage-frequency pairs will create a list, which can be stepped through at each measurement functions measurement management menu. This function is most powerful if an AC source is on-line and controlled by the POWER ANALYZER 6630 but can also be used manually.

The following example will use the steady-state Harmonics measurement function to describe the use of the Generator setting list parameter. Pressing Measure on the access page in figure 4-32 with a generator setting list as shown in figure 4-20, the extra information shown in figure 4-36 will appear. It shows the current generator list with the next-to-be-used generator

setting highlighted. The figure also indicates that the Generator setting is in manual mode, i.e. there is no AC source on-line. The user is now supposed to set whatever power source to the shown values and turn the EUT power on. If an AC source is on-line, no manual settings of voltage and frequency need to be done.

When pressing **Single measure** to start a measurement, if an AC source is on-line the current voltage and frequency in the list will be used to set the AC source and the AC source output is turned on. The user defined **Power on-delay** (see section 4.4.1.2) is then executed and a measurement is started.

After a measurement is completed, the AC source, if one is on-line, output is switched off, the power off-delay is executed and a measurement result display is shown similar to figure 4-37 only if the **Result acknowledge** parameter is set to **Always**. Evaluate the results as needed and then press **Next measure** to return to the operation control. If the **Result acknowledge** parameter was set to **No**, or after pressing **Next measure**, the operation control page in figure 4-36 will reappear.

A result summary is shown. In this case it's the THD result because no test against limits were performed. By setting the **Test against limits** parameter to anything but **No**, the Passed / Not passed result is shown instead. This behavior varies between different measurement functions.

Notice that the highlighted generator setting has moved one line. The instrument is now ready to execute a new cycle as described by pressing the **Single measure** key. After the complete Generator setting list has been stepped through, the final result page is shown as in figure 4-22 with result summaries for all steps.

If **Repeat measure** is used, all steps described above will be executed with the exception of the measurement step which is continuous until the **Stop** key is pressed. After pressing the **Stop** key, press **Next measure** to return to the operation control page.

To disable the generator list function, delete all entries in the **Generator setting** list parameter.

Chroma		ANALYZER 6630		1998.01.13 11:11:09	
Modify Application					
Name:	DEFAULT	<input type="text"/>			
Language:	<u>English</u>				
Hardcopy device:	HP LaserJet, PCL5				
Hardcopy port:	<u>Parallel</u>				
Graph grid:	<u>Yes</u>	No			
Modules:	<u>Discrete</u>	Triple-Y			
Generator setting:	Nominal values		115 U	60 Hz	
	230 U	50 Hz	----- U	----- Hz	
	----- U	----- Hz	----- U	----- Hz	
AC Source:	Yes	<u>No</u>			
Curr.transf.ratio:	1				
Volt.transf.ratio:	1				
Formula #1:	Eff : (B/A)*100 %				
Formula #2:	:				
(Next page, Press 'arrow down' > 1 s)					
Alpha-numerics is activated by 'Arrow enter'		Appl: DEFAULT		1.1.2.2	

Figure 4-20 Specifying a Generator Setting List

Chroma		ANALYZER 6630		1996.11.13 17:55:54	
Current Harmonics					
Setup: DEFAULT_H					
Generator setting: MANUAL					
U = 230 U f = 50 Hz					
Measurement list:	U = 115 U	f = 60 Hz	THD=72.98 %		
	U = 230 U	f = 50 Hz			
Measurement result summary					
				Single measure	
				Repeat measure	
				Last result	
				Continuous measure	
		Appl: DEFAULT		1.2.4	

Figure 4-21 The First Measurement Cycle in the List is Completed

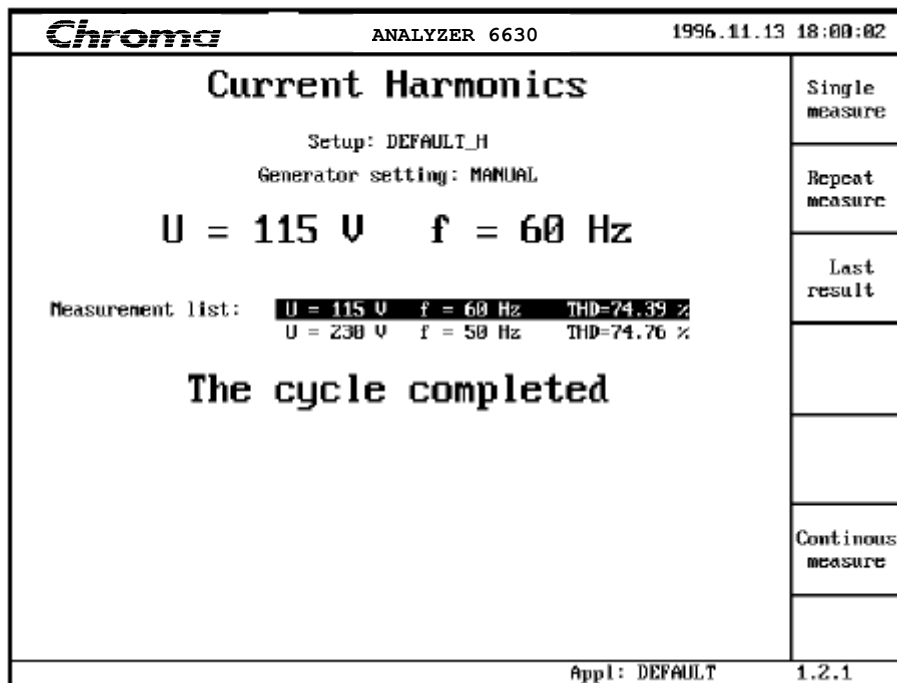


Figure 4-22 The Generator Setting List is Completed

AC source

If the POWER ANALYZER 6630 is supposed to control an external AC source this parameter must be set to **Yes**, otherwise set to **No**.

Power on-delay

If an AC source is on-line, this parameter sets the delay before a measurement is started after the AC source output is tuned on. Can be set between 0.9 and 100 seconds.

Power off-delay

This delay is used with the Generator setting list function. Can be set between 0 and 100 seconds. Setting the delay to zero will disable the power-off stage. See the Generator setting parameter for more information.

Curr. transf. ratio

This parameter is used to compensate current measurement results when an external current transformer is used to increase the maximum measured current of the instrument. It can be set between 1 and 10000. **NOTE!** This parameter is global, i.e. it will affect *all* installed measurement modules.

Volt. transf. ratio

This parameter is used to compensate voltage measurement results when an external voltage transformer is used to increase the maximum measured voltage of the instrument. It can be set between 1 and 2000. **NOTE!** This parameter is global, i.e. it will affect *all* installed measurement modules.

Formula #1, Formula #2

POWER ANALYZER 6630 supports user-defined formulas to create specialized measurements such as efficiency and more. A formula can be used by the Multimeter and

Recording measurement functions and will show up as two extra Input's, see the descriptions of the Multimeter and Recording configurations in section 4.4.4.1 and 4.4.5.1. Pressing Arrow Enter will start the formula editor as shown in figure 4-23.

The setting of **Variable A - C** is the same as for setting the **Row** parameters in the Multimeter function or the **Channel** parameters in the Recording function, described in section 4.4.4.1 and 4.4.5.1.

The **Name** parameter specifies the result name or type string that will be precede the result in the result display. Edit **Name** with Arrow Enter and enter a maximum of 4 characters.

Expression is the actual formula. Enter an expression by pressing Arrow Enter. The expression editor shows as in figure 4-24. An expression can be 30 characters long, use the four fundamental rules of arithmetic, use parentheses and numeric constants to make calculations based on combinations of the three variables A - C.

Unit specifies a unit description string or character, which will be added after the result in the result display. Press Arrow Enter to create a unit string of a maximum of 4 characters.

Automatic prefix enables or disables the use of a prefix such as **m** for milli or **k** for kilo instead of scientific notation in the result presentation. Select **No** to use scientific notation and **Yes** to use a prefix.

Chroma		ANALYZER 6630	1998.01.13 12:31:46
Define formula #1			Save Setup
Variable A:	Input	<u>M1</u>	<input type="text" value="M1"/>
	Mode	<u>AC</u>	
	Parameter	<u>Active power</u>	
Variable B:	Input	<u>M2</u>	
	Mode	<u>DC</u>	
	Parameter	<u>Active power</u>	
Variable C:	Input	<u>M1</u>	
	Mode	<u>AC</u>	
	Parameter	<u>Skip</u>	
Name:	Eff		
Expression:	(B/A)*100		
Unit:	%		
Automatic prefix:	Yes	<u>No</u>	
Pan by 'Arrow left' and 'Arrow right' key		Appl: DEFAULT	1.1.2.2.1

Figure 4-23 The Formula Editor

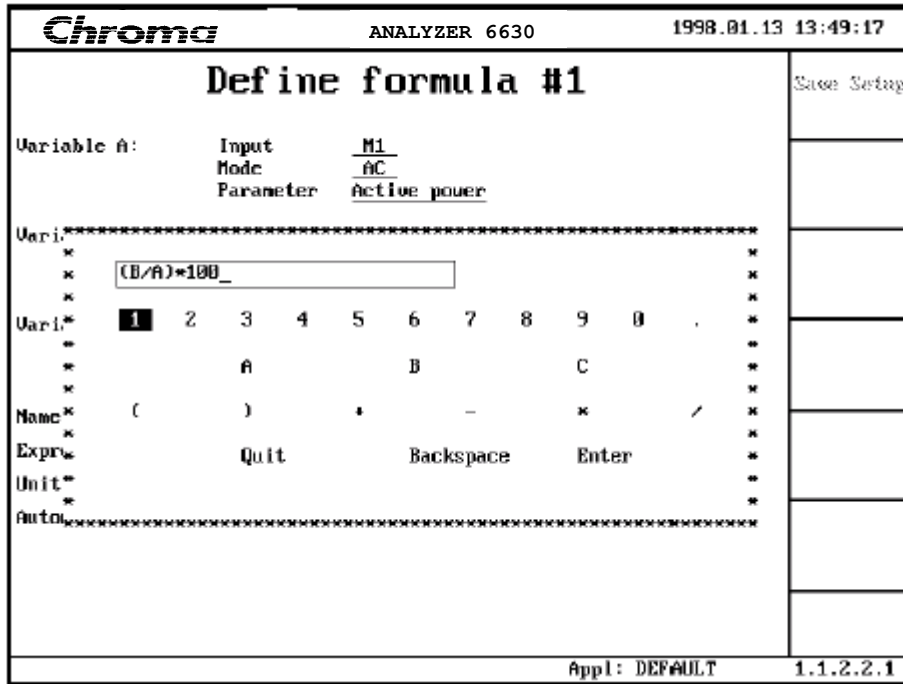


Figure 4-24 The Expression Editor

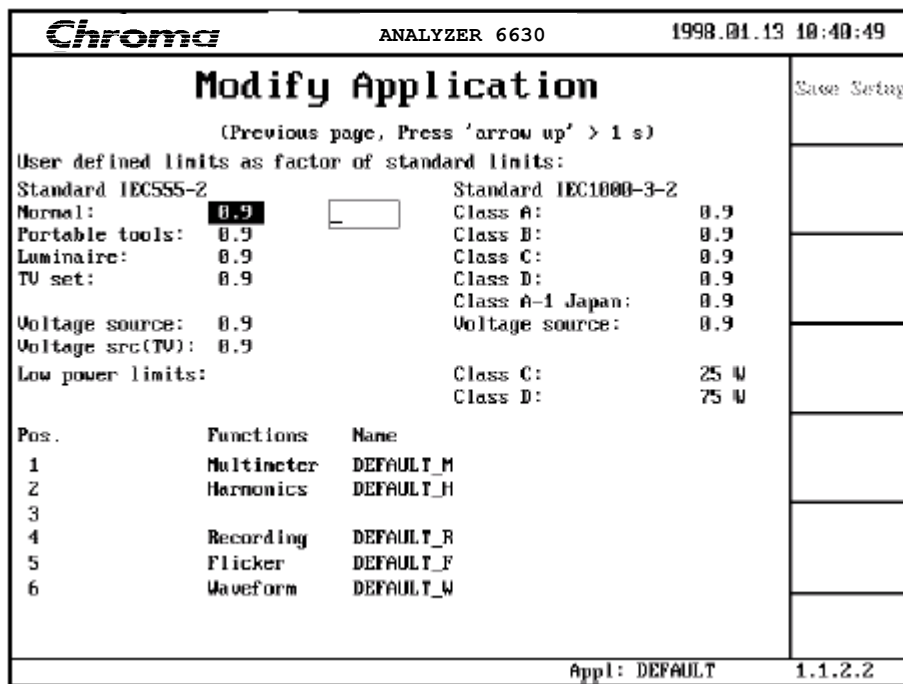


Figure 4-25 Modify Application, Page 2

User defined limits as factor of standard limits are used to customize the limits of the harmonics standards measurements. The custom factor can be set between 0.10 and 10.00. Default is 0.9. For details about the different classes and limits see the relevant standard.

The two Low power limits can be set as follows:

- Class C Between 1 and 75W. Default is 25W.
- Class D Between 1 and 75W. Default is 75W.

The last section of the page contains a list of the function setups in the currently selected application. As mentioned in section 4.3, an application can contain a maximum of 6 setups. An unoccupied setup line is blank, occupied setup lines contains information about measurement functions with their user defined setup names.

4.4.1.3 Tools

Menu page 1.1.3 contains the instrument tools:

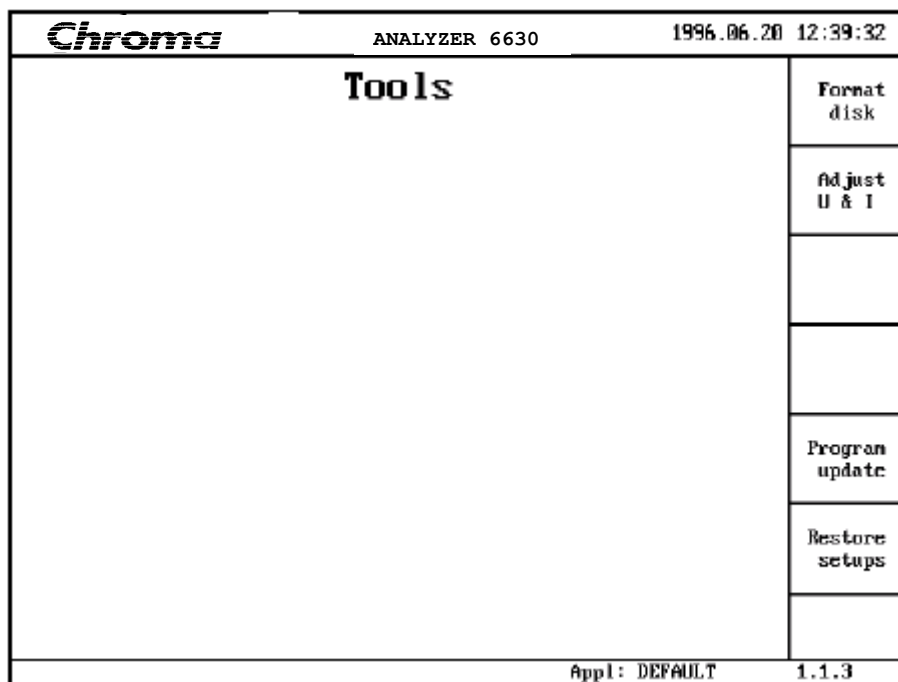


Figure 4-26 Tools Menu


Format disk -

The POWER ANALYZER 6630 reads and writes standard PC formatted 1.44M diskette. Due to hardware reasons, disk performance will suffer significantly if disks formatted on a PC are used with the instrument. Always use floppy disks formatted by the POWER ANALYZER 6630 with the instrument. POWER ANALYZER 6630 formatted disks can be used on any PC with no performance loss.

Press **Format disk**. Insert the disk to be formatted into the disk station. Make sure that the disk doesn't contain valuable information; no checking of disk contents will be made! An opportunity to create a disk label is made. If you wish, enter a disk label using the Alpha-numeric keyboard. Press **Format**. Formatting starts immediately and the status line contains a progress indicator. When the format is ready, the Format Disk menu will reappear. Insert another disk to be formatted or press **QUIT** to return to the Tools menu.

Adjust U & I -

This function is only available to production facilities and authorized laboratories and is password protected.

Program update - 

One of the advantages of the POWER ANALYZER 6630 is the ability to have its software upgraded on-site. This function is used to load the instruments software and you will need one or more diskettes with the software to be loaded.

Press **Program update** and you will get to the Software Installation display:

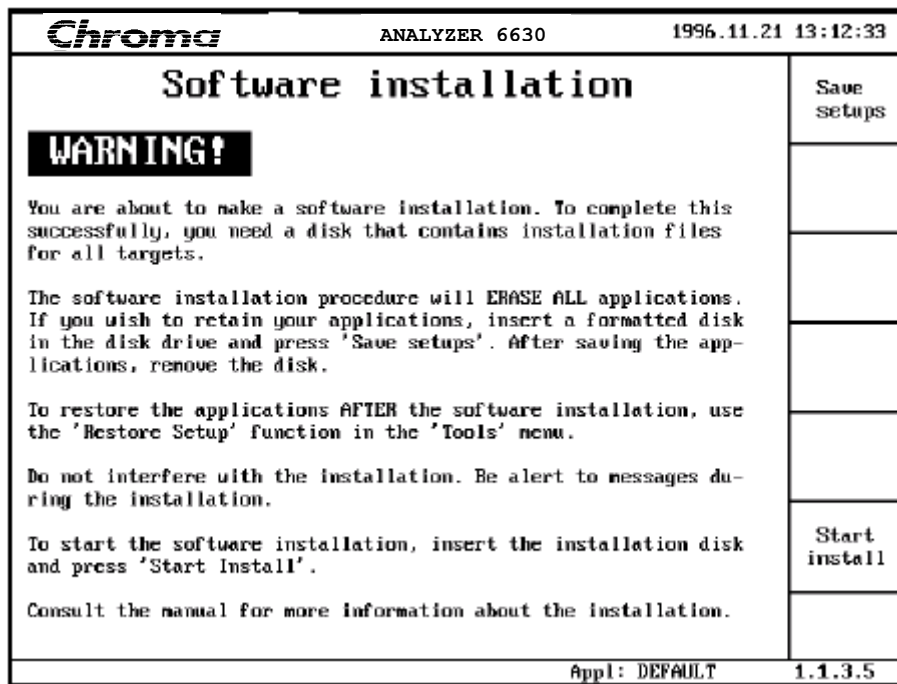


Figure 4-27 The Software Installation Page

The program update function will update the main and measurement module software. Updating software will as the display in figure 4-27 warns you about, erase **all** stored applications. If you want to retain your applications, insert a formatted diskette into the disk station and press **Save setups**.

If you saved your applications in the previous step, remove the diskette.

Insert the disk containing the software into the disk drive. You are now ready to start the installation.

During installation, the instrument will examine the instrument devices and check if there is a related software file on the disk. If there is a related file on the disk, the device(s) will be erased and reloaded from the disk. When all instrument devices with a corresponding file has been loaded, the instrument will restart automatically. Supervise the load procedure and watch carefully for messages during the installation procedure, failures may render the instrument unusable.

Press the **Start Install** key to start or **QUIT** key if you for any reason wish to abort.

Figure 4-28 shows the software load display and its components:

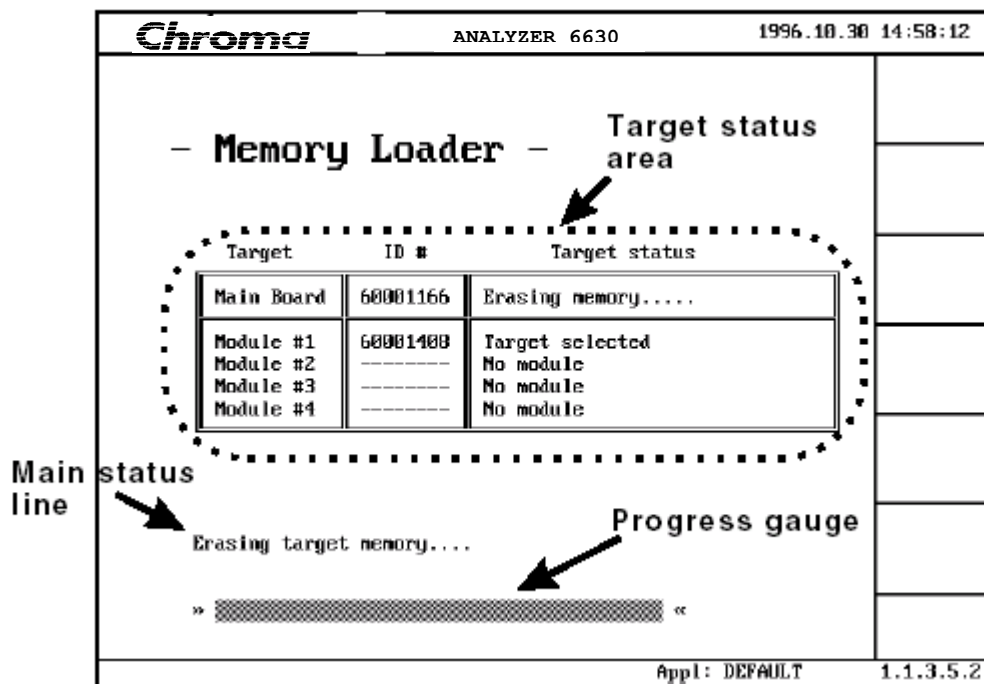


Figure 4-28 The Loader Display

Target status area

This area contains three columns where:

- Target** - Software load targets. The instrument contains a Main board which is the main frame and up to four measurement modules.
- ID #** - This line will show the respective targets ID # if present. The main board is always present and will always show. Since the instrument may have between 1 and 4 modules installed, the ID numbers for modules varies depending on the instruments configuration. Empty module slots will show up as '-----'.
- Target status** - This is the targets status line. This line is updated continuously with load status information about the respective target.

Main status line

This is the main status line of the software load function. This is where the current loader activity is reported as opposed to the **Target status** line where target specific information is shown.

The possible **Target status** messages are as follows:

No module

The slot contains no measurement module. If this message is reported for a slot that does contain a module, turn power off and then on. Retry the software load. If the problem persists, contact your dealer for advice.

Target selected

The target is selected and will be included in the load operation.

Erasing memory.....

The target is currently erasing its program memory.

Memory erasing failed!

Memory erasing failed. This is fatal and the target will be excluded from the load operation. Contact your dealer for advice.

Loading memory....

The target is currently being loaded.

Loading failed!

Memory loading failed. This is fatal and the target will be excluded from the load operation. Contact your dealer for advice.

No file!

The selected target did not have a corresponding load file on the inserted disk. This is fatal and the target will be excluded from the load operation. Insert the correct disk and retry the load operation.

Verifying checksum....

The target has finished loading and is now verifying the data checksum.

Checksum failed!

Checksum verify failed. This is fatal and the target will not start. See the note about load failure.

Target loaded OK

The target was loaded without any errors. Do not turn power off when this message is shown; there may be more targets to load. See description of the Main Status line messages.

Incompatible memory map

This message should normally not appear. If it does, contact your dealer.

The possible Main Status line messages are as follows:

Selecting targets....

The load function is selecting targets to be loaded.

Erasing target memory....

The load function is erasing memory in selected target(s).

Loading main board.....

The main board is currently being loaded.

Loading module(s).....

One of the selected module types is being loaded.

Verifying target checksum(s)...

The loaded target is verifying the data checksum.

Target checksum verification failed!

The current target(s) failed checksum verification.

Current target ready....

The current target loaded without errors and the next target, if available, are being prepared for load. Do not turn the instrument off at this stage!

Loading completed, no errors.

The load function is complete. All targets were loaded without errors. Press **Continue** to restart the instrument with the new software.

Warning! Load completed with errors!

Refer to users manual for information

One or more of the selected targets did not complete the load function properly. The cause of the error(s) must be corrected and then the software must be reloaded before the instrument can be used. See the note about load failure.

File operation error!

This is probably caused by a bad diskette. Replace the disk and try again.

Warning! File(s) missing!

One or more of the selected targets was missing a corresponding load file. This must be corrected before the instrument can be used for measurements.

Memory write error!

One or more of the selected targets failed to load. This is probably a hardware error and the target will need repair. Contact your dealer.

Memory range error!

Should normally not be shown. Contact your dealer.

The loading starts and the progress gauge shows how much is ready:

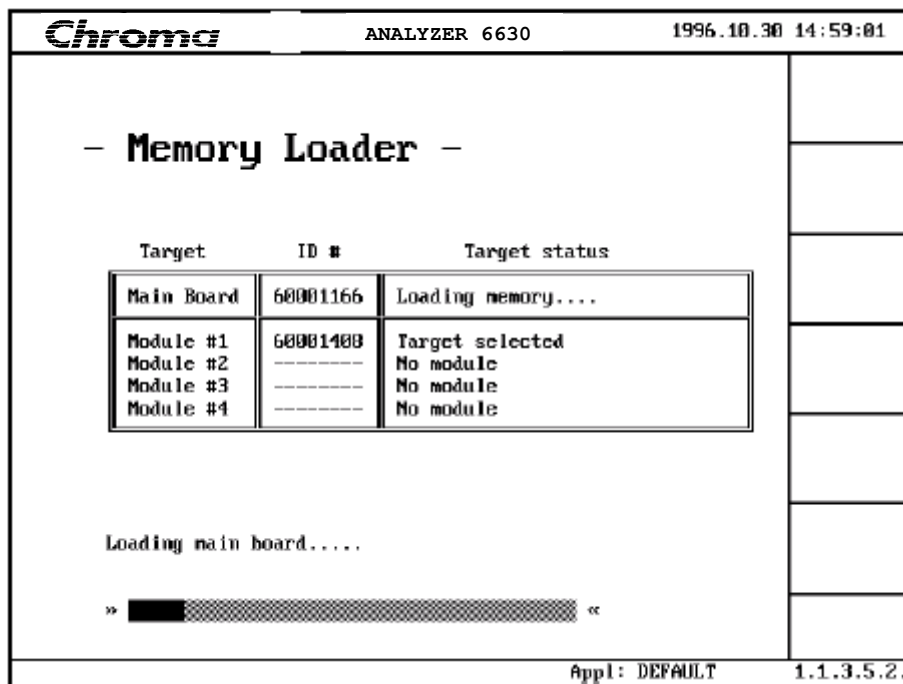


Figure 4-29 Loading of the Current Target Has Started

The main board is ready and the measurement module in slot 1 is erasing its memory:

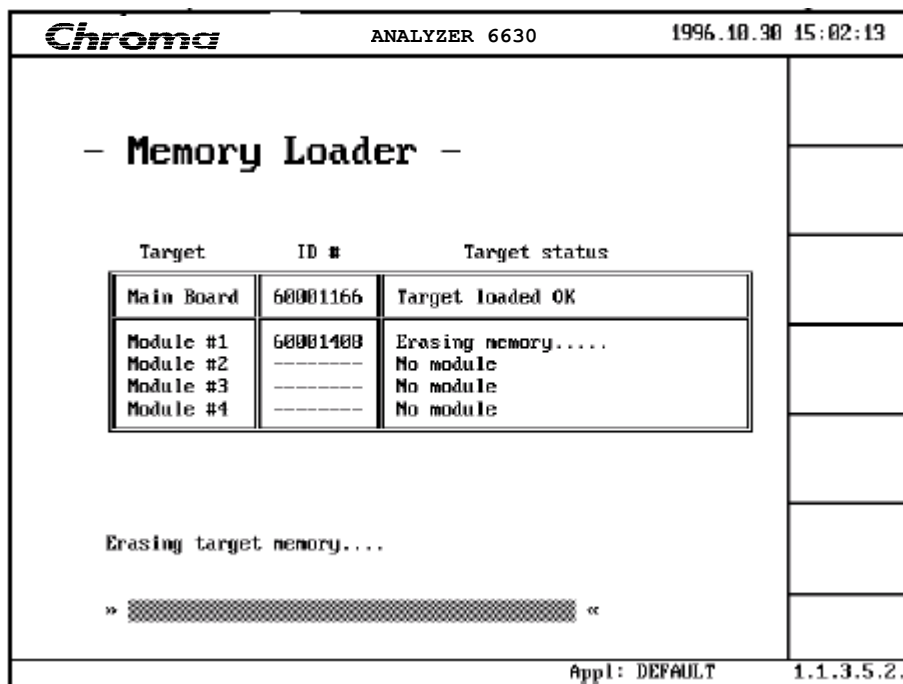


Figure 4-30 Main Board Ready, Measurement Module Is Erasing Its Memory

After all targets have been loaded without errors, the display shows:

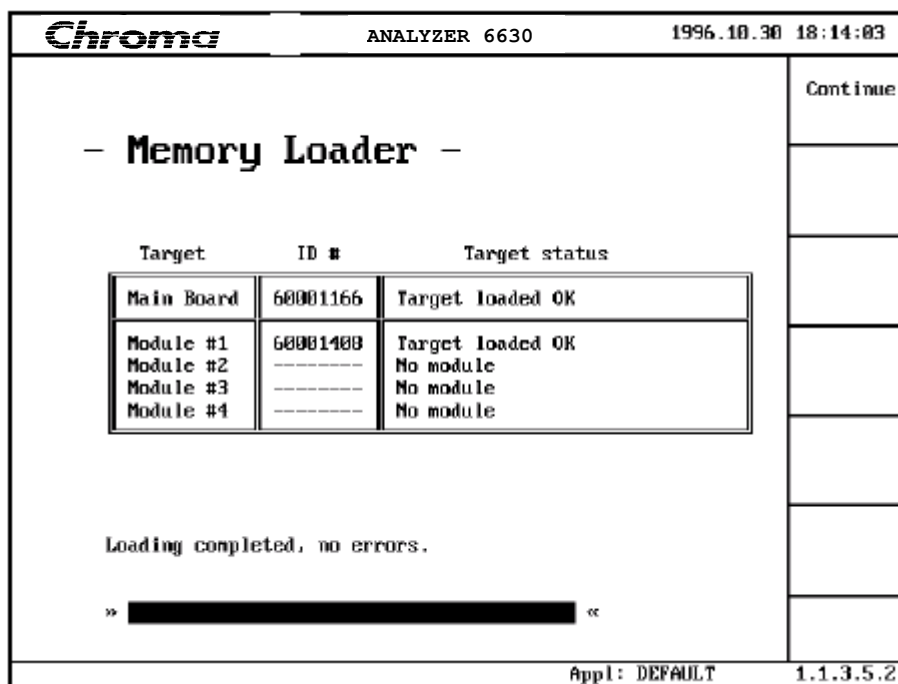


Figure 4-31 Loading Ready

The instrument has now loaded all targets without errors and is ready to be restarted. Press **Continue** to start the new software.

If loading failed for any reason, the cause must be corrected so the software can be installed properly. This must be done before the instrument can be used for measurements.

If the installation was completed successfully and you wish to restore the applications, return to the Tools menu, page 1.1.3 and press **Restore setups**. Insert the diskette that contains the saved applications and press **YES**.

The applications are reloaded.

4.4.1.4 If the Instrument Fail to Start

All instrument software is protected by a checksum. If the software gets corrupted, the checksum verification will fail and the instrument will stop working. Instrument software is usually loaded using the **Program Update** function under **System Functions / Tools** menu and will normally work without problems most of the time. But what happens if the instrument reports main board software checksum error?

In order to load the instrument software for the first time or if the software fails for some reason, the software load function can be reached using a special keyboard combination. To reach the loader directly, make sure the instrument is powered off. Depress the top-most soft key and numerical key 0 simultaneously and turn power on while keeping these two keys depressed until the software load menu appears. Then release the keys.

Insert the software disk and press numerical key 0 to start the loading. Watch the loading procedure for errors. When the loading is finished, press **Continue** and then 3 to restart the

instrument. It should now start without problems. If not, contact your dealer for advice.

4.4.2 Harmonics

Pressing **Harmonics** from the main menu gets you to the harmonics access page:

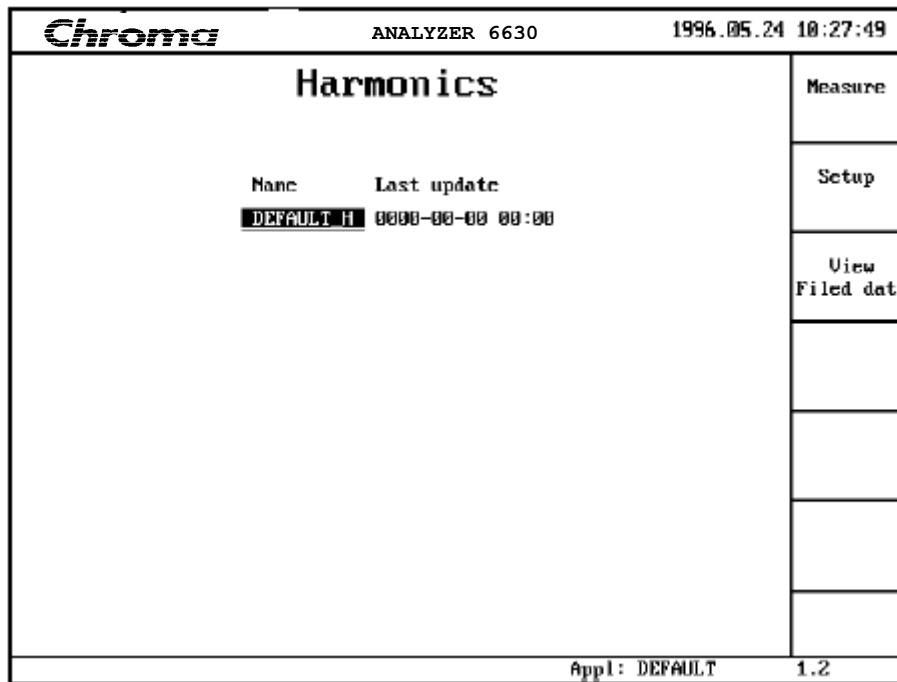


Figure 4-32 Harmonics Access Page

The harmonics measurement function in POWER ANALYZER 6630 measures and tests according to the IEC 1000-3-2, IEC 555-2, EN 60555-2 and EN 61000-3-2 international standards including the Japanese variant of EN-61000-3-2. The signal is analyzed from the fundamental to the 40:th harmonic and the result is tested against standard or user defined limits.

IMPORTANT

Please refer to section 4.5 *Connecting a Measurement Object* when connecting the EUT (Equipment Under Test).

In order to get accurate measurement results, the voltage source must be of sufficient quality. Before making current measurements, check the quality of the voltage by making a voltage harmonics measurement with the EUT connected and in operation. The instrument has a pass-fail check function according to the IEC 1000-3-2 standard, Annex A.

If you intend to use the mains supply as a voltage source make sure that it is clean and stable enough to satisfy IEC 1000-3-2, Annex A. Performing current measurements with a distorted voltage supply may introduce errors of both signs depending on the EUT load type.

The **View Filed data** function is described on page 50.

4.4.2.1 Harmonics Configuration

Pressing **Setup** from the harmonics access page 1.2 gets you to the Harmonics Setup access page:

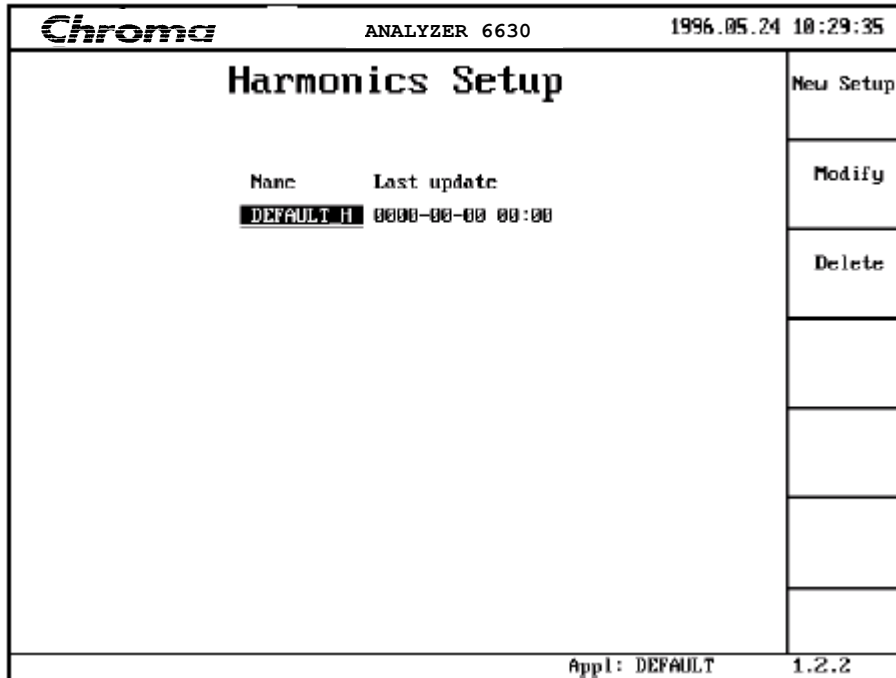


Figure 4-33 Harmonics Setup Access Page

Creating, modifying and deleting a setup is described in section 4.3 *Understanding the Setup System*.

Figure 4-34 shows the first page of the harmonics parameters.

Name

Sets the name (max 10 characters) of the harmonics setup. A setup is a part of an application, which can contain up to six setups. See section 4.3 *Understanding the Setup System*.

Periods / time slot

Specifies the measurement window in number of periods of the fundamental frequency of the selected **Frequency source**. The window type is rectangular and the sampling rate is synchronized to the fundamental frequency of the selected source. The measurement windows are continuous in time when performing fluctuating harmonics measurements to satisfy IEC 1000-3-2 B4.2.

Can be set between 1 and 47. The standard specifies 4 to 30. Default is 4.

NOTE

This setting is ignored by the Fluctuating harmonics function. Fluctuating harmonics always use a standard dictated 16 periods.

Frequency source

Selects the source, voltage or current, for fundamental frequency determination. Voltage is

default and normally preferred

Data source

Selects the data source, voltage or current, on which harmonics analysis is performed.

Result acknowledge

If a list of voltages and frequencies has been specified under **Generator setting** and an AC source is on-line, this parameter specifies if the measurement results from each step of the sequence should be acknowledged by the user. Selecting **Always** will cause the measurements to stop after each result presentation, waiting for an acknowledgment from the user. Selecting **>Limit** will only stop the measurement sequence if the result is above the selected limit. Selecting **No** makes the instrument go through the complete sequence without interruption. See description of **Generator setting** in section 4.4.1.2.

Presentation

Selects the measurement result presentation to be either **Graph** or **Table**. Default is **Graph**. See 4.4.2.2 *Harmonics Measurements*.

Vertical scale

Selects the measurement result presentation to be either **Relative** or **Absolute**. Default is **Absolute**. See 4.4.2.2 *Harmonics Measurements*.

Vertical resolution

Selects the measurement result graph vertical axis presentation to be either **Linear** or **Log**. Default is **Linear**. See 4.4.2.2 *Harmonics Measurements*.

Source

Selects which measurement module that will provide the source data. The parameter choice is dependent on the number of installed measurement modules.

Current range

Selects the measurement range for the current input. The default **Auto** selects an automatic range setting at each measurement. The following selections sets a fixed range:

300 Ap	300A peak
100 Ap	100A peak
30 Ap	30A peak
10 Ap	10A peak
3 Ap	A peak
1 Ap	1A peak
0.3 Ap	0.3A peak
0.1 Ap	0.1Apk

Voltage range

Selects the measurement range for the voltage input. The default **Auto** selects an auto metric range setting at each measurement. The following selections sets a fixed range:

2000 Vp	2000V peak
600 Vp	600V peak
200 Vp	200V peak
60 Vp	60V peak
20 Vp	20V peak
6 Vp	6V peak

The following parameters are for fluctuating harmonics measurements only. Fluctuating harmonics measurements requires a high performance (DSP) measurement module.

Chroma ANALYZER 6630 1998.01.13 15:22:13

Modify Setup Harmonics

Name: **DEFAULT_H**

Periods/timeslot: **4**

Frequency source: Voltage Current

Data source: Voltage Current

Result acknowledge: Always No

Presentation: Graph Table

Vertical scale: Relative Absolute

Vertical resolution: Linear Log

Source: M1 M2 M3

Current range: auto

Voltage range: auto

(Next page. Press 'arrow down' > 1 s)

Save Setup

Alpha-numerics is activated by 'Arrow enter' Appl: DEFAULT 1.2.2.2

Figure 4-34 Harmonics Parameters, Page 1

Figure 4-35 shows the second page of the harmonics parameters:

Chroma		ANALYZER 6630		1998.01.13 15:25:14	
Modify Setup Harmonics					Save Setup
(Previous page. Press 'arrow up' > 1 s)					
Test against limits:	No	User def	<u>Standard</u>		
Standard:	IEC555-2	IEC1000-3-2	Japan		
Class:	<u>A</u>	B	C	D	A-1
For fluctuating harmonics only:					
Observation time:	600 s				
LP-filter (T=1.5s):	Yes				
Sliding window:	150 s				
Max duration above limit:	10 % (of any sliding window)				
Max rel. freq. drift:	0.03 %				
Appl: DEFAULT				1.2.2.2	

Figure 4-35 Harmonics Parameters, Page 2

Test against limits

Selects if the instrument is supposed to check the measurement result against a limit and produce a passed/not passed result. Selecting **No** will disable all result tests. Selecting User defined will present the additional **Standard** and **Class** parameters as shown in figure 4-35. The passed/not passed test will then be done on the result using the selected standard and classes limits multiplied with the user defined limit factors defined in Application setup. See 4.4.1.2 *Application Setup*. Selecting **Standard** will make a passed/not passed test on the result according to the selected standard and class limits. Default is **No**. If the **Japan** standard is selected with classes A, B, D or A-1 and the voltage lies outside the 219.5 - 240.5 range, test limits are scaled using the factor '230 / Voltage'.

Standard

Selects according to which standard a passed/not passed tests will be done. Select **IEC555-2**, **IEC 1000-3-2** or **Japan**.

Class

The **Class** parameter selections are depending on the selections made in the **Data source** and **Standard** parameters. The following selections are available:

With Data source = Current and Standard = IEC555-2:
Class can be set to Normal, Portable, Luminiare and TV.

With Data source = Current and Standard = IEC1000-3-2:
Class can be set to A, B, C and D. The classification tool based on current waveform shape can be found in the Waveform measurement function.

With Data source = Current and Standard = Japan:
Class can be set to A, B, C, D and **A-1**. The classification tool based on current waveform

shape can be found in the Waveform measurement function.

With Data source = Voltage and Standard = IEC555-2:
Class can be set to Volt, and Volt_TV.

With Data source = Voltage and Standard = IEC1000-3-2:
Class can be set to Volt.

With Data source = Voltage and Standard = Japan:
Class can be set to Volt.

See the related standard for details about selecting the correct class.

Observation time

Sets the observation time for a fluctuating harmonics measurement. The time can be set between 150 and 30000 seconds. The standard and default value is 600 seconds.

LP-filter (T=1.5s)

Enables or disables the low pass harmonic result filter. The use of this filter is optional according to the standards. When used, the filters are applied to the harmonic results individually. See the related standard for more information. Select No to disable and Yes to enable.

Sliding window

The time window over which fluctuating harmonics is measured. This time is fixed to the 150 seconds standard time and cannot be changed.

Max duration above limit

The maximum duration that certain harmonics are allowed to break the limit. The limit can be set between 0 and 100%. The standard specifies 10%, which is default. See the measurement procedure section for more information.

Max rel. freq. drift

The maximum amount the fundamental frequency is allowed to drift during a fluctuating harmonics measurement. Can be set between 0.01 and 0.1%. The standard specifies 0.03%, which is default. See the measurement procedure section for more information.

4.4.2.2 Harmonics Measurements

Pressing **Measure** at the harmonics access page 1.2 gets you to the measurement operation control page:

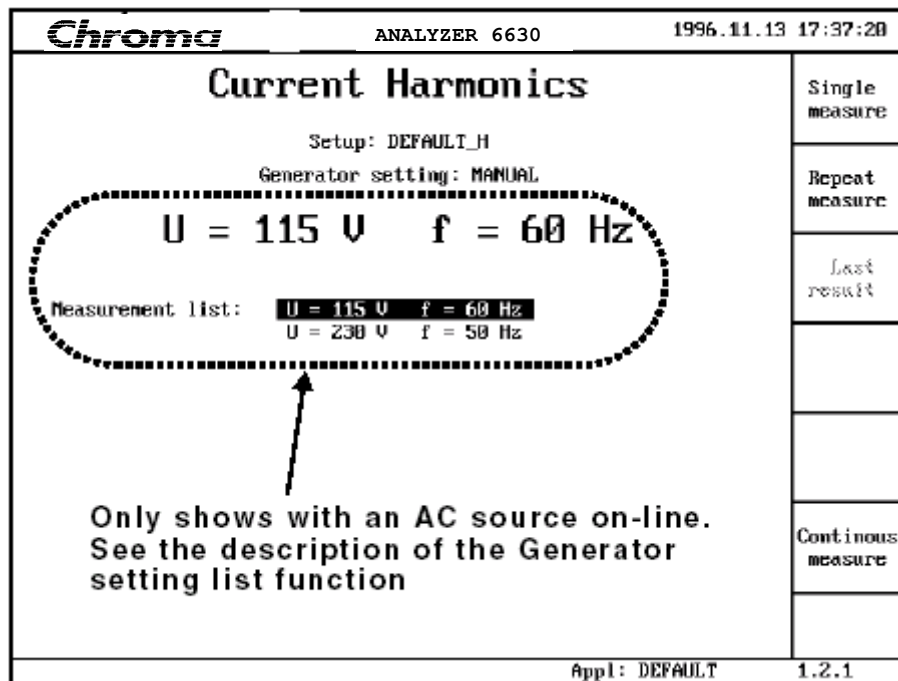




Figure 4-36 Measurement Operation Control Page

The display shows the current setup name and if an AC source is on-line or manual. From this menu measurements are started. The menu header will state which data source you are about to make measurements from, in figure 4-36 current harmonics measurement is selected.

Single measure - 

Pressing this softkey will start a single measurement. The display will show in consecutive order **Measurement in progress** during data collection, **Calculating data** when the harmonics are calculated and finally the measurement result display shown in figure 4-28.

Repeat measure - 

Starts repeated measurements. The result display will be updated every time a new result is available. The repetition rate depends on the number periods/time slot selected, see 4.4.2.1.

Continuous measure - 

Starts a fluctuating harmonics measurement. The result display will be updated every time a new result is available. The repetition rate depends on the selected number of periods/time slot, see 4.4.2.1.

4.4.2.3 Steady State Harmonics Measurements

Figure 4-28 shows a steady state harmonics measurement result display with default presentation format:

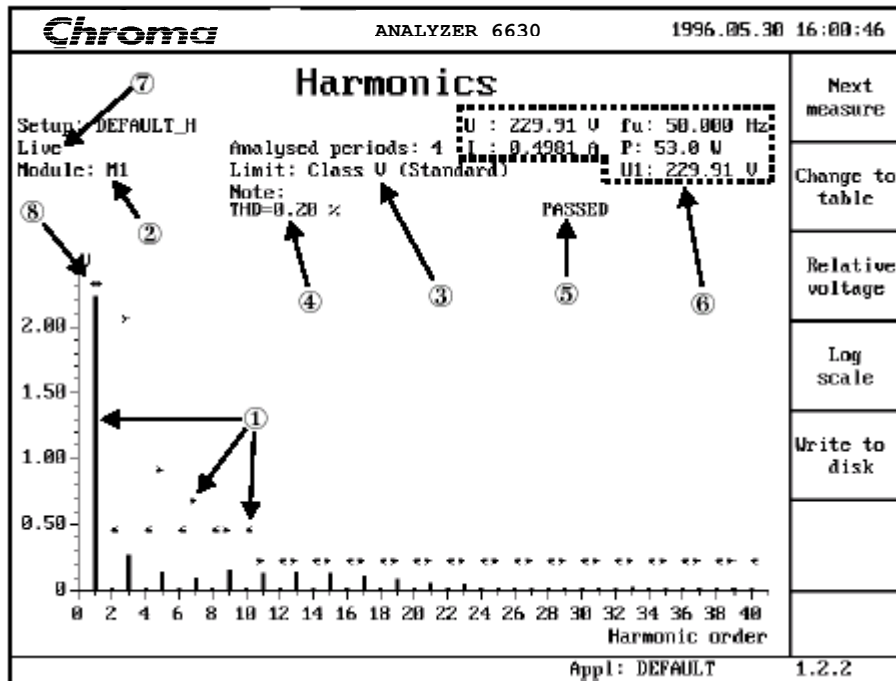


Figure 4-37 Default Harmonics Measurement Result Display

The presentation here is preset to **Graph**, **Absolute** and **Linear**. See 4.4.2.1.

The result display has the following components:

①

This is the graph with each of the 40 harmonics shown on the X axis and the level on the Y axis. The range of the Y axis is automatically adjusted to fit the largest value harmonic not counting the fundamental.

Included in the graph are markers that indicate the highest level accepted in the currently selected standard and class. The maximum levels for even order harmonics are marked with the left arrow < and the maximum level for odd order harmonics are marked with a right arrow >.

②

The **Module** field shows from which measurement module the data was collected.

③

The **Limit** field shows according to which standard the passed/not passed test is done.

④

The **THD** result field shows the Total Harmonic Distortion figure for the measured signal.

⑤

This field shows the passed/not passed test result. It will be empty if no test is done.

⑥

This is a summary of the input signal as follows:


U	Voltage RMS value.
fu or fi	Frequency of the fundamental of the frequency source..
I	Current RMS value.
P	Active power.
I1 or U1	RMS level of the fundamental of the data source.

⑦


This is an additional indicator of the result source. **Live** indicates that the results have been acquired from an actual measurement. If results are read from a diskette this field will show the filename.

⑧


If the fundamental's level is greater than the selected scaling, an asterisk will be shown to indicate that the column is actually larger than shown. **I1** or **U1** shows the actual level. After a result has been presented the presentation can be altered using the softkeys:

Change to table/Change to graph - 

Pressing **Change to table** will produce a display similar to figure 4-39. It shows each of the harmonics with its respective RMS value and standard limit. Return to graph by pressing **Change to graph**. If no test against a standard is made, the phase angle between each harmonic and the fundamental.

Relative/Absolute current/voltage - 

Pressing this key will alternate the display of a graph or table between levels represented as percentage of the fundamental level or actual levels.

Log scale/Linear scale - 

Shows the data with a logarithmic or linear Y axis scale.

Steady state harmonics in Triple -Y mode

The result page of a steady state harmonics measurement in Triple-Y mode differs from the single module result page:

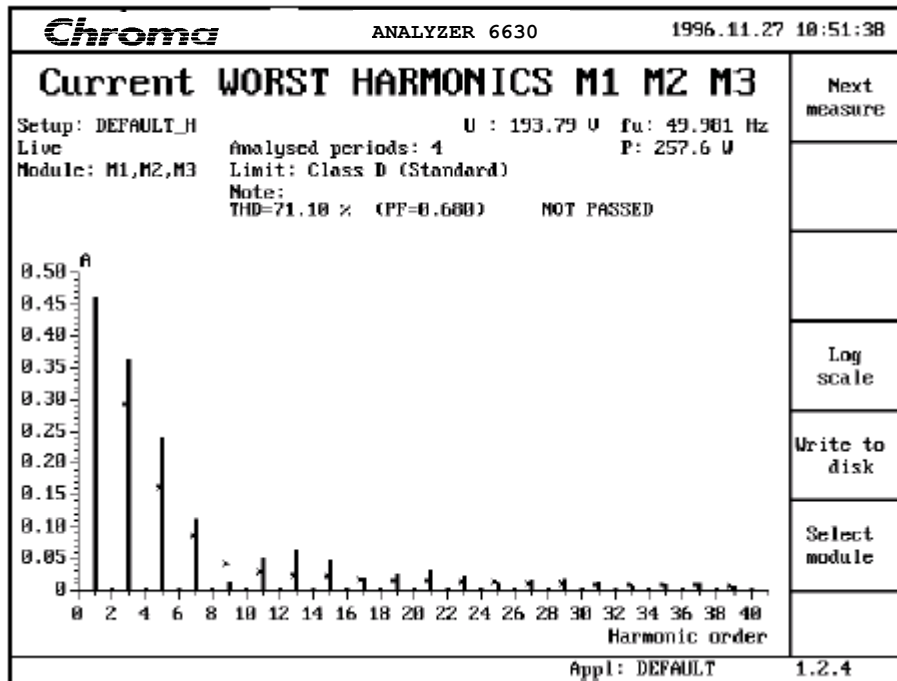


Figure 4-38 Steady State Harmonics Measurement Result Display, Triple-Y Mode


This is a composite result page, which means that each harmonic value shown is the worst case from any of the three modules.

The THD result shows the largest value and PF shows the smallest value from any of the three modules.

The P result is the sum of all three modules active power.

The U result is the mean of all three modules.

Figure 4-38 also shows the use of a test against standard. The PASSED/NOT PASSED result will only show PASSED when all three modules are passed.

Select module - 

Use this key to examine the individual results from each module. Select modules using the softkeys. The result pages are similar to the one described in figure 4-37. To return to the worst case summary, press QUIT.

Write to disk - 

The result can be saved to disk for export or archival purposes. Insert a diskette and press **Write to disk**. A list of available filenames on the current disk is shown. Select an existing file to append to or enter a new file name using the alpha-numeric function.

Press **Save** data and the last measurement result is saved. The data is saved in two files, a header file with a DBF extension and a data file where the filename has a preceding underscore.

For example, the file TEST would be save as:

TEST.DBF - header file
 _TEST.DBF - data file

The format is standard dBase DBF format for easy import into spreadsheet software.

Chroma		ANALYZER 6630		1996.05.30 16:01:51	
Harmonics					
Setup: DEFAULT_H			U : 229.91 V fu: 50.000 Hz		
Live			Analysed periods: 4 I : 0.4981 A P: 53.0 W		
Module: M1			Limit: Class U (Standard) UI: 229.91 V		
Note:			THD=0.20 % PASSED		
No	V	Lin V	No	V	Lin V
1	229.914		15	0.128	0.230
2	0.012	0.460	16	0.000	0.230
3	0.267	2.069	17	0.112	0.230
4	0.002	0.460	18	0.007	0.230
5	0.139	0.920	19	0.007	0.230
6	0.007	0.460	20	0.006	0.230
7	0.101	0.690	21	0.063	0.230
8	0.006	0.460	22	0.004	0.230
9	0.153	0.460	23	0.043	0.230
10	0.007	0.460	24	0.000	0.230
11	0.138	0.230	25	0.020	0.230
12	0.007	0.230	26	0.003	0.230
13	0.149	0.230	27	0.009	0.230
14	0.000	0.230	28	0.004	0.230
Voltage range: 600 Vp					
Appl: DEFAULT					1.2.2

Figure 4-39 Harmonics Measurement Result Display, Table Mode

Retrieving data

The data can then be retrieved with the **View Filed data** function on the access page 1.2. Select the preferred file and press **Read file**. A list of selection criteria fields is shown:

Chroma		ANALYZER 6630		1996.05.30 18:04:24	
Select significant field(s)					
File name: EUT					
DATE CURRENT POWER					
<u>DATE</u>	DEVICECLAS				
TIME	PHASES				
NAME	RANGE_U				
OBJECTNOTE	RANGE_I				
VOLTAGE	THREEPHASE				
FREQUENCY					
<u>CURRENT</u>					
POWER					
PERIODS					
DATASOURCE					
Character positions used 31 (67)					Appl: DEFAULT
					1.2.3

Figure 4-40 Selecting Measurement File Selection Criteria

The selected fields data will be included in the measurement selection display. Use the arrow keys and arrow-enter to select the preferred data types. Each measurement result in a file has one line of information at its disposal. The status line shows how much of the line that is in use with the current selection(s).

When the selection has filled the line, further selections will be refused. After selecting data fields, press **Save and continue**.

A measurement result selection list with the selected data will be shown as in figure 4-41. Use the arrow keys to browse through the results and press arrow-enter to select the preferred one followed by **Display data**. The selected measurement is read from disk and shown on the display.

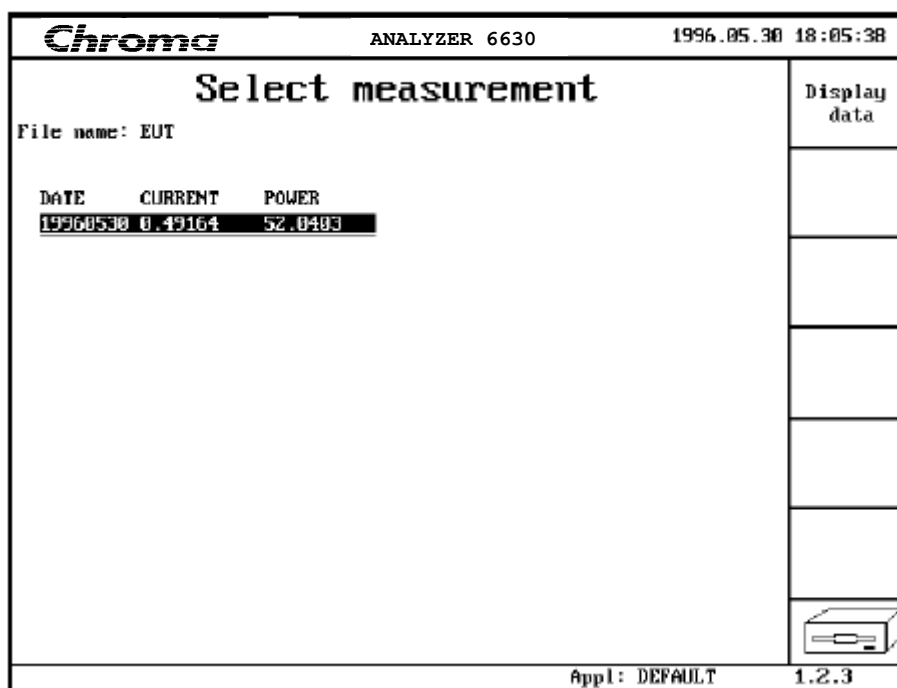


Figure 4-41 Measurement Selection List

The purpose of this function is to assist in searching for particular data. The result selection screen will show all results in a file together with the selected data making it easy to find results like 'A measurement with current larger than 1A and a frequency higher than 55Hz'.

4.4.2.4 Fluctuating Harmonics Measurements

By pressing **Continuous measure** on the measurement operation control page in Figure 4-36, a fluctuating harmonics measurement is started. The Fluctuating harmonics time slot is preset to a standard dictated 16 periods and ignores the setting in the **Periods/timeslot** parameter.

When testing against standard limits, there are two types of limits depending on the chosen class, a hard limit that if exceeded by anytime slot, will cause the function to report NOT PASSED at the end of the measurement.

The other limit is a soft limit where a limit crossing is allowed for a certain time within a sliding window. The Fluctuating harmonics function uses a 150 second sliding window, which acts as a circular buffer, updated every time slot. After each time slot, the buffer is checked to see if the soft limit was broken more than 10% of the time. This check is accumulative which means that the time of limit exceeding is summed and if larger than the allowed 10%, the function will report NOT PASSED.

During the measurement, a frequency drift check is made. At the start of the measurement, the frequency of the fundamental is saved. This result is then used as reference. If the fundamental frequency drifts outside the set limit, the measurement will be NOT PASSED.

If a test against limit is selected during fluctuating current harmonics measurements, a fluctuating voltage harmonics measurement will be performed in parallel to verify the quality of the voltage source. This cannot be disabled. If this is undesirable, use the 'User defined limits' under **System function, Application Setup** page to set a sufficiently large limit for the Voltage source to avoid being NOT PASSED.

In order for the function to report PASSED, all tests must pass including fluctuating current and voltage harmonics and frequency drift. The display will show which of the tests that fails. See the related standard for more details.

IMPORTANT

If the voltage and current range is set to **Auto**, the range is selected at the start of the measurement and is then set at that range during the entire measurement. This may cause the measurement to be aborted due to an over range condition. Always select a fixed voltage and current range suitable for the anticipated signals before starting a measurement.

NOTE

High performance measurement module(s) are required to perform Fluctuating harmonics measurements.

Figure 4-42 shows a started fluctuating harmonics measurement configured with no limits:

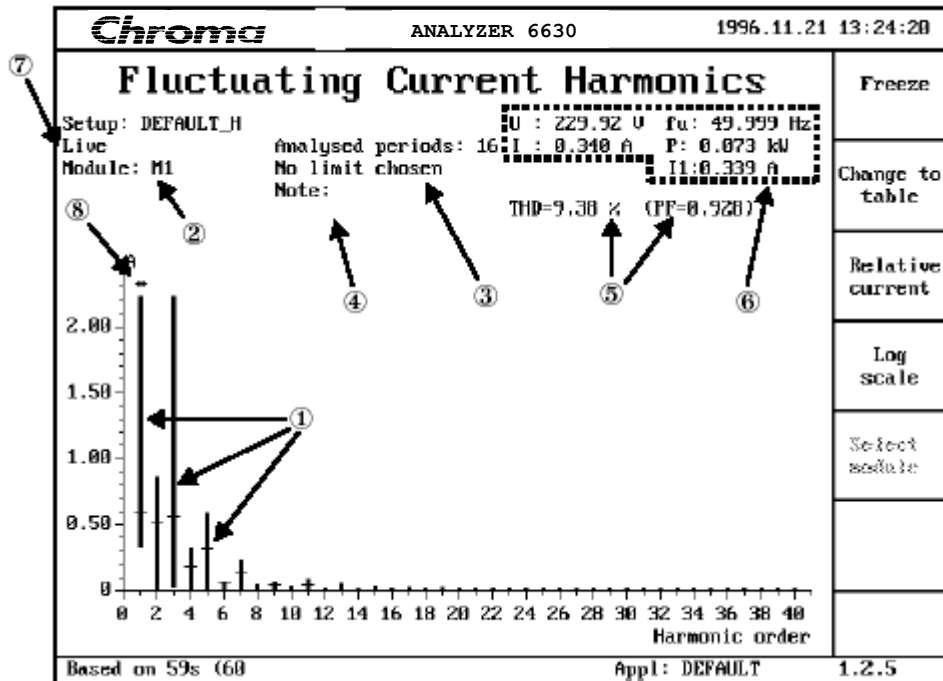


Figure 4-42 Fluctuating Harmonics Measurement Started

The display is updated every third timeslot with the accumulated worst case results over the entire elapsed measurement. The instantaneous results from every third timeslot is also indicated on the display. Every time slot is 16 periods so this will give a display update frequency of about 1 second.

The result display has the following components:

①

This is the graph with each of the 40 harmonics shown on the X axis and the level on the Y axis. Different from the steady state harmonics function, the result column for each harmonic shows a min-max span, not an absolute level. The instantaneous result from every third timeslot is represented by the dash-marker '-' on each column. If the dash is not visible, it is probably hidden by the X-axis.

The Y-axis presentation changes according to the chosen test class.

When no test against limits is chosen, the level can be presented as either an absolute value or as a percentage of the fundamental using a softkey. The range of the Y axis is auto adjusted to fit the largest worst case span not counting the fundamental.

When test against limit is chosen, the Y-axis is presented as a percentage of a test limit. This is cannot be changed during a measurement. Be aware that the test limit is different depending on the chosen test class.

Class A and B uses fixed levels so the Y-axis range will not change during a measurement. Class C and D are different though, the Class C limit is a percentage of the fundamental current and Class D limit is depending on the EUT power.

NOTE

With class C or D selected, a new limit is calculated every time slot and the Y-axis will change accordingly on each display update. This may cause confusion since the display data may become very complicated and consequently hard to understand.

②

The **Module** field shows from which measurement module the data was collected.

③

The **Limit** field shows according to which standard the passed/not passed test is done.

④

The **THD** result field shows the Total Harmonic Distortion figure for the measured signal.

⑤

This field shows the passed/not passed test result. It will be empty if no test is done.

⑥

This is a summary of the input signal as follows:

U	Voltage RMS value.
fu or fi	Frequency of the fundamental of the frequency source..
I	Current RMS value.
P	Active power.

⑦

This is an additional indicator of the result source. **Live** indicates that the results have been acquired from an actual measurement. If results are read from a diskette this field will show the filename.

⑧

If any level is greater than the selected scaling, an asterisk will be shown to indicate that the column is actually larger than shown.

Change to table/Change to graph - 

Pressing **Change to table** will produce a display similar to figure 4-43. It shows each of the harmonics with its respective RMS value and min-max values. Return to graph by pressing **Change to bar graph**. This function is only available when not testing against a limit.

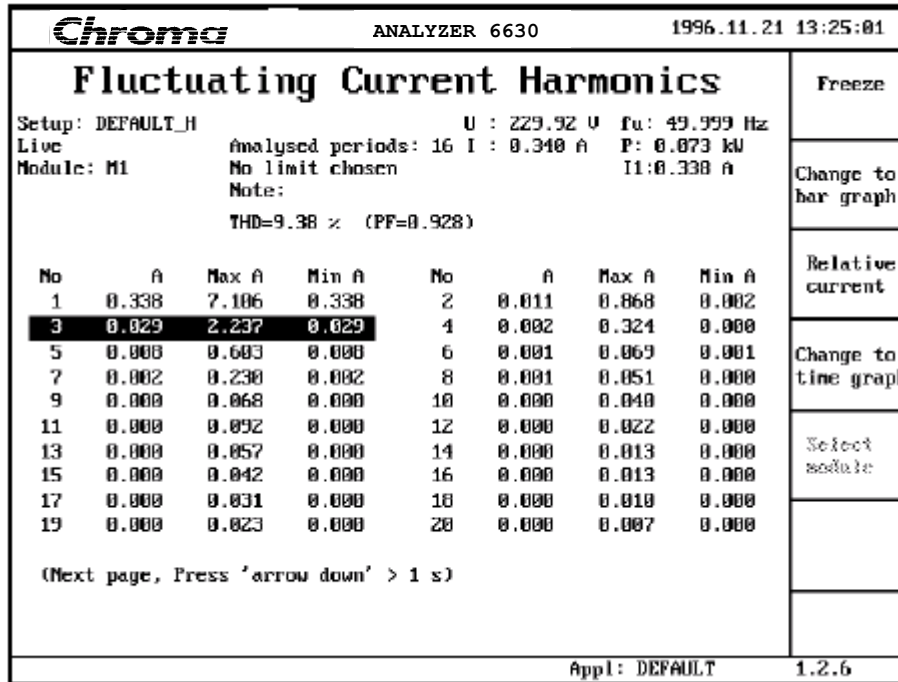


Figure 4-43 Fluctuating Harmonics Active, Table Mode

Relative/Absolute current/voltage -

Alternates the display of a graph or table between levels represented as percentage of the fundamental level or actual levels. Only available when not testing against a limit.

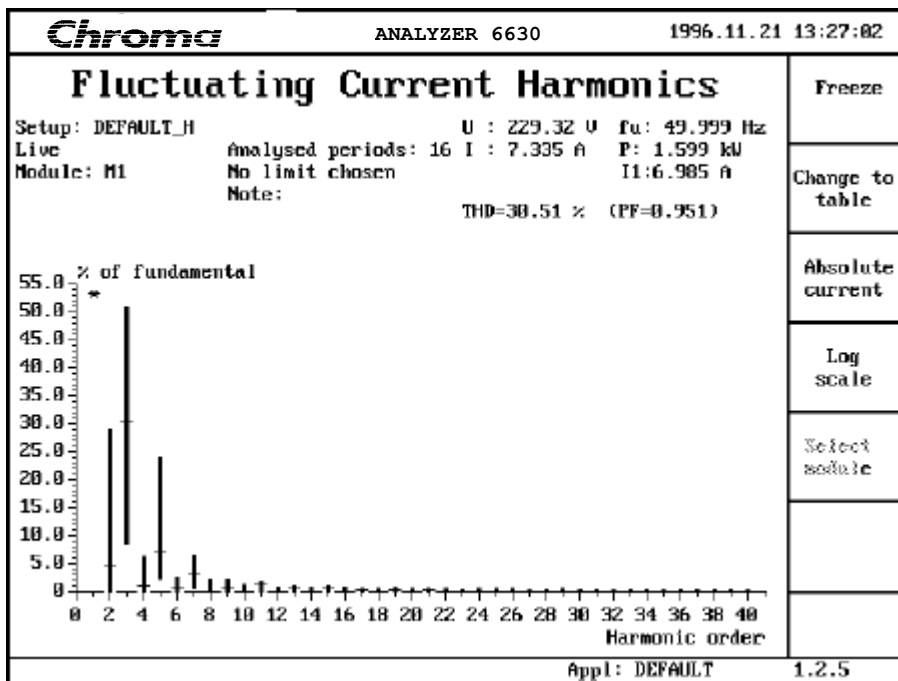


Figure 4-44 Fluctuating Harmonics, Relative Graph Mode

Log scale/Linear scale -

Shows the data with a logarithmic or linear Y axis scale. Only available when not testing against a limit.

Change to time graph - 

When a measurement is finished, see figure 4-45, the time graph of the worst case result for each harmonic may be examined. The display must be in table and absolute mode to use the **Change to time graph** function. Use the arrow keys to select the desired harmonic.

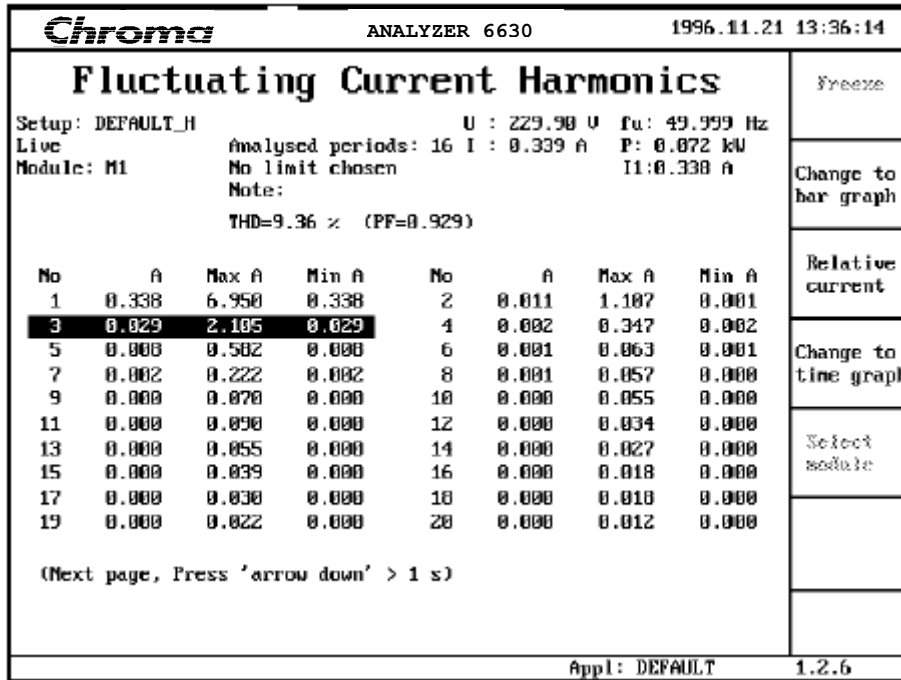



Figure 4-45 Fluctuating Harmonics Ready, in Table Mode to Select a Harmonic

After pressing Change to time graph, the display in figure 4-46 appears. It shows the time graph of the worst case for the selected harmonic where time zero is the worst case point.

Select module - 

During multi-module measurements, this key is used to switch between input modules.

Fluctuating harmonics with limit testing

Figure 4-47 shows a started measurement with limit testing enabled. The use of a hard and soft limit was mentioned earlier in this section and this is shown in the display where the dashed line represents the soft limit and the solid line the hard limit. The Class A test as shown in the example uses both a soft- and a hard limit, other test classes may have either. Also notice that the Relative/Absolute and Log/Linear scale functions are unavailable when testing against a limit.

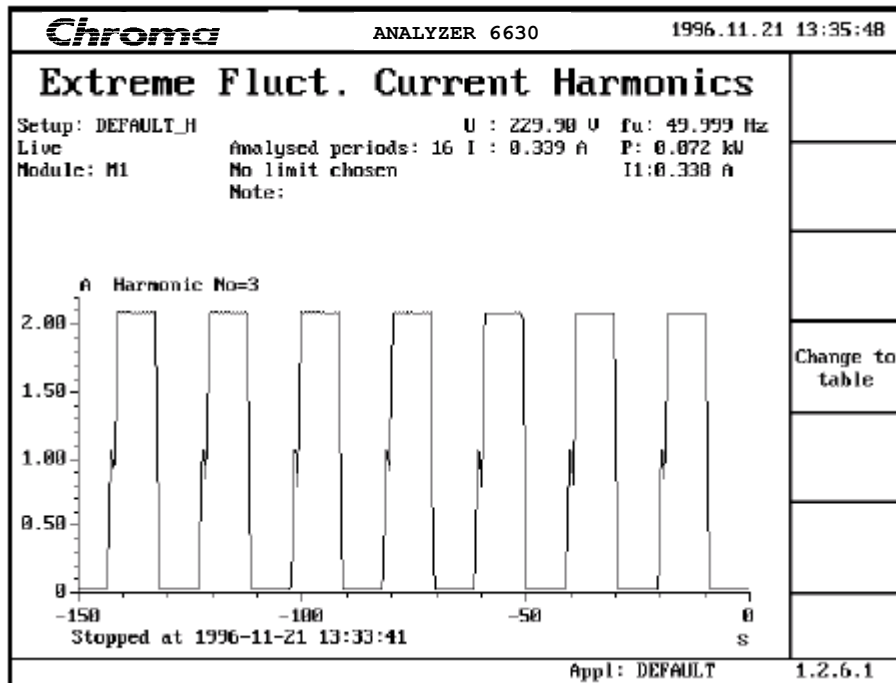


Figure 4-46 Time Graph of the Third Harmonic

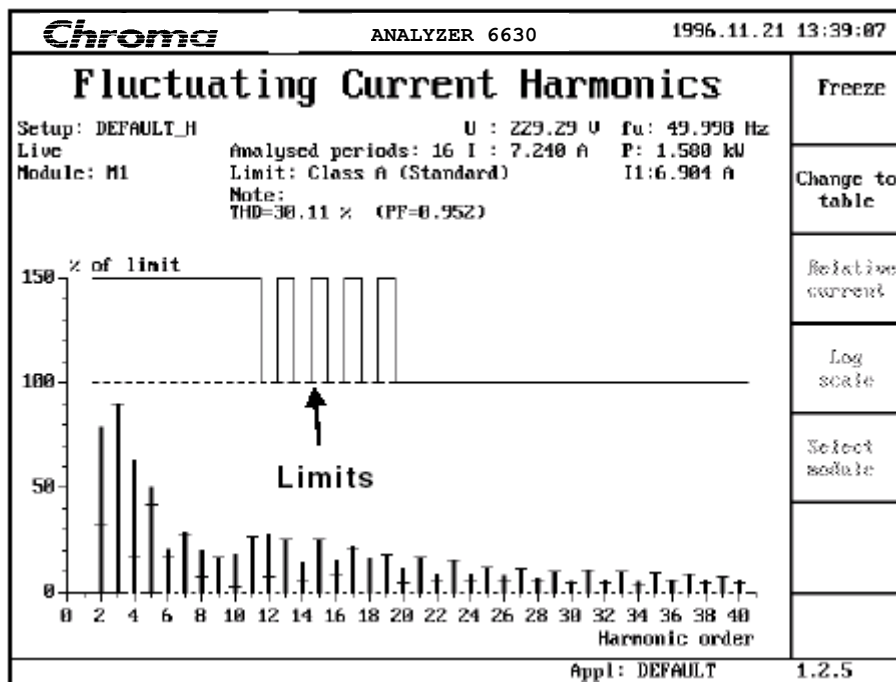


Figure 4-47 Fluctuating Harmonics Started, Class A limit Testing

The presentation can be changed to table mode:

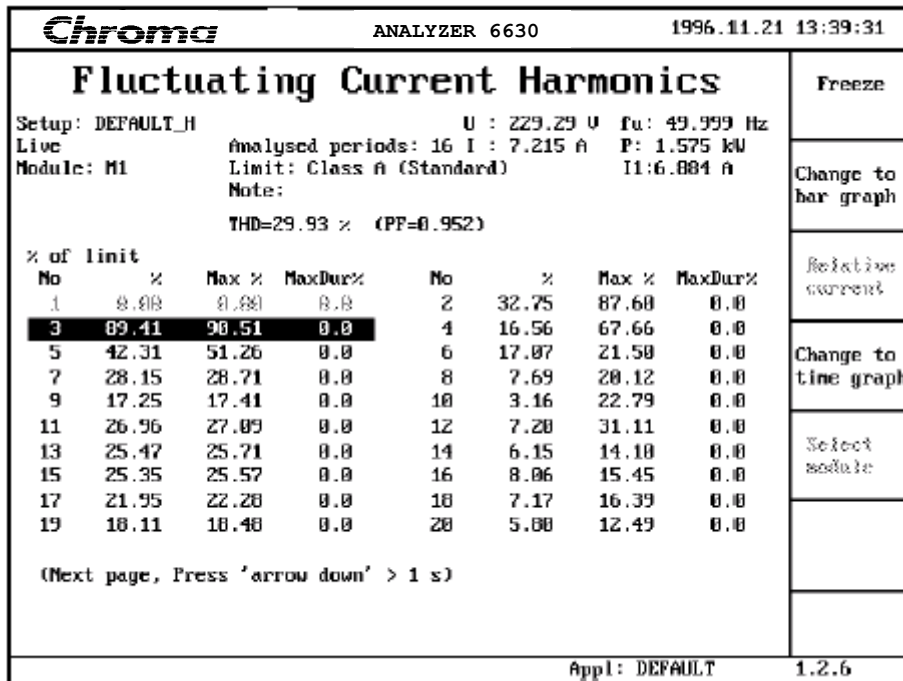


Figure 4-48 Fluctuating Harmonics Started, Class A Limit Testing in Table Mode

The % figure shows the instantaneous result of the current timeslot, the **Max %** figure shows the worst case maximum during the entire measurement and the **MaxDur %** result shows worst case amount of time the harmonic has broken the soft limit over the entire measurement. As mentioned before, the standard allows a maximum of 10% of the 150 seconds sliding window.

Figure 4-49 shows a finished measurement in table mode with the PASSED/NOT PASSED test reported. As with no limit testing, the time graph around the worst case for each harmonic may be examined as described earlier and shown in figure 4-50.

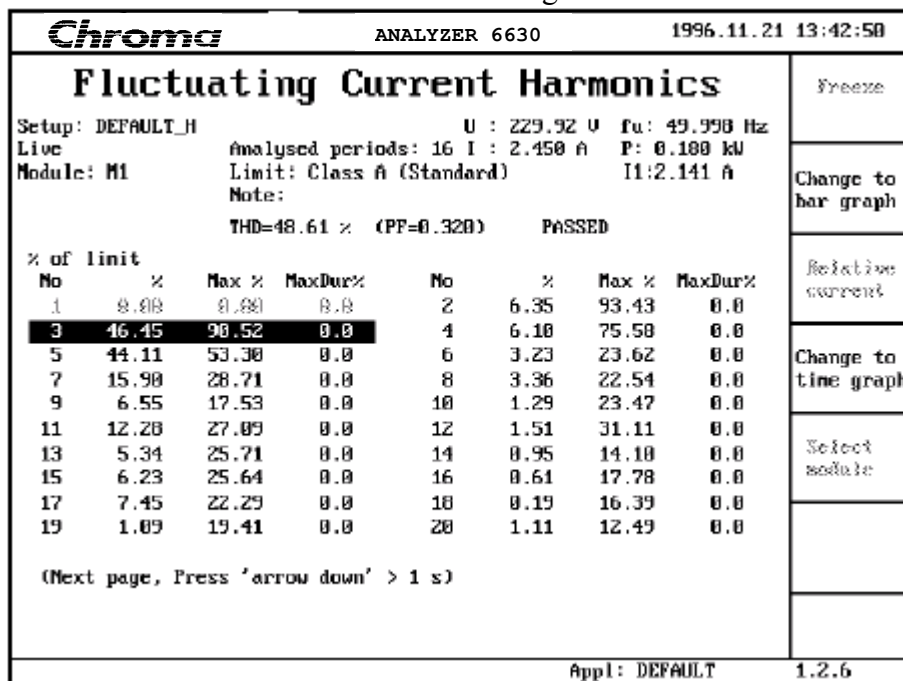


Figure 4-49 Fluctuating Harmonics Ready, Class A Limit Testing PASSED

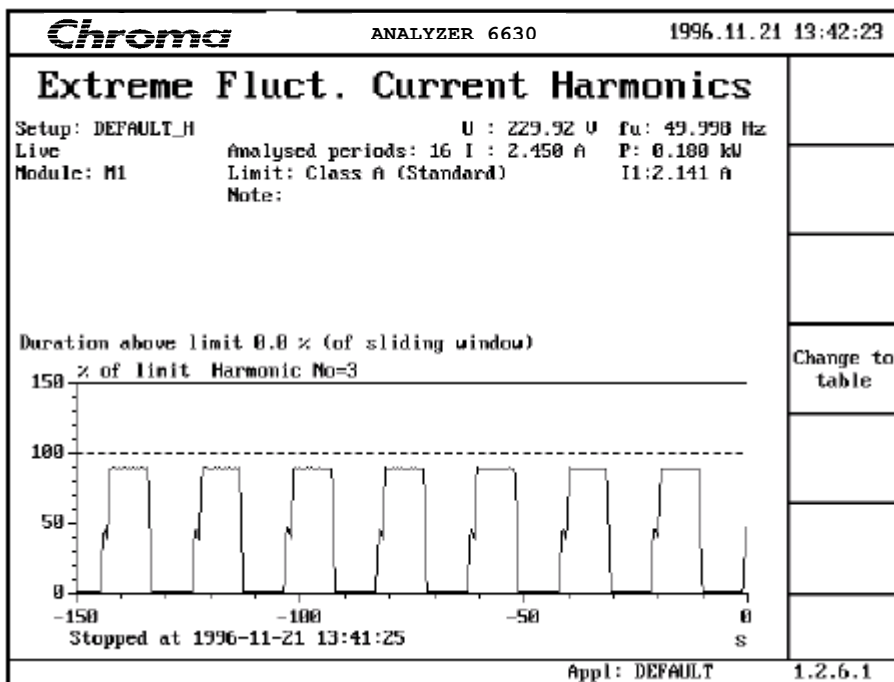


Figure 4-50 Fluctuating Harmonics Ready, Time Graph with Class A Limits

4.4.2.5 Harmonics Standard EN61000-3-2 Amendment 14 Operation

The software in Power Analyzer 6630 has been updated to incorporate EN61000-3-2 Amendment 14 as an additional choice for harmonics measurements. For harmonics measurements after 2001-01-01 both the original EN 61000-3-2 standard and the amendment 14 can be used as alternatives for harmonics testing.

4.4.2.6 Harmonics Setup

On the first page of the harmonics set up it is possible to enter the number of periods used for steady-state measurements. For 50Hz mains you should select 10 periods, and for 60 Hz you should select 12 periods when you test according to Amendment 14.

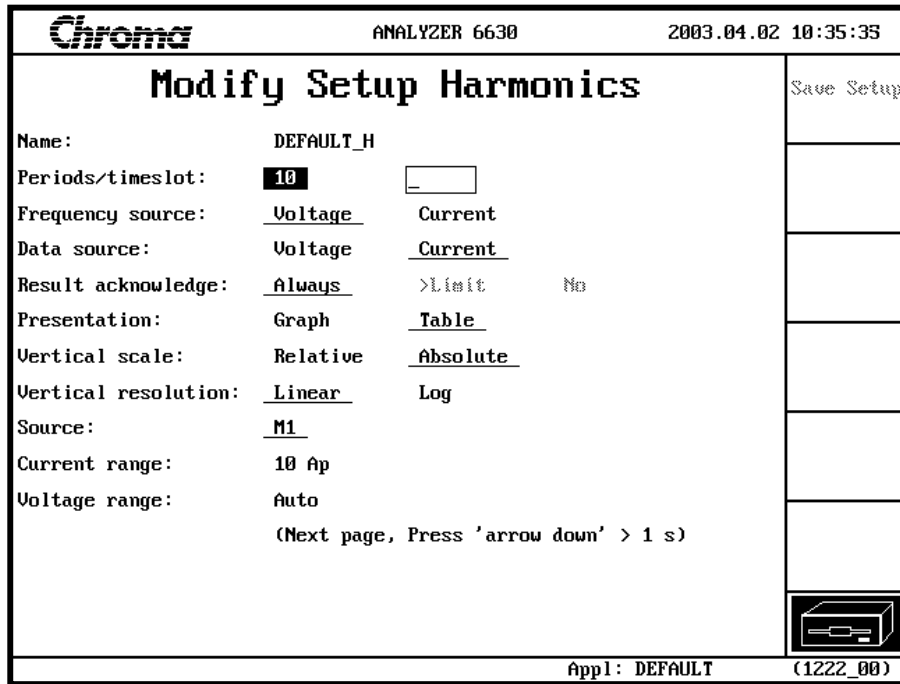


Figure 4-51 Periods/timeslot set

After finishing setting on the first page of the harmonics setup go to the second page.

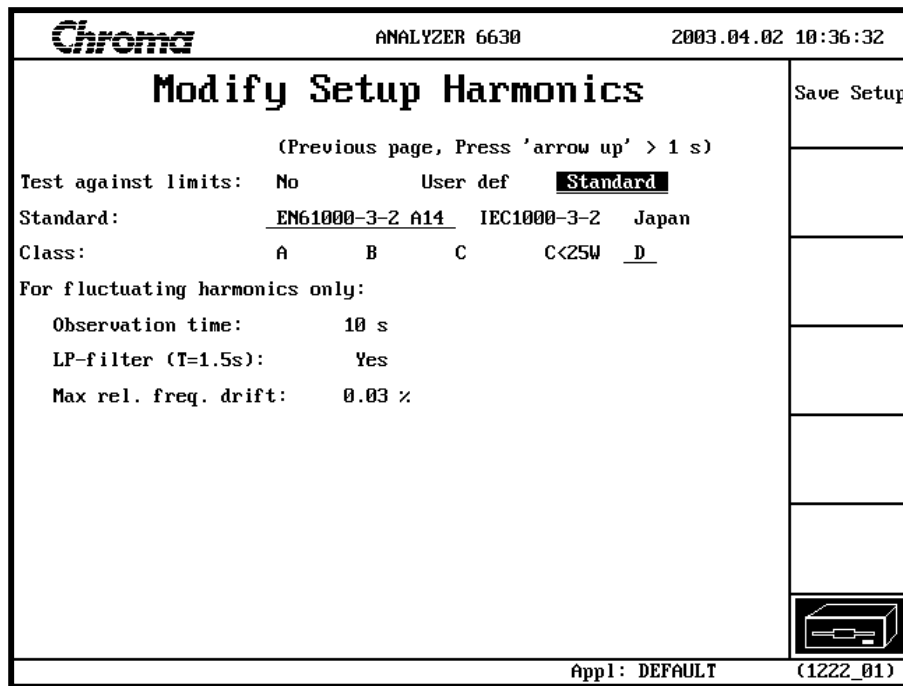


Figure 4-52 Standard set for EN61000-3-2 A14

On the second page of harmonics setup you can choose to test to 5 different classes depending on the type of equipment under test. Select class A or B or C or C<25W or D.

For equipment under test you should also select an observation time to meet the specified repeatability requirements for fluctuating harmonics measurements.

The observation period can be set to any value in seconds from 1-30,000 depending on the

required test time or operating cycle for test object.


Chroma		ANALYZER 6630		2003.04.02 11:14:45	
Modify Setup Harmonics					
(Previous page, Press 'arrow up' > 1 s)					
Test against limits:	No	User def	<u>Standard</u>		
Standard:	<u>EN61000-3-2 A14</u>	IEC1000-3-2	Japan		
Class:	A	B	C	C<25W	<u>D</u>
For fluctuating harmonics only:					
Observation time:	250 s	<input type="text"/>			
LP-filter (T=1.5s):	Yes				
Max rel. freq. drift:	0.03 %				
					
App1: DEFAULT					(1222_02)

Figure 4-53 Observation time setup

4.4.2.7 Test Results – Fluctuating Current Harmonics

For fluctuating current harmonics the results are shown as a table with mean value of the harmonic current for each order, the maximum value and the limits.

The test in Class A and Class B will have the result PASSED if:

- The mean value for each current harmonics order during the test is below the limit.
- If the maximum value is not above 150% for any current harmonics order.
- If mean values of harmonics order 21-39 are above the limit, but the POH sum is below the sum of the POH limits.

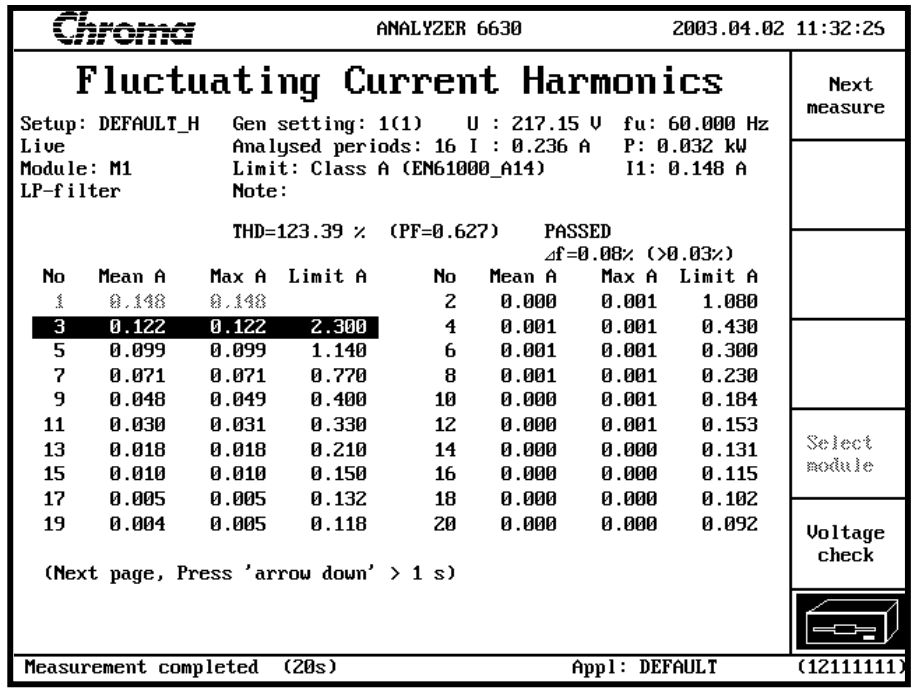


Figure 4-54 Fluctuating Current Harmonics Measurement Result for Class A

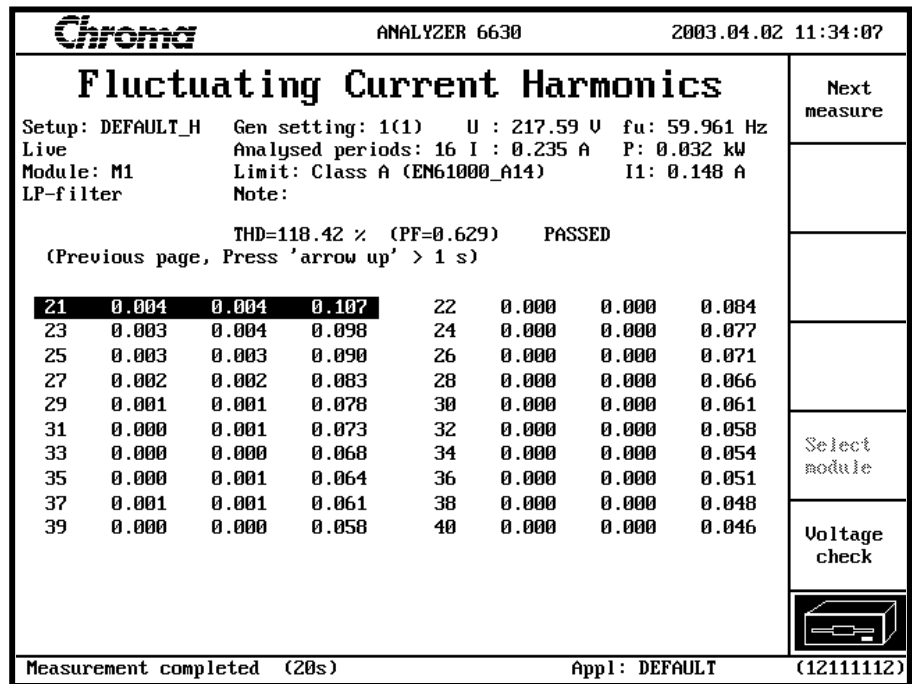


Figure 4-55 Fluctuating Current Harmonics Measurement Result for Class A

In Class D the test results are presented in a similar way to Class A and B, but here you can also get a PASSED result if the mean value or the maximum value is within 10% of the limits based on measured active power. In this case the test result will say that the result is PASSED if P is specified at a certain active power level.

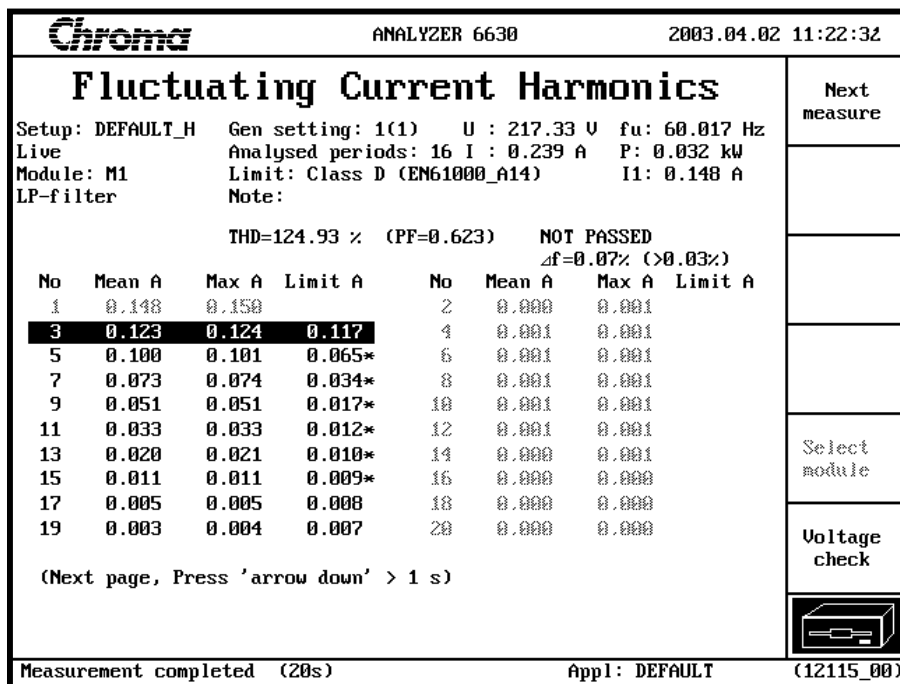


Figure 4-56 Fluctuating Current Harmonics Measurement Result for Class D

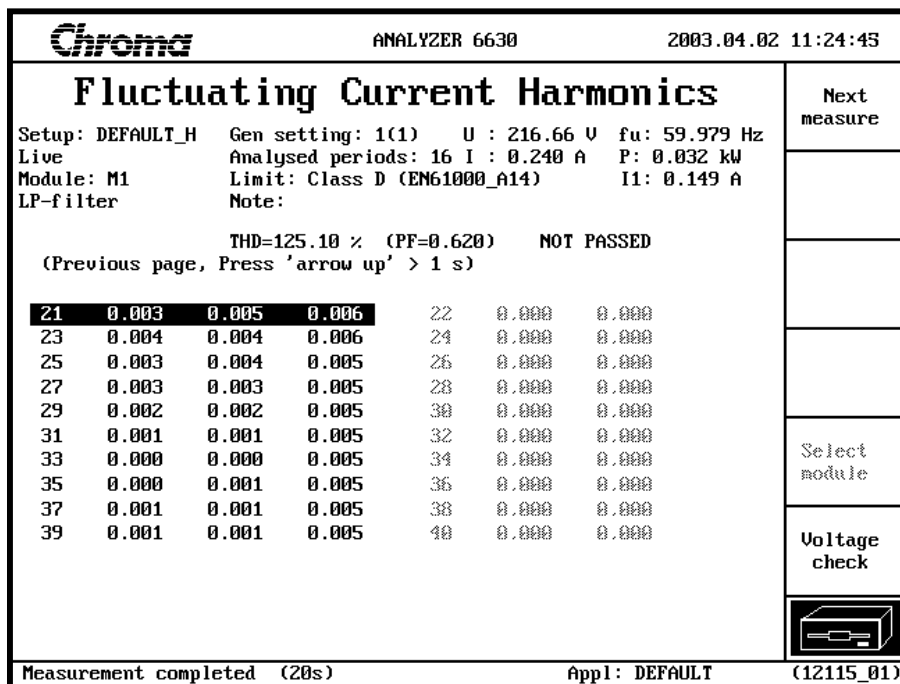


Figure 4-57 Fluctuating Current Harmonics Measurement Result for Class D

For Class C there are two choices depending on the active power. If power is <25W you should use the special class (C<25W) where the evaluation against limits corresponds to a Class D evaluation according to Amendment 14.

For equipment in Class C with active power >25W you should use Class C and the evaluation against limits is then based on the fundamental current and the power factor.

4.4.3 Flicker

Pressing **Flicker** from the main menu gets you to the flicker access page:

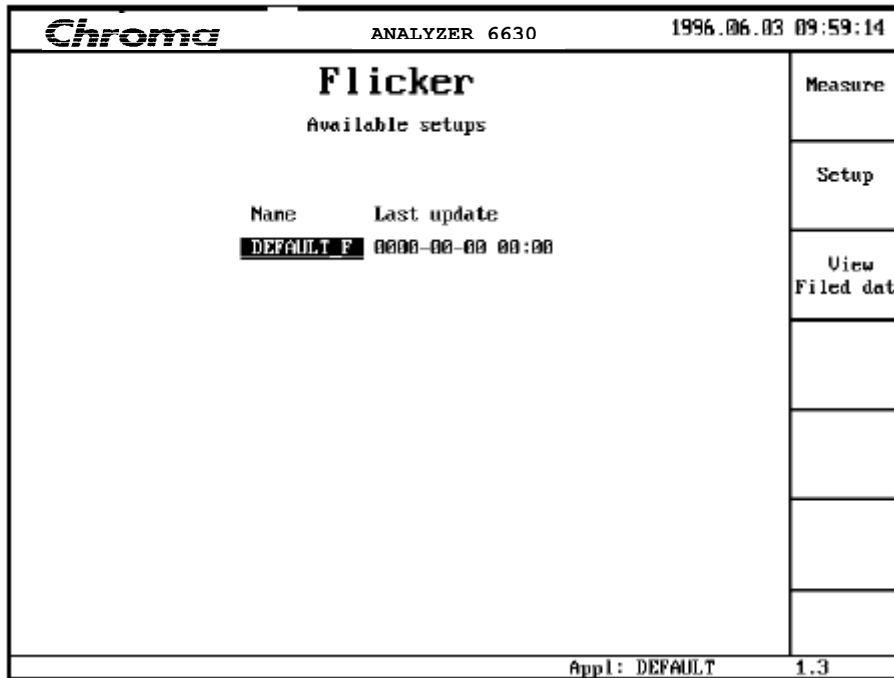


Figure 4-58 Flicker Access Page

IMPORTANT

Please refer to section 4.5 *Connecting a Measurement Object* when connecting the EUT (Equipment Under Test).

Introduction

The voltage fluctuation and flicker measurement function in POWER ANALYZER 6630 measures and tests according to the following standards:

- IEC 555-3 (European equivalent EN 60555-3)
- IEC 1000-3-3 (European equivalent EN 61000-3-3)

Automatic evaluation of test results against the standards is a built in function and selectable for a wide variety of equipment.

The flicker meter is a digital implementation of the Flicker Meter described in IEC 868 (EN 1000-4-15).

Understanding the information in this section requires good knowledge of the IEC 1000-3-3 and IEC 868 (EN 1000-4-15) standards.

Measurement principle

POWER ANALYZER 6630 uses a method of measuring voltage fluctuations and resulting flicker where no physical reference impedance is needed. Besides from superior measurement performance, this also eliminates the need of replacing this expensive component due to

changing standards.

The following figure illustrates the measurement model:

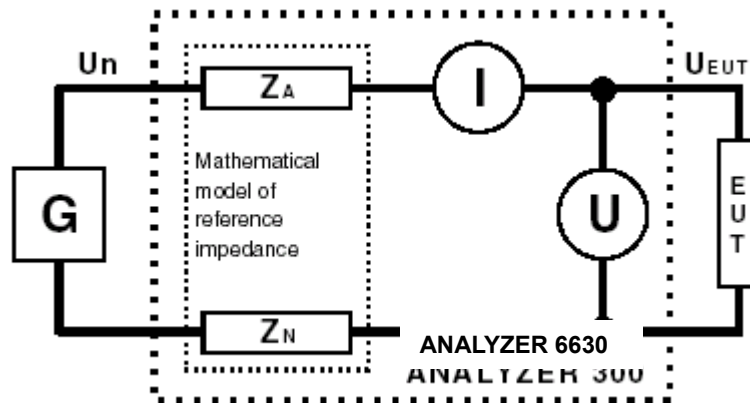


Figure 4-59 Measurement Model

The measurements are based on half-period RMS values where the relative voltage change component, $d(t)$, is derived by the active and reactive power components of the EUT as the following formula shows:

$$d(t) = 100 \frac{P(R_A + R_N) + Q(X_A + X_N)}{U_{EUT} \cdot U_n} (\%)$$

In the formula:

- P = active part of the EUT power
- R_A = resistance of the reference impedance phase conductor
- R_N = resistance of the reference impedance neutral conductor
- Q = reactive part of the EUT power
- X_A = reactance of the reference impedance phase conductor
- X_N = reactance of the reference impedance neutral conductor
- U_n = voltage at EUT terminals, U_{EUT}
- U_{EUT} = generator voltage

Since no physical reference impedance is present, there is no almost voltage drop present and therefore U_n is assumed to be equal to U_{EUT} . This causes a small second order error since the EUT is not subjected to the $d(t)$ value. It could be argued that the $d(t)$ value should be corrected for the change in the EUT current drain, but since the EUT behavior is unknown, it can be constant Z or constant P, such compensation is uncertain. Based on this fact and because the error is low, less than 4% of $d(t)$ and typically in the 0-3% range, the compensation is excluded.

The U_n value in the above formula is the actual real time half period RMS voltage present at the EUT terminals, which means that voltage drop on the AC source output, will introduce second order errors only. This enables the use of normal mains voltage as source.

A professional AC source is of course the preferred choice since voltage and frequency can be varied.

When the measurement is started it is considered to be in steady-state which means that the long-term **dmax** peak detector is reset and the **dc** relative steady-state voltage change result is cleared.

The long-term **dmax** result register is used to store the extreme over the entire measurement. A short-term **dmax** result register is updated during short-term periods after which the result is compared to, and if larger updated in, the long-term **dmax** register. At the end of the measurement, the long-term **dmax** register is compared to the chosen limit.

Since no external reference impedance is needed there is no need for cumbersome reconnections when measuring according to the related IEC 1000-3-2 harmonics standard.

Flicker measurements are only possible with source frequencies of $50 \pm 0.2\text{Hz}$ and $60 \pm 0.2\text{Hz}$ because of flicker meter digital filter limitations. The meter will check the source frequency at start and refuses to start if the frequency is out of range. The frequency range will not be checked during a flicker measurement, drifting outside the limits will cause errors in the measurement results. When using the non-standard frequency 60Hz, the flicker filter is corrected to remove filter errors.

4.4.3.1 Flicker Configuration

Pressing Setup from the flicker access page 1.2 gets you to the Flicker Setup access page:

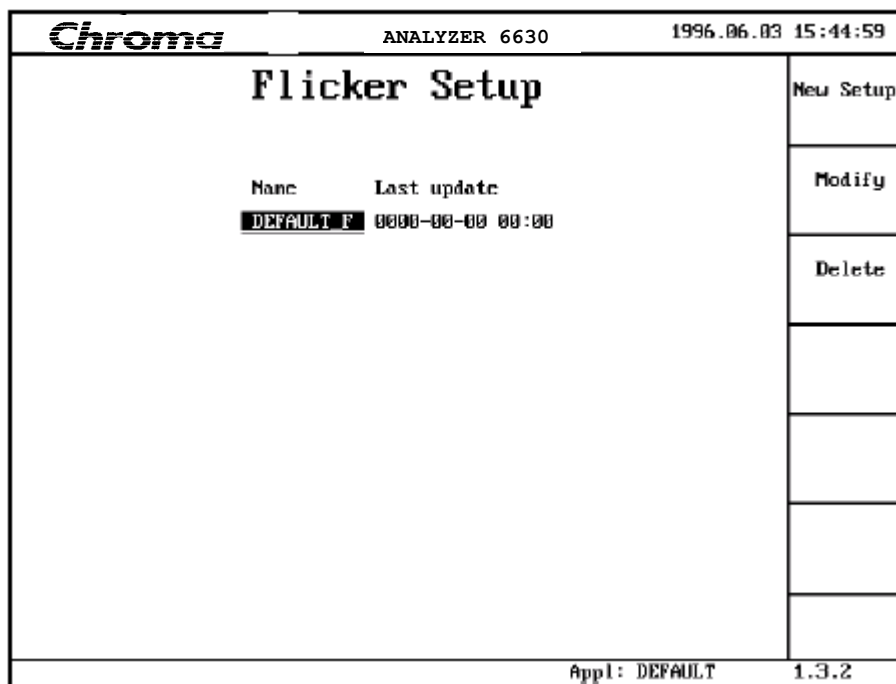


Figure 4-60 Flicker Setup Access Page

Creating, modifying and deleting a setup is described in section 4.3 *Understanding the Setup System*.

Figure 4-61 shows the first page of the flicker parameters.

Name

Sets the name of the flicker setup. A setup is a part of an application, which can contain up to six setups. See section 4.3 *Understanding the Setup System*.

Test against limits

Selecting **No** will disable the passed/not passed test at measurement completion. Only a limited selection of parameters that controls the actual measurement is available for modification. Selecting **User def** will test the measurement results against the user-defined limits. In this mode all parameters are available for modification including the limits.

When selecting **Standard** the passed/not passed test will be done strictly according to the IEC 1000-3-3 limits. All measurement control parameters and limits will be set to the standard dictated values and cannot be modified. Default is **Standard**.

Data source

Selects the flicker meter data source. Selecting Current will make the instrument calculate the resultant flicker using the mathematical model described in section 4.4.3. This is the preferred setting used in most cases. When selecting Voltage, the instrument will derive the resultant flicker directly from the voltage input signal where $d(t)$ is $U_{peak} - U_{instantaneous}$. This makes it possible to verify the quality of an AC source as required by the standard.

Short term window

Selects the observation time for short term flicker, Pst. Can be set between 1 and 30 minutes. Default and standard is 10 minutes.

No of short terms

Sets the number of completed short terms needed to obtain a complete long term flicker observation, Plt. Can be set between 1 and 1500. Default and standard is 12.

Real ref. impedance

Real part ($RA + RN$) in the mathematical model of the reference impedance used in the flicker calculations. Range is 0.03 and 50.00 ohms. Default and standard is 0.4ohm.

Imag. ref. impedance

Imaginary part ($XA + XN$) in the mathematical model of the reference impedance used in the flicker calculations. Range is 0.02 and 50.00 ohms. Default and standard is 0.25ohm.

Chroma		ANALYZER 6630	1998.01.13 15:40:52
Modify Flicker Setup			
Name:	DEFAULT_F		
Test against limits:	No	User def	<u>Standard</u>
Data source:	<u>Current</u>	Voltage	
Short term window:	<u>10 min</u>		
No of short terms:	<u>12</u>		
Real ref. impedance:	<u>0.4 ohm</u>		
Inag. ref. impedance:	<u>0.25 ohm</u>		
Steady state window:	<u>1 s</u>		
St-st hysteresis:	<u>0.05 %</u>		
Threshold d(t):	<u>3 %</u>		
Time lim d(t)>thres:	<u>0.2 s</u>		
Limit dmax:	<u>4 %</u>		
Limit dc:	<u>3 %</u>		
Limit Pst:	<u>1.00</u>		
Limit Pit:	<u>0.65</u>		
(Next page, Press 'arrow down' > 1 s)			
Appl: DEFAULT			1.3.2.2

Figure 4-61 Flicker Parameters, Page 1

Steady state window

Specifies the window time of which the d(t) signal must be stable within to be considered a steady state. Can be set between 1.00 and 5.00 seconds. Default is 1 second. The standard does not explicitly specify a steady-state. The default time of 1 second is derived from section 3.2 of the IEC 1000-3-3 standard and is considered the standard time. See also St-st hysteresis.

St-st hysteresis

Specifies the amount of ripple or fluctuations allowed on the d(t) signal and still be considered a steady state. This is needed since almost all signals have some noise component.

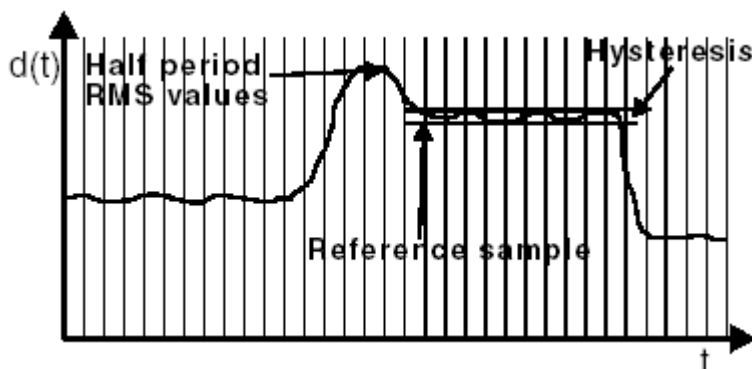


Figure 4-62 Steady State Hysteresis

Entered as a ± percentage of the Un voltage. Can be set between ±0.01 and ±0.1%. Default is ±0.03%.

A signal is considered to be in steady state when consecutive samples fall within the specified

hysteresis of the reference sample for at least the time specified by the **Steady state window** parameter. The reference sample is selected by comparing the current sample with the previous sample. If the current sample falls within the hysteresis, a steady state verification is started with the previous sample as reference.

If in steady state verification a sample falls outside of the hysteresis, the search for a new reference sample restarts. See also the related parameter **Steady state window**.

Threshold $d(t)$

Specifies the maximum $d(t)$ level allowed.

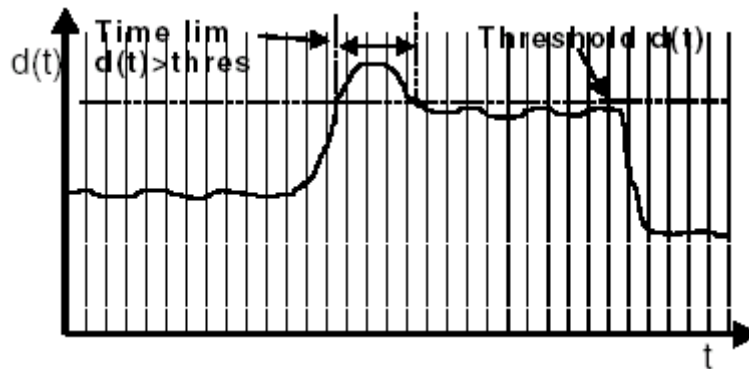


Figure 4-63 $d(t)$ Maximum Level and Time Limit

Figure 4-63 illustrates the $d(t)$ limit. It is entered as a percentage of the U_n level and can be set between 0.50 to 10.00%. Default and standard is 3%. Setting this parameter to 0 excludes this result from the passed/not passed test.

Time lim $d(t)>thres$

Specifies the time allowed to exceed the $d(t)$ level set in the **Threshold $d(t)$** parameter. Figure 4-63 illustrates the time limit. The time can be set between 0 and 1.00 second. Default and standard is 0.2 seconds. Setting this parameter to 0 disables the time limit function.

Limit d_{max}

Specifies the limit of the difference between the maximum and minimum levels between steady-state periods:

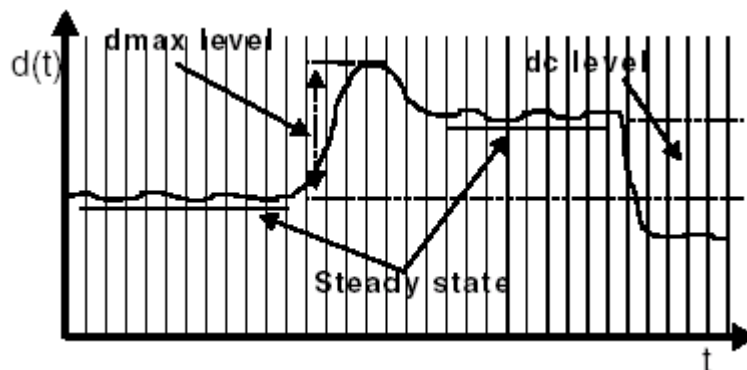


Figure 4-64 d_{max} and d_c

It is entered as a percentage of the Un level and can be set between 0.50 and 10.00%. Default and standard is 4%. Setting this parameter to 0 excludes this result from the passed/not passed test.

Limit dc

Specifies the limit of the difference between two adjacent steady-state levels as figure 4-64 illustrates. It is entered as a percentage of the Un level and can be set between 0.50 and 10.00%. Default and standard is 3%. Setting this parameter to 0 excludes this result from the passed/not passed test.

Limit Pst

Specifies the limit of a short-term flicker measurement. The limit is unitless and can be set between 0.50 and 2.00. Default and standard is 1. Setting this parameter to 0 excludes this result from the passed/not passed test.

Limit Plt

Specifies the limit of the long-term flicker measurement. The limit is unitless and can be set between 0.30 and 1.50. Default and standard is 0.65. Setting this parameter to 0 excludes this result from the passed/not passed test.

Figure 4-65 shows the second flicker parameter page:

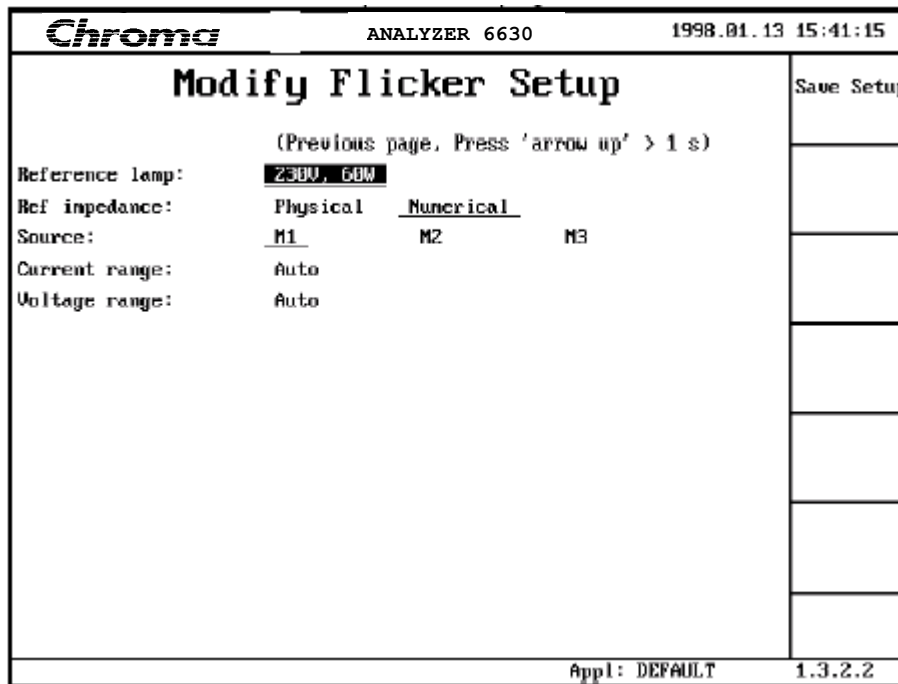


Figure 4-65 Flicker Parameters, Page 2

Reference lamp

Specifies the lamp characteristics for the flicker meter. This parameter has great impact on the filter characteristics of the flicker meter. See the IEC 868 (EN 1000-4-15) standards for details. 230V, 60W is standard and only choice.

Ref impedance

Specifies whether an external physical reference impedance is present or not. When selecting **Numerical**, the instrument will use the normal numerical method of measuring the voltage fluctuations as described on page 4-62.

When selecting **Physical**, the denominator in the formula shown on page 4-62 is modified to $U_{EUT}U_n + IZ$, i.e. the voltage drop in the physical reference impedance is compensated for. Besides that, the same numerical voltage fluctuation measurement method is used. By allowing the use of a physical reference impedance, the true EUT behavior is taken into account. This parameter is only used when **Source** is set to current.

IMPORTANT

The **Real ref. impedance** and the **Imag. ref. impedance** parameters must match the external physical reference impedance specifications.

Source

Selects which measurement module that will provide the source data. The parameter choice is dependent on the number of installed measurement modules.

Current range

Sets the measurement range for the current input. The default **Auto** selects an automatic range setting during measurements. The following selections sets a fixed range:

300 Ap	300A peak
100 Ap	100A peak
30 Ap	0A peak
10 Ap	10A peak
3 Ap	3A peak
1 Ap	1A peak
0.3 Ap	0.3A peak
0.1 Ap	0.1A peak

When **Auto** is chosen, the instrument will start the flicker measurement at the highest sensitivity (0,1Ap). If a range change is made it is irreversible which means the instrument will never switch back to a higher sensitivity during the entire measurement.

Voltage range

Selects the measurement range for the voltage input. The default **Auto** selects an automatic range setting at each measurement. The following selections are available and sets a fixed range:

2000 Vp	2000V peak
600 Vp	600V peak
200 Vp	200V peak
60 Vp	60V peak
20 Vp	20V peak
6 Vp	6V peak

4.4.3.2 Flicker Measurements

Single module flicker measurements

Pressing **Measure** at the flicker access page 1.3 shows the measurement management display. Press **Start measure** or start the flicker measurement. After a flicker meter filter stabilization the initial result display is shown:

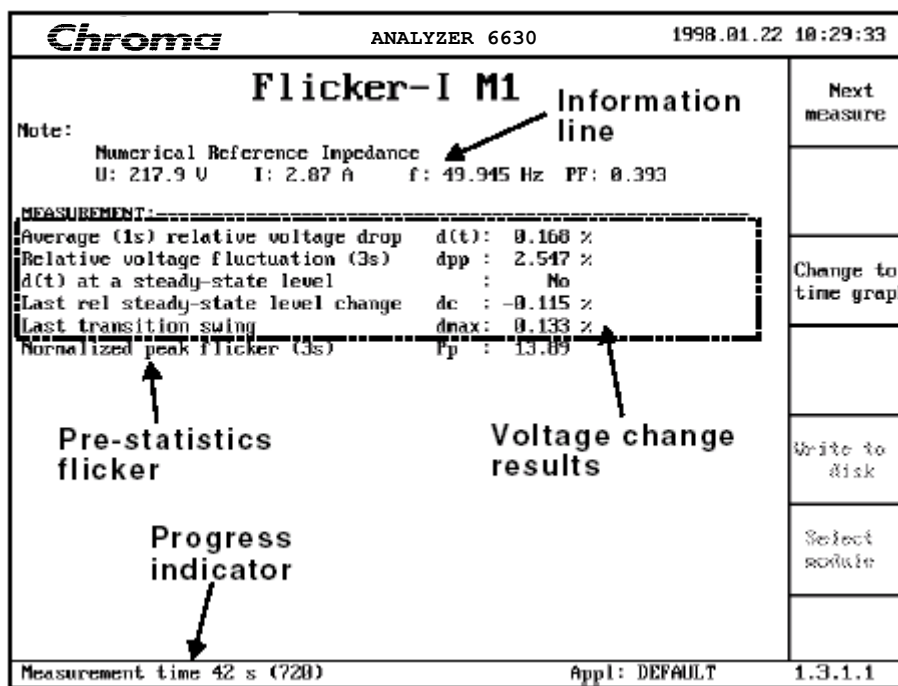


Figure 4-66 Initial Flicker result display

This result display is the first shown after measurement start during the first short term flicker period. It consists of:

The Information Line

Contains the following data which is updated once per second:

- U** Voltage input RMS value.
- I** Current input RMS value.
- f** Frequency of the voltage signal.
- PF** Power factor.

These results are provided for informational purposes only and are not included in the flicker measurement.

Voltage Change results

Average (1s) relative voltage drop $d(t)$

This is the $d(t)$ level. It is based on a one second average of the half-period r.m.s. values. See **Threshold $d(t)$** in section 4.4.3.1 for a description of the $d(t)$ result.

Relative voltage fluctuation (3s) dpp

This is a peak meter similar to the dmax result but without the dependency on steady state periods, which means it can be used to check voltage fluctuations at any time during a measurement.

It is updated once per second and is comprised of three one second min.-max. results where the extreme from any of these three buffers is the result presented. Each second a new min.-max. buffer is available and the oldest one is discarded forming a circular result register. This register can be used for flicker meter frequency response verification according to tables 1 and 2 in the IEC 868 (EN 1000-4-15) flicker meter standard. Apply a voltage or current fluctuation with a frequency and level indicated in the correct table and verify that the Normalized peak flicker (3s) Pp result is 1.

d(t) at a steady-state level

Shows Yes if the signal is considered to be in steady-state and No if not. See the Steady state window and St-st hysteresis parameters in section 4.4.3.1 for more information about steady-state.

Last rel steady-state level change dc

Shows the level difference between the two most recent steady-state periods. It is only updated when entering steady-state. See the Limit dc parameter in section 4.4.3.1.

Last transition swing dmax

Shows the maximum peak to peak level of the voltage change characteristics between the last two steady-state periods. Is only updated when entering steady-state. See the Limit dmax parameter in section 4.4.3.1.

Normalized peak flicker

Shows the normalized peak flicker at 'output 5' in figure 1 of the IEC 868 (EN 1000-4-15) flicker meter standard. This result is a peak detector updated once per second and is constructed, with three one second peak value buffers from which the extreme is displayed. Each second a new peak result is available the oldest one is discarded forming a circular buffer.

This result can be used to verify the frequency response of the flicker meter. See the **Relative voltage fluctuation (3s) dpp** result register.

Progress indicator

The progress indicator shows the elapsed measurement time in seconds followed by the total measurement time which is controlled by the short-term time multiplied with long-term number of short-terms.

After the first short-term flicker measurement is ready the result display shown in figure 4-60 is complemented with the first evaluation result:

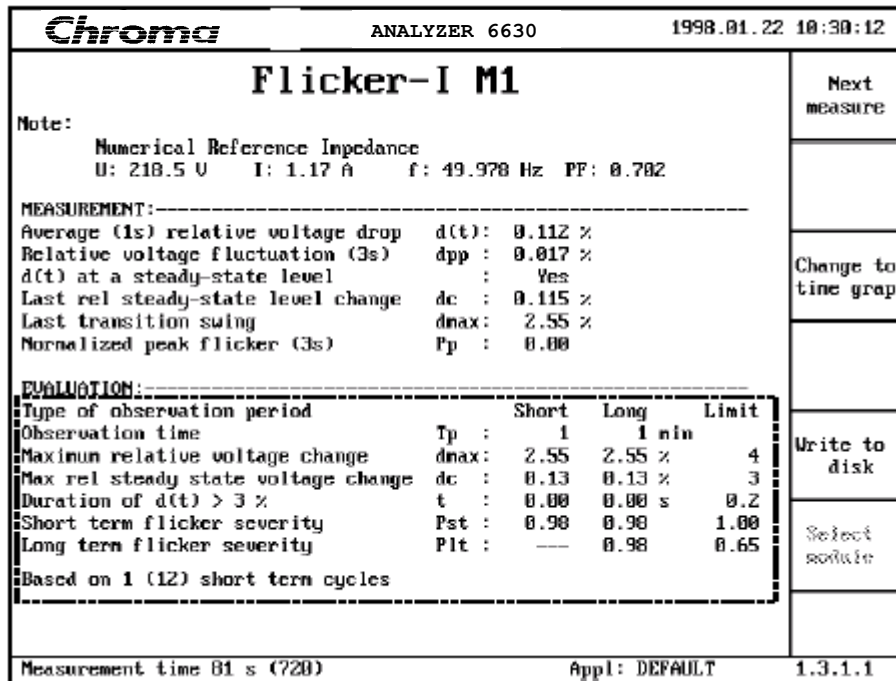


Figure 4-67 Flicker Evaluation Result Display

The evaluation section is updated at the end of each short-term period.

Observation time Tp

Shows what the current evaluation is based on, the short-term time under **Short** and the total time elapsed under **Long**. The short-term time is specified with the **Short term window** parameter which multiplied with the **No of short terms** parameter defines the total measurement time or long-term time. See section 4.4.3.1.

Maximum relative voltage change dnax

Short shows the maximum peak to peak voltage change between steady state periods in the most recent short-term period and **Long** shows the worst case value during the total elapsed measurement time. **Limit** shows the selected limit. See **Limit dnax** in section 4.4.3.1.

Max rel steady state voltage change dc

Short shows the maximum difference in level between two steady-state periods in the most recent short-term period and **Long** shows the worst case value during the total elapsed measurement time. **Limit** shows the selected limit. See **Limit dc** in section 4.4.3.1.

Duration of d(t) > X% t

Short shows the maximum time that the signal exceeded the chosen d(t) threshold, in the most recent short-term period and **Long** shows the worst case value during the total elapsed measurement time. The chosen threshold is shown on the display, in the example as 3%. **Limit** shows the selected time limit. See **Time lim d(t) > thres**.

Short term flicker severity Pst

Short shows the weighted short-term flicker severity in the most recent short-term period and **Long** shows the maximum short-term flicker severity during the total elapsed measurement time. **Limit** shows the selected flicker limit. See **Limit Pst** in section

4.4.3.1.

Long term flicker severity Plt

Long shows accumulated long-term flicker severity during the total elapsed measurement time. The long-term flicker is derived using the following formula:

$$Plt = \sqrt[3]{\frac{\sum_{i=1}^N Psti^3}{N}}$$

where Psti (i = 1, 2, 3, 4, 5,) are consecutive readings of short-term severity Pst.

Limit shows the selected flicker limit. See **Limit Plt** in section 4.4.3.1.

In the **Based on X (Y) short term cycles** line, X shows on how many short-term flicker measurements the current evaluation is based on and Y is the maximum number of short-terms needed to complete the measurement.

Change to time graph - ◀

During the measurement the Change to time graph key may be used to change the display to a graphical representation of the d(t) and Normalized flicker P(t) results:

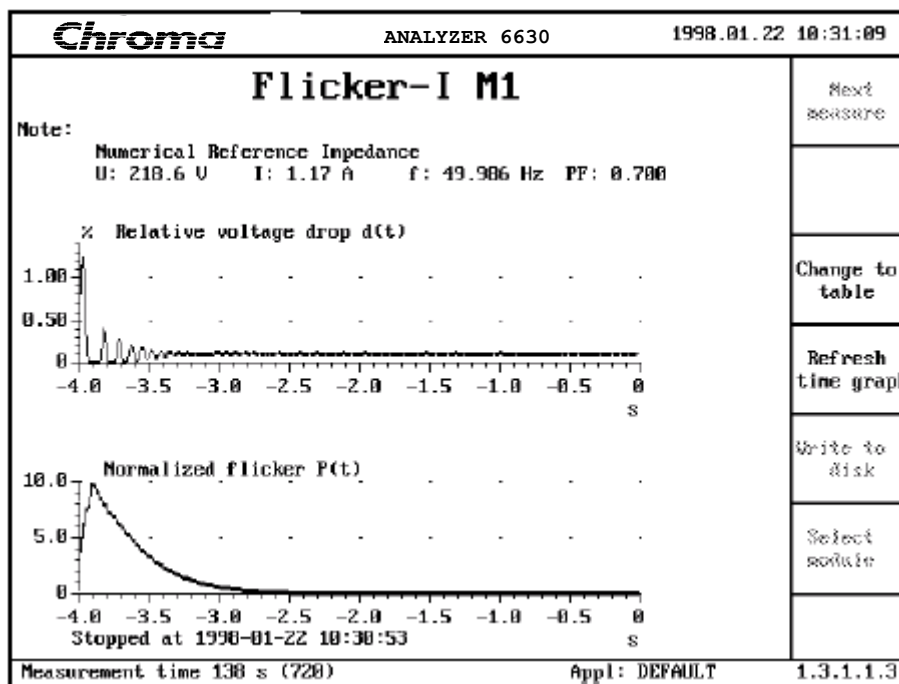


Figure 4-68 Flicker graph

This is a snapshot of the current measurement and **Stopped at . . .** shows the point in time where the snapshot was taken which is shown as time zero on the graph. Use **Refresh time graph** to take a new snapshot.

Press **Change to table** to revert to table data.

When the measurement is completed a final evaluation is done and a passed/not passed test is performed if requested:

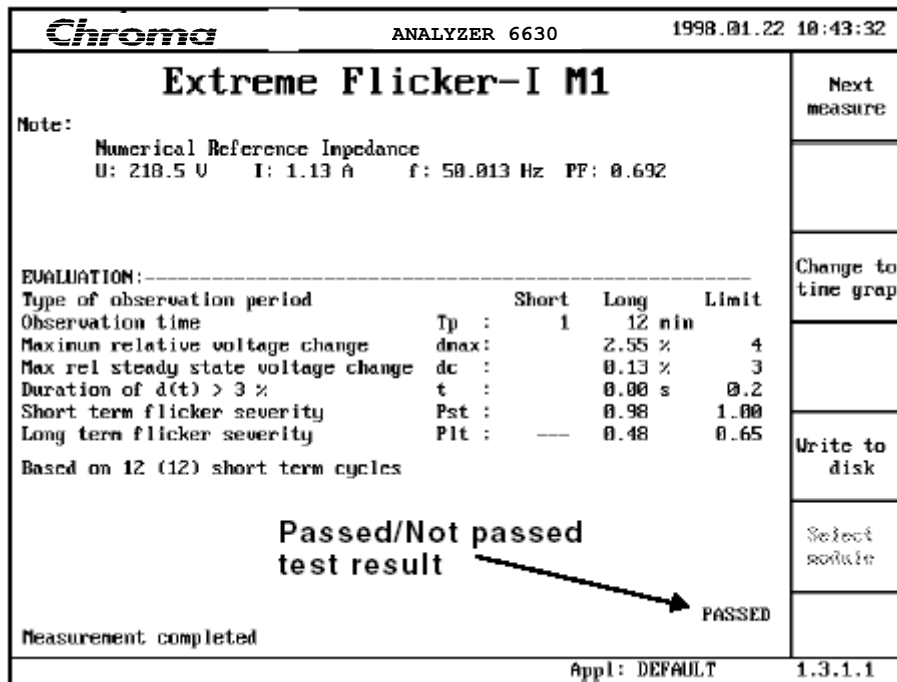


Figure 4-69 Flicker Completed

This evaluation is more or less the same as the one described in figure 4-67 with the difference that this is a measurement summary so no short-term figures are shown. All results except long-term flicker are worst case during the measurement. The long-term flicker severity figure is described in conjunction with figure 4-67.

Pressing **Extreme time graph** will show the d(t) signal and Normalized flicker P(t) as described on page 4-81 with the difference that only the time around the most severe flicker is shown. See figure 4-70. Naturally the graph cannot be refreshed since the measurement is finished.

Change to histogram - 

Pressing **Change to histogram** will show the normalized (pre-statistics) flicker in a histogram similar to Figure 4-71 where the X axis the normalized flicker ranging from 0.01 to 100 and the Y axis is the count. Press **Change to table** to return to the summary.

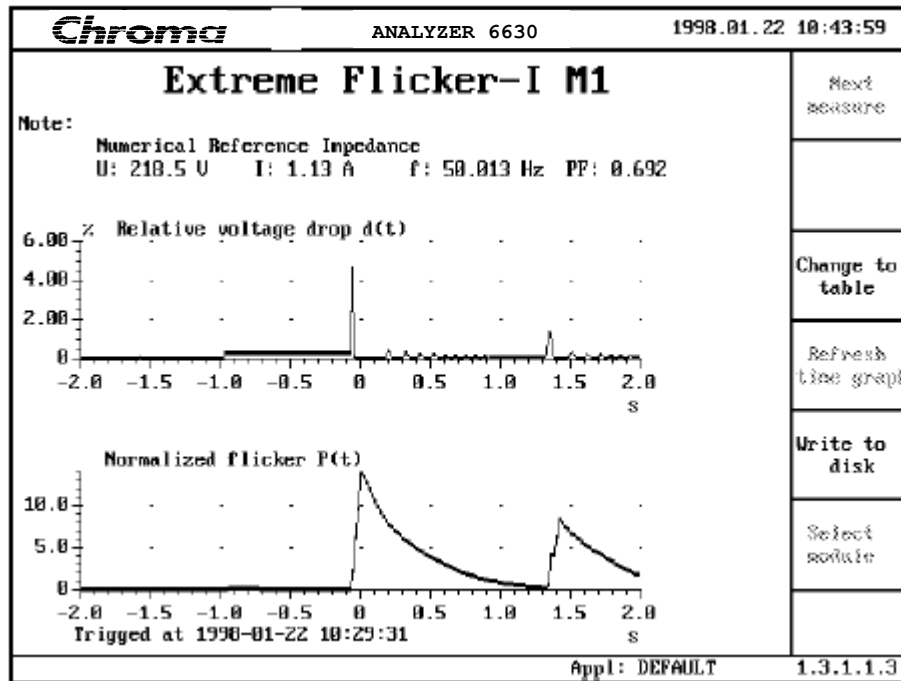


Figure 4-70 Flicker Completed, Extreme Flicker Graph

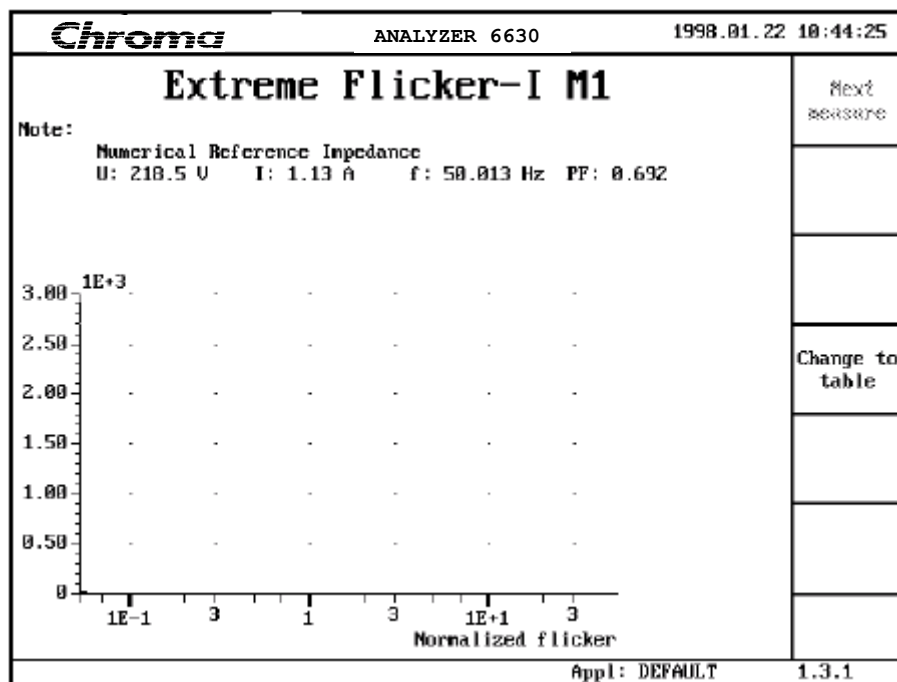



Figure 4-71 Flicker Completed, Normalized Flicker Histogram

Write to disk - 

After the first evaluation is presented, the current result can be saved to disk for export or archival purposes. Insert a diskette and press **Write to disk**. A list of available filenames on the current disk is shown. Select an existing file to append to or enter a new file name using the alpha-numeric function. Press **Save data** and the last measurement result is saved. The file format is in standard dBase DBF format for easy import into spreadsheet software.

Retrieving data

Saved data can be retrieved with the **View Filed data** function on the access page 1.3. Select the preferred file and press **Read file**. A list of selection criteria fields is shown. The selected fields data will be included in the measurement selection display. Use the arrow keys and arrow-enter to select the preferred data types. Each measurement result in a file has one line of information at its disposal. The status line shows how much of the line that is in use with the current selection(s). When the selections have filled the line, further selections will be refused. The available data fields are:

- MAXSWING - dmax
- MAXCHANGE - dc
- MAXTIME - Time that d(t) exceeded the limit
- LONGMAX - Long-term flicker severity
- SHORTSDONE - How many short-terms the data is based on
- SHORTSTODO - How many short-terms missing in data

After selecting data fields, press **Save and continue**. A measurement result selection list with the selected data will be shown. Use the arrow keys to browse through the results and press arrow-enter to select the preferred one followed by **Display data**. The selected measurement is read from disk and shown on the display.

Restart - 

The Restart key can be used to restart the measurement at any time.

Flicker measurements in Triple-Y mode

A flicker measurement in Triple-Y mode is very similar to the single module mode:

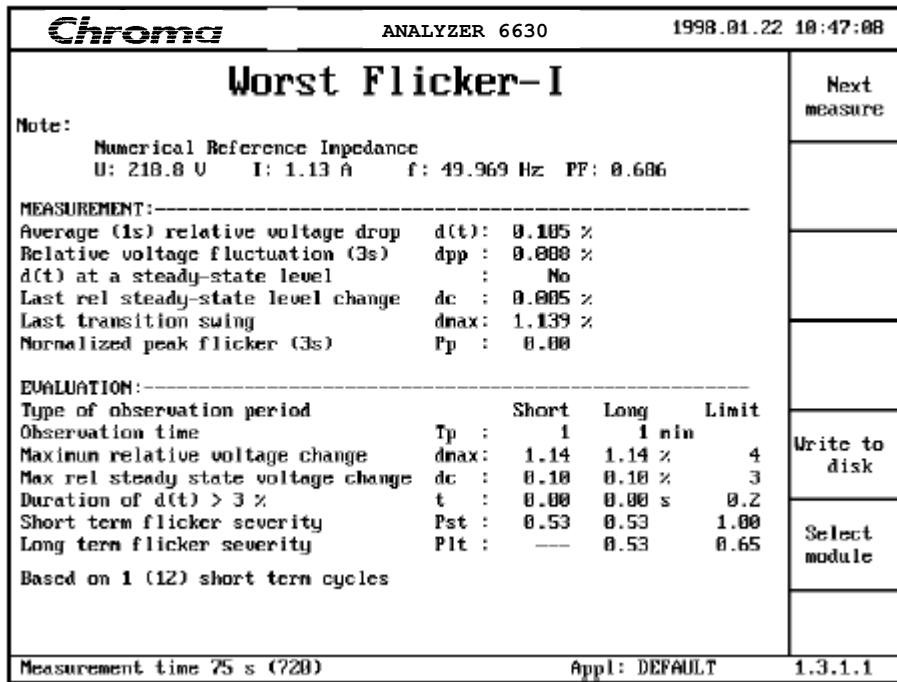


Figure 4-72 Triple-Y Mode Flicker Measurement Started

The figure shows the worst case result display and there are important differences from the single module display:


Each result is the worst case of all source modules.

The information line contains:

- U** The largest result of all modules
- I** The largest result of all modules
- f** Result from module M1
- PF** The smallest result of all modules

Similar to single module measurements, the results so far can be saved as soon as the first evaluation is ready.

See the *Single Module Flicker Measurement* section for a description of the display contents.

Select module - 

This key is used to select the source module of the result data shown on the display. Press it repeatedly to step between each module and the worst case display.

When selecting a module, the display shows the results from the selected module only:

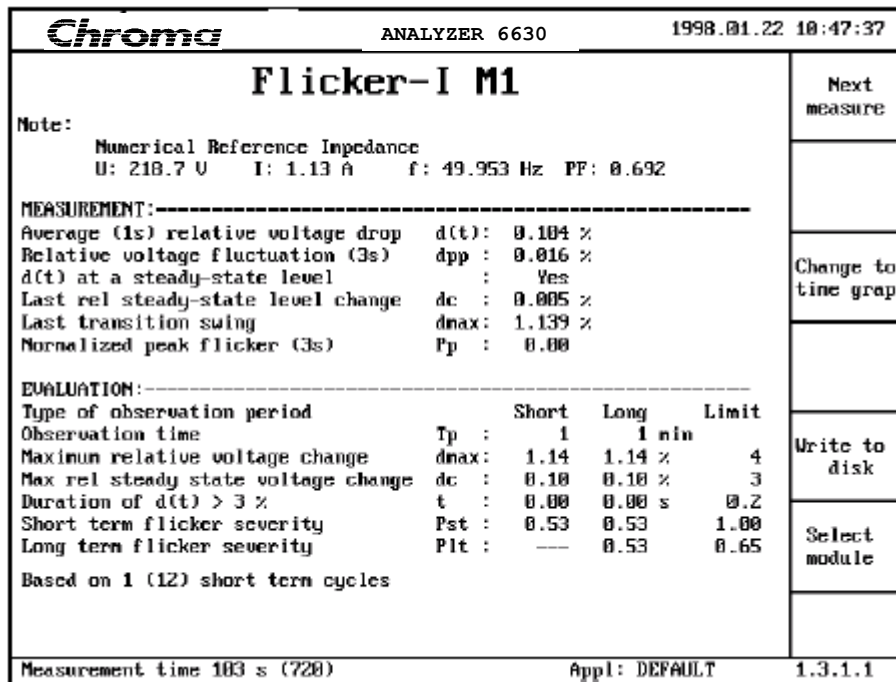


Figure 4-73 Triple-Y Flicker Measurement, Inspecting a Module's Result

Just as in single module measurements, the result display can be changed to time graph by pressing **Change to time graph**.

When the Triple-Y measurement is completed, a final evaluation is done and a passed/not passed test is performed if requested. All modules must be PASSED in order for the function to report PASSED.

Again, the **Select module** can be used to inspect the results from each module, view the time graph around the worst case flicker just as in single module measurements.

Press **Write to disk** to save the results of the completed measurement, including the PASSED/NOT PASSED test.

See the *Single Module Flicker Measurement* section for a description of the displays result contents.

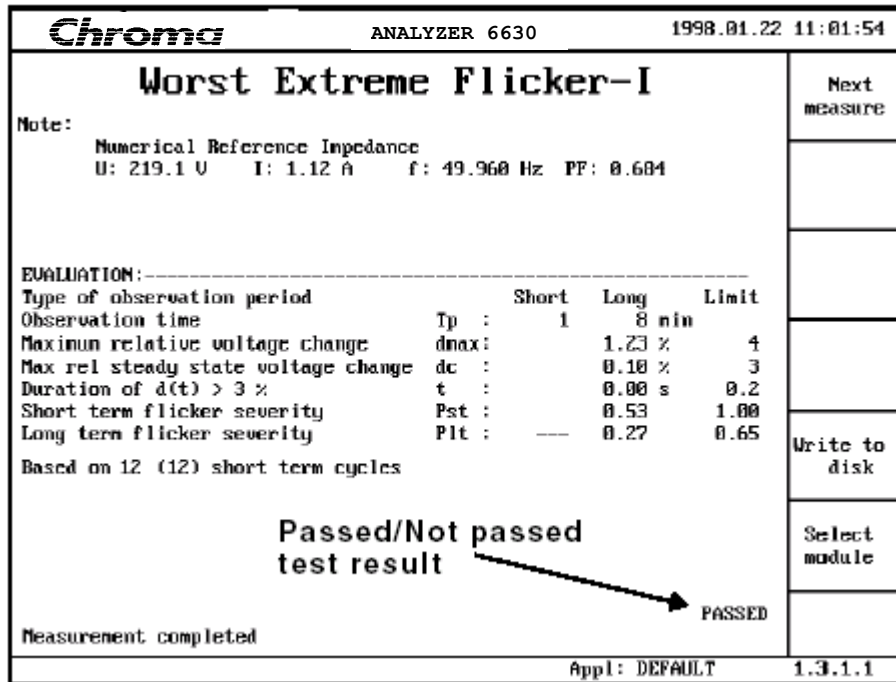


Figure 4-74 Triple-Y Flicker Measurement Completed

4.4.4 Multimeter

Pressing Multimeter from the main menu gets you to the multimeter access page:

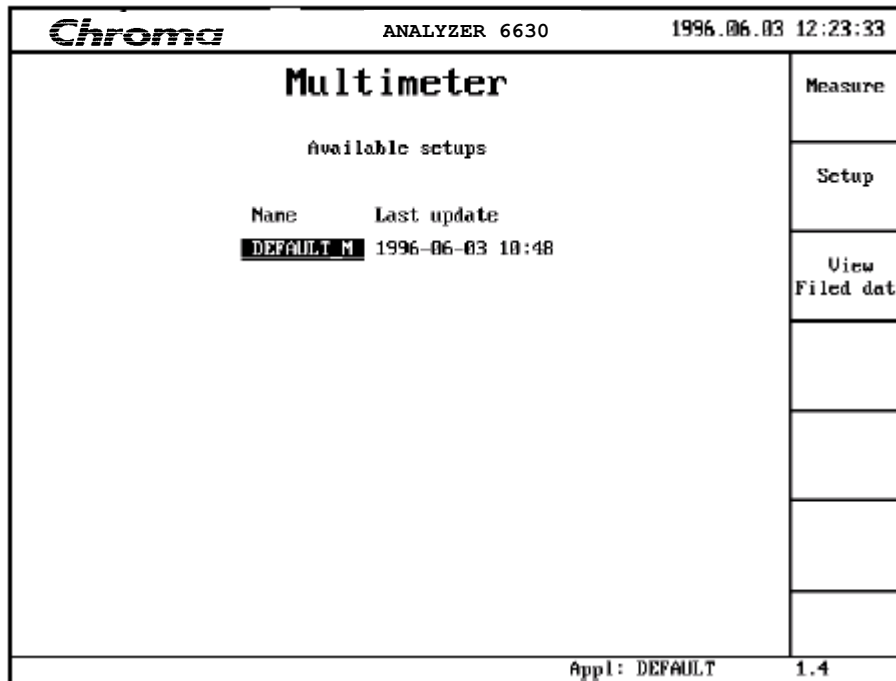


Figure 4-75 Multimeter Access Page

The POWER ANALYZER 6630 multimeter function is a powerful measurement facility, which incorporates up to 6 simultaneous measurements of selectable types. This capability makes it possible with one unit to fulfill needs that would otherwise require up to 6 standalone instruments.

The range of measurable electrical parameters include:

AC

Current	Current Crestfactor
Voltage	Voltage Crestfactor
Frequency	
Active Power	Reactive Power
Apparent Power	Power Factor
Phase Angle	Active Energy
Reactive Energy	Apparent energy
Current THD	Voltage THD

DC

Current	Voltage
Active Power	Active Energy
Charge	

AC and DC

Current	Current Crestfactor
Voltage	Voltage Crestfactor
Frequency	
Active Power	Apparent Power
Power Factor	Active Energy
Apparent energy	Charge
Current THD	Voltage THD

The **AC** and **AC** and **DC** parameters can be presented in the following ways:

- RMS
- Peak +
- Peak -
- Peak to Peak

4.4.4.1 Multimeter Configuration

Pressing Setup from the multimeter access page 1.4 gets you to the Multimeter Setup access page:

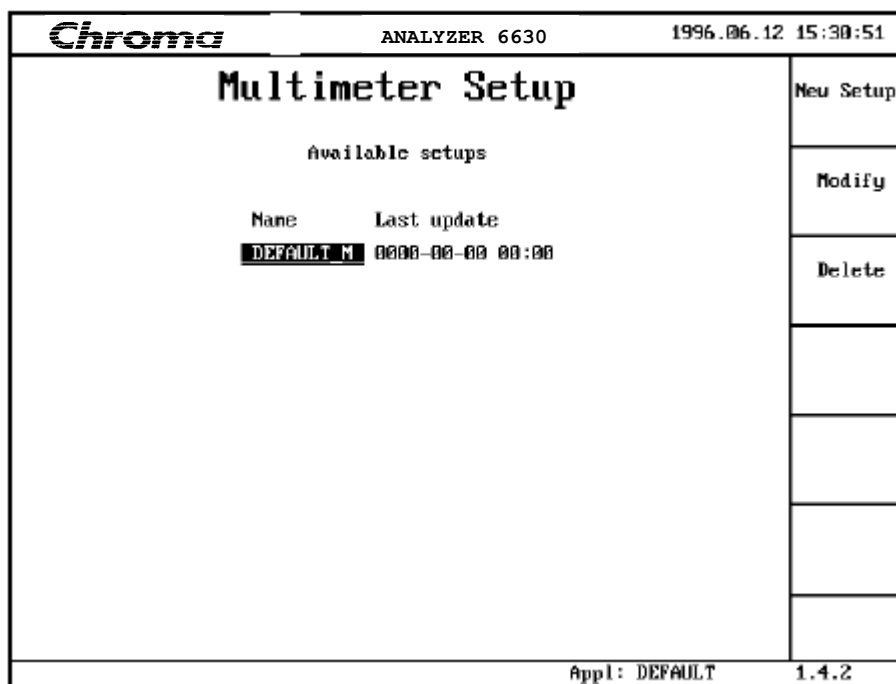


Figure 4-76 Multimeter Setup Access Page

Creating, modifying and deleting a setup is described in section 4.3 *Understanding the Setup System*.

Figure 4-77 shows the first page of the multimeter parameters. Each of the six meters has a row, which is numbered from 1 to 6. Each row contains a variable amount of parameters to configure the measurement. The number of available parameters depends on each other, for example, when selecting **DC** coupling the **Property** parameter disappears since there is no point in being able to select **Peak to Peak** for a DC signal. The amount of choices in a parameter varies for the same reason, for example when selecting DC coupling it is not possible to measure reactive parameters such as reactive power.

Name

Sets the name of the multimeter setup. A setup is a part of an application, which can contain up to six setups. See section 4.3 *Understanding the Setup System*.

Input

This parameter is only available when the instrument is in **Discrete** mode (see description of instrument application setup 4.4.1.2) and is used to select the data source. With a maximum of three installed modules in the instrument, **M1**, **M2** and **M3** can be selected. In addition to physical input modules, the results from predefined formulas, **Formula #1** and **Formula #2**, described in section 4.4.1.2 can also be used.

Mode

Mode selects which type of ‘coupling’ or components of the signal that should be included in the measurement. The available choices are:

AC	AC component only
DC	DC component only
AC and DC	AC and DC component

Parameter

Selects a measurement parameter. The available choices depends on the **Mode** setting as follows:

	<u>AC</u>	<u>DC</u>	<u>AC and DC</u>	
Skip	Yes	Yes	Yes	Disable ^①
Current	Yes	Yes	Yes	Current, I
Crestfactor I	Yes	No	Yes	Crestfactor of current
Frequency I	Yes	No	Yes	Frequency, I, Hz ^②
Voltage	Yes	Yes	Yes	Voltage, U
Crestfactor U	Yes	No	Yes	Crestfactor of voltage
Frequency U	Yes	No	Yes	Frequency, U, Hz ^②
Active power	Yes	Yes	Yes	Active power, W
Reactive power	Yes	No	No	Reactive power, var
Apparent power	Yes	No	Yes	Apparent power, VA
Power factor	Yes	No	Yes	Power factor
Phase angle	Yes	No	No	Phase angle, degrees
Active energy	Yes	Yes	Yes	Active energy, Wh
Reactive energy	Yes	No	No	Reactive energy, varh
Apparent energy	Yes	No	Yes	Apparent energy, VAh
Charge	No	Yes	Yes	Charge, Ah
THD I	Yes	No	Yes	THD, I, %
THD U	Yes	No	Yes	THD, U, %
Empty line	Yes	Yes	Yes	^③

^① Disables the meter. The result display will not contain any data from the meter.

^② Independent of the setting of the **Frequency source** parameter.

^③ The meter will only reserve space on the result display, no measurements are done.

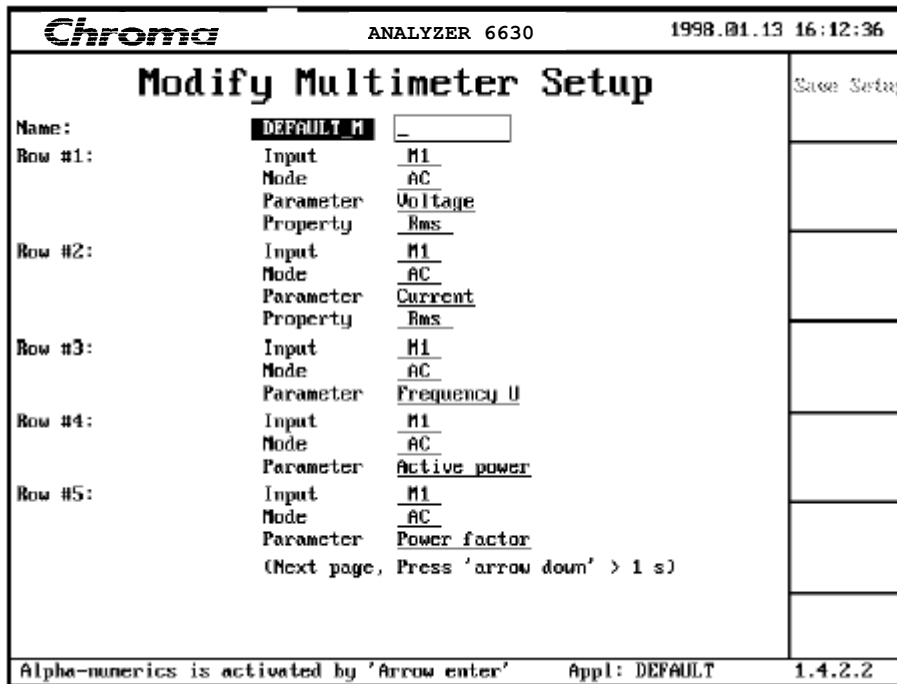


Figure 4-77 Multimeter Parameters, Page 1

Property

Selects the type of result presented. This parameter is only available with **Voltage** or **Current** selected with **Parameter** together with **AC** and **AC and DC** coupling selected by **Mode**.

Available choices are:

- Rms r.m.s. results
- Peak+ Positive peak results
- Peak- Negative peak results
- PeakPeak Peak to peak results

Result

Selects result presentation for triple-Y measurements and is only available when triple-Y measurements are selected with the **Modules** parameter in the Application parameters page 1.1.2.2. See section 4.4.1.2.

The available choices, depending on the **Parameter** setting, are:

- Mean of 3 A single mean value from the three modules is presented
- Sum of 3 A single sum from the three modules is presented
- Split into 3 Each value from the three modules is presented as a separate result

NOTE:

Power and energy calculations are valid only for Y-mode connected loads. See section 4.5 for more information.

Figure 4-78 shows the second multimeter parameter page:

Chroma		ANALYZER 6630		1998.01.13 16:13:05	
Modify Multimeter Setup					
(Previous page, Press 'arrow up' > 1 s)					
Row #6:	<u>Input</u>	<u>M1</u>		<u>M1</u>	
	Node	<u>AC</u>			
	Parameter	<u>Crestfactor 1</u>			
Frequency method:	<u>Autocorrelation</u>			<u>Level crossing</u>	
Measurement window:	<u>1.0 s</u>				
Windows in mean:	<u>5</u>				
Window type:	<u>Fixed</u>			<u>Adapted to fundamental</u>	
Frequency source:	<u>Voltage</u>			<u>Current</u>	
Fast follow:	<u>Yes</u>			<u>No</u>	
Fast f. threshold:	<u>1 %</u>				
Current range:	<u>M1</u>	<u>Auto</u>			
	<u>M2</u>	<u>Auto</u>			
	<u>M3</u>	<u>Auto</u>			
Voltage range:	<u>M1</u>	<u>Auto</u>			
	<u>M2</u>	<u>Auto</u>			
	<u>M3</u>	<u>Auto</u>			
Pan by 'Arrow left' and 'Arrow right' key		Appl: DEFAULT		1.4.2.2	

Figure 4-78 Multimeter Parameters, Page 2

Frequency method

Selects the method used for frequency measurements.

Autocorrelation selects a method that very simplified can be described as an image comparison method. A snapshot is taken of the signal, which is then compared with following snapshots. When a 'most likely' snapshot is found, the time offset from the original snapshot to the place where a match where found is used to calculate the frequency. This is the default and most accurate method of frequency measurements but is sensitive to amplitude modulation. If the signal is amplitude modulated more than a few percents, this method is not recommended.

Level crossing

This method is an intelligent zero crossing detection function. A zero crossing detector works fine with signals of known characteristics such as sine and square which have distinctive zero crossings but with signals of unknown shapes the zero crossing method is not stable enough.

The level crossing method, just as zero crossing, measures the time between level crossings but to avoid the problems with fixed level, the signal is analyzed to find a level where the signal is of high derivative, which produces distinct crossings.

Measurement window

Sets the measurement window time over which a measurement is done. For example, a measurement window time of 2 second would cause 100 periods of a 50Hz signal to be included in a single result. Can be set to 0.5, 1.0 and 2.0 seconds. Default is 1 second.

NOTE: 0.5 seconds only works with the high performance DSP module.

Windows in mean

Tells the instrument to calculate the mean of the chosen number of measurement windows.

Mean measurements are made with a circular buffer, which is updated with measurement window period results. When a new result is ready, the oldest one is discarded to make room for the new one and a new mean value is calculated.

For example, if **Measurement window** is set to 1 second and this parameter is set to 5, each mean measurement will be over 5 seconds but the result is updated every 1 second. Can be set between 1 and 10. Setting this parameter to 1 disables the mean function and fast follow function. Default is 5. Also see **Fast follow**.

Window type

Selecting **Fixed** will set the measurement window length to be exactly the time specified by the **Measurement window** parameter. This may cause result fluctuations if the signals fundamental frequency is not evenly divided with the window time. **Fixed** has the advantage of being continuous in time, which is needed when measuring accumulated parameters such as energy and charge.

NOTE!

Always select **Fixed** when measuring energy and charge.

When selecting **Adapted to fundamental** the instrument will use the signals fundamental frequency to adjust the measurement window length. This reduces the measurement errors by eliminating fractions of periods. It does however depend on accurate frequency measurements.

Frequency source

Selects which source, **Voltage** or **Current** that is used for measurement synchronization. All multimeter measurements depend on the ability to determine the source fundamental frequency correctly. See the **Window type** parameter for more information.

The default and normally preferred choice is **Voltage** because the voltage signal is mostly 'cleaner'. Select **Current** in cases where a voltage signal is unavailable or unstable.

In all cases, the frequency measurement source is input module 1.

Fast follow

This function is only available when the mean function is active and is used to follow rapid level changes that would otherwise be delayed in mean calculations over longer periods. Setting this parameter to **No** will disable the function, which means that measurements will be done as described in the **Windows in mean** parameter.

Setting this parameter to **Yes** will start a span check of the circular mean buffer. As long as the span falls within a preset limit (see **Fast f. threshold**), normal mean calculations as described in the **Windows in mean** parameter is done. If the signal falls outside of the set limit, the circular buffer is flushed to reflect the new level and the mean measurement is restarted.

Fast f. threshold

Sets the limit for the fast follow function described in the **Fast follow** parameter. It is

entered as a percentage of the mean of the maximum span in the mean buffer using the following formula,

$$FF_{Threshold} = \frac{Buffer_{Max} - Buffer_{Min}}{(Buffer_{Max} + Buffer_{Min}) / 2}$$

Can be set between 0.10% and 10.00%. Default is 1%.

Current range

Sets the measurement range for the selected modules, M1, M2 or M3, current input. The default **Auto** selects an automatic range setting during measurements. The following selections sets a fixed range:

300 Ap	300A peak
100 Ap	100A peak
30 Ap	30A peak
10 Ap	10A peak
3 Ap	3A peak
1 Ap	1A peak
0.3 Ap	0.3A peak
0.1 Ap	0.1Apk

Voltage range

Selects the measurement range for the selected modules, M1, M2 or M3, voltage input. The default **Auto** selects an automatic range setting at each measurement. The following selections sets a fixed range:

2000 Vp	2000V peak
600 Vp	600V peak
200 Vp	200V peak
60 Vp	60V peak
20 Vp	20V peak
6 Vp	6V peak

4.4.4.2 Multimeter Measurements

Pressing Measure at the multimeter access page 1.4 starts the measurements:

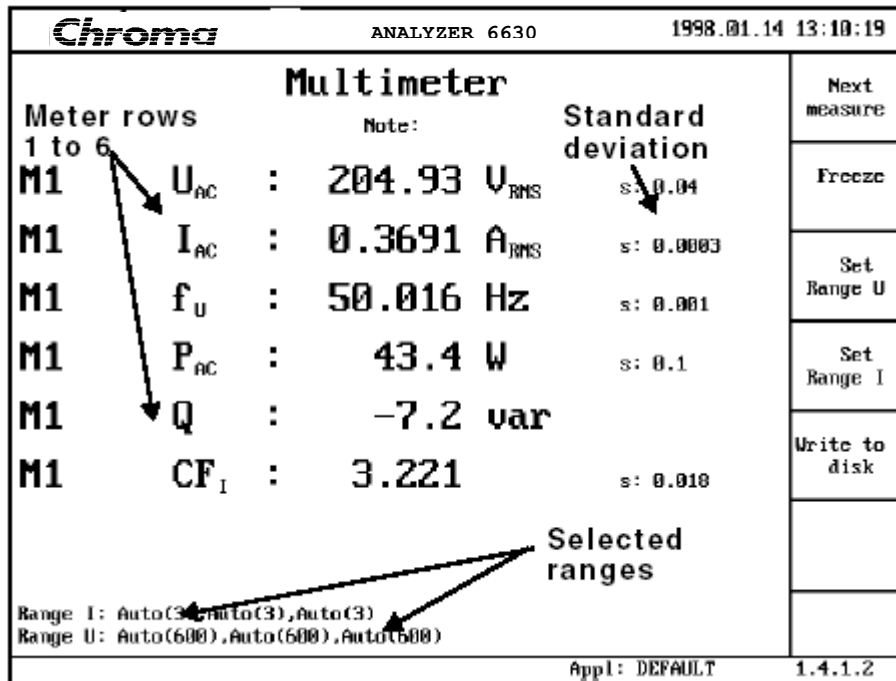


Figure 4-79 Multimeter Result Page, Single Source

Figure 4-79 shows a result page for a single module measurement with all six meters in use. Each row contains input indicator, the measured parameter together with result and unit. The result update rate is controlled by the **Measurement window** parameter.

If mean measurements are used an estimated standard deviation figure is presented for each meter's result as soon as the mean buffer is filled. This figure is derived through the following formula,

$$s = \sqrt{\frac{\sum_{N=1}^N (X_N - \mu)^2}{N - 1}}$$

where,

- s Estimated standard deviation
- N Number of samples as defined by the **Windows in mean** parameter
- X Sample in mean buffer
- μ Mean of buffer

When using the fast follow function, the presence of the estimated standard deviation result can be used to check the fast follow state, as soon as a steady state is acquired, the result will be presented.

The range information displays the currently select measurement range for voltage and current.

Set Range U / Set Range I - ◀

The measurement ranges can be changed directly at the result page without returning to the setup page. By pressing a Set Range softkey an input field is presented:

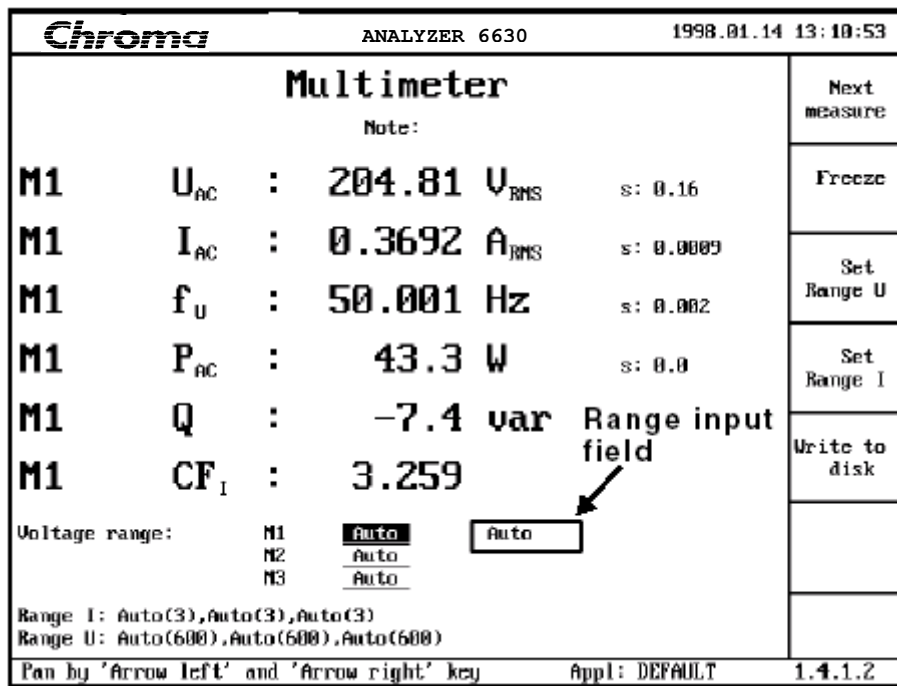


Figure 4-80 Multimeter Result Page, Changing Measurement Range

Use the arrow keys in the normal way to select input module and desired range. The new setting will be reflected on the display.

NOTE

This is a volatile range change. It will not be reflected in the setup.

Figure 4-74 shows a result display of triple-Y measurements with the three presentation methods Mean of 3, Sum of 3 and Split into 3 represented.

Freeze / Continue -

Freeze stops the display updating so results can be examined or printed without interference. Press **Continue** to resume measurements.

Restart -

Clears all buffers and restarts the measurements from scratch.

Write to disk -

During measurements the results can be saved to disk for export or archival purposes. Insert a diskette and press **Write to disk**. A list of available filenames on the current disk is shown. Select an existing file to append to or enter a new file name using the alphanumeric function. Press **Save data** and the last measurement result is saved. The file format is in standard dBase DBF format for easy import into spreadsheet software.

Retrieving data

Saved data can be retrieved with the **View Filed data** function on the access page 1.4. Select the preferred file and press **Read file**. A list of selection criteria fields is shown. The selected fields data will be included in the measurement selection display. Use the arrow keys

and arrow-enter to select the preferred data types. Each measurement result in a file has one line of information at its disposal. The status line shows how much of the line that is in use with the current selection(s).

Chroma		ANALYZER 6630		1998.01.14 13:07:51	
Multimeter M1 M2 M3					Next measure
Note:					
U_{AC}	: 205.06	221.45	221.38	U_{RMS}	Freeze
(Mean)	U_{AC}	: 215.97	U_{RMS}	s: 0.05	Set Range U
P_{AC}	: 43.5	50.3	50.2	W	Set Range I
(Sum)	P_{AC}	: 143.9	W	s: 0.0	Write to disk
Range I: Auto(3,3,3 Ap)					
Range U: Auto(600,600,600 Up)					
Appl: DEFAULT					1.4.1.2

Figure 4-81 Multimeter Result Page, True Three Phase

When the selections have filled the line, further selections will be refused. The available data fields are:

- DATE - date of data
- TIME - time of data
- NAME - name of setup
- OBJECTNOTE - Application Note field in the main menu

After selecting data fields, press **Continue**. A measurement result selection list with the selected data will be shown. Use the arrow keys to browse through the results and press arrow-enter to select the preferred one followed by **Display data**. The selected measurement is read from disk and shown on the display.

4.4.5 Recording

Pressing Recording from the main menu gets you to the recording access page:

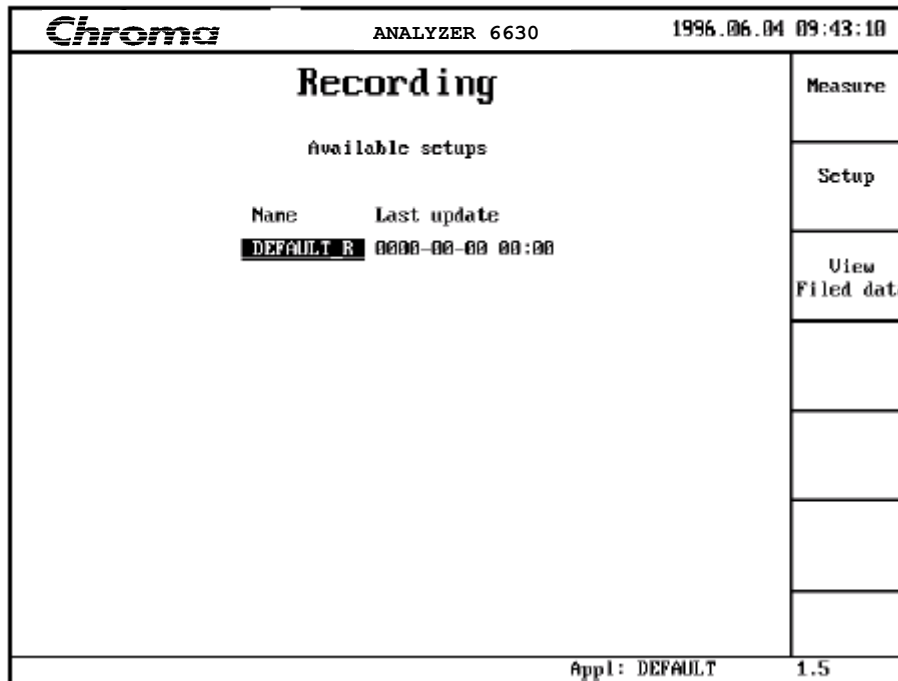


Figure 4-82 Recording Access Page

The recording function is a powerful digital data logger that is capable of simultaneous recording of up to 3 electrical parameters. The range of parameters include:

AC

- Current
- Voltage
- Frequency
- Active Power
- Apparent Power
- Phase Angle
- Current THD
- Current Crestfactor
- Voltage Crestfactor
- Reactive Power
- Power Factor
- Voltage THD

DC

- Current
- Active Power
- Voltage

AC and DC

- Current
- Voltage
- Active Power
- Power Factor
- Current THD
- Current Crestfactor
- Voltage Crestfactor
- Apparent Power
- Voltage THD

The **AC** and **AC and DC** parameters can be presented in the following ways:

- RMS
- Peak +
- Peak -
- Peak to Peak

4.4.5.1 Recording Configuration

Pressing Setup from the recording access page 1.5 gets you to the Recording Setup access page:

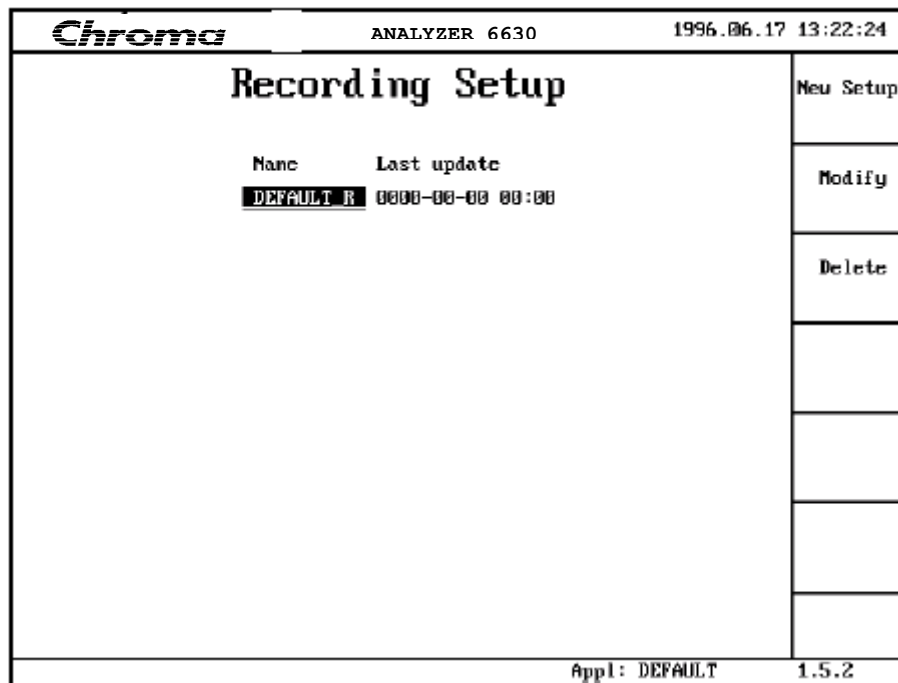


Figure 4-83 Recording Setup Access Page

Creating, modifying and deleting a setup are described in section 4.3 *Understanding the Setup System*.

Figure 4-84 shows the first page of the recording parameters. Each of the three recorder channels has a row, which is numbered from 1 to 3. Each row contains a variable amount of parameters to configure the measurement. The number of available parameters depends on each other, for example, when selecting **DC** coupling the **Property** parameter disappears since there is no point in being able to select **Peak to Peak** for a DC signal. The amount of choices in a parameter varies for the same reason, for example when selecting DC coupling it is not possible to measure reactive parameters such as reactive power.

Name

Sets the name of the multimeter setup. A setup is a part of an application, which can contain up to six setups. See section 4.3 *Understanding the Setup System*.

Time window

Specifies the recorder window size. The recorder window is the part of a recording that is retained in the instrument and is visible in result display graph. It contains 480 samples, i.e. measurements results. To get the recorder sample period time or sample rate, divide the selected time with 480. For example, an 8-minute window would give a sample rate of 1 per second. **Time window** can be set to **8min**, **15min**, **30min**, **1h**, **2h**, **4h**, **8h** and **24h**. Default is **8min**.

Type of diagrams

Selects the type of graph presentation of samples. Two types of presentations can be chosen, **Mean** which is the mean of all data during a sample period and **Min-Max**, which is the maximum difference of data during a sample period. Default is **Mean**. Source or Input The parameter is called **Source** in triple-Y mode as selected with the Modules parameter in the Application parameters page 1.1.2.2. See section 4.4.1.2.

The available choices are:

M1	Input module 1 as source
M2	Input module 2 as source
M3	Input module 3 as source
Formula #1	Formula 1 as source
Formula #2	Formula 2 as source
Mean of 3	A single mean value from the modules is presented

The parameter is called **Input** in discrete mode as selected with the **Modules** parameter in the Application parameters page 1.1.2.2. See section 4.4.1.2.

This parameter is used to select the data source. With a maximum of three installed modules in the instrument, **M1**, **M2** and **M3** can be selected. In addition to physical input modules, the results from predefined formulas, **Formula #1** and **Formula #2**, described in section 4.4.1.2 can also be used.

Mode

Mode selects which type of ‘coupling’ or components of the signal that should be included in the measurement. The available choices are:

AC	AC component only
DC	DC component only
AC and DC	AC and DC component

Parameter

Selects a measurement parameter. The available choices depends on the **Mode** setting as follows:

	<u>AC</u>	<u>DC</u>	<u>AC and DC</u>	
Skip	Yes	Yes	Yes	Disable ^①
Current	Yes	Yes	Yes	Current, I
Crestfactor I	Yes	No	Yes	Crestfactor of current
Frequency I	Yes	No	No	Frequency, I, Hz ^②
Voltage	Yes	Yes	Yes	Voltage, U
Crestfactor U	Yes	No	Yes	Crestfactor of voltage
Frequency U	Yes	No	No	Frequency, U, Hz ^②
Active power	Yes	Yes	Yes	Active power, W
Reactive power	Yes	No	No	Reactive power, var
Apparent power	Yes	No	Yes	Apparent power, VA
Power factor	Yes	No	Yes	Power factor

Phase angle	Yes	No	No	Phase angle, degrees
THD I	Yes	No	Yes	THD I, %
THD U	Yes	No	Yes	THD U, %

- ① Disables the channel. The result display will not contain any data from this channel.
- ② Independent of the setting of the **Frequency source** parameter.

Property

Selects the type of result presented. This parameter is only available with **Voltage** or **Current** selected with **Parameter** together with **AC** and **AC and DC** coupling selected by **Mode**.

Available choices are:

Rms	r.m.s. results
Peak+	Positive peak results
Peak-	Negative peak results
PeakPeak	Peak to peak results

Y-axis

Selects the Y-axis presentation in the result display graph. **Full range** will set the Y-axis start to 0 while the end is dynamically changed according to the recorded peak data in the recording window. **Interval** shows a Y-axis interval, which is dynamically controlled by the recorded data's min-max span.

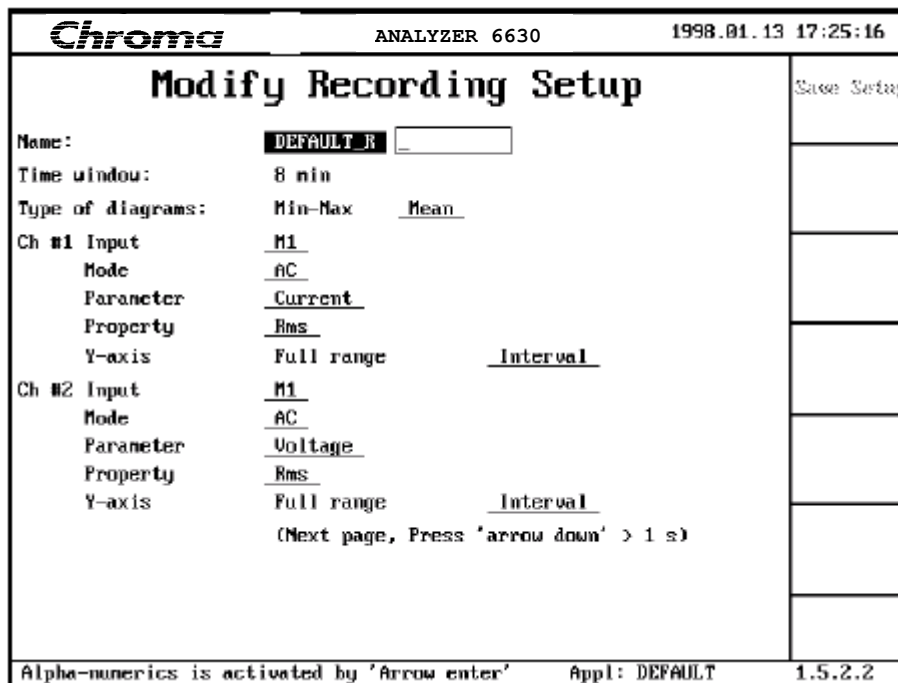


Figure 4-84 Recording Parameters Page 1

Ch #3 Mode		AC	AC
Parameter		Skip	
Y-axis		Full range	Interval
Frequency source:		Voltage	Current
Frequency method:		Autocorrelation	Level crossing
Measurement window:		1 s	
Window type:		Fixed	Adapted to fundamental
Roll mode:		On	Off
Current range:		Auto	
Voltage range:		Auto	

Chroma ANALYZER 6630 1996.06.04 10:55:51

Modify Recording Setup

(Previous page, Press 'arrow up' > 1 s)

Save Setup

Pan by 'Arrow left' and 'Arrow right' key Appl: DEFAULT 1.5.2.2

Figure 4-85 Recording Parameters, Page 2

Figure 4-85 shows the second recording parameter page.

Frequency method

Selects the method used for frequency measurements.

Autocorrelation selects a method that very simplified can be described as an image comparison method. A snapshot is taken of the signal, which is then compared with following snapshots. When a 'most likely' snapshot is found, the time offset from the original snapshot to the place where a match where found is used to calculate the frequency. This is the default and most accurate method of frequency measurements but is sensitive to amplitude modulation. If the signal is amplitude modulated more than a few percents, this method is not recommended.

Level crossing

This method is an intelligent zero crossing detection function. A zero crossing detector works fine with signals of known characteristics such as sine and square which have distinctive zero crossings but with signals of unknown shapes the zero crossing method is not stable enough. The level crossing method, just as zero crossing, measures the time between level crossings but to avoid the problems with fixed level, the signal is analyzed to find a level where the signal is of high derivative, which produces distinct crossings.

Measurement window

Sets the measurement window time over which a measurement is done. For example, a measurement window time of 2 second would cause 100 periods of a 50Hz signal to be included in a single result. Can be set between 0.80 and 5.00 seconds. Default is 1 second.

Window type

Selecting **Fixed** will set the measurement window length to be exactly the time specified by the **Measurement window** parameter. This may cause result fluctuations if the signals

fundamental frequency is not evenly divided with the window time. **Fixed** has the advantage of being continuous in time, which is needed when measuring accumulated parameters such as energy and charge.

When selecting **Adapted to fundamental** the instrument will use the signals fundamental frequency to adjust the measurement window length. This reduces the measurement errors by eliminating fractions of periods. It does however depend on accurate frequency measurements.

Frequency source

Selects which source, **Voltage** or **Current** that is used for measurement synchronization. All multimeter measurements depend on the ability to determine the source fundamental frequency correctly. See the **Window type** parameter for more information.

The default and normally preferred choice is **Voltage** because the voltage signal is mostly 'cleaner'. Select **Current** in cases where a voltage signal is unavailable or unstable.

In all cases, the frequency measurement source is input module 1.

Roll mode

Selects whether the recording should stop or continue when the recording window is filled. Selecting **On** will cause the recorder to continue 'forever' which means that the oldest sample is lost to make room for the newest one. With **Off** selected the recorder will stop once the recording window is filled.

Current range

Sets the measurement range for the selected modules, M1, M2 or M3, current input. The default **Auto** selects an automatic range setting during measurements. The following selections sets a fixed range:

300 Ap	300A peak
100 Ap	100A peak
30 Ap	30A peak
10 Ap	10A peak
3 Ap	3A peak
1 Ap	1A peak
0.3 Ap	0.3A peak
0.1 Ap	0.1A peak

When triple-Y measurement is selected, the setting cannot be made individually for each module, the current range is set in all three modules.

Voltage range

Sets the measurement range for the selected modules, M1, M2 or M3, voltage input. The default **Auto** selects an automatic range setting at each measurement. The following selections sets a fixed range:

2000 v_p	2000V peak
600 v_p	600V peak
200 v_p	200V peak
60 v_p	60V peak
20 v_p	20V peak
6 v_p	6V peak

When triple-Y measurement is selected, the setting cannot be made individually for each module, the voltage range is set in all three modules.

4.4.5.2 Recording Measurements

Pressing Measure at the multimeter access page 1.5 starts a recording:

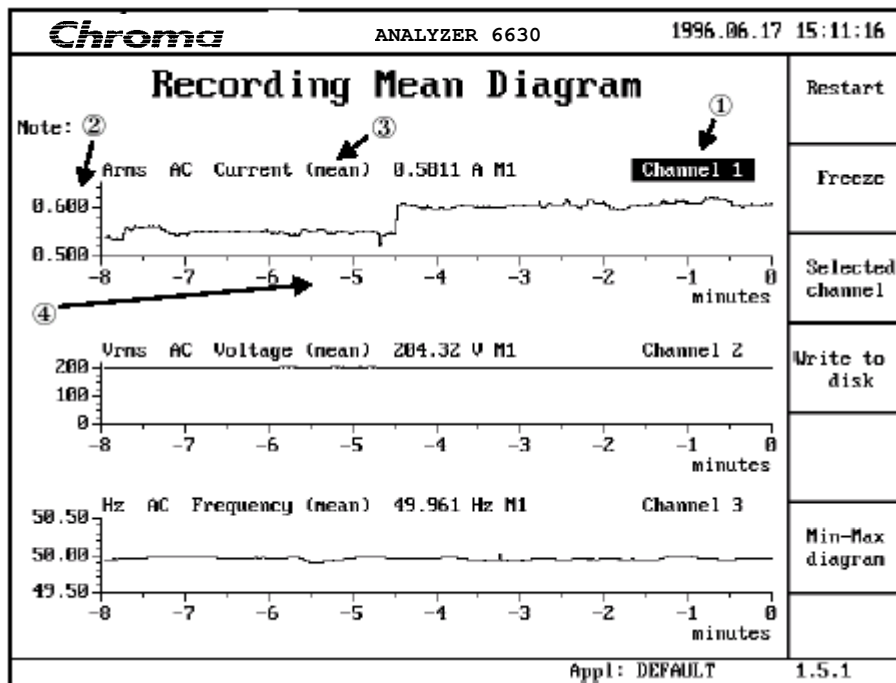


Figure 4-86 Recorder Result Page, Single Source


The channels will be shown as graphs. The top most graph is ① channel 1 and is currently selected which is indicated by the inverse video. The ④ recording window is 8 minutes as shown on the X-axis. The ② Y-axis is configured to show an **Interval** where the axis range is controlled by the min-max span of the recorded data. The ③ information line contains information about what type of data that is recorded, in this case AC coupled Current presented as the r.m.s. value. The presented value, here 0.5811 A, is the mean of the recording window. The last item on the line is the source indicator, in this case the source is input module 1, M1.

Channel 2 shows a **Full range** presentation on the Y-axis.


Freeze / Continue -

This softkey may be used to freeze the display for examination. The recording is still active

in the background so when pressing **Continue** the display will be updated with the new data.

Selected channel / All channels - 

Used to enlarge the presentation of a selected channel. Use the arrow up-down keys to select the preferred channel and press **Selected channel** or arrow enter. The selected channel will be shown alone on the display, which means that the Y-axis will be more readable. Press **All channels** to return to the parallel graphs.

Min-Max diagram / Mean diagram - 

May be used to switch live between the presentation modes described with the **Type of diagrams** parameter.

Restart - 

Restarts the recording.

Write to disk - 

During measurements the results can be saved to disk for export or archival purposes. Insert a diskette and press **Write to disk**. A list of available filenames on the current disk is shown, if any. Select an existing file to append to or enter a new file name using the alpha-numeric function. Press **Save data** and the last measurement result is saved. The file format is in standard dBase DBF format for easy import into spreadsheet software.

Retrieving data

Saved data can be retrieved with the **View Filed data** function on the access page 1.5. Select the preferred file and press **Read file**. A list of selection criteria fields is shown. The selected fields data will be included in the measurement selection display. Use the arrow keys and arrow-enter to select the preferred data types. Each measurement result in a file has one line of information at its disposal. The status line shows how much of the line that is in use with the current selection(s). When the selections have filled the line, further selections will be refused. The available data fields are:

DATE	- date of data
TIME	- time of data
NAME	- name of setup
OBJECTNOTE	- Application Note field in the main menu
COLLECTTIME	- The recording time of the saved data
SAMPLE_SEC	- The measurement time of a recording data sample

After selecting data fields, press **Save and Continue**. A measurement result selection list with the selected data will be shown. Use the arrow keys to browse through the results and press arrow-enter to select the preferred one followed by **Display data**. The selected measurement is read from disk and shown on the display.

4.4.6 Waveform

Pressing Waveform from the main menu gets you to the waveform access page:

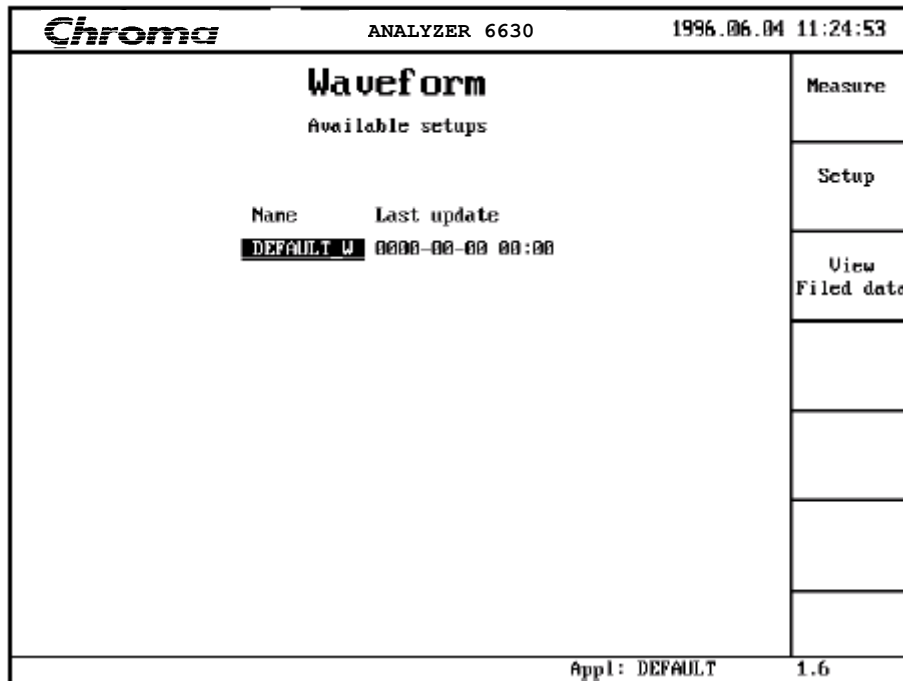


Figure 4-87 Waveform Access Page

The Waveform function is ideal for capturing and viewing events such as inrush current and voltage dropouts.

Its function resembles that of an oscilloscope with two channels available, one for voltage and one for current, powerful programmable trigger and selectable sweep time.

In addition to the oscilloscope functions, it contains a waveshape test function, which is a classification tool for the IEC 1000-3-2 harmonics standard.

After capturing an event, on-screen cursors can be used for detailed examination of the signal.

4.4.6.1 Waveform Configuration

Pressing **Setup** from the waveform access page 1.6 gets you to the Waveform Setup access page:

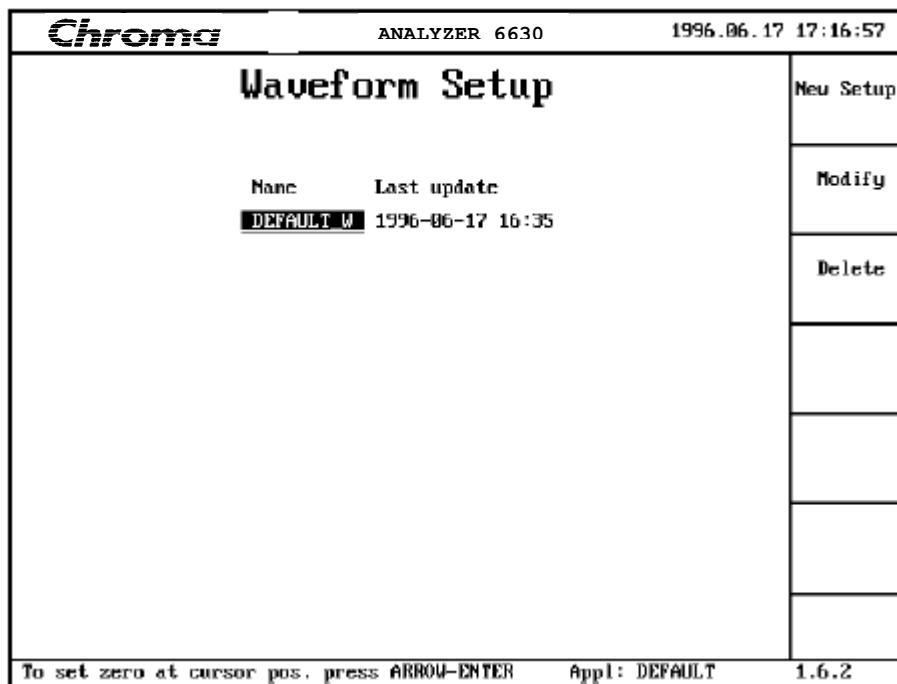


Figure 4-88 Waveform Setup Access Page

Creating, modifying and deleting a setup is described in section 4.3 *Understanding the Setup System*. Figure 4-82 shows the waveform parameters.

Name

Sets the name of the multimeter setup. A setup is a part of an application, which can contain up to six setups. See section 4.3 *Understanding the Setup System*.

Frequency source

Selects which source, **Voltage** or **Current**, that is used for frequency determination. Besides frequency measurements, all waveform measurements depend on the ability to determine the source fundamental frequency correctly. The default and normally preferred choice is **Voltage** because the voltage signal is mostly ‘cleaner’. Select **Current** in cases where a voltage signal is unavailable or unstable.

Number of periods

Selects the number of periods to display. Selecting low amounts of periods will enhance high frequency details on the display but reduce the time length of the displayed data. Selecting higher number of periods will invert this effect, high frequency components are lost but signals over a longer period of time will be captured making it possible to view signal envelopes.

Chroma		ANALYZER 6630		1998.01.14 10:42:30	
Modify Waveform Setup					
Name:	DEFAULT W				
Frequency source:	<u>Voltage</u>	Current			
Number of periods:	<u>2</u>	4	8	16	
Test of waveshape:	No	User def		<u>IEC1000-3-2</u>	
Min fraction of samples inside envelope for class D:					
95 %					
Trig source:	U-sample				
Trig slope:	Falling				
Trig level:	0 V				
Trig position:	50%				
Source:	<u>M1</u>	M2	M3		
Current range:	Auto				
Voltage range:	Auto				
Alpha-numerics is activated by 'Arrow enter' Appl: DEFAULT 1.6.2.2					

Figure 4-89 Waveform Setup Access Page

Test of waveshape

A test function of waveshape according to the IEC 1000-3-2 harmonics standard can be enabled with this parameter. Selecting **No** will disable the test. Selecting **User define** makes it possible to alter the minimum fraction of samples inside the envelope to fit class D and selecting **IEC1000-3-2** will make the test strictly according to the standard.

Min fraction of samples inside envelope for class D

Sets the waveshape test limit. Is only available for modification when **Test of waveshape** is set to **User define**. Default and standard is 95%.

Trig source

Selects the trigger type. The waveform function has an intelligent trigger to aid in capturing special events such as dropouts. The trigger has two modes, a sample level mode and a half-period rms value mode. The sample level mode is comparable to a traditional oscilloscope level trigger:

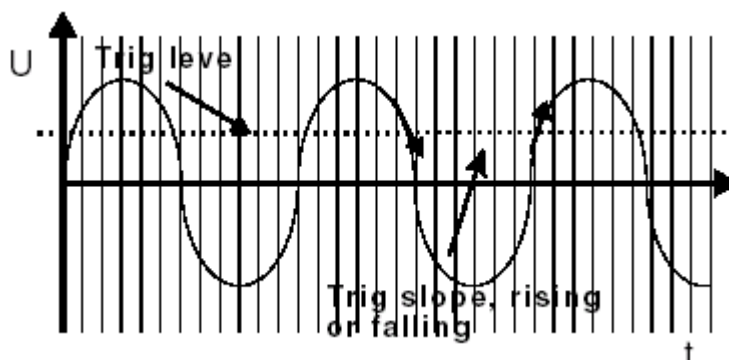


Figure 4-90 Waveform Sample Level Trigger

The rectified half-period rms trigger is used where the sample level trigger does not work such as triggering on dropouts:

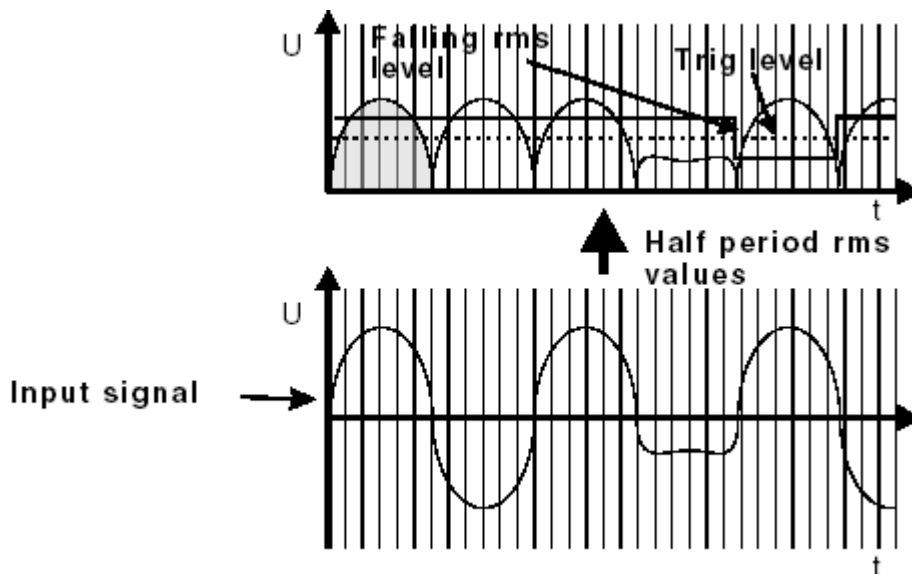


Figure 4-91 Waveform rms Level Trigger

Figure 4-84 shows the rms trigger function with an example of a falling level condition. Triggering on this is very easy, set the trigger level at the steady state level with a little margin and select falling slope.

TIP

Use the multimeter function described in section 4.4.4 to establish the different levels.

Both voltage and current can be used as trigger source. The following selections are available:

None	Trigger disabled, measurements will start immediately
U-Sample	Sample level trigger on voltage
U-Period-rms	Half period rms level trigger on voltage
I-Sample	Sample level trigger on current
I-Period-rms	Half period rms level trigger on current

Trig slope

Selects the polarity of the trigger. Selecting **Falling** will trig when going from a higher level to a lower, selecting **Rising** will trig when going from a lower level to a higher level compared to the set trigger level.

Trig level

Sets the trig level of the voltage or current trig source. If the trigger source is voltage- or current sample the parameter is entered as a peak level. If the trigger source is voltage- or current half period rms the value is entered as a half period rms level.

Trig position

Selects where on the display the trigger point is located. Can be set from left to right with 0%

being extreme left, going through 25%, 50%, 75%, to 100% being extreme right. Source Selects data source. When triple-Y measurements are selected with the **Modules** parameter in the Application parameters page 1.1.2.2, all modules are selected. See section 4.4.1.2.

The available choices are:

M1	Input module 1 as source
M2	Input module 2 as source
M3	Input module 3 as source

Current range

Sets the measurement range for the selected current input. The default **Auto** selects an automatic range setting during measurements. The following selections sets a fixed range:

300 Ap	300A peak
100 Ap	100A peak
30 Ap	30A peak
10 Ap	10A peak
3 Ap	3A peak
1 Ap	1A peak
0.3 Ap	0.3A peak
0.1 Ap	0.1A peak

Voltage range

Selects the measurement range of the selected voltage input. The default **Auto** selects an automatic range setting at each measurement. The following selections sets a fixed range:

2000 vp	2000V peak
600 vp	600V peak
200 vp	200V peak
60 vp	60V peak
20 vp	20V peak
6 vp	6V peak

4.4.6.2 Waveform Measurements

Pressing **Measure** at the waveform access page 1.6 starts a capture:

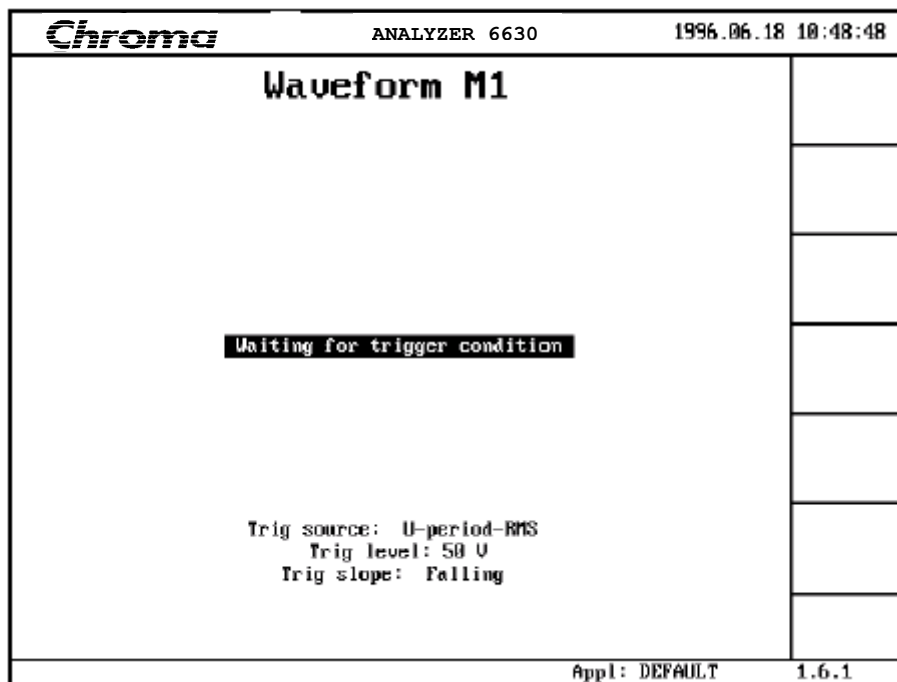


Figure 4-92 Waveform Waiting for Trigger

Figure 4-85 shows the waiting for trigger display with information about the current trigger configuration. The instrument will remain in this state until the trigger is satisfied or the QUIT key is pressed.

If no trigger is active or when the trigger is satisfied, a capture is made and the result is displayed as in figure 4-86. Two graphs are shown, the top one is voltage and below is current. Their respective information line shows the mean value of the signal as seen in the graph, the selected measurement ranges during capture in parentheses and the frequency of the selected frequency source.

Figure 4-86 also illustrates a possible problem. The current signal is as shown clipped. This is because automatic range was selected for the current signal. The instrument has had enough time to adjust the measurement range to the steady state level but had no chance to catch the sudden rise in current, which resulted in that the current peak was lost. The correct way to catch this type of signal is to set a fixed current range, high enough to capture the whole peak.

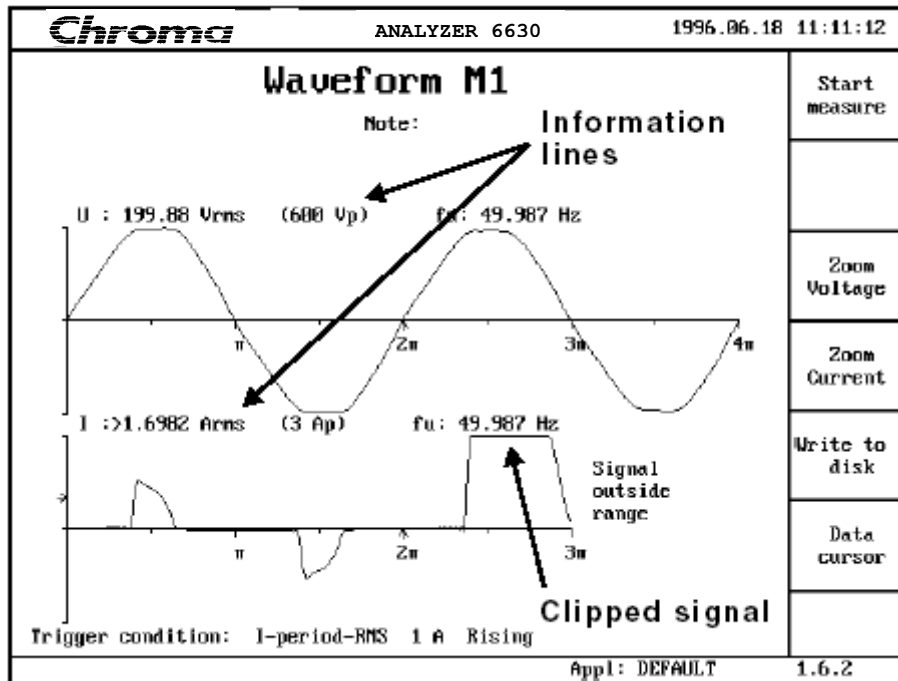


Figure 4-93 Waveforms Captured with Clipped Current

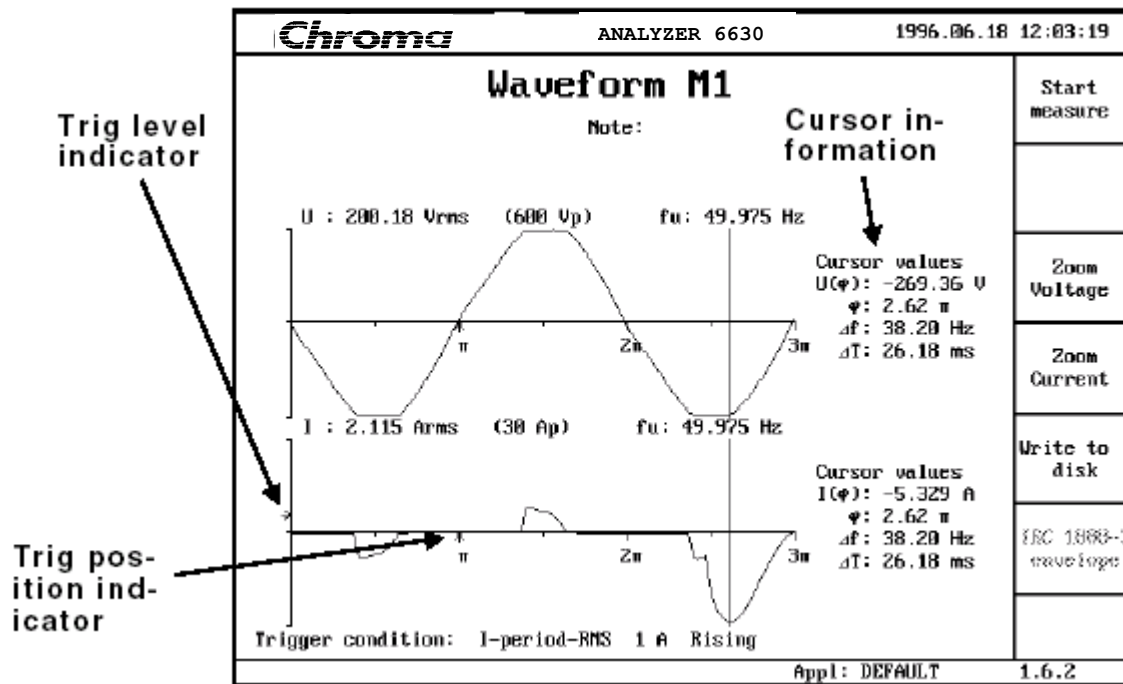



Figure 4-94 Correctly Captured Waveform

Figure 4-94 shows a correctly captured current signal. When no waveshape test is done the data cursors automatically becomes enabled. The cursor information fields are as follows:

- U/I (φ) Sample value
- φ Sample position relative reference point
- Δf The cursor to reference span as frequency
- ΔT The cursor to reference span as time

The cursor is moved with the arrow-left and right keys. Single depressing will move the cursor one sample. To move more rapidly, keep the arrow key depressed until the cursor has moved to the preferred position and then release it. Fine tune the position with single steps.

After a capture, the cursor reference position is automatically set to the trig point. Changing the reference position is done by placing the cursor at the preferred reference position and pressing arrow-enter.

Data cursor / IEC 1000-3-2 envelope - 

Toggles between cursor mode and IEC 1000-3-2 waveshape test mode.

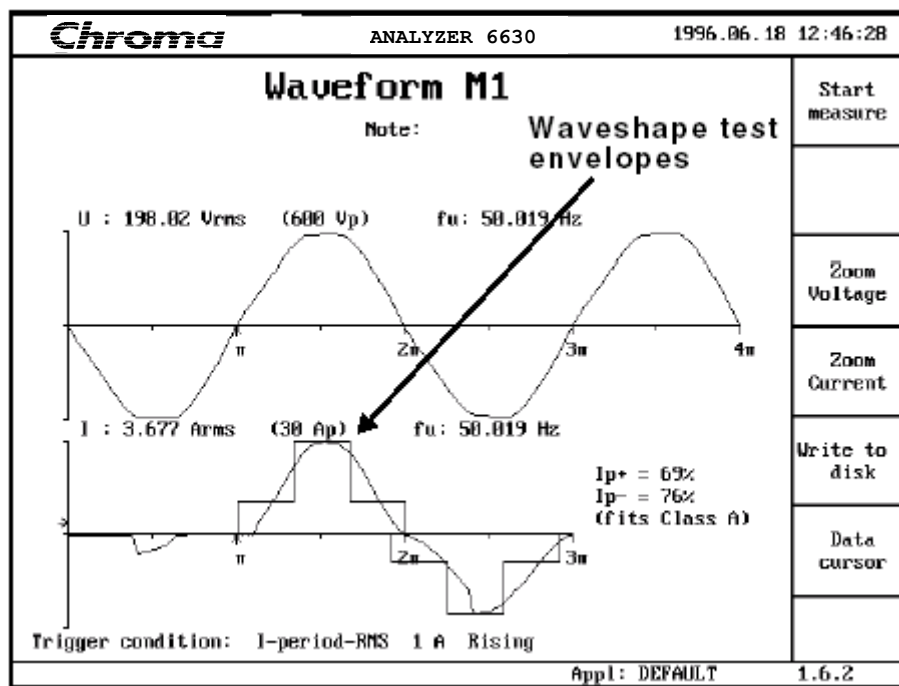



Figure 4-95 Waveforms Captured with Waveshape Test Enabled

Figure 4-95 shows a capture with the IEC 1000-3-2 waveshape test enabled. The test envelopes are as the standard dictates centered on the positive and negative current peaks. POWER ANALYZER 6630 will always center the envelopes on the highest peaks captured. The result of the waveshape test is reported with fitness for the positive and negative peaks together with the resulting harmonics test classification.

Zoom Voltage - 

Zoom Current - 

These softkeys may be used to expand the presentation of voltage or current to full screen. Waveshape test and data cursors are still available. Press QUIT to return to the dual waveform display.

Write to disk - 

After a capture the result can be saved to disk for export or archival purposes. Insert a diskette and press **Write to disk**. A list of available filenames on the current disk is shown. Select an existing file to append to or enter a new file name using the alpha-numeric function. Press **Save data** and the last measurement result is saved. The file format is in standard dBase

DBF format for easy import into spreadsheet software.

Retrieving data

Saved data can be retrieved with the **View Filed data** function on the access page 1.6. Select the preferred file and press **Read file**. A list of selection criteria fields is shown. The selected fields data will be included in the measurement selection display. Use the arrow keys and arrow-enter to select the preferred data types. Each measurement result in a file has one line of information at its disposal. The status line shows how much of the line that is in use with the current selection(s). When the selections have filled the line, further selections will be refused.

After selecting data fields, press **Save and continue**. A measurement result selection list with the selected data will be shown. Use the arrow keys to browse through the results and press arrow-enter to select the preferred one followed by **Display data**. The selected measurement is read from disk and shown on the display.

Start measure -

Starts a new waveform capture.

Waveform measurements in Triple-Y mode

In Triple-Y mode, the Waveform function is works very similar to discrete mode. There are two limitations though, the trigger only works with module 1 and there are no possibilities to save and retrieve data from diskette.

Figure 4-89 shows the result display in Triple-Y mode:

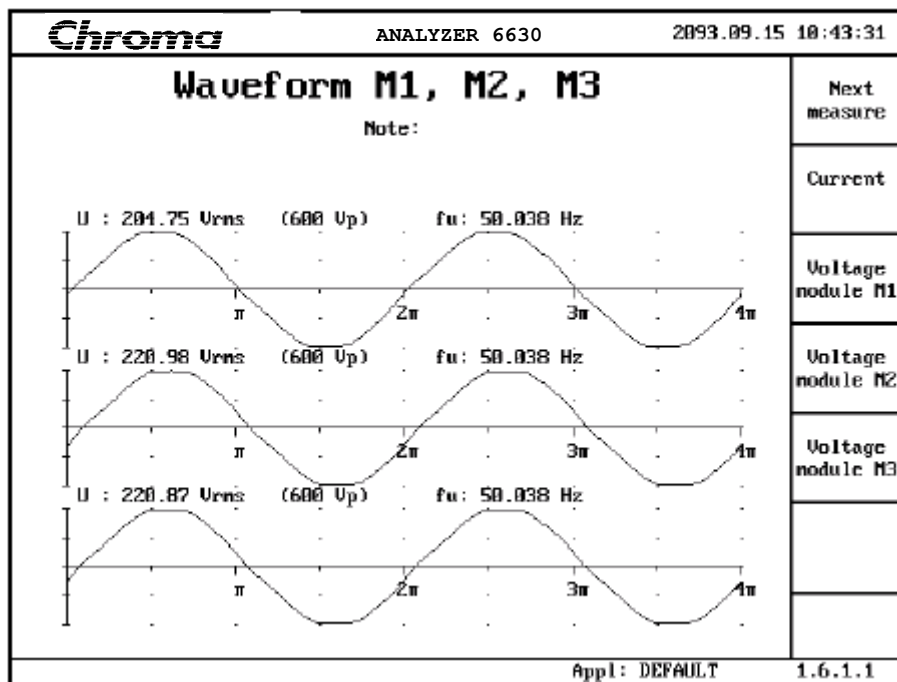




Figure 4-96 Waveforms Captured in Triple-Y Mode

The voltage signal of the three input modules are shown with M1 being the top-most graph.

Current - 

This key changes the display to show the current signals with M1 being the top-most graph as shown in figure 4-90. Use the Voltage key to return to the voltage signals.

Voltage module Mx, Current module Mx - 

These keys zooms a particular input module signal. A zoomed voltage signal is shown in figure 4-91. Zoom the other inputs by using the **Voltage module Mx** and **Current module Mx** buttons or return to the main display by pressing QUIT.

IEEE 1000-3 envelope - 

Press this key to add the harmonics EUT class classification tool as shown in figure 4-92.

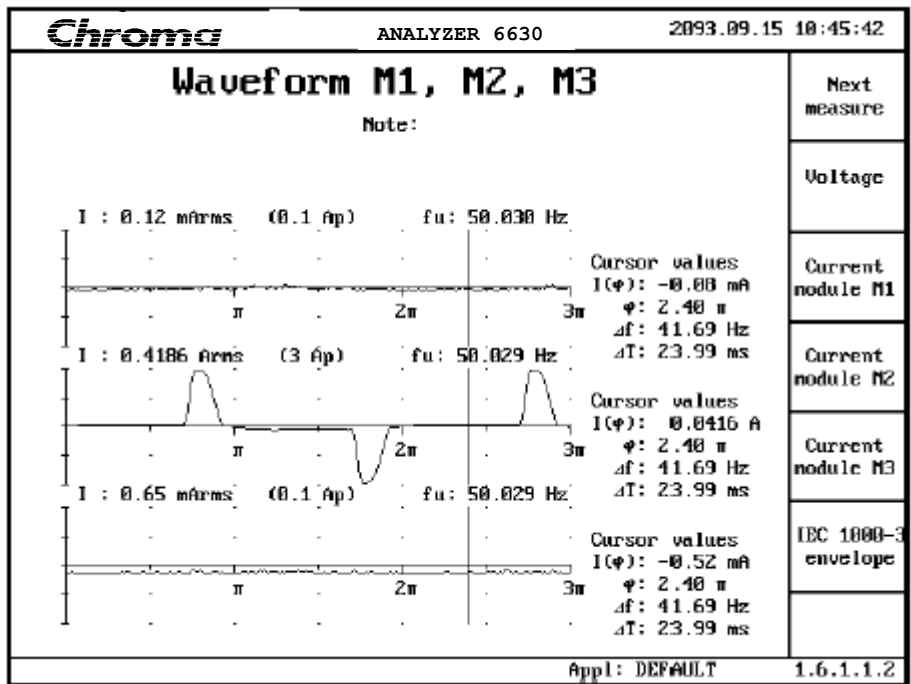


Figure 4-97 Current Waveforms in Triple-Y Mode

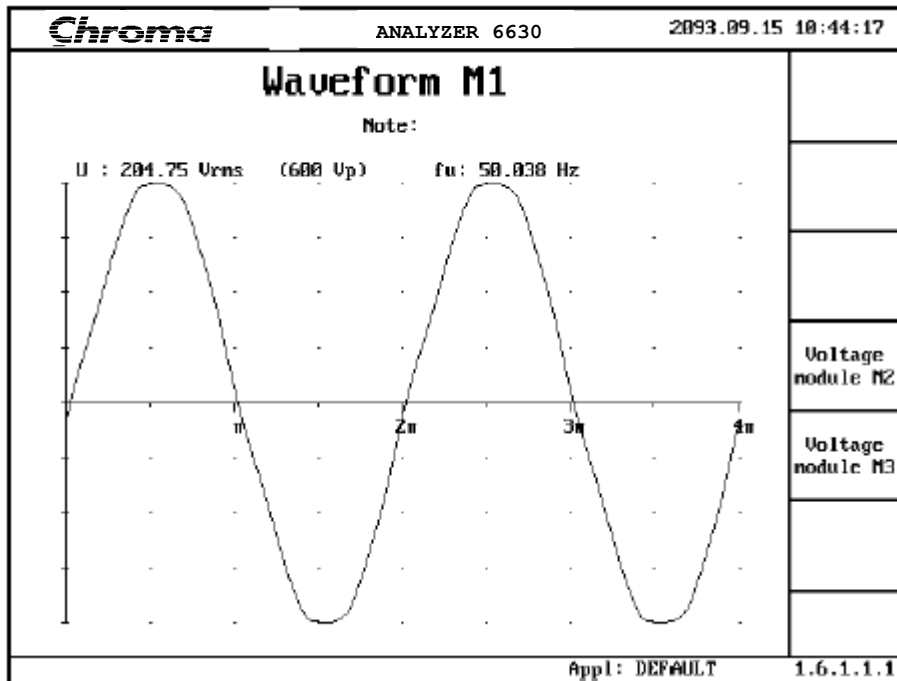


Figure 4-98 Voltage Waveform Zoomed

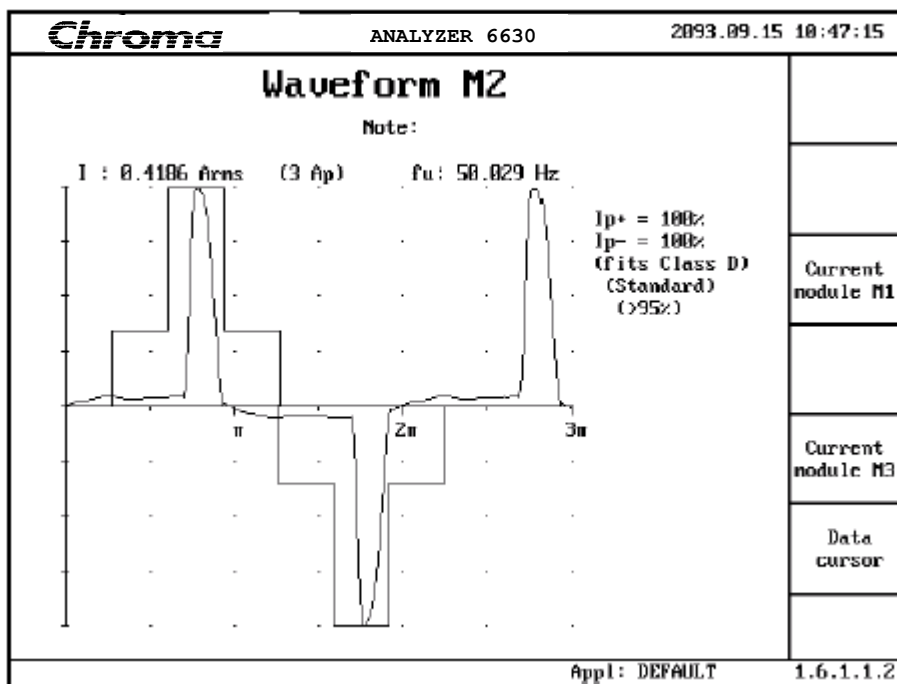


Figure 4-99 Current Waveform with Envelope

4.5 Connecting the Measurement Object

4.5.1 Single Module Measurements

Figure 4-93 shows the recommended connections for single module measurements:

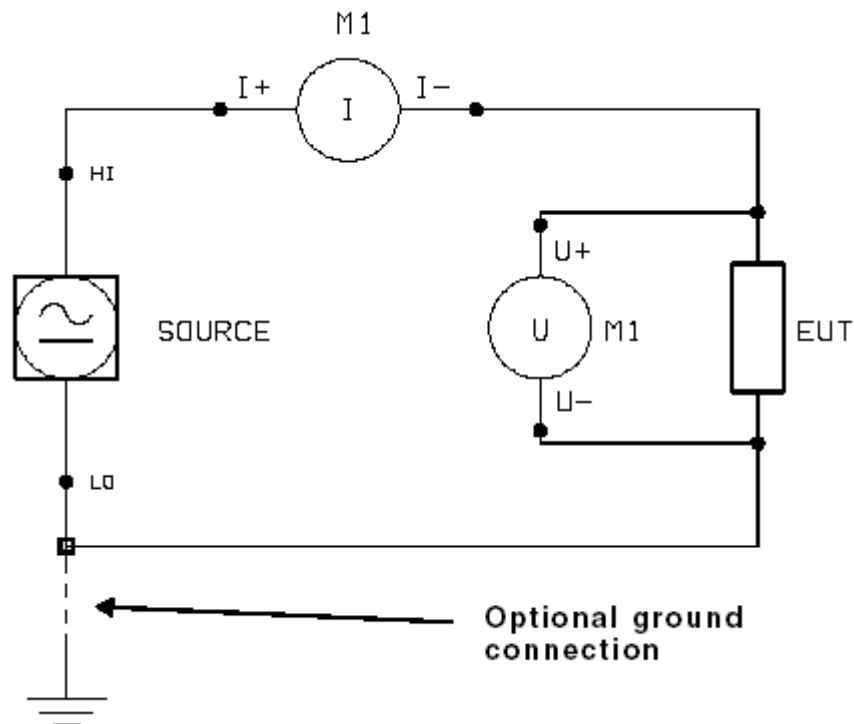


Figure 4-100 Single Module Connection

The voltage inputs should be connected as close to the EUT as possible to reduce the influence of wire voltage drop on the measurement results.

If an AC source with floating outputs is used, the optional ground connection can be used to make the AC source output referenced to safety ground. See section 6 for more information.

IMPORTANT

Before making the ground connection, consult section 6 and your AC source manual to make sure that the outputs really are floating to prevent damage to your AC source. Do not make the ground connection if you are using the mains as power source.

4.5.2 Multiple Module Measurements

Figure 4-94 shows an example of a multiple modules measurement setup operating in the Discrete mode selected with the Modules parameter in the Application setup page, see section 4.4.1.2. This example is practically the same as the single module connection example, but illustrates the use of several independent power sources and EUTs.

All measurement module inputs are individual. Each module is capable of being used according to the specifications regardless of the use of another module.

This makes it, for example, very easy to make production quality tests of power supplies. Parameters for the power supply input are measured by the first module and the output parameters by the second module.

The example also shows the optional safety ground connection used with the programmable

AC sources. See section 4.5.1 Single module measurements and section 6 for safety information before making this connection.

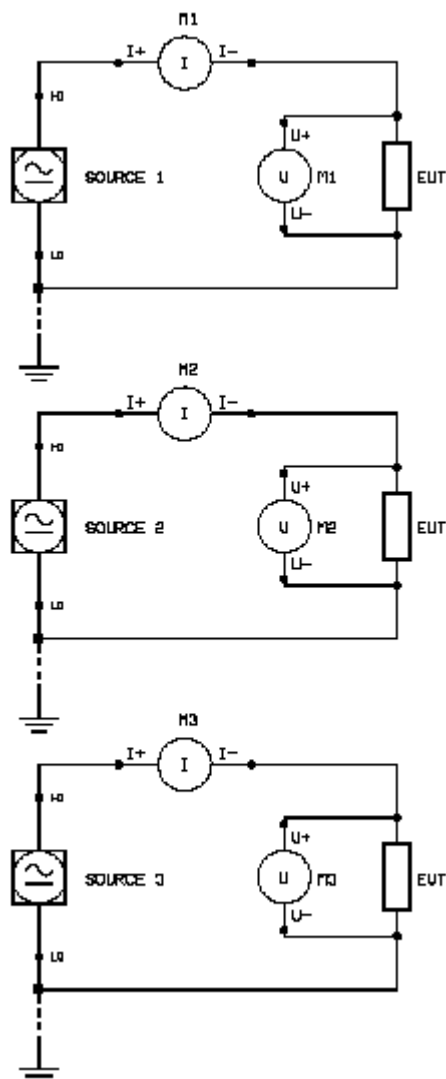


Figure 4-101 Multiple Modules Connections

4.5.3 Triple-Y Measurements

Figure 4-95 shows an example of a multiple modules, triple-Y measurement setup:

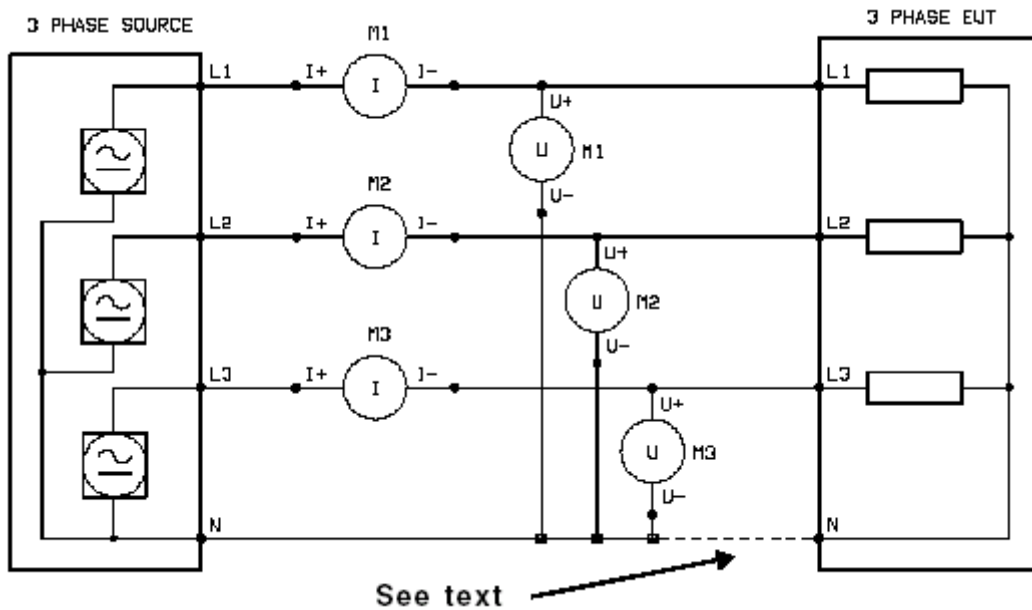


Figure 4-102 Multiple Module, Triple-Y Measurements

This setup is used to make three phase measurements of a Y-coupled EUT. To select the triple-Y mode, set the **Modules** parameter located in the Application setup page to **Triple-Y**, see section 4.4.1.2.

Using this setup, all legs of the Y-load may be simultaneously analyzed individually as well as the total 3-phase power and energy.

To make measurements on a Δ -coupled EUT, refer to the triple- Δ connection examples.

The dashed connection between source neutral and EUT neutral must be used if the EUT is not a balanced load (i.e. the voltage at the summing junction of EUT L1, L2 and L3 is not zero) to maintain power and energy measurements accuracy.

4.5.4 Triple- Δ Measurements, Normal

Figure 4-103 shows an example of a multiple modules, normal triple- Δ measurement setup:

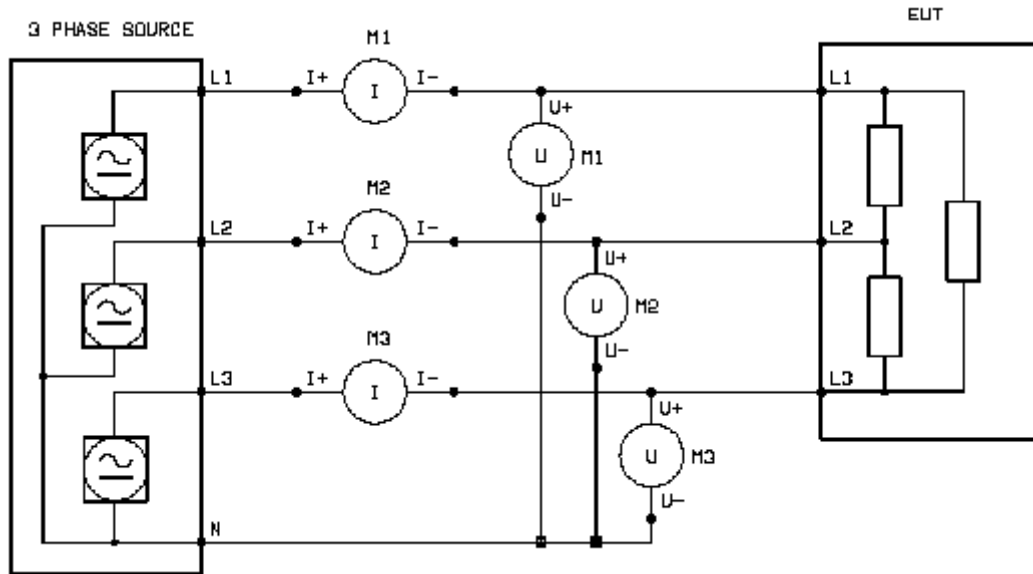


Figure 4-103 Multiple Module, Normal Triple- Δ Measurements

This setup is used to make three phase measurements on a Δ -coupled EUT when the characteristic of the individual legs is unimportant. To select the correct measurement mode, set the **Modules** parameter located in the Application setup page to **Triple-Y**, see section 4.4.1.2.

Using this setup, the characteristics of each individual leg cannot be determined. It is the Phase characteristic that is measured including total 3-phase power and energy.

As mentioned, a drawback of this setup is that the characteristics of the individual legs of the load cannot be determined. Use the advanced method described in section 4.5.5 if this is required.

4.5.5 Triple- Δ Measurements, Advanced

Figure 4-104 shows an example of a multiple modules, advanced triple- Δ measurement setup:

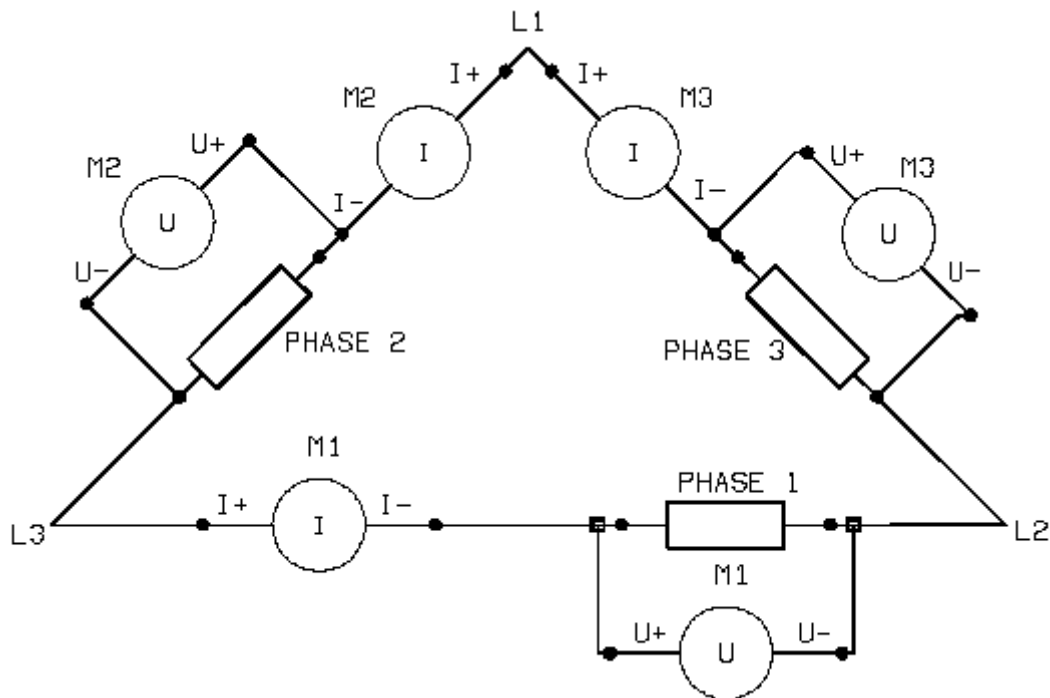


Figure 4-104 Multiple Module, Advanced Triple- Δ Measurements

This setup is used to make three phase measurements on a Δ -coupled EUT when the characteristics of the individual legs of the load is of interest. To select the correct measurement mode, set the **Modules** parameter located in the Application setup page to **Triple-Y**, see section 4.4.1.2.

As mentioned, all legs of the Δ -load may be simultaneously analyzed individually as well as the total 3-phase power and energy.

If the individual leg of the load is not available, use the normal method described in section 4.5.4.

4.5.6 Special Applications

Measuring small currents

To avoid influence from the input impedance to ground, connect the voltage source to the I+ input (Guard) on the current input if current measurements are done on the Hi-side in a ground referenced network as Figure 4-101 shows.

If current measurements are made on the Low-side or with a floating voltage source the connection order is not important.

Figure 4-98 shows a simplified current input schematic:

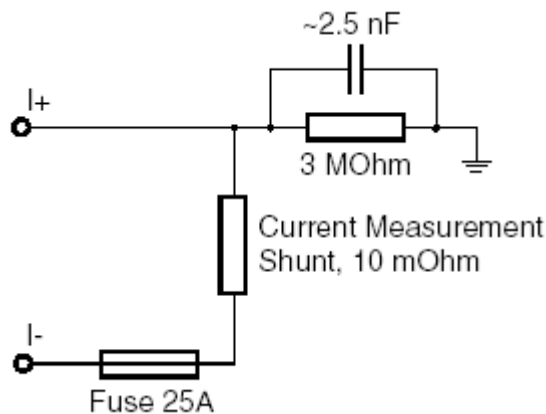


Figure 4-105 Current Input

This clearly shows why the previous recommendation is true, connecting the I+ input to the voltage source means that no input impedance current will flow through the measurement shunt.

The input impedance current at 50Hz and 230VAC is about 0.2 mA rms.

When measuring power, the I+ input should be connected to the voltage source. This will assure a positive sign on consumed power results.

Be aware that the maximum voltage between the I+/I- inputs and ground is 400Vrms.

The current measurement input is protected by a 25A fuse. Replace only with the type and rating specified in section 7.

Maximum continuous input current is 20Arms. Peak currents of up to 300Ap can be measured. 200Arms can be measured for a maximum of 20ms between 2 seconds of zero current.

High common mode voltage measurements

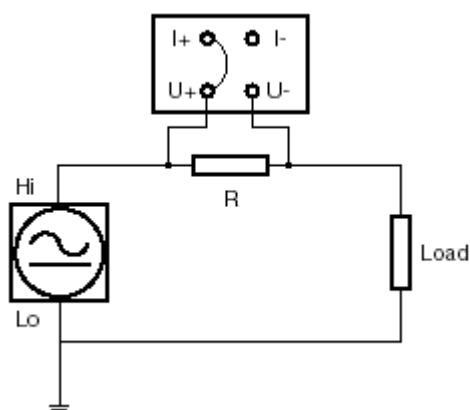


Figure 4-106 Measuring Voltage, High Common Mode

Connect I+ or I- to U+ or U- as figure 4-106 shows to reduce the common mode voltage influence on the measurements.

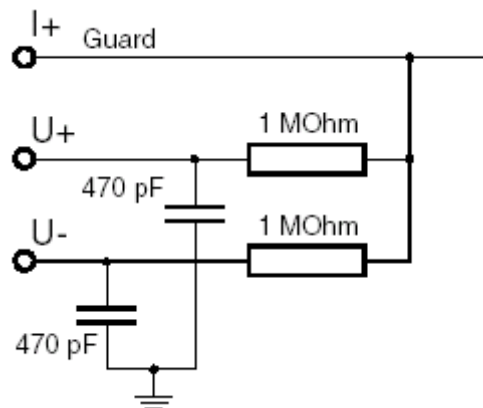


Figure 4-107 Voltage Input

Figure 4-107 shows a simplified schematic of the voltage input.

When measuring power, the U+ input should be connected to the voltage source Hi-side. This will assure a positive sign on consumed power results.

Be aware that the maximum voltage between the U+/U- inputs and ground is 400Vrms. Maximum voltage between U+ and U-, U+ and I+/I-, U- and I+/I- is 600Vrms. Short peaks of up to 2000Vp can be measured.

If voltage and current is measured simultaneously on objects with low power consumption, the voltage input impedance may affect the current measurements. To avoid this, connect the voltage inputs to the voltage source. At 230Vrms the voltage input leakage current is about 0.23mArms.

4.6 Connecting a Hardcopy Device

The Hardcopy device parameter in section 4.4.1.2 Application setup selects the type of printer. The section also contains notes about special considerations for different printers.

Here are some general guidelines:

- Never connect or disconnect a printer with POWER ANALYZER 6630 and/or the printer powered on.
- Use only the recommended printer communication cable. Failure to do so may violate the EMC approval.
- POWER ANALYZER 6630 can only print on the parallel port, LPT1.
- Use the default factory configuration of the printer. Altering the printer's configuration may result in distorted printouts or no printouts at all.
- Read the printers manual.

If there are problems with printing, please check:

- Is there paper in the printer?
- Is there toner or ink in the printer?

- Is the printer communication cable connected properly?
- Is the printer power cable connected properly and is the printer switched on?
- Is the printer on-line?
- Is the correct type of printer selected?

If none of these checkpoints correct the problem and you need assistance, please note that only printers listed in section 4.4.1.2 will be supported. When contacting your dealer, clearly state what brand and type of printer you are using and how the printer is configured. If the problem is a partial or distorted printout, include a printout example.

5. Remote Operation

5.1 Preparations

Remote controlling an advanced instrument can be quite complicated and should not be taken lightly. It requires careful planning of several things:

The instrument(s) and computer setup such as GPIB addresses and cabling.

Selecting and setting up proper development tools and equipment such as a computer GPIB card, a programming tool ranging from DOS Quick Basic to a fully fledged graphical programming environment such as NI's LabVIEW.

Defining the goals - what should be remote controlled and how will the results be presented?

In the POWER ANALYZER 6630 case there is one additional thing to observe:

Is the POWER ANALYZER 6630 supposed to control an AC source automatically during measurements?

If the answer is yes the POWER ANALYZER 6630 GPIB port will be occupied by the AC source connection and cannot be used to control the POWER ANALYZER 6630. In this case a serial port must be used for remote control.

IMPORTANT

If the POWER ANALYZER 6630 is configured to control an AC source the GPIB port must not be connected to another controller such as a computer GPIB card. This will cause a controller collision because in this configuration the POWER ANALYZER 6630's GPIB interface is in the active controller state and there can only be one active controller on a GPIB bus at one time. In this situation, only the AC source should be connected to the POWER ANALYZER 6630 GPIB port.

5.1.1 Configuring the Instrument

Refer to the descriptions in section 4.4.1.1 System setup of the **GPIB** and **Remote port** group parameters.

5.1.2 Making Connections

Use only high quality GPIB cables and connectors. Never connect or disconnect with devices powered on.

See section 7 for notes on EMC approval.

See the POWER ANALYZER 6630-Programming manual, part number 60-00-1397, for information about remote control via RS-232.

5.2 Remote Control Programming

Technical information about remote controlling the POWER ANALYZER 6630 is generally of no interest to the normal user and has been placed in a separate manual.

The POWER ANALYZER 6630 - Programming Manual, part number 60-00-1397, contains instructions about remote controlling including a thorough command reference and is available to registered customers free of charge. Contact your local dealer to order your copy.

6. Using an AC Source

6.1 AC Source 6404 / AC Source 6408

Figure 6-1 shows a connection example with AC Source 6404 or AC Source 6408 together with the POWER ANALYZER 6630:

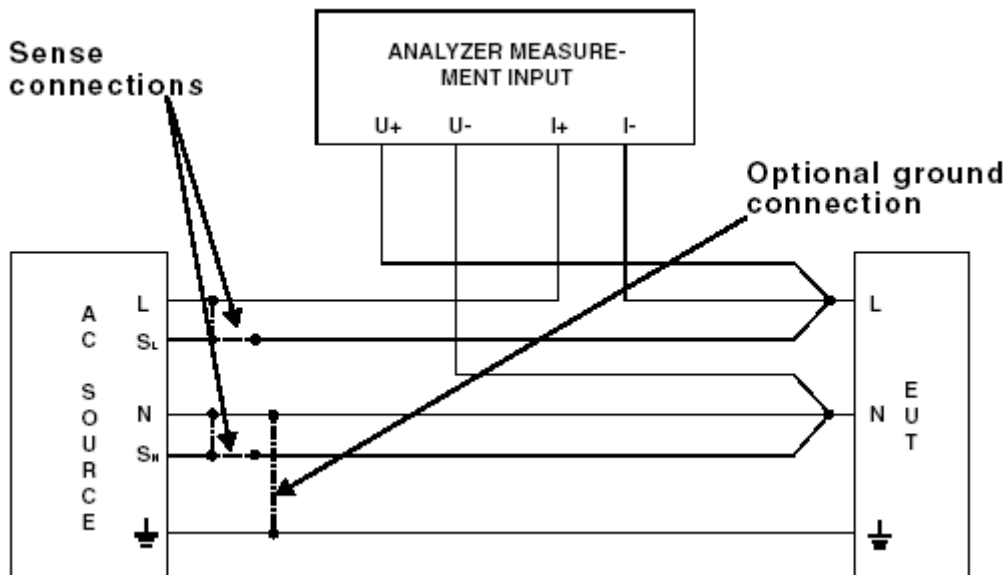


Figure 6-1 Connecting the AC Source 6404 or AC Source 6408

Always maintain a safety ground line and use cables capable of handling the anticipated currents. Failure to do so may result in personal injury and/or property damage. Also see section 4.5 for more detailed information about input module connections. Consult the AC Source manual before making any connections.

If the AC source sense function is used, connect the sense lines as close to the EUT as possible. **Do not** reverse the sense connections; always connect S_L to the L output and S_N to the N output. If the sense function is not used, make the S_L to the L and S_N to the N connections at the AC source using the jumpers supplied with the AC source.

The AC source outputs (L and N) are floating in respect to safety ground. If it is desirable to reference the power output to ground, make a connection between N and safety ground. This will make the output compatible with real world power distribution installations.

If the AC source is being remote controlled by the POWER ANALYZER 6630, always turn the AC source power on first and then the POWER ANALYZER 6630 to make sure that the AC source will be initialized properly.

6.2 AC Source 6530

Figure 6-2 shows a connection example with the AC Source 6530 and POWER ANALYZER 6630:

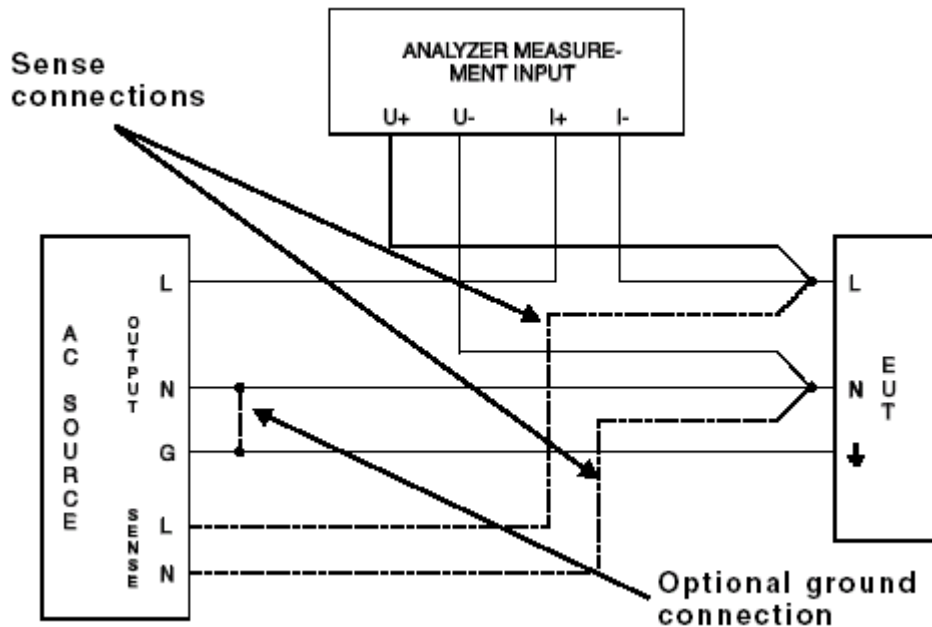


Figure 6-2 Connecting the AC Source 6530

Always maintain a safety ground line and use cables capable of handling the anticipated currents. Failure to do so may result in personal injury and/or property damage. Also see section 4.5 for more detailed information about input module connections. Consult the AC Source manual before making any connections.

If the AC source sense function is used, connect the sense lines as close to the EUT as possible. **Do not** reverse the sense connections; always connect L sense to the L output and N sense to the N output. If the sense function is not used, leave sense L and N unconnected and disable remote sense in the AC source.

Both AC source outputs, L and N, are floating in respect to safety ground. If it is desirable to reference the power output to ground, make a connection between N and safety ground. This will make the output compatible with real world power distribution installations.

If the AC source is being remote controlled by the POWER ANALYZER 6630, always turn the AC source power on first and then the POWER ANALYZER 6630 to make sure that the AC source will be initialized properly.

6.3 AC Source 6590

Figure 6-3 shows a connection example with the AC Source 6590 and POWER ANALYZER 6630:

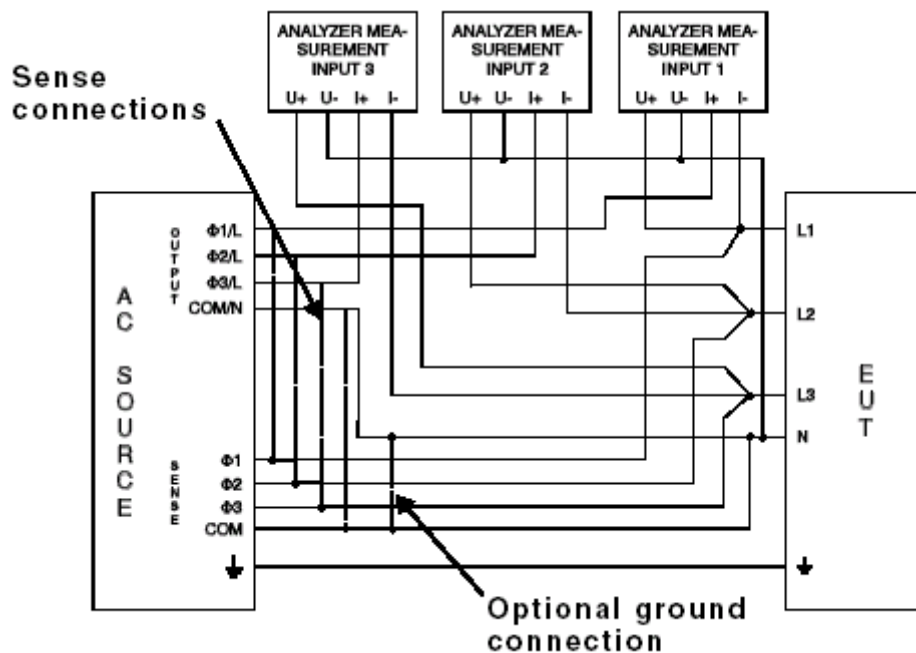


Figure 6-3 Connecting the AC Source 6590

Always maintain a safety ground line and use cables capable of handling the anticipated currents. Failure to do so may result in personal injury and/or property damage. Also see section 4.5 for more detailed information about input module connections. Consult the AC Source manual before making any connections.

When using the AC source sense function, **do not** mix the sense connections; always connect $\Phi 1$ sense to the $\Phi 1/L$ output, $\Phi 2$ sense to the $\Phi 2/L$ output, $\Phi 3$ sense to the $\Phi 3/L$ output and COM sense to the COM/N output. Connect the sense lines as close to the EUT as possible. If the sense function is not used, use the local sense connection to maintain the sense function and assure proper operation.

All AC source outputs, $\Phi 1/L$, $\Phi 2/L$, $\Phi 3/L$ and COM/N, are floating in respect to safety ground. If it is desirable to reference the power output to ground, make a connection between COM/N and safety ground. This will make the output compatible with real world power distribution installations.

If the AC source is being remote controlled by the POWER ANALYZER 6630, always turn the AC source power on first and then the POWER ANALYZER 6630 to make sure that the AC source will be initialized properly.

6.4 Remote Controlling an AC Source

If the POWER ANALYZER 6630 is supposed to remote control the AC source, connect the two units GPIB connectors using a good quality GPIB cable (see specifications). Make sure that the **Generator type**, and **AC Source address** parameters matches the AC source type and GPIB address. Also make sure that the **Analyzer is controller** parameter is set to **Yes**.

Refer to section 4.4.1 for information about changing the POWER ANALYZER 6630 parameters and to the relevant AC source manual for changing the AC source parameters.

7. Specifications

7.1 Instrument Specifications

7.1.1 Multimeter

MEASUREMENT SETUP AND PRESENTATION

Display:	The display is divided into six user defined rows and three or five columns. For each row, a suitable parameter and measurement mode may be selected	
Parameters:	Voltage (U) Current (I) Frequency (f) Active power (P) Reactive power (Q) Apparent power (S) Crest factor (CF) THD (I and U)	Power factor (PF) Phase angle (.) Active energy (W) Reactive energy (Wr) Apparent energy (Wa) Total Harmonic Distortion (%)
Measurement mode:	AC, DC or (AC+DC)	
Presented value:	Rms, peak± and peak to peak (for U and I only)	
Phases/channels:	One or three phase mode. At three phase measurements the display may be setup to present either mean or sum values for all phases or values split into phases.	
Frequency source:	Voltage or current channel	
Measurement window:	0.7-5 s	
Window type:	Fixed or adapted to full periods of source frequency fundamental	
Measurement average:	Moving of 1-100 measurements. Stand. dev. is displayed when averaging 2 or more measurements	
Fast follow:	Yes or no. If yes is selected, averaging will restart when the fast follow threshold is exceeded	
Fast follow threshold:	0.1-10% of reading + 10% of lowest range	
Result storage:	Hard copy	

COMMON TO ALL MULTIMETER PARAMETERS

Frequency range:	DC and 40-70Hz fundamental
Filter:	LP 2 kHz
Crest factor:	< 5
Power factor:	-1 to +1
A/D conversion:	Simultaneous sampling of U and I channels
Phase error between U and I inputs:	Less than 0.05° at 70Hz

VOLTAGE U

Ranges (AC peak and DC):	2000V / 600V / 200V / 60V / 20V / 6V Automatic or manual range selection
Maximum input voltage:	U+to U- or U+/U- to I+/I- 600Vrms (AC+DC) or 2000Vpeak U+/U- to case 400Vrms (AC+DC)
Uncertainty at 23±5°C ③	AC rms: ±(0.2% of rdg + 0.05% of range) DC and (AC+DC) rms: ±(AC spec. + 15mV) Peak: ±(AC spec. + 0.1% of rdg)
Temp. coeff. (0-18 and 28-40)°C:	±0.01%/°C of rdg AC and ±2mV/°C DC
Common mode voltage influence:	Less than 0.02% of any voltage range at a common mode voltage level of 400Vrms 50Hz.
Display resolution:	Better than 0.01% of range or 1mV
Input impedance:	2x1M//470pF

CURRENT I

Ranges (AC peak and DC):	300A / 100A / 30A / 10A / 3A / 1A / 0.3A / 0.1A Automatic or manual range selection
Maximum input current:	20Arms (AC+DC) continuous 300Apeak or 200Arms 20ms every 2sec
Maximum common mode voltage:	I+/I- to case 400Vrms (AC+DC)
Uncertainty at 23±5°C ③	AC rms: ±(0.3% of rdg + 0.05% of range) DC and (AC+DC) rms: ±(AC spec. + 0.5mA) Peak: ±(AC spec + 0.1% of rdg)

Temp. coeff. (0-18 and 28-40)°C:	±0.01%/°C of rdg AC and ±0.05mA/°C DC
Common mode voltage influence:	Less than 0.02% of any current range at a common mode voltage level of 400V _{rms} 50Hz.
Display resolution:	Better than 0.02% of range or 10µA
Input resistance:	~18mΩ
Protection:	Little fuse KLK 25A fuse on rear panel

- ① U_{cm} is applied between U+/U- and case. I+ or I- is connected to U+ or U-. If I+ or I- is connected to case, the influence is less than 0.02% of common mode voltage.
- ② U_{cm} is applied between I+/I- and case.
- ③ Conditions: 30 min warm up time. Sine wave. Within 6 month after cal. I+ connected to source. Measurement time 2s adapted.

POWER S, P, Q

Ranges: 48 ranges from 0.6VA to 12kVA. Automatic or manual selection of voltage and current range

Power range: Voltage range * Current range

Maximum input: 600V_{rms} and 20A_{rms}
 Uncertainty at 23±5°C ③

Apparent AC and active AC: ④ ±(0.4% of rdg + 0.1% of range)
 Reactive: ±(0.4+D)% of rdg S + 0.1% of range
 D=0.01*(U_{THD}%)*(I_{THD}%)

Temp. coeff. and common mode voltage influence: Refer to voltage and current spec.

Display resolution: Better than 0.02% of range or 0.1mVA

Calculation methods: (apparent) $S = U \cdot I \text{ VA}$

$$\text{(active) } P = \frac{1}{N} \sum_{1}^N (U_n \cdot I_n) \text{ W}$$

$$\text{(reactive) } Q = \frac{1}{N} \sum_{1}^N (U_n \cdot I(n+x)) \text{ var}$$

N = number of samples in acquisition time
 x = number of samples corresponding to 90° at the fundamental frequency

FREQUENCY f

Measurement range:	40 - 70Hz
Source:	Voltage or current input
Principle:	Auto correlation
Uncertainty:	±0.01% of rdg
Resolution:	0.001Hz

④ At DC or (AC+DC) power, add $(0.015 \cdot I_{rdg} + 0.0005 \cdot U_{rdg})$

ENERGY W, Wr, Wa

Measurement range:	0 - 999 999 kWh
Ranges and uncertainty:	refer to power spec.
Timer uncertainty:	±0.01% (fixed measurement window)
Timer value:	Elapsed time from start is displayed
Display resolution:	Better than 0.05% of rdg or 0.02% of (power range * 1h)

Calculation methods: ⑤ (apparent) $W_a = \sum_1^M S_m \cdot t_a \text{ VAh}$

(active) $W = \sum_1^M P_m \cdot t_a \text{ Wh}$

(reactive) $W_r = \sum_1^M Q_m \cdot t_a \text{ varh}$

CHARGE Ch

Measurement range:	0 - 999 999 Ah
Measurement mode:	DC single channel only
Ranges and uncertainty:	Refer to current spec.
Timer uncertainty:	±0.01% (fixed measurement window)
Timer value:	Elapsed time from start is displayed
Display resolution:	Better than 0.05% of rdg or 0.02% of (current range * 1h)

Calculation method: ⑤ $Ch = \sum_1^M Im \cdot ta$

COMPUTED PARAMETERS

Name:	Calculation method:	Range:	Resolution:	Unit:
Power factor	$PF = \frac{P}{S}$	-1 to +1	0.001	none
Phase angle	$\varphi = \arctan \frac{Q}{P}$	-180 to +180	0.01	deg
Crest factor U	$CF_U = \frac{U_{peak}}{U}$	1 to 5	0.001	none
Crest factor I	$CF_I = \frac{I_{peak}}{I}$	1 to 5	0.001	none
THD voltage	$THD_v = 100 \cdot \sqrt{\sum_{n=2}^{40} \left(\frac{U_n}{U_1}\right)^2}$	0 to 999	1	%
THD current	$THD_i = 100 \cdot \sqrt{\sum_{n=2}^{40} \left(\frac{I_n}{I_1}\right)^2}$	0 to 999	1	%

⑤ ta = acquisition time M = number of acquisitions

7.1.2 Harmonics Analysis

GENERAL

Compliance measurements acc. to:	IEC555-2, EN60555-2, IEC1000-3-2 and EN 61000-3-2
Testing:	Preprogrammed limits according to standards for pass/fail testing. User specified limits may be added
Result storage:	Automatic or manual on hard copy or floppy disk
External power source:	Remote control via GPIB. Selection of voltage and frequency from POWER ANALYZER 6630

PRESENTATION

Display:	Selectable between table and graphical presentation of harmonic rms values
Limits:	On or off, both in graph and table
Graph scale:	Relative or absolute

Graph resolution:	Linear or logarithmic
Displayed parameters:	Total rms value of U and I, source frequency, active power, rms value of fundamental and THD

MEASUREMENT

Harmonic order:	1-40
Frequency of fundamental:	40-70Hz
Frequency source:	Voltage or current
Data source:	Voltage or current
Voltage and current ranges:	Refer to voltage and current spec.
Phases/channels:	One or three
Calculation method:	FFT with 32 bit floating point math
AD-conversion:	18 bit resolution
Measurement window:	Rectangular
Analyzed periods (window with):	1-47
Synchronization uncertainty:	$\pm 0.01\%$
Antialiasing filter attenuation:	80dB
Measurement time:	3.5 s when analyzing 6 periods
Uncertainty at $23\pm 5^{\circ}\text{C}$, rms: ⑥	$\pm(0.5\% \text{ of rdg} + 0.03\% \text{ of range})$

⑥Conditions: 30 min warm up time. Within 6 month after cal. 6 periods/measurement

7.1.3 Fluctuations and Flicker Analysis

GENERAL

Compliance measurements acc. to:	IEC555-3, EN60555-3, IEC1000-3-3 and EN 61000-3-2
Method of analysis:	Implementation of IEC868/EN60868, flicker meter specification.

Testing:	Preprogrammed limits according to standard for pass/fail testing. User specified limits may be added
Result saving:	Hard copy
External power source:	Remote control via GPIB. Selection of voltage and frequency from POWER ANALYZER 6630

PRESENTATION

Displayed parameters:	Pst	Short-term flicker
	Plt	Long-term flicker
	dc	Relative steady state voltage change
	dmax	Max relative voltage change
	d(t)	Relative voltage change
	Test voltage and frequency with deviations for the collection period	
Limits:	On or off for pass/fail decision	

MEASUREMENT

Voltage and current ranges:	Refer to voltage and current spec.	
Range	Pst:	0.1 to 20
	Plt:	0.1 to 20
	d:	0 to 25%
Frequency range:	40-70 Hz	
Phases/channels:	1-3. One phase at a time	
Reference impedance:	R + jX simulated in calculation with compensation possibility for physical reference impedance.	
Impedance range (R and X):	0.01-70	
Reference lamp:	230V, 60W	
Measurement time:	1-15 min	
Number of measurements:	1-1100	
Uncertainty at 23±5°C	Pst:	± 4% of rdg for 0.5 < Pst < 20
	Plt:	± 4% of rdg for 0.5 < Plt < 20
	d:	± 2% of rdg for dmax > 0.1%

7.1.4 Recording

GENERAL

Display:	Simultaneous recording of up to three user defined parameters
Magnification:	Any trace may be selected to use full screen
Memory:	Freeze of recording, may be used any time without losing any information
Phases/channels:	One or three
Number of traces:	1-3
Result storage:	Hard copy or floppy disk

SELECTIONS FOR EACH TRACE

Channel:	M1, M2 or M3
Parameter:	Voltage (U) Frequency (f) Current (I) Crest factor (CF) Active power (P) Power factor (PF) Reactive power (Q) Phase angle (ϕ) Apparent power (S)
Measurement mode:	AC, DC or (AC+DC)
Incremental value:	Max and min or mean of collected measurements per increment
Vertical axis scaling:	Full range or interval

MEASUREMENT

Frequency range:	DC and 40-70 Hz fundamental
Frequency source:	Voltage or current channel
Filter:	LP 2 kHz
Horizontal axis length (time window):	8, 15 or 30 min. 1, 2, 4, 8 or 24 hours
Measurements per increment: ⑦	1, 2, 4, 8, 15, 30, 60, 180
Measurement window:	1 s

Window type: Fixed or adapted to full periods of source frequency fundamental

⑦ Due to horizontal axis length. One at 8 min. increasing to 180 at 24 hours

7.1.5 Waveform

GENERAL

Display: Simultaneous presentation of waveforms.
At single phase: voltage and current
At three phase: voltage or current for all phases

Testing: Mask for pass/fail testing acc. to IEC1000-3-2 class D

Wave measurements: A vertical cursor is available for on wave measurements

Phases/channels: One or three

Result storage: Hard copy or floppy disk

PRESENTATION

Displayed input parameters: Rms values of voltage and current. Frequency of frequency source

Displayed cursor parameters: Horizontal position (.), vertical position (u), relative time (.t) and relative frequency (.f) No. of waveforms: 2 at single phase and 3 at three phase

Magnification: Any wave may be selected to use full screen

MEASUREMENT

Frequency range: 40-70 Hz fundamental

Frequency source (upper trace): Voltage or current

Measurement mode: AC+DC

Filter: LP 6 kHz

Horizontal axis length: 1, 2, 4, 8 or 16 periods

Vertical axis: Normalized to peak values

7.1.6 Applications and Data Storage

Applications:	Up to 4 individual instrument setups may be stored as applications in an internal non volatile memory. More applications may be stored and read from disk
Data:	Collected data from recording, waveform or harmonics measurements may be stored and read from disk
Data format:	dBase DBF

7.1.7 Remote Control

Interface:	GPIB (IEEE488.1-87) RS232
Connectors	GPIB: According to IEEE488.1-87 RS232: 25 pin D-sub
GPIB interface capabilities:	Talker, Listener and Controller. SH1, T6, AH1, L4, SR1, RL1, PP0, DC1, DT1, (C0), E2
Remote control language:	IEEE488.2-87 and SCPI-1994.0 (Standard Commands for Programmable Instruments)
GPIB address:	User selectable to 0-30

7.1.8 General Specifications

Display:	LCD 640x480 pixel with backlight
Printer output for hard copy:	Parallel (Centronics compatible) or serial (RS232)
Floppy drive:	1.44MB 3½" PC-format. For software updates and result storage
Rack mounting:	With optional rack mount kit. Size 19" 3HE
Dimensions:	(HxWxL) 132x425x340 mm (5.2x16.7x13.4 inches)
Weight:	Single phase 9 kg (20 lbs), three phase 11.4 kg (25 lbs)

Operating environment:	0 to +40°C <80% R.H. non condensing
Storage environment:	-30 to +60°C non condensing
Power supply:	100-130V or 200-260V, automatic range selection
Power line frequency:	45-65 Hz
Power consumption:	45 W max
Fuses (rear panel):	Instrument power: 2 x F1A Current measurement: Littlefuse KLK 25A

NOTE:

Failure to use the specified type and rating of fuse may result in property damage and/or personal injury.

Safety:	Designed to comply with the Low Voltage Directive 73/23/EEC plus parts of 93/68/EEC. Applied standard, EN61010-1:1993 Installation Category II, CAT II
EMC:	Designed to comply with the EMC Directive 89/336/EEC and 92/31/EEC Applied standards, EN50081-1:92 and EN50082-1:92
Warranty:	See section 2.4