MAGNUM 1.0
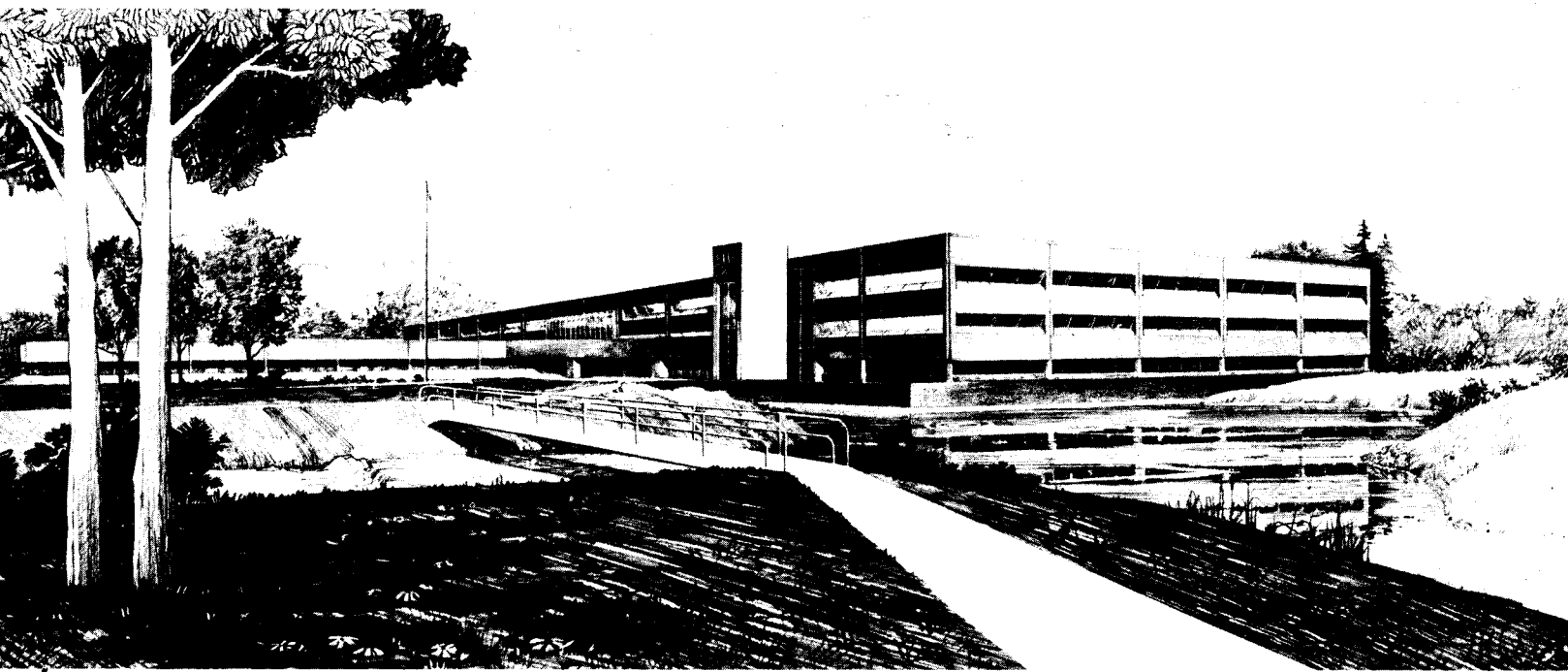
AN ISDMS INTERACTIVE GRAPHICS PROCESSOR

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This is an informal report intended for use as a preliminary or working document

Prepared for the
U.S. Department of Energy
Idaho Operations Office
Under DOE Contract No. DE-AC07-76ID01570

EG&G Idaho

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AN ISDMS INTERACTIVE GRAPHICS PROCESSOR

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Published February 1980

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MAGNUM 1.0

(An Interactive Graphics Program)

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12/01/79

INTRODUCTION

MAGNUM 1.0 is an interactive graphics program residing in the IDAHO NATIONAL ENGINEERING LABORATORY SCIENTIFIC DATA MANAGEMENT SYSTEM (ISDMS). It is designed to handle a number of file formats containing data to be either mathematically manipulated or plotted. The objectives in writing MAGNUM 1.0 were that it be fast, small, easy to use and versatile.

The code is currently implemented on a CDC CYBER 173 and CYBER 176 running under the NOS/BE operating system at the Idaho National Engineering Laboratory (INEL). The TEKTRONIX PLOT-10 product is utilized as the plotting software. TEKTRONIX Model 4006, 4014, 4025 and 4027 CRT keyboard terminals are supported, along with the Model 4662 digital plotter. A set of color commands is available to the user of the Model 4027 color CRT.

MAGNUM 1.0 is accessed by the user via MASTER in the following manner:

COMMAND- BEGIN,MASTER

COMMAND ... MAGNUM

FILES.

The program utilizes certain local file names that are reserved for the various data formats. For the ISDMS CWAF format, files CWAF, CWAF1, CWAF2, CWAF3, CWAF4, CWAF5 and CWAF6 are used. Files TAPE71, TAPE72, TAPE73, TAPE74, TAPE75 and TAPE76 are reserved for the remaining data formats, such as INDP and SIDU.

The user typically allows the code to attach data perm files to the reserved local file names. However, it is possible for the user to attach data perm files to any of the reserved local file names prior to entering MAGNUM 1.0. This allows the user to attach data perm files that are password protected or residing on a device that is not in the perm file set. The program determines if any of the reserved local file names are resident at the user's control point at execution time and will prompt the user for the proper data organization for local files TAPE71-TAPE76.

All of the files (CWAF1-CWAF6,TAPE71-TAPE76) attached by the user are assigned ordinals and located in the FILE TABLE by these ordinals. The ordinals are assigned sequentially from 1 to 6. The local file CWAF is a special case for which the ordinal is always 6, and for which a zero (0) must be specified for reference purposes. A maximum of six data perm files may be attached by the user prior to entering MAGNUM 1.0. Also, the CWAFn and TAPE7n local file names must be used such that "n" varies between 1 and 6 and is not duplicated between the two types of local file names. A FILE TABLE conflict will result if, for example, CWAF2 and TAPE72 are attached. A value of 6 for "n" is not allowed if local file CWAF is attached since this is a special reserved local file name and always occupies the sixth location in the FILE TABLE.

At the end of a MAGNUM 1.0 session, all local files, with the exception of CWAF and CWAF1-CWAF6 are returned to the system. The CWAF files are retained so that they may be used in other ISDMS programs without having to be attached again.

FILE FORMATS

The code is currently capable of accepting ten different file formats as input. These file formats may be summarized as follows:

01) CWAF ... ISDMS Common Word Addressable.

02) INDP ... Standard INDP with fixed delta time.

03) SIDU ... Standard SIDU.

04) TYP1 ... X/Y data pairs.

05) TYP2 ... Standard INDP with a time record.

06) TYP3 ... Seq. binary created by CATALOG command.

07) TYP4 ... TYP2 with a 15 character record ident and
            a 20 character Y-axis label.

08) TYP5 ... TYP2 with logical (bit patterns) data.

09) TYP6 ... X,Y,DXL,DXR,DYL,DYU data point sets.

10) CRTE ... Modified TYP1 input directly from terminal.

LIMITATIONS

The code is currently limited in certain areas in order to preserve efficiency. Limitations of major impact to the user are as follows:

01) Maximum of 6 files may be "ATTACHed" simultaneously.

02) Maximum of 75 records may be accessed simultaneously.

03) Maximum of 2000 data points per record.

04) Maximum of 6 curves per axes per plot.

05) Maximum of 1 DATA/CTRL block for INDP, TYP2, TYP4 and TYP5 files.

COMMANDS_

The code informs the user that it is ready and waiting for input by issuing "READY ...". The user may then type in any of the numerous commands available. At this time, the code analyzes the information input by the user and determines the proper action to be taken. Should the code detect an invalid input, an informational message is issued followed by "READY ...". MAGNUM 1.0 performs extensive error checking, and as such, the user need not worry about invalid inputs possibly aborting the session. Should a fatal error condition be detected by either the operating system or the code, MAGNUM 1.0 will intercept the system abort, issue an explanatory message, produce a dump to the local file DEBUG and then "gracefully" return to MASTER.

The code maintains a default table that minimizes the number of commands required to produce a basic plot. In general, the logical sequence of events in the generation of a plot is as follows:

01) "ATTACH" the data perm files.

02) "FIND" the required data residing on the perm files.

03) Set any of the plot attributes and/or perform a host of mathematical operations on the data.

04) "PLOT" the data of interest.

The available commands may be categorized as being either "general" or "mathematical". Commands that set specific attributes or actions, remain active throughout the session unless specifically "FLUSHed" or overridden.

GENERAL COMMANDS

ATTACH_(A)_-_Attach_a_data_perm_file_

READY ... ATTACH FO PFN ID CY

FO

Allowable file formats or organizations. (CWAF, INDP, SIDU, TYP1, TYP2, TYP3, TYP4, TYP5, TYP6).

PFN

Perm file name. If the PFN begins with a numeric, then enclose the PFN in quotes.

ID

Userid. The default is HRBSEX unless previously overridden by the UID command.

CY

Cycle number. The highest cycle is the default.

The ATTACH command performs an internal attach of the user specified perm files residing on the mass storage devices on the perm file set only. The code is not capable of "ATTACHing" perm files that are password protected or residing on other than the perm file set.

AUTO_-_Automatic_command_input_

READY ... AUTO

Having entered the above input, the user must enter the following form of the ATTACH command in order to initiate the automatic command input option:

READY ... ATTACH PFN ID CY

PFN

Perm file name of the file containing the commands to be executed.

ID

Userid. The default is HRBSEX.

CY
Cycle number. The highest cycle is the default.

The AUTO command allows a user to automatically execute a set of predefined commands. This is convenient in the case of required repetitive plots and/or mathematical operations. The AUTO command may only be initiated once per session and the user must be wary of the fact that any previous erroneous commands will perpetuate until either a "RETURN" is encountered or an "EOF" is reached on the command file.

The command file may be created in either "EDITOR" or "SENATOR" and it should contain the commands in the same order as if they were being entered in from the terminal. Note that the command file must be saved in either of the text editors with the "no-sequence" option.

BAUD_(BA)_=_Baud_rate_

READY ...   BAUD I

I
Baud rate (fixed pt).

As an example, a desired baud rate of 1200, which is the default value, is entered as 120 and not as 1200.

BLABEL1_(BL1)_=_Bottom_label_number_1_

READY ...   BLABEL1 I

I
Any label, up to a maximum of 40 characters, that must be enclosed in quotes if there are embedded blanks.

BLABEL2_(BL2)_=_Bottom_label_number_2_

READY ...   BLABEL2 I

I
Any label, up to a maximum of 40 characters, that

must be enclosed in quotes if there are embedded
blanks.

1

"TRAC - TYPE COMP CELL LEVEL/ROD".   This
label is automatically set whenever a TYP4
file is successfully "ATTACHed".

CATALOG_(C)_-_Catalog_COPY_command_records_

READY ...   CATALOG PFN ID

PFN

Perm file name.

ID

Userid.

Any perm file created by the COPY and CATALOG commands may
be "ATTACHed" at a later date by the code only if a file
organization of TYP3 is specified. This command automatically
prohibits any more COPY commands from being accepted during the
current session. The "CATALOGed" perm file is set with a
retention period of "infinity".

CHAN_(CH)_-_CWAF_locate_by_sequence_numbers_

READY ...   CHAN I J1 J2 J3 J4 J5 J6

I

File number, 1-6, corresponding to the FILE TABLE
ordinal (fixed pt). A file number of zero (0)
must be used to identify the special local file
CWAF.

J1-6

Individual sequence numbers to be used to locate
records on a CWAF structured perm file (fixed
pt).

COMMENT_-_Comment_

READY ...   COMMENT I

I

> Any alphanumeric string, up to a maximum of 70
> characters, that serves as a comment. This
> alphanumeric string is not processed by the code.

COPY - Copy WA file records.

READY ... COPY I

I

> WA file pointer of record to be copied (fixed
> pt).

Each copied record is written in a binary sequential manner. Although the format is designed for internal MAGNUM 1.0 use only, a user may access these records once the CATALOG command has created a perm file. The records are of the following form:

WORD(S)	DESCRIPTION
0001-2000	Y-axis data points.
2001-4000	X-axis data points.
4001	Physical record number.
4002	Engineering unit code.
4003	Record identification.
4004	Record identification.
4005	Number of valid data points.
4006	Xmin.
4007	Xmax.
4008	Ymin.
4009	Ymax.
4010	Physical record number.

The data point count (WORD 4005) specifies the number of legitimate Y-axis and X-axis data points that the record contains. The physical record number (WORDS 4001 and 4010) corresponds to the order in which each of the records was copied using the COPY command. This record number must also be used in a subsequent TYP3 FIND. Note that each record is always 4010 words in length, regardless of the number of valid points contained within.

CREATE (CR) - Input data directly from terminal.

        READY ...   CREATE

        The CREATE command allows a user to input data in the form
of X/Y pairs directly from the terminal. The code prompts the
user with "*** ENTER X AND Y :". In order to terminate input,
the user must enter END in response to the prompt.

        All X and Y data points must be entered in floating point
format with at least one blank or a comma separating the two
inputs per line.

DASH (D) - Dashed lines.

        READY ...   DASH I1 J1 I2 J2 I3 J3 I4 J4 I5 J5 I6 J6

        I1-6
              Curve numbers, 1-6 (fixed pt).

        J1-6
              Dash style, 1-6, corresponding to each of the
              curve numbers (fixed pt).

        The curve numbers and dash styles must be in the range of 1-
6. In the case of the dash styles, a 1 indicates very short line
segments. The dash segments increase with increasing dash style
numbers.

DASH2 (D2) - 2nd axes dashed lines.

        READY ...   DASH2 I1 J1 I2 J2 I3 J3 I4 J4 I5 J5 I6 J6

        I1-6
              Curve numbers, 1-6 (fixed pt).

        J1-6
              Dash style, 1-6, corresponding to each of the
              curve numbers (fixed pt).

        The curve numbers and dash styles must be in the range of 1-
6. In the case of the dash styles, a 1 indicates very short line

segments. The dash segments increase with increasing dash style numbers.

DISCARD_(DI)_-_Reset_the_WA_file_

        READY ... DISCARD

        This command will reset the WA file by destroying all "pointers" and unloading the file.

ECHO_(EC)_-_Echo_all_user_commands_to_a_file_

        READY ... ECHO

        This command "echos" each of the user commands encountered to local file TAPE7. This provides the user with an audit trail. Once invoked, the command remains in effect for the duration of the session. Also, the AUTO command may not be invoked while the ECHO command is in effect and vice versa.

ENGLISH_(E)_-_Metric_to_English_conversion_

        READY ... ENGLISH I1 I2 I3 I4 I5 I6

            I1-6
                WA file pointers of records to be converted (fixed pt).

        This automatic conversion keys off of an engineering unit code supplied with the data record. If the engineering unit code is missing or invalid, the conversion attempt will be rejected and an informational message will be issued.

FILES_(F)_-_FILE_TABLE_listing_

        READY ... FILES

        This command lists the currently active files by ordinal. A

file is active after a successful "ATTACH".

EILM_-_Generate_a_compressed_film_file_

READY ... FILM

This command allows a user to save plots on an intermediate file to be later processed by the FR80 command in MASTER. The FILM command must be issued by the user before any plots have been made on the terminal and this command is valid only once per session. Note that while this command is in effect, all plotting is diverted from the terminal screen.

The FR80 command when issued immediately following the "RETURN" from MAGNUM 1.0, will allow the user to either view or reformat and route the plots automatically to microfilm.

EIND_(EI)_-_Locate_and_save_perm_file_records_

The following form of the FIND command must be used for perm files with organization of either INDP, SIDU, TYP1, TYP3 or TYP6:

READY ... FIND I J1 J2 J3 J4 J5 J6

I

File number, 1-6, corresponding to the FILE TABLE ordinal (fixed pt). The FILE TABLE consists of six locations that are sequentially updated as reserved local files are encountered. A file number of zero (0) must be used to identify the special local file CWAF.

J1-6

Individual record numbers to be located on a perm file (fixed pt). These record numbers will be sorted in ascending order by the code if the file organization is INDP. In the case of TYP1 and TYP6 perm files, all records contained within the file are automatically located and saved each time a FIND is performed. Note that a maximum of 75 records may be located and saved on the intermediate WA file during any one session.

For TYP2, TYP4 and TYP5 perm files, the following form of the FIND command must be used:

    READY ...   FIND I J K1 K2 K3 K4 K5 K6

        I
                File number, 1-6, corresponding to the FILE TABLE
                ordinal (fixed pt). A file number of zero (0)
                must be used to identify the special local file
                CWAF.

        J
                Record number corresponding to the time record
                (fixed pt).

        K1-6
                Individual record numbers to be located on a perm
                file (fixed pt). These record numbers will be
                sorted in ascending order by the code.

    For CWAF perm files, the following form of the FIND command must be used:

    READY ...   FIND I J1 J2 J3 J4 J5 J6

        I
                File number, 1-6, corresponding to the FILE TABLE
                ordinal (fixed pt). A file number of zero (0)
                must be used to identify the special local file
                CWAF.

        J1-6
                Individual record identifiers or numbers to be
                located on a perm file (alphanumeric or fixed
                pt). If record identifiers are specified, a
                maximum of 16 characters may be entered per
                identifier.

    All records located with the FIND command are copied to an intermediate word addressable (WA) file and assigned a "pointer" for data location purposes. This WA "pointer" and not the original data record identifier or number must be referenced by the user in all subsequent work in the code with respect to the data.

FINDC (FIC) - CWAF locate by sequence numbers

        READY ...   FINDC I J1 J2 J3 J4 J5 J6

        I
                File number, 1-6, corresponding to the FILE TABLE
                ordinal (fixed pt). A file number of zero (0)
                must be used to identify the special local file
                CWAF.

        J1-6
                Individual sequence numbers to be used to locate
                records on a CWAF structured perm file (fixed
                pt).

FLUSH (FL) - Reset attributes to default values

        READY ...   FLUSH I1 I2 I3 I4 I5 I6

        I1-6
                Command names whose effects are to be deleted or
                reset to default values.

        Note that the command names must be fully spelled out.
Abbreviations of commands are not allowed.

FRAME (FR) - Frame the plot

        READY ...   FRAME

        This command simply places a frame around the plot.

HBAR (HB) - Horizontal bar graphs

        READY ...   HBAR

        Note that all curves plotted while this command is in effect
will be horizontal bar graphs.

HBAR2 (HB2) - 2nd axes horizontal bar graphs

    READY ...   HBAR2

    Note that all curves plotted while this command is in effect
will be horizontal bar graphs.

HCOPY (HC) - Automatic hard copy

    READY ...   HCOPY

    This command initiates an automatic hard copy of a plot if a
TEKTRONIX Model 4631 hard copy device is available. Note that
this option is automatically selected while the AUTO command is
in effect.

HELP (H) - Command summary information

    READY ...   HELP I

        I
                Full command name for which summary information
                is desired. Abbreviations are not allowed.

    In order to secure a listing of all currently available
commands, simply enter HELP. This listing is always up to date.

HWARE (HW) - Hardware character generation

    READY ...   HWARE

    This command inhibits the default software generation of
characters in all titles and labels with the exception of Y-axis
labels. Characters generated while this command is in effect
will be generated at a faster rate but the ability to output
subscripts and superscripts is lost.

IDS_(I)_-_Generate_a_record_IDENTIFIER_header_

        READY ...   IDS

        The record identifier for each plotted curve is located on
the top portion of the plot. Note that only the first 15
characters of an identifier are displayed. Both the TLABEL1 and
TLABEL2 commands automatically override this command. This
option is automatically set after each successful "ATTACH" of a
TYP4 perm file. The PLOT2 command inhibits this command unless
the NOXLAB2 command is also specified; then the record
identifiers for the first 6 curves of the first axes are
displayed only.

KATALOG_(K)_-_Catalog_KEEP_command_records_

        READY ...   KATALOG PFN ID

            PFN
                Perm file name.

            ID
                Userid.

        Any perm file created by the KEEP and KATALOG commands may
be "ATTACHed" at a later date by the code only if a file
organization of CWAF is specified. This command allows a
subsequent KEEP command to be executed. The "KATALOGed" perm
file is set with a retention period of "infinity".

KEEP_(KE)_-_Copy_WA_file_records_

        READY ...   KEEP I1 I2 I3 I4 I5 I6

        READY ...   KEEP IL TO IU

        READY ...   KEEP ALL

            I1-6
                WA file pointers of records to be copied (fixed
                pt).

            IL

Lower limit WA file pointer (fixed pt).

IU

Upper limit WA file pointer (fixed pt).

Each copied record is written in the CWAF file structure. The KATALOG command must be executed prior to session termination in order to catalog the copied records. The KEEP/KATALOG command sequence may be repeated as often as necessary during the session.

The "TO" parameter is positional dependent and signifies an inclusive copy from "IL" to "IU". By specifying "ALL", the code will copy all of the WA file records.

LAYOUT_(LA)_-_Produce_a_curveless_plot_

READY ... LAYOUT

This command allows a user to view a plot with all attributes set in order to ascertain if the plot appearance is correct. By not plotting the curves along with everything else, faster throughput is achieved while the user is "fine-tuning" the plot appearance. Note that this command must be "FLUSHed" before a final plot can be produced.

LINE_-_Create_a_line_segment_

READY ... LINE I R S1 S2

I

H

Horizontal line.

V

Vertical line.

R

X or Y value (floating pt).

S1

Lower X or Y limit (floating pt).

S2
Upper X or Y limit (floating pt).

This command generates either a two point horizontal or a two point vertical line segment. A WA file pointer is automatically assigned to the generated "line". This "line" must be "PLOTted" in the same fashion as any other data residing on the intermediate WA file.

LINEAR (L) = Linear axes scales

READY ... LINEAR

This command sets both the X-axis and Y-axis for linear scaling. This is also the default option.

LINEAR2 (L2) = 2nd axes linear scales

READY ... LINEAR2

This command sets both the 2nd X-axis and Y-axis for linear scaling. This is also the default option for the 2nd set of axes.

LOG = Logarithmic axes scales

READY ... LOG

Both the X-axis and Y-axis are set for logarithmic scaling.

LOG2 = 2nd axes logarithmic scales

READY ... LOG2

Both the 2nd X-axis and Y-axis are set for logarithmic scaling.

LOGO_-_EG&G_Idaho_Inc_logo_

READY ...   LOGO

This command produces the EG&G Idaho Inc logo on the top left portion of a plot. This command is overridden by the PLOT2 command unless the NOXLAB2 command is in effect also.

MACCAT_-_MACRO_catalog_

READY ...   MACCAT PFN ID

PFN
Perm file name.

ID
Jserid.

This command catalogs the MACROSC file with a retention period of "infinity". The file is also returned, thereby allowing the user to repeat the MACDEF/MACCAT command sequence as many times as required.

MACCPY_-_MACRO_copy_

READY ...   MACCPY I

I
MACRO name, 1-7 characters.

This command copies a MACRO residing on the MACROPF file to the MACROSC file.

MACDEF_-_MACRO_definition_

READY ...   MACDEF I

I
MACRO name, 1-7 characters.

This command allows a user to define a MACRO that will reside in the MACROSC file. Up to a maximum of 100 MACRO names may be defined. The length of an individual MACRO is not bounded.

The code prompts the user with "*** ENTER MACRO :". In order to terminate input, the user must enter END in response to the prompt.

MACDEL - MACRO deletion

      READY ...   MACDEL I

            I
                  MACRO name, 1-7 characters.

This command deletes a MACRO residing on the MACROSC file.

MACDIR - MACRO directory listing

      READY ...   MACDIR I

            I

                  PF
                        MACROPF residence.

                  SC
                        MACROSC residence.

This command lists either the MACROPF or MACROSC directory.

MACGET - MACRO attach

      READY ...   MACGET PFN ID CY

            PFN
                  Perm file name.

            ID
                  Userid.

CY
Cycle number.   The highest cycle is the default.

This command attaches the MACROPF file.

MACLST - MACRO text listing.

READY ...   MACLST I J

I
MACRO name, 1-7 characters.

J

PF
MACROPF residence.

SC
MACROSC residence.

This command allows the user to list any MACRO residing on
either the MACROPF or MACROSC file.

MACRUN - MACRO execution.

READY ...   MACRUN I

I
MACRO name, 1-7 characters.

This command initiates the execution of a MACRO. The
MACROSC file, if available, is searched first for the specified
MACRO name, followed by a search of the MACROPF file.

METRIC (M) - English to metric conversion.

READY ...   METRIC I1 I2 I3 I4 I5 I6

I1-6
WA file pointers of records to be converted
(fixed pt).

This automatic conversion keys off of an engineering unit code supplied with the data record. If the engineering unit code is missing or invalid, the conversion attempt will be rejected and an informational message will be issued.

NOGRIDS (NOGR) - Omit all grid lines.

READY ... NOGRIDS

This command omits all grid lines on both the X-axis and the Y-axis. Note that the PLOT2 command automatically invokes this option.

NOIDENT (NOID) - Omit plot identification.

READY ... NOIDENT

This command omits the code version and modification level and the time and date of the start of the session from the bottom of a plot.

NOXLAB2 (NOXL) - Omit 2nd axes X-axis label.

READY ... NOXLAB2

This command omits the 2nd X-axis label and numbering while in effect.

NOYLAB2 (NOYL) - Omit 2nd axes Y-axis label.

READY ... NOYLAB2

This command omits the 2nd Y-axis label and numbering while in effect.

PAUSE_-_Pause_

    READY ...   PAUSE I

       I
            Pausing factor, 1-1000 (fixed pt).

    This command will issue (10 * pausing factor) SYNCS at the time it is encountered in the input stream.

PLOT_(P)_-_Initiate_basic_plotting_

    For other than parameter versus parameter plots, use the following form of the PLOT command:

    READY ...   PLOT I1 I2 I3 I4 I5 I6

       I1-6
            WA file pointers of records to be plotted (fixed pt).

    In the case of parameter versus parameter plots, use the following form of the PLOT command:

    READY ...   PLOT I VS J1 J2 J3 J4 J5 J6

       I
            X-axis WA file pointer (fixed pt).

       J1-6
            Y-axis WA file pointers (fixed pt).

    Note that the "VS" parameter is positional dependent. After completion of a plot, 3 "bells" will sound, and the code will pause until the user enters any character from the terminal keyboard. If the AUTO command is in effect, the code will produce a hard copy of the plot automatically and not pause for user intervention.

PLOT1 (P1) - Initiate 1st axes plotting

For other than parameter versus parameter plots, use the following form of the PLOT1 command:

        READY ... PLOT1 I1 I2 I3 I4 I5 I6

            I1-6
                WA file pointers of records to be plotted (fixed pt).

In the case of parameter versus parameter plots, use the following form of the PLOT1 command:

        READY ... PLOT1 I VS J1 J2 J3 J4 J5 J6

            I
                X-axis WA file pointer (fixed pt).

            J1-6
                Y-axis WA file pointers (fixed pt).

Note that the "VS" parameter is positional dependent. This command will set the required internal logic and then return to the user without plot initiation. A PLOT2 command must follow in order to produce a plot consisting of two axes.

PLOT2 (P2) - Initiate 2nd axes plotting

For other than parameter versus parameter plots, use the following form of the PLOT2 command:

        READY ... PLOT2 I1 I2 I3 I4 I5 I6

            I1-6
                WA file pointers of records to be plotted (fixed pt).

In the case of parameter versus parameter plots, use the following form of the PLOT2 command:

READY ...   PLOT2 I VS J1 J2 J3 J4 J5 J6

    I
            X-axis WA file pointer (fixed pt).

    J1-6
            Y-axis WA file pointers (fixed pt).

    Note that the "VS" parameter is positional dependent. This
command will check to make sure that the PLOT1 command has
already been issued by the user and if all conditions are
satisfied, plotting of both set of axes will   commence.   After
completion of the plot, 3 "bells" will sound, and the code will
pause until the user enters any character from the terminal
keyboard.   If the AUTO command is in effect, the code will
produce a hard copy of the plot automatically and not pause for
user intervention.

PLOT3 (P3) - Initiate bit pattern plotting.

READY ...   PLOT3 I J K

    I
            WA file pointer (fixed pt).

    J
            Lower bit limit to be plotted (fixed pt).

    K
            Upper bit limit to be plotted (fixed pt).

    WARNING: This command applies only to data "ATTACHed" with
the TYP5 file organization and it is costly in both clock and CPU
times.

    After completion of a plot, 3 "bells" will sound, and the
code will pause until the user enters any character from the
terminal keyboard.   If the AUTO command is in effect, the code
will produce a hard copy of the plot automatically and not pause
for user intervention.

PLOTTER (PL) - Enable X/Y digital plotter.

READY ...   PLOTTER

This command informs the code that a TEKTRONIX Model 4662 digital plotter is available and all ensuing plots are output to both the screen and the plotter. Note that this command is overridden by the FILM command.

POINTS (PO) - Points only curves.

    READY ...   POINTS I1 I2 I3 I4 I5 I6

        I1-6
            Curve numbers to be represented by points only (fixed pt).

    Note that the curve numbers refer to the sequence of curves to be plotted and not to the WA file pointers.

POINTS2 (PO2) - 2nd axes points only curves.

    READY ...   POINTS2 I1 I2 I3 I4 I5 I6

        I1-6
            Curve numbers to be represented on the 2nd axes by points only (fixed pt).

    Note that the curve numbers refer to the sequence of curves to be plotted on the 2nd axes only.

RANGE (RA) - CWAE time range.

    READY ...   RANGE R1 R2 I

        R1
            Lower time limit (floating pt).

        R2
            Upper time limit (floating pt).

        I
            Decimation factor if positive, averaging factor if negative (fixed pt).

This command, when used in conjunction with the FIND, FINDC or CHAN commands for CWAF structured perm files, allows a user to locate and save up to 2000 data points from a perm file containing any number of data points.

RETURN (R) - Return to MASTER

    READY ...   RETURN

This command initiates the necessary "housekeeping" in order for MAGNUM 1.0 to "RETURN" control to MASTER.

REVIEW (RE) - List attribute status

    READY ...   REVIEW I

        I
            Optional starting page number, 1-5 (fixed pt).

This command provides the user with a current status of all of the plotting attributes.

SIZE (SI) - Symbol sizes

    READY ...   SIZE I1 R1 I2 R2 I3 R3 I4 R4 I5 R5 I6 R6

        I1-6
            Curve numbers, 1-6 (fixed pt).

        R1-6
            Symbol size for each of the preceding curve numbers (floating pt).

The default symbol size is set at 1.0.

SIZE2 (SI2) - 2nd axes symbol sizes

    READY ...   SIZE2 I1 R1 I2 R2 I3 R3 I4 R4 I5 R5 I6 R6

I1-6
> Curve numbers, 1-6 (fixed pt).

R1-6
> Symbol size for each of the preceding curve numbers (floating pt).

The default symbol size is set at 1.0.

STAGGER (SG) - Symbol staggering

READY ...   STAGGER I1 J1 I2 J2 I3 J3 I4 J4 I5 J5 I6 J6

I1-6
> Curve numbers, 1-6 (fixed pt).

J1-6
> Output a symbol every "J" th data point for each of the preceding curve numbers (fixed pt).

The default staggering factor is set at 30 per curve.

STAGGR2 (SG2) - 2nd axes symbol staggering

READY ...   STAGGR2 I1 J1 I2 J2 I3 J3 I4 J4 I5 J5 I6 J6

I1-6
> Curve numbers, 1-6 (fixed pt).

J1-6
> Output a symbol every "J" th data point for each of the preceding curve numbers (fixed pt).

The default staggering factor is set at 30 per curve.

STATUS (ST) - FILE and RECORD TABLE listing

READY ...   STATUS I

I

ALL

File and record tables listed.

F

File table listed only.

R

Record table listed only.

Note that the RECORD TABLE lists the correspondence between the record numbers off of the data perm files and the WA file pointers.

SUMMARY_(SU)_-_File_summary_listing_

READY ... SUMMARY I

I
File number, 1-6, corresponding to the FILE TABLE ordinal (fixed pt). A file number of zero (0) must be used to identify the special local file CWAF.

This command produces a summary listing consisting of the channel number, the identifier, the engineering unit code and the number of data points for all of the records on the file being processed. SIDU, TYP1 and TYP6 structured perm files are not supported by this command.

SYMBOL_(S)_-_Symbol_definition_

READY ... SYMBOL I1 J1 I2 J2 I3 J3 I4 J4 I5 J5 I6 J6

I1-6
Curve numbers, 1-6 (fixed pt).

J1-6
Symbol definitions for each of the preceding curve numbers as follows:

0 - no symbol
1 - 1
2 - 2

```
          3 - 3
          4 - 4
          5 - 5
          6 - 6
          7 - circle
          8 - x
          9 - triangle
         10 - square
         11 - asterisk
         12 - diamond
         13 - confidence interval
         14 - confidence interval, dx only
         15 - confidence interval, dy only
```

Note that the first six symbols (1-6) are hardware generated, while the remaining symbols are software generated. The SIZE command is only applicable for software generated symbols (7-12).

SYMBOL2 (S2) - 2nd axes symbol definition

READY ...   SYMBOL2 I1 J1 I2 J2 I3 J3 I4 J4 I5 J5 I6 J6

I1-6
Curve numbers, 1-6 (fixed pt).

J1-6
Symbol definitions for each of the preceding curve numbers as follows:

```
          0 - no symbol
          1 - 1
          2 - 2
          3 - 3
          4 - 4
          5 - 5
          6 - 6
          7 - circle
          8 - x
          9 - triangle
         10 - square
         11 - asterisk
         12 - diamond
         13 - confidence interval
         14 - confidence interval, dx only
         15 - confidence interval, dy only
```

Note that the first six symbols (1-6) are hardware generated, while the remaining symbols are software generated. The SIZE2 command is only applicable for software generated symbols (7-12).

TIME_(TI)_-_CP_and_IO_times_

        READY ...   TIME I

            I

                ALL
                    List CP and IO times.

                CP
                    List CP time only.

                IO
                    List IO time only.

        If a second entry is not entered along with the TIME command, then both the CP and IO times will be listed.

TITLE_(T)_-_Plot_title_

        READY ...   TITLE I

            I
                Any label, up to a maximum of 40 characters, that must be enclosed in quotes if there are embedded blanks.

TLABEL1_(TL1)_-_Top_label_number_1_

        READY ...   TLABEL1 I

            I
                Any label, up to a maximum of 40 characters, that must be enclosed in quotes if there are embedded blanks.

        Note that this command automatically overrides the IDS

command.

TLABEL2 (TL2) = Top label number 2

        READY ...   TLABEL2 I

                I
                        Any label, up to a maximum of 40 characters, that
                        must be enclosed in quotes if there are embedded
                        blanks.

        Note   that   this   command   automatically   overrides   the   IDS
command.

UID = Default ATTACH userid

        READY ...   UID

        This command will alter the default "ATTACH" userid of
HRBSEX to that specified at "LOGIN".

UNLOAD (U) = Return FILE TABLE resident files

        READY ...   UNLOAD I1 I2 I3 I4 I5 I6

                I1-6
                        File   numbers,   1-6,   corresponding   to   the   FILE
                        TABLE ordinals (fixed pt). A file number of zero
                        (0)   must   be   used to identify the special local
                        file CWAF.

VBAR (VB) = Vertical bar graphs

        READY ...   VBAR

        Note that all curves plotted while this command is in effect
will be vertical bar graphs.

VBAR2 (VB2) - 2nd axes vertical bar graphs

        READY ...   VBAR2

        Note that all curves plotted while this command is in effect
will be vertical bar graphs.

WINDOW (WI) - Place text in plot window

        READY ...   WINDOW R1 R2 I J K L

        R1
                Starting X coordinate, in the range from 0.0 to
                1.0 (floating pt).

        R2
                Starting Y coordinate, in the range from 0.0 to
                1.0 (floating pt).

        I
                Number of lines of text, 1-6 (fixed pt).

        J
                Maximum number of characters of text on any of
                the text lines, 1-40 (fixed pt).

        K
                Optional background color, 0-7 (fixed pt).

        L
                Optional text color, 0-7 (fixed pt).

        The code will generate a "window" inside the plot using the
starting X and Y coordinates as the lower left intersection   and
the number of lines and characters as the height and width.   The
code will ignore this command if the user specifies a "window"
that will lie outside of the plot itself.

XGRID (XG) - X-axis grid lines only

        READY ...   XGRID

This command will create grid lines on the X-axis only.

XLABEL (XL) = X-axis label

    READY ...   XLABEL I

       I

          Any label, up to a maximum of 40 characters, that must be enclosed in quotes if there are embedded blanks.

          1

             "TIME (SEC)".

          2

             "TIME AFTER RUPTURE (SEC)".

          3

             "TIME AFTER REFLOOD INITIATION (SEC)".

          4

             "TIME (S)".

          5

             "TIME AFTER RUPTURE (S)".

          6

             "TIME AFTER REFLOOD INITIATION (S)".

          7

             "REACTOR TIME (S)".

    Note that a successful "ATTACH" of a TYP4 perm file automatically sets the "REACTOR TIME (S)" label.

XLABEL2 (XL2) = 2nd axes X-axis label

    READY ...   XLABEL2 I

       I

          Any label, up to a maximum of 40 characters, that must be enclosed in quotes if there are embedded blanks.

          1

"TIME (SEC)".

2

"TIME AFTER RUPTURE (SEC)".

3

"TIME AFTER REFLOOD INITIATION (SEC)".

4

"TIME (S)".

5

"TIME AFTER RUPTURE (S)".

6

"TIME AFTER REFLOOD INITIATION (S)".

7

"REACTOR TIME (S)".

Note that a successful "ATTACH" of a TYP4 perm file automatically sets the "REACTOR TIME (S)" label.

XLOG_-_Semi-log_scale_with_log_X-axis_

READY ... XLOG

The X-axis is scaled logarithmically, while the Y-axis is linearly scaled.

XLOG2_-_2nd_axes_semi-log_scale_with_log_X-axis_

READY ... XLOG2

The X-axis is scaled logarithmically, while the Y-axis is linearly scaled.

XMAX_-_X-axis_maximum_

READY ... XMAX R

> R
>> X-axis maximum for plotting purposes (floating pt).

XMAX2_=_2nd_axes_X-axis_maximum_

READY ... XMAX2 R

> R
>> X-axis maximum for plotting purposes (floating pt).

XMIN_=_X-axis_minimum_

READY ... XMIN R

> R
>> X-axis minimum for plotting purposes (floating pt).

XMIN2_=_2nd_axes_X-axis_minimum_

READY ... XMIN2 R

> R
>> X-axis minimum for plotting purposes (floating pt).

XRANGE_(XR)_=_SIDU_time_range_

READY ... XRANGE R1 R2

> R1
>> Lower time limit (floating pt).

> R2
>> Upper time limit (floating pt).

This command, when used in conjunction with the FIND command for SIDU structured perm files, allows a user to locate and save any contiguous set of data points within a collection of more

than 2000 data points. Note that this command applies only to SIDU structured perm files and that the time range may not exceed 2000 data points.

XTICS_(XT)_=_X=axis_tic_mark_density_

        READY ...   XTICS I

            I
                Tic mark density code, 1-10 (fixed pt).

        A tic mark density code of 1 is the default value. A code of 1 indicates a minimum density, while a code of 10 indicates a maximum density.

XTICS2_(XT2)_=_2nd_axes_X=axis_tic_mark_density_

        READY ...   XTICS2 I

            I
                Tic mark density code, 1-10 (fixed pt).

        A tic mark density code of 1 is the default value. A code of 1 indicates a minimum density, while a code of 10 indicates a maximum density.

YGRID_(YG)_=_Y=axis_grid_lines_only_

        READY ...   YGRID

    This command will create grid lines on the Y-axis only.

YLABEL_(YL)_=_Y=axis_label_

        READY ...   YLABEL I

            I
                Any label, up to a maximum of 40 characters, that must be enclosed in quotes if there are embedded

blanks.

1

The engineering unit code equivalent label
will be generated automatically by the
code. No label will be generated if the
engineering unit code is missing.

2

The record supplied label is used. This
label, with a 20 character maximum, is
currently obtained from TYP4 perm files
only. Note that a successful "ATTACH" of a
TYP4 perm file automatically sets "YLABEL
2".

YLABEL2 (YL2) = 2nd axes Y-axis label

READY ...   YLABEL2 I

I

Any label, up to a maximum of 40 characters, that
must be enclosed in quotes if there are embedded
blanks.

1

The engineering unit code equivalent label
will be generated automatically by the
code. No label will be generated if the
engineering unit code is missing.

2

The record supplied label is used. This
label, with a 20 character maximum, is
currently obtained from TYP4 perm files
only. Note that a successful "ATTACH" of a
TYP4 perm file automatically sets "YLABEL2
2".

YLOG = Semi-log scale with log Y-axis

READY ...   YLOG

The Y-axis is scaled logarithmically, while the X-axis is
linearly scaled.

YLOG2 - = 2nd axes semi-log scale with log Y-axis

        READY ...   YLOG2

        The Y-axis is scaled logarithmically, while the X-axis is linearly scaled.

YMAX - = Y-axis maximum

        READY ...   YMAX R

                R
                        Y-axis maximum for plotting purposes (floating pt).

YMAX2 - = 2nd axes Y-axis maximum

        READY ...   YMAX2 R

                R
                        Y-axis maximum for plotting purposes (floating pt).

YMIN - = Y-axis minimum

        READY ...   YMIN R

                R
                        Y-axis minimum for plotting purposes (floating pt).

YMIN2 - = 2nd axes Y-axis minimum

        READY ...   YMIN2 R

                R
                        Y-axis minimum for plotting purposes (floating pt).

YTICS (YI) - Y-axis tic mark density

        READY ...   YTICS I

            I
                Tic mark density code, 1-10 (fixed pt).

        A tic mark density code of 1 is the default value. A code
of 1 indicates a minimum density, while a code of 10 indicates a
maximum density.

YTICS2 (YI2) - 2nd axes Y-axis tic mark density

        READY ...   YTICS2 I

            I
                Tic mark density code, 1-10 (fixed pt).

        A tic mark density code of 1 is the default value.   A   code
of 1 indicates a minimum density, while a code of 10 indicates a
maximum density.

Z4027 - Model 4027 color CRT initialization

        READY ...   Z4027

        This command must be the first color command entered by the
user of a Model 4027 color CRT in order to initialize the
terminal for graphics. The color codes used with the various
color commands are as follows:

        0 ... white
        1 ... red
        2 ... green
        3 ... blue
        4 ... yellow
        5 ... cyan
        6 ... magenta
        7 ... black

ZBGRND - Set background color

```
READY ...   ZBGRND I

        I
            Color code, 0-7 (fixed pt).
```

This command will set the background color within the boundary of the plot.

ZBLAB1 - Set bottom label number 1 color

```
READY ...   ZBLAB1 I

        I
            Color code, 0-7 (fixed pt).
```

This command will set the color of the bottom label number 1 text.

ZBLAB2 - Set bottom label number 2 color

```
READY ...   ZBLAB2 I

        I
            Color code, 0-7 (fixed pt).
```

This command will set the color of the bottom label number 2 text.

ZCRVS1 - Set 1st axes curves color

```
READY ...   ZCRVS1 I1 J1 I2 J2 I3 J3 I4 J4 I5 J5 I6 J6

        I1-6
            Curve numbers, 1-6 (fixed pt).

        J1-6
            Color codes, 0-7 (fixed pt).
```

This command sets the colors of the 1st axes curves.

ZCRVS2 - Set 2nd axes curves color

        READY ...   ZCRVS2 I1 J1 I2 J2 I3 J3 I4 J4 I5 J5 I6 J6

            I1-6
                Curve numbers, 1-6 (fixed pt).

            J1-6
                Color codes, 0-7 (fixed pt).

    This command sets the colors of the 2nd axes curves.

ZGRIDS - Set grid color

        READY ...   ZGRIDS I

            I
                Color code, 0-7 (fixed pt).

    This command sets the color of the grid lines.

ZIDENT - Set IDENTIFIER header color

        READY ...   ZIDENT I

            I
                Color code, 0-7 (fixed pt).

    This command sets the color of the IDENTIFIER header text.

ZLOGO - Set the EG&G Idaho Inc logo color

        READY ...   ZLOGO I

            I
                Color code, 0-7 (fixed pt).

This command sets the color of the EG&G Idaho Inc logo.

ZTITLE = Set title color

    READY ...   ZTITLE I

        I
            Color code, 0-7 (fixed pt).

This command sets the color of the title text.

ZTLAB1 = Set top label number 1 color

    READY ...   ZTLAB1 I

        I
            Color code, 0-7 (fixed pt).

This command sets the color of the top label number 1 text.

ZTLAB2 = Set top label number 2 color

    READY ...   ZTLAB2 I

        I
            Color code, 0-7 (fixed pt).

This command sets the color of the top label number 2 text.

ZWINDO = Set window color

    READY ...   ZWINDO I R1 R2 R3 R4 R5 R6 R7 R8

        I
            Color code, 0-7 (fixed pt).

        R1
            Lower left X coordinate (floating pt).

R2

Lower left Y coordinate (floating pt).

R3

Lower right X coordinate (floating pt).

R4

Lower right Y coordinate (floating pt).

R5

Upper right X coordinate (floating pt).

R6

Upper right Y coordinate (floating pt).

R7

Upper left X coordinate (floating pt).

R8

Upper left Y coordinate (floating pt).

This command defines a secondary color background.   All   of the R1-R8 values must be in the range from 0.0 to 1.0.

ZXLAB1_-_Set_X-axis_label_color_

READY ...   ZXLAB1 I

I
Color code, 0-7 (fixed pt).

This command sets the color of the X-axis label text.

ZXLAB2_-_Set_2nd_axes_X-axis_label_color_

READY ...   ZXLAB2 I

I
Color code, 0-7 (fixed pt).

This   command   sets   the   color of the 2nd axes X-axis label text.

ZYLAB1_-_Set_Y-axis_label_color_

        READY ...   ZYLAB1 I

            I
                Color code, 0-7 (fixed pt).

    This command sets the color of the Y-axis label text.

ZYLAB2_-_Set_2nd_axes_Y-axis_label_color_

        READY ...   ZYLAB2 I

            I
                Color code, 0-7 (fixed pt).

    This command sets the color of the 2nd axes Y-axis label
text.

MATHEMATICAL COMMANDS

The commands described in the following discussion provide the user with the capability of performing an assortment of mathematical operations on data to be plotted. All operations are performed in a "working buffer", which must first be filled with the LOAD command and must then be "SAVEed". The order of events may be summarized as follows:

01) "LOAD" a data record.

02) Perform any number of mathematical operations.

03) "SAVE" the resultant data record.

Note that the SAVE command will copy the contents of the "working buffer" to the WA file and that the limit of 75 records for that file applies. Also, all records that are to be manipulated, must previously nave been located and saved using the FIND, FINDC or CHAN commands and therefore already residing in the WA file.

ABS_-_Absolute_value_

READY ... ABS

The absolute value of the "working buffer" contents is taken and retained in the "working buffer".

ADD_-_Add_a_record_or_constant_

READY ... ADD I

I
WA file pointer if fixed point or an arbitrary constant value if floating point.

AVE_-_Average_and_replace_

READY ... AVE I

I
>
> Every "I" set of data points are averaged and the result placed at the mid point of the "I" data point interval (fixed pt).

BUTT - Butt data

READY ...   BUTT I

I
>
> WA file pointer (fixed pt).

This command will "butt" the data points found in WA file pointer "I" to the end of the data points currently "LOADed" in the "working buffer". Note that any number of "BUTTs" may be performed as long as the 2000 data point limit in the "working buffer" is not exceeded.

DEC - Decimate

READY ...   DEC I

I
>
> Decimation count (fixed pt).

The contents of the "working buffer" are decimated according to "I" and only every "I" th data point is retained.

DIF - Differentiate

READY ...   DIF

The contents of the "working buffer" are differentiated using a second degree Lagrangian interpolating polynomial technique. WARNING: This scheme breaks down rapidly at the end points of the tabulated function for 2nd, 3rd, etc differentiations.

DIV - Divide by a record or constant

        READY ...   DIV I

            I
                    WA file pointer if fixed point or an arbitrary
                    constant value if floating point.

    Note that the code will attempt to correct a divide by zero
condition by using the next non-zero data point and an
informational message will be issued should such action be
required.

EUNIT - Alter the engineering unit code

        READY ...   EUNIT I

            I
                    Engineering unit code (fixed pt).

EXP - Raise to a power

        READY ...   EXP R

            R
                    Power to which "working buffer" contents are to
                    be raised to (floating pt).

    Note that all negative quantities are first made positive,
then raised to the desired power, and then negated.

FIT - Least squares polynomial curve fitting

        READY ...   FIT I

            I
                    Polynomial order, 1-7 (fixed pt).

    The contents of the "working buffer" are curve fit using a
least squares polynomial fitting technique. The coefficients of

the polynomial are first returned to the user and then used to build new "working buffer" contents utilizing the given independent variable.

FIT1 - Inverse exponential curve fit

    READY ...   FIT1 I1 R1 I2 R2 I3 R3 I4 R4

        I1-4

            A
                    A coefficient.

            B
                    B coefficient.

            C
                    C coefficient.

            D
                    D coefficient.

        R1-4
                Coefficient values corresponding to A, B, C or D
                (floating pt).

    Any or all of the coefficients (A, B, C or D) and their respective values may be entered in any order. All of the coefficient values default to 1.0.

    The inverse exponential curve fit utilizes the currently "LOADed" independent variable and the input coefficients to calculate new "working buffer" contents according to the following form:

        F(X) = A / (B + C * EXP(D * X))

FIX - Data correction

    READY ...   FIX I J R1 R2

        I
                Data point number (fixed pt).

J

X

Signifies X data point portion.

Y

Signifies Y data point portion.

XY

Signifies X and Y data point portions.

R1

X or Y data point portion value (floating pt).

R2

Y data point portion value if XY specified (floating pt).

This command allows the user to selectively "FIX" the X and/ or Y portions of a data point currently residing in the "working buffer".

FLIP - Exchange X/Y

READY ... FLIP

In the above form, the X data points are interchanged with the Y data points on a one to one basis in the "working buffer".

READY ... FLIP I J K

I

WA file pointer (fixed pt).

J

X ... from X
Y ... from Y

K

X ... to X
Y ... to Y

This form of the FLIP command allows a user to interchange both the X and Y data points in the "working buffer" by

substituting from a second data record. The "from" indicates either the X or Y data points from the second data record and the "to" indicates either the X or Y data points in the "working buffer".

IDENT - Alter the identifier

    READY ...   IDENT I

        I
            Record identifier, 16 character maximum.

INT - Integrate

    READY ...   INT

    This command performs an integration of a monotonically tabulated function by the Trapezoidal Rule. The integration is performed on the contents of the "working buffer" and the integrated results are saved in the "working buffer".

INTRP - Linear interpolation

    READY ...   INTRP R1 R2

        R1
            Delta-x to be used in the linear interpolation of the "working buffer" contents (floating pt).

        R2
            Optional X0 to be used as the starting location of the linear interpolation of the "working buffer" contents (floating pt).

LIST - List (decimal)

    READY ...   LIST R1 R2

        R1
            Lower X limit (floating pt).

R2
> Upper X limit (floating pt).

The contents of the "working buffer" within the user specified limits are listed on the terminal screen. All of the "working buffer" is listed if the lower and upper limits are not specified.

LISTB - List (octal)

READY ...   LISTB R1 R2

R1
> Lower X limit (floating pt).

R2
> Upper X limit (floating pt).

The contents of the "working buffer" within the user specified limits are listed in an octal format on the terminal screen. This command is useful for listing TYP5 structured data (bit patterns).

LOAD - Load the "working buffer"

READY ...   LOAD I

I
> WA file pointer (fixed pt).

This command "LOADs" the "working buffer". This command must be executed before any other "mathematical" commands will be accepted by the code.

MUL - Multiply by a record or constant

READY ...   MUL I

I
> WA file pointer if fixed point or an arbitrary
> constant value if floating point.

ORDER_-_Rearrange_the_"working_buffer"_

        READY ...   ORDER I1 I2

            I1
                Lower data point number limit (fixed pt).

            I2
                Jpper data point number limit (fixed pt).

        This command allows a user to selectively choose, within a data point number range, desired data points residing in the "working buffer".

SAVE_-_Copy_"working_buffer"_to_WA_file_

        READY ...   SAVE

        This command must be executed by the user whenever the "working buffer" contents are to be "SAVEed" in the WA file.

SHIET_-_X_data_offset_

        READY ...   SHIFT R

            R
                Arbitrary constant to be added to each of the X data points in the "working buffer" (floating pt).

SLICE_-_Rearrange_the_"working_buffer"_

        READY ...   SLICE R1 R2

            R1
                Lower X limit (floating pt).

            R2
                Upper X limit (floating pt).

This command allows a user to selectively choose, within an X range, desired data points residing in the "working buffer".

SUB_-_Subtract_a_record_or_constant_

READY ... SUB I

I

WA file pointer if fixed point or an arbitrary constant value if floating point.

APPENDIX A

MAGNUM 1.0 is capable of generating plot titles and labels in both upper and lower case with subscripts and superscripts. This extended capability is only valid for software generated characters. The HWARE command will negate the ability to use subscripts and superscripts and lower case characters will not be allowed unless the user is using a TEKTRONIX Model 4014, 4025 or 4027 CRT terminal.

In order to inform the code that lower case characters or subscripts and superscripts are to be used, certain characters are reserved and therefore not available to the user as title or label information. These reserved characters and their use are illustrated in the following:

    !...label...!   Lower case.

    #...label...#   Superscripted lower case.

    %...label...%   Subscripted lower case.

    >...label...>   Superscripted upper case.

    <...label...<   Subscripted upper case.

APPENDIX_B_

The following table lists the currently available engineering unit codes and their respective labels:

```
CODE   LABEL_____

0001   Core Heater Temperature (F)
0002   Fluid Temperature (F)
0003   Pressure (psig)
0004   Strain (Microin/in)
0005   Volumetric Flow (gpm)
0006   Fluid Velocity (ft/sec)
0007   Force (lb)
0008   Length (in)
0009   Voltage (V)
0010   Material Temperature (F)
0011   Current (A)
0012   Specific Volume (ft3/lbm)
0013   Decibels (db)
0014   Pressure (psi)
0015   Pressure (psia)
0016   Differential Pressure (psid)
0017   Density (lbm/ft3)
0018   Power (kW)
0019   Heat Flux (Btu/hr-ft2)
0020   H. T. Coeff. (Btu/hr-ft2-F)
0021   Surface Temperature (F)
0022   Saturation Temperature (F)
0023   Enthalpy (Btu/lbm)
0024   Mass Flux (lbm/sec-ft2)
0025   Mass Flow (lbm/sec)
0026   Integrated Mass Flow (lbm)
0027   Momentum Flux (lbm/ft-sec2)
0028   Fluid Velocity (in/sec)
0029   Pump Speed (rpm)
0030   Elevation (ft)
0031   Quality
0032   Normalized Power
0033   Mass Flux (10x6 lbm/hr-ft2)
0034   Temperature (F)
0035   Time After Rupture (sec)
0036   Time (sec)
0037   Total Energy (Btu)
0038   Reactivity ($)
0039   Stored Energy (Btu)
0040   Energy (Btu)
0041   Mass Balance (lbm)
```

```
0042   Power (MW)
0043   Total Heat Removed (Btu/hr)
0044   Period (sec)
0045   Heat Transfer Rate (Btu/hr)
0046   Mass (lbm)
0047   Saturation Pressure (psia)
0048   Normalized Pump Torque
0049   Volumetric Flow (ft3/sec)
0050   Choking Index
0051   Heat Transfer Mode
0052   Time After Reflood (sec)
0053   Thermal Conductivity (Btu/hr-ft-F)
0054   Internal Rod Temperature (F)
0055   Liquid Level (in)
0056   Percent
0057   Frequency (Hz)
0058   Total Volume (ft3)
0059   Acceleration (ft/sec2)
0060   Core Heater Temperature (K)
0061   Fluid Temperature (K)
0062   Pressure (kPa)
0063   Strain (mm/m)
0064   Volumetric Flow (l/s)
0065   Fluid Velocity (m/s)
0066   Force (N)
0067   Length (cm)
0068   Material Temperature (K)
0069   Specific Volume (m3/kg)
0070   Differential Pressure (kPa)
0071   Density (kg/m3)
0072   Heat Flux (kW/m2)
0073   H. T. Coeff. (kW/m2-K)
0074   Surface Temperature (K)
0075   Saturation Temperature (K)
0076   Enthalpy (kJ/kg)
0077
0078   Mass Flux (kg/s-m2)
0079   Mass Flow (kg/s)
0080   Integrated Mass Flow (kg)
0081   Momentum Flux (kg/m-s2)
0082   Fluid Velocity (cm/s)
0083   Elevation (m)
0084   Temperature (K)
0085   Time After Rupture (s)
0086   Time (s)
0087   Pressure (MPa)
0088   Time After Reflood (s)
0089   Angular Velocity (rad/s)
0090   Pump Torque (N-m)
0091   Liquid Level (cm)
```

```
0092   Thermal Conductivity (kW/m-K)
0093   Internal Rod Temperature (K)
0094   Volumetric Flow (ml/s)
0095   Void Fraction
0096   Temperature Difference (F)
0097   Photo Tube Temperature (F)
0098   Average Velocity (ft/sec)
0099   Liquid Phase Velocity (ft/sec)
0100   Vapor Phase Velocity (ft/sec)
0101   Horsepower (kW)
0102   Mass Flow/Vol (lbm/ft3-sec)
0103   Slip Ratio
0104   Flow Quality
0105   Thermodynamic Quality
0106   Steam Quality
0107   Neutron Detectors (Percent PWR)
0108   Valve Position (Percent Open)
0109   Valve Position (Percent Closed)
0110   Guide Tube Temperature (F)
0111   Fuel Rod Temperature (F)
0112   Reactor Power (MW)
0113   Fuel Rod Peak Power (kW/m)
0114   Fuel Rod Ave Power (kW/m)
0115   S-P Neutron Detector Curr (nA)
0116   Neutron Flux (n/cm2-s)
0117   Fuel Off-Center Temperature (K)
0118   Fuel Centerline Temperature (K)
0119   Outlet Temperature (K)
0120   Inlet Temperature (K)
0121   Cladding Elongation (mm)
0122   Cladding Elongation (Percent)
0123   Rod Internal Pressure (MPa)
0124   Peak Flux (n/cm2-s)
0125   Cladding Surface Temperature (K)
0126   Momentum Flux (10x3 lbm/ft-sec2)
0127   Total Density (kg/m3)
0128   Liquid Density (kg/m3)
0129   Vapor Density (kg/m3)
0130   Specific Int Energy (J/kg)
0131   Specific Liq Int Energy (J/kg)
0132   Specific Vap Int Energy (J/kg)
0133   Liquid Void Fraction
0134   Vapor Void Fraction
0135   Volume Liquid Velocity (m/s)
0136   Volume Vapor Velocity (m/s)
0137   Volume Pressure (Pa)
0138   Volume Static Quality
0139   Volume Equilibrium Quality
0140   Volume Heat Source (W)
0141   Volume Liquid Temperature (K)
```

```
0142    Volume Vapor Temperature (K)
0143    Volume Equil Temperature (K)
0144    Volume Sonic Velocity (m/s)
0145    Junction Liq Velocity (m/s)
0146    Junction Vap Velocity (m/s)
0147    Interface Velocity (m/s)
0148    Junction Liq Density (kg/m3)
0149    Junction Vap Density (kg/m3)
0150    Junction L/I Energy (J/kg)
0151    Junction V/I Energy (J/kg)
0152    Power Input (W)
0153    Heat Transfer Rate (W)
0154    Critical Heat Flux (W/m2)
0155    Heat Transfer Coeff (W/m2-K)
0156    Mesh Point Temperature (K)
0157    Mass Flow Rate (kg/s)
0158    Viscosity (lbm/ft-hr)
0159    Viscosity (cp)
0160    Liquid Viscosity (lbm/ft-hr)
0161    Liquid Viscosity (cp)
0162    Vapor Viscosity (lbm/ft-hr)
0163    Vapor Viscosity (cp)
0164    Surface Tension (lbf/ft)
0165    Surface Tension (N/m)
0166    Specific Heat (Btu/lbm-F)
0167    Specific Heat (J/kg-K)
0168    Liquid Specific Heat (Btu/lbm-F)
0169    Liquid Specific Heat (J/kg-K)
0170    Vapor Specific Heat (Btu/lbm-F)
0171    Vapor Specific Heat (J/kg-K)
0172    Heat of Vaporization (Btu/lbm)
0173    Heat of Vaporization (kJ/kg)
0174    Thermal Diffusivity (ft2/sec)
0175    Thermal Diffusivity (m2/s)
0176    Time (hr)
0177    Time After Rupture (hr)
0178    Time To CHF (s)
0179    Crit. Heat Flux (Btu/hr-ft2)
0180    Crit. Heat Flux (kW/m2)
0181    Power (Btu/hr)
0182    Vapor Velocity (ft/sec)
0183    Vapor Velocity (m/s)
0184    Flooding Rate (ft/sec)
0185    Flooding Rate (m/s)
0186    LEIDENFROST Temperature (F)
0187    LEIDENFROST Temperature (K)
0188    T(wall) - T(sat) (F)
0189    T(wall) - T(sat) (K)
0190    Distance (ft)
0191    Distance (m)
```

```
0192   Area (ft2)
0193   Area (m2)
0194   Area (in2)
0195   Area (cm2)
0196   Diameter (ft)
0197   Diameter (m)
0198   Diameter (in)
0199   Diameter (cm)
0200   Radius (ft)
0201   Radius (m)
0202   Radius (in)
0203   Radius (cm)
0204   Volume (ft3)
0205   Volume (m3)
0206   Discharge Coefficient
0207   Flow Regime
0208   Friction Factor
0209   REYNOLDS NUMBER
0210   WEBER NUMBER
0211   LEWIS NUMBER
0212   FROUDE NUMBER
0213   KNUDSEN NUMBER
0214   STABILITY NUMBER
0215   NUSSELT NUMBER
0216   PRANDTL NUMBER
0217   MARTINELLI NUMBER
0218   BOILING NUMBER
0219   MACH NUMBER
0220   GRASHOF NUMBER
0221   RALEIGH NUMBER
0222   STANTON NUMBER
0223   ECKERT NUMBER
0224   EULER NUMBER
0225   STROUDAL NUMBER
0226   Liquid Density (lbm/ft3)
0227   Vapor Density (lbm/ft3)
```

APPENDIX C

A TYP1 perm file may be created in either "EDITOR" or "SENATOR" and it must be saved with the "no-sequence" option. The TYP1 perm file structure is as follows:

```
1
X    Y
X    Y
.    .
.    .
.    .
X    Y
2
X    Y
X    Y
.    .
.    .
.    .
X    Y
n
X    Y
X    Y
.    .
.    .
.    .
X    Y
END
```

The first entry must always be a unique fixed point curve number. As many as 2000 floating point X/Y data pairs may follow each of the curve numbers. The final set of X/Y data pairs must be followed by END.

APPENDIX_D_

A TYP6 perm file may be created in either "EDITOR" or "SENATOR" and it must be saved with the "no-sequence" option. The TYP6 perm file structure is as follows:


```
1
X   Y   Dxl   Dxr   Dyl   Dyu
X   Y   Dxl   Dxr   Dyl   Dyu
......................
......................
......................
X   Y   Dxl   Dxr   Dyl   Dyu
n
X   Y   Dxl   Dxr   Dyl   Dyu
X   Y   Dxl   Dxr   Dyl   Dyu
......................
......................
......................
X   Y   Dxl   Dxr   Dyl   Dyu
END
```


The first entry must always be a unique fixed point curve number. As many as 400 floating point sets of data points may follow each of the curve numbers. The final set of data points must be followed by END.