μGRAPH

The Micro Graphic Data Analyzer

Visualization

Data Analysis

File Formatting

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User's Manual

MGR v1.9 Release 3

How to contact EDAS

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µGRAPH User's Manual

Written in Paris, Brussels, Yogyakarta, Guadeloupe & Lanzarote, May 2004.

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Getting Started

Introduction

What is µGRAPH?

µGRAPH is a simple tool to help analysis of time data series. It reads regular raw ASCII data files, offers standard processing, and produces an interactive and intuitive visualization via time referenced graphics. Results can be exported in new file under various data formats or GIF image.

Other software's allow to produce high-quality graphics, but usually require the very last update of computer performances as soon as you want to process large data files... µGRAPH is a tiny stand-alone *MS-DOS*® program "`mgr.exe`" (about 100 Kb), running with standard graphic display and processor 80286 or higher. It does not need RAM and can handle up to 30 channels and 200 files together of **unlimited size** because all the processes are sequential. All options can be specified on a single line at the *MS-DOS*® prompt or into alias script files, such as full automatic processing / graph outputs are allowed.

µGRAPH can be used in three different ways:

- From almost any ASCII data file(s), process data (filtering, extraction, averages, regression, arithmetic...), change date, time and data formats with a set of options on the *MS-DOS*® command line;
- Visualize these data file(s) as time referenced graphics in an interactive mode (channel selection, scale adjustment, zooming, simple formula and data fitting,...), with keyboard or mouse functions, and export the final graphic in a GIF image;
- View graphics in real-time from *EDAS* data-loggers connected on the serial port.

The syntax of µGRAPH is (brackets stand for optional arguments)

`mgr` *filename1* [*filename2* ...] [/*options*] [@*script1* [@*script2* ...]]

and you get a graph of your data and/or processed data file!

The Figure 1 shows basic principles of µGRAPH.

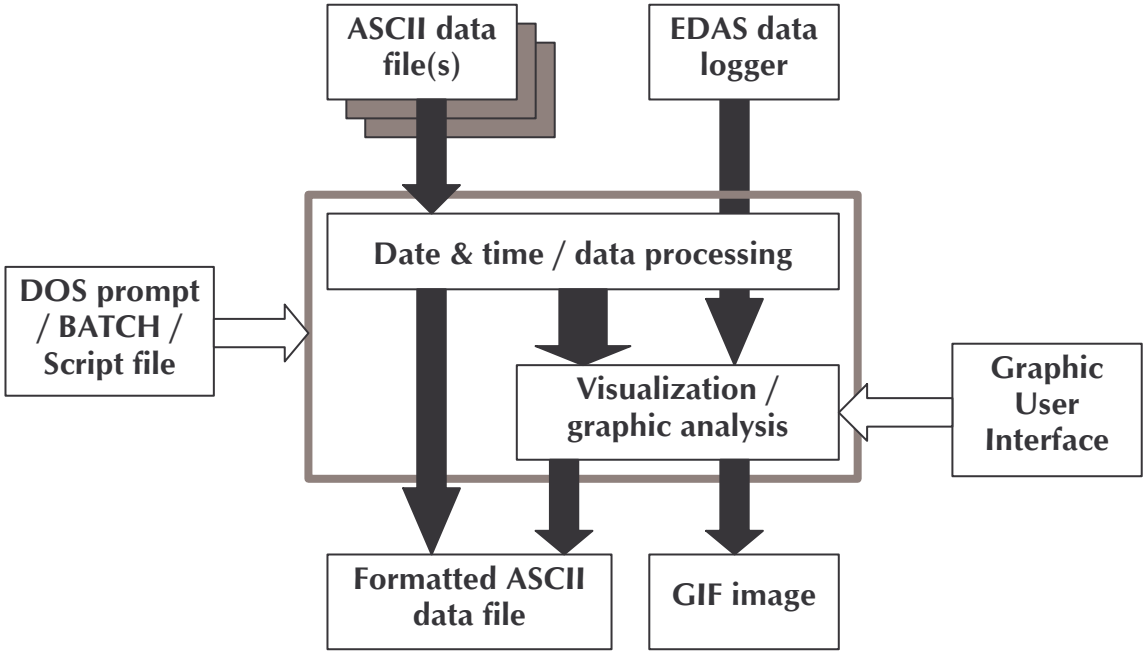


Figure 1. Basic principles of µGRAPH: Inputs, outputs and interfaces.

Installing µGRAPH

µGRAPH is delivered as a single software package "`mgrpack.exe`", auto-extractable zipped file, small enough to be stored on a floppy disk, which contains all the files (executable, help and documentation). If you want to access to µGRAPH from any of your data directories, it is advised to install it in your *MS-DOS*® path. For correct installation, use the following steps:

1. Execute the package by double-clicking on it, or under a *MS-DOS*® prompt window

   ```
   C:\TEMP\mgrpack
   ```

2. Execute the BATCH file "`install.bat`"

   ```
   C:\TEMP\install
   ```

3. To access µGRAPH from any directory, reboot your computer; otherwise, call

   ```
   c:\mgr\mgr
   ```

   from the *MS-DOS*® prompt or in your BATCH files, instead of "`mgr`".

µGRAPH Package Contents

Strictly speaking, µGRAPH can run properly with the only file "`mgr.exe`".

However, to be fully functional, it needs three other files in a directory included in your *MS-DOS*® PATH:

`mgr.exe`	Main executable.
`mgr_help.dat`	On-line help file.
`mgr_tide.dat`	Earth tide wave list.
`mgr.ini`	Script initialization file
`day.exe`	Date & time converter.

The other files provided in the package are:

`mgr.pdf`	User's manual (this document).
`example.clb`	Example of calibration file.
`example.bok`	Example of book file.
`example.dat`	Example of data file.
`example2.dat`	Example of data file with *header*.
`readme.txt`	Information for installation.
`lisezmoi.txt`	Full history of previous updates (in French).

µGRAPH Philosophy

µGRAPH has been first developed for data processing of the µ*DAS* data-logger (*Micro Data Acquisition System*®), and was named at this time µ*DAS Grapher*. It has been written during my doctorate thesis field missions supported by IPGP and ORB, from 1995 to 1997, and a lot on my personal free time. In 1996, it became a part of the *EDAS* (*European Data Acquisition for Scientists*) project of the Royal Observatory of Belgium (ORB). The related functions, specific to these materials, are still supported and have been extended to recent *EDAS* hardware's and software's.

In this framework, it has been oriented to help the work on data acquisition stations in natural conditions, i.e., using very basic portable computers (for instance, without Windows and RAM) and with a special need of fast and simple manipulation, in order to get a quick view of the data in the field. Regarding these constraints, we tried to make the software as simple as possible, with a lot of automatic settings.

On the other hand, the intuitive aspect and quickness of the program have encountered so much success, that it is presently used also on desk computers to process a large range of files and data types. For this reason, it has been recently renamed µGRAPH and is currently used by various laboratories / observatories in the world for data analysis.

Since µGRAPH is mainly used by students, technicians and researchers for monitoring / routine data processing an research, it must be efficient and must answer to general and specific problems. For this reason, µGRAPH is an evolutionary software: Do not hesitate to contact us if you feel that additional functions of general interest may be added!

Basic Operations

Getting Help

Running the program without any argument will launch the on-line help. You will have access to a set of 10 pages (using arrow keys or page number) that covers most of the options of µGRAPH.

A Windows help file is provided with the software package: "`mgr.hlp`"; it offers an interactive document with cross links and can be open under *Windows® 3.1, 95, 98, 2000, NT and XP.*

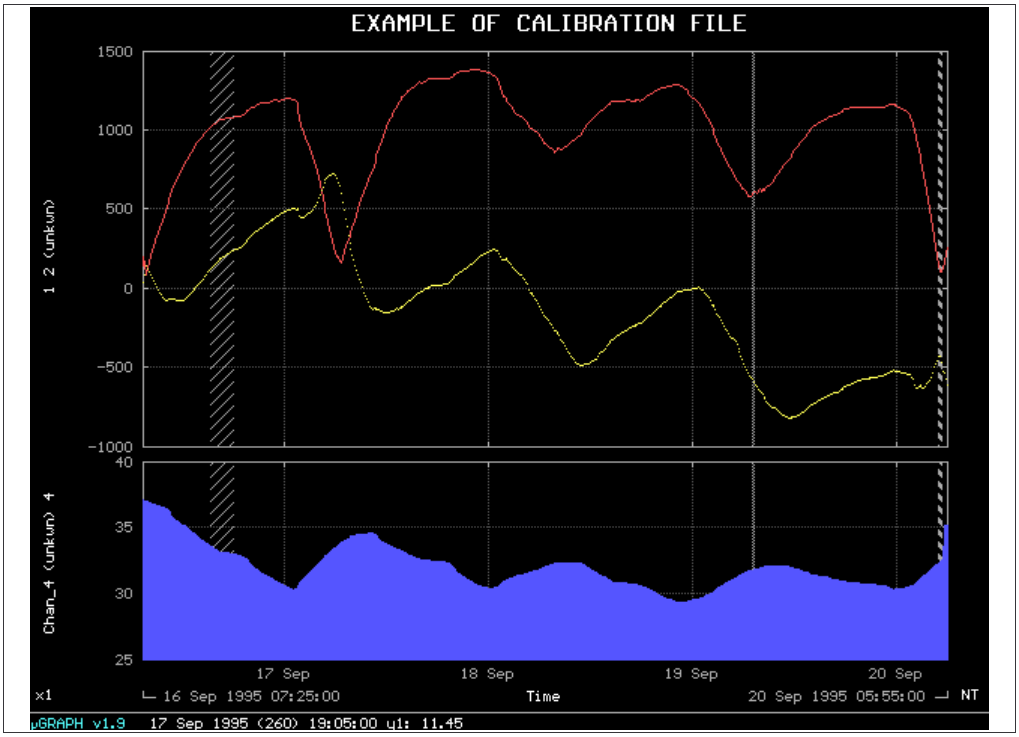
The present document is also available in a PDF file: "`mgr.pdf`"; it can be read and printed on any operating system with the *Adobe Acrobat Reader®*. See the Web site `http://www.adobe.com` to get the software (free download).

Execute the example script

For a quick demo of µGRAPH possibilities, go to the program directory and type:

```
mgr @example.mgr
```

This produces the following graph:



Command Summary

This chapter lists μGRAPH commands by functional area. There is two categories of commands:

- the arguments (DOS prompt, Batch and script files);
- the keyboard and mouse functions (GUI = graphic user interface).

Since some of the commands have an equivalent in both categories, GUI function keys are noted in left margin when applicable.

General Purpose Commands

Help

Alt H	*no argument*	Display on-line help

Main Commands

filename	Import the file *filename* as data
/	Option
@	Script file (argument list)
/com	Connect to an EDAS data logger on port COM
/test	Test the file(s) format and display information
/tmp	Change directory for temporary files

Exit

default	Automatic exit after exporting data or GIF using argument commands (not GUI)
Alt X / F10	Exit (GUI)

Importing Data Files

Main Commands

default	All columns imported as data channels
/i	Specify column format (date, time and data)
/ic	Interpret coma as decimal point
/im	Interpret minus as separator
/x	Exclude first lines
/xt	Exclude lines with text

Multiple Files

	default	Append channels (for visualization only)
	/a	Append files in time
Alt F1	/merge	Merge files using common time reference

Date and Time

	/b	Extract from specific date & time (begin)
	/e	Extract until specific date & time (end)
	/it	Impose a sample period
	/nt	Exclude time recovering
	/r	Center data versus sample period
	/s	Time lag
Ctrl F1	/sort	Sort time
	/tr	Time restore
	/y	Specify date & time reference
	/yn	Specify date & time reference from filename

Preset Formats

defaults	Files with µGRAPH header or µDAS binary files
/l	LTERM capture files
/das	PC-DAS shot files
/mdas	MDAS shot files (µDAS v4)
/reunion	Reunion tiltmeter binary files

Data Processing

Calibration / Channel Names and Units

/c	Apply full calibration on the data
/cn	Use only names & units
/cf	Calibrate in frequency (DAS processes only)
/cv	Calibrate in voltage (polynomial factors)
/cg	Calibrate in physical unit (general factor & constant)

Filtering

	/d	Decimate data (average)
Alt T	/df	Apply moving average
	/ed	Extract data (under sampling)
	/fx	Remove noise (differential threshold criteria)
	/nan	Define Not-a-Number value
Alt S	/spike	Remove noise (intelligent criteria)
	/vm	Remove noise (maximum threshold criteria)
	/vn	Remove noise (minimum threshold criteria)

Data Fitting

Alt O	/do	Remove offset (mean value)
Alt L	/dl	Remove trend (linear regression)
Alt W	/dh	Remove first harmonics (sinusoidal decomposition)
F7		Data fitting preview (GUI)

Specific Calculations

Alt C	/dc	Compute cumulative sum
Alt D	/dd	Compute derivative
F8	/f	Compute formula (arithmetic)
Shift F8	/hicum	Compute periodic histogram (HiCum)
	/m	Retrieve over-scales from DAS shots
Shift F7		Show over-scales limits (GUI)

Exporting Data File

Main Commands

	default	Data exported after import options and data processes application, with space-separated columns and μGRAPH header
F1	/nh	No header
F1	/o	Specify output data filename
F1	/t	Export data and specify column format

Formatting Options

/iso	ISO standard for date and time
/os	Specify column separator
/shot	Keep 5-digit shots for DAS data
/tf	Export numerical data format
/xi	No information lines in header

Graphics

Main Commands

	default	All channels on separated axis, solid lines
graph_string	/g	Specify graphic type (channels and styles)
Shift F1	/gif	Make GIF image
Alt I / F2	/test	Display statistical information on data (GUI)

Graph Parameters

	/bk	Adds time event marks (book)
Alt F2	/c	Define or change channel names and units
Ctrl F2	/c	Define or change graph title
Shift F2	*default*	Return to original channel colors
F6	/g	Define line type
Ctrl F6	/g	Define marker type
Shift F6	/gd	Turns grid off
Alt F6	/lw	Use heavy lines

Display Features

	/novga	Use EGA/CGA video mode
Ctrl F9	/pe	Use full screen (no header window)
F9	/sc	Specify screen color mode
Shift F9	/vga	Specify display resolution mode

Scale, Scrolling and Zooming

+		X-axis zoom in
–		X-axis zoom out
Alt Z	/zb	X-axis zoom begin

Alt Z	/ze	X-axis zoom end
arrows		X and Y-axis scrolling
Home		Go to X-axis begin
End		Go to X-axis end
Esc	*default*	Return to X-axis full scale
F5	*default*	Magnify scales
Shift F5	/es	Equal scale interval for all axis
F4	/fs	Full / normalize scales

Graphic User Interface Menu

Alt F		Display the File menu
Alt A		Display the Data menu
Alt V		Display the View menu
Alt G		Display the Graph menu
Alt N		Display the Screen menu
Esc	*default*	Return to main GUI menu

Reference

This chapter describes all μGRAPH command line options and menu functions, in alphabetic order. The Graphic User Interface functions are referenced as GUI *function key*.

Purpose Script files (argument list)

Syntax @*filename1 [@filename2] ...*

Description Script files allow specifying an unlimited number of arguments to µGRAPH. A script file is a simple text file that contains a list of argument (filenames and/or valid options), separated by spaces or a carriage return character. Recursive calls are ignored.

Examples

```
mgr @example.mgr
```

uses arguments in the script file `example.mgr`:

```
example.dat /mdas
/c:example.clb
/g:1.2,,|b4
/pe
/bk:example.bok
```

i.e., data filename, import format options, calibration and graphic options.

```
mgr sta*.dat /a @stafmt.mgr @stadsp.mgr /gif
```

will append all the files `sta*.dat`, using the import format options in `stafmt.mgr` script file, display the data using graphic options in `stadsp.mgr` script file, then export the result in a GIF image (named `mgr.gif` in this case).

Remarks The arguments given on the command line are limited by *MS-DOS®*: line length cannot exceed 127 characters and some of them are strictly reserved to *DOS*: `,` (coma), `|` (pipe), `<`, `>`, `"` (double quote). This limits the number of arguments passed to µGRAPH and limits the use of some options. To solve this problem, script files must be used.

The file `mgr.ini`, if exists, is interpreted as script a file. It can be used to set permanent options.

/a

Purpose Append files in time

Syntax `/a`

Description By default, channels of multiple files are concatenated. The `/a` option append them in time, thus the files must have the same number of channels.

Examples

```
mgr file1.dat file2.dat /a
```

where the two files have 8 channels for instance, appends the files and display data as a unique continuous file of 8 channels. On the contrary,

```
mgr file1.dat file2.dat
```

concatenates the files and display 16 different channels.

Remarks If the `/a` option is forgotten when loading a large amount of files, it will usually produce an error because the number of channels is limited to 30 (from `A` to `U`), while total number of imported files is limited to 200.

See Also `/merge`, *limitations*

Purpose Extract data from a specific date and time (begin)

Syntax `/b:`*time_string*

Description Specify a begin date and time by *time_string* to keep only data with time reference after this limit.

Examples

```
mgr example.dat /i:ymdhns /b:9509181520
```

imports data in MDAS format with date and time after 1995-09-18 15:20:00.

Remarks This option applies after all other time and date options have been taken into account. For instance, it supposes that date and time format has been correctly defined with import options.

See Also `/e`

/bk

Purpose Add time event marks on graphics

Syntax `/bk:` *filename*

Description Display dashed areas on the background of graphics, to mark specific time events related with data (for instance intervention on the station), using *filename*, a text file containing lines in the following format:

```
begin_time end_time [level [text_info]]
```

where

begin_time is the begin date and time of event (*time_string* format);

end_time is the end date and time of event (*time_string* format);

level is a number to determine the type of dashing:

`0` =  (default), `1` =  , `2` =  ,

`3` =  , `4` =  , `5` =  ,

`6` =  , `7` = , `8` =  ,

text_info is ignored and can be used to describe the event.

Examples `mgr example.dat /i:ymdhns /bk:example.bok`

displays 3 different types of events below the example data file. The file `example.bok` is:

```
9509161530 9509161800 0 Electronic checking
9509190705 9509190715 6 Seismic event
9509200500 9509200515 2 Data transfert
```

See Also `/c`

Purpose Calibration of the data

Syntax

`/c:`*filename*

`/cf:`*filename*

`/cg:`*filename*

`/cn:`*filename*

`/cv:`*filename*

Description To give names and units to the channels, a graph title and to calibrate the data, µGRAPH uses a calibration file with a specific format. This file must contain all information about the data you want to process. Especially, for DAS data for what specific calculations apply.

If *filename* does not exist, it will be created and filled with default values (like `example.clb`). Calibration file is a text file which contains all calibration parameters and other data information as keywords followed by arguments, then a table of parameters for each channel:

```
# TITLE: text_title
# BOOK:  begin_time end_time [level]
# BOOK:  begin_time end_time [level]
# VALID: begin_time end_time
# LAG: hour
SENSOR_NAME   UNIT   DIV   FREQ   FACT   CST   A0 …   A3    B0 …   B3
Chan_1        unkwn  1     0      1      0     0  …   0     1  …   0
Chan_2 …
…
# VALID: begin_time [end_time]
# LAG: hour
SENSOR_NAME   UNIT   DIV   FREQ   FACT   CST   A0 …   A3    B0 …   B3
Chan_1        unkwn  1     0      1      0     0  …   0     1  …   0
Chan_2 …
```

where:

`# TITLE:` define text line used as title for graphics;

`# BOOK:` book marks (same as `/bk` option). The number of these lines is unlimited;

`# VALID:` define the validity time domain of the following calibration parameters (*begin_time* and *end_time* in *time_string* format). *end_time* can be omitted for the last set of parameters (valid until last data);

`# LAG:` define the time lag (same as `/s` option);

These information must be followed by a table of description and calibration

parameters for each channels, separated by spaces:

SENSOR_NAME = sensor name (16 characters max.);

UNIT = physical unit name (7 characters max.);

DIV = 2, 16 or 128 = frequency divisor, for DAS data (set in µDAS box);

FREQ = initial frequency, in Hz, for DAS data shots only; this frequency value will fix the number of over-scales at the beginning of the file; 0 value also means no change from previous data and -1 value means the sensor is a real counter (not FM signal), thus, time sampling will not be applied and decimation will compute the sum (and not the average) of the data.

FACT and CST = general factor and constant of calibration applied after the polynomial, (physical unit per Volt for DAS data);

A0 to A3 and B0 to B3 = 3rd order polynomials factors (in Volt per Hz for DAS data); by default, all factors equal 0 except A1 = B0 = 1;

The complete calibration formula is given by the relation:

$$d = fact\,\frac{a_0 + a_1 x + a_2 x^2 + a_3 x^3}{b_0 + y_1 x + b_2 x^2 + b_3 x^3} + cst$$

where *d* is the calibrated data, and *x* is original data (frequency in Hz for DAS data).

A single calibration file can be used to specify several calibration parameters varying in time. The two lines # VALID and # LAG, followed by a new table of parameters for each channels can be added below the previous ones. This allows to describe, for instance, the evolution of sensors parameters on the same station.

There is five ways to use a calibration file:

- /c = apply full calibration;
- /cn = apply only names, units and book marks for graphics;
- /cf = calibrates data in "Frequency unit" (apply only DIV, FREQ and SENSOR_NAME);
- /cv = calibrates data in "Voltage unit" (apply only DIV, FREQ, 3rd order polynomials A0 to B3 and SENSOR_NAME);
- /cg = calibrates data in "Geophysical units" (only FACT, CST and SENSOR_NAME and UNIT).

Examples

```
mgr example.dat /i:ymdhns /c:example.clb
```

uses default calibration file to name channels of example data file and give a title.

Remarks

Calibration file format of previous versions are still accepted, µGRAPH detects the header line to read them normally:

Versions up to 1.8a:

```
DIV   FREQ   FACT   CST   X   X^2   X^3   UNIT   NAME
```

Versions up to 1.6a:

```
DIV   FREQ   CST   X   X^2   X^3   UNIT   NAME
```

Attention: the variable CST in these old files correspond to A0 in the new version and not CST which is now applied after the multiplication by FACT.

See Also

/bk, *filename*, /m, /s, *time_string*, *Ctrl F2*, *Alt F2*

/com

Purpose Real-time graphics for µDAS data logger

Syntax `/com`*x*

`/com`*x*`:`*nnn*

Description Connect to an EDAS data logger via the COM port *x* (`1` or `2`) and display graphic of the data in real-time, after at least 2 data are received. Most of the functions are then allowed (zoom, scales, analysis, exporting, ...), except formula. The first syntax is used for µDAS EEPROM v4 or previous, the second syntax is for higher versions, when specifying the µDAS or nanoDAS identification number *nnn* (between `001` and `255`).

Examples

```
mgr /com1
```

connects to a µDAS EEPROM up to v4 on the COM port 1.

```
mgr /com2:1
```

connects to a µDAS EEPROM greater than v4 or nanoDAS with identification number 1, on the COM port 2.

Purpose Decimate data (average)

Syntax `/d:`*n*

Description For each data channels, computes the average of *n* data and imports the result, starting by the first data line. It increases the sampling period (and reduces the amount of data) by a factor *n*.

For DAS shot data, computes the sum of the data and not the average, in order to allow future calibration in frequency.

Examples

```
mgr @example.dat /d:6
```

imports example data (originally with a 10-min sampling period) and decimates to obtain one data per hour. Because the data are DAS shots, values are summed and not averaged (amount of shots per hour).

Add the `/r` option to center the average data on the new time sampling period, in order to avoid delay; but in this case, the data will not be causal anymore.

See Also `/b`, `/ed`, `/r`

/das

Purpose PC-DAS data format

Syntax `/das`

Description Specify that imported data are in PC-DAS files format:

DD/ MM/YY
HH NN Chan_1 Chan_2 Chan_3 Chan_4 Chan_5 Chan_6 Chan_7 Chan_8

it reads the date in the first line of file, applies it for all the data file, sets the *format_string* to `hn*`, and the file type to DAS (shots).

Examples `mgr u@*.m95 /a /das`

appends all the files `u@*.m95` located in the current directory, using PC-DAS format.

See Also `/l`, `/mdas`

Purpose Cumulative sum

Syntax `/dc`

Description Compute the cumulative sum for all channels

$$D_i = \sum_{j=1}^{i} d_j \ .$$

During the graphic visualization, use *F3* to return to original data (undo).

GUI *Alt C*

See Also `/dd`, *F3*

/dd

Purpose Difference

Syntax `/dd`

`/dd:`*n*

Description Compute the difference between 2 or *n* consecutive data for all channels. If a regular sample period *T* has been detected, it computes

$$D_i = \frac{d_i - d_{i-n+1}}{t_i - t_{i-n+1}} T$$

which is the approximate derivative normalized by *T* (per sample period). Otherwise, it divides by the time interval (in second) and give values expressed in data unit per second.

During the graphic visualization, use *F3* to return to original data (undo).

Remarks When *n* is more than 2, it is equivalent to differentiate after applying a moving average filter on *n* data.

GUI *Alt D*

See Also `/dc`, `/df`, *F3*, *Alt D*, *sample_period*

Purpose Moving average filter

Syntax `/df:`*n*

Description Compute the moving average on *n* consecutive data for all channels (low pass filtering)

$$D_i = \frac{1}{n} \sum_{j=i-n+1}^{i} d_i$$

During the graphic visualization, use *F3* to return to original data (undo).

GUI *Alt T*

See Also `/dd`, *F3*

/dh

Purpose Harmonic correction

Syntax `/dh:`*n*

Description Correct phase data from its first 4 harmonics. The number *n* is equal to the decimal value of binary combination of harmonics, where harmonic #1 = 1 (fundamental), harmonic #2 = 2, harmonic #3 = 4 and harmonic #4 = 8. For instance, *n* = 15 corresponds to the sum of harmonics # 1+2+3+4.

During the graphic visualization, use *F3* to return to original data (undo).

Examples

```
mgr tide.dat /hicum:s2 /dh:1
```

computes a periodic histogram on wave S2, then removes the fundamental to give the residue.

GUI *Alt W*

See Also `/hicum`, *F3*, *F7*, *Alt I*

Purpose Linear correction

Syntax `/dl`

Description Correct all channels from its linear regression (trend).

During the graphic visualization, use *F3* to return to original data (undo).

GUI *Alt L*

See Also `/do`, *F3*, *F7*, *Alt I*

/do

Purpose Mean value correction

Syntax `/do`

Description Correct all channels from its mean value (offset).

During the graphic visualization, use *F3* to return to original data (undo).

GUI *Alt O*

See Also `/dl`, *F3*, *F7*, *Alt I*

Purpose Extract data until a specific date and time (end)

Syntax `/e:`*time_string*

Description Specify end date and time by *time_string* to keep only data with time reference before this limit.

Examples

```
mgr example.dat /i:ymdhns /e:950920
```

imports data in MDAS format with date and time before 1995-09-20 00:00:00.

Remarks This option applies after all other time and date options have been taken into account. For instance, it supposes that date and time format has been correctly defined with import options.

See Also `/b`

/ed

Purpose Extract data (under sampling)

Syntax `/ed:`*n*

Description For each data channels, imports one data every *n* data, starting with the first data. It increases the sampling period (and reduces the amount of data) by a factor *n*.

Remarks This option must be used under special conditions, since it does not respect the Shannon's theory and could generate aliasing. Prefer `/d` the option to decimate data.

See Also `/d`

Purpose Compute formula

Syntax `/f:` *formula_string* [`/f:` *formula_string*] ...

Description Creates new channel(s) as the result of an arithmetic combination of existing channels, using formula defined by *formula_string*. Several formula can be specified, in order to use the result of the previous one, for instance.

Accessing to formula needs a single data file or multiple files in append mode (`/a`). For concatenated files, use the merge function first (`/merge`).

The first formula applies eventually on result of data calculations like derivative, cumulative sum, mean and linear corrections.

Examples

```
mgr @example.mgr /dd /f:12/2 /f:4-3 /g:5#6
```

imports example data, computes the derivative of all channels, creates a new channel (5th) as the average of 1st and 2nd, creates a 6th channel as the difference between 4th and 3rd, and plots the results on separated axis.

Remarks Because some of the *formula_string* characters are reserved to DOS, prefer script files to specify formula.

GUI *F8*

See Also `@`, `/a`, *formula_string*, `/merge`

filename

Purpose Specify a file

Syntax *[drive*`:`*][directory]filename[*`.`*extension]*

Description Data filename is the main arguments passed to µGRAPH. It uses *DOS* syntax to specify where the file is and its name:

drive`:` is the letter of drive disk followed by `:` (default is current drive);

directory is the path of folders, separated by `\` and using `..` for up directory (default is current directory of the drive);

filename is a string of 8 characters maximum;

extension is a string of 3 letters maximum, separated from the filename by `.` (default is all files corresponding to *filename*).

For the data filename arguments, group of files can be specified using `*` (star) and `?` to replace group or single characters of the filenames and access multiple files.

Examples

```
mgr c:\mgr\example.dat
```

```
mgr ..\data\sta*.asc /a
```

Remarks µGRAPH uses the `dir` *DOS* function to interpret *filename* argument(s) and access files. See *MS-DOS* documentation for a complete review of filename possibilities.

See Also `@`, `/bk`, `/c`, `/gif`

Purpose

Column formatting

Syntax

channels

{`[xymdhnsbi.]`*}*

{`gtlkq`*}*

Description

The *format_string* allows to define each column meaning (time and data) for import (`/i`) and export (`/t`) data file formatting. One character, or expression between brackets, stands for one column:

`1` to `9` then `A` to `U` = channel number

`*` = all channels in order (automatically added if no *channel* character is specified)

`x` = unused column (*NaN* for export)

`y` = year (after 1970)

`m` = month (01 to 12)

`d` = day in month (01 to 31)

`j` = ordinal day (001 to 366)

`h` = hour

`n` = minute

`s` = second

`b` = month name (3 letters)

`t` = Matlab's datenum format (floating number of days since January 1, 0000)

`i` = data index or phase (as x-axis)

`.` = fractions of time, can be added after date and time characters for export

`[...]` = group into one column, without separator (the dot is allowed)

Here is some shortcut letters and their equivalent:

`g` = `[yyyymmdd]`

`l` = `[hhnnss]`

`k` = `[hhnn]`

`q` = `[hh.nn]`

Examples

`/i:*`

Chan_1 Chan_2 Chan_3 Chan_4 ...

imports all column as data channels (default import format if no *header* is present and no preset format specified).

`/i:1ymd[hhnn]23`

Chan_1 YYYY MM DD HHNN Chan_2 Chan_3

imports a file with channel 1, year, month, day, concatenated 2-digit hour and minutes, and channels 2 and 3.

`/t:ymds134`

YYYY MM DD SSSSS Chan_1 Chan_3 Chan_4

exports a file with 4-digit year, month, day, seconds in the day (from 0 to 86399) and channels 1, 3 and 4.

`/t:yj.*`

YYYY JJJ.jjjjj Chan_1 Chan_2 ...

exports a file with 4-digit year, ordinal day with fractions, and all channels.

Remarks

For import, each letter of the *format_string* is interpreted independently, and the date and time is reconstructed as the sum of each. Then, order of appearance has no importance and numerical values are able to exceed their normal limits, i.e., 12 for month, 31 for days, 24 for hours, 60 for minutes and seconds. This allows a lot of possibilities in format and a very simple coding. For instance, a column that codes the number of second in a day (from 0 to 86399) will be simply coded as `s`. In that sense, `d` and `j` are strictly equivalent (day).

For export, the principle is to never lost information on date and time, even if uncompleted formats are specified. For example:

`ys` = year and number of seconds in the year;

`dn` = "absolute" number of days (in fact, since 1970-01-01), and number of minutes in the day;

`yd` = `yj` = year and number of day in the year (ordinal date).

Thus, `d` and `j` are also equivalent at export, if only year is specified (and not the month). Indeed, the `j` character has been kept in order to fix 3-digit number with leading zeros, especially when using the ISO standard at export (see `/iso`).

Fractions (dot `.`) are not allowed at import for year (`y`) and month (`m`), since they do not constitute regularly spaced bases (leap year, 28 to 31 days for months). In these cases, the fractions will be ignored and only the integer part will be considered. However, for the time characters `d`, `h`, `n`, `s` and `j`, fractionate parts will be converted in hour, minutes or second correctly.

See Also

`/i`, `/iso`, *F1*, *header*, `/t`, `/tr`

Purpose Formula coding

Syntax

channel

{+-./\}

<*x*>

{cstelvw}

Description Formula can be used to process simple calculation on channels or to keep the result of a data calculation (simply a copy of a channel). The *formula_string* is a combination of characters for channels and operators, read in the order of appearance:

1 to U or * = channel number, or all channels.

0 = time vector, in *Unix* format (number of seconds).

<x> = constant number (real).

+ - . / \ = addition, subtraction, product, division right and left modes. All following channels will be added, subtracted, multiplied with, or divided by previous result, until an other mode encountered. Addition mode is default.

l and e = logarithm (base 10) and exponential of previous result.

c, s and t = cosinus, sinus and tangent of previous result (in radian).

v and w = synchronised time events mode. For instance, v123 produces a function with steps where there is events on all channels 1, 2 and 3 at a same time, and flat no where else. v123w4 excludes events present also on channel 4.

Examples

1.2+3/4	= (*ch1* * *ch2* + *ch3*) / *ch4*
123/<3>-4	= (*ch1* + *ch2* + *ch3*) / 3 – *ch4*
123\4	= *ch4* / (*ch1* + *ch2* + *ch3*)
/2 or <1>/2 or 2\<1>	= 1 / *ch2*
12e	= $e^{(ch1 + ch2)}$
3l	= $\log_{10}(ch3)$
0.<1e-8>s	= sin(*time**10^{-8})

See Also /f, *F8*

/fs

Purpose Normalize scale mode

Syntax `/fs`

Description For axis with single channel, magnify the Y-axis between exact maximum and minimum, instead of rounded values, and indicates the values on axis legend.

For axis with multiple channel, draws each channel on its own scale and indicates ticks as percent (unknown scale). This is useful for data comparison when scales or units are different.

GUI *F4*

See Also *F5*

Purpose Noise filtering (difference)

Syntax `/fx`*N*`:`*x*

Description Exclude data of channel *N* if absolute difference between 2 data is more than *x* value. If no `/nan` option is specified, the entire data line will be excluded. Otherwise, the single data will be replaced by *NaN*.

Examples `/fxB:50`

tests the data of channel B and excludes it if $abs(d_i - d_{i-1}) > 50$.

See Also `/nan`, `/spike`, `/vm`, `/vn`

/g

Purpose Graphic type

Syntax `/g:`*graph_string*

Description Select channel to draw, line style and colors to use. This option allows to determine the first graphic pattern which will be displayed, e.g. for very large files (default is all channels on separated axis, solid lines and default colors).

Examples

```
/g:#:o1-3
```

plots channels 1 to 3 on separated axis with dotted line and circle markers, default colors.

```
/g:1.2##/sb4
```

plots on the first axis channel 1 (solid line) and channel 2 (dots), and on the second axis (of half size), channel 4 (blue solid line and square markers).

Remarks Because some of the *graph_string* characters are reserved to DOS, prefer script files to specify graph type.

GUI any of *graph_string* characters, Alt I

See Also *graph_string*

Purpose Grid off

Syntax `/gd`

Description Turns off the background grid of graphics.

GUI *Shift F6*

/gif

Purpose Make a GIF image

Syntax `/gif`

`/gif:`*filename*

Description Exports the graphic in a GIF image file `mgr.gif` (in the current directory) or in *filename*.

Example

```
mgr @example.mgr /gif:example.gif
```

produces a GIF image file named `example.gif` (included in the software package).

Remarks To obtain the best results, use SVGA resolution (`/vga`), full display screen (`/pe`), and set the screen colors to white background (`/sc`).

This option makes a screen copy and writes a binary file in *GIF87a* format, no transparency color. Prefer the `.gif` extension for *filename* if you want an automatic recognition with photo editor software's.

With `/t`, this option is the main batch µGRAPH function, because it forces the program to exit after all processes done, without entering GUI mode.

GUI *Shift F1*

See Also *graph_string*, `/pe`, `/sc`, `/vga`

Purpose

Graphic type coding

Syntax

channels

{-#,ve}*

{/:.os|}

{rygcbm}

Description

The *graph_string* format allows to specify a graphic parameters in a single word. It is used both on the command line (`/g`) and on keyboard while visualize data (see GUI). Characters used are:

`1` to `9` then `A` to `U` (uppercase) for channels;

`*` for all channels on the same axis;

`-` to select intervals;

`#` or `,` (coma) to separate axis between channels and specify the axis relative size (for example, two comas = previous axe will be double).

`v` (versus) to make XY graphs: next channel will be X-axis instead of time or data index.

`e` (error): next channel will be display as error bar of the previous one.

Any combination of line and marker types preceding channel(s):

`/` = solid line (default) `:` = dotted line `.` = dots `x` = crosses

`s` = squares `o` = circles `|` = bars

Any of one colors preceding a channel (the number stands for default channel attribution):

`r` = red (1) `y` = yellow (2) `g` = green (3)

`c` = cyan (4) `b` = blue (5) `m` = magenta (6)

Examples

`23,,1,4` = draws channels 2 and 3 in first double size axis, channel 1 in a second axis and channel 4 in a third one;

`1-4v5` = draws channels 1 to 4 versus channel 5;

`,:s1-5|B` = draws channels 1 to 5 with dotted line and squares, and B (11) with bars, all in separated axis;

`1e4,5` = draws channel 1 using errors (channel 4), and channel 5 in a second axis.

Remarks

Because some of the *graph_string* characters are reserved to *DOS* (coma and pipe), prefer script files to specify graph type on the command line.

Line style is by default a continuous line between data, interrupted when the time interval exceeds 1.5 times the acquisition period. If no regular acquisition period is detected, the line is continuous. For line types, see also the *F6* and *Ctrl F6* keys (GUI).

See Also /g, *Shift F2*, *F6*, *Ctrl F6*

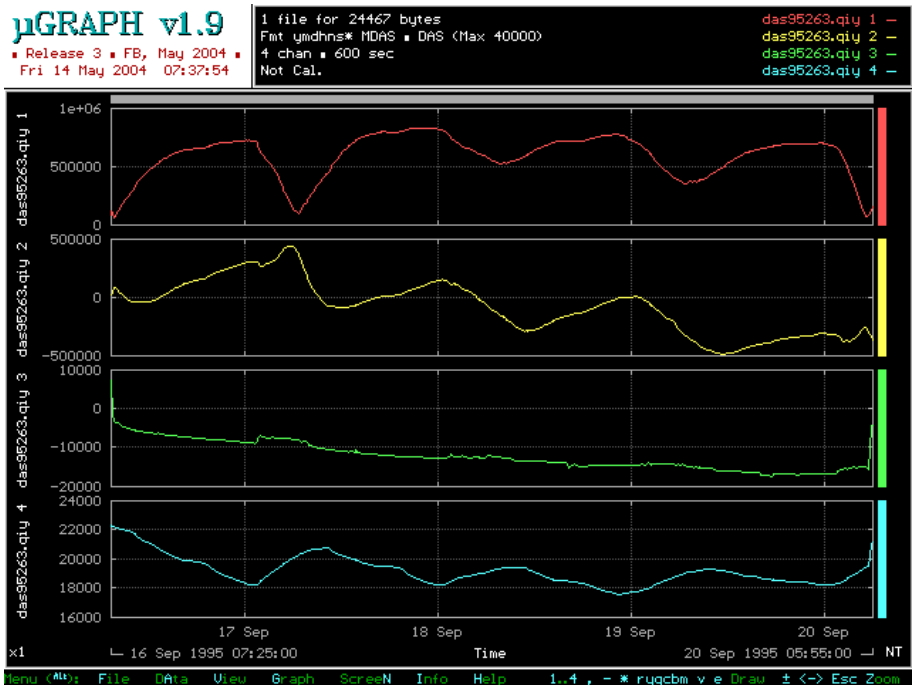
Purpose Graphic user interface functions

Syntax Any GUI functions (keyboard or mouse)

graph_string + *Enter*

{+ - ←→ *Home End PgUp PgDn Esc*}

Description When entering GUI mode, µGRAPH displays a graph screen and a set of functions are available on keyboard or mouse (see all following GUI pages):



Any *graph_string* character prompts for graphic string editing. *Enter* applies and *Esc* cancels.

+ or − keys zoom in or out in time by a factor of 2. At the bottom-left of the screen, the zoom factor is indicated (default is x1) (See also mouse functions).

Left and right arrow keys (←→) shift the view backward or forward by half-screen, if a zoom is active. At the bottom-left and bottom-right of the graph axis, date and time interval is displayed.

Home and *End* function keys go to the begin or end of the time interval, keeping the zoom factor.

Esc returns to plain time view (no zoom)

See Also *graph_string*, *GUI mouse*, *GUI* functions

GUI *Alt*A

Purpose Display the Data menu

Syntax *Alt*A

Esc returns to main menu

Description Display the available Data menu function keys:

AltO Offset
AltL Linear
AltD Derivative
AltC CumSum
AltT Filter
AltW WaveHarm (appears only with phase type files)
AltS Spike
F3 Undo
F8 Formula (appears only with single, appended or merged files)
ShiftF8 Hicum (appears only with time referenced files)

Example

Remarks It is not necessary to use this command to access functions; this is just a help for the user.

See Also *GUI menu*, *Alt*O, *Alt*L, *Alt*D, *Alt*C, *Alt*T, *Alt*S, *F3*, *F8*, *Shift*F9

Purpose Cumulative sum

Syntax ^{Alt}C

F3 returns to original data

Description Compute and display the cumulative sum for all channels

$$D_i = \sum_{j=1}^{i} d_j \ .$$

Command `/dc`

See Also ^{Alt}A, *F3*

Purpose Difference or derivative

Syntax *Alt*D

`Approximate Derivative =` *n* (*Esc* to cancel)

F3 returns to original data

Description Compute and display the difference between 2 or *n* consecutive data for all channels. If a regular sample period *T* has been detected, it computes

$$D_i = \frac{d_i - d_{i-n+1}}{t_i - t_{i-n+1}} T$$

which is the approximate derivative normalized by *T* (per sample period). Otherwise, it divides by the time interval (in second) and gives values expressed in data unit per second.

Remarks When *n* is more than 2, it is equivalent to differentiate after applying a moving average filter on *n* data.

Command `/dd`

See Also *Alt*A, *F3*

Purpose Display the File menu

Syntax ^{Alt}F

Esc returns to main menu

Description Display the available File menu function keys:

`F1 Export`

`Shift`F1 `Make GIF`

`Alt`F1 `Merge` (appears only with concatenated files)

`Ctrl`F1 `Sort Data`

`Alt`X `F10 Exit`

Remarks It is not necessary to use this command to access functions; this is just a help for the user.

See Also *GUI menu*, *F1*, $^{Shift}F1$, $^{Alt}F1$, $^{Ctrl}F1$, ^{Alt}X, *F10*

GUI *Alt*G

Purpose Display the Graph menu

Syntax *Alt*G

Esc returns to main menu

Description Display the available Graph menu function keys:

```
F2 Info
AltF2 Names
ShiftF2 Title
CtrlF2 Reset Colors
F6 Line
CtrlF6 Marker
ShiftF6 Grid
AltF6 Bold
```

Remarks It is not necessary to use this command to access functions; this is just a help for the user.

See Also *GUI menu*, *F2*, *ShiftF2*, *AltF2*, *CtrlF2*, *F6*, *CtrlF6*, *AltF6*, *ShiftF6*

Purpose Display the on-line help

Syntax ^{Alt}H

{0 ... 9←→} select pages

{↓↑ *PgUp PgDn* } vertical scroll into page

Esc or ^{Alt}H quit or returns to previous screen

Description Display 10 pages of quick help:

0. `Introduction` (default from command line)
1. `How to use µGRAPH`
2. `General options and index`
3. `Import/export file format options`
4. `Data calibration`
5. `Data calculation options`
6. `Graphic options`
7. `Main menu functions` (default from GUI)
8. `Limitations`
9. `About µGRAPH...`

See Also `mgr.hlp` *Windows* help file

Purpose Graphic and data information

See *F2*

Purpose Linear correction

Syntax ^{Alt}L

F3 returns to original data

Description Correct each channel from its linear regression (trend), computed on the viewed time interval.

$D_i = d_i - (at_i + b)$.

Command `/dl`

See Also ^{Alt}A, *F3*

GUI *Alt*N

Purpose Display the Screen menu

Syntax *Alt*N

Esc returns to main menu

Description Display the Screen menu function keys:

F9 Colour/B&W

ShiftF9 VGA Mode

CtrlF9 Full Screen

Remarks It is not necessary to use this command to access functions; this is just a help for the user.

See Also *GUI menu*, *F9*, *ShiftF9*, *CtrlF9*

Purpose Offset correction

Syntax ^{Alt}O

F3 returns to original data

Description Remove mean value of each channel, computed on the viewed time interval.

$D_i = d_i - \text{mean}(d_i)$.

Command /do

See Also ^{Alt}A, *F3*

Purpose Remove spikes

Syntax ^{Alt}S

`Remove spikes (STD):` *n* (*Esc* to cancel)

Description Remove "aberrant" data in the signal using an intelligent criteria. This function allows to remove local data points out of *n* times the RMS of the signal.

This process cannot be undo, and will degrade the data on a regular noisy signal.

Values between 5 and 10 are advised, and the process can be done iteratively.

Command `/spike`

See Also ^{Alt}A

Purpose Moving average filter

Syntax *Alt T*

`Filtering (moving average):` *n* (*Esc* to cancel)

F3 returns to original data

Description Compute the moving average on *n* consecutive data for all channels (low pass filtering)

$$D_i = \frac{1}{n} \sum_{j=i-n+1}^{i} d_i$$

Remarks Moving average applies a phase delay on the signal, equal to *n*/2 time sampling, in order to remain causal.

Command `/df`

See Also `/dd`, *F3*

GUI *Alt*V

Purpose Display the View menu

Syntax *Alt*V

Esc returns to main menu

Description Display the View menu function keys:

```
F4 Normalize
F5 Magnify
F7 Data Fit
ShiftF7 OverScale
```

Remarks It is not necessary to use this command to access functions; this is just a help for the user.

See Also *GUI menu*, *F4*, *F5*, *F7*, *Shift*F7

Purpose Harmonic correction

Syntax *Alt W*

`Enter harmonic binary combination (1 to 15):` *n*

F3 returns to original data

Description Correct phase data from its first 4 harmonics. The number *n* is equal to the decimal value of binary combination of harmonics, where harmonic #1 = 1 (fundamental), harmonic #2 = 2, harmonic #3 = 4 and harmonic #4 = 8.

Example *n* = 15 corresponds to the sum of fundamental and harmonics 2, 3 and 4.

Command `/dh`

See Also `/hicum`, *F3*, *F7*, *Alt I*

Purpose Exit

Syntax ^{Alt}X

Description Exits the program without prompting.

See Also *F10*

Purpose Zoom time interval

Syntax `Enter zoom begin date (YYMMDDhhnnss):`*time_string*

`Enter zoom end date (YYMMDDhhnnss):`*time_string*

Description Specify a begin and/or end date and time by *time_string* to zoom the first graphic display.

Command `/zb`, `/ze`

See Also *+*, *-*, *mouse*

Purpose Export data and specify column format

Syntax *F1*

`Output File Name:` *filename* (*Esc* to cancel)

`Output File Format:` *format_string*

[`Merge Files (Y/N):` *{*`yn`*}]*

[`Include File Header (Y/N):` *{*`yn`*}]*

Description Writes data corresponding to the displayed time interval, in a new ASCII file *filename*, using column formatting *format_string*, and optional text header.

filename can be any valid *DOS* file name. By default, a name is proposed that corresponds to the one defined by `/o` command (if apply), or an automatic name constructed from the first data file name with an extension in format `.$`*nn*, where *nn* is a number between `00` and `99`.

format_string defines the column formatting. By default, the import format is proposed (from `/i` command, text header or preset formats).

If multiple files have been imported without append option `/a`, export them will produce a single data file containing each file concatenated with a *header* in front of each. It is here proposed to merge them. Default is *no*.

Except if the previous answer has been *no*, it is here proposed to include a *header* in the data file. Default is *yes*.

Command `/o`, `/t`, `/merge`, `/nh`

See Also *filename*, *format_string*, *AltF*, *AltF1*, *header*

Purpose Merge concatenated files

Syntax *Alt F1*

`Merge the Files (Y/N): {yn}` (*Esc* to cancel)

Description When multiple data files have been imported without append command `/a`, they are concatenated: Each file is displayed sequentially with its own data channels. This function merge the channels to produce a new single file with a single time reference. If the time periods are different, or if some data are missing for a given date and time intervals, data are interpolated using the neighbor method. If a `/nan` command has been specified, missing data are replaced by *Not_a_Number*.

This allows to access to formula calculation, XY axis drawing, and to export a data file with all channels in a single time referenced table.

Default answer is *yes*.

Command `/merge`

See Also `/a`, *Alt F*, *F1*, *F8*, *Not_a_Number*

GUI *Ctrl F1*

Purpose Sort data in time

Syntax *Ctrl F1*

`Sort the Data (Y/N): {yn}` (*Esc* to cancel)

Description Sets the data in chronological order, and if necessary, deletes redundant data.

This allows faster display and clean file exporting.

Default answer is *yes*.

Command `/sort`

See Also *Alt F*, `/nt`

Purpose Make GIF image

Syntax Shift F1

`Enter GIF File Name:` *filename* (Esc to cancel)

Description Exports the screen display in a GIF image file *filename*.

Remarks The export takes few seconds while the mouse cursor disappears. To obtain best results, use SVGA resolution (Shift F9), full display screen (Ctrl F9) and set the screen colors to white background (F9).

This option makes a screen copy and writes a binary file in *GIF87a* format, no transparency color. Prefer the `.gif` extension for *filename* if you want an automatic recognition with photo editor software's.

Command `/gif`

See Also *filename*, Alt F, F9, Ctrl F9, Shift F9

Purpose Graphic and data information

Syntax *F2* or *Alt I*

channels selects one channel

* selects all channels

F6 changes line type

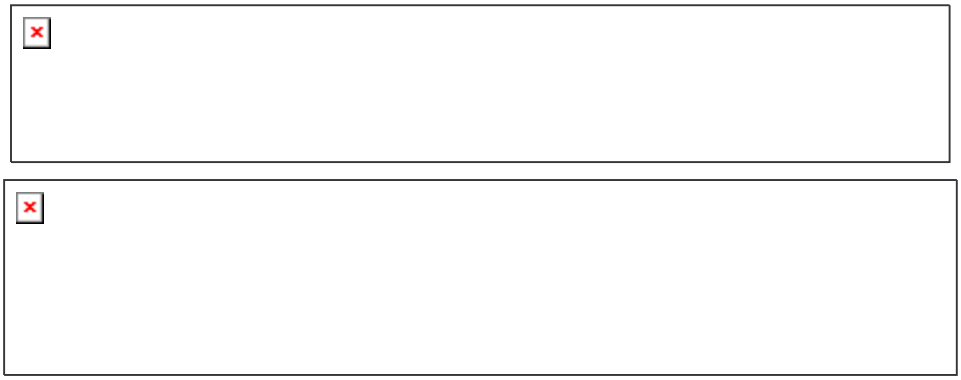
Ctrl F6 changes marker type

F2, for phase type only, displays a second page of information

Enter validates selection

Esc returns to graph

Description Displays one or two window(s) with actual graphic and data parameters, and allows selecting channels to draw and graphic type:



- `Gr.` = graph number and line type;
- `Name` = channel name, unit and number;
- `RMS Difference` = an estimation of short term noise (root mean square of derivative) ;
- `Resol.` = smallest non-zero value between two consecutive data;
- `Mean Value` = average of displayed data (see *Alt O*);
- `Linear Coeff.` = linear regression rate of displayed data (see *Alt L*);
- `Valid Data` = percent of existing data calculated from global time interval and time period;
- `Over Scale` (for DAS data type only) = number of over-scale corrected (see `/m`);
- `Over Range` (for DAS data type only) = number of excluded data for over-scale correction (see `/m`);
- `Harmonic n° 1` to `4` (for phase data only) = phase and amplitude of the first four harmonics (see *Alt W*).

Mouse *left-button click* on a channel line = change line type

left-button double click on a channel line = select one channel only

right-button click on a channel line = change graph number

right-button double click = select all/none channel

left-button click on the *Enter* area = accept selections and redraw

Command `/test` (partial equivalence)

See Also *graph_string*, *F7*, *Alt*G, *Alt*I, *Alt*L, *Alt*O, *Alt*W, `/m`

Purpose Undo

Syntax *F3*

`Undo` *last_operation* `(Y/N): {yn}` (*Esc* to cancel)

Description Undo the last operation and return to orginal data. This function works with the following operations:

- offset correction (*Alt O*);
- linear correction (*Alt L*);
- derivative / finite difference (*Alt D*);
- cumulative sum (*Alt C*);
- harmonic correction (*Alt W*);
- remove noise / spike correction (*Alt S*);
- formula (*F8*);
- periodic histogram / HiCum (*Shift F8*).

For the formula, the undo function is available only once (last calculated formula). Idem for spike correction and HiCum (back to original data).

See Also *Alt A*

Purpose Full / normalize scale

Syntax *F4*

F4 again returns to normal scale mode

Description Normalizes Y-axis for all channels between their minimum and maximum.

For single-channel axes, indicates maximum and minimum numerical values on the Y-axis legend.

For multiple-channel axes, draws each channel on its own scale and indicates percent on Y-axis legend (unknown scale). This allows comparison of different type of data.

After a zoom, use *F5* to adjust scales on the new X-axis interval.

Command `/fs`

See Also *F5*, *Alt V*

Purpose Magnify scale

Syntax *F5*

Description Magnifies Y-axis for all channels in order to view existing data in the current X-axis interval.

After a zoom, use *F5* again to adjust scales on the new X-axis interval.

See Also *Alt V*, *zooming*

Purpose Equal scale

Syntax *Shift* *F5*

F5 returns to normal scale mode

Description Adjusts all Y-axis scales at the same interval value. This is useful when units of all displayed channels are consistent.

Command `/es`

See Also *Alt* *V*

GUI *F6*

Purpose Line type

Syntax *F6 [F6 [F6]]*

Enter validates the choice

Description Changes the line type of displayed channels. Hitting *F6* successively sets the line type to:

dotted line;

none;

solid line (default).

Command `/g`

See Also *graph_string*, *Ctrl F6*

Purpose Marker type

Syntax *Ctrl F6 [Ctrl F6 [Ctrl F6 [Ctrl F6 [Ctrl F6 [Ctrl F6]]]]]*

Enter validates the choice

Description Changes the marker type of displayed channels. Hitting *Ctrl F6* successively sets the line type to:

dots;

crosses;

squares;

circles;

bars;

none (default).

Command `/g`

See Also *graph_string*, *F6*

GUI *Shift F6*

Purpose Grid on/off

Syntax *Shift F6*

Description Turns the grid on or off (grid on by default)

Command `/gd`

See Also

Purpose Data fitting preview

Syntax *F7 [F7 [F7]]*

Enter applies the offset or linear correction

Description Displays average, linear trend or period counting. This function has two different modes:

1. If the displayed data are original, i.e., there is no Offset, Linear, Derivative or Cumulative Sum calculations, then press *F7* successively shows:

the average;

the linear trend;

returns to normal mode.

If a single channel is displayed, the numerical values of the fitting will be displayed on the right side of the graph. These grey lines are shown for each graph, and correspond to the correction which will be applied when using Offset or Linear modes. Press *Enter* applies the correction (similar to *Alt O* or *Alt L*). Note that in X-Y mode, the average shows a small cross (the "gravity centre" of data!) instead of a line.

2. If one of the Offset, Linear or Derivative modes are active, and only one channel is displayed, then press *F7* once indicates on the right vertical label the average period of the signal, obtained by counting time intervals between zeros (positive transition).

See Also `/do`, `/dl`, `/dd`, *Alt O*, *Alt L*, *Alt D*

Purpose Shot over-scale limits

Syntax Shift F7

Description Displays over-scale limits for DAS shots data.

See Also /m, /das, /mdas

Purpose Compute formula

Syntax *F8*

`[ Replace channel` *n* `(Y/N):` {*yn*} *]*

`Enter formula for channel` *n*`:` *formula_string* (*Esc* to cancel)

Description Creates new channel(s) as the result of an arithmetic combination of existing channels, using formula defined by the *formula_string*. The created channel will be labeled automatically.

If a formula has already been created, µGRAPH proposes to replace the previous formula channel. Answering `N` (for No) will create a new channel.

Accessing to formula needs a single data file or multiple files in append mode (`/a`). For concatenated files, use the merge function first (`/merge`).

Formula applies eventually on result of data calculations like derivative, cumulative sum, mean and linear corrections. A simple use of the formulas is a copy of a channel to keep in memory these data calculation as separated channels from original data.

Command `/f`

See Also `/a`, *formula_string*, `/merge`

Purpose HiCum (periodic histogram)

Syntax Shift F8

```
HiCum: Enter the wave name, Doodson argument or
integer period: wave                          (Esc to cancel)
Enter the number of samples: p                (default is 360)
```

Description Computes HiCum algorithm on all channels. Given a known tide wave or simple period defined by *wave*, this function computes the mean of signal in regular phase intervals (360° divided in *p* intervals).

The *wave* argument can be specified in three different ways:

1. *xxx.xxx* = Doodson argument for a tide wave (i.e., `164.555` for S1)

2. *wave_name* = tide wave name (i.e., `S1`, `M2`, ... see `mgr_tide.dat` file)

3. *n* = period (in samples)

p corresponds to the number of phase intervals into 360°.

This function transforms time referenced data into "phase" data. Some additional functions are available in this mode, like first harmonic fitting values (Alt I), fitting preview (F7) and correction (Alt W).

Remarks To computes correctly the phases of tide waves, data must be referenced in UT (Universal Time, GMT). Use `/s` option to apply a delay if necessary.

Command `/hicum`

See Also Alt I, Alt W, F7, `/hs`, `/phase`

Purpose Screen colors

Syntax *F9 [F9 [F9 [F9]]]*

Description Set the screen colors. Four modes available (hit successively *F9* key):

2 colors (gray) on black background

2 colors (gray) on white background

16 colors (dark) on white background

16 colors (saturated) on black background (default)

Command `/sc`

See Also *Alt N*, *Shift F9*, *Ctrl F9*

Purpose VGA video mode

Syntax Shift F9

`Enter VGA video mode (0 to 4):` *n* (*Esc* to cancel)

Description Sets the screen resolution. Six modes *n* are available depending on the hardware video card compatibility :

0 = 320 x 200 pixels

1 = 640 x 350 pixels (EGA)

2 = 640 x 480 pixels (VGA, default)

3 = 800 x 600 pixels (SVGA)

4 = 1024 x 768 pixels (XGA)

Remarks The default resolution (VGA) is usually sufficient for data analysis, but higher modes may be necessary to produce better quality graphics (see Shift F1). Lower modes can be used to run µGRAPH on pocket PC.

Command `/vga`

See Also Alt N, F9, Ctrl F9

Purpose Full screen mode

Syntax Ctrl F9

Ctrl F9 returns to normal screen mode

Description Toggles normal screen / full screen mode.

Default screen mode includes a header with clock and information on file(s) and channels. The full screen mode contains only data axis and a bottom line for simplified legend and prompt.

Command /pe

See Also Alt N, F9, Ctrl F9

Purpose Exit

Syntax *F10*

```
Do you really want to quit (Enter to confirm):
```

Description Exit the program with prompt confirmation.

See Also *Alt X*

Purpose

Header files

Syntax

[# DATE: creation_date]

[# PROG: command_line]

[# INFO: information]

[# TITL: title]

[# SHOT: n]

[# SAMP: time_sampling]

CHAN: = *time and data format*

Description

The file header of µGRAPH is managed internally by the program or created by EDAS download utilities. It allows handling basic information on file formats and processing through the following keywords (order has no importance):

DATE: = date and time of file creation

PROG: = complete path and line command when calling µGRAPH

INFO: = copy of a maximum of ten information lines from original file header (use option /xi to exclude it from exported files)

TITL: = copy of title from calibration file, original file header or defined by *Alt F6* key

SHOT: = data are original DAS shots (must correct over-scale)

SAMP: = time sampling (in seconds)

CHAN: = time and data format, including channel names and units into parenthesis preceded by an underscore. This is the only needed line for valid header. Others are optional.

Example

File header of an exported file:

```
# DATE: 2000-09-01 10:13:54
# PROG: D:\METEO\DATA\mgr cr1x0005.dat /i:xyj[hhnn] /iso
/c:meteo.clb
# TITL: MGR EXAMPLE 2: METEO STATION
# SAMP: 900s
# CHAN: YYYY MM DD HH NN SS Wind_Speed_(m/s) Wind_Dir_(deg)
IRRad_(W/mý) Atm_Pressure_(mbar) Batt_(V)
2000-03-18 11:30:00 0.305 123.5 440.4 722 14.06
2000-03-18 11:45:00 0.303 67.8 438.6 722 14.04
…
```

Remarks A file with this text header can be loaded by µGRAPH without the import option `/i:`. Thus, it is advised to keep this header in all exported files, but if you do not want it, use `/nh` option or answer "no" at the appropriate question when using the *F1* key.

See Also `/i`, `/nh`, `/t`, `/x`, `/xi`

Purpose HiCum (periodic histogram)

Syntax `/hicum:` *wave*

Description Computes HiCum algorithm on all channels. Given a known tide wave or simple period defined by *wave*, this function computes the mean of signal in regular phase intervals (360° divided in 1° intervals).

The *wave* argument can be specified in three different ways:

1. *xxx.xxx* = Doodson argument for a tide wave (i.e., `164.555` for S1)

2. *wave_name* = tide wave name (i.e., `S1`, `M2`, ... see `mgr_tide.dat` file)

3. *n* = period (in samples)

This function transforms time referenced data into "phase" data. In GUI mode, some additional functions are available in this mode, like first harmonic fitting values (*Alt I*), fitting preview (*F7*) and correction (*Alt W*).

Remarks To computes correctly the phases of tide waves, data must be referenced in UT (Universal Time, GMT). Use `/s` option to apply a delay if necessary.

GUI *Shift F8*

See Also *Alt I*, *Alt W*, *F7*, `/hicum`, `/hs`, `/phase`, `/s`

/hs

Purpose HiCum phase samples

Syntax `/hs:` *n*

Description Determine the number of phase intervals for HiCum computing (default is `360`).

GUI *Shift F8*

See Also *Alt I*, *Alt W*, *F7*, `/hicum`, `/phase`, `/s`

Purpose Import file format

Syntax `/i:`*format_string*

Description Specifies the column format (date, time and data) for file(s) import. When no EDAS *header* is available in the file(s) or no preset format is specified, the default is `/i:*` and imports each raw as data channel.

Examples See *format_string* examples.

See Also *header*, *format_string*, `/t`

/ic

Purpose Coma as decimal point

Syntax `/ic`

Description Interprets all comas as decimal points when importing data file(s). Some countries use coma as decimal point in numerical formats; without this option, µGRAPH may interpret comas as column separator.

This option does not affect exporting format. The point is always used.

See Also *format_string*, `/i`, `/im`

Purpose Minus as separator

Syntax `/im`

Description Interprets all minus as column separator when importing data file(s).Without this option, µGRAPH may interpret minus as negative numbers.

This option does not affect exporting format.

See Also *format_string*, `/i`, `/ic`

/iso

Purpose ISO 8601 format

Syntax `/iso`

Description Uses ISO 8601 standard format for date and time when exporting file (*F1* or `/t`), i.e., adds minus between date field and colon between time field. Only two export formats will respect the ISO standard (see *format_string*):

`ymdhns` = *YYYY-MM-DD HH:NN:SS*

`yjhns` = *YYYY-DDD HH:NN:SS*

These complete format can be truncated at the condition that the order for date and time are respected: Year-Month-Day and Hours:Minutes:Seconds, i.e., the biggest first. Since 2-digit years are forbidden, any '`y`' will be replaced automatically by '`Y`'.

See Also *format_string*, `/t`

Purpose

LTERM capture file format

Syntax

`/l`

Description

Specify that imported data are in LTERM (terminal emulator for serial connections) capture file format:

```
*YYMMDDHHNNSS  Chan_1  Chan_2  Chan_3  Chan_4
```

This option sets the *format_string* to `[yymmddhhnnss]*`, and the file type to *DAS* (shots).

See Also

format_string, `/i`, `/das`

/lw

Purpose Line width

Syntax `/lw`

Description Sets the line and points at 3-pixels width (instead of 1).

GUI *Alt F6*

See Also `/gd`, `/vga`

Purpose Retrieve over-scales from DAS shots

Syntax `/m:` *n*

`/m`

Description When importing DAS shots data files, rebuilts the full dynamic by correcting overs-scales of 100 000 shots. This option sets the DAS data mode, adjusts the correction of over-scales with a maximum absolute difference *n* ($0 < n < 50\,000$) between two consecutive data (default is $n = 40\,000$). Use `/m:0` to not correct over-scales (keep original data, see also option `/shot` for exports).

`/m` by itself avoids all DAS specific computations.

See Also `/das`, *Shift F7*, `/mdas`, `/shot`

/mdas

Purpose µDAS shot data format

Syntax `/mdas`

Description Specify that imported data are µDAS data logger format without header (v4):

YY MM DD HH NN SS Chan_1 Chan_2 Chan_3 Chan_4

This option sets the *format_string* to `ymdhns*`, and the file type to *DAS* (shots).

See Also `/das`, *format_string*, *header*, `/i`

Purpose Merge concatenated files

Syntax `/merge`

Description When multiple data files have been imported without append command `/a`, they are concatenated: Each file is displayed sequentially with its own data channels. This function merges the channels to produce a new single file with a single time reference. If the time periods are different, or if some data are missing for a given date and time intervals, data are interpolated using the neighbor method (nearest data value). If a `/nan` command has been specified, missing data are replaced by *Not_a_Number*.

This allows to access to formula calculation, XY axis drawing, and to export a data file with all channels in a single time referenced table.

GUI *Shift F1*

See Also `/a`, *Alt F*, *F1*, *F8*, `/nan`, `/t`

/nan

Purpose Not a Number

Syntax `/nan`

`/nan:` *n*

Description Filtered data will be replaced by a *NaN* (Not A Number) value equal to *n* (default is `1e-37`), which will be ignored in graphics and calculations, and used to export `x` columns (see *format_string*).

If this option is not specified when importing file(s) with filtering, any invalid data will exclude the entire line (all channels).

See Also *format_string*, `/fx`, *F1*, `/spike`, `/t`, `/vm`, `/vn`

Purpose No header

Syntax `/nh`

Description Puts no *header* in exported file. By default, a µGRAPH *header* is added to the file when exported, in order to import it without format options.

GUI *F1*

See Also *header*, `/i`, `/x`, `/xi`

/nt

Purpose No negative time

Syntax `/nt`

Description When importing file(s), this option excludes any back time data lines.

See Also `/i`, `/sort`

Purpose Output file name

Syntax `/o:` *filename*

Description Specifies the output data filename for command line batch.

By default, exported data file will have the name of the first imported data file, with extension `.$`*nn*, where *nn* is a 2-digit number automatically set to avoid existing file replacement.

GUI *F1*

See Also *filename*, `/t`

/os

Purpose Output separator character

Syntax `/os:` *n*

Description Specifies the ASCII code *n* for separator character between columns (default is a space). Here are some values of ASCII codes (see a table in your MS-DOS User Guide for others):

`9` = tabulation (TAB)

`32` = space (default)

`44` = coma (`,`)

`45` = minus (`-`)

`58` = colon (`:`)

`59` = semicolon (`;`)

See Also `/o`, `/t`, `/tf`

Purpose Full screen mode

Syntax `/pe`

Description Sets the graphic screen in full screen mode.

Default screen mode includes a header with clock and information on file(s) and channels. The full screen mode contains only data axis and a bottom line for simplified legend and prompt. It is adapted to export images (see `/gif`).

GUI *Ctrl F9*

See Also `/gif`,`/sc`, `/vga`

/phase

Purpose Full screen mode

Syntax

```
/phase
/phase:rad
```

Description Sets the angle unit (default is degree) for phase files, as produced by HiCum.

See Also `/hicum`

Purpose Center data versus sample period

Syntax `/r`

Description When importing file(s), this option subtracts *p*/2 on time reference, where *p* is the sample period. This applies especially to EDAS data loggers, which produce result of an integration referenced to the end time of the period.

Remarks Attention: The data will not be causal anymore. This option can be used when decimation (`/d`) is applied on data, to avoid time delays.

See Also `/d`

/s

Purpose Time shift

Syntax `/s:`*n*

Description Applies *n* hours (negative or positive) of time correction on the imported data file(s). This option is useful to process local time or GMT referenced data. See also `# LAG:` flag in *calibration_file*.

See Also *calibration_file*, `/hicum`

Purpose Screen colors

Syntax `/sc:`*n*

Description Set the screen colors for graphics. Four modes *n* are available:

`0` = 16 colors (saturated) on black background (default)

`1` = 2 colors (gray) on black background

`2` = 2 colors (gray) on white background

`3` = 16 colors (dark) on white background

GUI *F9*

See Also

/shot

Purpose 5-digit shots DAS data

Syntax `/shot[:`*maxshots*`]`

Description Without argument *maxshots*, keeps the 5-digit shots numbers when exporting DAS data file. By default, DAS data are corrected from 100 000 shots over-scales (see `/m`) to reconstruct full dynamic data values. This option will produce phase wrapping as made by EDAS data loggers. This may be useful when using `/d` decimation option on DAS data.

When *maxshots* is specified, uses this value to apply DAS corrections (over-scales, frequency conversion, ...).

See Also `/d`, `/das`, `/m`, `/mdas`

Purpose Sort data in time

Syntax `/sort`

Description Sets the data in chronological order, and if necessary, deletes redundant data. This allows faster display and clean file exporting.

GUI *Ctrl F1*

See Also `/nt`

/spike

Purpose Remove spikes

Syntax `/spike:`*n*

Description Removes "aberrant" data in the signal using an intelligent criteria. This function allows to remove local data points out of *n* times the RMS of the signal.

Values of *n* between 5 and 10 are advised, and the process can be done iteratively.

GUI *Alt*S

See Also `/fx`, `/vm`, `/vn`

Purpose Export file format

Syntax `/t`

`/t:`*format_string*

Description Exports imported data as a new file, without entering GUI mode. By default, `/t` option uses the imported format (`/i`). Specify the *format_string* will determine the column format (date, time and data) for file export. A *header* will be added to the file by default (see `/nh` to avoid it).

Examples See *format_string* examples.

Remarks With `/gif`, this option is the main batch μGRAPH function, because it forces the program to exit after all processes done, without entering GUI mode.

GUI *F1*

See Also *format_string*, *header*, `/i`, `/nh`, `/o`, `/os`, `/tf`

/test

Purpose File test mode

Syntax `/test`

`/test:`*n*

Description Displays, in DOS text mode, information about file format and data you may import. This function supposes that the import format is OK, so use `/i:*` if you do not know it exactly. Two modes *n* are available:

`0` = displays number of columns and acquisition period (reads only file header, default)

`1` = display also statistics on the data, like in the *Data Information Window* in GUI mode (reads the whole file).

See Also *Alt*`I`, `/i`

Purpose Export numerical format

Syntax `/tf:`C_*printf_format*

Description Specifies the numerical format for export data file, using C_*printf_format* string. Default is `%1.8g` for 8-digit (maximum) generic float format, which works correctly with integers and floats and reduce file space.

Example `/tf:%03.4f` will write the data in a formatted columns with 3-digit before point, leading zeros if necessary, and 4-digit after the decimal point.

Remarks Attention: Respect strictly the C syntax because µGRAPH does not make any verification. See any C code *printf* command manual.

See Also `/o`, `/os`, `/t`

time_string

Purpose Date and time coding

Syntax *YYMMDDHHNNSSsss*

Description Date and time coding format used by various functions of µGRAPH. The complete *time_string* format is formed by 15 digits: 2-digit year, month, day, hour, minute, second and 3-digit millisecond. This string can be truncated anywhere from the right, keeping the most significant digits.

Examples

99	= 1999-01-01 00:00:00
950920	= 1995-09-20 00:00:00
000807221455	= 2000-08-07 22:14:55

Remarks The 2-digit year is interpreted as followed: 70 to 99 = 1970 to 1999, and 00 to 38 = 2000 to 2038. Years before 1970 and after 2038 cannot be handled by µGRAPH.

See Also /b, /bk, /c, /e, *header*, *limitations*, /y

Purpose Temporary drive

Syntax `/tmp`

`/tmp:`*drive*

Description Specifies the *drive* for temporary file. Without this option, µGRAPH use `C:\`. Default is local drive.

Remarks µGRAPH needs some drive space to process data (about twice the size of imported data files). If some RAM is available, it may be efficient to set a RAM-drive and define it as temporary drive to accelerate processes.

See Also *limitations*

/tr

Purpose Time restore

Syntax `/tr`

Description Allows automatic continuous time restore when the imported file(s) has an uncompleted time reference.

When the time reference is uncompleted in the data files, and files are append, µGRAPH can produce with this option a continuous time, increasing automatically when negative time jumps are encountered. This option may be used when time reference is unknown, but it is better to use if possible `/yn` option to get complement information from data filename.

Examples A data file without the year will possibly have dates jumping from December to January, and then one year will be added (option `/i:mdhn` to specify format):

```
...
12 31 23 50 1234.5 6789.0    => 1970-12-31 23:50
01 01 00 00 1234.6 6788.9    => 1971-01-01 00:00
...
```

If the complete date is missing, and hours jump from 23 to 00, a day will be added (option `/i:hns` to specify format):

```
...
23 59 59 1234.5 6789.0       => 1970-01-01 23:59:59
00 00 00 1234.6 6788.9       => 1970-01-02 00:00:00
...
```

See Also `/a`, `/i`, `/yn`

Purpose VGA video mode

Syntax `/vga:`*n*

Description Sets the screen resolution. Five modes *n* are available depending on the hardware video card:

`0` = 320 x 200 pixels

`1` = 640 x 350 pixels (EGA)

`2` = 640 x 480 pixels (VGA, default)

`3` = 800 x 600 pixels (SVGA)

`4` = 1024 x 768 pixels (XGA)

Remarks The default resolution (VGA) is usually sufficient for data analysis, but higher modes may be necessary to produce better quality graphics (see `/gif`). Lower modes can be used to run µGRAPH on pocket PC.

GUI *Shift F9*

See Also `/pe`, `/gif`

/vm /vn

Purpose Threshold data filtering

Syntax `/vm`*[channels]*`:`*max*

`/vn`*[channels]*`:`*min*

Description Removes data values of channels above a maximum *max* and a minimum *min* when importing data file(s).

channels (optional) specifies one or more channels instead of all channels.

By default, the entire line of data is excluded. Use `/nan` to replace invalid data by a Not a Number.

Examples `/vm:1000` = excludes all channels data greater than 1000

`/vn26:450` = excludes channels 3 and 6 data lower than 450

`/vm2:25.2 /vn5:1.3` = excludes channel 2 data greater than 25.2 and channel 5 data lower than 1.3

See Also `/fx`, `/spike`

Purpose Exclude first lines of file

Syntax `/x:`*n*

Description Excludes first *n* lines of imported file(s).

This option allows importing files that contain lines of headers. It will apply to all imported files.

See Also `/i`, `/xt`

/xi

Purpose No information in header

Syntax `/xi`

Description Excludes information lines in exported file *header*.

By default, *header* information lines (`#INFO:`) are kept and append when exported, and may be numerous after a lot of import/export operation. This option allows avoiding it while keeping the file *header*.

See Also *header*, `/nh`, `/t`

Purpose Exclude lines with text

Syntax `/xt`

Description Excludes all lines of imported file(s) that contain some text or letters (like comments or remarks).

This option allows excluding data lines that contain text or non numerical characters. It will apply to all imported files.

See Also `/i`, `/x`

/y

Purpose Specify date and time reference

Syntax `/y:`*time_string*

Description Specifies date and time reference when importing uncompleted file(s). This option will impose a part of date and time to all data.

See Also `/i`, *time_string*, `/yn`

Purpose Specify date and time reference from filename

Syntax `/yn:`*date_string*

Description Searches for time reference in the imported data filenames. The time will be completed for each file. The *date_string* uses the same codes defined for *format_string*, but it describes in this case the meaning of each character of the filename (`x` replaces an unknown character).

Examples `sta0225.d97` is one of the daily files acquired containing columns with hours, minutes and data channels, but no date reference except in the filename itself, with format `sta`*MMDD*`.d`*YY* (here, on February 25, 1997). To import all the similar files and complete the time reference, use the following options:

```
mgr sta*.* /i:hn* /a /yn:xxxmmdd.xyy
```

See Also `/a`, *filename*, *format_string*, `/i`, `/y`

/zb /ze

Purpose Zoom time interval

Syntax `/zb:` *time_string*

`/ze:` *time_string*

Description Specify a begin and/or end date and time by *time_string* to zoom the first graphic display.

GUI *Alt Z*

See Also `/b`, `/e`

Technical Notes

References and Acknowledgments

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