MM EXTENDED: A SCIENTIFIC EXTENSION TO THE MULTIMATE WORD PROCESSOR

By N. R. Sumner and A. A. Curtis

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ABSTRACT

The preparation of scientific papers and manuscripts often requires the inclusion of Greek letters and scientific symbols. For a word processor to be suited to scientific work it must be able to meet the more rigorous demands made by the inclusion of special characters. The MultiMate/Multimate Advantage word processor for the IBM personal computer has been extended to provide these facilities. This extension may also be adapted to other word processing systems.
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1. INTRODUCTION

Conventional word processing systems are not suited to the preparation of scientific papers and manuscripts. For a word processor to be suitable for the preparation of scientific documents it must facilitate the inclusion of Greek letters and scientific symbols with text. A scientific word processor must also allow mathematical equations to be constructed from the symbols available. Most conventional word processors do not have these facilities, or if they are available, the range of symbols is limited to the character set of the computer used. For a word processor to be suited to the preparation of scientific documents it must be able to provide the full range of facilities required for this type of work.

The CSIRO Division of Water Resources required a word processing system that is suited to the preparation of scientific papers and manuscripts as well as to general correspondence and administrative work. The word processing system required had also to support existing microcomputers (IBM compatible personal computers) and printers (Impact Laser 800, and Epson FX).

Scientific word processing systems designed specifically for the preparation of papers and manuscripts are available for some microcomputers (Barcellos 1984; Knuth 1979). Some of these systems offer the quality and features required by the Division of Water Resources for this type of work. However none of the systems available at the time this work began could support the laser printers used by the Division.

The Division had also recently purchased several copies of the MultiMate/MultiMate Advantage word processor. This was used by word processing operators and scientists who corrected their own papers. MultiMate however is a conventional word processor and does not allow Greek letters and scientific symbols to be entered into a document.

2. SCIENTIFIC WORD PROCESSING REQUIREMENTS

The Division of Water Resources is multi-disciplinary, the Division employing scientists with backgrounds in Chemistry, Mathematics, Statistics, Engineering and many other disciplines. A scientific word processing system must be sufficiently flexible to be able to create the type of documents required by all staff in the Division.

Any suitable word processing system must utilize existing computer equipment. IBM compatible personal computers are used for a variety of tasks including word processing. Epson FX printers are used by scientists to produce draft copies of manuscripts, while Impact Laser 800 printers are used by word processing operators to prepare final copies.
Any proposed scientific word processing system should suit the way word processing is carried out in the Division. Most of the word processing is carried out by skilled word processing operators. Some scientists perform their own corrections avoiding further typing delays. Other scientists prefer to type their own documents. A scientific word processing system should thus be suitable for use by both scientists and word processing operators.

After considering other options it was decided that MultiMate could be extended to provide the facilities required for typing scientific papers and manuscripts. This was considered preferable to replacing existing word processing software with a new system, for the following reasons:

1) Staff re-training would not be required.

2) There would be no cost to the Division, other than that for the initial development.

3) Existing equipment could be used.

3. MM Extended DEVELOPMENT

3.1 Overview

MM Extended is an extension to MultiMate (Multimate International 1986a; Multimate International 1986b) which enables a word processing operator to type scientific documents using MultiMate.

MM Extended consists of a Printer Action Table (PAT) and a Greek Math (Greek letters and mathematical symbols) download software font for the printer being used. The PAT is the MultiMate equivalent of a printer driver. The printer driver contains printer specific commands used by the word processing software for printing documents. The download software font contains bit maps for the Greek letters and mathematical symbols used by MM Extended.

MM Extended allows Greek letters and mathematical symbols to be entered in documents using alternate key sequences. These are typed by holding down the Alt key on a keyboard and typing the number corresponding to the symbol required, using the numeric keypad on the right of the keyboard. One of the symbols from the IBM extended character set (characters 128 – 255) is displayed on the screen. Often this will be the same as the symbol required by the operator. If the symbol is not available in the IBM extended character set then a similar symbol is displayed in its place.

The MM Extended User's Guide in Appendix 1 contains a table of the symbols available and the corresponding Alt numbers. Large built-up symbols such as integral signs or square brackets may also be typed using MM Extended. These symbols must be constructed from several normal sized characters.
MM Extended contains the following features:

1) Greek letters.
2) An extensive range of mathematical symbols.
3) Enables equations to be incorporated with text in documents.
4) Italic, condensed, and enlarged fonts.
5) Commonly used subscripts and superscripts in appropriate sizes.

MM Extended does not interfere with the normal functioning of the MultiMate word processor, and the full features of MultiMate are still available. Non-scientific documents may be entered and printed normally.

3.2 Developing the Printer Action Table

The MM Extended PAT is a file that contains the printer commands required to access characters in the Greek Math download software font. This file is written in a special format known to MultiMate.

A PAT has been developed for Epson FX printers and the Impact Laser 800 series of printer. Each PAT contains commands specific to the particular printer. In addition to the MM Extended commands to access the Greek Math font, the PAT also contains the commands required to perform normal printer operations such as starting a new page and changing the printer's pitch.

When special symbols are printed the PAT must perform the following operations:

1) Change font to the Greek Math font.
2) Send ASCII code corresponding to the character required.
3) Return to the original font.

These operations are performed by a character translation table. This table translates the Alt sequence for a symbol into the commands necessary to print the symbol.

3.3 Creating Download Software Fonts

A download software font is a binary file containing bit patterns describing characters. The font is loaded by sending the binary file to the printer. The printer stores the font in random
access memory until either the area of memory is used for another font or the printer is turned off. If the download fonts are loaded each day before work is commenced, they are available for the day’s printing.

Creating download fonts is a time consuming task. Each character in the font must be described by means of a character bit map. The character bit map for the Impact Laser 800 printer has a glyph height and glyph width of 32 dots. The glyph height and glyph width describe the maximum height and width for a bit map character (measured in 1/300 inch units for most laser printers). This means that 1024 bits must be set to describe each character and 131,072 bits must be set to describe a full 128 character font.

The Greek Math font was created using a font editor. The font editor allows the character bit maps to be developed interactively using a grid representing the dimensions of the character. When a complete font has been designed a binary file containing the font is created. This file may then be sent to the printer to load the font.

The font editor used was developed by TCI Software Research (1987). This font editor could not create download font files with the correct format for the Impact Laser 800 series of printers. A download font for another laser printer, the Hewlett Packard Laserjet Plus, was created instead. A computer program was then written to convert the Hewlett Packard Laserjet font into the correct format for downloading to the Impact Laser 800 printer.

Versions of the Greek Math font were developed for the Impact Laser 800 printer and Epson FX printer. Separate versions were required because of the different size of the character bit maps for each printer and the printer-specific download commands used.

Other useful fonts for the Impact Laser Printer were also created and are shown in Appendix 2. These fonts may be accessed by placing the change font printer command in a document.

4. IMPLEMENTING MM Extended

MM Extended was initially placed on the word processing operator’s personal computers in the CSIRO Division of Water Resources, Western Australia. The operators suggested many improvements such as the inclusion of additional symbols which have been implemented. Subsequently MM Extended has been installed on most personal computers using MultiMate in the Division. New users of MM Extended are responsible for installing MM Extended on their own personal computers.

An installation program, developed by the authors, is used to install MM Extended on a personal computer. This program copies the PAT and Greek Math download software font to the same directory as the MultiMate word processor. The word processor must be installed on the disk before MM Extended is installed.
A start-up computer program was developed to initialize MM Extended before invoking the MultiMate word processor. This program uses another computer program developed by the authors to download the Greek Math font for the printer being used. MM Extended does not interfere with the normal operating of the MultiMate word processor: it is transparent to the operator and is only used when a document requires the inclusion of Greek letters or mathematical symbols.

5. ADAPTING OTHER WORD PROCESSORS AND PRINTERS

MM Extended has been designed so that the techniques used may be easily transferred to other word processors. The techniques developed for MM Extended will work on any word processor that has a character translation table as part of the printer driver. Adapting another word processor requires modifying the character translation table to send special instructions to the printer for printing Greek letters and mathematical symbols. Most commonly used word processors such as Microsoft Word have a character translation table.

MM Extended currently supports two printers. Other printers that allow downloading of software fonts can also be supported. A PAT and Greek Math download software font are required for each printer supported by MM Extended. Other printers may be included by developing a new PAT and download software font.

6. MARKETING MM Extended

MM Extended is currently being marketed by the CSIRO Division of Water Resources. The market for this product is limited to organizations with a need to produce scientific papers and manuscripts, which are using MultiMate and, which have one of the two printers currently supported. The number of organizations meeting this criteria is relatively small.

The market could be significantly increased by adapting MM Extended to other word processors. This would take little effort and would greatly increase the market for MM Extended.

The market can also be broadened by increasing the number of printers supported by MM Extended. It is more difficult to develop support for a new printer than adapt word processors themselves because a download software font has to be created and, as discussed, considerable effort is required to develop printer fonts.

Computer software needs to be properly marketed before many sales can be expected. At the moment all sales have resulted from word of mouth promotion. A much larger market may be reached by advertising.
7. CONCLUSION

MM Extended is being used by the CSIRO Division of Water Resources in Western Australia and other Divisions on the same site. It is also used by a small number of outside organizations.

MM Extended has been extremely useful, allowing word processing operators to type scientific papers and manuscripts using a conventional word processor. There has been no need to replace the existing word processing system used by the Division or to re-train operators.

The concept of MM Extended may be easily adapted to other word processing software. It is also possible to develop support for other printers. These improvements would increase the market for MM Extended.
REFERENCES


APPENDIX 1

MM Extended USER'S GUIDE
MM Extended

A Scientific Word Processing Extension to MultiMate

developed by

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Enquiries: Mr N.R. Sumner
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LICENCE AGREEMENT

CSIRO Division of Water Resources

This document is an agreement between licensees of the MM Extended and the CSIRO Division of Water Resources, the developers of this scientific word processing extension.

The following conditions shall apply to the Licence Agreement:

1) Software Licence
   The Licence Agreement gives the purchaser of MM Extended the right to use the software on a single microcomputer.

2) Ownership
   MM Extended is the property of the CSIRO Division of Water Resources.

3) Copy Restrictions
   Unauthorised copying of MM Extended is forbidden. Licensees are permitted to make one copy of the distribution disk solely for backup purposes.

4) Updates
   Updates of MM Extended may be created from time to time. These updates will be available to licensees upon payment of an update fee.

Disclaimer

While every effort has been made to ensure the correct functioning of this software product, the CSIRO Division of Water Resources accepts no responsibility whatsoever, and shall not be liable for any losses resulting from the use of MM Extended.
MM Extended User’s Guide
July 1, 1988

Introduction

**MM Extended** is a scientific word processing extension to the MultiMate / MultiMate Advantage word processor. **MM Extended** was developed by the CSIRO Division of Water Resources in Perth, Western Australia. **MM Extended** has been developed independently of Multimate International.

**MM Extended** requires the MultiMate / MultiMate Advantage word processor version 3.6 or earlier.

**MM Extended** supports the following printers:

1) EPSON FX
2) IMPACT Laser 800

These printers are supported by downloading a Greek Math font to the printer before printing. Drivers for other printers are being developed.

**MM Extended** also requires an IBM PC/AT compatible microcomputer running MS-DOS version 2.0 or higher.

Installation

The MultiMate / MultiMate Advantage word processor must be installed before installing **MM Extended**. Instructions for installing the basic word processing system should be included in the documentation for that system.

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1 MultiMate and MultiMate Advantage are trademarks of Multimate International.
2 Epson FX printers are developed by Epson America, Inc.
3 Impact Laser Printers are developed by Impact Technology Ltd.
4 Microsoft and MS-DOS are trademarks of Microsoft Corporation.
Installing MM Extended.
The MM Extended software comes on one diskette. MM Extended is installed by an installation program. The installation program requires the name of the drive and directory containing the MultiMate / MultiMate Advantage word processing files. It is possible to install support for only one type of printer. MM Extended is installed by carrying out the following steps:

1) Insert the MM Extended diskette into disk drive A.

2) Set the default disk drive to A by typing A: followed by the enter key.

3) Install MM Extended by typing the following:

```
install printer directory
```

followed by the enter key.

Where 'printer' is the name of the printer connected to your computer and may be either IMPACT or EPSONFX. 'directory' is the MS-DOS path to the directory containing MultiMate. This is usually C:\MM on a computer with a hard disk and always B: for a computer with two floppy diskette drives.

For example to install MM Extended on a computer with a IMPACT Laser 800 printer and MultiMate on a hard disk in the C:\MM directory type:

```
install IMPACT C:\MM
```

To install MM Extended on a computer with a EPSON FX printer and two floppy disk drives type:

```
install EPSONFX B:
```

4) Follow the instructions given by the installation program. The program will indicate when MM Extended has been successfully installed.

The installation program copies the following files to your MultiMate directory:

`MMEXTEND.BAT`
`DOWNLOAD.EXE`
`GRKMATH.PNT`
`MMEXTEND.PAT`

Additional Instructions for Printers Connected to a Serial Port
The above procedure assumes the printer is connected to the computer's parallel port. The parallel port provides faster communication between the computer and printer. If the printer is connected to the serial port the following changes must be made:
1) Copy the MS-DOS 'MODE.COM' file into the MultiMate directory. Replace the 'download.exe' line in the MMEXTEND.BAT file with the MS-DOS 'MODE' command. The parameters on this command must match the serial port parameters set on the printer.

2) Change the destination of the Greek Math download font (GRKMATH.FNT) in the MMEXTEND.BAT file from PRN to COM1.

Setting Up The Printer

EPSON FX printers
If the EPSON FX printer has an IBM mode this mode must be disabled by setting the DIP switches before using MM Extended. The factory setting of the switches disables IBM mode. The printer will not accept the EPSON ESC/P control codes in IBM mode.

The EPSON FX printer will not accept the EPSON ESC/P control codes in NLQ mode. Do not use the EPSON NLQ mode. If NLQ output is required set the 'Draft Print' option on the MultiMate 'Print Parameters For Document' screen to 'N'.

IMPACT Laser 800
The printer must be configured correctly before using MM Extended. The method for setting up the printer is explained in the Impact Laser 800 User's Guide. The settings required for MM Extended are as follows:

1) PAGE FORMAT MENU
   no. of copies : 1
   lines/inch : 6
   char's/inch : 10
   forms length : 66
2) FONT MENU
   primary font : 1
   secondary font : 2
3) SERVICE MENU
   hex dump : off
4) EMULATION MENU
   emulation : Diablo 630 ECS
5) INTERFACE MENU
   interface : Centronics
   data bits : 8 *
6) USER MENU
   auto 1f : off
   auto cr : off
   auto wrap : off
   graphics : off (software release 20.42 onwards)
   lp spacing : off
   compress : off
   lic1 : 7E (hex) *
   lic2 : 0 (hex) (software release 20.37 onwards)
   pjam : no reprint
   language : US ASCII
The settings that differ from the factory options are marked with an asterisk. Particular attention to setting the emulation and lead-in code is warranted. The lead-in code (\texttt{\textbackslash licl}) must be set to the tilde character (\texttt{\textasciitilde}) (\texttt{\textbackslash \textbackslash 7E hex}). These settings should be checked by printing the printer statistics.

Internal font area (IFA) 4 is used to store the Greek Math download font. This area must be available and should not be reserved by library fonts. This must be checked using the Laser 800 Font Menu.

The IMPACT Laser 800 fonts should be set up as follows:

<table>
<thead>
<tr>
<th>IFA</th>
<th>Font Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Courier 10 (Primary font).</td>
</tr>
<tr>
<td>2</td>
<td>not used.</td>
</tr>
<tr>
<td>3</td>
<td>Courier 12 (Enlarged font).</td>
</tr>
<tr>
<td>4</td>
<td>leave empty for Greek Math download font.</td>
</tr>
<tr>
<td>5</td>
<td>Courier 8 (Small font).</td>
</tr>
<tr>
<td>6</td>
<td>Courier 10 Italics.</td>
</tr>
<tr>
<td>7</td>
<td>reserved for Italics.</td>
</tr>
<tr>
<td>8-15</td>
<td>not used.</td>
</tr>
</tbody>
</table>

Alternate fonts such as Prestige 10 or TMS RMN 10 may be used instead of Courier 10 in IFA 1. The corresponding enlarged, small, and italics fonts should also be loaded into IFA's 3, 5, and 6 respectively.

Early IMPACT Laser 800 software releases (such as 20.17) do not accept the download fonts correctly. If your printer does not accept the download fonts check the printer statistics. In particular check that the lead-in code is set correctly. Also ensure that the printer is switched on and that the 'On line' message is displayed on the control panel. If these options are correctly set and the printer will still not accept the download fonts contact Impact Systems Ltd. and ask about your software release.

The download fonts may be displayed after downloading by taking the printer off line and pressing the test button. Once the Laser 800 is working satisfactorily with \texttt{MM Extended} it is a good idea to save the options and library font settings using the Laser 800 Save Menu.

Using \texttt{MM Extended}

To use \texttt{MM Extended} turn your printer on (the printer must be switched on and be 'on line' so \texttt{MM Extended} is able to download the Greek Math font) then type:

\texttt{MMExtend}

\texttt{MM Extended} first downloads the Greek Math font for the printer being used, it then invokes the MultiMate word processor.
Printing Documents with MM Extended

When printing with MM Extend use the 'MMEXTEND' printer action table (only this printer action table is able to access the Greek Math font).

Proportional Spacing and Justification
Do not use Proportional Spacing or Justification with documents containing complex equations. If these options are used with large built-up symbols that extend over two or more lines the top and bottom parts of the symbol may not line up correctly.

Condensed mode will also cause similar problems on EPSON FX printers because this mode changes the character pitch.

Files on The MM Extended Distribution Diskette

The MM Extended diskette contains the following files:

- INSTALL.BAT : MM Extended installation program.
- MMEXTEND.BAT : Batch file to download Greek Math font and start MM Extended.
- DOWNLOAD.EXE : Program to download Greek Math font to printer.
- EPSONFX.FNT : Greek Math download font (EPSON FX version).
- IMPACT.FNT : Greek Math download font (IMPACT version).
- EPSONFX.PAT : Printer action table (EPSON FX version).
- IMPACT.PAT : Printer action table (IMPACT version).
- GRKTABLE.DOC : Table of Greek letters and symbols.
**MM Extended Tutorial**

**MM Extended** is an extension to MultiMate. The full features of the MultiMate word processor are still available. **MM Extended** enables a typist to type technical documents using MultiMate. The tutorial is not an introduction to word processing or a beginner's guide for MultiMate. The tutorial is intended to teach an experienced word processing operator to type technical documents using **MM Extended**. The tutorial assumes the reader is familiar with the MultiMate word processor.

**Getting Started**
Firstly execute **MM Extended** by typing 'MMExtend'. After a slight delay you should see the MultiMate menu. You can now use MultiMate as you normally would. Select Option 2 to create a new document. Call the document 'MMETutor'.

**Typing Greek Letters and Symbols**
Greek letters and symbols can be typed by using the **Alt** key together with the numeric keypad on the right of the keyboard. You will need the table of Greek letters and symbols included with **MM Extended**. Now type the following sentence:

The angle θ is 37°.

The 'θ' can be typed by holding down the **Alt** key and typing the number 233 as shown in the table. The '°' corresponds to the number 248. Unfortunately not all Greek letters and symbols appear on the screen as you might expect although they will be printed correctly. Type the following sentence:

The second derivative of gamma is $\gamma''$.

The delta is **Alt** 30, the 2 superscript **Alt** 253, and gamma **Alt** 157. Note that the appearance of the delta and gamma on the screen is not quite what you may expect. Now save and print this document.

**Printing Documents with MM Extended**
Print the document 'MMETutor' in the same way that you would print a normal document with MultiMate. The only difference is that you must change the Printer Action Table to 'MMEXTEND' on the Document Print Parameters Screen. The document will now be printed complete with Greek letters and symbols.

**Large Built-Up Symbols**
Now edit the 'MMETutor' document. Large built up symbols such as integral signs or square brackets can be printed using **MM Extended**. Type the following equation.

$$ \int f(x)dx = \Gamma(\beta) - \Gamma(\alpha) $$
The above equation takes three lines. The top line contains only the upper section of the integral sign (Alt 244). The next line contains a vertical bar (Alt 221) and the equation. The lower section of the integral sign (Alt 245) is on the bottom line.

Print the document again. Your integral sign may have gaps between the vertical line and the top and bottom of the integral sign as in the example above. The occurrence of these gaps depends on the printer being used. This problem cannot be corrected on EPSON FX printers. This problem may be overcome on the IMPACT Laser 800 printers by placing vertical lines between the symbols to fill the gaps. If you have a IMPACT Laser 800 printer insert the following keystrokes between the vertical bar (|) and the letter 'f' on the second line:

\[ \text{Alt 176, Alt Q, Alt 221, Alt W, Alt 176, Alt W, Alt 221, Alt Q} \]

The Alt 176 is a backspace which makes the printer overstrike the previous character on the same line. Alt Q, and Alt W are the MultiMate superscript and subscript commands respectively. This string of commands simply places two additional vertical bars (Alt 221) in the two gaps. The first bar is in a superscript position while the second vertical bar is in a subscript position.

The equation can now be completed by inserting the upper and lower limits.

\[ \int_{\alpha}^{\beta} f(x) \, dx = I(\beta) - I(\alpha) \]

The upper limit is added by inserting a superscripted beta (Alt 225) after the upper integral on the first line as follows:

\[ \text{Alt Q, Alt 225, Alt W} \]

The lower limit is added by inserting a subscripted alpha (Alt 28) after the lower integral on the third line as follows:

\[ \text{Alt W, Alt 28, Alt Q} \]

Average Bar, Tilde and Vector Dot
These symbols automatically overstrike the previous character. To place an average bar over a character simply follow the character with the average bar symbol (Alt 22).

The symbol for sample mean is \( \bar{x} \).

Differentials and Fractions
Differentials and fractions can be entered into MM Extended by using the MultiMate underline facility. The best method for entering differentials and fractions depends on the type of printer available. Select the method that suits your requirements and your printer. If draft copies are printed on one printer and the final
copy on a different type of printer use the method best suited to the printer that will be used to print the final copy. Type the following equation using the method relevant to your printer.

\[ \frac{dF}{dx} = F'(x) = f(x) \]

1) Dot Matrix Printers

The equation should be typed on two separate lines. The top part of the differential should be typed on the first line and underlined. The bottom part of the differential should be typed on the second line directly under the corresponding part of the equation above. It is not possible to use half line spacings on most dot matrix printers.

2) Laser Printers

On a laser printer the equation should be typed on one line. The top part of the differential is superscripted and underlined while the bottom part is subscripted. The differential part of the equation can be entered by typing the following key sequence:

\[ \text{Alt} Q, \text{Alt} -, dF, \text{Alt} -, \text{Alt} W, \text{Alt} 176, \text{Alt} 176, \text{Alt} W, dx, \text{Alt} Q \]

Note that 'Alt -' is the MultiMate command to enter or exit from automatic underlining mode. The backspace (Alt 176) is used to overstrike with the bottom part of the differential.

**Italics, Condensed, and Enlarged Fonts**

These fonts or styles may be selected by typing the appropriate alternate key sequence as described on the **MM Extended** table of Greek letters and symbols. As an example to print in *italics* type an Alt 1. To end *italics* type Alt 2. These fonts or styles will be ended by the use of another alternate key sequence on IMPACT laser printers.

**When Things Go Wrong**

In a few minor circumstances the printer may not behave as expected. These problems are generally due to limitations in the capability of the printer being used. These circumstances have been documented to make MM Extended users aware of any known problems and to inform users of ways to circumvent these problems if they occur.

1) Enhanced Print Works Inconsistently

When printing documents on IMPACT laser printers set the Draft Print option on the Print Parameters Screen to 'Y'. If this option is not set to 'Y' the whole document will be printed in enhanced print. If enhanced print is also used within the document a conflict will result.
2) **Superscripts and Subscripts are not Correctly Positioned**

The Impact Laser 800 printer does not correctly position superscripts and subscripts if the line spacing is set to a fractional value such as 1½. The positioning of the superscripts and subscripts can be corrected by inserting additional superscript (Alt Q) or subscript (Alt W) commands before the letter to be raised or lowered respectively.

**Epilogue**

If you have completed the short tutorial you are well on the way to becoming a competent **MM Extended** user. The more you use **MM Extended** the more proficient you will become (practice makes perfect). If you are a word processing operator and technical typing is part of your job, you will soon be typing equations far more complex than those shown in the **MM Extended** tutorial.
### MM Extended Users Guide

All Alt numbers must be typed using the numeric keypad (on the right)

Start *italics* with an...Alt 1...end with an Alt 2
Start condensed with an...Alt 5...end with an Alt 6
start Enlarged with an...Alt 11...end with an Alt 12

(backspace = Alt 176)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Alt No.</th>
<th>Symbol</th>
<th>Alt No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>alpha</td>
<td>$\alpha$</td>
<td>Go to aro</td>
<td>170</td>
</tr>
<tr>
<td>beta</td>
<td>$\beta$</td>
<td>Go bk aro</td>
<td>169</td>
</tr>
<tr>
<td>gamma</td>
<td>$\gamma$</td>
<td>GAMMA</td>
<td>$\Gamma$</td>
</tr>
<tr>
<td>delta</td>
<td>$\delta$</td>
<td>DELTA</td>
<td>$\Delta$</td>
</tr>
<tr>
<td>epsilon</td>
<td>$\varepsilon$</td>
<td>EPSILON</td>
<td>$\varepsilon$</td>
</tr>
<tr>
<td>zeta</td>
<td>$\zeta$</td>
<td>DollarAus</td>
<td>$$</td>
</tr>
<tr>
<td>eta</td>
<td>$\eta$</td>
<td>Pound Str</td>
<td>£</td>
</tr>
<tr>
<td>theta</td>
<td>$\Theta$</td>
<td>THETA</td>
<td>$\Theta$</td>
</tr>
<tr>
<td>kappa</td>
<td>$\kappa$</td>
<td>Litre</td>
<td>$\ell$</td>
</tr>
<tr>
<td>lambda</td>
<td>$\lambda$</td>
<td>LAMBDA</td>
<td>$\Lambda$</td>
</tr>
<tr>
<td>mu</td>
<td>$\mu$</td>
<td>1/2 symbol</td>
<td>$\frac{1}{2}$</td>
</tr>
<tr>
<td>nu</td>
<td>$\nu$</td>
<td>1/4 symbol</td>
<td>$\frac{1}{4}$</td>
</tr>
<tr>
<td>xi</td>
<td>$\xi$</td>
<td>XI</td>
<td>$\Xi$</td>
</tr>
<tr>
<td>pi</td>
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^1 Alt number follows the letter to be overstruck (backspace is automatic).
APPENDIX 2

DOWNLOAD SOFTWARE FONTS
IMPACT LASER 800 DOWNLOAD FONTS

developed by

THE CSIRO DIVISION OF WATER RESOURCES
PERTH, WESTERN AUSTRALIA

Pica Fonts

IBM (Pica 10 Point)

IBMUpper (Pica 10 Point)

S1 (Pica 10 Point)

Symbol (Pica 10 Point)

Built Up (Pica 10 Point)

Chemistry (Pica 10 Point)
Elite Fonts cont.

Greek (Elite 10 Point)

S1 (Elite 10 Point)

Symbol (Elite 10 Point)

Built Up (Elite 10 Point)

Chemistry (Elite 10 Point)
APPENDIX 3
PROMOTIONAL MATERIAL
MM Extended

A Scientific Word Processing Extension to MultiMate

CSIRO Division of Water Resources

Print Greek letters and symbols using the MultiMate / Multimate Advantage word processor.

Equations such as:

$$\frac{\partial u}{\partial t} = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \frac{\partial u}{\partial x} + \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \frac{\partial u}{\partial y}$$

$$\int_{0}^{\infty} \frac{\partial}{\partial z} \mu(z) \frac{\partial \alpha}{\partial z} \, dz = E - E_{\alpha}$$

are no longer a problem for typists. Equations can be entered into the MultiMate word processor and printed with the document using MM Extended.

Features which can be incorporated with MultiMate by using MM Extended include:

1) Greek letters.
2) An extensive range of mathematical symbols.
3) \textit{Italic}, \textbf{condensed}, and \textbf{enlarged} fonts.
4) Commonly used \textit{subscripts} and \textit{superscripts}.

MM Extended includes a Greek Math download printer font and a Printer Driver. The Printer Driver allows the Greek Math download font to be accessed using alternate key sequences. MM Extended is currently available for EPSON FX and IMPACT Laser 800 printers. Documents are portable between these printers.

MM Extended requires an IBM PC/AT compatible microcomputer running MS-DOS version 2.0 or higher. The MultiMate / Multimate Advantage word processor (version 3.6 or earlier) is also required.

The system is currently being adapted to other word processors such as Microsoft Word. Drivers for other printers are also being developed.

MM Extended is available for $90.00 per individual copy for use with one printer (2 or more $80.00). MM Extended is supplied on one 360K 5¼ inch floppy disk. Please specify make and model of printer together with version of Multimate / Multimate Advantage when ordering.

Available from: Mr Neil Sumner
CSIRO Division of Water Resources
Private Bag P.O.
Wembley W.A. 6014
Enquiries: (09) 387 0240

1 MultiMate and MultiMate Advantage are trademarks of Multimate International.
2 Epson FX printers are developed by Epson America, Inc.
3 Impact Laser Printers are developed by Impact Technology Ltd.
4 Microsoft and MS-DOS are trademarks of Microsoft Corporation.
DOWNLOAD PRINTER FONTS

For Impact Laser 800 and Epson FX Printers

CSIRO Division of Water Resources

Print Greek letters and symbols on the EPSON FX\textsuperscript{1} and IMPACT Laser 800\textsuperscript{2} range of printers using download fonts.

Equations such as:

\[ W_{n-k} = \frac{\int_{(m-1)h}^{mh} \frac{dx}{a(x)} = \mu_{n-1} - \mu_m}{(m-1)h} \]

\[ B_m = \frac{1}{h} \left[ \int_{mh}^{(m+1)h} \frac{dx}{a(x)} \right]^{-1} \]

can be printed using the download fonts. Equations can be entered into a word processor and printed with the document.

The download fonts can be accessed by most word processing software.

Printer drivers are also available for MultiMate / MultiMate Advantage\textsuperscript{3} to facilitate the use of the download fonts using alternate key sequences.

The download fonts available are as follows:

1) **Download Font Set for IMPACT Laser 800 printers** which contains Greek letters, scientific symbols, and foreign language fonts. Pica and Elite versions of most fonts are included........$60.00 (2 or more $50.00).

2) **Download Greek Math Font for EPSON FX printers** which contains Greek letters and scientific symbols........$60.00 (2 or more $50.00).

Available from: Mr Neil Sumner
CSIRO Division of Water Resources
Private Bag P.O.
Wembley
Western Australia, 6014
Enquiries: (09) 387 0240

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1 Epson FX printers are developed by Epson America, Inc.
2 Impact Laser Printers are developed by Impact Technology Ltd.
3 MultiMate and MultiMate Advantage are trademarks of Multimate International.