EMG for VCM

By Motion Lab Systems, Inc.
Intended Audience

This manual is written for anyone using the EMG4VCM program and is familiar with Windows 98 or Windows NT operating systems and with the VICON Clinical Manager software. Manuals for these products are available from their manufacturers.

The following are registered trademarks:

- AMASS
- EMG4VCM, ReportGenerator
- Paradox
- VCM, VICON Clinical Manager
- Windows 98, Windows NT, ODBC

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Motion Lab Systems, Incorporated
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Oxford Metrics, Limited
Microsoft Corporation
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Introduction

EMG4VCM Features

The EMG4VCM application was written to enable users to read the analog EMG data present in a C3D file and write it into a GCD file for any given gait cycle. This will allow you to plot raw EMG data using the Oxford Metrics Limited VICON Clinical Manager (VCM) program as shown in Figure 1. Without EMG4VCM the VICON Clinical Manager is limited to only displaying EMG data as a filtered envelope as shown in the top two graphs in Figure 1.

The plots demonstrate the standard envelope output generated by VICON Clinical Manager (VCM) in the upper graphs while the raw EMG signal generated by EMG4VCM for the same channel and gait cycle is displayed below. These plots compare two simultaneous recording from a surface electrode (on the left) and a fine wire electrode (right) inserted into the same muscle. The recording were made using a Motion Lab Systems MA-100 EMG system with each channel of analog data sampled at 1600 samples per second. This recording has an effective bandwidth of 20 to 800 Hz. The higher frequency content of the fine wire signal can be clearly seen in the display in the lower right.

![Figure 1 - Typical raw output from EMG4VCM](image)

The EMG4VCM program runs in Database Mode or the Manual Mode depending on your system configuration. The Manual Mode requires almost no interaction with VCM since all that is required is that you provide the gait cycle frame numbers manually. The Database mode automates the entry of the gait information by
reading the VCM database to obtain the information – this requires that the VCM database is accessible via ODBC.

In the Database Mode, the application reads the VCM database of your choice and lets you browse the database for the desired trial that you wish to process. When you pick a trial from the database, EMG4VCM immediately knows which C3D file, GCD file and CFG file which are associated with that trial. This means that you will not have to keep typing in the names of the input and output files as required in the Manual Mode. You will however, have to configure Microsoft 32-bit ODBC through your control panel to locate the VCM database and set it up as a Data Source for access by EMG4VCM. This is described in detail later in the manual.

In the default Manual Mode, you can browse the directory structure of the machine and choose the different input and output files one at a time. This mode does not require a VCM database and can be used without the VCM application.

Some of the commands in EMG4VCM will work only when you are in the Database mode, and some apply only to the Manual mode of operation. Notes in the margins will indicate which commands work (or apply) to the mode of operation (Database or Manual).

EMG4VCM shows the name of the registered user in the About dialog box accessed from the help drop-down menu. This can be opened by choosing the About command (Help menu) or by clicking on the button on the Toolbar. This dialog box will also show you the Version Number of the program and Serial Number for your site or location.

Evaluation mode

EMG4VCM can run in an evaluation mode so that you can try out the product before you purchase a copy. In this mode, you will be able to extract the raw EMG data from only one channel into the GCD file. A registered version of the application allows all the EMG channels to be displayed as raw EMG data in the VCM report.

You can purchase a registration key from Motion Lab Systems, Inc., by contacting us via the address or phone numbers listed at the front of this manual. Entering the registration key will convert the application to a fully functional program without requiring any additional installation or configuration.
Installation

You can use the Windows Add/Remove Programs option in Control Panel to install EMG4VCM from a floppy disk or, if you download a copy from our world wide web site on the Internet (http://www.emgsrus.com) and then just run the installation file. This will install the program on your system together with some example files that you can use to demonstrate and learn to use the program.

During installation EMG4VCM will prompt you to enter a license number - if you have not purchased a license then you can run in evaluation mode by entering 0000-0000-0000-0000 as the serial number so that you can try out the product before you purchase a copy. If you have purchased a copy then enter your license number together with your User Name and Organization details exactly as supplied.

If you accept the default options during installation, then you will have created a short-cut in the Gait Lab menu group called MLS - EMG4VCM together with a desktop short-cut for EMG4VCM and a VCM example short-cut that connects VCM to a sample database supplied with the installation.

Using EMG4VCM

This is a very easy program to use - the following quick instructions assume that you have been using VCM for a while and are familiar with Windows 95 or Windows 98.

Install EMG4VCM by using the Add/Remove Programs function in Control Panel or running SETUP.EXE from the floppy disk. The installation procedure will ask you a number of questions - if you select a "typical installation" then you will be asked for the location of the following items:

<table>
<thead>
<tr>
<th>Application Folder</th>
<th>This is where EMG4VCM will be installed. Normally this will be c:\program files\mls\emg4vcm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Data</td>
<td>EMG4VCM will install sample data for you to learn to use the program and see the output results. The default is c:\emg4vcm.</td>
</tr>
<tr>
<td>VCM program directory</td>
<td>This is the directory where your existing VCM.EXE program is located. Normally this is c:\vicon or c:\vicon\vcm.</td>
</tr>
<tr>
<td>Default C3D file directory</td>
<td>This is the directory where VCM usually finds its data files. The default is c:\ud.</td>
</tr>
</tbody>
</table>

When the installation finishes you will see two new icons on your desktop - these should look like the top pair on the right side.

The icons may not necessarily be placed next to one another on your desktop but they should look like the pair shown on the right. This indicates that EMG4VCM is installed correctly and that the VICON Clinical Manager program is in its expected location.

If you do not see the VCM icon but instead see a small "DOS-box" icon (as shown to the right) then you have not entered the correct VCM program directory. Repeat the installation and enter the correct VCM program directory so that you will be able to run the VCM demonstration provided with EMG4VCM.

Once the programs are installed correctly you should be able to run the "EMG 4 VCM example" shortcut. VCM will start and display a small database - you can then
view the EMG4VCM generated raw EMG data in the normal VCM report. This is using the sample data and database that is provided with EMG4VCM and does not affect your existing data or database.

Starting the "EMG for VCM" shortcut will start the EMG4VCM application in the manual mode and allow you to step through the file selection and EMG data extraction process as documented later in this manual.

In normal use you would collect kinematic, kinetic and EMG data using your normal Motion Capture system and then process the data in the normal way with VICON Clinical Manager. When you have selected the gait cycle that you wish to use to generate a Gait Report you should select **PROCESS** in the normal way and generate a standard VCM report. When the report has been produced you would switch to EMG4VCM and either select the trial using the integrated database access in EMG4VCM or select the C3D, GCD and CFG files manually using the browse boxes provided. Then right-click on EMG4VCM, ensure that the Append "Raw" to Labels option is not checked and select "Extract".

This will then replace the existing envelope EMG data in the processed GCD file with raw data for the same gait cycle. You can check the Append "Raw" to labels to append the raw EMG data instead of overwriting the existing data if you want to be able to compare both the VCM and the EMG4VCM report formats. However, you will have to edit your VCM report format file(s) - RPT files - to add graphs for these new label names. This is the mode that was used to generate most of the illustrations in this manual.

**To produce a sample report:**

1. Use the browse button to the left of the C3D file selection box to open EMG01.C3D as the file containing the raw data.
2. Use the browse button to open the GCD file associated with the EMG01 data file that you have just picked - the correct GCD file is EMG01.GCD.
3. Use the browse button to open the CFG file that contains EMG channel information for these sample files - there are two CFG files supplied, the correct file for the EMG0x files is the EMG4VCM.CFG file.
4. Right-click anywhere on the EMG4VCM window and select "Extract" - this will read the CFG file to determine the correct EMG channels and open the C3D and GCD files. An extract dialog box will be displayed - enter the correct file numbers for the left and right gait cycles. If you were using the database mode then these would already be filled in - in manual mode you must enter the numbers that were used in the VCM analysis - these are 20 - 68 for the left side and 44 - 91 for the right side. Select OK and the raw EMG data will be written into the GCD report and can be viewed the next time that the report is opened in VCM.

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*EMG4VCM can insert the raw EMG into the GCD file in one of two ways – it will either overwrite the existing EMG labels (replacing the old envelope data) or create new labels.*
Commonly Used Terms

Terms and concepts

This chapter discusses some of the terms used in the documentation and also the different input and output files that are used by EMG4VCM.

Controls

These are the User Interface items that are found in Windows. These controls work much the same way in most applications. The most commonly used controls are Edit boxes, List boxes, Radio buttons, Check boxes, File Open dialog box etc.

Data Sources

A "data source" is simply a term that is used to refer to the general method that a program (in this case EMG4VCM) uses to obtain access to data. In this case the Data Source is the Paradox database that is used by VCM.

The purpose of a data source is to gather all of the technical information needed to access the data-the driver name, network address, network software, and so on-into a single place and hide it from you, the user. You should be able to look at a list that includes Patient Name, Patient ID, and Trial Number, choose Patient ID from the list, and have the EMG4VCM connect to the list of Patient ID records, all without knowing where the data resides.

Types of Data Sources

When you set up the Microsoft 32-bit Open Database Connectivity (ODBC) service you will be shown two types of data sources: machine data sources and file data sources. Although both contain similar information about the source of the data, they differ in the way this information is stored.

Open Database Connectivity (ODBC)

ODBC is a service that lets any Windows application access any database using a single SQL (Structured Query Language) like language. Database manufacturers create ODBC drivers that let ODBC access the database. Under this system any program that knows how to talk to ODBC can talk to the database provided that the system contains the appropriate ODBC driver for that database. The EMG4VCM database mode uses ODBC to access the VCM database.
VICON Clinical Manager (VCM)

The VICON Clinical Manager (known as VCM) is a program that has been sold by Oxford Metrics Ltd. since 1992 for the primary purpose of producing clinical analysis reports. It allows the user to analyze gait data with standard marker placement. It was written for Windows 3.0 and has a Paradox database that holds the biomechanical variables and information about the subject.

VCM processes EMG data by displaying only the smoothed envelope of activity in it graphs - this is due to a decision in the original program design to normalize all kinematic and kinetic gait data to 51 samples per gait cycle. This limitation is also applied to the EMG data display. However, the VCM report display does not suffer from this limitation and EMG4VCM takes advantage of this to read the raw analog data from the original file and insert the correct frames into the GCD file displayed by VCM.

File Types

EMG4VCM uses and accesses three of the four files types used by VICON Clinical Manager. The remaining file type (RPT files) are not accessed by EMG4VCM but may require modification to display the additional information added to the processed output.

C3D Files

The C3D file format is a standard file format used within the Biomechanics community to store 3D co-ordinates and analog information. It is an extremely flexible but complex binary format that can store not only the raw data but also varied information about the data (parameters) that may be required to interpret or process the data.

GCD Files

The GCD file format (Gait Cycle Data) is a part of a suite of file specifications developed by the CAMARC (Computer Aided Movement Analysis in a Rehabilitation Context) project. The GCD files used by VICON Clinical Manager contain the results of the kinematic and kinetic processing of the raw data according to the Clinical Model used by VCM. Further details on the Clinical Model are provided in the VCM documentation.

EMG4VCM can be configured to either overwrite existing EMG data within an exiting GCD file or can add additional EMG data to any existing GCD file.

CFG Files

The VICON Clinical Manager model processing is controlled by a CFG (configuration) file that provides information to VCM about the marker names and analog channel contents. EMG4VCM read the EMG channel assignments from this file.

RPT Files

EMG4VCM does not use or access the RPT file which defines the format of the Clinical Report. EMG4VCM can write EMG data to the GCD file with new names or it can use the same names as existing data. Using the same names as existing EMG data causes the results of the original EMG processing to be lost. However GCD files modified in this manner will generally display in any existing RPT file without any problems.
EMG4VCM Modes

EMG4VCM can run in one of the two modes, Database Mode and Manual Mode. The program acts differently and has a different appearance in each of the two modes. The two sections below describe the way EMG4VCM looks in the two modes. In general Manual Mode is used to set up the program and perform initial testing – you can look at it as a "diagnostic" mode that will almost always work regardless of the system configuration.

Once you can comfortable with EMG4VCM you will almost certainly want to configure the program to use the powerful Database Mode.

Manual Mode View

In the Manual mode, you have to choose the C3D, GCD and CFG files by browsing through the directory structure using the Standard Windows File Open dialog box. You will need to enter a filename into each of these boxes before the EMG4VCM program can generate the desired raw EMG output. The view in this mode enables you to select all the files that you need as shown in Figure 3.

![Figure 3 The View in Manual Mode](image-url)
**C3D File**

This is the name and location of the C3D File that contains the analog EMG information. If no file has been selected the program will not work because you have not told it which file contains the raw EMG data.

**GCD File**

This is the name and location of the GCD File that contains the results of the Clinical Kinematic calculations. If no file has been selected the program will not know where to write the raw EMG output so that VCM can display it when it produces a report. You must select the GCD file that has been created from the same C3D file that you are using as a source for the raw EMG data unless you are creating a new GCD file that will only contain EMG information.

**CFG File**

This is name and location of the CFG File that was used by VCM to generate the GCD file. If no file has been selected the program will not know which channels in the C3D file contain EMG data. Clicking on the file icon next to the filename boxes allows the user to choose a file from a file selection box. All three files need to be selected before the data from the C3D file can be extracted and written to the GCD file.

**Database Mode View**

In the Database mode, EMG4VCM presents you with a view of the contents of the VCM database. For this to work you must have previously selected this database as a Data Source and this is normally the default VCM database that you will see when using the VICON Clinical Manager. In this mode EMG4VCM eliminates the need to manually enter the filenames that contain the data. EMG4VCM is able to read the information directly from the VCM database.

The Database is displayed in a tree form and the hierarchy is as shown below. Each level shown has information separated by colons. You can sort and display the Subject level by Subject Name, Subject Number or Physician Name.
Subject
This level contains the Subject Name, Subject Number and Physician Name and the order in which these items are displayed depends on the sorting order as shown.

SORTED BY ITEM ORDER
Subject Name    Subject Name : Subject Number : Physician Name
Subject Number  Subject Number : Subject Name : Physician Name
Physician Name  Physician Name : Subject Name : Subject Number

Session
This level contains the Session Number and the Session Date.

Trial
This level contains the Trial Number and the Trial Type. The Trial Type tells you the kind of data that was collected in the trial. The types of trials can be Static Trial, Dynamic Gait Data, and Dynamic Gait Data with EMG. The last one is of most interest because it tells you that the trial contains EMG data that you want to extract into a GCD file. It is possible to display only those trials with EMG data or to display only those subjects who have a trial with EMG data in it.

Report
This level contains the Report Number and the Report File Name (which is the RPT file that VCM uses to control the formatting of the displayed data in a Report).
EMG4VCM in Database Mode.

The following items are present in the view:

**Database Tree**

This is a view of the VCM database in a tree format similar to that used in VCM and is used to navigate through the database to select the EMG trial that you wish to process. When you select an appropriate EMG trial the file names associated with the trial will be displayed below the tree.

**Files**

This is a display panel that shows you the C3D File, GCD File and CFG File associated with the selected trial. These are the files that will be used in the Extract operation. If the item selected in the Tree is not a Trial, then this panel will be empty and you will not be able to Extract raw data to the GCD file.

![Database Tree](image)

![Files](image)

*Figure 4 - View in Database Mode*
Extracting EMG Data

Moving data from C3D to GCD

The EMG4VCM application can be used in the Manual mode or the Database mode. The method of data extraction is a little different in the two modes, as explained in the sections below.

The command that is used for the data extraction is the Extract command (Tools menu) which is also accessible by the right mouse button. EMG4VCM can be used while the VICON Clinical Manager is running and will not interfere with the other program. To view the results of EMG4VCM you will just need to open a VCM report - if you have the report open while EMG4VCM runs then you must close and reopen the report as VCM does not update the screen to automatically show any changes in the GCD file.

Extraction in Manual Mode

Each operation must be performed by the user in manual mode.

The data extraction in the Manual mode is carried out on the data files that have been manually selected by you. Thus it is necessary that the C3D, GCD and CFG filenames have been chosen before this command is used.

If the files have been chosen, the Extract command will be available and will extract the raw EMG data to the desired GCD file. It is most important that you enter the correct file names when using Manual Mode as the program has no way of confirming that you are extracting the correct EMG data and inserting it into the same file that you are viewing in VCM.

You will need to enter the frame numbers of the gait cycles that you want to analyze when you issue the Extract command.

NOTE: You can extract the data to a new GCD file by the entering the name of a GCD file that does not exist and EMG4VCM will create this file for you.

Extraction in Database Mode

Database mode works graphically using the Windows GUI interface.

The extraction in the Database mode is carried out using the files associated with the selected database record. Thus it is unnecessary to manually select the C3D, GCD and CFG files.

The Extract command will extract the raw EMG data to the desired GCD file after displaying some information to you so that you can confirm that you are processing
the correct trial and gait cycle. If a trial has multiple cycles defined then you may need to manually select a different cycle than that displayed.

**Extraction Dialog box**

This is a dialog box that displays the selected files, the EMG channel assignments and the frames of raw EMG data to be extracted. The dialog box is shown in Figure 5 and appears whenever you click on the Extract short-cut button. Its function is to display the EMG data extraction parameters. If you are in Manual Mode, the short cut button will allow you to enter the frame range for the gait cycle that you wish to process.

![Extraction Dialog box](image)

The Extraction box displays the following information,

**Files Selected**

This displays the names and locations of the CFG (configuration) file, the C3D data file and the GCD output file. In the Manual mode these files would have been chosen by you, while in the Database mode, these files are automatically associated with the Trial chosen from the VCM Database Tree as displayed by EMG4VCM.

**Configuration File**

This is a window with a scroll bar so that you can check the EMG assignments made within the file. The window contains only the EMG channel assignments found in the "Left EMG" and "Right EMG" sections. This must be the same configuration file (CFG file) used by VCM to process the original data. Its format is described in the VCM manual. It is reported as,

\[
\text{Label} = \text{Channel Number}
\]

where,

- Label is the name that will be written into the GCD file with a "Left" or "Right" prefix depending on the side under investigation.
- Channel Number is the Analog channel number in the original C3D file from which the raw EMG data will be taken.
C3D File

This displays some of the relevant parameters from the C3D file namely,
- Analog channels: The number of Analog channels in the C3D file.
- Sampling Frequency: The rate at which the 3D data has been sampled in Hertz.
- A/V Ratio: The number of Analog samples, per sample of 3D Data.
- First Frame: The First frame of data present in the file.
- Last Frame: The Last Frame of data present in the file.

Frames

This box has four components. These are the frame numbers in the C3D file from which the raw EMG data will be taken and written to the GCD file.

When using the EMG4VCM program in Database Mode you will find that these frame numbers are filled in automatically with the first full gait cycle recorded in the VCM database. If there are several cycles defined then you may wish to check that you are processing the correct cycle and enter new start and end frame numbers by hand if necessary.

In Manual mode you will have to enter these numbers to define the gait cycles before you can extract the raw EMG data.
- Left Start: Start Frame on the Left Side.
- Right Start: Start Frame on the Right Side.
- Left End: End Frame on the Left Side.
- Right End: End Frame on the Right Side.

If you do not want the raw EMG data from a side to be extracted, enter zeros in the Start and End Frame for that side.

Errors and Warnings

This box lists any errors or warnings that might occur during the raw EMG extraction so that you have a chance to correct them.

A Warning will not stop you from extracting the EMG data while an Error will not allow you to extract the data and must be corrected before any further progress can be made.

Warnings Reported

- User in Manual mode - Tells you that EMG4VCM is in manual mode.
- The CFG file contains channel number(s) higher than those in C3D file. This tells you that one or more of the assignments in the CFG file are incorrect and have channels numbers larger than the highest Analog channel in the C3D file. Only assignments with the correct channel numbers will be extracted.
- No assignments made for EMG data - Tells you that no assignments were found in the CFG file. This generally indicates that you have not chosen the correct CFG file.
Errors Reported

- Left Start Frame is not in C3D file Frame Range - This tells you that the Left Start Frame is not within the collected frames of data. Check that data exists for the selected frames and correct the entry.
- Left End Frame is not in C3D file Frame Range - This tells you that the Left End Frame is not within the collected frames of data. Check that data exists for the selected frames and correct the entry.
- Right Start Frame is not in C3D file Frame Range - This tells you that the Right Start Frame is not within the collected frames of data. Check that data exists for the selected frames and correct the entry.
- Right End Frame is not in C3D file Frame Range - This tells you that the Right End Frame is not within the collected frames of data. Check that data exists for the selected frames and correct the entry.

What EMG4VCM does to the GCD file

The Extract operation will cause the raw EMG data from the C3D file to be written to the GCD file in a format that VCM is able to display. Unlike normal VCM data this raw EMG data will contain as many samples as you originally recorded when you collected the data. This overcomes the 51 samples per graph limitation in the standard VICON Clinical Manager displays. As a result the size of the GCD file may increase dramatically after EMG4VCM has been used.

NOTE: If the GCD file that you have specified does not exist, the Application will create the file for you.

The number of raw EMG channels added to the GCD file will depend on the number of EMG channel assignments that you have made in the CFG file. Each channel will have entries equal to

\[ \text{Number of frames} \times \text{Analog to Video Ratio} \]

Where,

- Number of frames, is the difference between the End Frame and Start Frame.
- Analog to Video Ratio is the number of Analog frames collected per frame of Video data.

Note that the evaluation (unregistered) version of EMG4VCM will only extract a single raw EMG channel so that you can evaluate the program before deciding to purchase it.

A Limitation in VCM

VICON Clinical Manager was originally written for Windows 3.0 and is a 16-bit application. As a result it can have problems opening very large files and may crash. VCM can handle normal gait cycles (1-2 seconds) generated by EMG4VCM but may experience problems if the gait cycles are very long and/or contain large amounts of data. VCM will crash with gait cycles of 5 seconds when data has been recorded at 800 samples per second – this is an internal problem within VCM and can not be fixed by EMG4VCM. If you experience problems you may wish to consider purchasing our ReportGenerator program that is compatible with the VCM graphic output but does not have any of the limitations of the VCM graphics display routines.
How to Use EMG4VCM

The Commands

This chapter goes through some features of EMG4VCM and discusses the menu commands.

Exporting the Database

The Export command (File menu) allows you to export the VCM database that you are using to a text file. The items will be sorted in the same manner as is seen in the database tree. You can choose the levels that are to be exported to the file.

When this command is chosen the dialog box shown in Figure 6 is displayed.

Figure 6 - The Levels to Export dialog box

This offers the user the chance to select the amount of data that will be exported to the text file. You can chose one of four levels to write to a text file. The four choices are:

- One exports only the Subject entries.
- Two exports the Subject and Session entries.
- Three exports the Subject, Session, and Trial entries.
- Four exports the Subject, Session, Trial, and Report entries.
The Annotation field allows you to type a note or description for the database. This will be written to the second line of the text file.

**Exiting EMG4VCM**

Exit EMG4VCM using the Exit command (File menu). You can also use the Close command on the Control menu or the ALT+F4 shortcut.

**Finding Items in the Database Tree**

The Find command (Edit menu) allows you to look for one of the two following things in the Database Tree,

- A Subject whose ID number you already know. To do this, select the Subject Number button in the dialog shown in Figure 7 and enter the ID in the box. On clicking the OK button, if the Subject with the ID is present in the database, then EMG4VCM will highlight the Subject.

- The last trial that was processed in VCM. This trial is recorded in the vcm.ini file. However this is only updated when you exit VCM. Thus the trial that will be found will be the last one that you were processing before you exited VCM.

*Figure 7 - The Find Dialog box*

It is possible to display only those sections that have EMG trials in them. If this has been done and the Subject or Trial is not on the tree, the above command may not get you the desired results.

**Switching the Application Mode**

EMG4VCM can function in one of the two modes,

- Manual Mode. (Default)
- Database Mode.

Use the Database Mode command (Edit menu) to toggle between the two modes. If the EMG4VCM program is in the Database Mode, a check mark appears next to this menu item. If you are in Manual Mode then no check will be shown. While switching from the Manual Mode to the Database Mode, the program will prompt you to choose a Data Source or to create a Data Source if no existing Data Source has been set up. If the Data Source does not exist, or has never been set up then you will see a warning message. Select YES to choose or create a new Data Source or NO to return to Manual Mode.
Figure 8 - A warning is generated if the ODBC data source can not be found.

Once a Data Source has been created for EMG4VCM then it will be the default Data Source until you select a different one. It is possible to configure several different VCM databases - each with their own unique Data Source name - so that you can quickly switch between different VCM databases. For help in setting up a Data Source using ODBC refer to page 21.

**Choosing the Label for the Output file**

The Append Raw to Label command (Edit menu) causes the string "Raw" to be appended to the labels that will be written to the GCD file. If this option is set a check mark appears next to this item.

The EMG4VCM program reads the EMG labels from the CFG file and their corresponding channels. The format of the label written to the GCD file is,

!Left/Right Label[Raw]

The Raw part will be written only if this option has been chosen - if you do not append "Raw" to the output labels then EMG4VCM will **overwrite** any existing EMG envelope data in the GCD file. If you wish to preserve the VCM envelope output for analysis or comparison then you must append "Raw" to the EMG channel labels.

If you append "Raw" to the labels then you must modify your VCM RPT file to use the new labels. Sample RPT files are included with EMG4VCM.
Viewing the Toolbar

The Toolbar command (View menu) can be used to display and hide the Toolbar, which includes buttons for some of the most common commands in EMG4VCM. A check mark appears next to the menu item when the Toolbar is displayed.

- Find a subject or go to last VCM Trial.
- Toggles the mode of the Application.
- Sort the database display by Subject Name.
- Sort the database display by Subject Number.
- Sort the database display by Subject Number.
- View only those subjects with EMG data.
- View only those trials with EMG data.
- Expand the selected item in the database tree.
- Extract the EMG data.
- Show the About box of EMG4VCM.
- Context sensitive help.

The toolbar is displayed across the top of the application window, below the menu bar. The toolbar provides quick mouse access to many tools used in EMG4VCM.

Sorting Data Items in the Tree

You must be in Database mode to sort the database.

The first level of the Database Tree contains subject information and can be sorted by EMG4VCM. There are three components to this, namely,

- Subject Name
- Subject Number
- Physician Name

You can sort the tree in one of three ways as described earlier.
Selectively Viewing Tree Items

In VCM, during processing, it is possible to mark a trial as one of the following:

- Static Trial
- Dynamic Gait Data
- Dynamic Gait Data with EMG

You can choose to have EMG4VCM show you only those trials that have been marked as Dynamic Gait Data with EMG. This will make the database tree less cluttered, as it will not include any trials which do not have EMG data in it. There are two commands that will allow you to do this,

Show Only EMG Trials

Using this command in the view menu will ensure that only those trials marked as Dynamic Gait Data with EMG will be shown on the tree. However, even if a session or a subject does not contain a trial, it will still be shown on the tree.

Show Only Subjects with EMG

Using this command in the View menu will ensure that only those trials marked as Dynamic Gait Data with EMG will be shown on the tree. The difference of this command from the one above is that if a Session or Subject does not contain a trial with EMG data, it will not be shown on the tree.

Expanding a Node

It is possible to expand or contract any selected node of the database tree by using the Expand command (View menu).

Tools Menu

EMG4VCM includes a Tools Menu that offers the user option to change the ODBC Data Source, Clean the GCD File and Extract the data from the C3D file to the GCD file.

The "Clean the GCD file" option is included to help with GCD file corruption problems that occur with some versions of VICON Clinical Manager. Under some circumstances VCM will corrupt the GCD file structure and can generate spurious data entries.

You can use the "Clean the GCD File" option to display the individual GCD data labels and delete any unwanted data sections from the GCD file. This can be useful when VCM has problems displaying processed data.

Pop-up Menu

EMG4VCM provides you with a pop-up menu with the commonly used menu commands. You can access this by right clicking anywhere in the Application window.
The appearance of the Pop-up menu will be different in the two modes of the program and will contain the commands relevant to that mode.

**Getting Help**

You can get help in the following ways,

- By pressing the F1 key, the application will take you to the appropriate topic.
- By pressing SHIFT+F1 or clicking on the button on the Toolbar, you will get help for that item.
- All dialog boxes have a Help button, which will give you help about the dialog box.
Data Sources

Choosing and creating data sources

*EMG4VCM requires a Data Source to operate in Database mode.*

This chapter deals with choosing a Data Source and creating new Data Sources to enable you to directly access the information contained in the VCM database. This is only possible if EMG4VCM is in the Database mode or you are exiting from Manual Mode to Database Mode.

Setting up the Database Mode can be a little tricky if you are not familiar with the Microsoft Open DataBase Connectivity (ODBC) feature. However, a little effort to get this working will pay off as you will then be able to browse through the VCM database and extract raw EMG to the VCM GCD files without having to know what any of the files are called. Instead you simply process data that is associated with a particular subject trial and then view the results in VCM.

These instructions assume that you are using the current 32-bit ODBC application available directly from Microsoft and running on the Windows 98 operating system - if your ODBC displays do not look like the ones shown in Figure 10 on page 22, then you may need to obtain an update from Microsoft or upgrade your operating system.

There are several different releases of the ODBC environment – while they all function in the same manner you may find that your displays do not match the illustrations in this manual exactly. You can create all the ODBC Data Sources that you need through the EMG4VCM interface or you can access ODBC directly from the Windows 98 control panel.

The EMG4VCM command used to tell the program which database to use is the Data Source command (Tools menu). In addition, all the operations described in this chapter are accessible through the 32-bit ODBC option in the Windows Control Panel.

**Selecting an Existing Data Source**

1. The Data Source command should be chosen from the Tools menu. However, note that a data source will have to be created before it can be selected so if this is your first time switching from Manual Mode to Database Mode then you will need to create the sources before you can select them. You may create as many Data Sources as you have VCM databases and then switch between them instantly by using this command.
2. The Select Data Source dialog box opens. This box has two tabs. Choose the Machine Data Source tab. This tab has a multiple column list box which lists the following,
   - Names of the Data Source.
   - Type of data source, which can be User or System.
   - Description of Data Source.

![Select Data Source Dialog Box](image)

Figure 10 - Selecting the Data Source

3. Choose the Data Source in the list box by clicking on it and then click the OK button. EMG4VCM will now use this Data Source and display the contents of the selected database.

Creating a new Data Source

1. The Data Source command should be chosen from the Tools menu.

2. If there is no existing data source or the data source is incorrect then you may receive an error message - if so select YES to select a new data source. The Select Data Source dialog box opens. This box has two tabs. Choose the Machine Data Source tab. This tab has a multiple column list box as shown below and which lists the following,
   - Names of the Data Source.
   - Type of data source, which can be User or System.
   - Description of Data Source.

3. Click on the New button to create a new Data Source.

4. This opens a dialog box that contains two radio buttons User Data Source and System Data Source.
• Choosing User Data Source will mean that the Data Source created will be available only to the user who creates it.

• Choosing System Data Source means that the Data Source will be available to all users on the machine.

![Figure 11 - Selecting a Data Source Type](image)

5. After choosing one of the above in Step 4 click on the Next button. Choose System Data Source unless you have a good reason for selecting User Data Source.

6. This opens the Create New Data Source page shown below which will give you a list of drivers present. Choose the Microsoft Paradox Driver (*.db) as the VCM database is a Paradox Database. Click on the Next button.

![Figure 12 - Selecting the Paradox Driver](image)

7. This opens the ODBC Paradox Setup dialog box in which you need to enter some information in the following fields,

• Enter the Name you want the Data Source to have in the Data Source Name box. This is usually something short (8 characters) that you will use to reference this ODBC link.
Enter the Description for the Data Source in the Description box. This step is optional but useful if you are using several different VCM databases as you can enter a long description.

Uncheck the Use Current Directory box otherwise this will usually point to the wrong directory - you need to specify the directory that stores the VCM database.

Click on the Select Directory button. This opens a Select Directory dialog box, which you can use to browse the directory structure of the machine. Choose the directory in which the VCM database files reside, and click OK.

8. Once you are back at the ODBC Paradox Setup you can use the "Options" button (lower left corner) to configure the rest of the ODBC link.
9. Click OK in the ODBC Paradox Setup dialog box. This takes you back to the Select Data Source dialog box in Step 2 where you will see that the newly created Data Source is listed. Choose the Data Source that you have just created and click OK. EMG4VCM will now open the VCM database and display the database contents.

10. If you do not see the correct database entries you may have entered some information incorrectly and will need to either delete the entry or modify it using the 32-bit ODBC option in the Windows 98 control panel.
How to configure EMG4VCM to your site.

EMG4VCM needs to know the default locations of your input and output files. When the program is installed on your system you are asked some questions and the installation program attempts to set these locations correctly, based on your answers. These locations can be changed using the Settings command (View menu).

This command has two tab pages,

- File Locations page, where EMG4VCM looks for data files.
- VCM Information page, where you enter some information about VCM.

File Locations Page

This page is used to set the default locations of the C3D, GCD and CFG file. This page contains the following fields:

- **C3D File**: This is the default location of the C3D files that contain the raw EMG data.
- **GCD File**: This is the default location of the GCD files that contain the data that VCM displays.
- **CFG File**: This is the default location of the CFG files used by VCM to specify the EMG channels used.

These settings are relevant only if EMG4VCM is in the Manual mode. EMG4VCM reads these values at start up and any changes made manually to these values will be applied only when you restart EMG4VCM the next time. EMG4VCM will use these locations by default to open files.

However, if you select a file from a different location than the default, then EMG4VCM will remember the new file location and will start off looking in the new location the next time you open a file. You will have changed the default location and the next time EMG4VCM starts up it will look in the new location for its files.

You can change the locations directly or clicking the button. This opens the Select Directory dialog, which allows you to browse through the directory structure and choose a new directory.
VCM Information Page

This page is used to set the default locations of the C3D, GCD and CFG file as entered in the VCM Preferences. This page contains the following fields,

C3D File   This is an edit box showing the default location of the C3D files.
GCD File   This is an edit box showing the default location of the GCD files.
CFG File   This is an edit box showing the default location of the CFG files.
VCM INI File This is an edit box showing the name and location of the VCM initialization file. This file is needed if you want to find the last trial processed by VCM.

These settings are relevant only if EMG4VCM is in the Database mode. These locations are necessary because VCM sometimes stores the names of the C3D, GCD and CFG files as relative paths and the locations you enter above are needed to prefix to the paths obtained from VCM.

You can change the locations by typing in the edit box or clicking the button by the side of the edit box. This opens the Select Directory dialog box that allows you to browse through the directory structure and choose a directory.

The name of the Initialization file can be changed by typing the full path of the file in the edit box or by clicking the button. This opens the Standard File Open dialog box and you can then choose the VCM Initialization File.
Input and Output Files

A look at the input and output files.

There are three different files used by EMG4VCM and the VICON Clinical Manager. The C3D and CFG files are used as input files and the GCD file is used as the output file.

Configuration Files (CFG)

The configuration file is a text file required by VCM and contains sections and assignments that store information about the trial data. The sections that this application searches for are Left EMG and Right EMG for the Left and Right channel assignments respectively. A sample of these section are shown below,

```
[Left EMG]
LGlutMax=               { Gluteus maximus }
LGlutmed=               { Gluteus medius }
LAddLong=               { Adductor longus }
LIliopso=               { Iliopsoas }
LRectFem=1              { Rectus Femoris }
LMedHams=2              { Medial hamstrings }
LLatHams=               { Lateral Hamstrings }
LVastLat=               { Vastus Lateralis }
LVastMed=               { Vastus Medialis }
LGasTroc=3              { Gastrocnemius }
LSoleus=                { Soleus }
LTibAnte=4              { Tibialis anterior }

[Right EMG]
RGlutMax=               { Gluteus maximus }
RGlutmed=               { Gluteus medius }
RAddLong=               { Adductor longus }
RIliopso=               { Iliopsoas }
RRectFem=6              { Rectus Femoris }
RMedHams=7              { Medial hamstrings }
RLatHams=               { Lateral Hamstrings }
RVastLat=               { Vastus Lateralis }
RVastMed=               { Vastus Medialis }
RGasTroc=8              { Gastrocnemius }
RSoleus=                { Soleus }
RTibAnte=9              { Tibialis anterior }
```
These sections indicate the channel numbers of the Analog channels carrying EMG data. The analog channel numbers go on the right-hand side of the assignment. It also assigns names to the EMG channels stored in the GCD file. The Left or Right prefix is added to each EMG name before it is written into the GCD file. Sample CFG files are included with the installation of the demonstration data.

**Data Files (C3D)**

The C3D file contains analog and/or 3D Data and parameters related to the data collection session. The format for the data in this file is described in the AMASS Users Manual - VCM and EMG4VCM expect the data to be DEC formatted Integer data.

The C3D file must contain the analog EMG data and the channels specified in the CFG configuration file must be present in the data file.

**Processed Data Files (GCD)**

The GCD (Gait Cycle Data) file is an ASCII text file based on the European Union CAMARC DST file format. It contains lines comprising either a header or data field delimited by any number of Carriage Returns, Line Feed, or Form Feed characters. The lines are grouped into sections with each section containing one header line and multiple data lines.

The EMG data written into the GCD file has a header of the form,

!<Left/Right>Name

or

!<Left/Right>NameRaw

where,

- Left or Right is prefixed depending on whether the data belongs to the Left side or the Right side.
- Name is the EMG name that is taken from the Configuration file.

If the Choose Append Raw to Label command (Edit menu) has been selected, the text "Raw" will be appended to the label. If you have not chosen to Append Raw to Label then any existing duplicate labels in the GCD file will be overwritten!

The number of data lines written to the GCD file is given by,

\[
\text{Data Lines} = (\text{End Frame} - \text{Start Frame}) \times \text{Analog to Video Ratio}
\]

where,

- End Frame is the value you specify in the (Left/Right) End Frame box.
- Start Frame is the value you specify in the (Left/Right) Start Frame box.
- Analog to Video Ratio is the number of Analog frames collected per video frames.