

**MAGALI SOFTWARE**
**MAGALI**
**DESCRIPTION**


**MAGALI is a test oriented software designed for data processing and analysis in real-time and post processing.**

**This product is complete and easy to use.**

**KEY POINTS**

- **Real-Time and Post-Processing**, the user always works in the same software environment, with the same interface.
- **On the shelf**, **MAGALI** is ready immediately after installation.
- **Modular product**, it is easy to add new acquisition or generation stream. **MAGALI** can be used as the core of simple or complex multi source systems.
- With its **Network Distributed Architecture**, **MAGALI** can be extended on several stations: acquisition, management, visualization.
- **Multiplatform**
- **Multilanguage**

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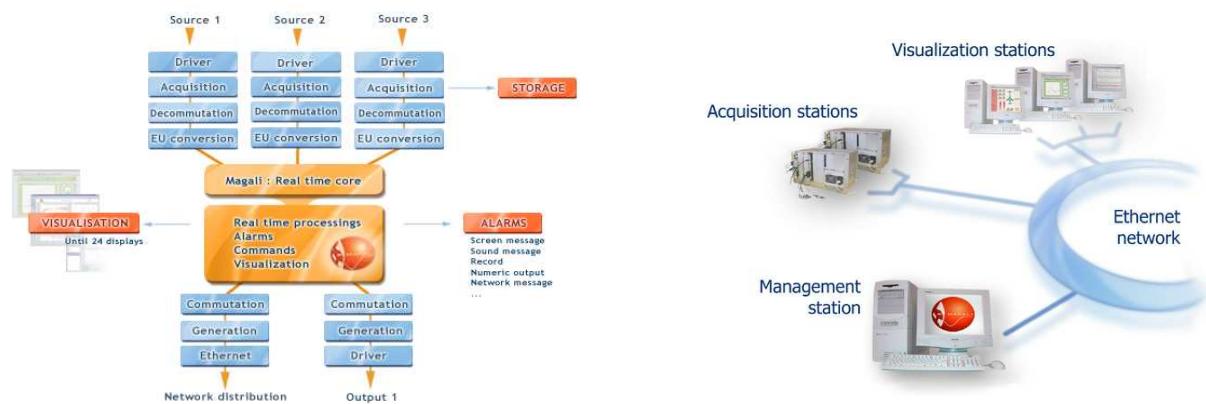
## REAL-TIME FUNCTIONALITIES

The structure of MAGALI Real-Time is based on a kernel with various services. It manages inputs and output streams (I/O streams).

This kernel allows high speed or low speed acquisition.

With this modular architecture, it is easy to add new I/O streams

Visualization can display data from several acquisition systems, by using the Distributed Network Architecture (NDA).



MAGALI is a complete Data Acquisition, Generation and Analysis System, answering to the requirements of Test Engineers, with the following services,

- Acquisition and storage
- Decommuration and Engineering Unit conversion
- Process parameters
- Alarms
- Events management
- Visualization
- Network communication

**Real-Time mode** is increased with the **Replay mode**.

This mode can be run after real-time mode has done acquisition.

The Real-Time mode acquires data from input streams and stores them on data files.

The Replay mode uses the data files as inputs instead of input streams, and processes this data in the same way than Real-Time mode.

## ACQUISITION, GENERATION AND STORAGE

This function supervises the modules dedicated at each I/O stream. The module controls the interface cards and exchange raw data and status, available for others services, mainly storage, and decommutation.

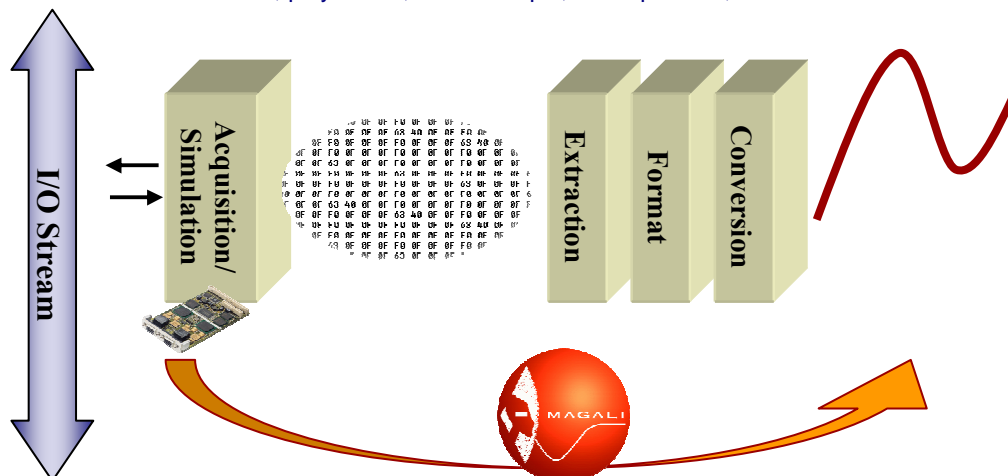
- Storage  
Storage of raw data, status, with management of data files. This task has the highest priority to guaranty no lost of data.  
The storage conditions could be manual, automatic, trigger, or date.  
Storage of decommuted data is possible (option).
- Time  
The acquisition is synchronized with the system time or an external IRIG time.  
It allows managing the date of the parameters:
  - absolute time (from the IRIG time or system time)
  - elapsed time (relative time, count from zero at the acquisition start, but can be modified on an event, with negative and positive time)
- Quick look mode  
For the distribution to others modules, 2 modes are available, depending of the performance and CPU.  
The Quick Look mode, where only a sub-sample of occurrences are distributed, (at least 20 samples / second).  
The All-Points mode, where every occurrences are distributed.

## DECOMMUTATION ENGINEERING UNIT CONVERSION

This function supervises the modules dedicated at each I/O stream.

The module extracts and qualifies the information included in the raw blocks, parameters, packets, embedded streams as video, and gets this data available for others services, mainly displays, processes, alarms and network communication.

- The decommutation function includes two sub-functions, "block decommutation" and "parameter decommutation". The blocks type depends on the decommutation type.
- Block decommutation  
The block decommutation extracts blocks of data (zones, embedded messages, packets ...). These blocks contain parameters, video, voice or others.
- Parameters decommutation  
The parameter decommutation extracts each sample of parameters in term of value in raw format, time and quality factor. The extraction takes in accounts the format of the parameters: number of bits, format, mask,
- Engineering Unit conversion  
Convert the raw value of the parameters in physical value. Every major conversion function is available: linear, polynomial, thermocouple, look-up tables, sensor database ...



## PROCESSED PARAMETERS

Allows to build new parameters from arithmetic and mathematic function, acquisition parameters, others processed parameters.

The calculation respects the All-points or Quick-look mode.

- Synchronization

When the input parameters don't have the same synchronization, the user can define a trigger parameter, used for the synchronization of the process.

- New process functions

The user can create new functions with the Software Development Toolkit for Real-Time (option).

## ALARMS

This module detects alarms when a condition on a parameter occurs. For example, overpass a level, verify a profile ...

On alarms, different actions can be launched: display a message, logging, send message on the network, discrete output ...

Specific actions can be defined with the Real-Time Software Development Toolkit (SDK\_RT) (option).

## EVENTS MANAGEMENT

Events are designed to tag any special information during test. They are recorded during the acquisition. They can be displayed in other acquisition.

## VISUALIZATION

- Graphic display

This function visualizes parameters on graphic displays. Inputs are acquired parameters or processed parameters. They can be visualized in curves, charts, bar-graphs, digital units, images.

Several displays can be used in real time, up to 24 per station.

The graphic displays are standard or customized by the user, with the graphic editor.

The selection of graphic displays and the selected parameters, displayed on graphic displays are defined in the test configuration.

Any parameter from any source can be displayed.

The refreshing rate is over 25 Hz. For graphic objects like digital unit, chart ... the rate can be pre-defined for each object.

The user can freeze the visualization, copy the display in a list in memory for a later display, or printing.

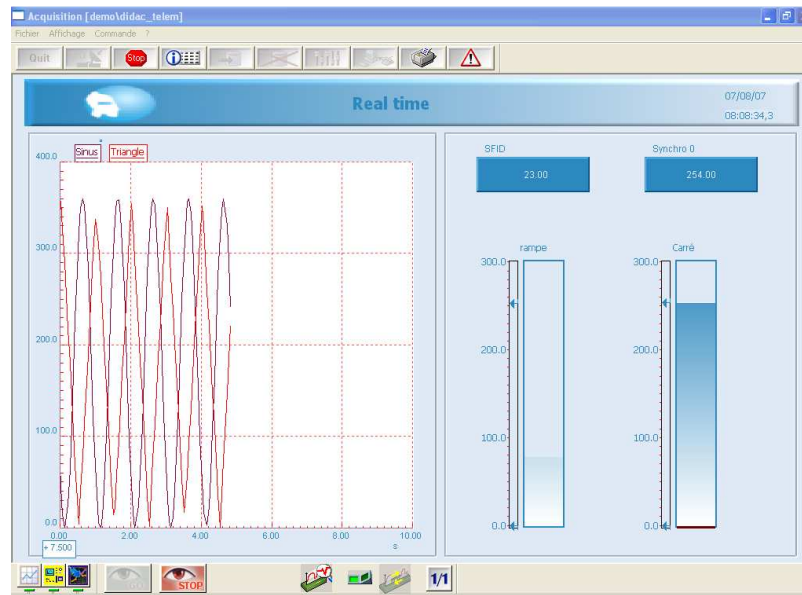
- Block and messages display

Block data can be displayed in a dump form, with binary, decimal, octal, hexadecimal format. The visualization is refreshed periodically and can be frozen.

This tool is useful for debug mode or control, to visualize ram data, for example:

- Telemetry minor frame
- Telemetry black old asynchronous embedded messages
- 1553 messages,

...



## NETWORK COMMUNICATION

The network communication is based on the NDA protocol. This protocol is detailed in the specific datasheet.

The communication is possible with additional modules (option).

The MAGALI/NDA module is a server module. It sends data on the network according to the request of other stations, and defined in the configuration. The data is formatted on packets, with,

- decommuted data, on raw format or engineering format,
- status
- events
- raw blocks of data : minor frames, embedded messages, video, ...

The MAGALI/QLM module sends decommuted data, on a defined format for external application. This format is documented.



## REPLAY MODE

The replay mode uses data coming from files instead of inputs streams

The services available for Replay Mode are the same than Real-Time mode, storage excepted.

- Decommutation and Engineering Unit conversion
- Process parameters
- Alarms
- Events management
- Visualization
- Network communication

This mode is controlled with a dedicated panel, including the following functions

- play
- position on a date, the beginning, an event, ...
- pause
- speed faster or slower

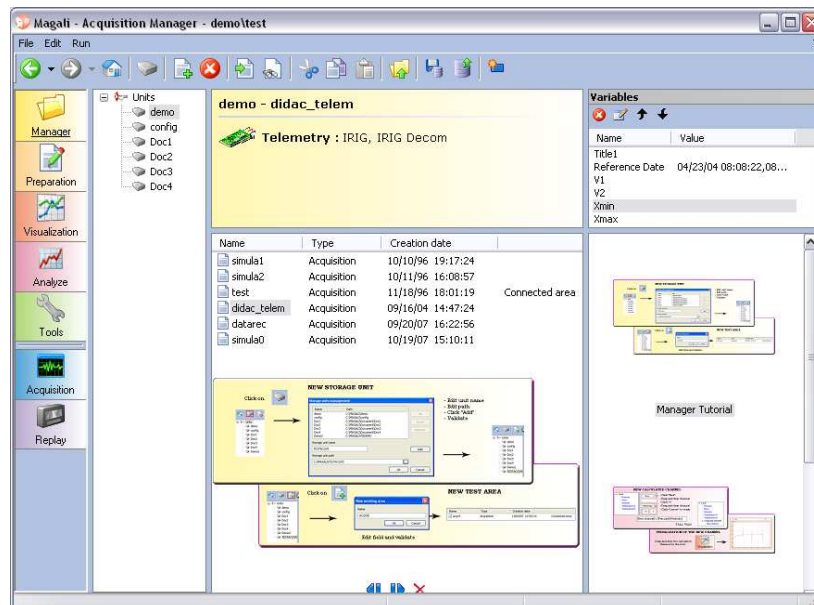
## PREPARATION & POST PROCESSING

### TEST MANAGEMENT

Each test is defined in a **Test Zone**, gathering all information about the test:

- Test configuration
- Data files
- Description of parameters. These files contain all the information to be able to extract and manipulate the parameters from the data file.
- Processed parameters
- Information on the test: alarms, event ...
- Video and image linked with the test.

A manager gives information on the test zones, and help to browse and to organize them;



#### Option: external database

The Test Zone Manager can be linked to an external database.

### TEST CONFIGURATION

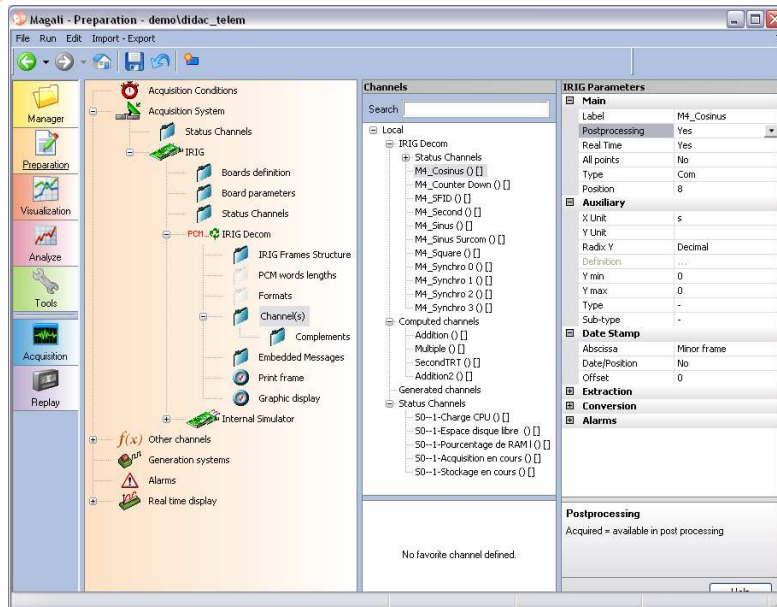
#### Description

The Test Configuration Manager defines the complete set of information to run a test. It includes acquisition systems configuration, real time functions definition, visualization, processing, alarms and output definition.

In network architecture (NDA), the configuration of the different workstations in the network can be defined by the Test Configuration Manager on the Management Station.

Definition is on a tree structure representing the complete system. This structure is designed to find easily and logically any element of the system. The channels are defined in tree lists following the system architecture. Configurations with several thousand channels are today operational.





## Elements of the test configuration

The test configuration defines the following elements.

### **Test information**

There are general information to identify the test: environmental conditions, date, material in test...

### **Test conditions**

Definition of start and stop conditions for acquisition and storage: manual, on internal trigger, on external trigger, on date, on duration, automatic ...

### **Acquisition system**

This element includes one node per acquisition system used. Each node includes global information to configure the acquisition system, and information on each measure channel defined. Information is very complete, to use each channel in real time and post processing, only from the name (label on 32 characters).

Channels definition includes:

- General information, units, channel type, range ...
- Parameter structure, mostly for the channels defined in digital frames, location, bit number, format, binary, real, complemented ...
- Definition of the acquisition. Mostly for analogue channels, acquisition, canal, gain, frequency, conditioning...
- Information on datation
- Information on conversion into engineering units, linear, polynomial, per segment conversion functions.

### **Real time process**

Definition of the real time calculated channels. Calculated channels are defined with a function or a mathematic expression. The definition is easy with a calculator integrating all functions, standard or specific. Each expression can be displayed in form of a tree structure and validated with example values.

### **Alarms**

Definition of trig conditions (channels, threshold, pattern, frame) and of actions on alarms (log, visual or sound message, information distribution on Ethernet, Internet or phone network, digital or relay output, ...)

### **Real time visualization**

Definition of the real time displays used and configuration of them (displayed channels, limits of graphic objects). Displays are selected in the list of available displays, already built with the graphic editor.

## Distributions

Definition of the outputs used. There is one node per output available: analogue channels, digital bus, network frames.

## Import external configurations

Additional functions can be added to MAGALI to import information from an external application. These functions translate external tables in the MAGALI configuration format.

These functions have the advantage to avoid double inputs of information, to win time and avoid errors.

Some standard functions exist and can be propose as options, and it is possible to develop specific ones. For example, functions can be used for « on-board » system or to use on external calibration database

## Import and export internal configurations

The Test Configuration Manager has importation and exportation functions, to transfer a test configuration or part of it, from one test zone to another.

# V I S U A L I Z A T I O N

### o Display

The Post-Processing Visualization module displays parameters with form

- o curves time-history,  $y = f(t)$
- o curves  $y = f(x)$ , where  $x$ ,  $y$  are 2 parameters
- o chart with raw or engineering unit values

The displays are standard or customized, built easily with the graphic editor.

Several signals can be displayed in the same frame, coming from one or several acquisitions.

The axis limits are defined by the operator, estimated automatically with the signal features, or chosen in a list of set of limits defined during the data analysis.

The particular points as events, synchronization losses ... are materialized with brackets.

### o Graphic analysis

Some interactive functions are available to add new signals, to enrich the display with text comments, graphic or values...

Cursors are available, to see the value of a data point, and to follow the acquisition point by point. They can also display the values of several signals simultaneously. Several cursors allow calculation between values.

Cursors allow a switch between the graphic display and the raw values, directly in the dump of the data block, very useful for debug of the configuration of digital bus.

### o Test report

The test report is the set of displays, saved with the acquisition in the test zone.

The displays include all the information added by the operator, cursors, texts ...

The aim is to define a complete test reporting, linked with the test zone.

It is possible to open any display of the test report, to modify it, to save it.

The test report can be printed.

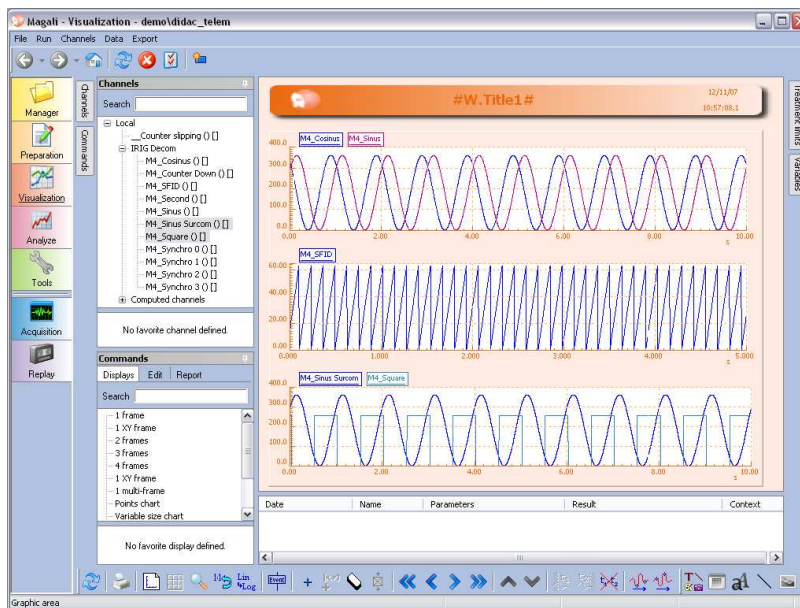
### o Data browser

The data browser displays the test acquisition, source per source in raw format.

It displays raw data, minor frames or embedded messages, block per block in dump format.

It is easy to navigate on the acquisition.





## PROCESS FUNCTIONS

### Description

The post-processing functions are a set of mathematical, signal frequency, statistic ... functions.

These functions generate processed parameters. They are applied on acquisition or processed parameters.

Processed parameters can be used with every other MAGALI tools, in the same way than acquisition parameters.

If a function requires several input parameters, the time synchronization is managed internally.

Available calculation functions are as follows:

### Search

- On position
- On abscissa
- On ordinate
- On slope
- On integral
- On range
- Minimum
- Maximum

### Arithmetic operators

- Addition
- Subtraction
- Multiplication
- Division

### Logic operators

- Negation
- And
- Or
- XOR
- Lower
- Lower or equal
- Greater
- Greater or equal
- Equality

### Mathematic functions

- Absolute value
- Square root
- Square
- Power
- Exponential
- Neperian logarithm
- Decimal logarithm
- Decibel conversion
- Reverse Decibel conversion
- Base 2 logarithm
- Sine
- Cosine
- Tangent
- Arcsine
- Arccosine
- Arctangent
- Hyperbolic Sine
- Hyperbolic Cosine
- Hyperbolic Tangent
- Module
- Phase
- Linear Function
- Sign function
- Indicator function
- Modulus function
- Interpreted function
- Derivation
- Lapacian
- Integration
- Surface estimation
- Concatenation

### Signal processing

- FFT
  - Power spectrum
  - Energy spectrum
  - Real/Imaginary
  - Module/Phase
  - Real/Imaginary inverter
- Autocorrelation
- Cross-correlation
- Module / Phase Interspectrum
- Real / Imaginary Interspectrum
- Coherence function
- Transfer function
  - Real/Imaginary
  - Module/Phase
- Digital filter
  - Basic
  - Finite impulse response
  - Butterworth
  - Tchebichev
  - Elliptic
- Smoothing
- Repeated smoothing
- Basic frequency function
- Envelop
- Function time frequency

### Statistic processing

- Average and standard deviation
- Statistic report
- Linear regression
- Inter Channel(s) averages
- Approximation
- Resample
- Interpolation
- Distribution and density
- Statistics on working areas
- Channel build of channel

## ADDITIONAL FUNCTIONS

Additional functions are available as option module to answer to specialized requirements.

To answer to specific requirements, the MAGALI system accepts external functions developed with the Post-Processing Development Toolkit (SDK).

## IMPORT/EXPORT FUNCTIONS

Data issued from PCM streams, are available in raw or decommuted formats.

From these formats, decommutation and exportation modules of MAGALI are designed to dispose of data in form of:

- Binary: decommuted real value files
- Text: decommuted ASCII value files

These files can be exported in software as MATLAB or EXCEL.

Importation of data is easy using drag and drop functions. The file is dropped in MAGALI software and an assistant helps to extract data.

## MACRO-COMMANDS

A macro-command is a chain of commands. It can include every operation: acquisition, visualization, process, configuration modification, import, export ...

It is possible to define input, output and internal variables. And then to define embedded macro-commands to have several levels.

This feature is an easy way to build customized application.

The macro-commands are assembled with a graphic builder.

## REFERENCES

Syst/MAGALI

MAGALI software