

Script Language Reference

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User Manual for PE0003 Scripting Language

1 Introduction

This document provides a reference to the commands and syntax for the script language used in the PE0003 Evaluation Kit Interface Card.

1.1 History

Version	Changes	Date
1	First Release	02/12/14
2	Minor corrections and revised layout	03/07/15
3	Section 6.1.6: information now presented as a table Section 8.6 and section 8.6.3: Port command extended with new functionality Section 8.6.1 and 8.6.2: corrected C-BUS connector references	15/01/16
4	Fixed template conversion issues that caused formatting errors Corrected minor errors. Added fclose command	19/11/19

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2.1 Glossary

<i>CML</i>	CML Microsystems plc group of companies
<i><CR></i>	A carriage return plus a line-feed character or the 'Enter' key on host PC keyboard
<i>PC</i>	Script program counter
<i>host PC</i>	A personal computer running the GUI application and connected to the PE0003
<i>White space character</i>	
	A space, tab or carriage return character
<i>ISR</i>	Interrupt Service Routine

3 Background & System description

This script language was developed for evaluating CML's new generation ICs including *FirmASIC*[®]-based products, and greatly simplifies the approach to the evaluation and design-in process.

A host PC-based GUI loads, compiles and controls scripts, which are plain text files, and executes them on the PE0003. The scripts use a simple syntax to allow the user to read and write up to 2 C-BUS ports and the Host port on the PE0003. Script functions allow flexible program flow control with data manipulation and message display. The result is much better real-time performance than when executing the script from the host PC. The script language also provides debugging, tracing and I/O control facilities.

4 PE0003 data handling

The memory on the PE0003 is divided into a number of discrete segments. At run time, the entire script is compiled and downloaded to the PE0003 "Command Buffer". A fixed "Data Buffer" is set aside for the contents of variables and arrays used in the script. If the Command Buffer or Data Buffer is exceeded then the script will abort and a "Data out of range" message will be displayed in the console at run-time.

When a **filew** command is encountered, data is transferred from the PE0003 to the host PC via a fixed buffer (FIFO). This is transparent to the user and the buffer is unlikely to overflow and cannot underflow in use.

When a **filer** command is encountered, data is transferred from the host PC to the PE0003 via another fixed buffer (FIFO), the "File Buffer". This buffer cannot overflow but may underflow in use.

It is important to understand how data is handled and transferred between the PE0003 and the host PC using these commands. The PE0003 packs all data in 16-bit words, regardless of format. This includes data transferred to and from the host PC.

A **fopenw** command opens or creates a file on the host PC that will be used to receive data from the PE0003 script. Each time a **filew** command is encountered, 16-bits of data are transferred from the script to a buffer. The GUI application on the host PC will read this buffer in bursts and write the data to the file in the required format.

A **fopenr** command opens a file on the host PC that will be used to send data to the PE0003 script. The script is suspended while the file is downloaded to the PE0003 File Buffer. The data from the file is read using the format specified in the **fopenr** command and, if smaller, padded to 16-bits. If possible, the entire file will be transferred to the File Buffer and the script will continue. If the file is too large, the script will suspend until the File Buffer is full and then resume. Each time a **filer** command is encountered, 16-bits of data are transferred from the File Buffer to the destination specified. As data is consumed by **filer** commands, the host PC will send bursts of data to the File Buffer until the entire file has been transferred.

If the data is consumed faster than it is sent then the script will abort and a run-time error message, "File buffer underflow" will be displayed in the console. To avoid an underflow, the script tool provides the **waitfile** command. This causes the script to suspend until the File Buffer contains at least the number of words specified by the command.

A **fopenr** command has an optional variable associated with it. This variable acts as a size-of-file at the time the file is opened although it will report files greater than \$FFFF as \$FFFF – the size limitation of variables. After the first **filer** command is encountered, the variable will act as a number-of-file-reads remaining because its value is re-calculated following every **filer**.

Note there is no direct connection between the size of the file reported by the **fopenr** variable and the real size of the file. This is because **fopenr** is reporting the number of possible **filer** cycles that can be performed on the file, not its size.

The current sizes of the Command, Data and File Buffers, are given in the About box of the PC GUI.

The data transfer rate between the host PC and the PE0003 depends on the host PC processors speed, the OS and other applications that are running. Data is transferred across the USB link in bursts so file reads and writes may be managed in bursts with a script delay imposed between, although this is not normally necessary. For optimal data handling between the PE0003 and the target card, try and keep as much data on the PE0003 as possible: Ensure that files read from the host PC will require less than 256k file cycles. The script will be suspended while these files are downloaded.

Try to avoid writing data to files on the host PC where the write cycles will be continuous or with little script processing in between. Also try to limit the rate at which messages are sent to the GUI. The PE0003 buffers this data until it is consumed by the PC/GUI. If the buffer fills faster than the PC/GUI can empty it, an overflow will occur and the script will terminate.
See Micro File read buffer underflow

Where possible, write to an array on the PE0003 and then transfer the data to the host PC at the end of the script or while the script is busy on other tasks or where delays can be inserted between the **filew** commands. If a delay in script execution can be tolerated use the **waituplink** command to stall script execution until the data is transferred.

5 File types

The script language recognises two filetypes; binary and text. The filetype is inferred from the extension '.bin' as binary and anything else as text.

5.1 Text files

Reading: Files should have one value per line. Lines should be formatted per the string supplied in the **fopenr** command. Blank lines and leading/trailing whitespace are ignored. Any text following a semicolon and on the same line, is ignored. **Fopenr** reports the number of values that can be read from the file.

Writing: Lines will be written per the formatted string in **filew**. Only one value is permitted per **filew** command but **/c** can be used to put more values on a line.

5.2 Binary files

Reads and writes are 16-bit. **Fopenr** reports the number of 16-bit words that can be read from the file. The formatted string in **fopenr** is ignored, but must be present if the '**filesize**' parameter is used. The string in **filew** is ignored, but must be present.

6 Script - Command Format

Commands take the general form of:

Label command operand1,operand2,..... ;comment

- Labels must start in the first column and must start with a letter or underscore character. Labels are case sensitive.
- Commands must be separated from a Label by at least one white space character except <CR>.
- Commands are not case sensitive.
- The command must NOT start in the first column. Only one command is allowed per line.
- Operands must be separated from the command by at least one white space character except <CR>.
- Operands must be separated by a comma or at least one white space character except <CR>. The number of operands required by each command varies and some commands have a flexible syntax.
- Blank lines, lines with just a label, just a comment or just a command (plus operands) are all allowed.

7 Syntax

7.1 Operands

7.1.1 Constants

Constants are declared as follows:

```
STATUS      const  $C6
BIT1_MASK   const  2
```

The following are all treated as 16-bit:

#1234	Constant, decimal value 1234.
678	Constant, decimal value 678.
#\$56AB	Constant, hex value 56AB.
\$FE	Constant, hex value FE.

7.1.2 C-BUS handling

C-BUS register accesses comprise an address byte followed by zero or more data bytes. The script compiler assumes a default length of two data bytes. To change this, use the **register** command. For streaming C-BUS register access, use the **read** and **write** commands.

7.1.3 C-BUS Addresses

A * character is used to specify the address of a C-BUS register (C-BUS address).

*45	C-BUS address specified in decimal, value 45
*\$A7	C-BUS address specified in hex, value A7
*STATUS	C-BUS address specified by the constant STATUS

7.1.4 Strings

Strings have a maximum length of 64 characters. If this length is exceeded the scripting tool will abort without warning.

" hello world." Strings presented in double quotes.

7.1.4.1 Formatted strings

Some of the commands make use of 'formatted strings'. These work much like the 'printf' function in C, with the following differences:

- A carriage-return and line-feed (\n in the C language) is assumed at the end of a line (use \c to continue if you don't want a new line).
- The **disp**, **dialog**, **dialogyesno**, **dialogentry** & **filew** commands support only one parameter after the string, so only one format specifier can be used in the string.
- Formatted strings have a maximum length of 64 characters. If this length is exceeded the scripting tool will abort without warning.
- The standard format specifiers supported are:
 - %d (signed decimal).
 - %u (unsigned decimal).
 - %x and %X (hexadecimal).
 - %f (floating point. When used in **filer** the string is converted to a 16-bit signed value and a warning generated if out of range).

The usual flags, field width and precision specifiers can be used with these.

- The following additional format specifiers are also available:
 - %b (binary) no leading zero suppression.
 - %q (Q15 fixed point)

7.1.5 Variables

Variables are stored and treated as 16-bit unsigned values throughout the script except when operated on by the arithmetic shifts, **asl** and **asr**, when the sign bit, b15, will be preserved.

Variables are declared as follows:

```
bar word n           ;Specifies a 16-bit variable 'bar',
                     ;initialised to value 'n'.
foo buffer x         ;Specifies an array of x 16-bit words,
                     ;all initialised to zero.
foo word 1,2,3,4,5   ;Specifies an array of 5 16-bit words
                     ;initialised to the values 1 through 5.
```

Note that 'bar' & 'foo' are labels that identify the variables, so must start in the first column.

Variables are global and can be declared and used at any point in a script. They can also be used before they are declared.

Variables are case sensitive.

Only one instance of any variable can exist.

Arrays of variables are indexed from 0. When initialising an array, the values must be on the same line and separated by at least one white space character except <CR>.

Variables can be accessed in the following ways:

bar	Return the variable bar.
foo	Return the first word in the array foo.
foo[0]	Return the first word in the array foo.
foo[3]	Return the fourth word in the array foo.
foo[bar]	Return the word at n+1 in the array foo where bar = n.
foo[bar++]	As above, and increment bar.
foo[bar--]	As above, but decrement bar.

If the post-increment and post-decrement operators are used in arrays, no bounds checking is done by the script. The user must ensure that the indexing remains in bounds or the script may behave unexpectedly.

Scripts may make use of the lack of bounds checking to deliberately cause overruns when using arrays. This is helpful for creating long arrays. Consider the following look-up table:

```
lut word 1 2 3 4 5 6 7 8 9 0      ;create a long array
lut_a word 11 12 13 14 15 16 17 18 19 20
lut_b word 21 22 23 24 25 26 27 28 29 30
lut_c word 31 32 33 34 35 36 37 38 39 40
lut_d word 41 42 43 44 45 46 47 48 49 50
lut_e word 51 52 53 54 55 56 57 58 59 60
lut_f word 61 62 63 64 65 66 67 68 69 70

disp "%u" device_lut[1]           ;will display 2 in the console
disp "%u" device_lut[31]          ;will display 32 in the console
disp "%u" device_lut[54]          ;will display 55 in the console
disp "%u" device_lut[75]          ;unpredictable
```

Array indexing is from 0 and so the first **disp** command will retrieve the entry at index 1 from the array device_lut and display 2 in the console. The second entry will display 32 because, although the array bounds have been exceeded the script handler does not detect this deliberate error. Arrays are stacked end-to-end in the order they appear in the script. The indexing will roll over to the next line because this is the next array in memory. The last display command is unpredictable because there are no further arrays to index.

If another array is placed further down the script, for example after the **disp** commands:

```
test_array word 71 72 73 74 75 76 77 78 79 80
```

The indexing will continue to step through this array and `disp "%u" device_lut[75]` above will display 74 in the console.

7.1.6 Conditionals

The following conditional evaluators and operators can be used with the **jmpc**, **jsrc**, **if**, **elseif** and **while** commands:

<	Less than
>	Greater than
= or ==	Equal to
!=	Not equal to
<=	Less than or equal to
>=	Greater than or equal to
&	Bitwise AND
	Bitwise OR
^	Bitwise XOR
!&	Logical inverse of bitwise AND
!	Logical inverse of bitwise OR
!^	Logical inverse of bitwise XOR

Bitwise !& (NOT AND) is equivalent to operand1 AND operand2 with the result being negated. The following example compares !& to &:

operand1 & operand2

Op1	Op2	Result
0	0	FALSE
0	1	FALSE
1	0	FALSE
1	1	TRUE

operand1 !& operand2

Op1	Op2	Result
0	0	TRUE
0	1	TRUE
1	0	TRUE
1	1	FALSE

The same is true for the other 'logical inverse' conditions, !| and !^.

The script environment assumes only unsigned integer values are used. Be cautious when using evaluators as there is no concept of values less than zero. For example, this code fragment will work as expected provided count is assigned an even number before the loop. If count is assigned an odd number, it will be decremented; 0005.. 0003.. 0001.. FFFF – The loop will *never* exit.

```

copy <var> to count                ;get number of items to be processed
while count > 0
    ..                             ; do something
    ..
    sub 2 count
endwhile

```

The evaluation of a condition does not change any variables. For example:

```

copy *Status to sstatus            ; read the device status into shadow
If sstatus & $1000                  ; Test status bits without changing the shadow
    ..                             ; do something if b12 = 1
    ..
elseif sstatus !& $10
    ..                             ; do something if b4 = 0
    ..
Endif

```

8 Commands – Summary

A detailed description of the commands is available in section 9. The following nomenclature is used throughout this section:

"str"	A formatted string or formatted string as described in section 7.1.4.1
<cond>	A condition code as listed in section 7.1.6
<label>	A label referencing a script line, used in jmp , jsr , if & while commands.
#<const>	A constant as described in section 7.1.1
*<C-BUS>	A C-BUS address as described in section 7.1.3
<var>	A variable as described in section 7.1.5
<any>	Any one of #<const>, or *<C-BUS> or <var> (as specified in the description)

Where more than one parameter of the same type is used, an identifier will be added, for example:

<var1> <var2>

8.1 IO involving the host PC

Command	Parameters	Description
Fopenr	"filename", "str"	Instructs host PC to open file "filename" for reading using formatted string <str>
	"filename", "str", <var>	As above but writes the number of filer cycles remaining into the variable <var>
Fopenw	"filename"	Instructs host PC to open file "filename" for writing.
Waitfile	#<any>	Pause the script until the fopenr process has downloaded at least enough data to complete <any> filer cycles
Filer	*<C_BUS>	Read a value from PC file opened previously by fopenr and write it to the C-BUS address *<C-BUS>
	<var>	As before, but write to variable <var>
Filew	"str", <any>	Read the C-BUS address, variable or constant <any> and write the data, using formatted string "str", to the host PC file previously opened using fopenw
	"str"	Write the string "str" to the host PC file previously opened using fopenw
Fclose	None	Closes a previously open file. Stalls script until the OS reports the file has closed.
Waituplink	<any>	Pause the script until the buffer for sending to the GUI has enough space for <any> messages.
Disp	"str", <any>	Read the C-BUS address, variable or constant <any> and display the data in the console using formatted string "str"
	"str"	Write the string "str" to the console
Dialog	"str", <any>	Read the C-BUS address, variable or constant <any> and display the data in a dialog box using formatted string "str".
	"str"	Display a dialog box containing the string "str"
Dialogyesno	"str", <var>	As dialog , except this dialog box has three buttons; 'Yes', 'No' and 'Abort'. If the user presses 'Yes' <var> will be set to 1. If the user presses 'No' <var> will be set to 0. 'Abort' will abort the script.
Dialogentry	"str", <var>	As dialog , except this dialog box has an edit box; If the user presses 'OK' <var> will be set to the value typed in the edit box (decimal, or hex preceded by \$ or 0x are accepted). 'Abort' will abort the script.
Cls	None	Clear the contents of the console

8.2 Arithmetic and logic operations

These commands take the form; command <source>, <destination>. The result is always in the <destination> operand.

Command	Parameters	Description
Copy	<any>, <var>	<var> = <any>
	<any>, *<C-BUS>	*<C-BUS> = <any>
Add	<any>, <var>	<var> = <var> + <any>
Sub	<any>, <var>	<var> = <var> - <any>
And	<any>, <var>	<var> = <var> & <any>
Or	<any>, <var>	<var> = <var> <any>
Xor	<any>, <var>	<var> = <var> ^ <any>
Lsl	<any>, <var>	<var> = <var> << <any>
Lsr	<any>, <var>	<var> = <var> >> <any>
Asl	<any>, <var>	<var> = <var> << <any> (Sign bit preserved)
Asr	<any>, <var>	<var> = <var> >> <any> (Sign bit preserved)

8.3 Streaming C-BUS

These two commands only apply to C-BUS when used in streaming mode. Not all C-BUS devices support streaming mode.

Command	Parameters	Description
Read	*<C-BUS>, <var>, <any>	Read C-BUS in streaming mode from C-BUS address *<C-BUS> and store the results into an array starting at <var>. <any> determines the number of words read.
Write	<var>, *<C-BUS>, <any>	Read from an array starting at <var> and copy to C-BUS address *<C-BUS>. <any> determines number of words copied.

8.4 Program flow

Throughout this section, zero equates to FALSE, any non-zero value equates to TRUE.

Command	Parameters	Description
Jmp	<label>	PC=<label>
Jmpc	<any> <cond> <any> <label>	PC=<label> if <cond> is TRUE
Jsr	<label>	Push PC+1, PC=<label>
Jsrc	<any> <cond> <any> <label>	As jsr if <cond> is TRUE
Return	None	Pop PC
Setvect	#<const>, <label>	On interrupt from device <const> Push PC+1, PC=<label>
Intson		Turn on script interrupt handling
Intsoff		Turn off script interrupt handling
Rfi		Pop PC and re-enable interrupts
If	<any> <cond> <any>	If <cond> evaluates as FALSE: Jump to matching endif or first matching else or elseif . If <cond> evaluates as TRUE: Execute until matching endif , or execute until first matching else or elseif then jump to matching endif
	<any>	As before but <any> is evaluated instead of <cond>
Else	None	This is just a marker for if

Elseif	<any> <cond> <any>	If <cond> evaluates as FALSE: Jump to matching 'endif' or next matching else or elseif . If <cond> evaluates as TRUE: Execute until matching endif , or execute until next matching else or elseif then jump to matching endif
	<any>	As before but <any> is evaluated instead of <cond>
Endif	None	This is just a marker for if
While	<any> <cond> <any>	Jump past matching endwhile if <cond> evaluates as FALSE.
	<any>	As before but <any> is evaluated instead of <cond>
Endwhile	None	Jump to matching while
Stop	None	Stop executing script

8.5 Timers

Command	Parameters	Description
Settime	<any>	Set current value of <i>count up timer</i> to <any>
Gettime	<var> or *<C-BUS>	Read current value of <i>count up timer</i> to <var> or <C-BUS>
Settimer	<any>	Set start value of <i>countdown timer</i> to <any>
Starttimer	None	Start <i>countdown timer</i> running
Stoptimer	None	Stop <i>countdown timer</i> running.

8.6 Miscellaneous

Command	Parameters	Description
Port	<any>	Select Port <any> to be 'current'
Getport	<var>	Read currently selected port into <var>
Portc	<any>	Configure current port with value of <any>. A 1 in a bit position sets the corresponding bit in the port to be an INPUT. A 0 sets it to be an OUTPUT.
Portw	<any>	Set hardware output pins of current port to value of <any>.
Portr	<var>	Set <var> or *<C-BUS> to value read from hardware input pins of current port.
	*<C-BUS>	As before but send the value read to C-BUS address *<C-BUS>
Ones	<any>,<var>	Count the number of ones in <any>. Put the result in <var>.
Device	<any>	Select Device <any> (C-BUS device 1 or 2)
Getdevice	<var>	Read currently selected device into <var>
Delay	<any>	Script waits for <any> milliseconds
Microdelay	<any>	Script waits for <any> x 10 microseconds
Register	#<const1>, #<const2>, #<const3>	Defines the format of the C-BUS register on C-BUS1/2 <const1> is the device (C-BUS device 1 or 2) <const2> is the C-BUS register address <const3> is the number of bytes required after the address byte
Logon	None	Start logging C-BUS transactions
Logoff	None	Stop logging C-BUS transactions

9 Commands – Detailed Description

Commands are not case sensitive; **Fopenr** is the same as **fopenr**.

Commands must not start in the first column but they can start in any other column. A label, but no other text, can precede a command on the same line.

A command and its parameters must all be on same line. If the line is broken then compile errors or unexpected script operation will occur.

A command's parameters can separated by a single comma, any number of white space characters

(except carriage return) or any mix of these. Eg:

```
fopenr "myFile.txt" "04x" FileSize
fopenr "myFile.txt","04x", FileSize
fopenr "myFile.txt", "04x", FileSize
```

are all valid and will give the same result.

The following structure is used throughout this section:

Command

Parameters

Description

Example usage

Restrictions

The following nomenclature is used throughout this section:

"str"	A formatted string as described in section 7.1.4.1
<cond>	A condition code as listed in section 7.1.6
<label>	A label referencing a script line, used in jmp , jsr , if & while commands.
#<const>	A constant as described in section 7.1.1
*<C-BUS>	A C-BUS address as described in section 7.1.3
<var>	A variable as described in section 7.1.5
<any>	Any one of #<const>, or *<C-BUS> or <var>

Where more than one parameter of the same type is used, an identifier will be added, for example:

<var1> <var2>

9.1 IO involving the host PC

9.1.1 Fopenr

Parameters - "filename", "str", <var> or "filename", "str"

Description - The script instructs the host PC to open file "filename" for reading. If the file/folder does not exist then an error message will be displayed. The file can be opened from a sub-folder using a path specifier in front of the file name. The string "str" describes the format of the data read.

The optional parameter <var> can be used to determine the effective size of the file or as an end of file marker. At run-time, the host PC will determine the number of **filer** cycles that are possible with the file. This value will be written to the variable <var> and updated every time a **filer** is executed. If the number of possible **filer** cycles exceeds \$FFFF, the variable limit, then the variable will read \$FFFF until the number of remaining **filer** cycles can be stored precisely.

At runtime, data that matches the format specified in the **fopenr** command is copied from the host PC file. This data is converted to unsigned 16-bit word and stored in the File Buffer. The entire file is processed in this way or until File Buffer is full. If the File Buffer is smaller than the file, the file's content will be piped in bursts until the entire file has been transferred.

When opening binary files, the formatting string must be present but is ignored if the variable indicating the size of the file is required.

Each **filer** cycle accesses one word sequentially from the File Buffer. If the data in the File Buffer is consumed faster than it is transferred from the host PC, an empty buffer may occur. This event will terminate script execution with an error message. Such buffer underflows can be avoided using the **waitfile** command.

The same file can be opened for reading and writing but note that the **fopenw** command erases the file contents when executed by the script. Any file previously opened for reading will be closed before the specified file is opened.

Example Usage – The following script fragment uses the parameter 'FileSize' in **fopenr** to check that the size of the file is not too large for the array, **Array**. It then uses the same parameter to control download of the entire file content to the array.

```
Array buffer $FF                                ;initialise an array

fopenr "inputfile.txt", "%04X" FileSize          ;Tell host PC to open file inputfile.txt
if FileSize > #$FF
    Dialogue "Error in Source File - Aborting"
    stop
endif

while FileSize != #0                            ;While the file contains valid data
    filer Buffer[BufSize++]                      ;read it into the array and increment the
                                                ;index variable.
endwhile                                         ;end of while loop
```

Also see Script Examples, Example 4

Restrictions – The file name, including the filetype and any path specifiers, cannot be longer than 64 characters. The filetype should be specified or will default to NULL. The folder in which the source script resides is the default.

Only one file can be open at any time for reading.

The rate at which the PE0003 File Buffer is filled depends on many factors including the USB link and the host PC hardware and OS. Any activity that reduces the rate at which data is sent over the USB link may cause the File Buffer to underflow.

The format specifier determines how binary data is read from the file. The data is stored as unsigned 16-bit words in the File Buffer.

9.1.2 Waitfile

Parameters - <any>

Description – This command allows the script to pause while data is downloaded from the host PC, potentially avoiding File Buffer underflows. At run time, script execution pauses at this command until the PE0003 file buffer contains at least the number of **filer** cycles that can be executed on the file specified in <any>. If there is insufficient data in the file, the script will pause until the last of the data has been downloaded and then the script will continue even though the PE0003 File Buffer has not been filled to <any> bytes. Data that does not match the required format specified in the **fopenr** command will be ignored. **Waitfile** is only required when the file being read contains more than 256k **filer** cycles. For files smaller than this, the script will pause at the **fopenr** command until all the data is downloaded.

Example Usage – This script fragment reads data bursts from a large external file (>256k). A **waitfile** has been inserted ensuring that the PE0003 File Buffer always contains enough data for the loop. The script only pauses at the **waitfile** if there is insufficient data in the PE0003 File Buffer. If the PE0003 File Buffer contains at least 27 **filer** cycles, the script will not pause at the **waitfile** command.

```
const FrameSize 27

copy #0count                                ;reset counter
WaitFile FrameSize
while count < FrameSize                      ;Get another Frame ready
    filer Frame[count++]
```

endwhile

Restrictions – The maximum **waitfile** delay is 64k **filer** reads. This limitation is due to the maximum value that can be assigned to variables.

9.1.3 Fopenw

Parameters - "filename", <any> or "filename"

Description - The script instructs the host PC to open file "filename" for writing. If the file/folder-list does not exist then it will be created. The file can be opened from a sub-folder using path specifiers in front of the file name. The format of the data written is controlled by the **filew** command. The file contents, if any, will be erased when the **fopenw** command is executed by the script. The write is piped to the host PC via a single buffer. The script will terminate with an error message if the buffer overflows.

The same file can be opened for reading and writing but note that the **fopenw** command erases the file contents when executed by the script.

Example Usage - None

Restrictions – The file name cannot be longer than 64 characters and the filetype should be specified. Unspecified filetypes will default to NULL. The folder in which the source script resides is the default. The rate at which the PE0003 buffer is emptied depends on many factors including the USB link rate, the host PC hardware and OS activity. Any activity, including PE0003 commands and data, which reduces the rate at which data is consumed by the host PC may cause the buffer to overflow.

9.1.4 Filer

Parameters - *<C-BUS> or <var>

Description – Read the next value from the File Buffer created by **fopenr** and write it to the C-BUS register <C-BUS> or variable <var>.

Data that matches the format specified in the previous **fopenr** command is copied from the host PC file. This data is converted to unsigned 16-bit word and stored in the File Buffer. The entire file is processed in this way. Each **filer** cycle accesses one word sequentially from the File Buffer. Values read by **filer** are converted to the format required by the destination. Leading zeroes are added where necessary.

*<C-BUS> - write the value to the C-BUS address as MSB/LSB if the register is 16-bit or LSB only if the register is 8-bit.

<var> - write the value to the variable as a 16-bit unsigned value.

Example Usage – The following table shows the data that will be passed to a variable by the **filer** command. Note how the data is padded with leading zeroes to maintain the 16-bit unsigned integer format of variables. If the target is a C-BUS register address, then leading zeroes will be added to accommodate the number of data bytes required by the C-BUS register specified.

File Content	format string in fopenr command		
	01x	02x	01d
ABCD	000A	00AB	Ignored
AB CD	000A	00AB	Ignored
0	0000	0000	0000
01	0000	0001	0000
A B	000A	000A	Ignored
h	Ignored	Ignored	Ignored
1	0001	0001	0001

See Script Examples, Example 4

Restrictions – See **Fopenw** command

9.1.5 Filew

Parameters - "str", <any> or "str"

Description – Read the C-BUS register address, variable or constant <any> and write it to the file created by **fopenw**. The format of the data written is specified by the parameter "str". The <any> parameter can be omitted so that only the string "str" will be written to the file. If the file being written is a binary or wav file then the formatting string is ignored.

Example Usage -

```
filew "Received Data" ;Start the file with a header
```

Restrictions – The length of the string cannot exceed 64 characters. Only one placeholder can appear in the string and if present, must be followed by the second parameter <any>.

9.1.6 Waituplink

Parameters - <any>

Description – File writes are written into a buffer as they are executed, and sent from the micro to the GUI as soon as possible. If the script writes faster than the data can be sent the buffer will overflow and the script will abort with an error message. To avoid an overflow, and if delay in script execution can be tolerated, the script provides the **waituplink** command. This causes the script to suspend until the buffer has enough space for the number of messages specified by <any>.

Example Usage - None

Restrictions – It is possible that **waituplink** may fail in some instances. This is due to the rate at which the PE0003 and the GUI are processing. **Waituplink** is more likely to fail on a faster PC.

9.1.7 Fclose

Parameters - <any>

Description – Closes the currently open file and stalls script execution until the PC Operating System confirms that it has closed the file. When the OS signals that the file has been closed, script operation will continue executing at the line following **fclose**. This allows scripts and other PC apps to avoid clashing if they access the same file at mutually exclusive times. **Fclose** is not required to close open files. **Fopenr** and **fopenw** commands both close previously open files automatically but script operation continues without delay. An open file is also closed when a script ends or is aborted. **Fclose** will have no effect if called when no file has been opened.

Example Usage – The following script prewrites a value of 0 to GPIO b0 and then sets it to an output. A small array is loaded with ten values from 0 to 9. A text file on the same path as the script is opened, or created and then opened. The data from the array is copied to the file. The file is then closed using the **fclose** command and GPIO b0 is set 1 to indicate that file is now free.

```
;Define some vars
temp      word          ;general purpose var
data      buffer 10     ;create an array with a length of 10 words
index     word 0         ;array indexer
```

```

;Initialise GPIO
port    1                                ;Ensure Port1 is default
portr   temp                            ;Read port state
and     $FF0F temp                       ;outputs low
portw   temp                            ;pre-configure the GPIO pin states
portc   $FFAF                           ;b4..7 = GPIO1-4 DDR = 0000b all O/P

;put some data in an array
copy    0 index
while   (index < 10)
    copy    index data[index++]
endwhile                                ;put 10 words in the array

;write the data to a file
fopenw  "data.txt", "%04X"               ;Open file for writing data
copy    0 index
while   (index < 10)
    filew   rx_data[index++]             ;write the data in the array to a file
endwhile

;close the file and then trigger the GPIO1 high when the OS releases the file
fclose
portr   temp                            ;Read port state
and     $FF1F temp                       ;configure GPIO1 output high
portw   temp                            ;and write it

disp    "File can now be opened by external app"
stop

```

Restrictions – None

9.1.8 Disp

Parameters - "str", <any> or "str"

Description – Read the C-BUS register address, variable or constant <any> and write it to the console. The format of the data written is specified by the parameter "str". The <any> parameter can be omitted so that only the string "str" will be written to the console. Use **disp** to send messages to the console that indicate script progress or to help de-bug scripts. To provide user prompts, use **Dialog**

Example Usage –

Disp "Data Exchanged"	;Debug - Table Header in console
Disp "Write Value =%x", OutValue	;Value written in hex
Disp "Read Value =%b", RetValue	;Result returned in binary

Also see Script Examples, Example 4

Restrictions – The length of the string cannot exceed 64 characters. Only one placeholder can appear in the string and if present, must be followed by the second parameter <any>.

9.1.9 Dialog

Parameters - "str", <any> or "str"

Description – Read the C-BUS register address, variable or constant <any> and display it in a dialog box. The format of the data written is specified by the parameter "str". The <any> parameter can be omitted so that only the string "str" will be written to the console. Script execution will be suspended until one of the dialog buttons is clicked. The dialog box is modal so must be addressed. Clicking 'OK' will resume the script. Clicking 'Abort' will terminate the script.

Dialog is best used to provide user prompts or warnings. It can be used with the Trace facility to debug script because it provides an exact point at which to stop and abort script execution. The trace facility can then be accessed from the GUI window. Use **disp** to send messages to the console that indicate script progress or to help de-bug scripts.

Example Usage - Same as **disp** but the string is displayed in a modal dialog box. Also see Script Examples, Example 4

Restrictions – The length of the string cannot exceed 64 characters. Only one placeholder can appear in the string and if present, must be followed by the second parameter <any>. The dialog box is modal so will prevent the GUI application being focused until the dialog box closes.

9.1.10 Dialogyesno

Parameters – “str”,<var>

Description – Produces a dialog box with a message “str” and three buttons: ‘Yes’, ‘No’ and ‘Abort’. Script execution will be suspended until one of the dialogue buttons is clicked. The dialog box is modal so must be addressed:

If the user clicks ‘Yes’, a 1 will be returned to the variable and the script resumes execution. If the user clicks ‘No’, a 0 will be returned to the variable and the script resumes execution. If ‘Abort’ is selected the script will be aborted.

Example Usage –

```
response word                                ;declare variable response

start                                        ;label indicating start of script
..                                          ;do something
..
dialog "Repeat Transmission" response      ;display the dialogue
If response == 1                          ;if yes..
    jmp start                            ;loop back to the start
elseif response == 0
    jmp shutdown                        ; if no..close down gracefully
endif
;Abort will stop the script but will not stop the hardware!!

shutdown                                  ;shutdown routine
..                                       ;script to shutdown the hardware and perhaps
Stop                                    ;read some debug values
```

Restrictions – The length of the string cannot exceed 64 characters. The dialog box is modal so will prevent the GUI application being focused until the dialog box is closed.

9.1.11 Dialogentry

Parameters – “str”,<var>

Description – This command gives the user the ability to modify a variable independent of the script. Typical use is to set a variable at run time but is also useful for testing and debugging scripts. When the script reaches the line at which **dialogentry** is located, the dialog will be displayed with the message “str” and an edit box. The script will be suspended at this point and the user can enter a value in the box. Values can be hexadecimal, prefixed with \$ or 0x, or integer. Integers are treated as signed and so negative numbers will be limited to 15-bit and the sign bit set to 1. When the user clicks ‘OK’ the value entered will overwrite the current value of the variable <var>. If the user clicks ‘Abort’ the script will be aborted.

Example Usage –

```
;This loop fragment did not exit so dialogentry has been inserted to force the
;loop to exit on the required loop_count. De-bug code has been added at the
;end of the loop to determine the problem.
```

```
while loop_count < max
..
..
    add 1 loop_count
    dialogentry "Modify loop_count" loop_count
endwhile
..    ;run some debug code
..
stop
```

Restrictions – The length of the string cannot exceed 64 characters. The dialog box is modal so will prevent the GUI application being focused until the dialog box is closed. Integer values entered via the edit box will be treated by the environment as unsigned. It is the user's responsibility to handle signing appropriately.

9.1.12 CLS

Parameters – None

Description – Clear screen. Clears the console and returns the cursor to the upper, left-hand corner.

Example Usage - None

Restrictions – None

9.2 Arithmetic and logic operations

These commands take the form:

command <source>,<destination>

The result is always in the <destination> operand.

9.2.1 Copy

Parameters - <any>,<var> or <any>,*<C-BUS>

Description – Read the C-BUS register address, variable or constant <any> and copy it to the variable <var> or alternatively to the C-BUS register address *<C-BUS>

Example Usage –

```
copy    #1234, bar                ;bar is assigned 1234d
copy    *$E0, bar                 ;Read C-BUS register E0h and put the result in bar
copy    bar, foo[1]               ;Copy the value in bar to buffer at index1
copy    bar, *$E0                 ;Copy data in bar to C-BUS register E0h
copy    *$E4, *$E5                ;loop back data between C-BUS registers
```

Restrictions – Variables are not typed so use caution when using signed values or other formats. When *<C-BUS> is used as either or both operands, **device** determines which C-BUS connector is active. The last example cannot be used to copy data from one C-BUS device to another because only one device is active at any time.

Copy is the only *arithmetic and logic operations* command that accepts *<C-BUS> as a destination in its parameter list. The rest of the commands in this section are identical to **add** below. Also, the destination for **add** and the following commands can only be a <var>.

9.2.2 Add, Sub

Parameters - <any>,<var>

Description – Read the C-BUS register address, variable or constant <any> and add to (or subtract from) the value stored in variable <var>. The result is stored in <var>

Example Usage –

```
add      #1, bar           ;bar is incremented by 1
add      *$E0, bar         ;Read C-BUS register E0h and add to
                           ;the value in bar
add      bar, foo[1]       ;Add the value in bar to buffer at index 1
```

Restrictions – Variables are not typed so use caution when using signed values or other formats. Variables can only store 16-bits and arithmetic overflows are ignored.

9.2.3 And, Or, Xor

Parameters - <any>,<var>

Description – Read the C-BUS register address, variable or constant <any> and logically AND (OR or XOR) with the value stored in variable <var>. The result is stored in <var>. The **and**, **or** and **xor** functions are particularly useful for masking variables to determine bit settings, set specific bit patterns or to test for bit changes.

Example Usage –

```
*****
;Subroutine, ReadStat, to read Data Ready flag in Status register
*****
ReadStat

Status      word 0           ;Variable status is instantiated
ReadyFlag   word 0           ;Status of Data Ready flag

copy *$E0, Status             ;Read C-BUS register E0h and copy to Status
and  #0040, Status            ;zero all bits except b6
jmpc Status = 0, NotSet       ;ReadyFlag shadows C-Bus
copy #1, ReadyFlag            ;register E0h
return

NotSet                               ;this is a label
copy #0, ReadyFlag
return
```

Restrictions – Variables are not typed so use caution when using signed values or other formats.

9.2.4 Lsl, Lsr, Asl, Asr

Parameters - <any>,<var>

Description -

Lsl – Logical Shift Left
Lsr – Logical Shift Right
Asl – Arithmetic Shift Left
Asr – Arithmetic Shift Right

All four commands shift the bits stored in variable <var> in the direction stated (either left or right) by the number of places stored in the variable or constant <any>. Bits shifted right beyond b0 are discarded.

For logical shifts, bits shifted left beyond b15 are discarded.

For Arithmetic shifts, bits shifted beyond b14 are discarded but b15 (the sign bit) is always preserved.

The result is stored in <var>.

Example Usage - None

Restrictions – Variables are not typed so use shift with caution when using signed values and other formats.

9.3 Streaming C-BUS Read,Write

Parameters:

Read - *<C-BUS>, <var>, <any>

Write - <var>, *<C-BUS>, <any>

Description – These two commands allow streaming accesses between C-BUS registers and variables. Three parameters are required; an address of the C-BUS register <C-BUS>, an array, indexed with the start location of the data <var> and a length parameter <any>. The number of data ‘items’ transferred is equal to the length parameter. Data ‘items’ are stored or read consecutively beginning at the array index. The array index is automatically incremented. When an 8-bit C-BUS register is read, the least-significant byte of <var> is used to store the data. The most-significant byte is padded with zeroes. When an 8-bit C-BUS register is written, only the least-significant byte of <var> is read.

Example Usage - See Script Examples, Example 3

Restrictions – Reads or writes to an array are not checked to be within range. If the specified index is outside the array boundary, then it may produce unexpected results. A fixed-size memory pool is assigned for variables, including arrays. When the script is running, a check is made to ensure that the available pool is not exceeded. If it is, the script will terminate with an error message.

9.4 Program flow

Throughout this section, zero equates to FALSE, any non-zero value equates to TRUE.

9.4.1 Jmp

Parameters - <label>

Description – Jump always. Start executing script from label <label>. (The current PC value is replaced by the script address marked by label <label>).

Example Usage - None

Restrictions – None

9.4.2 Jmpc

Parameters - <any> <cond> <any>, <label>

Description – Jump on Condition. Evaluate the condition <cond> and if the result is TRUE, continue script execution from label <label>. The parameters <any> are not affected by the evaluation. If the result is FALSE, continue script execution from the next script line. (The current PC value is replaced by the script address marked by label <label> only if the condition <cond> evaluates to a non-zero value.).

Example Usage – See Script Examples, Example 4

Restrictions – The script environment assumes only unsigned integer values are used. Be cautious when using evaluators as there is no concept of values less than zero.

9.4.3 JSR

Parameters - <label>

Description – Jump to Subroutine. Continue script execution from label <label>. (The current PC value is pushed onto the stack and the PC loaded by the script address marked by label <label>).

Example Usage – See Script Examples, Example 4

Restrictions – There can be as many return commands as the programmer wishes but if the script encounters a return before a **jsr** or **jsrc** have been taken, the stack will underflow. This will terminate the script execution and an error message will be displayed.

9.4.4 Setvect

Parameters - #<const>, <label>

Description – Set the vector for a device interrupt or for the countdown timer timeout - when it reaches 0. When an interrupt occurs on the device connected to the device interface specified by the value <const>, script execution will continue from the label <label>. The <const> value 3 is reserved for the countdown timer. When the countdown timer reaches zero, script execution will continue from the label <label>. The script interrupt handler must have been previously turned on by **intson**. The script interrupt handler can be disabled by the command **intsoff**. There is no limit to the number or the placing of **intson** and **intsoff** in the script.

Example Usage - See Script Examples, Example 5

Restrictions – <const> can only be 1, 2 or 3. Any other value may cause unpredictable effects.

There can only be one instance of **setvect** for each device number. If additional instances occur only the last one declared in the script will be used. I.e.

```
Setvect 1 ISR1                ;Set up an interrupt vector on device1
..
..                            ;some other script lines
Setvect 1 ISR2                ;Set up a second interrupt vector on device1
Setvect 3 ISR3                ;Set up a countdown timer interrupt vector

ISR1                          ;This ISR will never be taken
..                            ;because the second declaration of
..                            ;setvect 1 supersedes it.
rfi

ISR2                          ;This ISR will be taken when
..                            ;device 1 interrupts
..
rfi

ISR3                          ;This ISR will be taken when the countdown timer
..                            ;reaches 0
..
rfi
```

Script interrupt handling is automatically disabled when a jump to the interrupt vector occurs so it is not possible for a second interrupt to interrupt the current ISR. This is true for both interrupts so IRQN1 cannot pre-empt IRQN2, for example.

Intson should not be used if an interrupt vector has not been defined by **Setvect**.

Try to limit the number of script lines in the ISR. This makes the ISR exit more quickly and can avoid getting stuck in the ISR.

9.4.5 Intson, intsoff

Parameters - None

Description – Turn on and off script interrupt handling. See **setvect** above.

Example Usage - See Script Examples, Example 5

Restrictions – **Intson** and **intsoff** should not be used if an interrupt vector has not been defined at some point in the script.

9.4.6 Rfi

Parameters – None

Description – Return from Interrupt. Start executing script from the line after the line that the jump to the ISR was taken from and re-enable interrupts. (The current PC value is replaced by the value popped off the stack). See **setvect** above.

Example Usage - See Script Examples, Example 5

Restrictions – There can be as many instances of **rfi** as required but if the script encounters an **rfi** while it is not executing an ISR, the stack will underflow. This will terminate the script execution and an error message will be displayed.

9.4.7 If

Parameters - <any> <cond> <any> or <any>

Description – Evaluate the condition <cond> and if the result is TRUE, continue script execution until the next **else** or **elseif**, then jump to the matching **endif**. If the result of the evaluation is FALSE, jump directly to the next matching **else** or **elseif**. If there is no matching **else** or **elseif**, then jump directly to the next matching **endif**. The parameters <any> are not affected by the evaluation.

If the conditional statement is not present, then read the C-BUS register address, variable or constant <any>. The value determines whether or not the jump is taken exactly as if the condition had been evaluated. **If** can be nested, together with **elseif** where required, to any depth.

Brackets can be used around the conditional evaluation for clarity.

Example Usage –

```
If      foo != 0                ;is the same as
If      (foo != 0)
```

Restrictions – The script environment assumes only unsigned integer values are used. Be cautious when using evaluators as there is no concept of values less than zero.

9.4.8 Elseif

Parameters - <any> <cond> <any> or <any>

Description – Evaluate the condition <cond> and if the result is TRUE, continue script execution until the next matching **else** or **elseif**, then jump immediately to the matching **endif**. If the result of the evaluation is FALSE, jump directly to the next matching **else** or **elseif**. If there is no matching **else** or **elseif**, then jump directly to the next matching **endif**. The parameters <any> are not affected by the evaluation. **Elseif** can be nested, together with **if** where required, to any depth.

Example Usage – None

Restrictions – The script environment assumes only unsigned integer values are used. Be cautious when using evaluators as there is no concept of values less than zero.

9.4.9 Else, Endif

Parameters - None

Description – Markers to enclose the script bound to **if** and **elseif**

Example Usage - None

Restrictions – None

9.4.10 While, Endwhile

Parameters - <any> <cond> <any> or <any>

Description – Do While Condition is True. Evaluate the condition <cond> and if the result is TRUE, execute the script between the **while** and the matching **endwhile**. The condition is evaluated after each pass and the enclosed script executed until the condition evaluates to FALSE. Script execution will then continue at the line after the matching **endwhile**. The parameters <any> are not affected by the evaluation.

If the conditional statement is not present, then read the C-BUS register address, variable or constant <any>. The value determines whether or not the enclosed script (between **while** and **endwhile**) is executed exactly as if the condition had been evaluated. **While** can be nested to any depth.

Brackets can be used around the conditional evaluation for clarity.

Example Usage –

```
While    foo != 0                                ;is the same as while(foo != 0)
    ..do something
endwhile

while(1)                                       ;do forever
endwhile
```

Restrictions – The script environment assumes only unsigned integer values are used. Be cautious when using evaluators as there is no concept of values less than zero.

9.4.11 Stop

Parameters - None

Description – Terminates script execution. A stop is required at some point in all scripts that are not intended to loop forever.

Example Usage – See Script Examples

Restrictions – None

9.5 Timers

There are two timers associated with the scripting language: Time (which is a system timer) and Timer (which is a countdown timer). Time is an incrementing timer, running constantly from zero when the script starts up. Timer is a decrementing timer (used, for example, for timeouts) which only runs when enabled. Both Time and Timer count in milliseconds and are reasonably accurate. However, precise measurements cannot be guaranteed.

Commands **Settime** and **gettime** work with 'Time'.

Commands **settimer**, **starttimer** and **stoptimer** work with 'Timer'

9.5.1 Settime

Parameters - <any>

Description – This command sets the Time to <any>. Setting Time to a particular value occurs as the script line is executed. Time will continue incrementing from the value <any> and will continue to \$FFFF, roll over to 0 and continue incrementing. This command is particularly useful for timing events or scheduling a series of events.

Example Usage –

```
settime 0                                ;initialise Time to 0
..                                       ;do something..
..
```

```
gettime time                ;read the current value of Time
disp "Time lapse is %u ms" time    ;display how long 'something'
                                   ;took to complete
```

Restrictions – There is no signal to indicate when Time rolls over so the script must keep track of this.

9.5.2 Gettime

Parameters - #<var>

Description – Reads the current value of Time and returns it to the variable <var>.

Example Usage – See **Settime**

9.5.3 Settimer

Parameters - <any>

Description – Sets the Timer to an initial value <any>. Timer will not begin decrementing until started with **starttimer**. When Timer decrements to zero (if an interrupt vector has been defined), execution will continue from the interrupt vector defined by **setvect3**.

Example Usage –

This script fragment sets up Timer as timeout while waiting for *PFflag* to set in the IRQ Status register. Without the timeout, the script will wait forever if *PFflag* does not get set.

```
Setvect 3 Timer_Int          ;IRQ vector initialised in script
intson

settimer 5                   ;set Timer to 5ms
starttimer                   ;and start it
                             ;Timer is running..
wait_on_PFflag               ;Poll the Status register
jmpc *IRQ_STATUS !& $4000 wait_on_PFflag ;until the PF flag is set or
                             ;Timer times out (=0)

Stoptimer

Timer_Int                   ;Timer has timed out
disp "Timeout waiting for PF flag" ;so display a message
jmp shutdown                ;and shutdown cleanly
rfi
```

Restrictions – The maximum value for Timer is \$FFFF or just over 6.5 seconds.

9.5.4 Starttimer

Parameters – None

Description – Enables the countdown timer. Timer then decrements every millisecond until it reaches 0 and then stops.

Example Usage – See **Settimer**

Restrictions – None

9.5.5 Stoptimer

Parameters – None

Description – Freezes Timer at the current value. **Starttimer** will then restart the countdown from its current value.

Example Usage – See **Settimer**

Restrictions – None

9.6 Miscellaneous

9.6.1 Port

Parameters - <any>

Description – Selects the currently active port <any>. Only values of 1 to 19 are valid.

Port 1 and **Port 2** are in the I/O space of the PE0003,

When the GUI is first started all the configurable I/O lines are set as inputs. If a script command changes the state or direction of an I/O pin, the setting will be maintained even when the script completes or is aborted. This is helpful where the test/evaluation environment needs to be maintained while scripts are cascaded. The default direction and state will only be restored when the GUI is closed and restarted. Inputs directly signal the state of the connector pins to which they are connected – there is no inversion.

Port 3 to **port 19** is extension to the **port** command that allows storage of data that are persistent between script executions. The values are stored in a RAM area of the PE0003, making them available between scripts through the commands **portr** and **portw**. This memory area is not erased before the script execution but a reset of the PE0003 will cause the loss of such data.

Example Usage – see example in Port 3, 4, 5, 19

Restrictions – None

9.6.1.1 Port 1

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
IO15	IO14	IO13	IO12	IO11	IO10	IO9	IO8	GPIO3	GPIO2	GPIO1	GPIO0	DO4	DO3	DO2	DO1

b15-8 I/O lines connected to Device 2. Can be configured as input or output (default is input).

Target kits may use these pins and require their states to be defined. Check the relevant kit's user manual.

These pins can only be used on PE0003 RevB boards. For earlier PE0003 boards, read as 0.

b7-4 General purpose I/O lines connected to J6. These can be configured as input or output

(default is input). The external connections are open circuit and will drift if configured as inputs without external hardware pre-setting the state.

b3-0 Outputs connected to LED bank. Always configured as output. These pins are connected via open-drain, current sinks. Writing a 1 to the bits will turn the respective LED on. Default state is 0 (LED off).

9.6.1.2 Port 2

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	IO7	IO6	IO5	RS232\ C-BUS	BOO TEN2	BOO TEN1	IRQN 2	IRQN 1	IO4	IO3	IO2	IO1	IO0

b15-13 Not available. Writing the port configuration or writing the state of these bits will have no effect. These bits will always read as 0.

b12-b10

I/O lines connected to Device 1. Can be configured as input or output (default is input).

Target kits may use these pins and require their states to be defined. Check the relevant kit's user manual.

- b9 RS232/C-BUS mode selection output line connected to Device 1 and Device 2. Always configured as output. Default state is 0.
- b8-b7 Boot mode selection output lines connected to Device 1 and Device 2. Always configured as outputs. Default state is 0.
- b6-5 Interrupt input lines connected to Device 1 and Device 2. Interrupts normally signal active low – therefore 0 = Interrupt. Always configured as inputs.
- b4-0 I/O lines connected to Device 1 and Device 2. Can be configured as input or output (default is input). Target kits may use these pins and require their states to be defined. Check the relevant kit's user manual.

NOTE: Device 1 – PE0003 J3, Device 2 – PE0003 J7

See commands: **Device**, **setdevice**, **getdevice**

Port, **getport**, **portc**, **portr**, **portw**

9.6.1.3 Port 3, 4, 5, 19

Any port value from 3 to 19 can be used to store variables. These data can be recovered by a subsequent script and used. This allows configuration data to be shared between scripts without having to having to configure each script or use an external file for configuration data.

```
;Process to store a variable value to be used by other script
port 3                               ;set the port to use
portw 1234                           ;store data

port4                                ;set port 4
portw mydata                         ;store data from variable

;Process to recover the value of the variable (it can be in a different script file)
port 3                               ;set the port to use
portr port_val                       ;read data from the port
                                     ;port_val = 1234

Port4                                ;set port 4
portr newdata                       ;newdata = mydata
```

9.6.2 Getport

Parameters - <var>

Description – Getport <var> reads the currently selected port into the variable <var>

Example Usage – None

Restrictions – None

9.6.3 Portc

Parameters - <any>

Description – Read a configuration word from C-BUS register address, variable or constant <any> and copy it to the current Port's data direction register. A 1 in a bit position sets the corresponding bit in the port to be an INPUT. A 0 sets it to be an OUTPUT. See the tables above for mapping of bits to pins.

Example Usage – None

Restrictions – Changes to unused bits will be ignored. Changes to bits with a fixed direction will be ignored.

9.6.4 Portw

Parameters - <any>

Description – Read a configuration word from C-BUS register address, variable or constant <any> and copy it to the current Port's hardware output pins.

Example Usage – None

Restrictions – Target kits may use these pins to determine start-up or running conditions. Certain bit states may have to be pre-defined or appropriately defined in use. Check the relevant kit's user manual for any restrictions.

9.6.5 Portr

Parameters - <var> or *<C-BUS>

Description – Read the current port and copy the value to variable <var> or C-BUS register address *<C-BUS>.

Example Usage – None

Restrictions – Target kits may use these pins to determine start-up or running conditions. Certain bit states may have to be pre-defined or appropriately defined in use. Check the relevant kit's user manual for any restrictions. Unconnected input pins will drift and return arbitrary values.

9.6.6 Ones

Parameters - <any>,<var>

Description – Count the number of ones in the value read from C-BUS register address, variable or constant <any> and put the result in variable <var>.

Example Usage –

```
ones #$0000,count           ;count = 0
ones #$1111,count           ;count = 4
ones #$1248,count           ;count = 4
ones #$aa55,count           ;count = 8
ones #$ffff,count           ;count = 16
```

Restrictions – None

9.6.7 Device

Parameters - <any>

Description – Selects the currently active Device (C-BUS pins on Connector J3 or J7) <any> Only values of 1 or 2 are valid.

Example Usage – see Script Examples, Example 2

Restrictions – None

9.6.8 Getdevice

Parameters - <var>

Description – Getdevice <var> reads the currently selected device into the variable <var>

Example Usage – None

Restrictions – None

9.6.9 Delay

Parameters - <any>

Description – Pauses script for a number of milliseconds equal to value <any>.

Example Usage –

```
delay 10                                ; pause script processing for 10ms
```

Restrictions – None

9.6.10 Microdelay

Parameters - <any>

Description – Pauses script for a number of microseconds equal to the value <any> multiplied by 10.

Example Usage –

```
microdelay 10                          ; suspend script processing for approx 100us
```

Restrictions – **Microdelay** is provided to obtain a shorter or less granular delay than **delay** provides. The resolution of **microdelay** is not guaranteed and can be greatly affected by time consuming tasks such as coincident USB activity. Do not use for critical timing delays.

9.6.11 Register

Parameters - #<const1>, #<const2>, #<const3>

Description – C-BUS registers comprise an address byte followed by zero or more data bytes. The **register** command allows the user to select a device (on PE0003 C-BUS port <const1>) and assign device C-BUS registers (<const2>) connected to that port with the number of data bytes (<const3>) that follows the address byte. If undeclared, C-BUS registers are assumed to require two data bytes after the address byte. Thus only C-BUS registers that require 0 data bytes (normally only General Reset) or 1 data byte, need be declared.

Example Usage –

```
Register 1, $01, 0                      ;Set C-BUS register $01 on device connected to  
                                         ;Port 1 to receive zero data bytes after the  
                                         ;address byte
```

Note that the second parameter, \$01, in the register command is a constant that represents a C-BUS register. Using * to indicate a C-BUS register is not used with **register** or a build error will occur.

Restrictions – **Register** can only be 1 or 2. Setting a C-BUS register to receive an incorrect number of data bytes may cause unexpected operation.

9.6.12 Logon, Logoff

Parameters - None

Description – Start or stop logging C-BUS transactions. **Logon** turns on a C-BUS tracing

feature that records all C-BUS transactions, with a timestamp, until a **logoff** is encountered. There can be more than one incidence of **logon** and **logoff** in the script. When the script completes or is aborted, the “See Trace” button on the GUI is enabled. When clicked, this button uploads the Log from the PE0003 SD card, if fitted. See the PE0003 User Manual for a description of this facility.

Example Usage – None

Restrictions – The trace facility is only available if an SD card is fitted in the PE0003 SC card slot. If a SD card is not fitted, the **logon** and **logoff** commands will be ignored. Trace logging places an extra load on the PE0003 and will cause the script to run more slowly. If buffer overflows or underflows occur, try disabling logging which allows script processing to run more quickly.

10 Error Messages

10.1 De-bug Messages

When a script is aborted the current line number is reported back to the GUI. The console will display script aborted at line number *n*.

10.2 Build Errors

Build errors are reported in the script console and show the script line number where the problem was encountered. An error may occur in a line preceding the line number at which the error is reported so check back from the line number given. In the case of missing **endif/endwhile** commands the line number for the unmatched **if/while** is given. The error messages are listed as follows:

- Unrecognised command
- If/while** without matching **endif/endwhile**
- Unresolved label(s)
- Command requires *n* parameters
- Parameter type not allowed
- Duplicate label

10.3 Runtime Errors

Runtime errors that occur on the PE0003 are always reported in the script console and give the value of the PC where the problem was encountered.

10.3.1 PC out of range

This means that the PC (i.e. the address of the next instruction) is not within the script. Check for unexpected **jmp**, **jsr** or **return** commands.

10.3.2 Invalid opcode

This means that the PE0003 is trying to execute a command it doesn't recognise.

10.3.3 Data index out of range

A fixed-size memory pool is assigned for variables, including arrays. A check is made to ensure that the available pool is not exceeded. This message signals that the variable addressed has exceeded the available pool size. Probably caused by excessive use of the `foo[bar++/--]` syntax. This message also occurs if the variable name used in a loop control argument has been misspelled or has not been declared. The line number returned in the error message will help identify the error.

10.3.4 Stack overflow

The stack is used to hold return addresses when **jsr** or **jsrc** commands are used. Overflow usually indicates repeatedly using **jsr** without a matching return. An overflow also occurs if jumps are used in loops or subroutines. Jumping leaves call data on the stack and eventually the stack will overflow.

10.3.5 Stack underflow

See Stack overflow above. Underflow usually results from using return without having first used **jsr**.

10.3.6 Micro text out buffer overflow

This is an error in the PE0003 buffer used to transfer data from the PE0003 to the GUI. An overflow indicates that data is being sent too fast. Commands that send data via this buffer include **disp** and **filew** so try inserting delays around these. Note that the actual strings are not sent over this link so reducing their length will not help. If script delays can be tolerated, use **waituplink**.

10.3.7 Micro File read buffer underflow

This is an error in the PE0003 File Buffer used to transfer data from the PE0003 to the GUI and will not normally underflow. Data may underflow if the script uses the data faster than the GUI can supply it. Use the data more slowly by inserting delays or use the **waitfile** command. Also ensure that the number of host PC applications running are minimised and disconnect other USB devices that are not necessary.

10.3.8 Micro File read buffer overflow

This is an error in the PE0003 buffer used to transfer data from the GUI to the PE0003. The amount of data in the buffer is monitored and managed by the PE0003 in such a way that it should never overflow. See advice on Micro File read buffer underflow above.

10.3.9 Attempt to read past end of file

An attempt has been made to read more data than is available from a file on the host PC. This may be an indexing error or not checking for data of the correct format. Use the variable in the **fopenr** to check that the file is not empty and then to control the number of read cycles executed.

10.3.10 Invalid Jump Destination

This means that the value which a **jmp**, **jsr** return, if or while command is trying to write to the script program counter (i.e. the address of the next instruction) is not within the script.

10.3.11 Attempt to reference non-existent string

This means that the PE0003 has passed up a string reference that the GUI doesn't recognise. The GUI couldn't open the file specified. Check access permissions.

10.3.12 Unable to open file

The GUI couldn't open the file specified. Check the file exists and that filename and path are correct. Also check the permissions allow access for reading or writing as appropriate.

10.3.13 Error - RX Queue is full.

This is an error in the host PC buffer used to transfer data from the PE0003 to the GUI. An overflow indicates that data is being sent too fast. Commands that send data via this buffer include **disp** and **filew**. Limit the use of **disp** and try inserting delays around **filew** to find the source of errors. Note that the contents of the string are not sent over this link, so reducing the length of the strings will not help.

10.3.14 Uplink buffer is smaller than requested space

This means that **waituplink** has requested more space than the size of the buffer. The buffer on the PE0003 can hold 200 messages.

10.3.15 UART overflow / USB comms error / USB queue full /Serial framing error

These all relate to problems with the USB link between the PE0003 and the GUI. Sending less data may help, or using a faster PC.

10.3.16 Other possible errors

Ensure that all incidences of a variable or constants are spelt identically including case. These are NOT tested in loops or conditional expressions during compilation. A misspelt variable or constant is effectively a new item but it will not have been declared. The scripting tool will exit abnormally at runtime when it tries to process the misspelt item.

Ensure that evaluations are complete. Use of **elseif** without a condition will NOT be identified during compilation. The scripting tool will exit abnormally at runtime when it tries to process the evaluation.

11 Script Examples

11.1 Example 1

```
;*****  
;Send a General Reset to device 1  
;*****  
GEN_RESET      const $01  
  
    register 1, GEN_RESET, 0          ;Set C-BUS port $01 on Device 1 to receive  
                                       ;zero data bytes following the address byte  
    copy #0 *GEN_RESET               ;Send General Reset  
    stop                             ;End of script
```

11.2 Example 2

```
;*****  
;Copy a block of data from one device to another  
;Consecutive reads of a data block are not possible on all CML devices  
;*****  
Bar      buffer 10  
Index    word 0  
  
    device 1                          ;Select device 1  
    copy #0, index  
    while index < #10  
        copy *$B5, bar[index++]      ;Read from C-BUS, store in bar[n]  
    endwhile                          ;and increment index  
  
    device 2                          ;Select device 2  
    copy #0, index  
    while index < #10  
        copy bar[index++], *$A7      ;Read from bar[n] write to C-BUS  
    endwhile                          ;and increment index  
  
    stop                              ;End of script
```

11.3 Example 3

```
;*****  
;Copy from one device to another using streaming C-BUS  
;*****  
bar      buffer 10  
RxDat    const $B5  
TxDat    const $A7  
  
    device 1                          ;Select device 1  
    read *RxDat, bar[0], #10          ;Read from C-BUS and store in bar[n]  
  
    device 2                          ;Select device 2  
    write bar[0], *TxDat, #10         ;Read from bar[n] and write to C-BUS  
    stop                              ;End of script
```

11.4 Example 4

```
;*****
;Read from a file into a C-BUS address, controlled by flags
;*****

count    word 1
status   word 1
temp     word 1

fopenr   "inputfile.txt","%04X"      ;Tell host PC to open file & stream data
cls                      ;Clear console

copy #0, count                ;Set up loop counter
while count < #32             ;Start while loop
    filer temp                ;Read from file
    write temp, *$A7          ;Write to C-BUS
    jsr  read_and_wait        ;Wait for status flag
    add  #1, count            ;Increment counter
    disp "Written %d values.\n", count ;write to console
endwhile                      ;End of while loop

dialog "Finished"             ;Send end to message box
stop

read_and_wait
copy *$C1, status             ;Read C-BUS address $C1 into variable
and  #$0010,status            ;Mask off the wanted bits
jmpc status != #$0010, read_and_wait ;If bit 4 not set, try again.
return
```

Note that if data is consumed by the script (**filer** in **while** loop) at a rate faster than the PC can supply it, a buffer underflow may occur – see Micro File read buffer underflow for further information.

11.5 Example 5

```
;*****
;This script is to test an encode from the vocoder in the EV8610 kit.
;Vocoder mode is set from an external file, CodecSetup.txt file, which can be found at the
;end of this example.
;Interrupt driven.
;The sound source is from a PC sound card.
;*****

;Variables
CodeMethod word #$37 ;read external file to set these to
                    ;something other than default
FrameSize word #$1B ;External file format:
                    ;CodeMethod <CR> FrameSize <CR>
count word 0 ;G/P counter
Port2cpy word 0 ;Copy of Port2
Status word 0 ;Shadow Status
templ word 0 ;G/P register
Frame buffer 144 ;buffer to read streaming C-Bus. Could be
                    ;up to 144 bytes
FrameCount word 0 ;Counter to count the number of frames
                    ;saved to disc

;Register defines - device, C-Bus reg, no of bytes
register #1 #$09 #1 ;Powersave
register #1 #$07 #1 ;VCFG-Vocoder Configuration
register #1 #$2E #1 ;SVCACK - Service Acknowledge
register #1 #$05 #1 ;AIG - Analogue Input Gain
register #1 #$06 #1 ;AOG - Analogue Output Gain
register #1 #$30 #1 ;ENCFRAME # - Encoded frame

fopenr "CodecSetup.txt" "%02x" ;Get vocoder mode from external file
filer CodeMethod
filer FrameSize

setvect 1 WaitIRQn1 ;Set interrupt 1 vector

;Open the file for the encoded frames - the PC takes a short time to open files and pass
;back handles
Fopenw "Vocoder.smp"

;Configure the CMX618
jsr GenReset ;Subroutine to Reset the CMX618
intson ;turn on the interrupts

jsr WaitRDY ;wait until RDY flag is set
copy #$03 *$09 ;Codec/Bias=Enable
copy #$0F *$05 ;MicAmp=0dB, IPGain=22.5dB
copy #$8001 *$1F ;unmask VDA IRQ (RDY already unmasked by default)
copy CodeMethod *$07 ;default - HardCoding, FEC=Enable,
                    ;2400bps, 3x20msFrames

jsr WaitRDY ;Wait for configuration to complete
jsr SvcAck ;Service acknowledged? SvcAck checks can be
                    ;removed once code is stable.

delay 100 ;Wait for VBIAS to settle

copy #$0002 *$11 ;Turn on encoder
jsr WaitRDY ;This is another service
jsr SvcAck

disp "Recording Started"
copy #0 FrameCount

Recording
jsr WaitVDA ;wait for an encoded sample
read *$30 Frame[0] FrameSize ;load Frame buffer with 27 bytes(default)
copy #0 count ;reset counter
while count < FrameSize ;write the buffer to the PC file
    filew "%02x" Frame[count++]
endwhile
add #1 FrameCount ;update the frame counter
jmpc FrameCount < 200 Recording ;Set the maximum recording length here
                    ;(200x60ms by default)

EndRecording
copy #$0000 *$11 ;Turn off vocoder
```

```

    jsr    WaitRDY                                ;Another service
    jsr    SvcAck
    intsoff                                     ;Turn off the interrupts disp "Recording Stopped"
    disp   "%d Frames stored" FrameCount

    stop

;*****Wait on IRQN1*****
;ISR. When the IRQN pin goes low on the CMX618 this ISR will run

WaitIRQN1
    copy   *$40 Status                          ;Read Status
    rfi

;*****

;*****wait for flags*****
;Wait here for an interrupt to set the appropriate flag
WaitRDY
    copy   Status templ
    and    #$8000 templ
    jmpc   templ != #$8000 WaitRDY
    and    #$7FFF Status                        ;Clear the Ready flag in shadow
    return

WaitVDA
    jmpc   templ != $0001 WaitVDA                ; copy Status templ and #$0001 templ
    and    #$FFFE Status                        ;Clear the VDA flag in shadow
    return

;*****

;*****General Reset*****
GenReset
RESET    const $01                             ;C-Bus register definition
         register #1 RESET #0                   ;C-Bus register requires 0 bytes

         copy   #0 *RESET
         return

;*****

;*****Read Ack from SVCACK*****
;Poll here until the SVC flag is set.
SvcAck
    copy   *$2E Status                          ;Copy SVCACK reg to status
    and    #$0001 Status                        ;mask for ACK flag
    jmpc   Status != #$0001 SvcAck              ;loop until SVC flag set
    return

;*****

;*****
CodecSetup.txt file
;*****
;This external text file is used to set the required codec format.
;Format:
;    CodeMethod (hex)
;    FrameSize (hex)
;Remove the ';' at the beginning of the line for the two values required.
;Only the first two incidences matching the fopenr format will be used.
;The other codec formats can be easily added except those using soft bit coding.

;2050bps, 1x20ms
;01
;06

;2400bps, 3x20ms
37
1B
;2750bps, 3x20ms, FEC, Hard bits
;3B
;1B

```

```
;2050, 4x20ms, FEC, Hard bits
;30
;24

;2750, 4x20ms, FEC, Hard bits
;38
;24
```

11.6 Example 6

```
;*****
;This script fragment uses the ones command in a bit error rate (BER) test.
;A copy of the being data sent from the far-end modem is in the file
;data.txt. This file is read and compared to the data received by the modem.
;Any bit differences are flagged as ones (bit=1) which can be counted.
;*****

count          word 0
rx_data        word 0
file_data      word 0
error_bits     word 0
tot_error_bits word 0

fopenr  "data.txt", "%04X"          ;Open file with expected data.

while (count < 100)                ;Do 100 words.
  while (*$AB != 1)                ;Wait for modem to indicate word received.
  endwhile
  copy  *$12, rx_data              ;Read word from modem.
  filer file_data                  ;Read word from file.
  xor   file_data, rx_data          ;Compare.
  ones  rx_data, error_bits         ;Count bits which are different.
  add   error_bits, tot_error_bits  ;Keep running total.
  add   #1, count                  ;Increment count
endwhile

disp  "Received 100 words, %d bits in error", tot_error_bits
stop
```

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