Technologie

APR16 DFR

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GENERAL

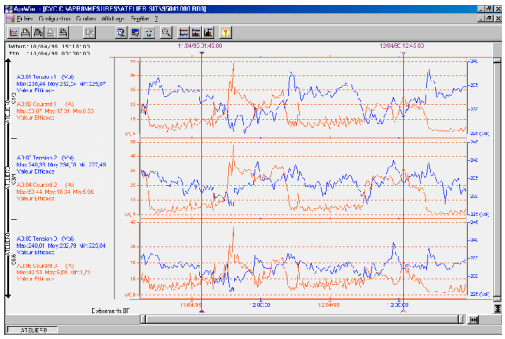
APR16 replaces two analyser/recorders:

1) APR16 continuously records each mains network electrical parameter (U,I,P,Q,S,Phase,Harmonics ...) with an integrating period adjustable between one minute and one hour.

2) APR16 detects and records low frequency events (voltage drop, over-voltages, wave distortion) with a sampling frequency of 6400 Hz.

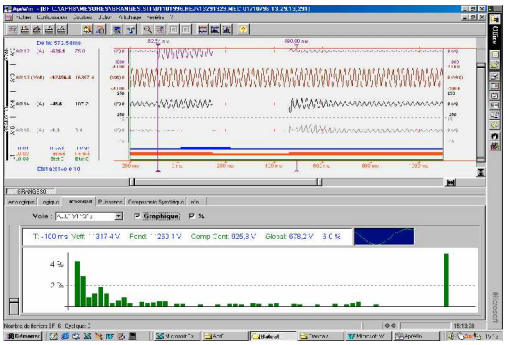
OPERATING DIAGRAM

Level 1 (Recorder)



Cyclic measurements for a long period
(integrating period 1 mn)

Level 2 (Disturbance Fault Recorder)



LF measurements
(sampling freq. 6400 Hz)

According to its programming the APR16 enables an electrical network to be monitored in real time disturbance mode.

Monitoring:
– 2-phase or 3-phase networks (3 or 4 wires)

Detection:
- voltage drops
- over-voltages
- wave distortion

Restoration:
– RMS. voltages and currents
– Active, reactive power
– Cosine and tangent
– Asymmetrical mode (3-phase networks)
– Harmonic levels V and I by order (2 to 63), and transfer direction
– Level of global distortion for V and I

Measurement storage is optimised to reduce the memory occupation as far as possible without affecting the measurement accuracy.

Analysis of measurements is achieved:

Locally
- with the APR16 (with a VGA screen, PC keyboard and external printer)
- or with a compatible Personal Computer, this analysis is performed with all the 3-phase mains network parameters, by means of APRWIN software.

Remotely (Option)
– by a compatible Personal Computer, by means of a modem connected to the switched network, to a dedicated link or to a multiple point-to-point network

During the data transfer or processing, APR16 continues scanning and storage of measurements.

APR16 calculation capacity permits the RMS. value and the curve of the wave of 8 alternating channels (Voltage or current) to be monitored in real time, as well as the variation in state of 16 logical channels. It is possible to survey 16 analog channels and 32 logical channels by adding a second data acquisition card, an analog measuring unit and a logical channel unit

Triggering:

The triggering and storage of measurements may be obtained:

in "Manual mode"

– by hitting a keyboard key

in "Automatic mode"

– by overrunning a max. or min. threshold of RMS. value on one of channels
– by variation of signal amplitude in time (dv/dt or di/dt)
– by overrunning a max. or min. threshold of rate on an harmonic order
– by overrunning global rate threshold
– by variation of state of one or more logical channels (AND function, OR function)

Threshold and duration alignments of each channel are completed by the user using the keyboard.
In these 2 modes the APR16 stores measurements with a pre-time adjustable from 20 to 200 ms, and a post-time adjustable from 400 ms to 4800 ms.
If triggering occurs before the post-time end, the recording time is increased by the time of the post-time.
The max. storage time is 5 seconds (40 seconds with the optional software ref. -PE-LOGDEM).

Measurement storage:

The storage of measurements is performed on the APR16 hard disk.

Measurement processing:

The processing of measurements is achieved :

- by APR16 by means of the keyboard, screen and external printer.
- with an IBM or compatible Personal Computer, measurement may be transferred by means:
  - of 3½ inch disks
  - of RS 232 link, locally or remotely on the switched network.

APR16 Description

The APR16 is made up of two main parts:

1) <u>A measuring and detection module</u>

This module is based on a high-capacity signal processor, DSP by Motorola.
DSP performances permit a real-time measurement and detection of overrunning the programmed thresholds onto 8 analog and 16 numerical channels (or 16 analog and 32 logical channels).
Measured signals are sampled at an average frequency of 6400 Hz. An automatic synchronisation system enables adjustment of the sampling frequency to obtain 128 samples per period (input frequency of 50 Hz). All channels are simultaneously sampled by the use of blocker-samplers.
Each input signal period is fractioned into a series of 128 complex numbers (Fast Fourier Transform) characterising the module and the phase of each component of the signal up to the 63rd harmonic. This mode of representation greatly facilitates all future numerical processing:

- RMS. value calculation
- Calculation of active, reactive power and apparent of the cosine and tangent phase taking into account an input voltage and an input current.
- Calculation of direct, reverse and zero-sequence voltage taking into account a 3-phase system.

With this mode of representation, it is possible to restore the original signal (visualisation).
Each sampled period is analysed in real-time to detect a programmed event. In case of detection the DSP transfers the set of measurements corresponding to the element detected into the host system memory (second part) and informs it for immediate acknowledgement and storage.

2) <u>Host module for dialog and storage</u>

This module drives the detection module. It is constituted of a CPU board micro-processor with:
- 16 Mbytes of RAM
– 1 x 3.5 inch floppy disk
– 1 x 2Gbytes hard disk
– 1 x parallel output for external printer
– 3 x serial outputs (RS232, modem, radio clock)
– 1 x VGA output for external video monitor

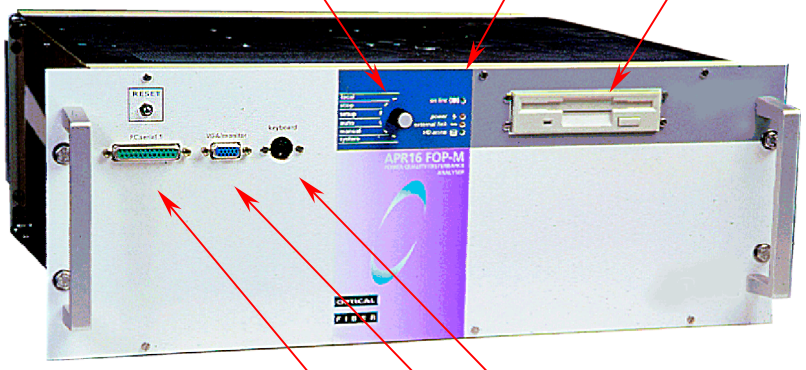
The operating system used is a multi-task system, called SDOS. This system enables the best management of the host processor activity, by modifying the priority of processing tasks to be accomplished according to detected events.

All software is stored on the hard disk to simplify any possible modification or improvement. The software which manages the DSP is also stored on the hard disk and automatically loaded in its memory during the initialisation. Host module functions are:

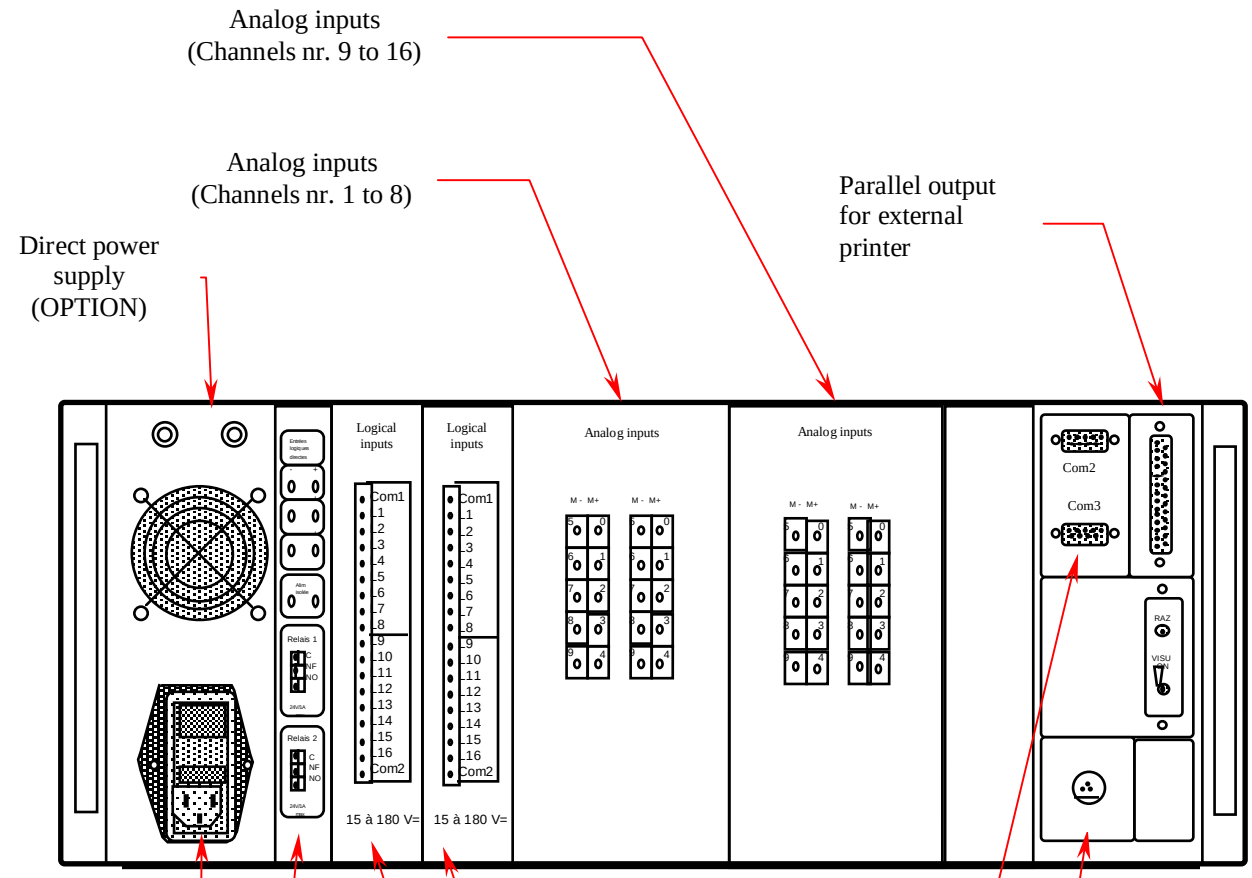
– Detection module programming:
When measurement begins, the software detection module is loaded in the DSP module memory, and also the set of overrunning parameters requested by the operator. These overrunning parameters are introduced in the APR16 by means of an interactive software.

– Storage of events detected by the DSP:
A priority task, advised by the detection module that an event has to be stored, processes the raw data, compacts and stores them on the hard disk, which decreases the space used and increases the storage capacity.
Management of memory is optimised to permit a detection of consecutive events without APR16 saturation. The maximum duration of an event is 5 seconds. An optional module enables events to be processed within 40 seconds (E.g. motor starting)
All measurement files are available for displaying and on-site processing.

Front panel of the APR16



Rear panel of the APR16



Analog inputs
(Channels nr. 9 to 16)

Analog inputs
(Channels nr. 1 to 8)

Direct power
supply
(OPTION)

Parallel output
for external
printer

RS232 serial outputs
2: Modem
3: Synchro

Mains power
supply
220V 50 Hz +
Earth

12VDC power supply
output 0,5A used for
accessories (Example:
ADAPTI units)

Contact inputs
and outputs
+
24 VDC power
supply for dry
loops

Logical inputs
(Channels nr. 17 to 32)

Logical inputs
(Channels nr. 1 to 16)

<u>Note</u> : The connectors used for analog channels and logical channels and contact outputs are delivered with the APR16.

Technical features

Sampling principle
Sampling is automatically synchronised in order to obtain 128 points per period or 6400Hz for a fundamental frequency of 50 Hz. The frequency may vary according to the software used.
Sampling frequency :
Analog channels : 6400 Hz (50 Hz)
Logical channels : 1600 Hz definition 0,6 ms

APR16 analog channels
Number : 16 differential inputs (8 optional)
Measurement range (2 ranges) : 0 to 2,4 volts and 0 to 240 volts switching by software
Permanent overload : 8KV direct current
Input impedance : 10 Mohms
Bandwidth = sampling freq. / 2
Resolution 12 byte + 1 sign bit

Note : The analog channels accept just as well the AC voltages as the DC voltages (in this case the P, Q, S, ... measurements are invalid)

APR16 logical channels
Number : 32 (16 optional)
Consumption 1 mA (>12 volts <220 volts)
Response time : 0,6 ms

Setting-up of analog measurement channels
Each channel is definite by :
- His name (11 characters)
- The measurement unit V, A, °C etc ...
- The beginning and end values of scale of the parameter measured
- The beginning and end values of scale of the sensor used

Setting-up of logical channels
Each channel is definite by :
- His name (11 characters)
- Name of low status (0)
- Name of high status (1)

Measurement accuracy
- RMS value +/- 0,2 %
- Apparent, active, reactive power and tangent and cosine +/- 0,4 %
- Harmonics
  Analysis of order 2 to 63 (50 Hz)
  Accuracy +/- 0,2 %

Real time clock
- Saved clock (saved about 1 year)
- Date, month, day, year, hour, minute, second

Storage
- 3 ½ inch disk 1.44 MB
- 2Gbyte hard disk

Display screen
- External screen (VGA)

Keyboard
- External keyboard (5-pin DIN PC AT-style keyboard)

Outputs
- 3 RS232 connections (RS232, Modem, Clock)
- 1 CENTRONICS parallel external printer connection
- 1 VGA external display screen connection

Contact outputs
- output nr. 1 closure of active contact (about 3 seconds) by detection of an event. The contact is definitively closed if the hard disk is full.
- output nr. 2 closure of active contact during APR16 operating, opening of active contact in case of stand-by or failure of the APR16.

Features of the contacts :
Reverse contacts cut-off power on resistive circuit 1 A 24 VDC or 24VAC. An external noise reducing circuit is necessary in case of inductive circuit.

Printer
- External parallel printer.

Modem (optional)
- External compatible Hayes modem, please consult us for the type of modem to be used.

Triggering conditions
The triggering conditions are set by the software used.

Power supply
- 230 volts +/- 20 % - 45 - 400 Hz
- 30 min. back-up by internal battery (Nickel Cadmium)
  The back-up time is adjustable by software (preset at 10 mn)
- Possibility of external D.C. power supply (Optional : 48 V, 127 V, 220V).

Physical dimensions & Weight :
- 178 x 485 depth 485 mm 17Kg

Environment :
- Storage temperature : - 20°C to + 60°C
- Operating temperature : + 5°C to + 45 °C
- Humidity : 0 to 70 %.

Warranty :
- 12 months (Return to factory)

Principle of measurement

Principle of the cyclic measurement

The signal is sampled each second then integrated on a progammable duration from 1 minute to 60 minutes.

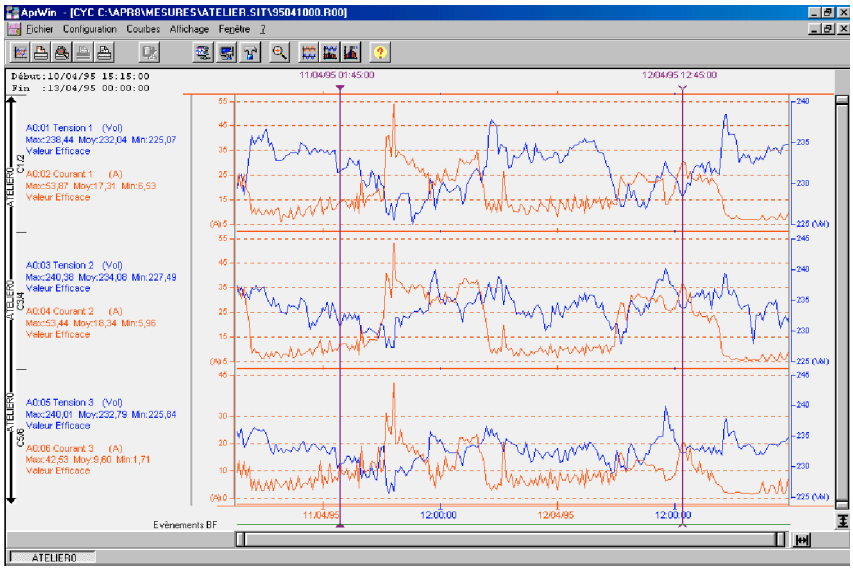
All following parameters may be drawn :

- RMS value
- Single-phase active power
- Single-phase reactive power
- Single-phase apparent power
- 3-phase active P (with or without neutral)
- 3-phase reactive P (with or without neutral)
- 3-phase apparent P (with or without neutral)
- V/I phase
- Harmonic global ratio
- Harmonic order (from 2 to 63) + Fundamental + continuous component
- Reverse voltage
- Direct voltage
- Homopolar voltage

The maximum measurement duration is 15 days long.

If LF events come during measurement period, they are stored and marked on cyclic restitution.

Example of restitution

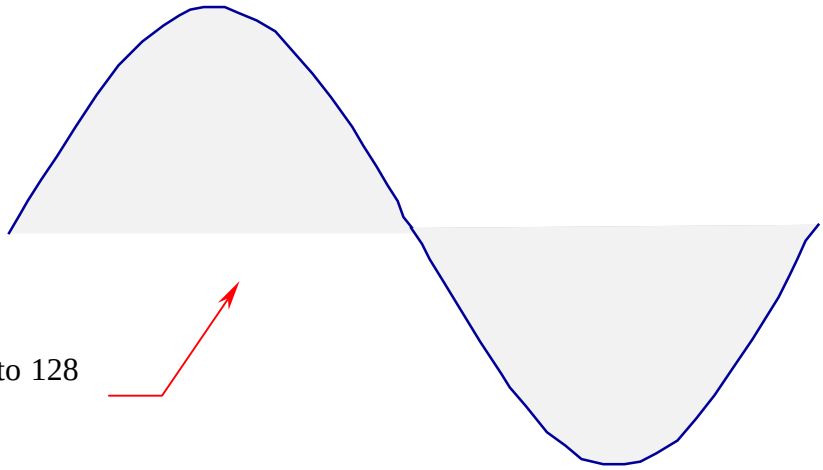


Principle of LF measurement

All analog channels are simultaneously sampled at a frequency proportional to the frequency of the fundamental signal.

For a fundamental frequency of 50 Hz, the sampling frequency is 6400 Hz. The bandwidth is 3200 Hz.

Samples are numerical values coded with 12 bits (4096 points) and a sign bit.



A period is sliced into 128 samples

At the end of **each period**, the signal is decomposed into a series of 128 complex numbers (Fast Fourier Transform), which characterise in module and in phase, **every component** of the signal up to 63rd harmonic.

With these results, it is easy to compute the following values:

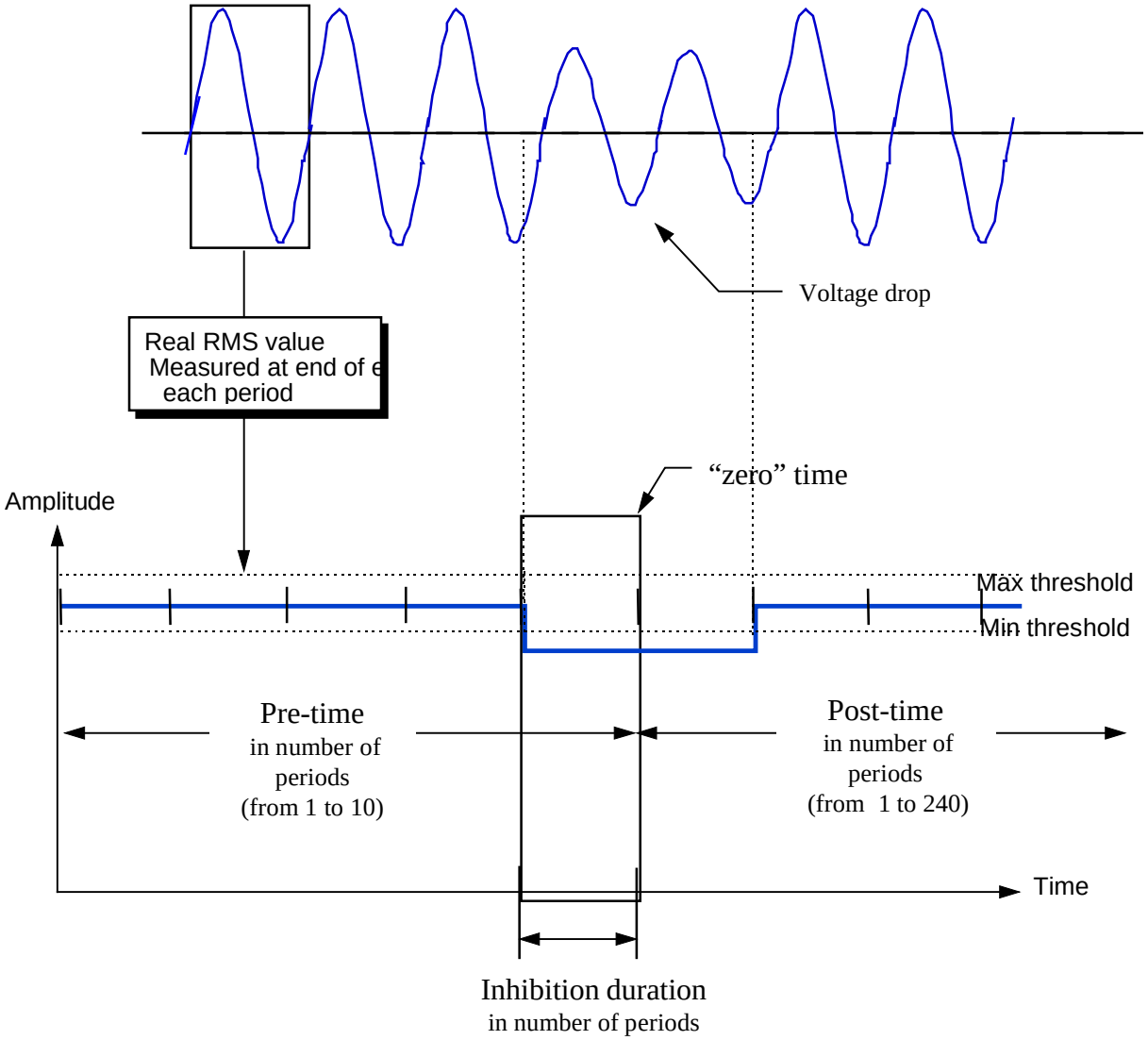
- RMS. Value
- Active and reactive power, cosine and tangent on a single or 3-phase network
- Direct, forward, homopolar voltage on 3-phase network
- Voltage and current harmonic order 2 through 63 and global distortion rate
- Harmonic power and transfer direction

In the “LF mode”, APR16 may be triggered by 5 different conditions:

– overrunning a max. or min. threshold (RMS. value)
– relative threshold (RMS. value)
– rate of the global harmonic (harmonic distortion)
– rate of a specific harmonic order
– activation of a logical channel (level 0, level 1 or state modification)

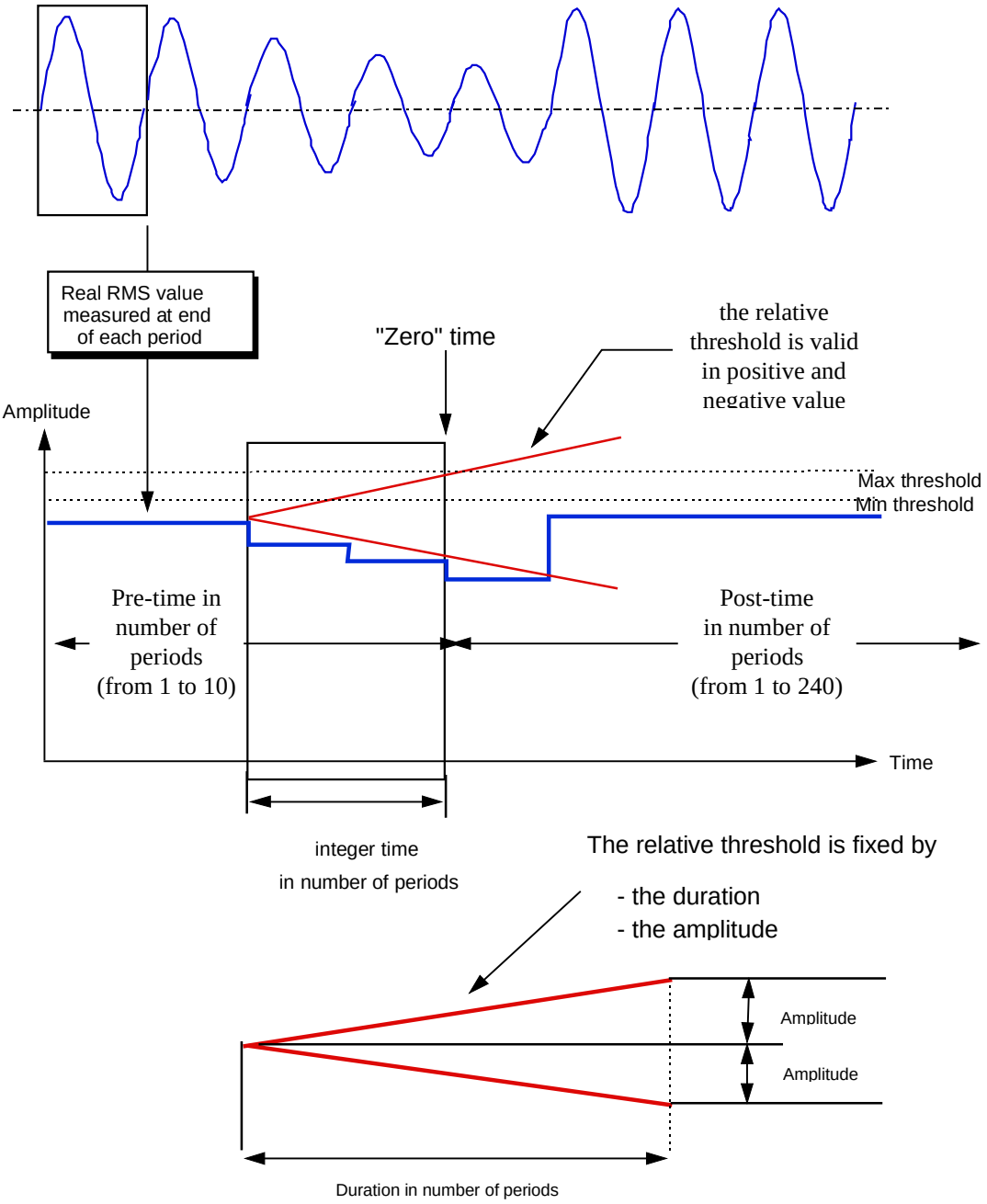
Detection of RMS value (Mini and Maxi threshold)

The threshold values are adjusted by software for each analog channel.



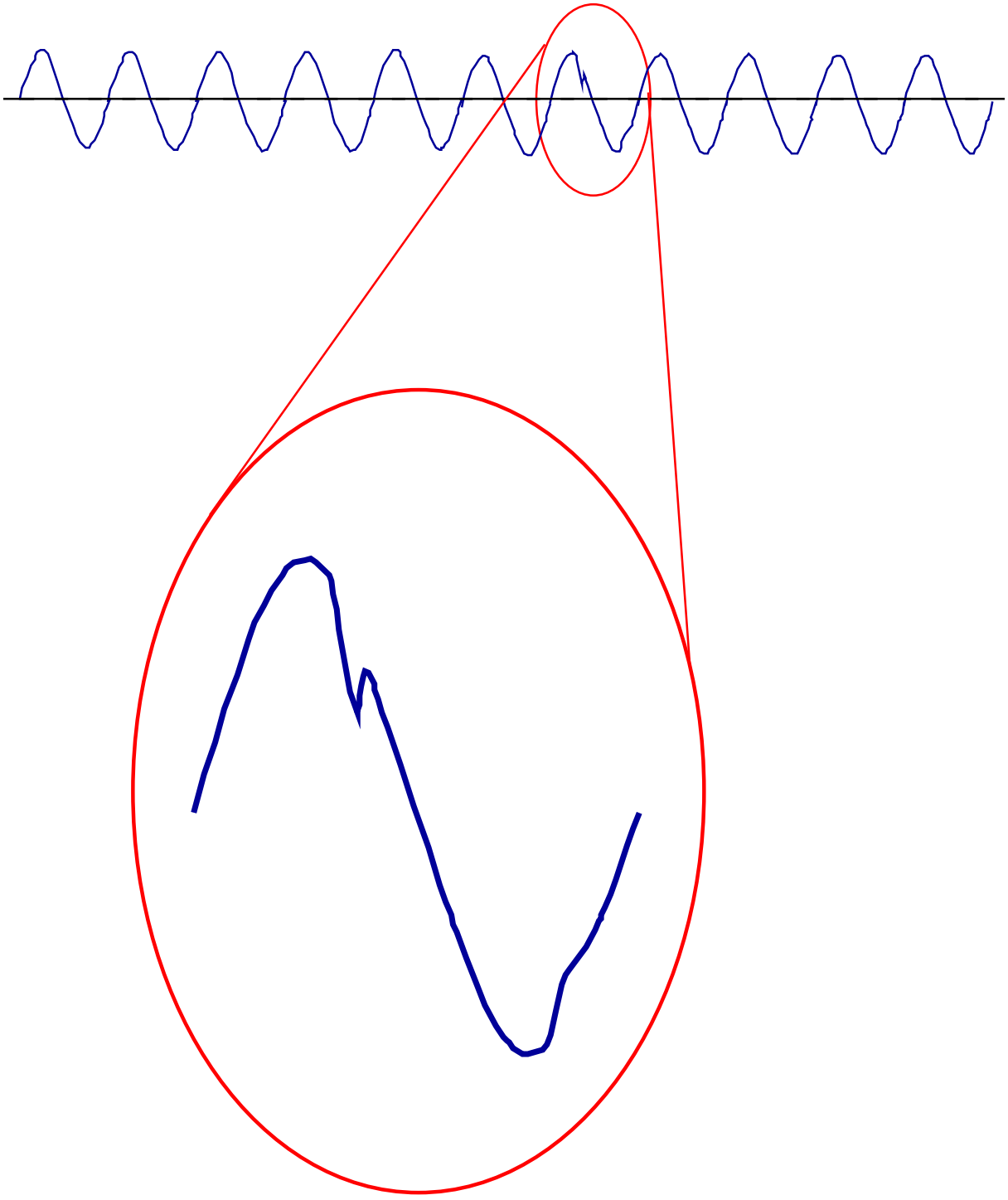
The inhibition is the duration for which an occurence is not account. The APR16 detects the event if it lasts longer than the inhibition duration.

Detection on a relative variation of amplitude (dV/dT or dI/dT)



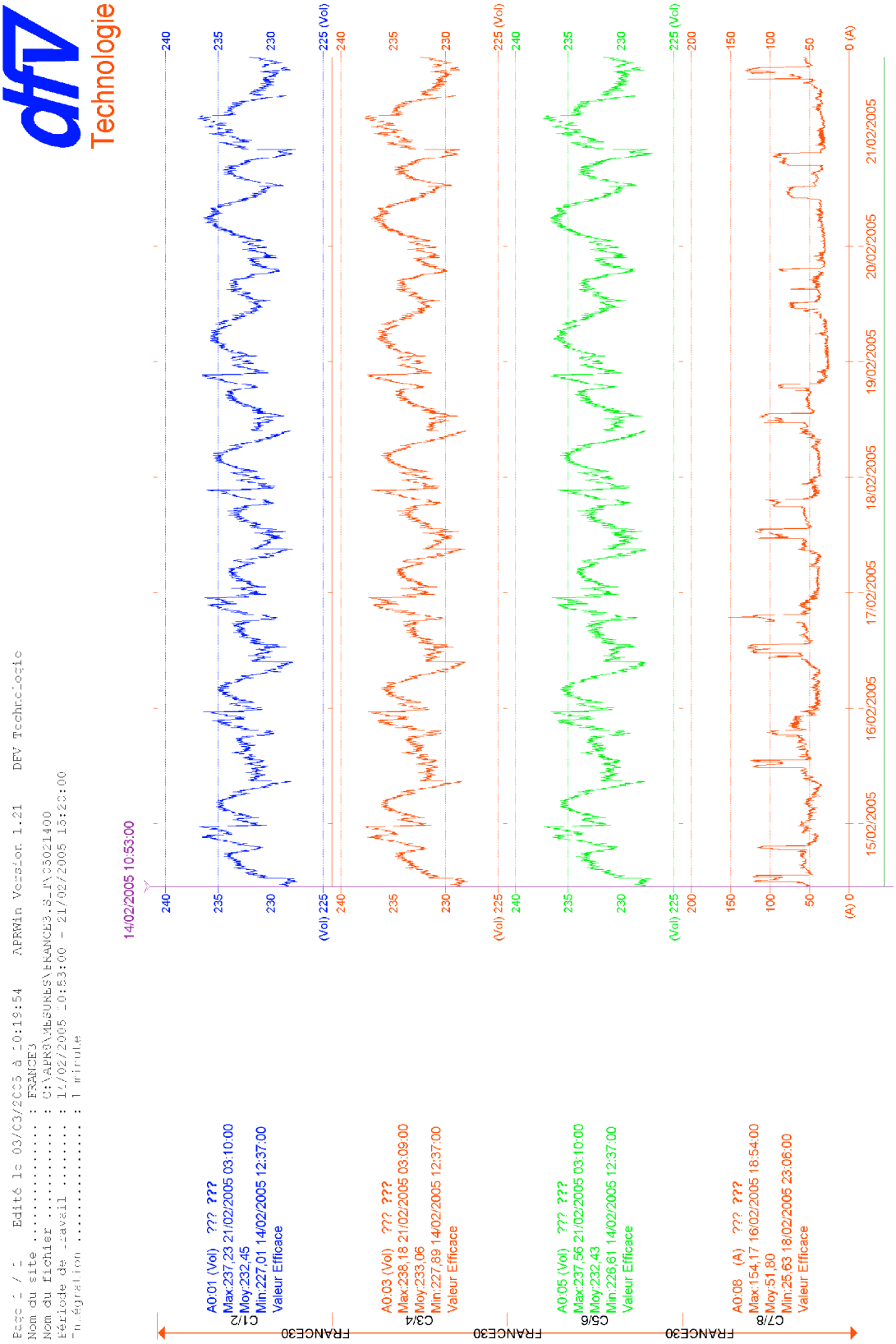
Detection on wave distortion

Monitoring of 12 harmonic orders and of global ratio (period by period). A distortion of the wave can be detected because the wave produces a modification of the harmonic spectrum.

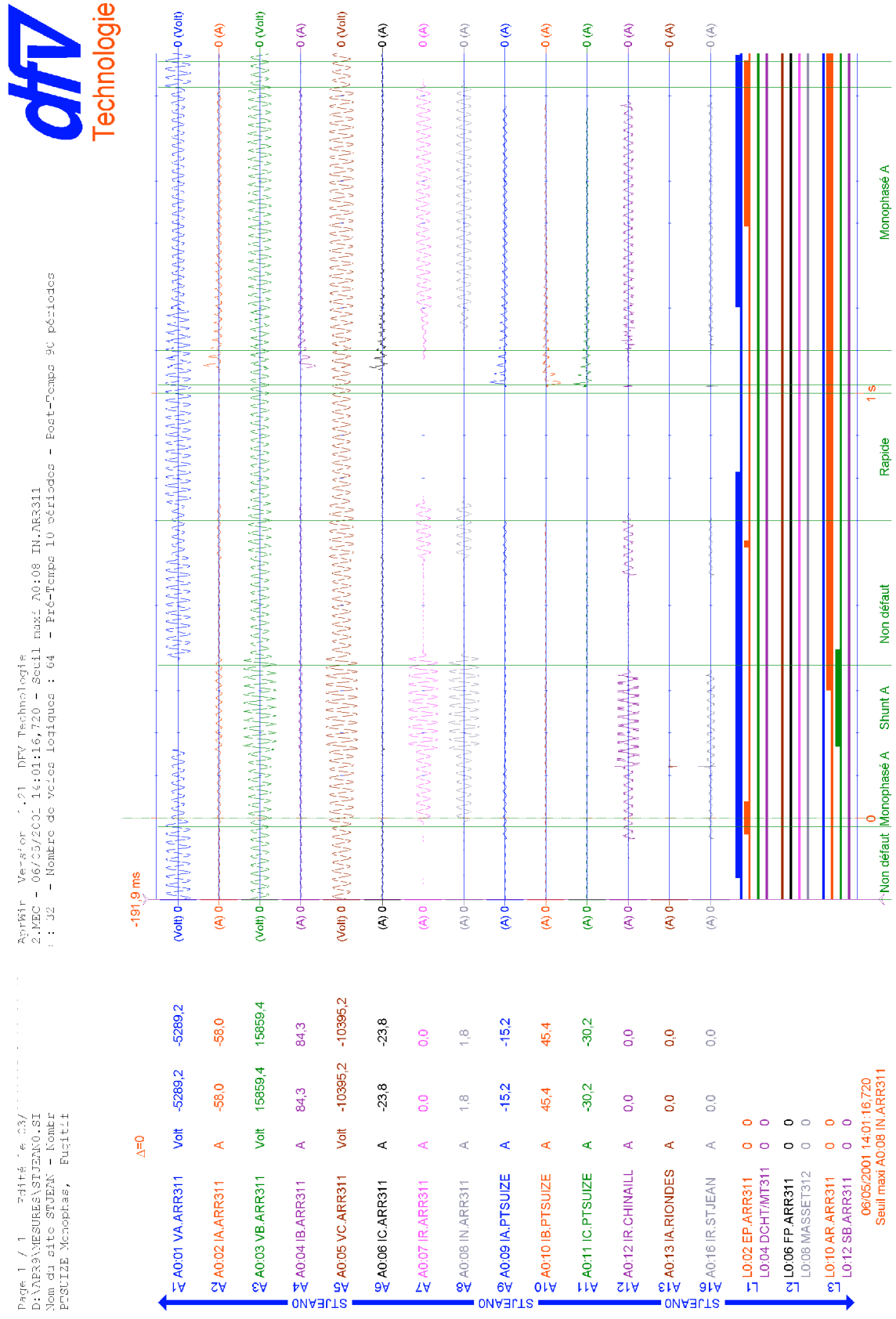


A threshold on the global ratio may be programmed to detect a wave distortion.

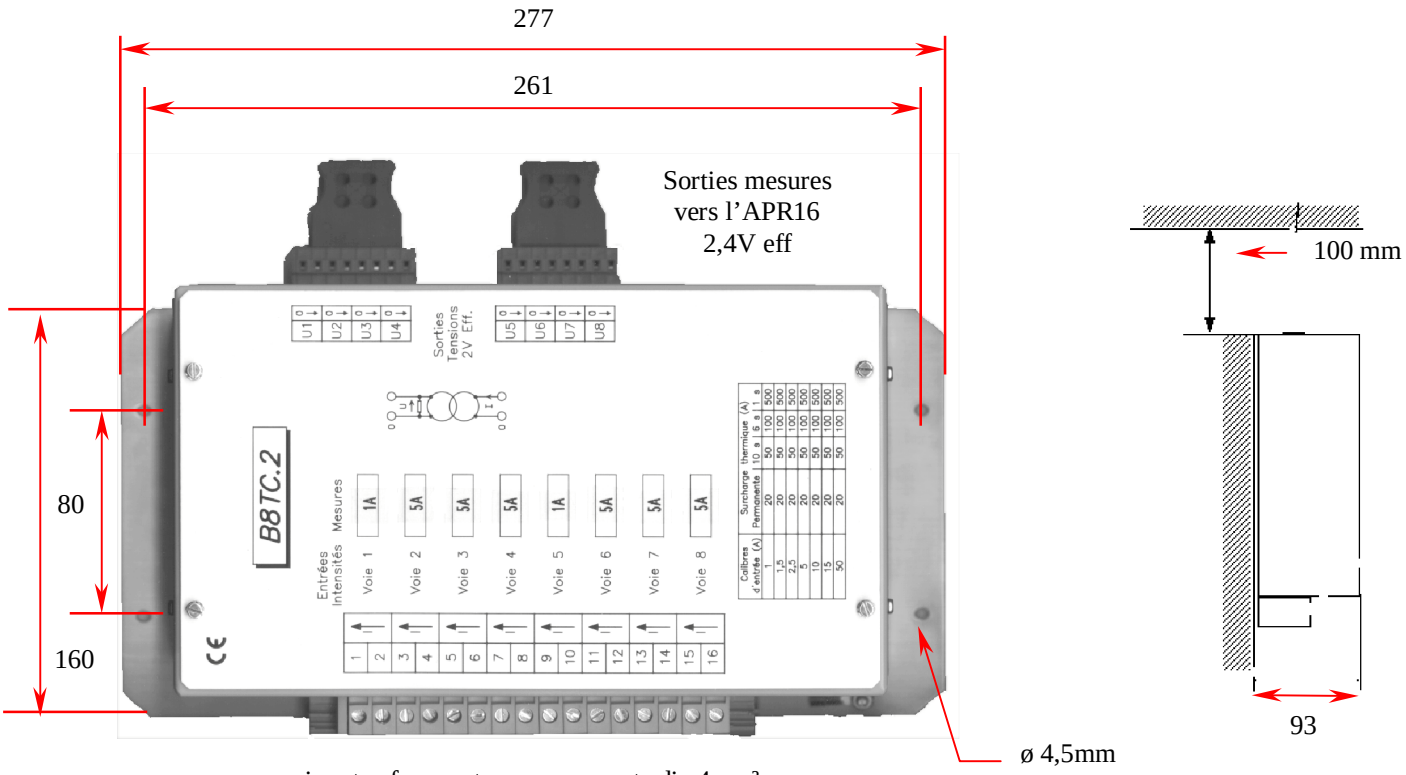
Example of printing of the cyclic curves:



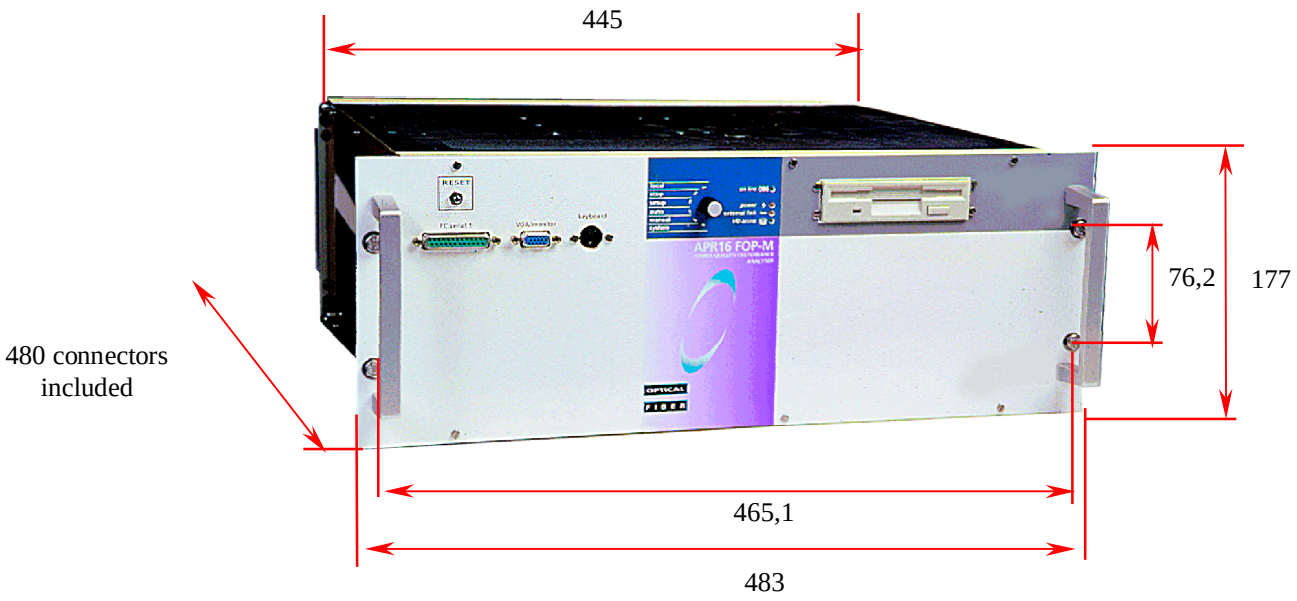
Example of restitution of LF curves:



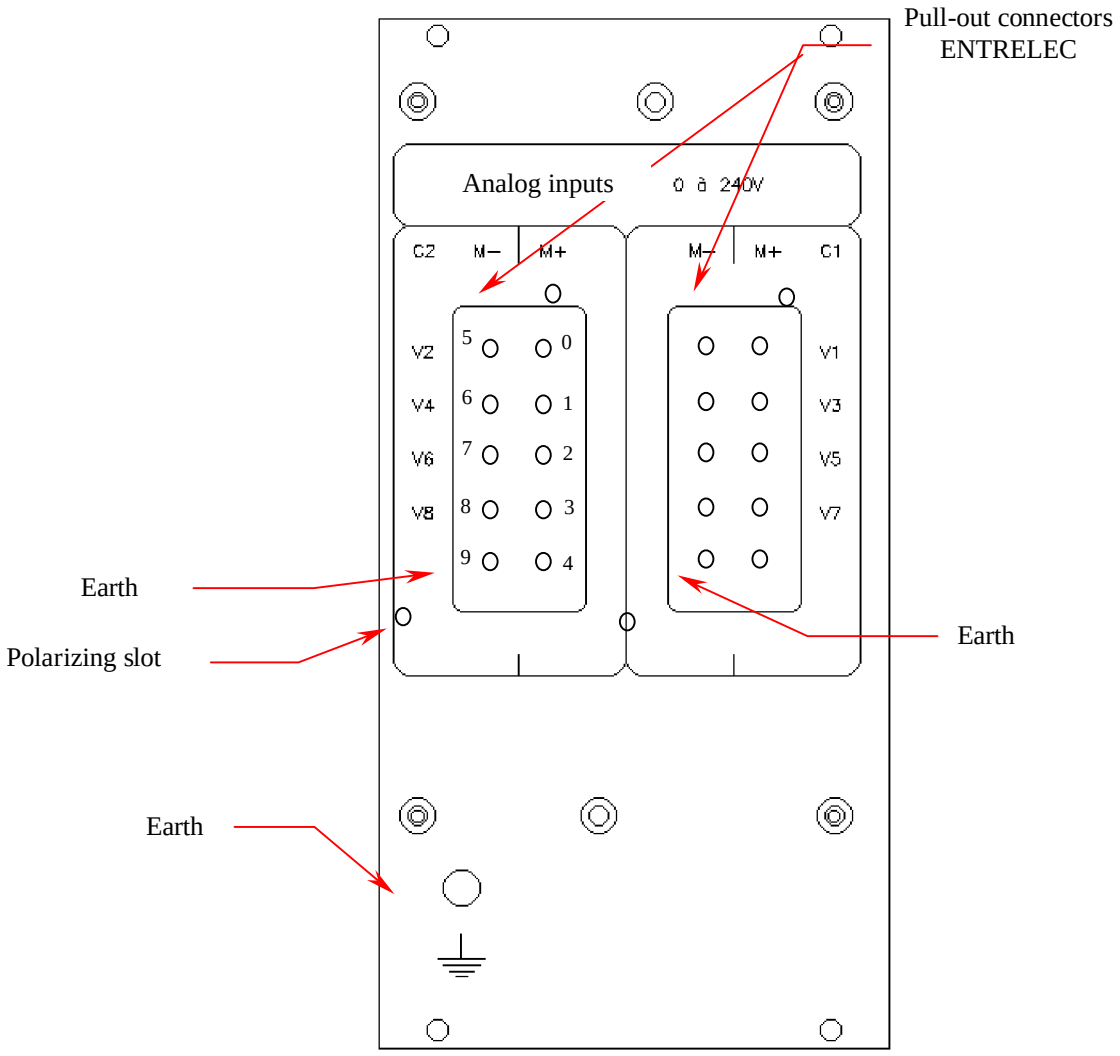
Accessories



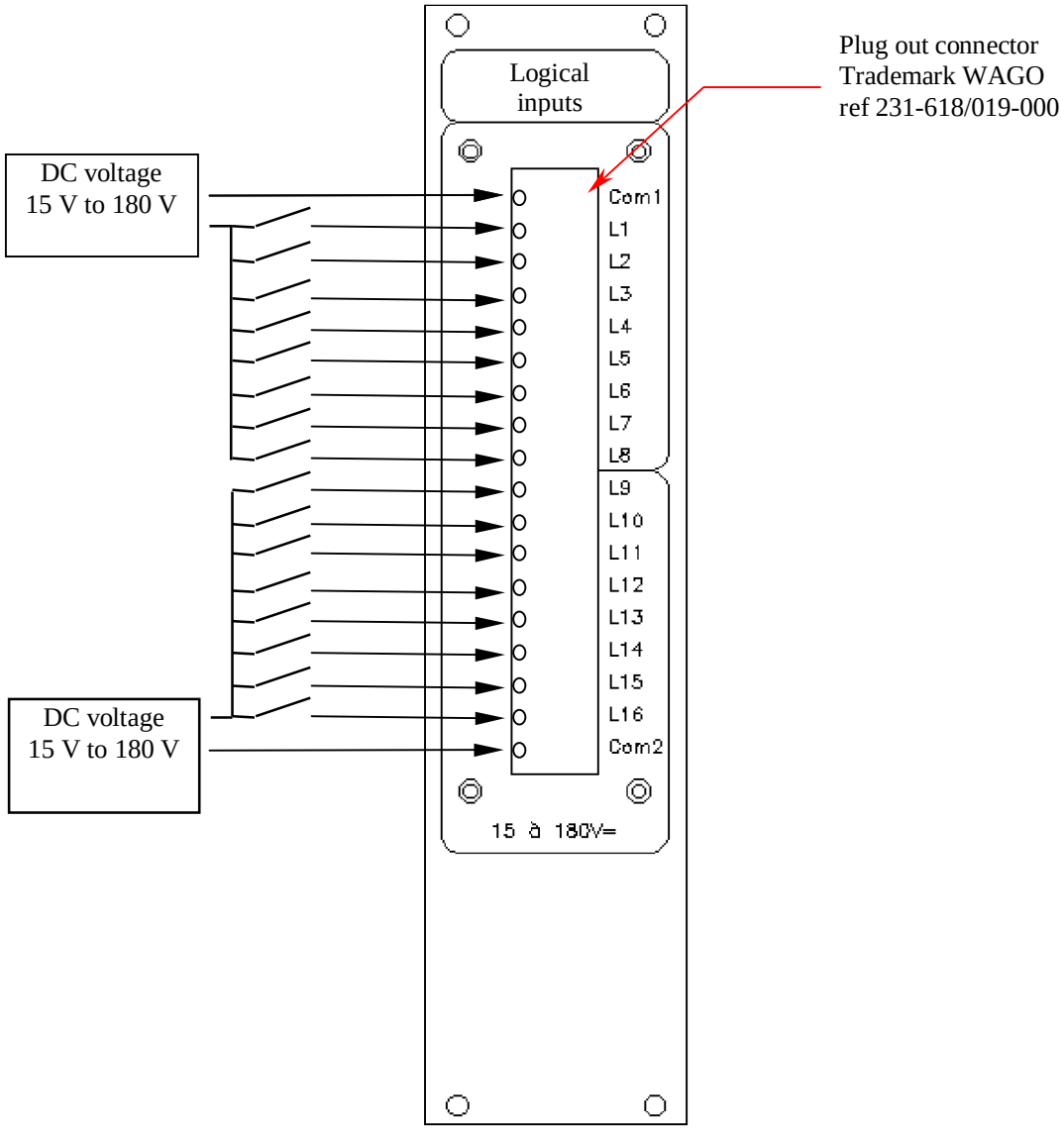
inputs of currents measurements dia 4mm²



APR16 Unit with analog inputs



APR16 Logical inputs



APR16 Auxiliary unit