



SUPPLY NETWORK ANALYZER

AR5

(Code 7 71 301)

**Power line quality program
(Disturbances version)**

(Code 7 71 325)

INSTRUCTION MANUAL

(M 981 503 / 99 A)

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1.- DESCRIPTION

This manual is aimed to familiarize de user with the operation of the portable analyzer model AR5 when working with the “Disturbances version” of the power line quality program. To get all necessary information about operation instructions and safety warnings of the portable analyzer AR5 consult its instruction manual (code M981501).

The AR5 analyzer loaded with the “disturbances” program permits to detect and record disturbances (sags, surges, dropouts,...) that may occur in the power line in a SINGLE-PHASE or THREE-PHASE mode (According program).

| Code | Program | Version | Three-phase | Single-phase |
|----------|---------|---------|-------------|--------------|
| 7 71 325 | Disturb | 3.1x | Yes | Yes |

Recorded data can be downloaded from the AR5 to a PC (Files *.A5D) and further analyzed by means of the PC software.

Recording data process is done by means of an liner memory. That means that once memory is full, no new data is recorded anymore.

1.1.- Technical description

The “Disturbances version” of the power line quality program for the AR5 permits:

- To detect disturbances that last for more than 500 μ s.
- To detect sags. Cycles the present maximum voltage that does not exceed a voltage peak value determined from the Rated Voltage and the user-defined voltage limits.
- A sample is captured each 500 μ s at each phase, for a total of 40 samples per cycle at 50Hz.
- Disturbances and sags analysis is performed every time a sample is obtained.
- Depending on the operation frequency, 40 samples are an exact cycle for a 50 Hz power line; or one cycle and a quarter for a 60 Hz power line.

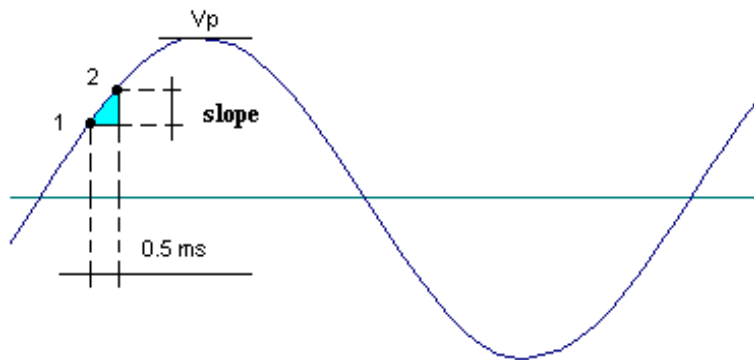
The AR5 analyzer loaded with the “disturbances” program permits the user to set through keyboard the Rated Voltage (from 10 V to 500 V), the Trigger Level (1.2 to 5) and the Rated Frequency of the power line. All these values are essential to calculate the disturbance maximum slope. This slope is calculated every time the analyzer is turn on or each time Set-up is exited

Disturbances monitoring in single-phase mode is always performed through phase L1 and Neutral.

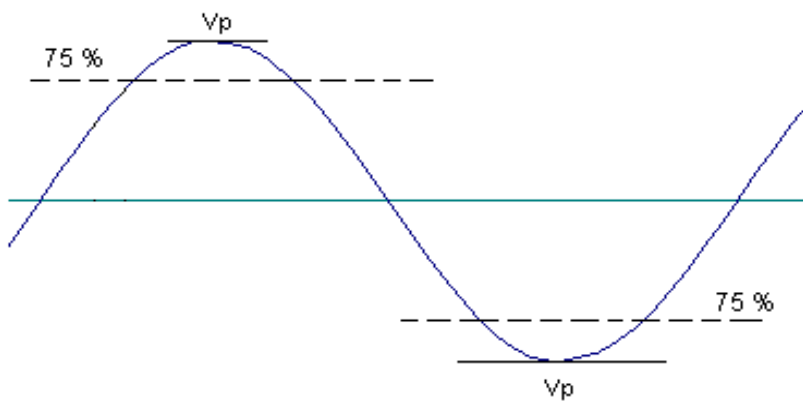
1.2.- Operation mode

The analyzer takes 40 samples per cycle between the L1 and Neutral voltage inputs when working in single-phase mode. The analyzer takes 40 samples per phase and cycle when working in three-phase mode (40x3=120 samples per cycle).

The difference between each sample and the previous one is calculated by the analyzer, so that this difference is then compared with **the maximum slope** calculated. That way, whether the difference between two successive samples exceeds the maximum slope, a disturbance is considered to be occurred.



This sample is compared with an user-defined voltage value (% over V_p). In case that positive and negative limits are not exceeded when the 40 samples have been captured, a sag has occurred.



The maximum slope is determined in function of the previously user-defined values for the rated voltage and trigger (when the analyzer is turn on); or every time these values are modified by keyboard (Set-up menu).

Values to be user-programmed:

- Rated Voltage : $V_n = 10$ to 500 V
- Voltage limits : From 100% to 50% of peak voltage
- Trigger Level : TL = de 1.2 a 5
- Rated Frequency: $F_n = 45$ to 65 Hz

Calculated parameters :

- Scale : Auto-scaling according to the rated voltage.
 - Scale 1 : Rated voltage from 151 V to 500 V (multiplied x 1)
 - Scale 2 : Rated voltage from 10 V to 150 V (multiplied x 2)
- Sampling time : $t_m = 500 \mu s$ (constant) .

Maximum slope = $(V_p \cdot \sin \varphi) \cdot \text{trigger level} = V_p \cdot (2 \pi \cdot t_m / P) \cdot TL$

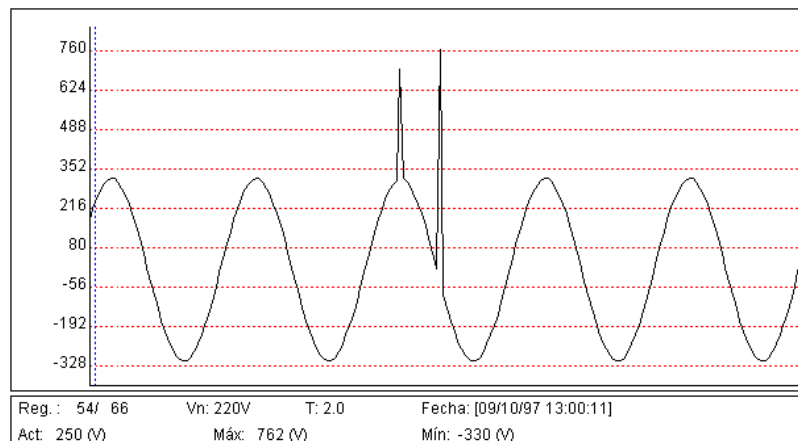
Example of maximum slope determination

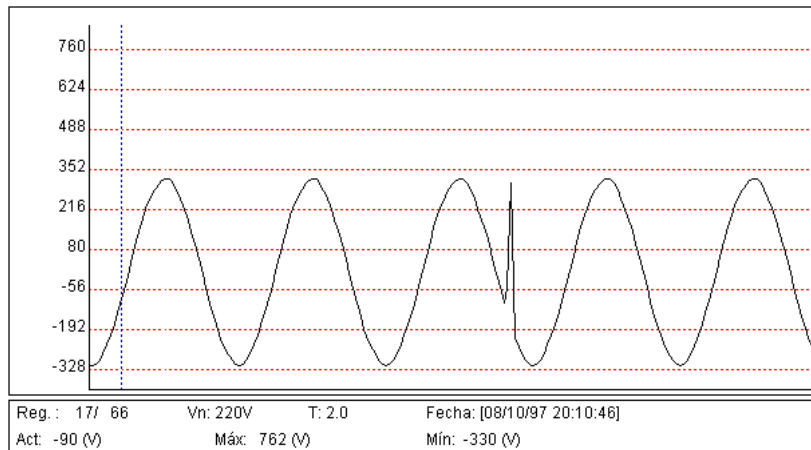
$V_n = 220$ V
 Trigger Level = TL = 1.5
 % limit = 75%
 $F_n = 50$ Hz.
 Sampling time = $t_m = 500 \mu s$
 Period = $P = 1/F_n = 20$ ms
 $V_{\text{peak}} = V_p = V_n \cdot \sqrt{2} = 220 \text{ V} \cdot \sqrt{2} = 311.12 \text{ V}$

Maximum slope = $V_p \cdot \sin \varphi \cdot \text{trigger level} = V_p \cdot (2 \pi \cdot t_m / P) \cdot TL$
 $= 311.12 \cdot (2 \pi \cdot 0.5 \text{ ms} / 20 \text{ ms}) \cdot 1.5 = \underline{73 \text{ V}}$.

Some disturbance examples:

Some examples of common power line disturbances are shown on following figures:





Previous figures (Figure 1 & 2) show disturbances detected due to the maximum slope permissible value (according to user-define magnitudes) has been exceeded between two successive samples.

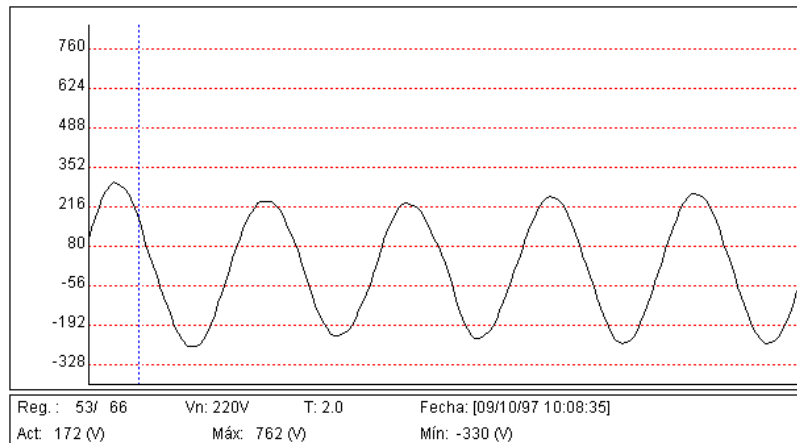


Figure 3 shows another type of disturbance (voltage sag) where no value exceed for a cycle the 75% of the pre-defined peak voltage ($V_{peak} = V_n \cdot \sqrt{2}$).

2.- Checking the contents of your package

After receiving the analyzer, please check the following points:

- a) The delivered material corresponds with your order specifications.
- b) After unpacking, check that the instrument has not been damaged in transit.
- c) The standard set includes the following items:
 - 1 cartridge for programming the AR5 containing the ordered operation mode program.
 - 1 Instruction Manual.
 - 3,5" diskettes containing the PC software update.

3.- ANALYZER STARTUP

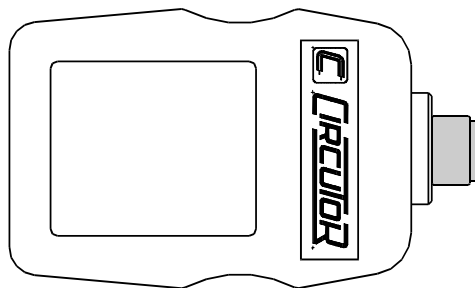
3.1.- Loading a new program

The AR5 has an internal memory to save diverse operation mode programs to be used by the user.

Before initiating this procedure, check that the AR5 battery is charged. Loading program action cannot be done whether the power supplier set is connected to the AR5, since the cartridge is to be connected to the input also used to connect the power supplier set.

To load any program, follow these instructions precisely:

- Turn the meter off.
- Connect the cartridge to the *AUX* input of the meter.
- Turn the meter on.
- Select with the keys [**▲**] & [**▼**] that you want to perform a program loading action (LOAD PROGRAM). Press [**ENTER**] or wait for a while to confirm this operation.
- Select the position to save the program into.
- The AR5 will perform a test to check that the cartridge has been properly connected.
- If an inserted cartridge is detected, then the program will be loaded.
- Once the loading is completed, reset the meter.
- If no cartridge was found or a loading mistake occurred, reset the meter and redo the above steps.



**A cartridge will be only valid for the analyzer which the program was for the first time loaded into.
Note on the cartridge the serial number of its related AR5.**

3.2.- Choice of the operation mode program

The AR5 can hold in memory different operation mode programs. The choice of the program to be used is done when starting the meter up.

- Turn the AR5 on.
- A list of available programs will be shown on display.
- Use keys [▲] & [▼] for the choice of the desired program.
- Press [ENTER] or wait for a while to confirm this operation.

CHECK THE SETUP UP !!!!

All programs have an independent setup, therefore, the setup must be always check to ensure a proper operation.

For instance, whether the setup is modified at the “ANALYZER” program, these modification will not be valid for the “DISTURB” program, and so for any program.

An accurate selection of setup parameters is specially essential for the Disturbances Program in order to obtain a precise power line analysis. A bad selection might suppose either that no disturbance is captured or, on the contrary, that all cycles are captured.

3.3.- Energy saving

The AR5 has an energy saving system. So, if no key is pressed for at least 5 minutes, the display is automatically off. The analyzer continues the recording data process but nothing appears on display.

The display will be automatically on when any key¹ is pressed.

¹ Keys that light the display on are: [◀],[▶],[▲],[▼],[SET],[ENTER] y [ESC].

The key [ON] has no effect

The key [OFF] turns the meter off without lighting the display

4.- DATA VISUALIZATION ON DISPLAY

4.1.- Base screen

The disturbance analyzer AR5 has an only visualization screen. Main measurement or set-up parameters can be read at this screen.

| AR5 DISTURB | | 3.xx |
|--------------------|------|----------|
| V | L1 | |
| | 220V | |
| Hz | 50.0 | |
| Dist. | 10 | |
| 04/06/98 | | 16:06:35 |
| File:STD-PROG.A5D | | |
| Trigger: | | |
| 200V/ 50.0 Hz | | |
| Level:1.2/ 75% | | |
| Com: 9600/ NO /8/1 | | |

Single-phase analyzer


| AR5 DISTURB | | | 3.1x |
|--------------------|------|------|----------|
| V | L1 | L2 | L3 |
| | 220V | 219V | 220V |
| Hz | 50.0 | | |
| Dist. | 41 | | |
| 04/06/98 | | | 16:06:35 |
| File:STD-PROG.A5D | | | |
| Trigger: | | | |
| 200V/ 50.0Hz | | | |
| Level:1.2/ 75% | | | |
| Com: 9600/ NO /8/1 | | | |

Three-phase analyzer

The 160 x 160 pixels, liquid crystal display can be divided into two parts: instantaneous parameters measured from the power line (V = Voltage, Hz = Frequency & Dist. = No. of detected disturbances) are shown on the upper part; while Set-up values (file name, trigger values & communication parameters) are shown on the lower part.

4.2.- Warning messages

Some warning messages can appear at the visualization screens. These messages inform about the AR5 performance:

- **STOP:** The analyzer is recording no data.
- **TRIG?:** Trigger conditions are not met. No data is being recorded.
- **M. Full:** Memory is full.
- **M.Error:** There is an error in the memory. The memory must be formatted.
-  Analyzer's battery status. Notice that when only one bar is shown, the analyzer's battery is very low and this can be powered off at any moment.
- **WARNING MAX 500 V:** The maximum allowable phase to neutral voltage of 500 V has been exceeded during the measuring process. When measuring phase to phase voltages the limit is set at 866 V.

5.- PROGRAMMING THE AR5

To access AR5 setup options press the key **[SET]**. The analyzer will then inquiry for a password that consists of a key sequence to be pressed (the user has 15 seconds to press this sequence):

| |
|----------------------------|
| PASSWORD |
| [◀] [SET] [▲] [SET] |

Once the password is pressed, the analyzer will inquire for a confirmation before stopping the disturbance capture process and permitting the modification of setup parameters.

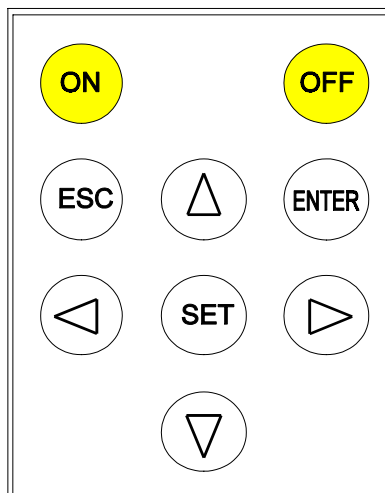
Configuration parameters are independent for each program, that is, a modification over a certain program will not be applied over other programs.

Diverse setting MENUS are available:

| |
|---------------------------------------------|
| SETUP CONTRAST RUN FILES |
|---------------------------------------------|

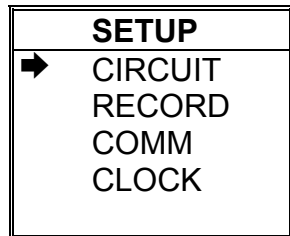
➔ INITIAL MENU

- Select one option with keys **[▼]** & **[▲]**.
- To access any menu option use **[▶]** or **[ENTER]**.
- To close the menu press **[◀]** or **[ESC]**. If this key is used when only the main menu is open, this is closed. Whether any modification over any setup parameter was done, before closing a confirmation of setup change is requested on display.



5.1.- SETUP menu

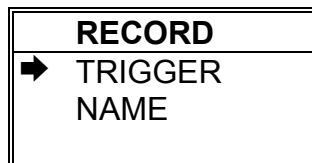
The **AR5 meter** can be user-configured to different performances involving its data analysis and recording modes, as it is followed shown:



⇒ SETUP menu.



Single-phase / Three-phase



Level, rated voltage, rated frequency, % limit V
File name (8 characters)



Baud / Parity / Bits / Stop bits



DD/MM/YY hh:mm:ss

5.1.1.- CIRCUIT Menu

The user can at this point select the operation mode of the disturbance analyzer.

- Single-phase: to perform a single-phase mode disturbance monitoring over a power line, voltage leads must be connected into inputs **L1 & Neutral**.
- Three-phase: when working in three-phase mode, the analyzer continuously monitors each phase, and when a disturbance is detected at any phase, the disturbance wave form is recorded in memory.

NOTE:

When working in three-phase mode and voltage leads are only connected into L1 & Neutral, the analyzer will detect disturbances at L2 & L3 and, therefore, memory will be full in a few time.

5.1.2.- RECORD menu.

The recording conditions are here user-programmed:

| |
|-------------------|
| RECORD |
| ➔ TRIGGER NAME |

Level, Rated Voltage, Rated Frequency & % limit V
File name (8 digits)

5.1.2.1.- TRIGGER: Trigger conditions.

| |
|---------------------------------|
| TRIGGER |
| LEVEL VNOM HZNOM V.LOW |

You can program here certain conditions (Trigger) so that disturbance wave forms are recorded in memory only when these conditions are met.

When the analyzer detects a disturbance, following data is saved in memory:

- 2 previous cycles before the disturbance.
- n disturbed cycles or up to 2 not-perturbed successive cycles are detected.
- 2 not-disturbed cycles.

- **LEVEL:**

Set here the sensitivity level to perform disturbance detection. Available values are within the range from 1.2 to 5.0.

- Trigger Level = 1.2 means a very sensitive level, thus low-disturbed wave forms are recorded.
- Trigger Level = 5.0 means a few sensitivity level, thus highly-disturbed wave forms are recorded.

- **VNOM:**

Set here the rated voltage of the monitored power line, a value used by the analyzer to determine whether any disturbance occurs.

- **HZNOM**

Set here the rated frequency of the monitored power line. The analyzer will determinate the tripping sensitivity at this frequency when turning on the analyzer or exiting Set-up.

- **V.LOW**

Set here value for the voltage limit that will determine that a disturbance event has occurred when the peak voltage has not exceeded this value (% of rated voltage).

Ex. If V.LOW is set at 90%, a disturbance will be detected and captured when the voltage do not reach, during a cycle, a value equal to the 90% of the user-programmed peak voltage.

5.1.2.2.- NAME: recording file name

Type here the file name (8 characters, no extension).

| |
|------------------|
| NAME STD-PROG |
|------------------|

NOTE!

- Extension for disturbance files is always A5D.
- Whether the name of the working file is change, previous file will not be deleted, since several files can be at the same time saved in the AR5 internal memory provided these are differently named. All data will be automatically saved in this file until a new one is opened.

5.1.3.- COMM: Communication parameters

Set here the parameters of the built-in RS-232 serial output. When selecting this option the present parameters are shown on display:

| | | | | |
|------|----|---|--|---|
| COMM | | | | |
| 9600 | NO | 8 | | 1 |

Baud / Parity / Long / Stop bits

- Pressing **[ENTER]**: values on display are directly validated.
- **To modify:** (rotary input).
- Select with keys **[▶]** or **[◀]** the position to modify.
- Through keys **[▼]**, **[▲]** the value of the selected position is modified.
- **[ENTER]** to validate the total value or **[ESC]** to exit with no modification.

NOTE!

- Data length cannot be modified. This is set at 8 bits.

5.1.4.- CLOCK: Internal clock

Set here the AR5 internal clock: date / time. When selecting this option the present values are shown on display:

| | | | | | |
|-------|-----|-----|--|----|----------|
| CLOCK | | | | | |
| 00 | /00 | /00 | | 00 | :00 : 00 |

day/month/year hour/minute/second

Proceed as for the previous section.

5.2.- CONTRAST: Screen contrast

The user can here vary the contrast of the AR5 display:

- With the [▶] you can intensify the display contrast and with the key [◀] this can be lowered:



LOW ◀ ▶ HIGH %

5.3.- RUN: data recording process status

You can here enable or disable the data collection and logging action in the AR5.

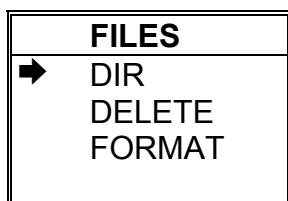


- With keys [▼], [▲] RUN or STOP are selected.
- [ENTER] to validate or [ESC] to exit with no modification.

5.4.- FILES Menu

Non-volatile AR5 internal memory is storing data up to its maximum capacity. Once full, neither new data will not be saved in, nor stored data will be lost (provided no incorrect operation is done).

When memory is full, the display will show: **"MEMORY FULL"**.



☞ FILES MENU

5.4.1.- DIR: Directory

This option shows on display a directory of all files saved in memory.

| AR5 - DIR | | |
|----------------------|---------------------|------------|
| File name | File size | Day / Time |
| STD-PROG. A5M | xxxxx bytes | |
| dd / mm / yy | hh : mm : ss | |
| TEST1. A5D | xxxxx bytes | |
| dd / mm / yy | hh : mm : ss | |
| STD-PROG. A5I | xxxxx bytes | |
| dd / mm / yy | hh : mm : ss | |

Free bytes: xxxxxxxxxx *Number of free bytes in memory*

- Keys [▼] or [▲] allows reading more files in case that all files stored by the AR5 cannot be shown in only one screen.
- Keys [ENTER] or [ESC] to exit.

5.4.2.- DELETE: Deleting a file

You can here delete any file from the internal memory.

| AR5 – DELETE | | |
|----------------------|-------------|--|
| File name | File size | |
| STD-PROG. A5M | xxxxx bytes | |
| TEST1. A5D | xxxxx bytes | |
| STD-PROG. A5I | xxxxx bytes | |
| | | |

- With keys [▼] & [▲] select the file to be deleted.
- [ENTER] to confirm selected file erasing. Once press, a confirmation is required.
- Press key [ESC] to exit with no modification.

5.4.3.- FORMAT: Formatting the AR5 internal memory

This option lets the user to format the internal memory. A confirmation is required to perform this action. Take into account that this action will mean all stored data to be deleted.

Note: Do not turn the AR5 off during the memory format process, otherwise the display will show an error message and the process should be redone.

6.- TECHNICAL SPECIFICATIONS

Voltage measurement:

Measuring range : Single-phase mode 10 to 500 V a.c. (L1-Neutral)
Three-phase mode 10 to 500 V a.c. (Phase-Neutral)

Frequency : 45 to 65 Hz

Disturbance detection:

Disturbances > 500 μ s
Voltage sags < 75% of peak voltage

CONSTRUCTIVE CHARACTERISTICS OF THE CARTRIDGE

Case : Anti-chock plastic

Dimensions : 64 x 19 x 40 mm

Connection terminals : 1 input/output terminal

7.- SAFETY WARNINGS



The user should take into account all installation instructions referred in sections INSTALLATION AND STARTUP, CONNECTION INSTRUCTIONS and TECHNICAL SPECIFICATIONS of the analyzer.

Note that with the instrument powered on, the terminals could be dangerous to touching, and cover opening or elements removal actions may allow accessing dangerous parts. The analyzer has been designed and tested to meet IEC 348 standard and is factory-shipped in proper conditions.

8.- TECHNICAL SERVICE

For any inquiry about the instrument operation mode or in case of malfunction, you can contact CIRCUTOR S.A.'s technical service.

CIRCUTOR S.A. - Aftersales Service
Lepanto, 49
08223 - TERRASSA (SPAIN)
Tel: 34 - 93 - 745 29 00
Fax: 34 - 93 - 745 29 14

e-mail: ar5@circutor.es

A.- QUICK GUIDE (AR5 – DISTURBANCES)

| Menu | | Description | Options | Standard | |
|----------|---------|---------------------------------------------|-----------------------------------|-----------------------------------------|-------------------|
| Set-up | Circuit | | Choice type of measuring circuit. | Single-phase Three-phase | |
| | Record | Trigger | Level | Sensitivity level setting | 1.2 |
| | | | VNOM | Rated voltage of monitored power line | 230 V |
| | | | HZNOM | Rated frequency of monitored power line | 50 Hz |
| | | | V.LOW | % of voltage limit. Sag voltage | 50% - 100% 75% |
| | Name | | Working file name | | STD-PROG |
| | Comm | | Communication parameters setting | | 9600,n,8,1 |
| Clock | | Analyzer's date and time setting | | | |
| Contrast | | Contrast. | | | |
| Run | | Enabling / Disabling data recording process | Stop Run | Run | |
| Files | Dir | | Directory of stored files | | |
| | Delete | | Deleting a file | | |
| | Format | | Clearing all memory content | | |