MODULUS – Ptolemy

EGSE Software User Manual (SUM)

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Prepared by: …… *Date:* ……
Alan Larman

Approved by: …… *Date:* ……
Andrew Morse

Authorised by: …… *Date:* ……
S. J. Barber

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1 Introduction

1.1 Scope

This document has been written as a user manual for the Ptolemy EGSE software as well as to provide sufficient information for the basic running of the Ptolemy instrument via the EGSE software with appropriate hardware.

1.2 Applicable Documents

AD1 RO-LPT-RAL-TN-3403 Ptolemy Telecommand and Telemetry Definitions
Issue 5 26th February 2001

AD2 RO-LPT-OU-TN-3401 Ptolemy Hardware/Software Interface Document
Issue 5 3rd April 2001

1.3 EGSE Software Overview

The EGSE software is separated into two self contained executable files (.exe extension):

Pto Egse1.1.exe – This program handles all the incoming telemetry, housekeeping and Science from the instrument. The form structure is shown in Figure 1-1. This figure shows the possible transitions from one form to another that are possible (shown as arrows) and which menu the come under (text, export , etc).

STARTER.exe – This program handles command generation, checking, simulation and transmission. The form structure for this program is shown in Figure 1-2. The octagonal shaped icons indicate file type output and the graphical arrows are used to show at what points information is transmitted to the instrument.

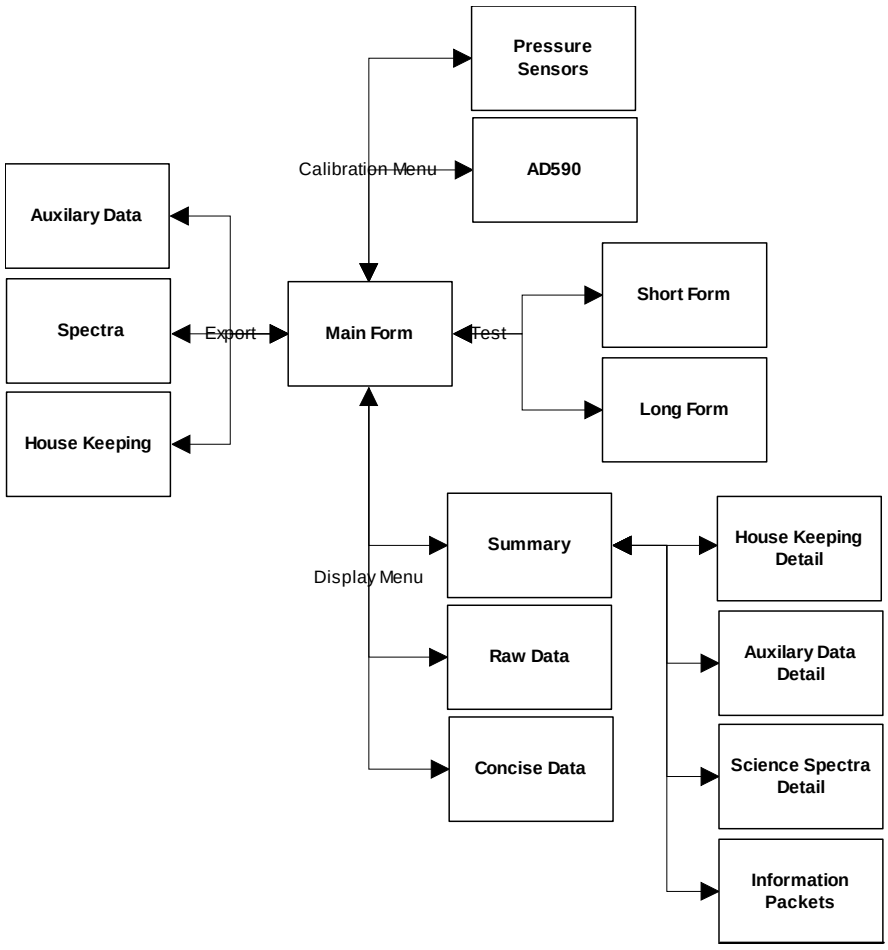


Figure 1-1 Form Structure for Pto Egse1.1.exe

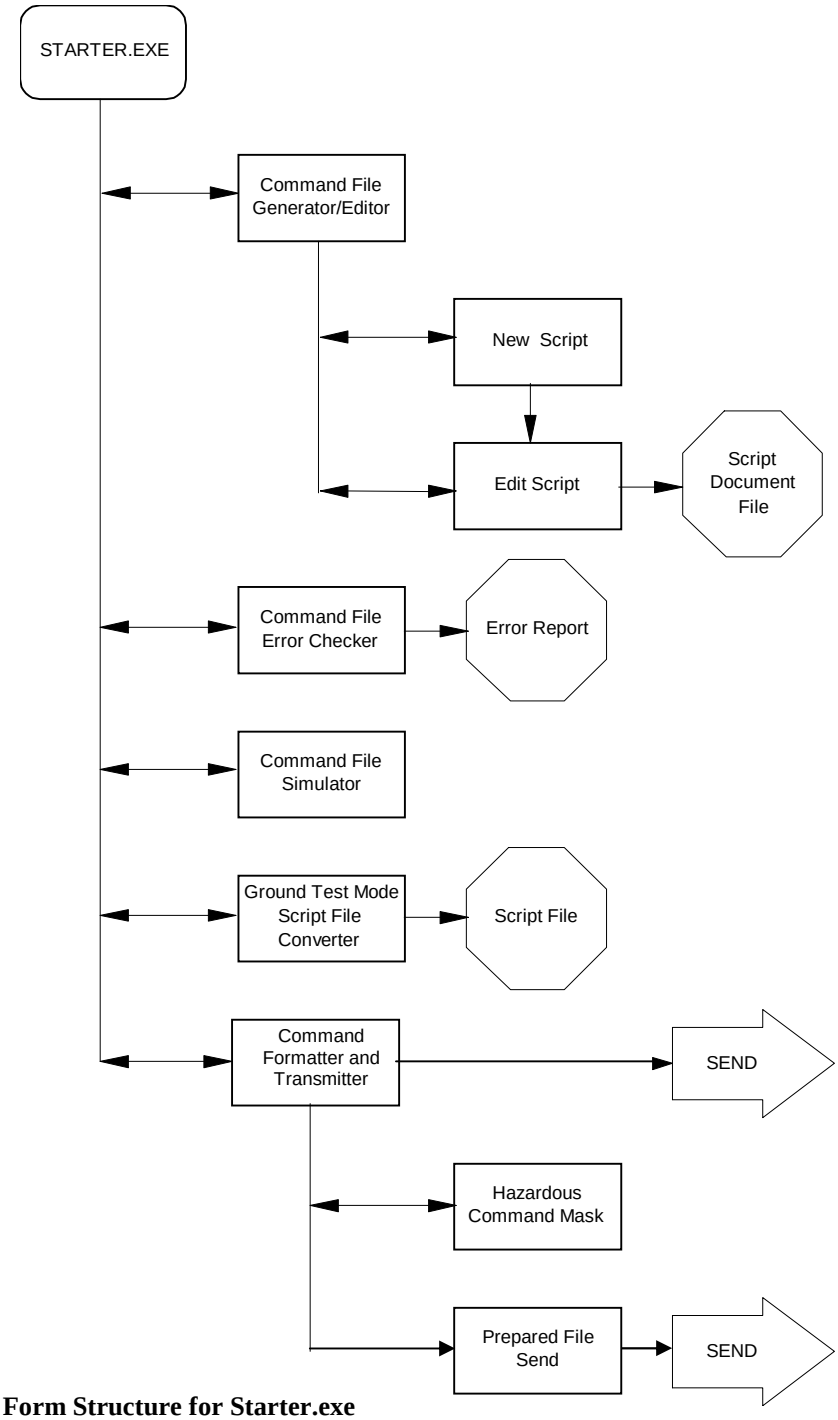


Figure 1-2 Form Structure for Starter.exe

2 STARTER.EXE

2.1 Warning and Safety Information

All commands in the 'Command File Generator/Editor' section of this document (pages 24 to 43) will have any important warning and safty information included with each command. This information will be presented in a red bordered text box similar to the one shown in Figure 2-1.

Warning and Safety Information

Example
There are no special limits or requirements for this command.

Figure 2-1 Example of a 'Warning and Safety Information' Textbox

2.2 STARTER.EXE Overview

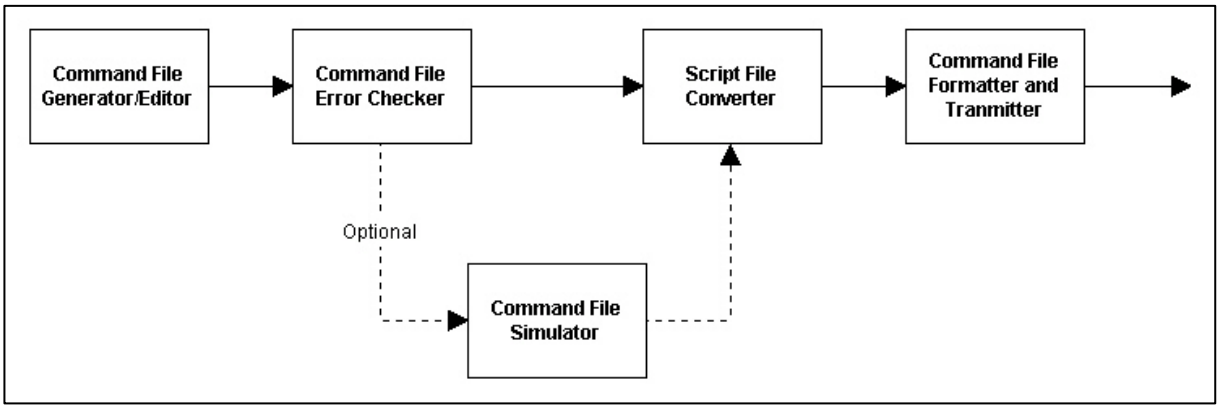


Figure 2-2 Module Flow Diagram

STARTER.EXE allows the user to generate script files, test for errors, simulate the script, convert to raw hex, and finally to send the converted script files to the instrument. The common order for these steps is the order in which they appear in the menu but this is also shown in Figure 2-2. It should be noted that the simulation phase is not essential but is recommended. A module flow diagram, showing the module being described in red, will appear at the beginning of each section.

2.3 Starting STARTER.EXE

The Command transmission part of the EGSE program is performed by a file called STARTER.EXE. STARTER.EXE will appear on the desktop as an icon similar to the one shown in Figure 2-3. Double click this icon to start the program.

Figure 2-3 STARTER.EXE desktop icon

Upon execution you will be presented by the menu shown in Figure 2-4.

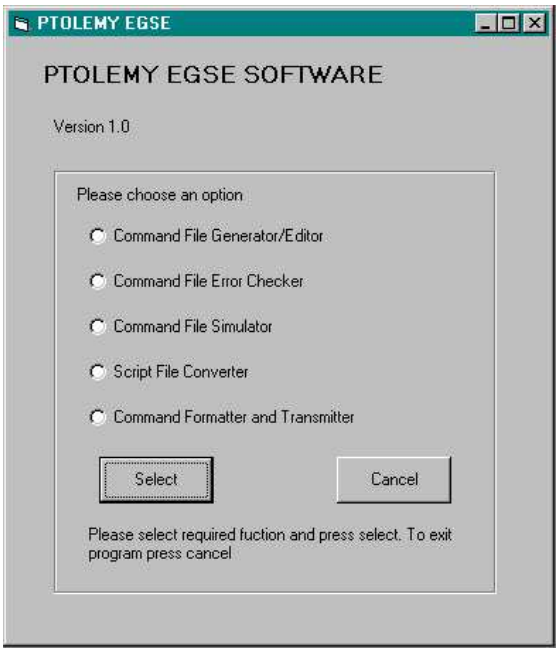


Figure 2-4 STARTER.EXE Start-up form.

At this stage you simply select the action you wish to perform and press the 'Select' button to continue. To exit STARTER press the 'Cancel' button. Detailed instructions describing the use of the individual components of this program are handled in sections 2.4 to 2.8.

2.4 Command File Generator/Editor

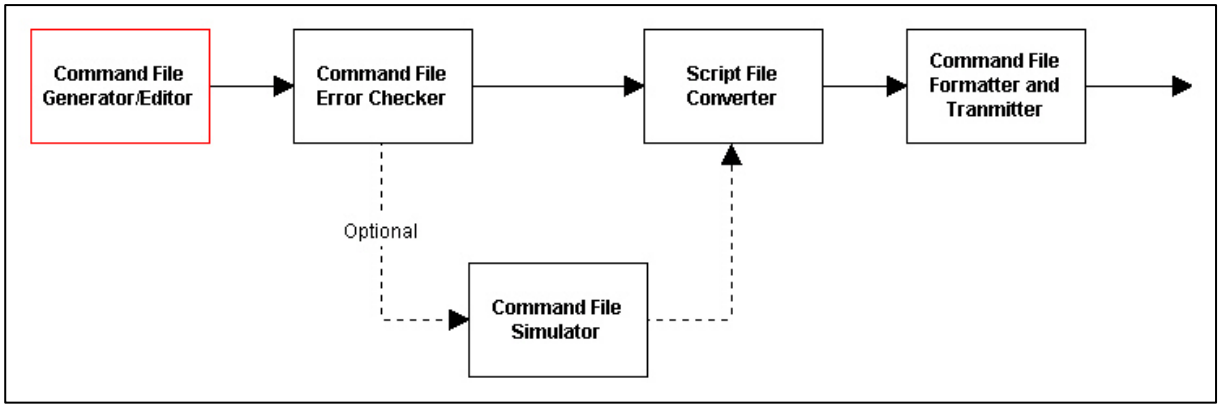


Figure 2-5 Module Flow Diagram – Command File Generator/Editor

The first step of the process (see Figure 2-5) is to select 'Command File Generator/Editor' from the 'Starter.exe' main menu (see Figure 2-4) you will be presented with the screen shown below in shown in Figure 2-6. This is essentially a blank form using a menu bar at the top of the form.

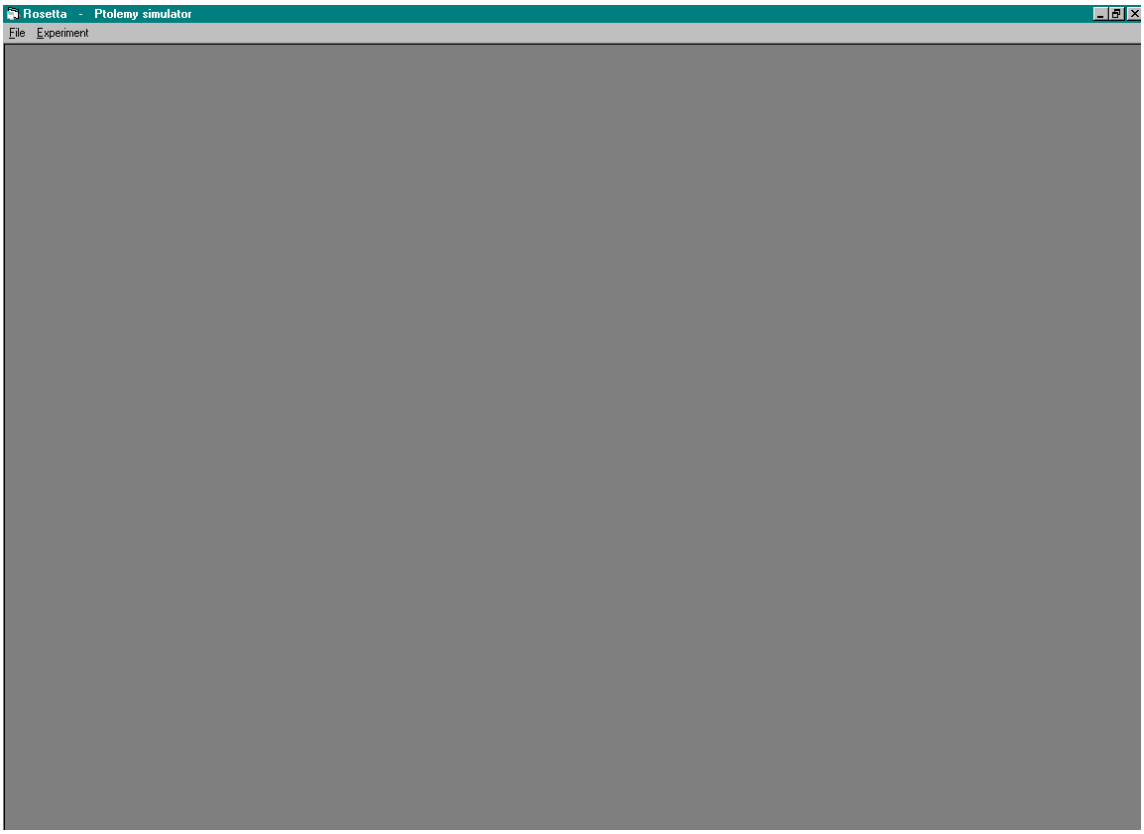


Figure 2-6 The Command File Generator/Editor Start-up Screen

There are two menu options 'File' and 'Experiment'. The File Menu, shown expanded in Figure 2-7, only has one option 'Exit'. This option exits this program and returns you to the 'Starter.exe' start-up form.

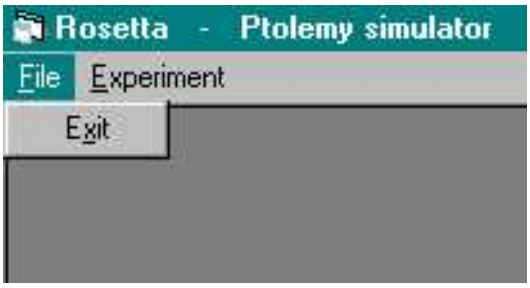


Figure 2-7 The File Drop-down Menu

The 'Experiment' menu has five options: Load Experiment, Save Experiment, Save Experiment As, Edit Experiment and New Experiment (see Figure 2-8). The following bulleted sections deal with each of these menu commands and closes with a general section on 'Script Writing/Editing'.

NOTE that in order to 'Edit' an experiment it must **first** be loaded using the 'Load' command.

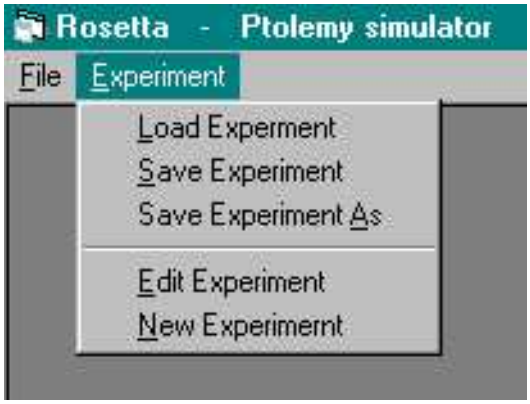


Figure 2-8 The Experiment Drop-down Menu

➢ **Load Experiment**

Having selected 'Load Experiment' (the first option in the 'Experiment' menu) the first of two 'Open' common dialog boxes appears. The first is shown in Figure 2-9.

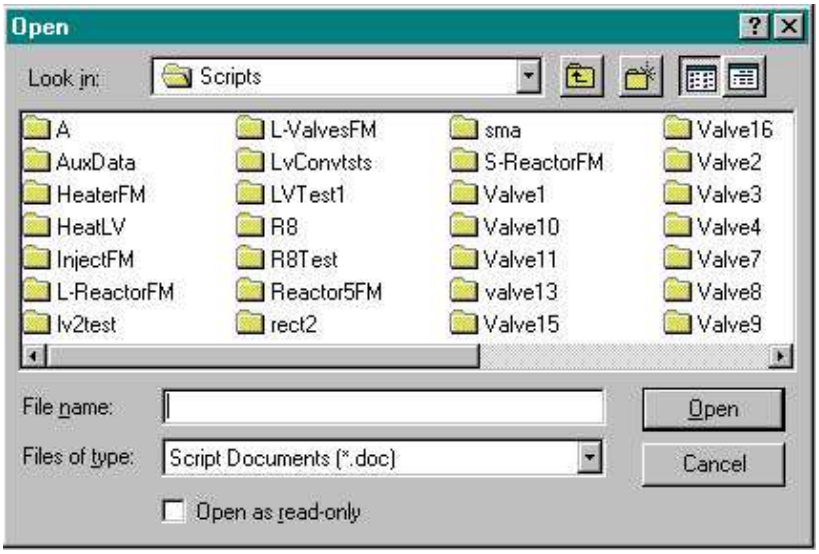


Figure 2-9 The First 'Open' Common Dialog Box

Once the First common dialog box appears simply select the sub-directory corresponding to the file name you wish to Edit. Say, for example, you clicked the subdirectory HeaterFM (third item in the first column). A common dialog box similar to Figure 2-10 would then appear.

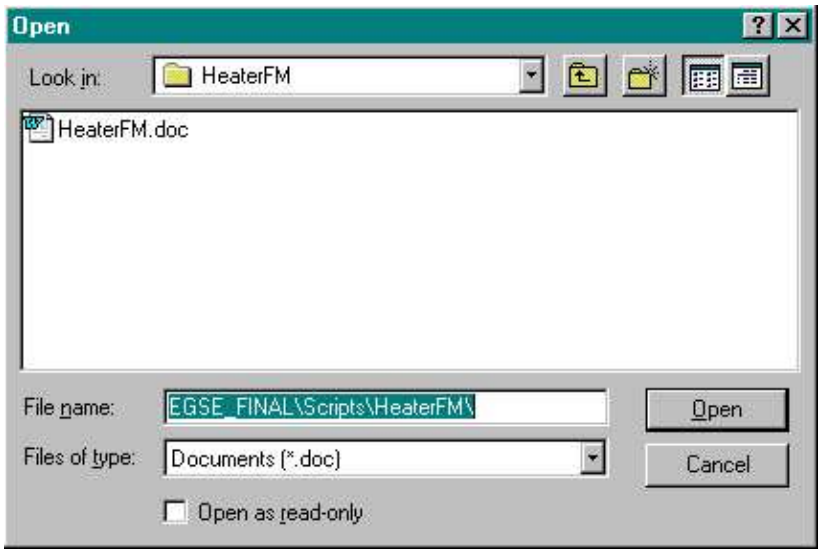


Figure 2-10 The Second 'Open' Common Dialog Box

Once you have selected the file you wish to load and selected it the 'Edit Experiment Script Form' will appear (shown in Figure 2-12).

- **Save Experiment**

Having selected 'Save Experiment' (the second option in the 'Experiment' menu) the program will overwrite the current copy of the script file with a new one.

NOTE the overwrite will occur **without** asking for further confirmation.

- **Save Experiment As**

Having selected 'Save Experiment As' (the third option in the 'Experiment' menu) the 'Save As' common dialog box will appear as shown in Figure 2-11. The default directory is the one you loaded from of the one associated with the new file you have written. The default name can be changed if you require other wise you will write over the original in a similar manner to the 'Save' command

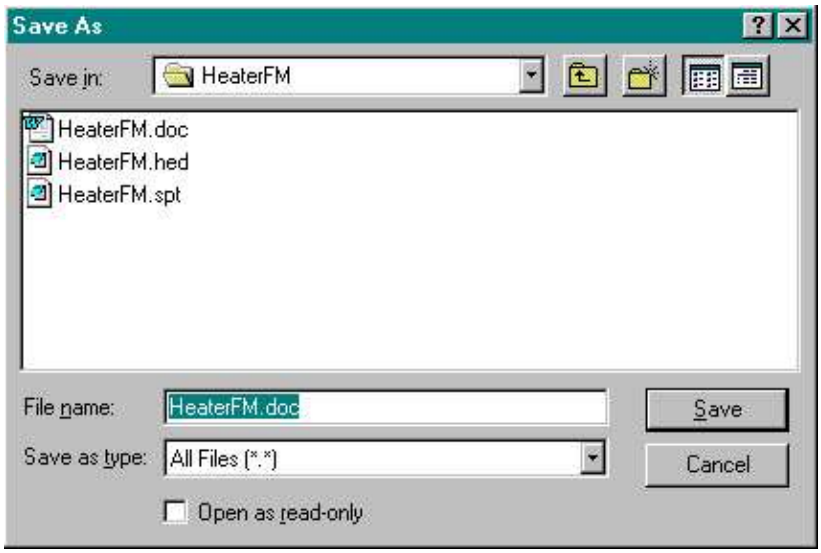


Figure 2-11 The Save As Common Dialog Box

➢ **Edit Experiment**

If 'Edit Experiment' (the forth option in the 'Experiment' menu) is chosen then the following screen will appear (see Figure 2-12). See the 'Script Writing/Editing' section starting on page 22 for more details of how to generate/edit script files.

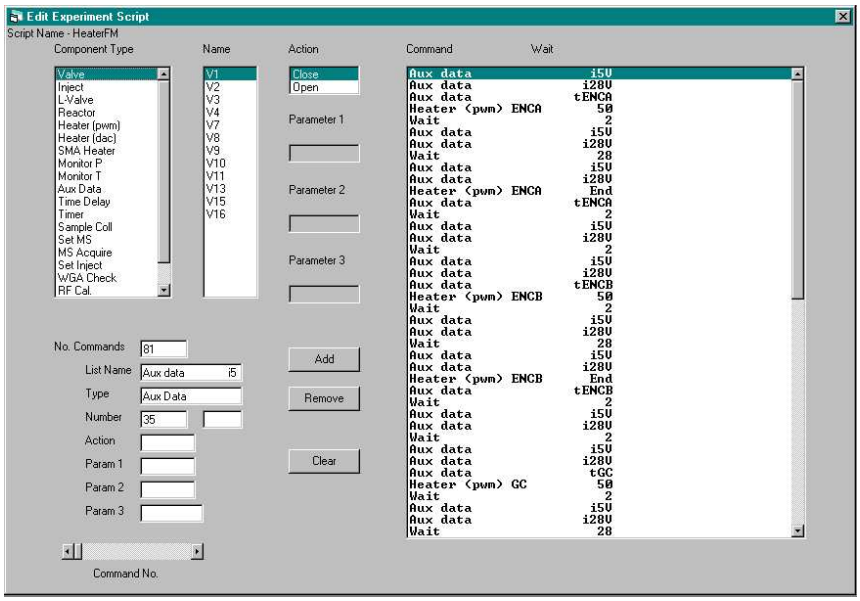


Figure 2-12 Edit Experiment Script Form – Edit Mode

➢ **New Experiment**

If 'New Experiment' (the fifth and final option in the 'Experiment' menu) is chosen then the following screen will appear (see Figure 2-13).

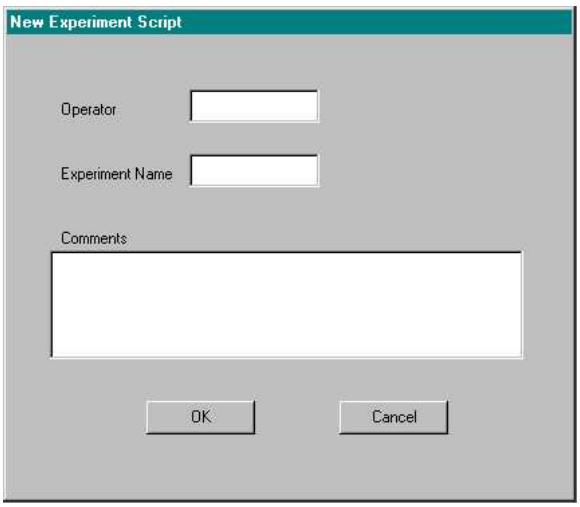


Figure 2-13 New Experiment Form

Once this has been completed the menu shown in Figure 2-14 will appear. This is essentially the same form used it the 'Edit Experiment' command except the list box located to the left of the form will be blank. See the 'Script Writing/Editing' section starting on page 22 for more details of how to generate/edit script files.
NOTE the form that appears to write the script is the same as the edit form and will say 'Edit Experiment Script' in the title bar. This **is** perfectly normal.

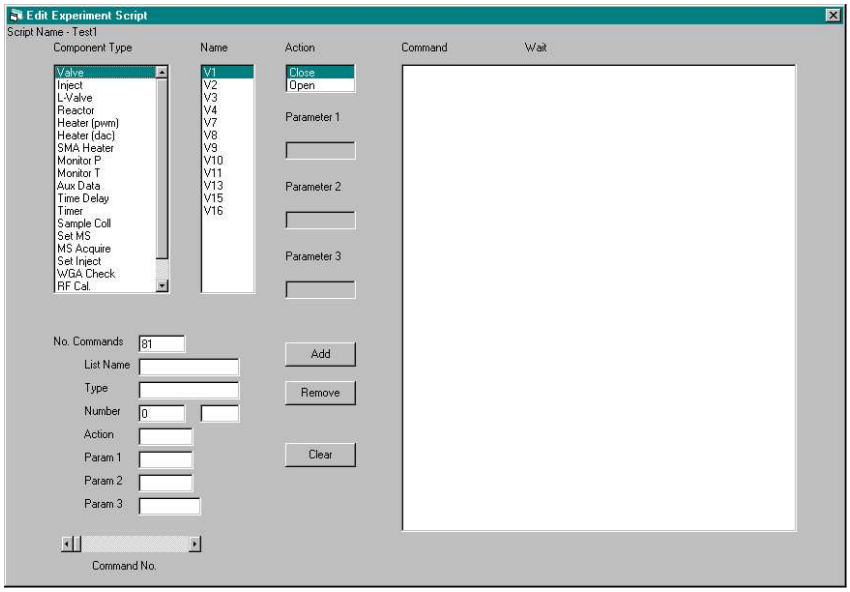


Figure 2-14 Edit Experiment Script Form – New Experiment Mode

➢ **Script Writing/Editing**

Table 1 shows a breakdown of all commands available in a mode event sequence. Each command is dealt with individually later in this section.

Command	Designator	Action	Parameter 1	Parameter 2	Parameter 3
Valve	<Valve>	Open Close	- -	- -	- -
Inject	VA, VB, VC	-	-	<Inject Time>	-
L-Valve	<L-Valve>	Open Close	<Target Pressure> -	<Max Power> -	<P Gauge> -
Reactor	<Reactor>	Begin End	<Target Temperature> -	<PW Start> -	<PW Length> -
Heater (pwm)	<Heater>	Begin End	<Target Temperature> -	<PW Start> -	<PW Length> -
Heater (dac)	<L-Valve>	Begin End	<Target Temperature> -	<Max Power> -	- -
SMA Heater	<SMA>	Begin End	- -	- -	- -
Monitor P	<P gauge>	-	<Target Pressure>	<Time out>	-
Monitor T	<T sensor>	-	<Target Temperature>	<Time out>	-
Aux Data	<Sensor>	-	-	-	-
Time delay	-	-	-	<Time>	-
Timer	-	Start Wait	- -	<Time> -	- -
Sample Coll	-	Dock Undock	- -	<Max Power> -	- -
Set MS	<Ion Table> -	On Off	- -	- -	- -
MS Acquire	<Ion Table>	-	<WGA>	<No. Spectra>	<Repeat Pd>
Set Inject	<P gauge>	-	<K1>	<K2>	-
WGA Check	-	-	-	-	-
RF Cal.	-	-	-	-	-
DS Cal.	-	-	-	-	-
EOM	-	-	-	-	-

Table 1 Command Breakdown Template for All Commands

<Valve>	V1, V2, V3, V4, V7, V8, V9, V10, V11, V13, V15, V16
<L-Valve>	LV1, LV2, LV5, LV6, LV7, LV[GT]
<Reactor>	R1, R2, R4, R5, R6, R7, R8, R9, R13, R15, Oven
<Heater>	ENCA, ENCB, PIPE, GC, ION
<SMA>	SMA1, SMA2
<P Gauge>	G1, G2, G3, G4, G5
<T Sensor>	tR1, tR2, tR4, tR5, tR6, tR7, tR8, tR9, tR13, tR15, tOven, tENCA, tENCB, tPIPE, tGC, tION, tLV1, tLV2, tLV5, tLV6, tLV7, tLV[GT]
<Sensor>	<T Sensor>, pG1, pG2, pG3, pG4, pG5, AD590, vDS, iNT,vDET, v5V, v28V i5V, i28V, RFCAL

<Inject Time>	is in units of 10 milliseconds 2 - 400, or 65535 (use <tK1>), or 65534 (use <tK2>).
<Target Pressure>	is in bar.
<Temperature>	is the target temperature in ^{o}C.
<Max Power>	is in DAC units and is 8 bits (0 - 255)
<PW Start>	is in DAC units and is 8 bits (0 - 255)
<PW length>	is in DAC units and is 8 bits (0 - 255)
<Time Out>	In units of seconds and is up to two bytes long
<Time>	In units of seconds and is up to two bytes long
<Ion Table>	Ion trap electrical characteristics table from IT 0 to IT 17
<WGA>	WGA scan function number from 1 to 17
<No. Spectra>	Number of mass spectra, maximum of 1024
<Repeat pd>	Spectrum repeat period, in units of one tenth of a second
<K1>*	Constant value, supplied by the Set Inject command.
<K2>*	Constant value, supplied by the Set Inject command.

*The variable <Kx>, is calculated as <Kx>/<Pgauge>. Minimum 2, maximum 400

2.4.1 Valve

The 'Valve' command is used to open/close 2- and 3-way 'clippard' style valves. To open a valve simply highlight 'Valve' from the 'Component Type' column (having done this the option menus should look similar to Figure 2-15). Then highlight the valve number from the 'Name' column and lastly highlight the required action from the 'Action' list and press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

There are no special limits or requirements for this command.

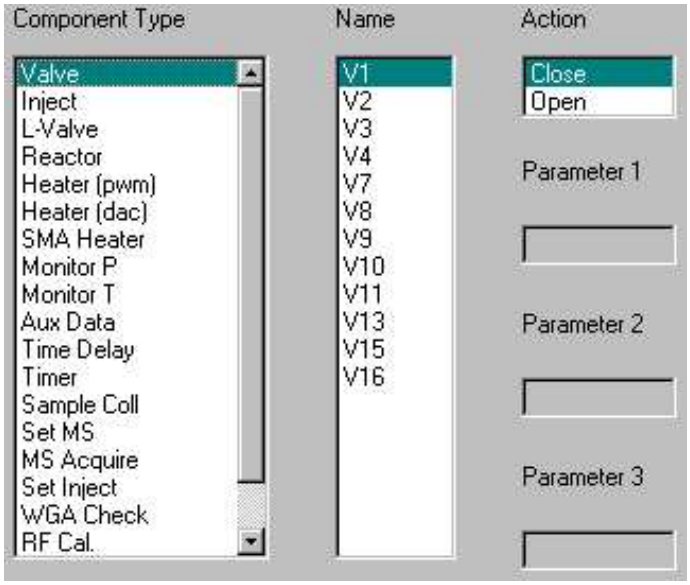


Figure 2-15 Option Menus for the Valve Command

2.4.2 Inject

The 'Inject' command actuates the injector valves. To actuate a valve simply highlight 'Inject' from the Component Type' column (having done this the option menus should look similar to Figure 2-16). Next highlight the valve letter from the second column and lastly enter the activation duration (in units of milliseconds 2-400, 65535 for K1 or 65534 for K2) in the parameter 2 text box and press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

There are no special limits or requirements for this command.

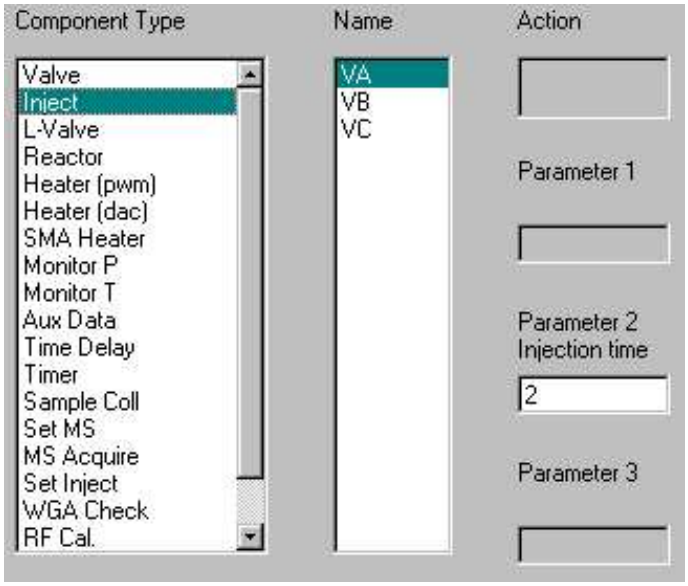


Figure 2-16 Option Menus for the Inject Command

2.4.3 L-Valve

The 'L-Valve' command is used to open/close the 'Lindau' style valves. To open/close a valve simply highlight 'L-Valve' from the 'Component' column (having done this the option menus should look similar to Figure 2-17). Next highlight the valve number from the 'Name' column and enter the Target pressure (in bar) in the 'Target pressure' text box. Next in the 'Parameter 2' text box enter the maximum power, and in the 'Parameter 3' Text box enter the required pressure gauge number (1-5). Finally press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

For all LV's: Do NOT power if the background temperature is >60°C this may lead to accidental activation and the release of either hydrogen or high-pressure carrier gasses.

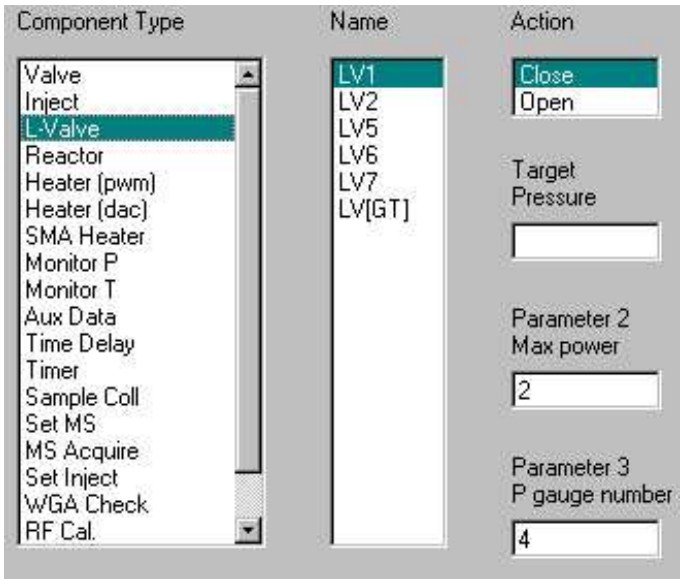


Figure 2-17 Option Menus for the L-Valve Command

2.4.4 Reactor

The 'Reactor' command is used to operate both the small and large reactors. To operate a reactor simply highlight 'Reactor' from the 'Component' column (having done this the option menus should look similar to Figure 2-18). Next highlight the reactor number from the 'Name' column and enter the Target temperature in the 'Target Temperature' text box. Next in the 'Parameter 2' text box enter the PWM Start value, and in the 'Parameter 3' Text box enter the PWM length value (0-255). Finally press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

For all Reactors: Do NOT heat using full power (PWM <40) if in air as this may lead to release of reference gasses including fluorine.

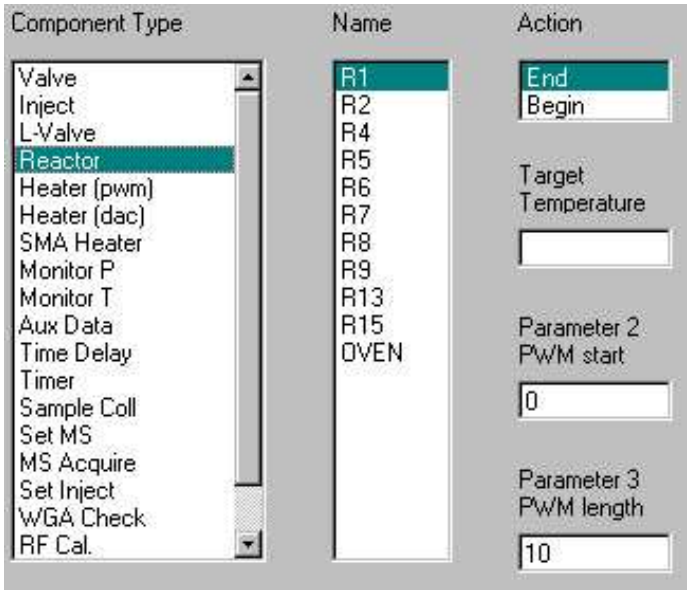


Figure 2-18 Option Menus for the Reactor Command

2.4.5 Heater (pwm)

The 'Heater (pwm)' command is used to operate the Pulse Width Modulated controlled heaters. To operate a heater simply highlight 'Heater (pwm)' from the 'Component' column (having done this the option menus should look similar to Figure 2-19). Next highlight the heater name from the 'Name' column and chose end/begin from the 'Action' list box. Next in the 'Target Temperature' text box enter the target temperature, in the 'Parameter 2' text box enter the PWM Start value, and in the 'Parameter 3' Text box enter the PWM length value (0-255). Finally press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

There are no special limits or requirements for this command.

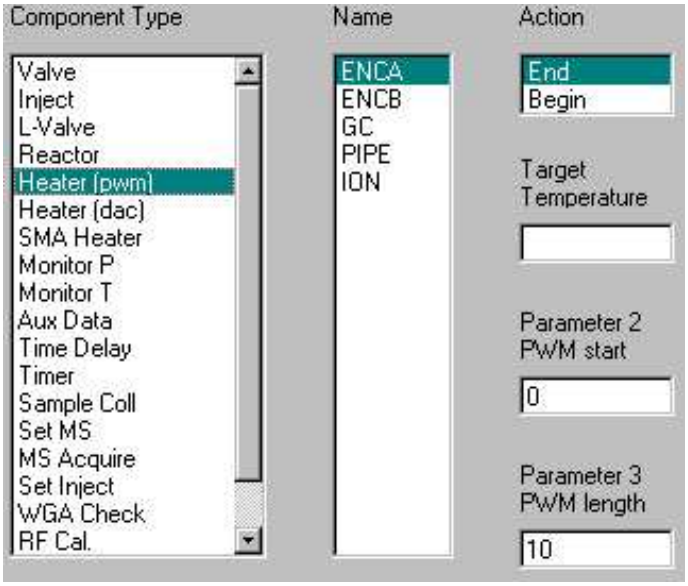


Figure 2-19 Option Menus for the Heater (pwm) Command

2.4.6 Heater (dac)

The 'Heater (dac)' command is used to operate the Lindau type valve heaters. To operate a heater simply highlight 'Heater (dac)' from the 'Component' column (having done this the option menus should look similar to Figure 2-20). Next highlight the heater name from the 'Name' column and chose end/begin from the 'Action' list box. Next in the 'Target Temperature' text box enter the target temperature, and in the 'Parameter 2' Text box enter the maximum power. Finally press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

For all LV's: Do NOT power if the background temperature is >60°C this may lead to accidental activation and the release of either hydrogen or high-pressure carrier gasses.

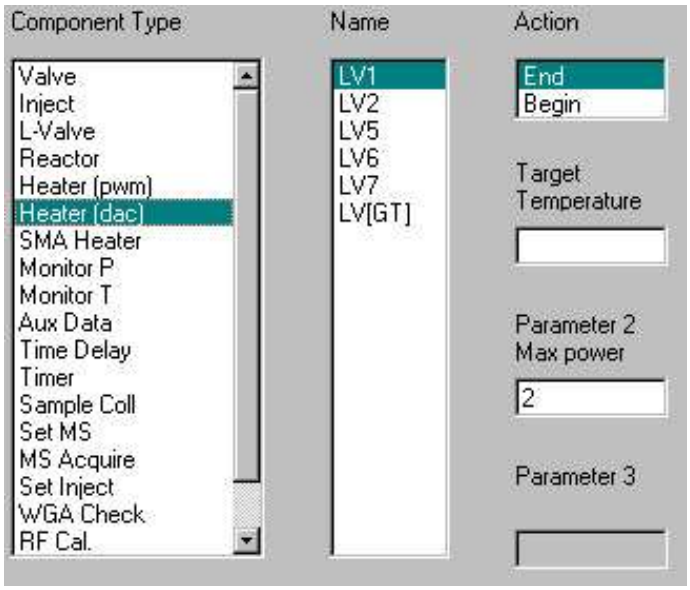


Figure 2-20 Option Menus for the Heater (dac) Command

2.4.7 SMA Heater

The 'SMA Heater' command is used to operate the SMA. To operate a heater highlight 'SMA Heater' from the 'Component' column (having done this the option menus should look similar to Figure 2-21). Next highlight the heater name from the 'Name' column and chose end/begin from the 'Action' list box. Finally press 'Add' (located just below the 'Parameter 3' text box).

Warning and Safety Information

Do NOT power if the background temperature is >-50°C this may lead to accidental activation. Maximum duration of operation 4 seconds. Once heated allow >2 minutes for cooling before powering again

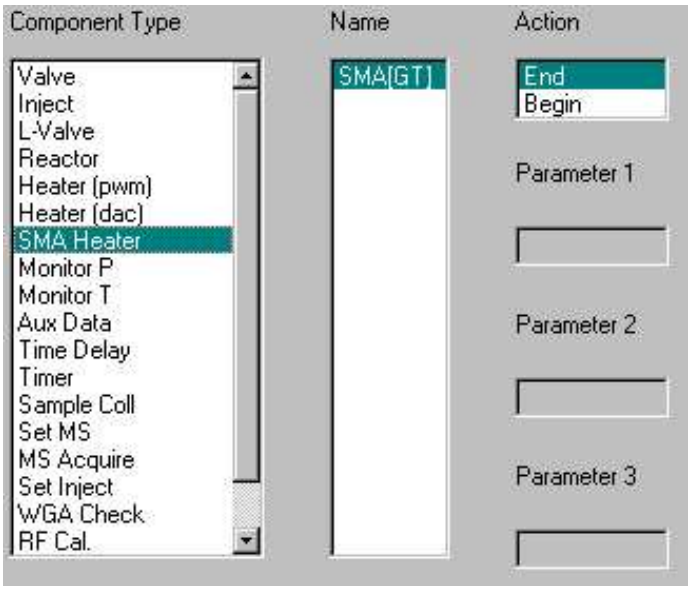


Figure 2-21 Option Menus for the SMA Command

2.4.8 Monitor P

The 'Monitor P' command is used to monitor pressure sensors. To instigate a monitor pressure event simply highlight 'Monitor P' from the 'Component' column (having done this the option menus should look similar to Figure 2-22). Next highlight the gauge name from the 'Name' column, in the 'Target Pressure' text box enter the target pressure, and in the 'Parameter 2' Text box enter the duration. Finally press the 'Add' button (located just below the 'Parameter 3' text box.

Warning and Safety Information

There are no special limits or requirements for this command.

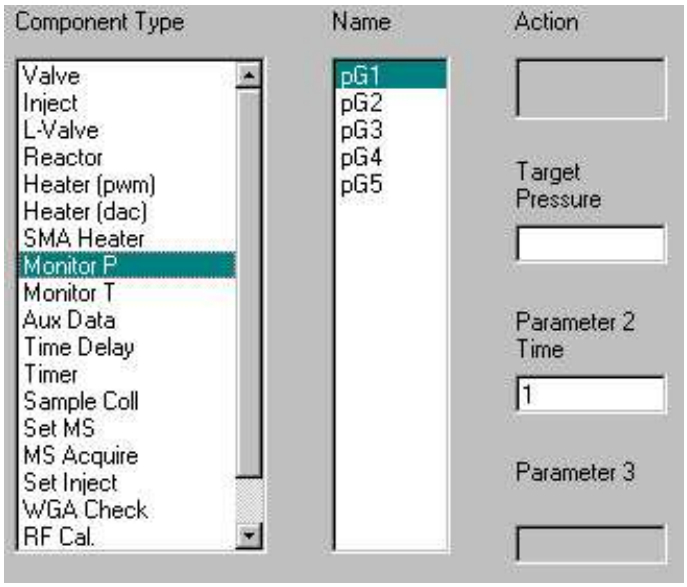


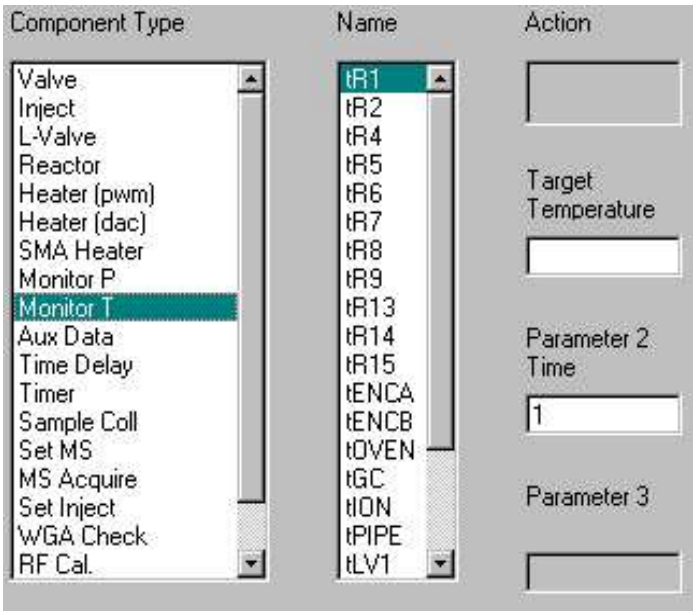
Figure 2-22 Option Menus for the Monitor P Command

2.4.9 Monitor T

The 'Monitor T' command is used to monitor pressure sensors. To instigate a monitor temperature event simply highlight 'Monitor T' from the 'Component' column (having done this the option menus should look similar to Figure 2-23). Next highlight the Temperature sensor name from the 'Name' column, in the 'Target Temperature' text box enter the target temperature, and in the 'Parameter 2' Text box enter the duration. Finally press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

There are no special limits or requirements for this command.



Full contents of 'Name' column	
tR1	tLV2
tR2	tLV5
tR4	tLV6
tR5	tLV7
tR6	tLV[GT]
tR7	
tR8	
tR9	
tR13	
tR14	
tR15	
tENCA	
tENCB	
tOVEN	
tGC	
tION	
tPIPE	
tLV1	

Figure 2-23 Option Menus for the Monitor T Command

2.4.10 Aux Data

The 'Aux Data' command is used to obtain the full 16-bit values of any sensor on the instrument (normal house keeping supplies the most significant 8-bits only). To instigate an auxiliary data event simply highlight 'Aux Data' from the 'Component' column (having done this the option menus should look similar to Figure 2-24). Next highlight the sensor name from the 'Name' column (shown in full next to the options menu figure) then press the 'Add' button (located just below the 'Parameter 3' text box).

NOTE the 'Auxiliary Data Packets' are classed as science data packets and contain the 16-bit sensor values individually time stamped as an aid to interpreting the mass spectrometer science data.

Warning and Safety Information

There are no special limits or requirements for this command.

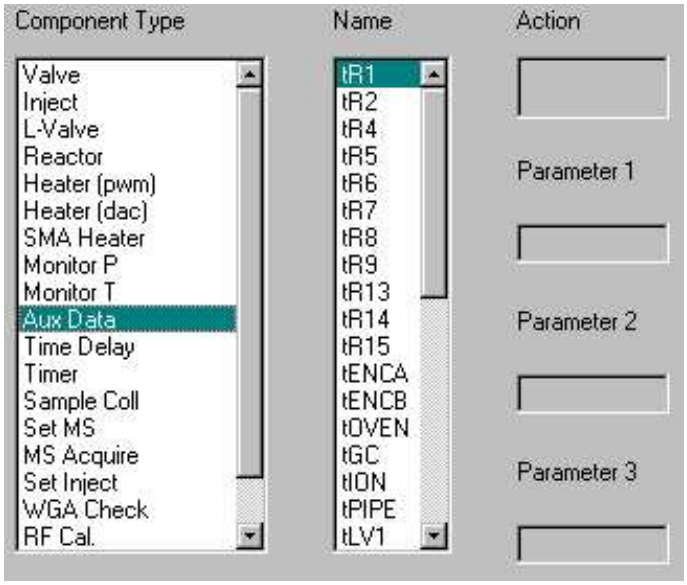


Figure 2-24 Option Menus for the Aux Command

Full contents of 'Name' column	
tR1	tLV5
tR2	tLV6
tR4	tLV7
tR5	tLV[GT]
tR6	pG1
tR7	pG2
tR8	pG3
tR9	pG4
tR13	pG5
tR14	pG5
tR15	AD590
tENCA	vDS
tENCB	iNT
tOVEN	vDET
tGC	v5V
tION	v28V
tPIPE	i5V
tLV1	i28V
tLV2	vRFCAL

2.4.11 Time Delay

The 'Time Delay' command is used to build in fixed time delays to command files. To instigate a time delay event simply highlight 'Time Delay' from the 'Component' column (having done this the option menus should look similar to Figure 2-25). Next enter the time delay required in the 'Parameter 2' Text box and then press the 'Add' button (located just below the 'Parameter 3' text box). When the program gets to a time delay it will do nothing else until the specified period has elapsed.

Warning and Safety Information

There are no special limits or requirements for this command.

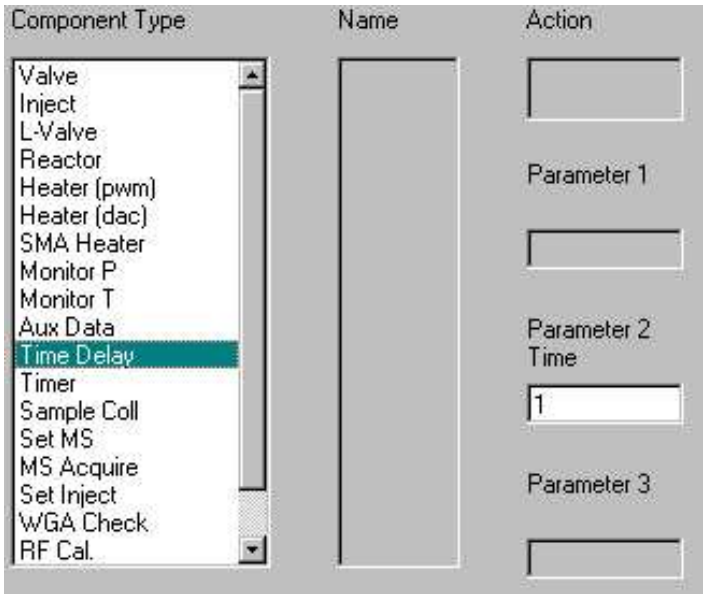


Figure 2-25 Option Menus for the Time Delay Command

2.4.12 Timer

The 'Timer' command is used to insert monitored time delays in command files. To instigate a timer event simply highlight 'Timer' from the 'Component' column (having done this the option menus should look similar to Figure 2-26). Next chose wait/start from the 'Action' list box and enter the time delay required in the 'Parameter 2' Text box and then press the 'Add' button (located just below the 'Parameter 3' text box).

NOTE 'Timer - Start' will continue through the command sequence until it reaches a 'Timer Wait' command. If the time specified in the timer – start command has already elapsed the program will continue on to the next command in the command sequence. If however the timer is still running it will wait until the specified time delay has finished before continuing further.

Warning and Safety Information

There are no special limits or requirements for this command.

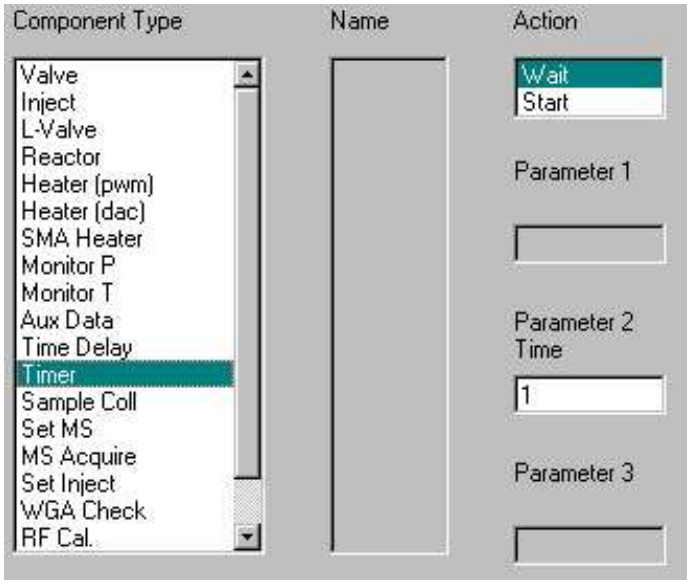


Figure 2-26 Option Menus for the Timer Command

2.4.13 Sample Coll

The 'Sample Coll' command is used to control the sample collector docking station to carousel oven interface. To instigate a sample collector event simply highlight 'Sample Coll' from the 'Component' column (having done this the option menus should look similar to Figure 2-27). Next chose undock/dock from the 'Action' list box and then press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

The docking station motor is a limited lifetime item and an approval must be obtained from the PI/PM prior to its operation. Depending upon the type of motor fitted to the docking station in use, the motor maybe unsuitable for use either in air or in vacuum.

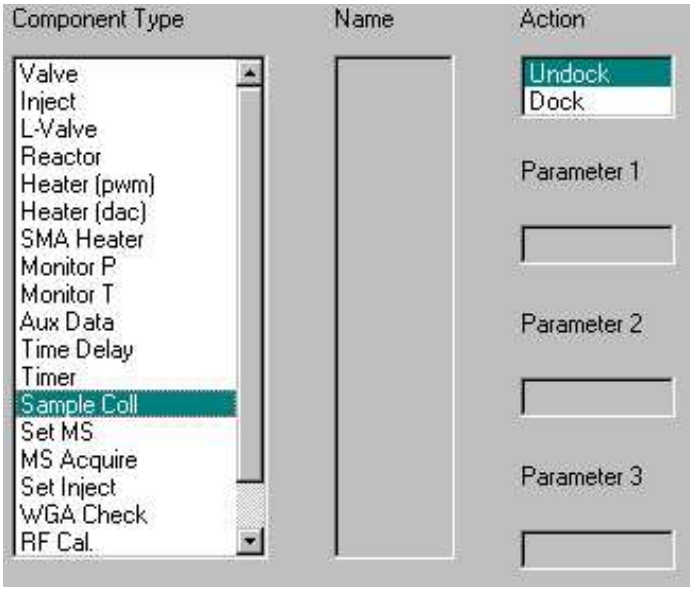


Figure 2-27 Option Menus for the Sample Coll Command

Will be included in next software update

2.4.14 Set MS

The 'Set MS' command is used to set up the mass spectrometer prior to operation. To instigate a set mass spectrometer event highlight 'Set MS' from the 'Component' column (having done this the option menus should look similar to Figure 2-28). Next highlight the required ion trap table number from the 'Name' column and chose off/on from the 'Action' list box. Finally press 'Add' (located just below the 'Parameter 3' text box).

Warning and Safety Information

There are no special limits or requirements for this command.

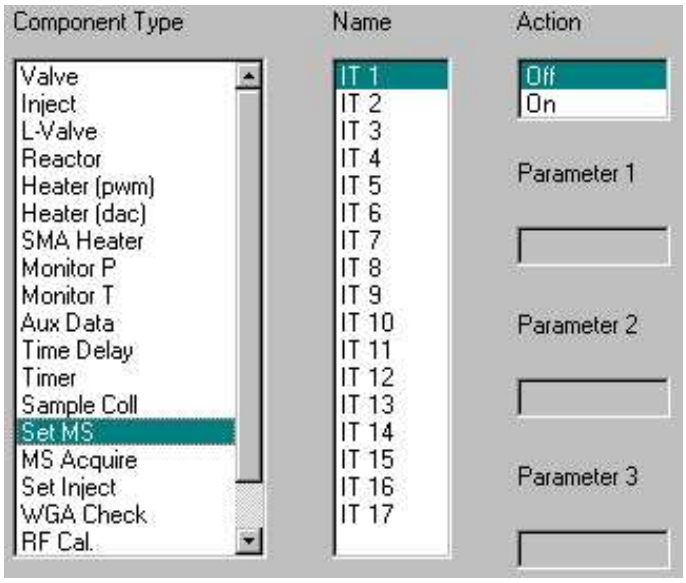


Figure 2-28 Option Menus for the Set MS Command

2.4.15 MS Acquire

The 'MS Acquire' command is used to operate the mass spectrometer to collect science data. This operation will turn on mass spectrometer high voltages, the electron multiplier and the nanotips. **Note the warning and safety information below!** To operate the mass spectrometer simply highlight 'MS Acquire' from the 'Component' column (having done this the option menus should look similar to Figure 2-29), then highlight the required ion trap table number from the 'Name' column. Next enter the required WGA table number in the 'WGA table number' text box (1 to 17), in the 'Parameter 2' text box enter the value of the number of spectra you require (1-1024), and in the 'Parameter 3' Text box enter the repeat period (units in 10^{th}'s of seconds). Finally press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

The nanotips are a limited lifetime item and approval must be obtained from the PI/PM prior to their use. Do not execute 'MS Acquire' unless all of the following are true:

- The instrument is currently in vacuum ≤ $1x10^{-6}$mbar
- The instrument has been in vacuum ≤ $1x10^{-6}$mbar for at least 48 hrs
- The ion trap has been baked at a temperature of at least 100°C for a minimum of 12 hrs
- Action has been taken to ensure that the pressure within the ion trap chamber is likely to be at an acceptably low value

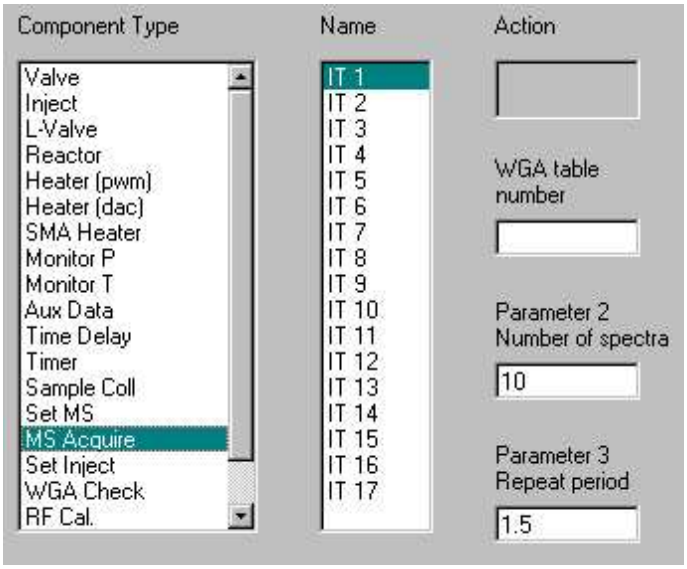


Figure 2-29 Option Menus for the Sample Coll Command

2.4.16 Set Inject

The 'Set Inject' command is used to operate the injector valves with a variable time length. To operate an injector valve simply highlight 'Set Inject' from the 'Component' column (having done this the option menus should look similar to Figure 2-30), then highlight a pressure sensor from the 'Name' column. Next enter the required value for the constant K1in the 'Constant value K1' text box, in the 'Parameter 2' text box enter the value of the variable K2. Finally press the 'Add' button (located just below the 'Parameter 3' text box).

NOTE the time delay is based on a combination of the pressure measured from the specified pressure sensor and the two variables K1 and K2. The next time an 'Inject' command is used and the time delay is set to 65535/65534 the variable time limit calculated from the previous 'Set Inject' command will be used.

Warning and Safety Information

There are no special limits or requirements for this command.

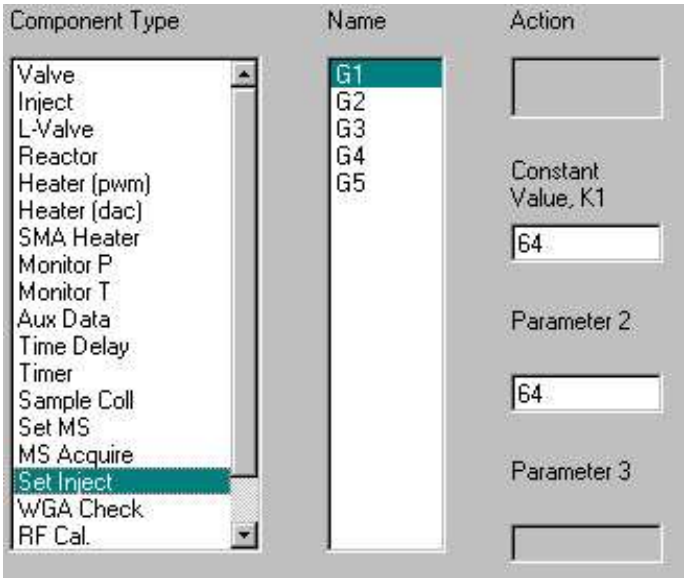


Figure 2-30 Option Menus for the Set Inject Command

2.4.17 WGA Check

The 'WGA Check.' command is used to check the WGA memory. To instigate a WGA check event simply highlight 'WGA Check' from the 'Component' column (having done this the option menus should look similar to Figure 2-31) then press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

There are no special limits or requirements for this command.

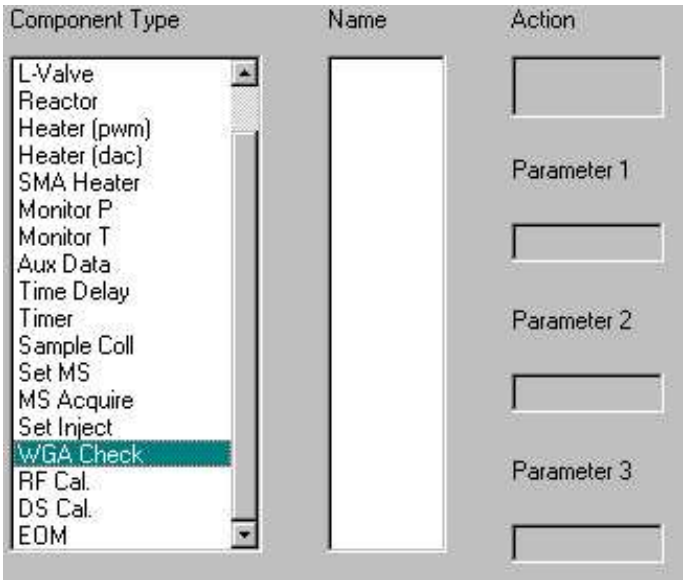


Figure 2-31 Option Menus for the WGA Check Command

2.4.18 RF Cal.

The 'RF Cal.' command is used to calibrate the Ion Trap RF. To instigate RF calibration event simply highlight 'RF Cal.' from the 'Component' column (having done this the option menus should look similar to) then press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

There are no special limits or requirements for this command.

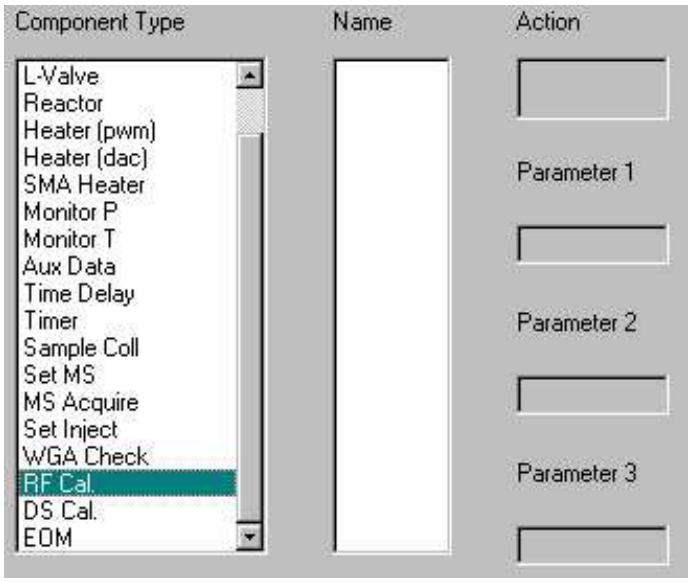


Figure 2-32 Option Menus for the RF Cal. Command

2.4.19 DS Cal.

The 'DS Cal.' command is used to calibrate the docking station. To instigate a docking station calibration event simply highlight 'DS Cal.' from the 'Component' column (having done this the option menus should look similar to Figure 2-33) then press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

Do not operate unless a valid oven is below the docking station
Awaiting input

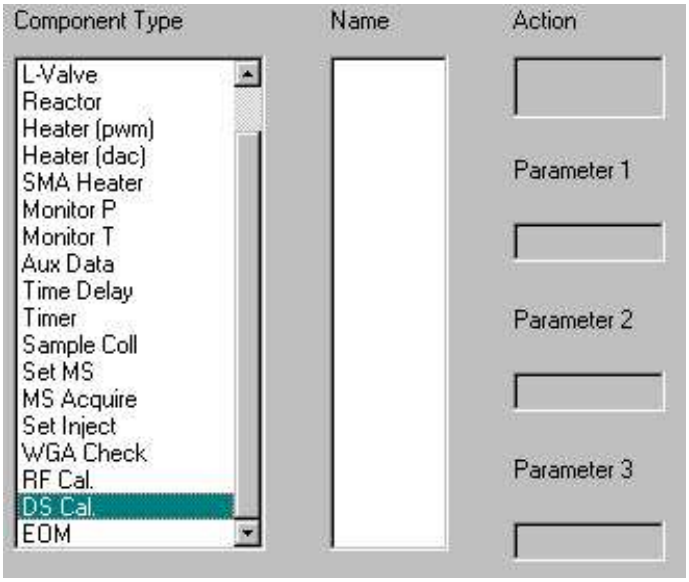


Figure 2-33 Option Menus for the DS Cal. Command

2.4.20 EOM

The 'EOM.' command is used to indicate an end of mode. To instigate an end of mode event simply highlight 'EOM' from the 'Component' column (having done this the option menus should look similar to Figure 2-34) then press the 'Add' button (located just below the 'Parameter 3' text box).

Warning and Safety Information

There are no special limits or requirements for this command.

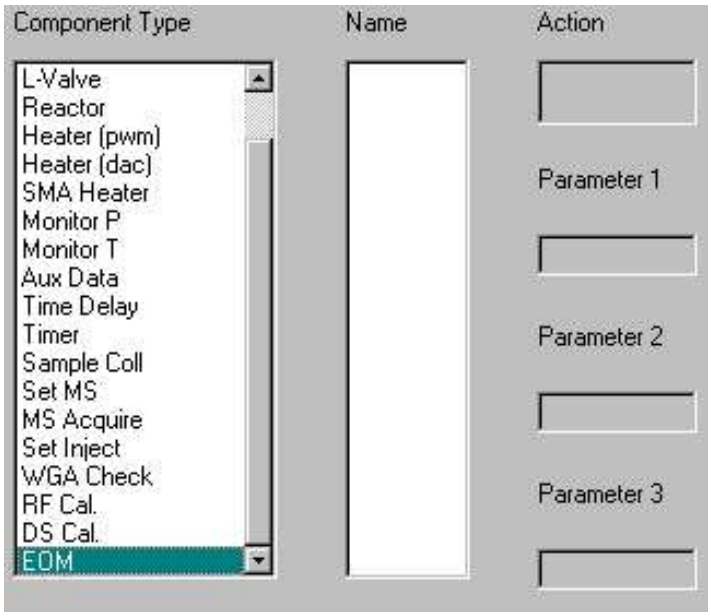


Figure 2-34 Option Menus for the EOM Command

2.5 Command File Error Checker

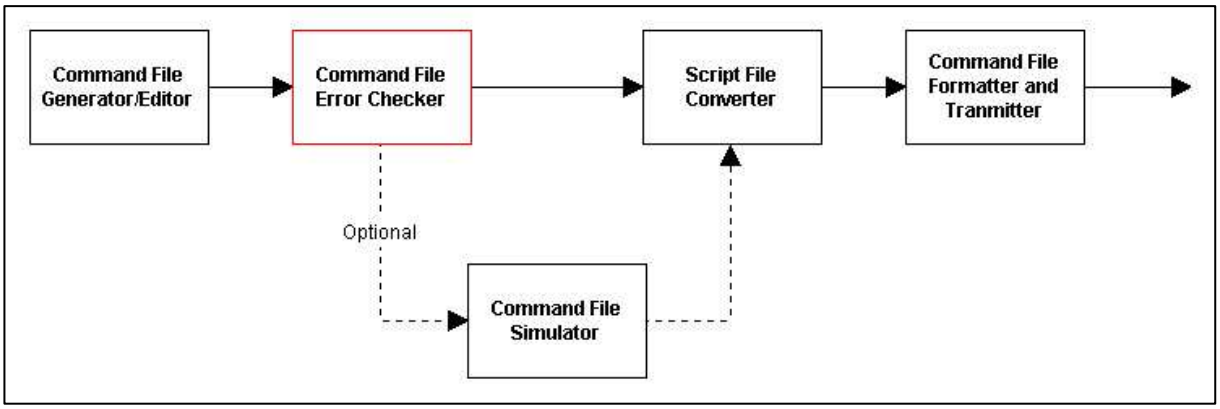


Figure 2-35 Module Flow Diagram – Command File Checker

The second step of the process (see Figure 2-35) is to select 'Command File Error Checker' from the 'Starter.exe' main menu (see Figure 2-4) you will be presented with the screen shown in Figure 2-36. The 'Command File Error Checker' will take the script files and check for errors, which will be highlighted. The error reports generated can be saved for later use.

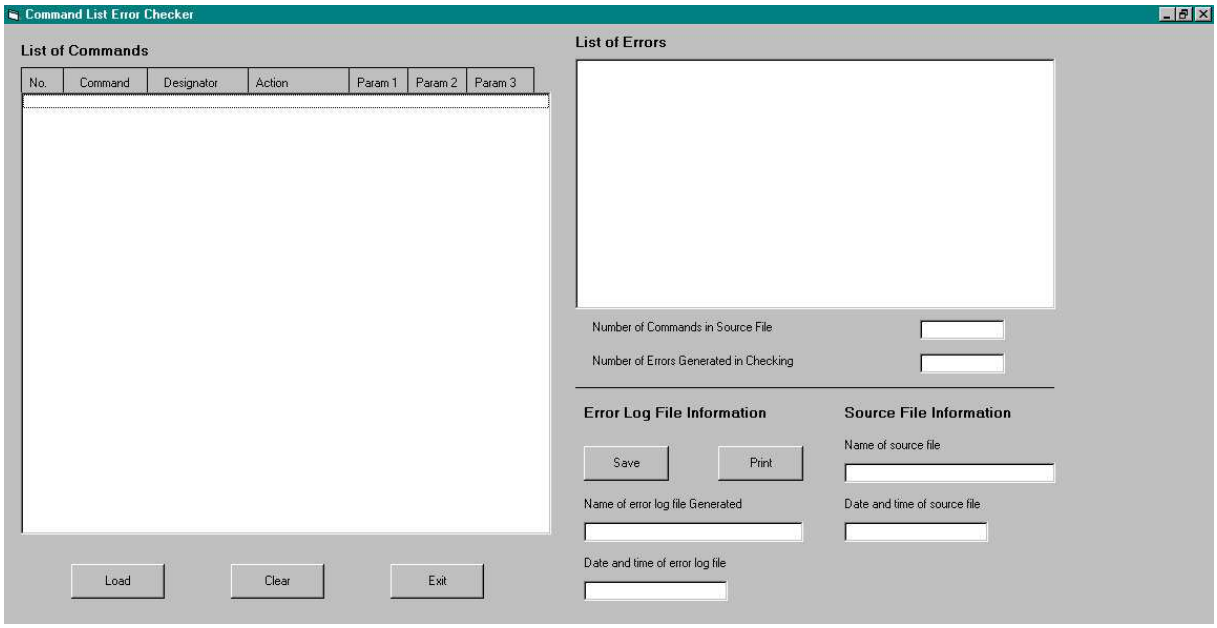


Figure 2-36 The Command File Error Checker Form

The first thing to do is to open the source file you wish to check for errors by pressing the 'Load' button. Once this is pressed a menu similar to the one shown in Figure 2-37 will appear. You can clear the list and open a new file by pressing 'Clear' followed by 'Load'. Alternatively you can quit back to the 'STARTER.EXE' main menu by pressing 'Exit'.

The default directory of this form is \Scripts\. To change the directory use the drop-down menu located near the text saying 'Look in:'

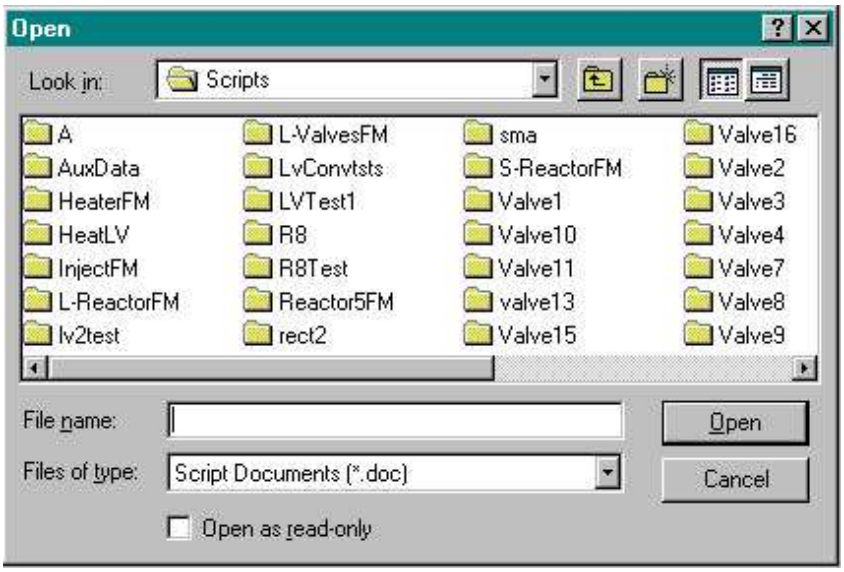


Figure 2-37 The Source Sub-directory Select Form

Once the first common dialog box appears simply select the sub-directory corresponding to the file name you wish to check. Say, for example, you clicked the subdirectory LvConvtsts (second item in the second column). A form similar to Figure 2-38 would then appear.

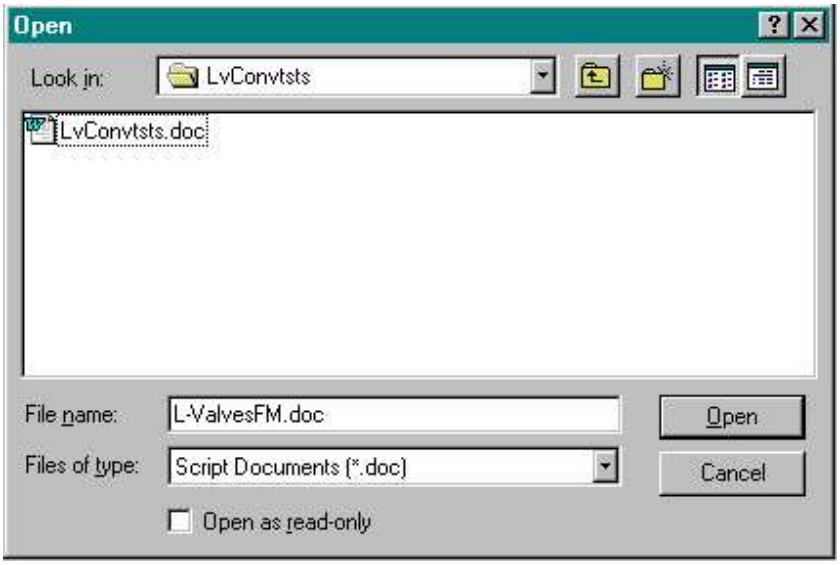


Figure 2-38 The Source File Select Form

To open a file simply click on the file with *.doc extension (there should only be one per sub-directory but more than one is possible if they were saved as different names).

Once a file is opened it is scanned for errors automatically. If no red text appears in the 'List of Errors' box and zero is displayed in the text box next to the label 'Number of Errors generated in Checking' then your source file is error free and the screen will look similar to the one in Figure 2-39.

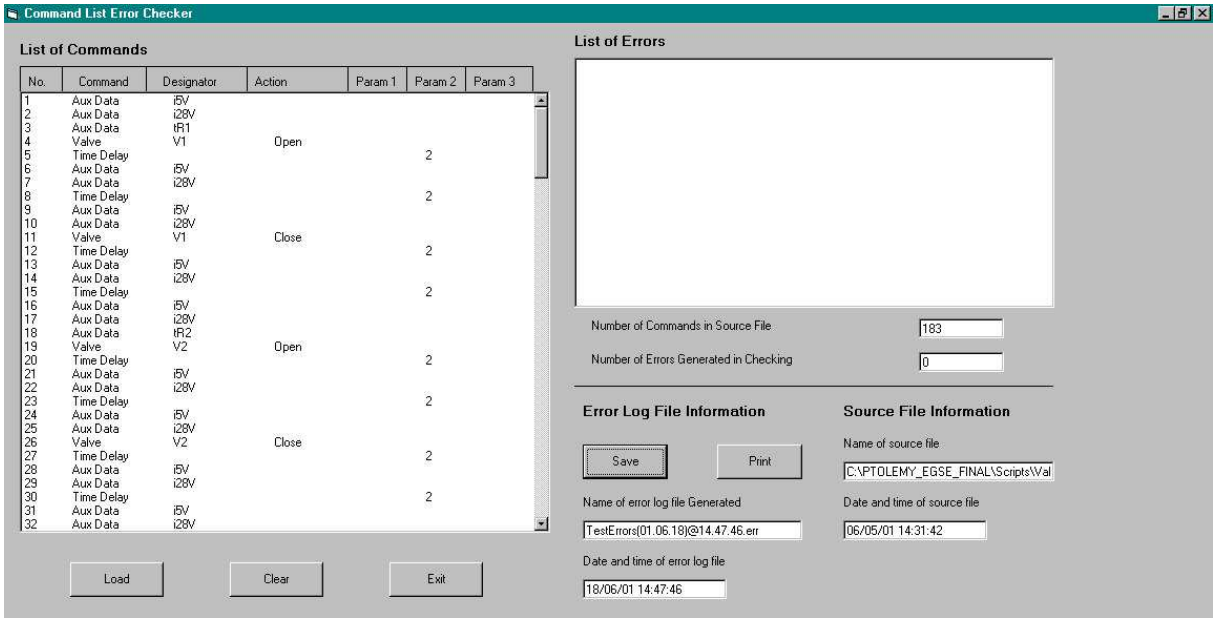


Figure 2-39 An Example of an Error-Free Source File

Even though there are no errors you can still save an error log file stating this by pressing the 'Save' button located under the label saying 'Error Log File Information'. The time the error check was run and the file name are automatically generated when the source file is opened.

For an input file with no errors the resulting text file would look something like Figure 2-40.

```
"Error Report Name: TestErrors(01.06.18)@15.34.59.err"
""
"Date Generated: 18/06/2001"
"Time Generated: 15:35:39"
""
"Source Command File Name: C:\PTOLEMY_EGSE_FINAL\Scripts\AuxData\AuxData.doc"
"Date and Time of Source File: 06/05/01 16:58:34"
""
"
"
"*** COMMAND LIST FREE OF ERRORS ***"
```

Figure 2-40 An Error Report File for an Error-Free Source File

If however your source file contains errors, having opened your source file, the screen will look something like Figure 2-41.

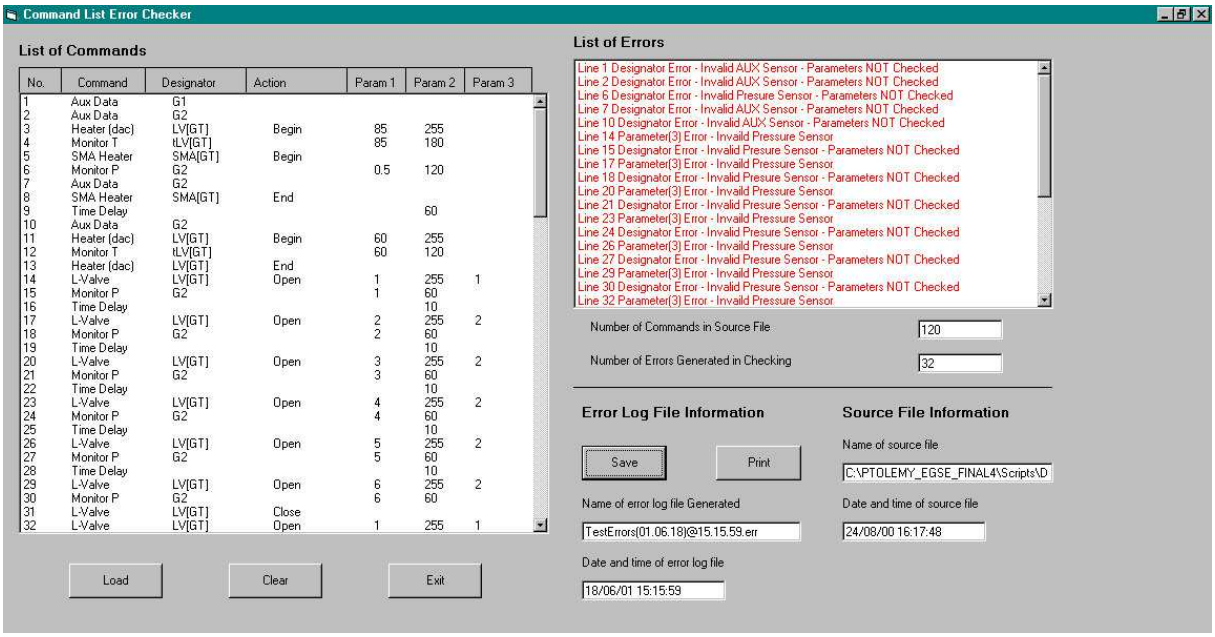


Figure 2-41 An Example of a Source File with Errors

The error-checking program works through each command in the following order.

Command – Designator – Action – Parameter 1 – Parameter 2 – Parameter 3

Once it has found a problem at any stage it will stop so, you may still need to do another error check even if you have rectified all the initial errors. For example if a line had an error in both the *action* and *parameter 3*, for instance, the first pass would pick up the action error but at that point it would stop and flag that error disregarding the remainder of the line. A second pass would be required to catch the *parameter 3* error. If in doubt keep running the error checker until you get an all clear screen as shown in Figure 2-39.
If required the list of errors found can be printed by pressing the 'Print' button or saved to a file by pressing the 'Save' button. The format of the saved error log file will look similar to the one shown in Figure 2-42. The default directory for storage of the error log files is \Working\.

```
"Error Report Name: TestErrors(01.06.18)@15.15.59.err"
""
"Date Generated: 18/06/2001"
"Time Generated: 15:28:54"
""
"Source Command File Name: C:\PTOLEMY_EGSE_FINAL4\Scripts\Dynamic\Dynamic.doc"
"Date and Time of Source File: 24/08/00 16:17:48"
""
"Line 1 Designator Error - Invalid AUX Sensor - Parameters NOT Checked
"
"Line 2 Designator Error - Invalid AUX Sensor - Parameters NOT Checked
"
"Line 6 Designator Error - Invalid Pressure Sensor - Parameters NOT Checked
"
"Line 7 Designator Error - Invalid AUX Sensor - Parameters NOT Checked
"
"Line 10 Designator Error - Invalid AUX Sensor - Parameters NOT Checked
"
"Line 14 Parameter(3) Error - Invalid Pressure Sensor
"
"Line 15 Designator Error - Invalid Pressure Sensor - Parameters NOT Checked
"
```

Figure 2-42 An Error Report File for a Source File with Errors

2.6 Command File Simulator

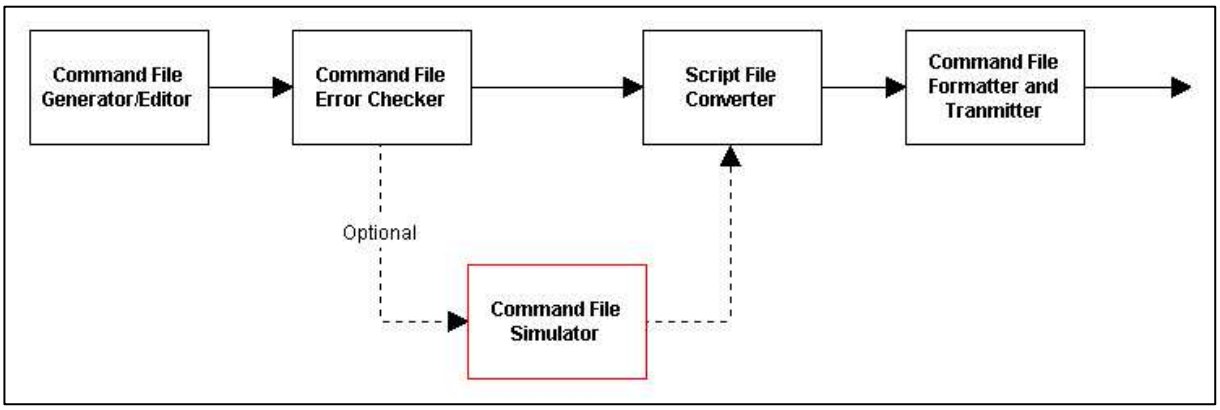


Figure 2-43 Module Flow Diagram – Command File Simulator

The third step of the process (see Figure 2-43) is to select 'Command File Simulator' from the 'Starter.exe' main menu (see Figure 2-4) the following screen will appear (see Figure 2-44). The 'Command File Simulator' is used to check the script do what is expected and to identify superfluous commands. The selection of the file to simulate is selected by pressing the 'Load' button (located just below the 'Command File List' list box. To close the form press the 'Quit' button (located at the bottom of this form). The 'Clear' button clears the 'Command File List' list box. Explanations of the buttons located in the 'Run Mode' frame are explained later in this chapter.

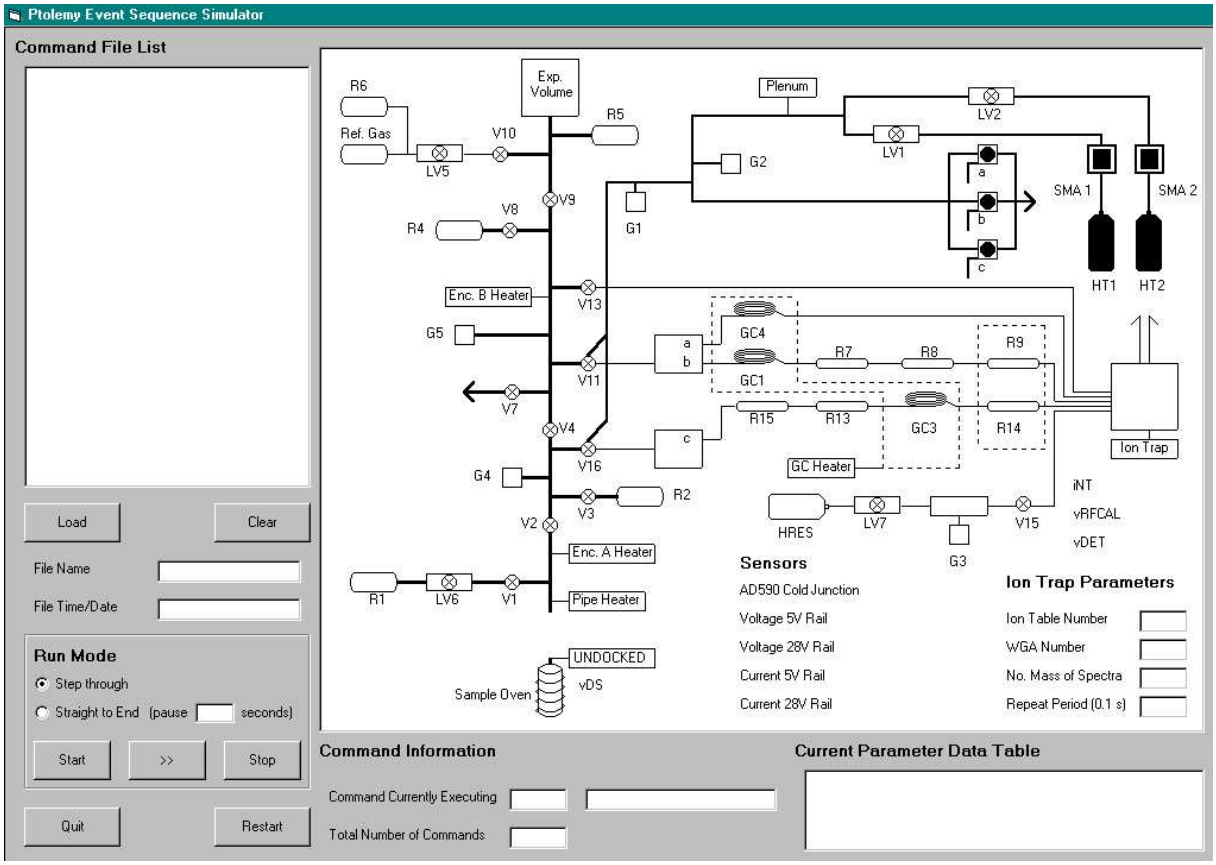


Figure 2-44 The Command File Simulator Form

Having selected 'Load' an 'Open' common dialog box will appear similar to Figure 2-45.

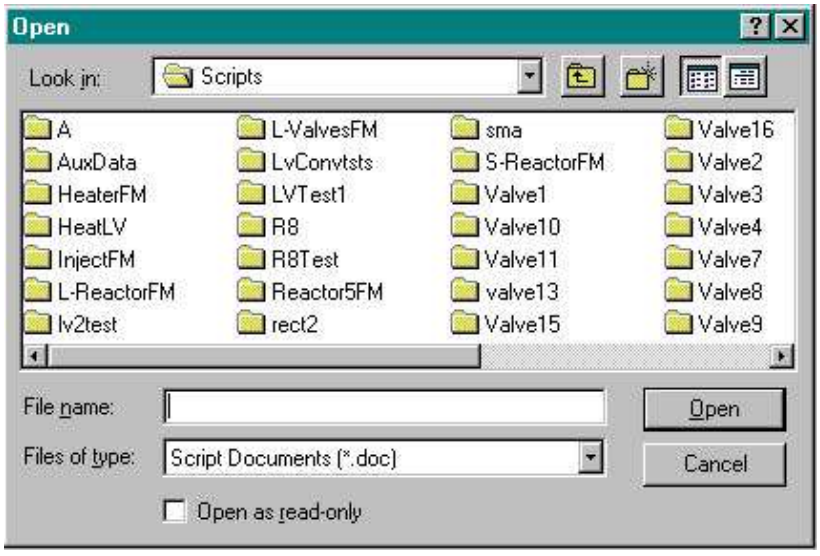


Figure 2-45 The First 'Open' Common Dialog Box

Once the First common dialog box appears simply select the sub-directory corresponding to the file name you wish to check. Say, for example, you clicked the subdirectory HeaterFM (third item in the first column). A form similar to Figure 2-46 would then appear.

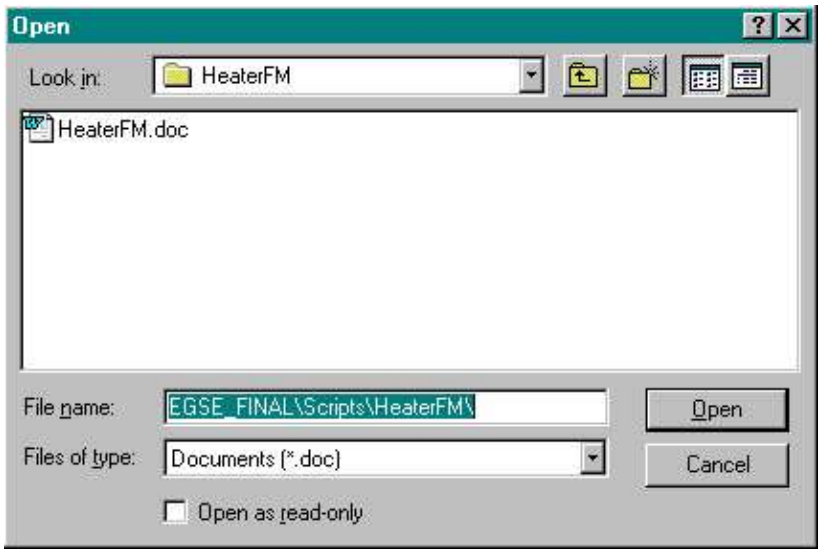


Figure 2-46 The Second 'Open' Common Dialog Box

To open a file simply click on the file with *.doc extension (there should only be one per sub-directory directory but more than one is possible if they were saved as different names)

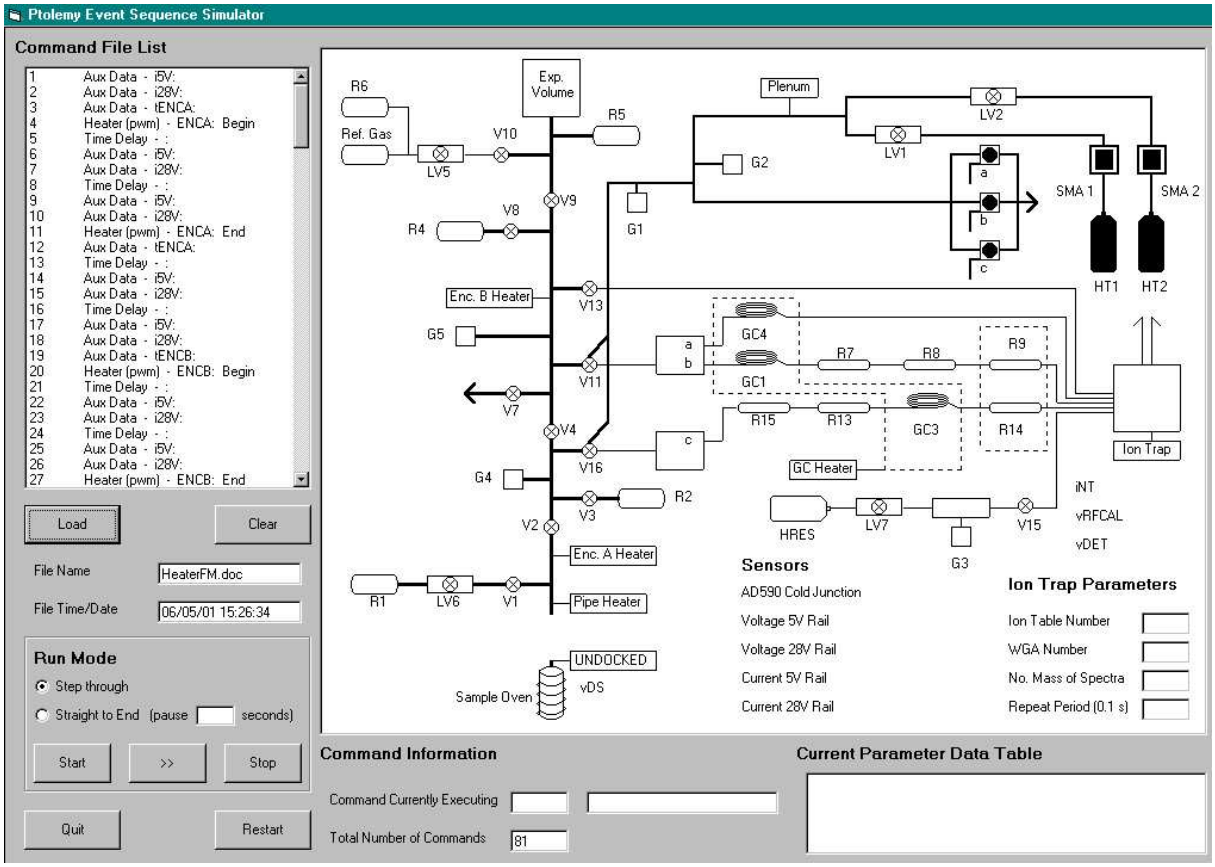


Figure 2-47 The Command File Simulator Form With File Open

Having chosen which file to open there is now two ways to run through the simulation:

Step through: In this mode the 'Start' button is pressed and the program graphically executes the first command in the list, to move on to the next command you press the '>>' key.

Straight to end: In this mode the program works it way through the list of commands graphically executing them in order with no input required by the user. The user chooses the pause between the individual commands.

Step through mode is selected by selecting the appropriate option button and pressing 'Start' as shown in Figure 2-48. Once selected movement through the commands is accomplished by pressing '>>' once for each command you wish to execute from 1 up to the total as shown in the 'Total Number of Commands' box under the title 'Command Information'.

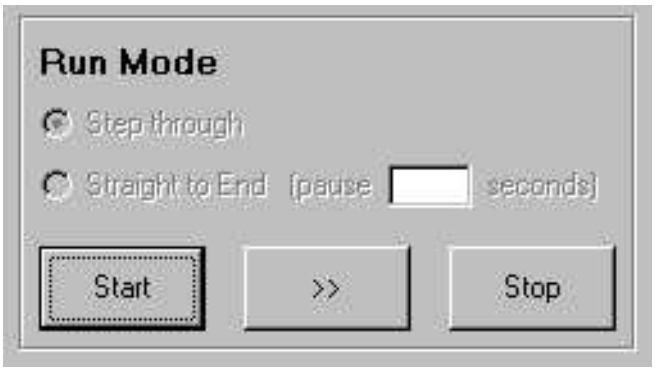


Figure 2-48 Run Mode – Step Through Selected

To select straight to end mode simply select the appropriate option button as shown in Figure 2-49.

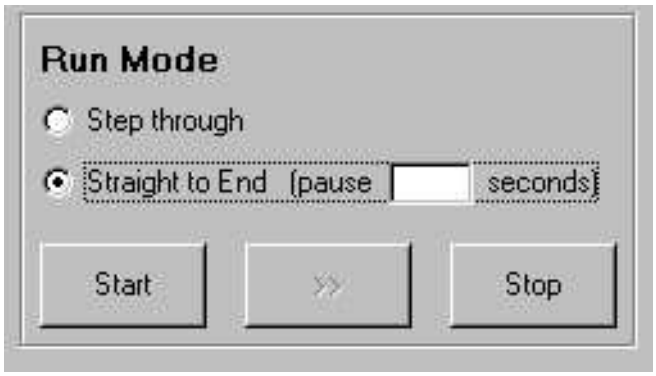


Figure 2-49 Run Mode – Straight to End Selected

Having selected straight to end mode the next step is to choose a pause period between commands. This is done by filling in the required pause period in the data input box situated between the text '(pause' and 'seconds)'. This value is in seconds but can be in units of 1/10 of a second by using a decimal point (.) between the whole and fractions of a second. If you enter digits for whole seconds only the decimal point is automatically added as shown in Figure 2-50.

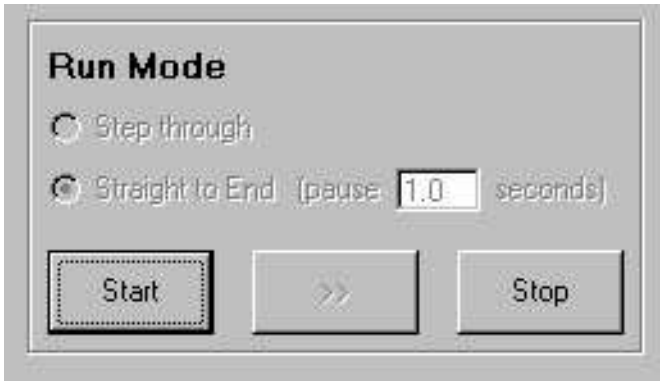


Figure 2-50 Run Mode – Straight to End Selected With Time Delay

In either mode to monitor the command currently being executed you can look at the information shown under the title 'Command Information' as shown in the example Figure 2-51 (located at the bottom centre of the form).

Also if the currently executing command has any parameters associated with it they will appear at the top of the list box located under the title text 'Current Parameter Data Table'.

In the example shown below the fourth command in the list is currently being executed by the simulator (as shown in the 'Command Currently Executing' first text box). The command is to start the heater attached to enclosure A (Shown in the second text box right of the title 'Command Currently Executing' as 'Heater (pwm) ENCA Begin). The parameter test box also shows that, in this example, the target temperature for this heater is 50°C and the power window (PW) for this heater starts at 0 (PW start) and is 255 long (the maximum power window size). Also shown is the 'Total number of Commands', this combined with 'Command Currently Executing' the gives you an idea how far through the command list you are.

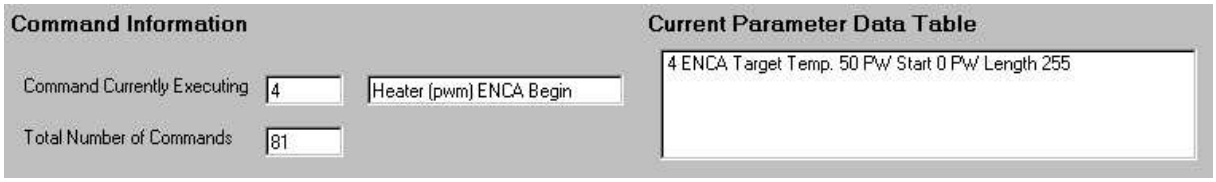


Figure 2-51 'Command information' and 'Current Parameter Data Table' Example

In most cases as each instruction is executed something will be shown graphically to assist the list writer in finding mistakes in his/her program. There are 20 definite commands and most have several permutations the list of commands is shown below (these are written as they would be seen in the 'Command File List' window, each is covered separately later):

1. Valve
2. Inject
3. L-Valve
4. Reactor
5. Heater (pwm)
6. Heater (dac)
7. SMA Heater
8. Monitor T
9. Monitor P
10. Aux Data
11. Time Delay
12. Timer
13. Sample Coll
14. Set MS
15. MS Acquire
16. Set Inject
17. WGA Check
18. RF Cal.
19. DS Cal.
20. EOM

In the following examples the simulator window is divided into four sections A-D, which help relate the location of the graphical feedback the user will receive for each command (see Figure 2-52). Purple arrows will also assist these close-up views.

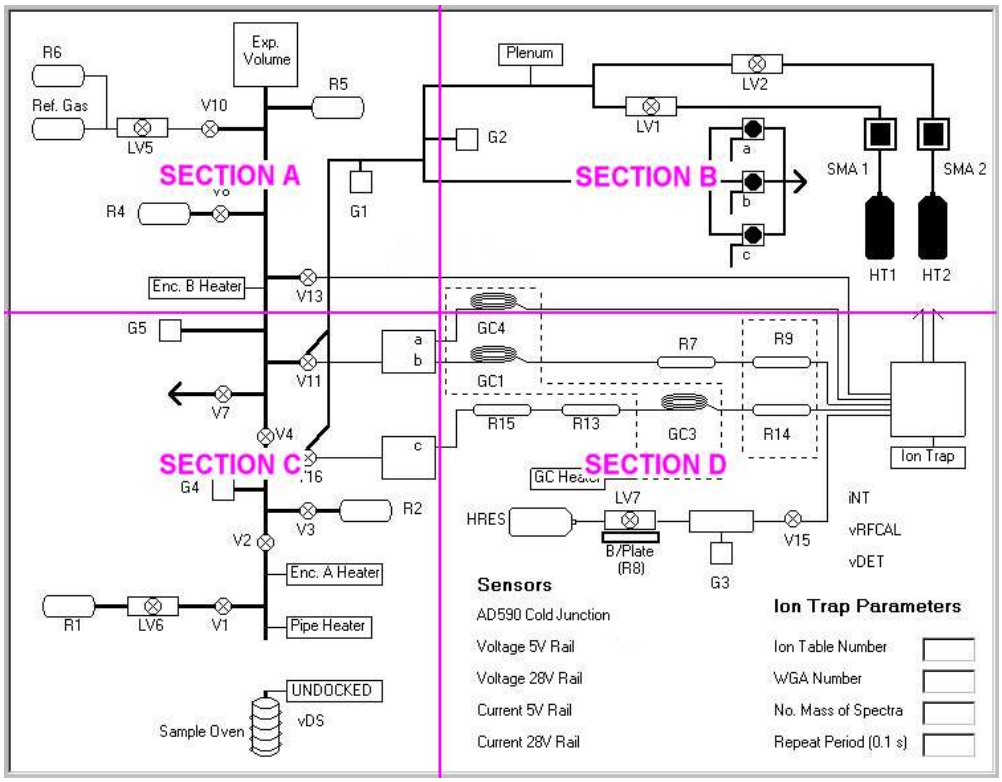


Figure 2-52 Close-up of the Simulator Window

2.6.1 Valve

This command controls the clippard-type valves of which there are 12 (V1, V2, V3, V4, V7, V8, V9, V10, V11, V13, V15, V16). The options for these are either OPEN or CLOSE and there are no parameters. The graphical feedback you will receive is that the icon representing the valve will turn red (as shown in Figure 2-53). In the example valve 8 is switched on (actuated).

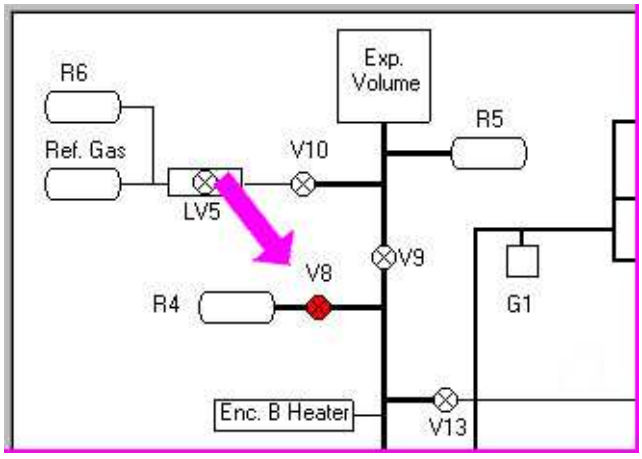


Figure 2-53 Section A View of Valve Open Command

2.6.2 Inject

This command controls the injector valves of which there are 3 (VA, VB, VC). There are no options for these and one parameter, which is the 'Inject Time' (in seconds or 65534 for a variable delay). When actuating a valve the graphical feedback you will receive is as follows; firstly the icon representing the injector valve will turn red and the accompanying label will turn blue (as shown in Figure 2-54), also the corresponding channel label will turn blue (as shown in Figure 2-55). The example assumes injector valve A is used.

*** NOTE that if the 'Inject Time' is set to 65535/65534 then the delay will be the delay calculated by the last 'Set Inject' command (see command 16).***

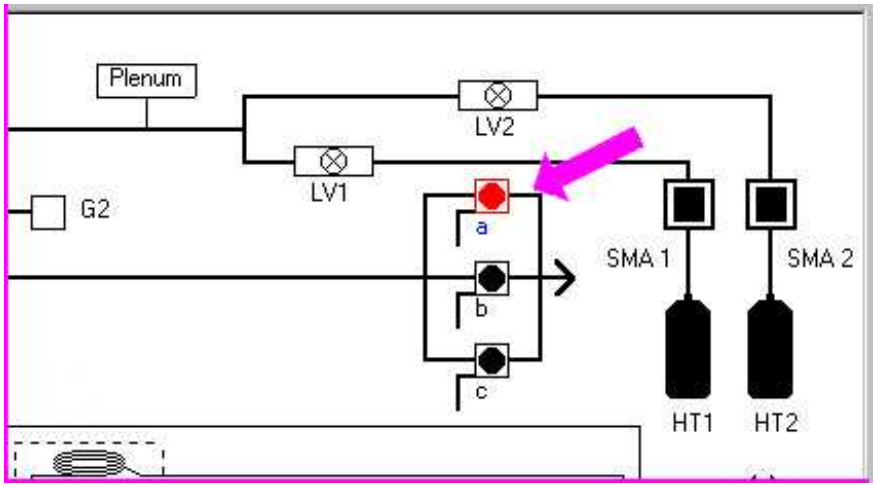


Figure 2-54 Section B View of the Inject Command

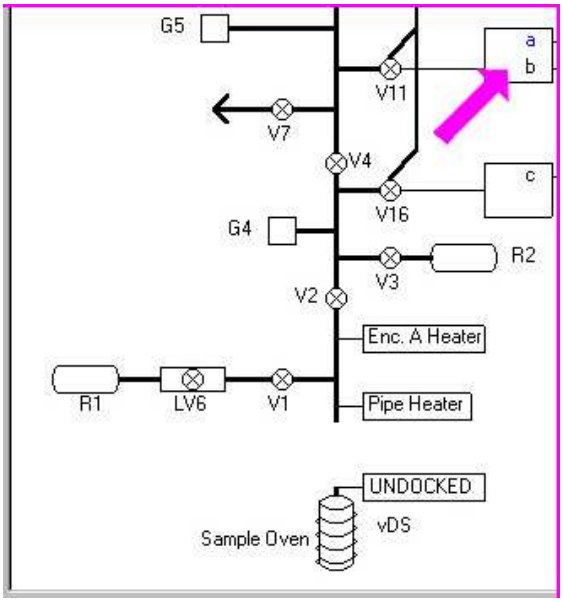


Figure 2-55 Section C View of the Inject Command

2.6.3 L-Valve

This command controls the Lindau valves of which there are 5 (LV1, LV2, LV5, LV6, LV7). The options for these are either OPEN or CLOSE. There are three parameters for OPEN; these are 'Target Pressure (Target P)', 'Pressure Gauge (P Gauge)' and 'Maximum Power (Max Power)'. The graphical feedback you will receive is that the icon representing the Lindau valve and the icon border will turn red when turned on (as shown in Figure 2-56). The example assumes Lindau valve 2 is used.

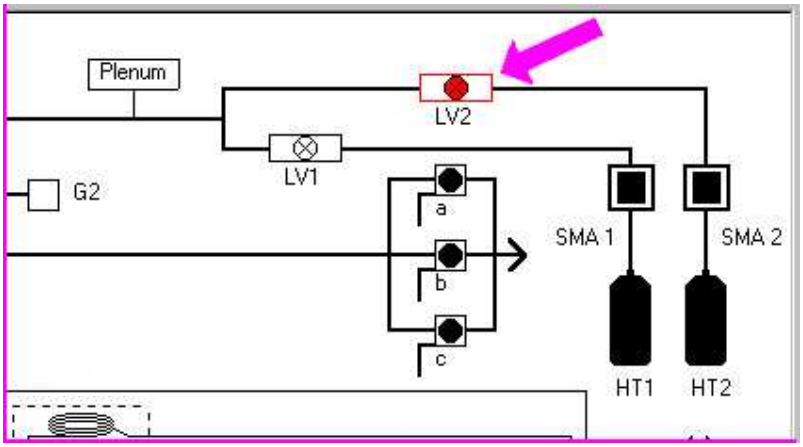


Figure 2-56 Section B View of the L-Valve Command

2.6.4 Reactor

This command controls the Reactor Heaters of which there are 11 (R1, R2, R4, R5, R6, R7, R8, R9&14, R13, R15, tOVEN). The options for these are BEGIN and END. There are three parameters for BEGIN; these are 'Target Temperature', 'Power Window Start (PW Start)' and 'Power Window Length (PW Length)'. The graphical feedback you will receive is that the icon representing the Reactor turning red when turned on (as shown in Figure 2-56). The example assumes reactors 9&14 and reactor 13 are used (reactor 9 and 14 use the same heater).

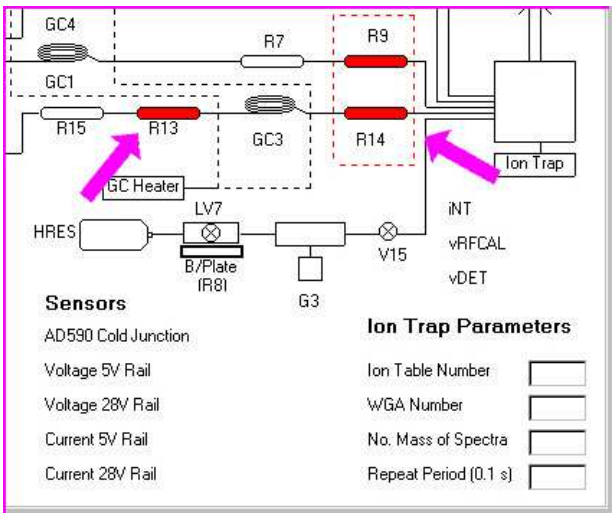


Figure 2-57 Section D View of the Reactor Command

2.6.5 Heater (pwm)

This command controls the Pulse Width Modulated Heaters of which there are 5 (ENCA, ENCB, PIPE, GC, ION). The options for these are BEGIN and END. There are three parameters, for BEGIN; these are 'Target Temperature', 'Power Window Start (PW Start)' and 'Power Window Length (PW Length)'. The graphical feedback you will receive is that the area representing the heated area and the heater label will turn red when turned on (as shown in Figure 2-58 and Figure 2-59) The examples assumes the Enclosure A and GC heaters are used (all three GC columns use the same heater).

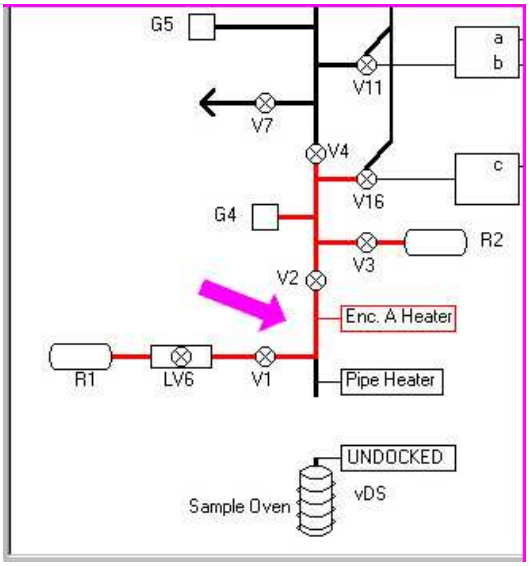


Figure 2-58 Section C View of the Heater (pwm) Command

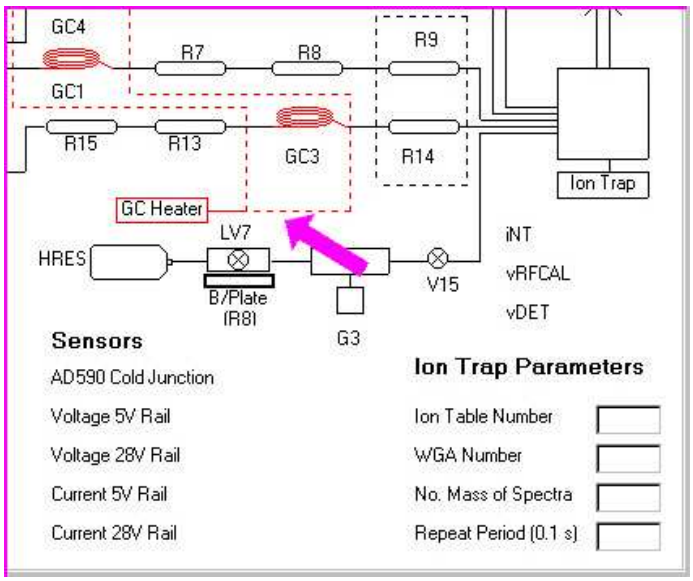


Figure 2-59 Section D View of the Heater (pwm) Command

2.6.6 Heater (dac)

This command controls the Digital to Analogue Converter-controlled heaters of which there 5 (LV1, LV2, LV5, LV6, LV7). The option for these is BEGIN and END. There are two parameters for BEGIN; these are 'Target Temperature' and 'Maximum Power (Max Power)'. The graphical feedback you will receive is that the border of the icon representing the Lindau valve will turn red when the heater is turned on (as shown in Figure 2-60). The examples assumes LV2 is used.

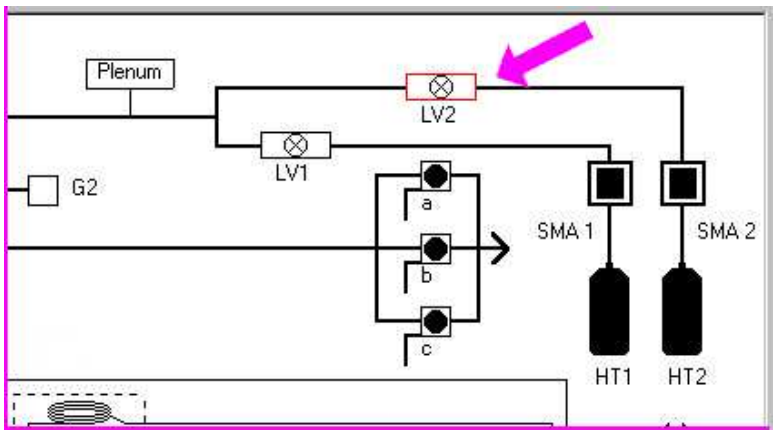


Figure 2-60 Section B View of the Heater (dac) Command

2.6.7 SMA Heater

This command controls the Shaped Memory Alloy actuator heaters of which there are 2 (SMA1, SMA2). These heaters will cause the mechanically sealed Helium tanks to be opened. The options for these heaters are BEGIN and END. This command has no parameters. The graphical feedback you will receive is the icon representing the SMA will turn red and the associated Helium Tank (HT) will turn white to indicate is no longer sealed (as shown in Figure 2-61). This example assumes the heater SMA2 is used opening HT 2.

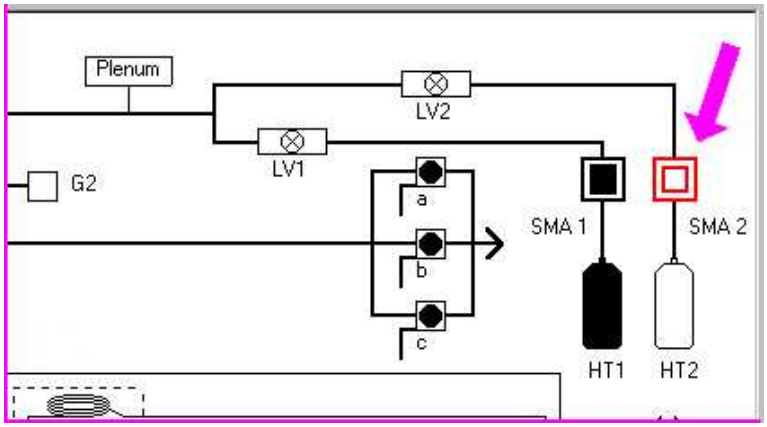


Figure 2-61 Section B View of the SMA Heater Command

2.6.8 Monitor T

This command monitors temperature from the temperature sensors of which there 21 (tR1, tR2, tR4, tR5, tR6, tR7, tR8, tR9&14, tR13, tR15, tOVEN, tENCA, tENCB, tPIPE, tGC, tION, tLV1, tLV2, tLV5, tLV6, tLV7). This command has no options but there are two parameters, these are 'Target Temperature' and 'Time out'. This command serves as a pause in an instrument mode until either the 'Target temperature' has been reached or until the 'Time out' period has expired. After either the instrument will carry out the next instruction in the mode. The graphical feedback you will receive is that the label next the icon representing the temperature sensor will turn blue (as shown in Figure 2-62). This example assumes the temperature of R4 is required.

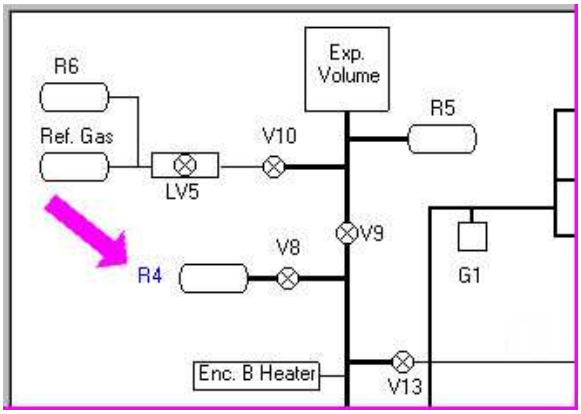


Figure 2-62 Section A View of the Monitor T Command

2.6.9 Monitor P

This command monitors pressure from pressure sensors of which there are 5 (pG1, pG2, pG3, pG4, pG5). This command has no options but there are two parameters, these are 'Target temperature' and 'Time out'. The command serves as a pause in an instrument mode until either the 'Target Pressure' has been reached or until the 'Time out' period has expired. After either the instrument will carry out the next instruction in the mode. The graphical feedback you will receive is the label next the icon representing the pressure sensor will turn blue (as shown in Figure 2-63). This example assumes the temperature of R4 is required.

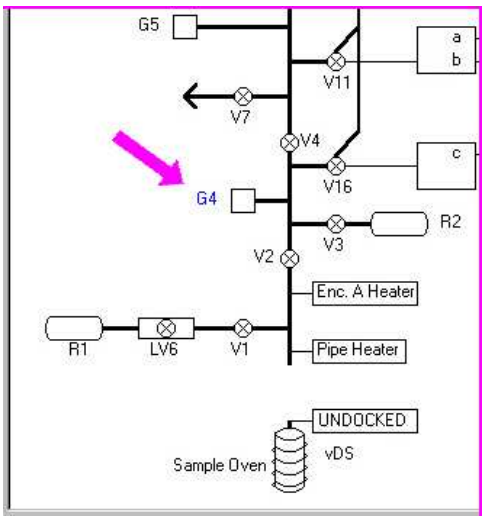


Figure 2-63 Section C View of the Monitor P Command

2.6.10 Aux Data

This command collects Auxiliary science data, i.e. the full 16-bit readings, from the various sensors in the instrument of which there are 35 (tR1, tR2, tR4, tR5, tR6, tR7, tR8, tR9&14, tR13, tR15, tOVEN, tENCA, tENCB, tPIPE, tGC, tION, tLV1, tLV2, tLV5, tLV6, tLV7, pG1, pG2, pG3, pG4, pG5, AD590, vDS, iNT, vDET, v5V, v28V, i5V, i28V, vRFCAL). The command generates a 'Auxiliary data' science packet. It has no options or parameters. The graphical feedback you will receive is that next to the icon label a piece of purple text will appear that says AUX. In Figure 2-64 Auxiliary data is being gathered about the voltage present on the 28V power rail, there are many Auxiliary items where only a label is used to represent them. Figure 2-65 shows Auxiliary data being gathered about the temperature of reactor 4.

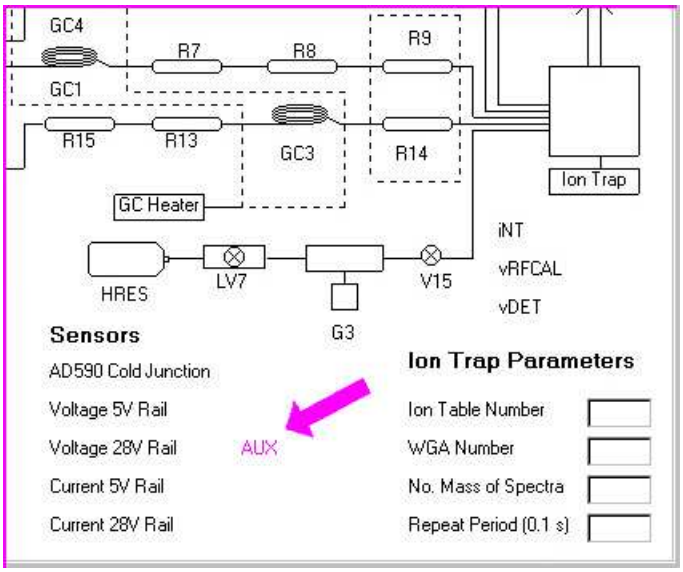


Figure 2-64 Section D View of AUX Command

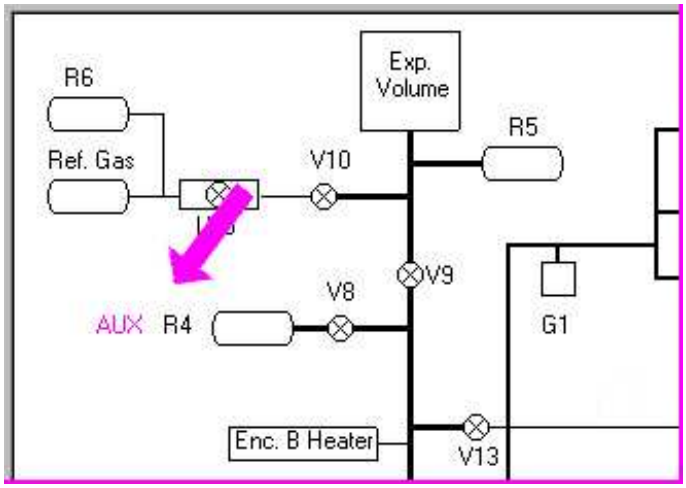


Figure 2-65 Section A View of AUX Command

2.6.11 Time Delay

This command is used to insert time delays in command sequences. The sequence will reach a 'Time Delay' command and will wait until the specified period has elapsed before doing the next step in the sequence. The graphical feedback you will receive is that a time delay icon will appear in the bottom left-hand side of the simulator window when a time delay command is encountered (see Figure 2-66). The example assumes a delay of two seconds is required.

NOTE the time the icon is visible is not an indication of the duration of the event.

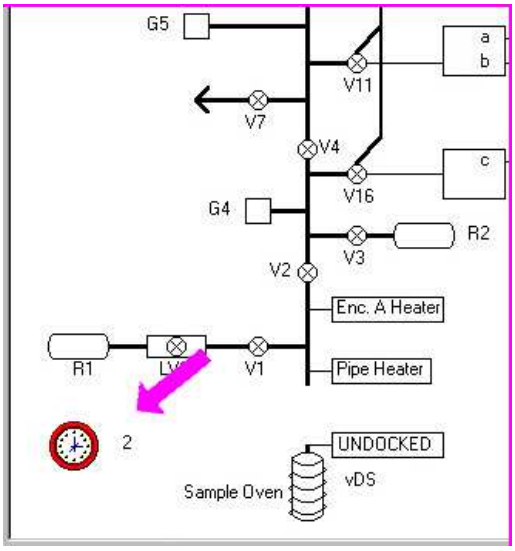


Figure 2-66 Section C View of the Time Delay Command

2.6.12 Timer

This command is used to insert monitored time delays in command sequences. When the program encounters an 'Timer - Start' command it will continue through the command sequence until it reaches a 'Timer Wait' command. If the time specified in the timer – start command has already elapsed the program will continue on to the next command in the command sequence. If however the timer is still running it will wait until the specified time delay has finished before continuing further. It has options START and WAIT and one parameter for START, which is the duration time in seconds. The graphical feedback you will receive is a timer icon which will appear in the bottom left-hand side of the simulator window when a timer command is encountered (see Figure 2-68 and Figure 2-68).

NOTE the time the icon is visible is not an indication of the duration of the event.

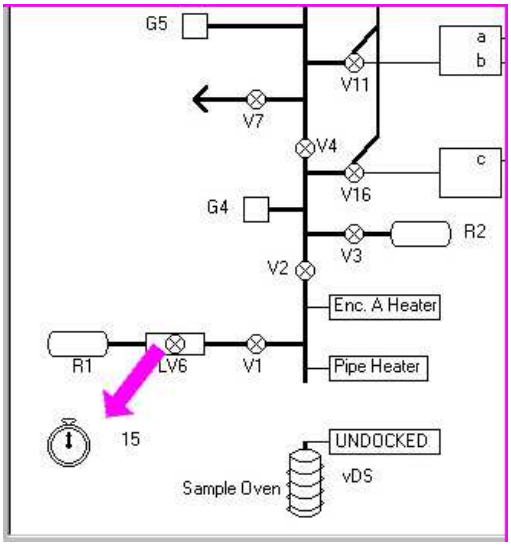


Figure 2-67 Section C View of the Timer – Start Command

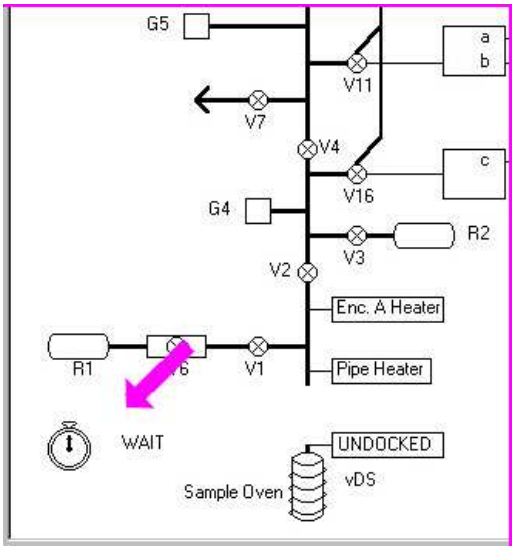


Figure 2-68 Section C View of the Timer – Wait Command

2.6.13 Sample Coll

This command controls the sample collector oven. The options for the oven is either DOCKED or UNDOCKED and there are no parameters. The docking mechanism presents the prepared cometary samples to the instrument. The carousel contains a CASE oven (that will be directly under the docking station at launch) as well as a selection of Medium Temperature Ovens (MTO) and High Temperature Ovens (HTO). The graphical feedback you will receive is that the icon representing the oven-connecting pipe will lengthen to connect it to the rest of the instrument and the text box next to the sample oven will read DOCKED (as shown in Figure 2-69).

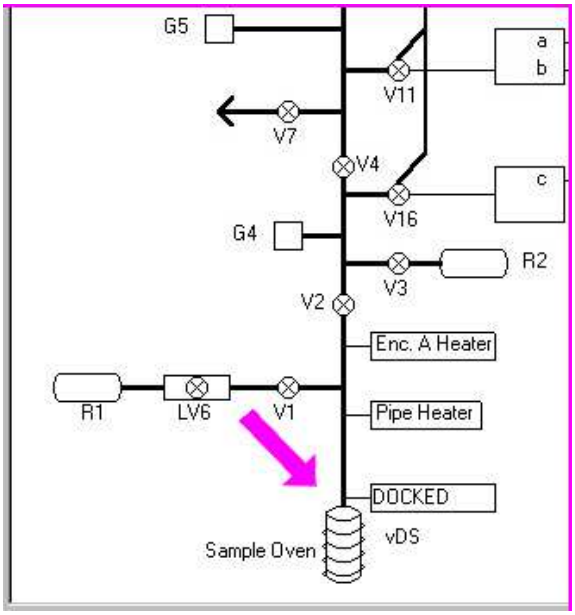


Figure 2-69 Section C View of the Sample Coll (DOCK) Command

2.6.14 Set MS

This command configures the mass spectrometer, in accordance with the selected Ion trap Table number, and powers up the high voltage items. This command has two options ON and OFF. For ON there is one parameter and this is the Ion Table number. The graphical feedback you will receive is that a value will appear in the text boxes to the right of the label text 'Ion trap Table number'. The example shown uses IT 4.

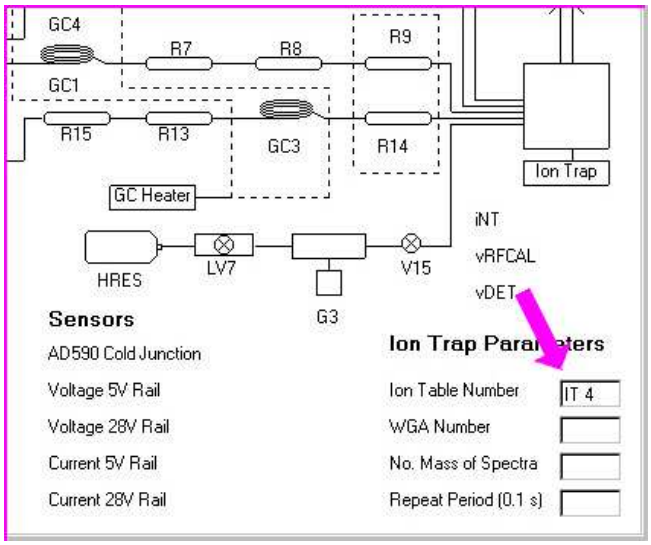


Figure 2-70 Section D View of the Set MS Command

2.6.15 MS Acquire

This command controls the mass spectrometer and starts sample measurements. This command has no options but four parameters; these are Ion Table number, WGA number, the Number of Spectra required and the Repeat Period, in seconds. The graphical feedback you will receive is that values will appear in the four text boxes under the title text 'Ion Trap Parameters' (as shown in Figure 2-71).

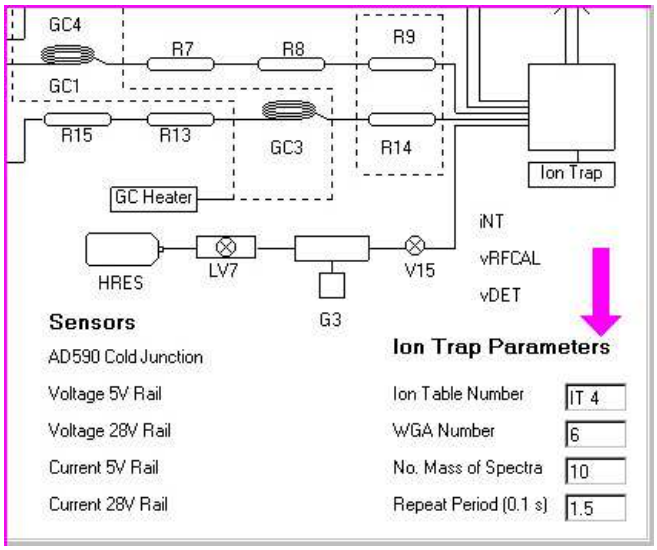


Figure 2-71 Section D View of the MS Acquire Command

2.6.16 Set Inject

This command is used when an injector valve command requires a variable inject time. The time delay is based on a combination of the pressure measured from the specified pressure sensor and the two variables K1 and K2. The next time an 'Inject' command is used and the time delay is set to 65534 the variable time limit calculated from the previous 'Set Inject' command will be used. The set inject command has no options but three parameters; these are Pressure Gauge number, variable K1 and variable K2. The graphical feedback you will

receive is that values will appear in the text boxes under the title 'Current Parameter Data Table' (as shown in Figure 2-72).

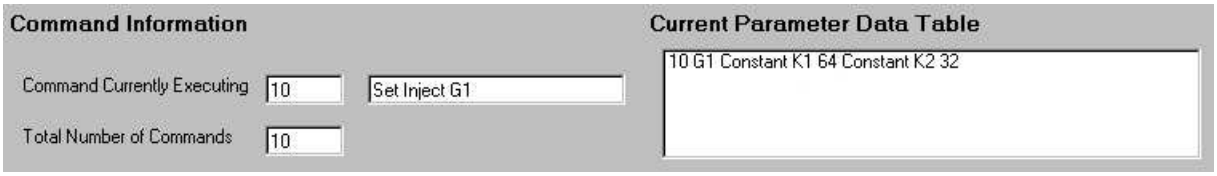


Figure 2-72 Command Information for the Set Inject Command

2.6.17 WGA Check

This command instigates a memory check over all the WGA memory and generates a 'Normal Progress Event' housekeeping packet (Event ID 55103 decimal D73Fh 'WGA Memory Check'). It has no options or parameters and there is no graphical feedback for this command.

2.6.18 RF Cal.

This command instigates a calibration of the RF frequency and generates a 'Normal Progress Event' housekeeping packet (Event ID 55113 decimal D749h 'RF Calibration Report'). It has no options or parameters and there is no graphical feedback for this command.

2.6.19 DS Cal.

This command instigates a calibration check of the docking station and generates a 'Normal Progress Event' housekeeping packet (Event ID 55114 decimal D74Ah 'Docking Station Sensor Data) as well as ~30 packets (Event ID 55115 decimal D74Bh 'Docking Station Calibration Report'. There are no options, or graphical feedback for this command.

2.6.20 EOM

This command simply ends the current mode and the instrument software will return to safe mode. There are no options, or graphical feedback for this command.

2.6.21 Errors

The above commands (2.4.1 to 2.4.20) and their associated graphical feedback methods assume that the command list is error-free. However there is a degree of error-tolerance within the simulator and if a command happens to not exist or have an illegal option or parameter then the following error message box will appear (see Figure 2-73). If this should occur then the simulator will take no further action (after the message box) and will move on to the next command

Figure 2-73 Simulator Error Message Box

2.7 Script File Converter

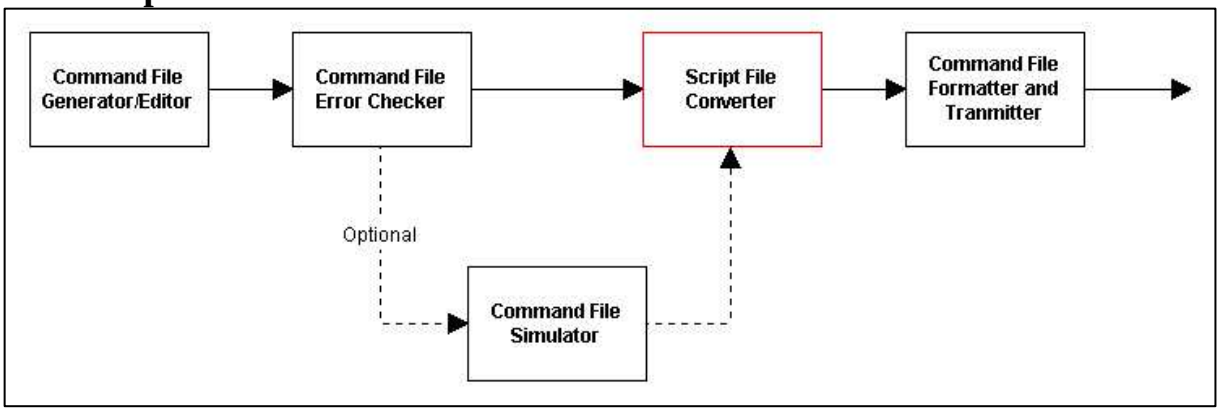


Figure 2-74 Module Flow Diagram – Script File Converter

The forth step of the process (see Figure 2-74) is to select 'Script File Converter' from the 'Starter.exe' main menu (see Figure 2-4) the following screen will appear (see Figure 2-75). The purpose of the 'Script File Converter' is to convert the text based script file into a hex format that can be transmitted to the instrument. The selection of the file to convert is achieved by pressing the 'Load' button (located just below the 'Command File List' list box). To close the form press the 'Quit' button (also located just below the 'Command File List' list box). The 'Clear All' button clears the entire form and the 'Clear' button just clears the 'Code File List' list box.

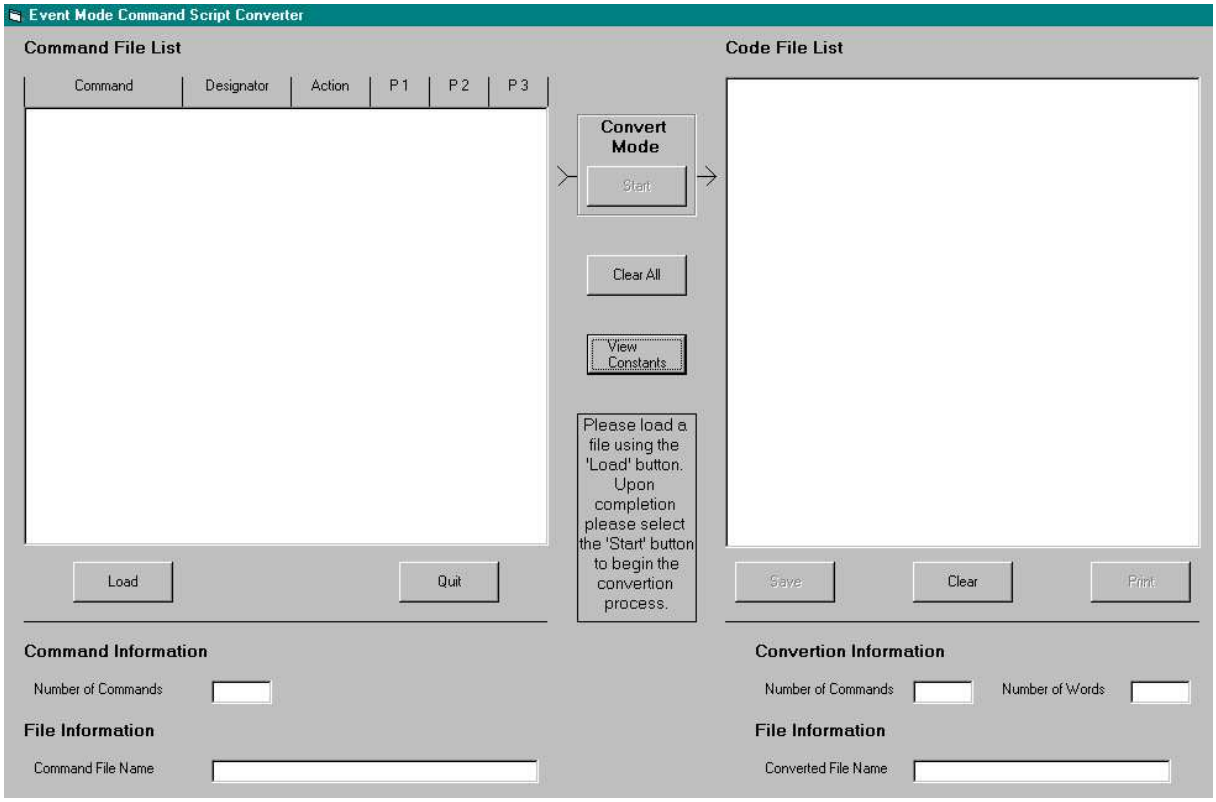


Figure 2-75 The File Converter Form

The 'View Constants' button in the centre of the form will bring up the form shown in Figure 2-76. This form allows the user to select the constants used to convert the pressure in bar specified in the command source file to an ADC reading in millivolts. The 'Pressure Sensor Constants' show the reading of the pressure gauge at both vacuum and atmospheric pressure.

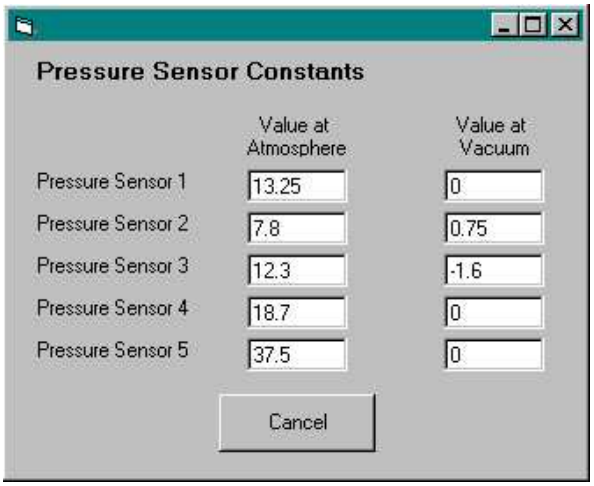


Figure 2-76 The Pressure Sensor Constants Form

To open a source file for conversion press the 'Load' button. Upon pressing the load button an 'Open' common dialog bow will appear similar to the one shown in Figure 2-77.

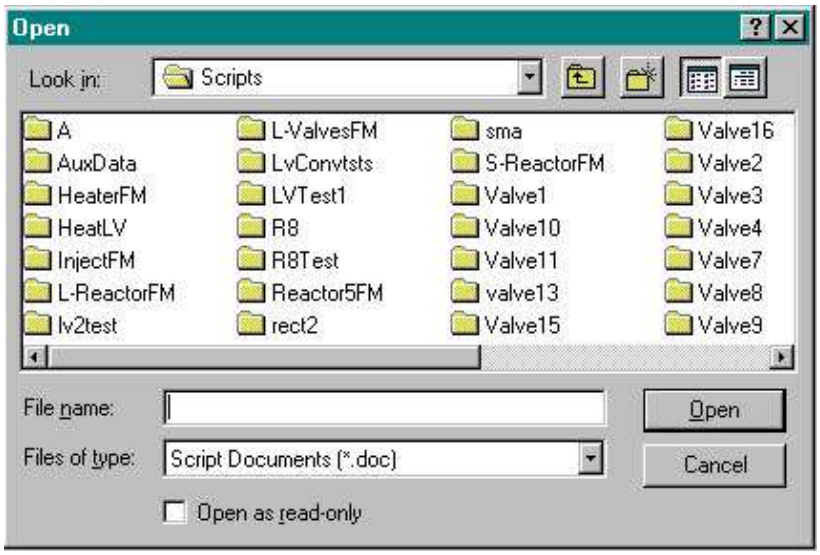


Figure 2-77 The Source Sub-directory Select Form

Once the First common dialog box appears simply select the sub-directory corresponding to the file name you wish to convert. Say, for example, you double-clicked the subdirectory HeaterFM (third item in the first column). A form similar to Figure 2-78 would then appear.

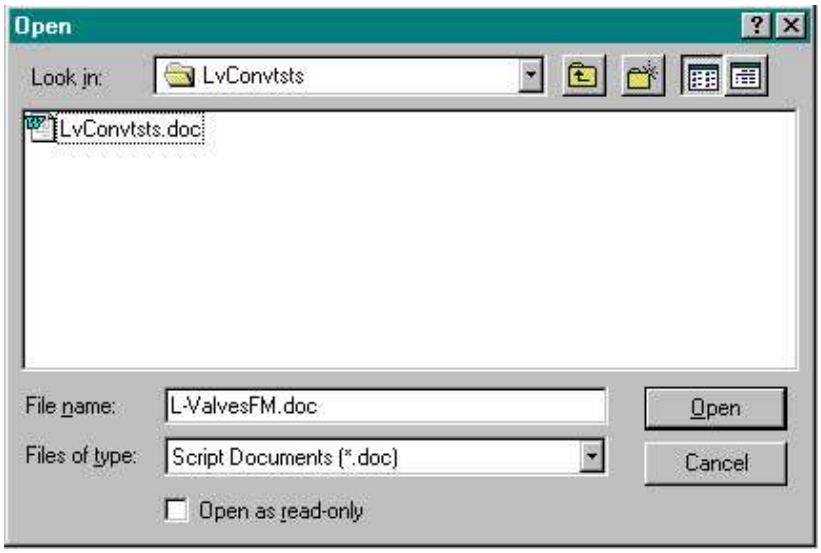


Figure 2-78 The Source File Select Form

Once this has been done a list of instructions in plain text should appear in the 'Command File List' list box as shown in Figure 2-79. Also once a source file has been loaded the 'Start' button located under the title text 'Convert Mode' is enabled.

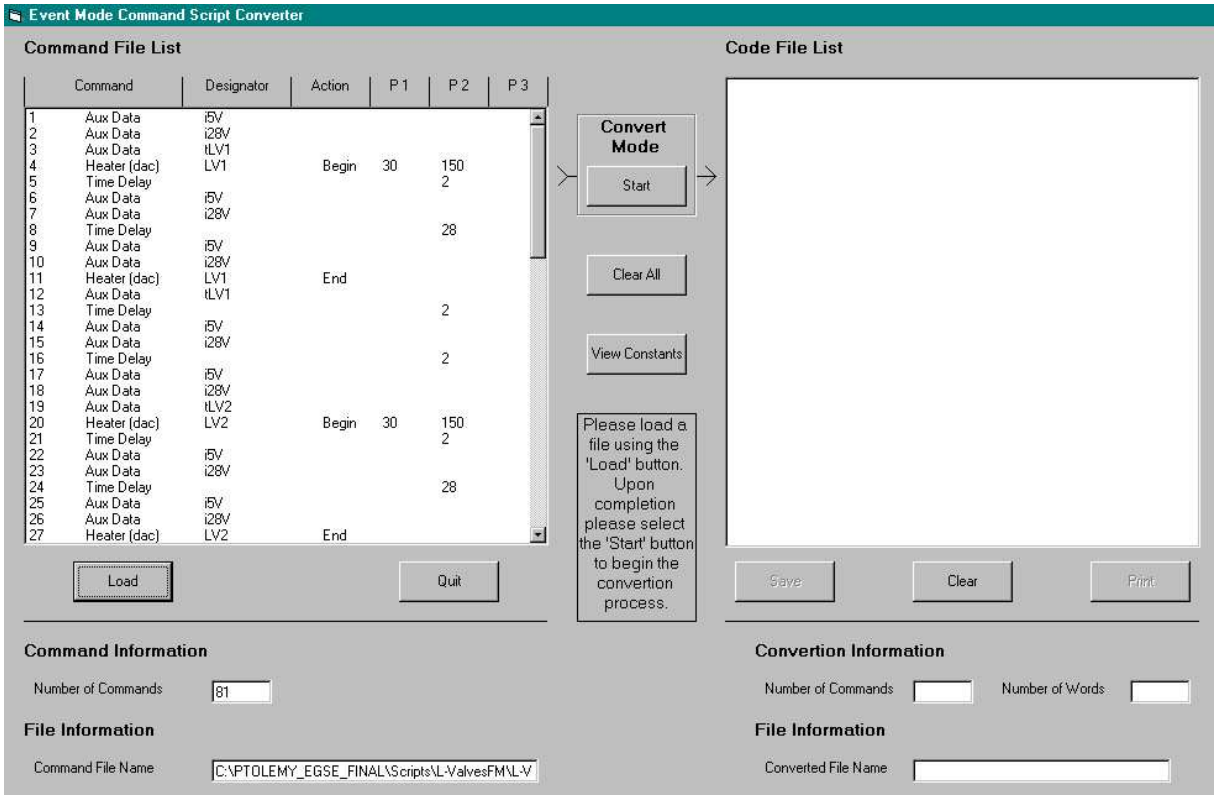


Figure 2-79 The File Converter Form with Source File Open

Once you have pressed the 'Start' button the translation into raw hex code should appear in the list box under the title text 'Code File List' as shown in Figure 2-80.

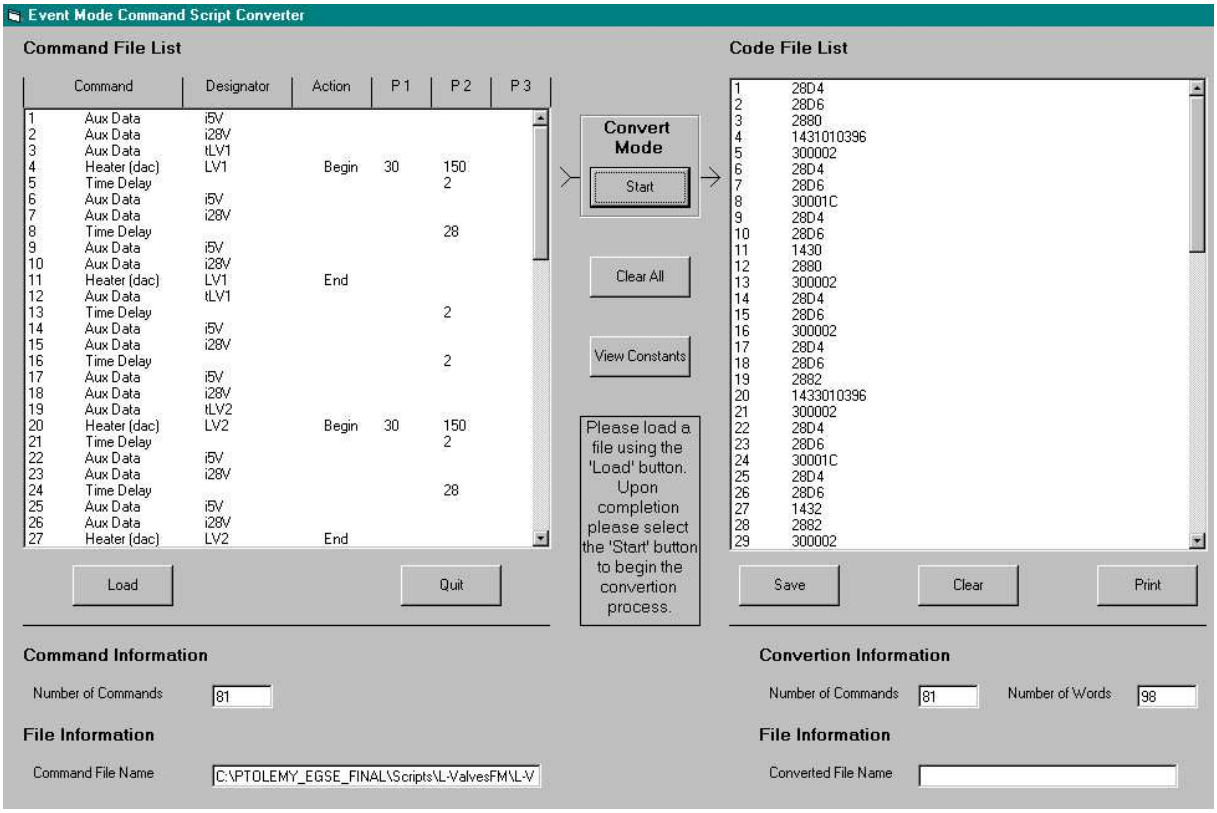


Figure 2-80 The File Converter Form After File Conversion

Once the source file has been converted the next stage is to save the converted code file for eventual transmission to the science instrument. To save the converted code file simply press the 'Save' button located under the 'Code File List' list box. Alternatively you can clear the contents of the 'Code File List' list box by pressing the 'Clear' button. If a printout is required of the converted code press the 'Print' button. If you select to save the converted code to a file by pressing the 'Save' button the following 'Save As' common dialog box will appear (see Figure 2-81). When you press 'Save' the file name (that appears in the 'File name:' box) is generated automatically according to the following format:

CommandFile(*YY.MM.DD***)@***HH.mm.ss***.txt** **BOLD** = items that always appear

YY	=	year
MM	=	month
DD	=	day
HH	=	hour
mm	=	minutes
ss	=	seconds

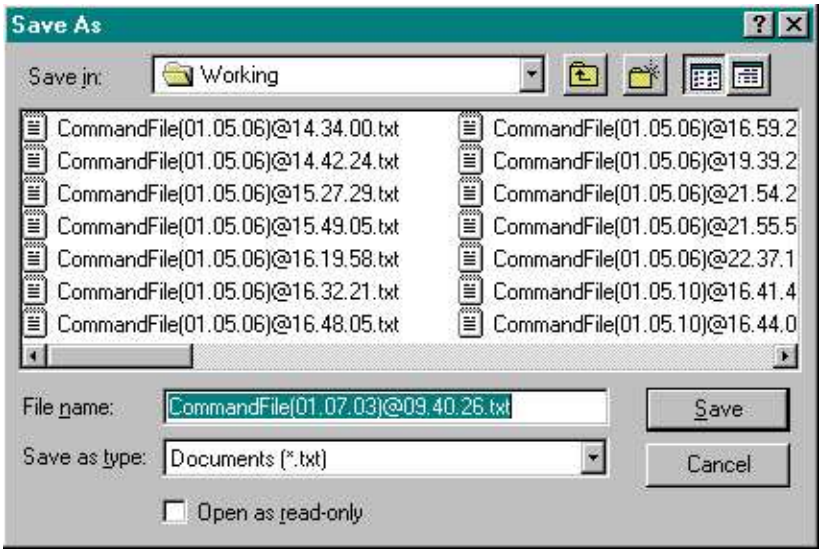


Figure 2-81 The Converted Code File Saving Form

The format of the saved file is shown in Figure 2-82. The header automatically fills in the following information

- Source File Name:
- Error File Generated Name:
- Date Command File was Generated:
- Time Command File was Generated:

Source File Name: C:\PTOLEMY_EGSE_FINAL\Scripts\LvConvtsts\LvConvtsts.doc
Error File Generated Name: CommandFile(01.05.15)@13.41.20.txt
Date Command File was Generated: 15/05/2001
Time Command File was Generated: 13:41:20
0A3102D146020A300A311C2946020A300A33000746020A320A33000A46020A320A39000F46020A38
0A39001146020A380A3B001446020A3A0A3D000446020A3C

Figure 2-82 An Example of a Converted Code File

There is minimal error checking at his stage due to the fact that by the time a command list reaches the conversion stage it should have (if the normal sequence of steps have been followed) been error checked and simulated to remover any errors. The one thing that is checked is the length of the resulting converted code file. This has to be an integer number of bytes or there will be an error during transmission. An automatic check is completed on all files if the 'Number of Words' field found under the title text 'Conversion Information' is not an integer then the number is highlighted in red and the converted file cannot be saved (as shown in Figure 2-83).
Another feature designed to mitigate the risk of incorrect length fields is a check on whole command files (those that end in FF for end of mode - EOM). Where EOM is the last instruction in the list, the program will check to see if the addition of 'FF' to the 'Code File List' list box will lead to an invalid file length field. If it will then the program automatically adds another 'FF' to give an even byte number as shown in Figure 2-84.

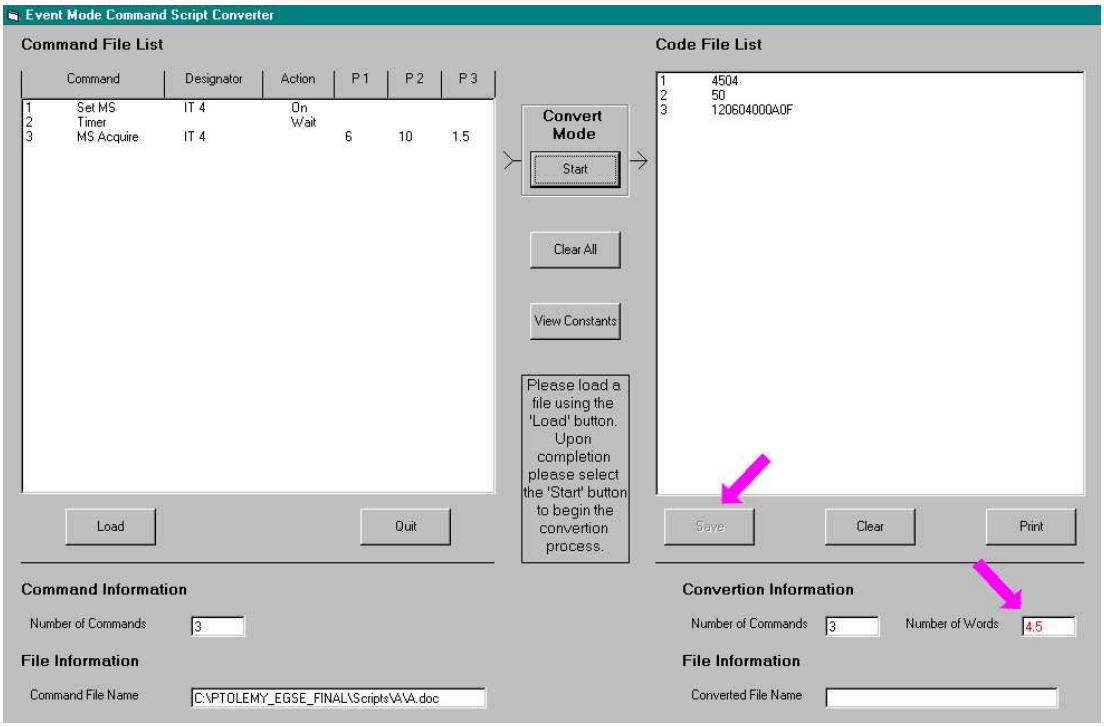


Figure 2-83 The File Converter Form Showing a File Length Error

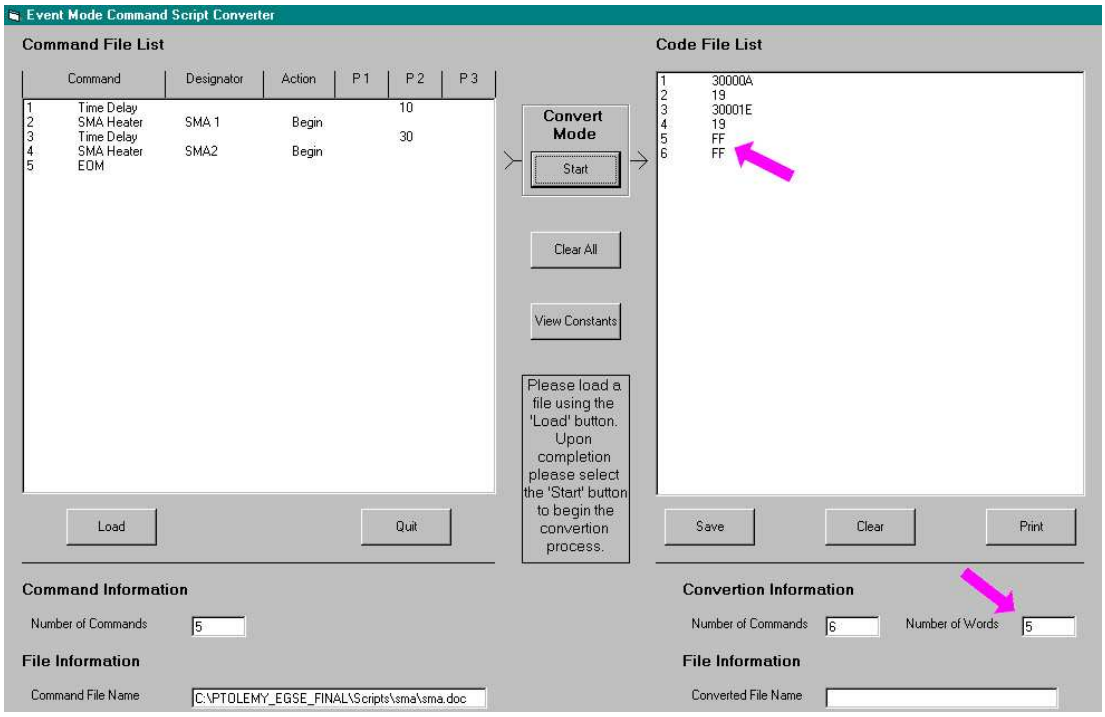


Figure 2-84 The File Converter Form Showing the Additional 'EOM' Correction

2.8 Command Formatter and Transmitter

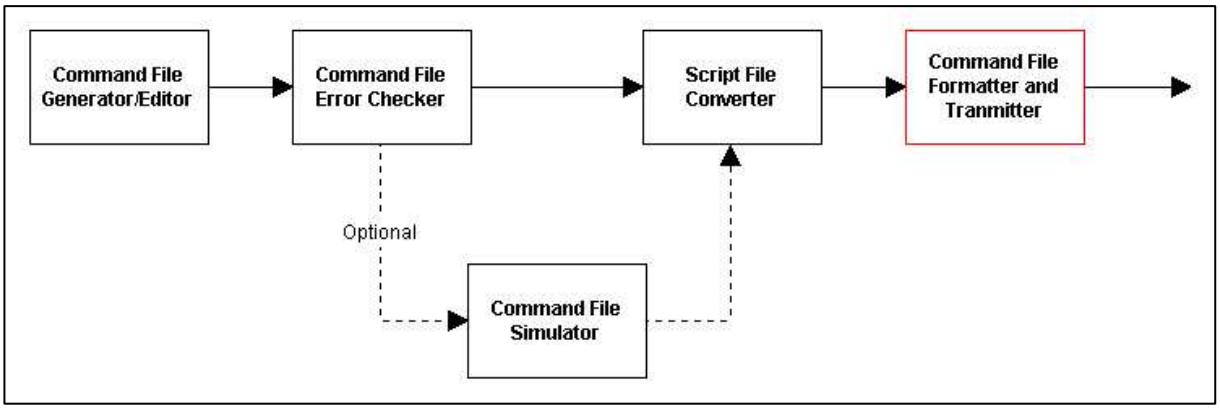


Figure 2-85 Module Flow Diagram – Command Formatter and Transmitter

The fifth step of the process (see Figure 2-85) is to select 'Command Formatter and Transmitter' from the 'Starter.exe' main menu (see Figure 2-4) the following screen will appear (see Figure 2-86). The purpose of command formatter and transmitter is to prepare properly formatted command packets for transmission to the instrument (this includes all the necessary packet header/checksum information). The initial selection of a required function is available from the pull down menu in the upper left-hand corner of the form.

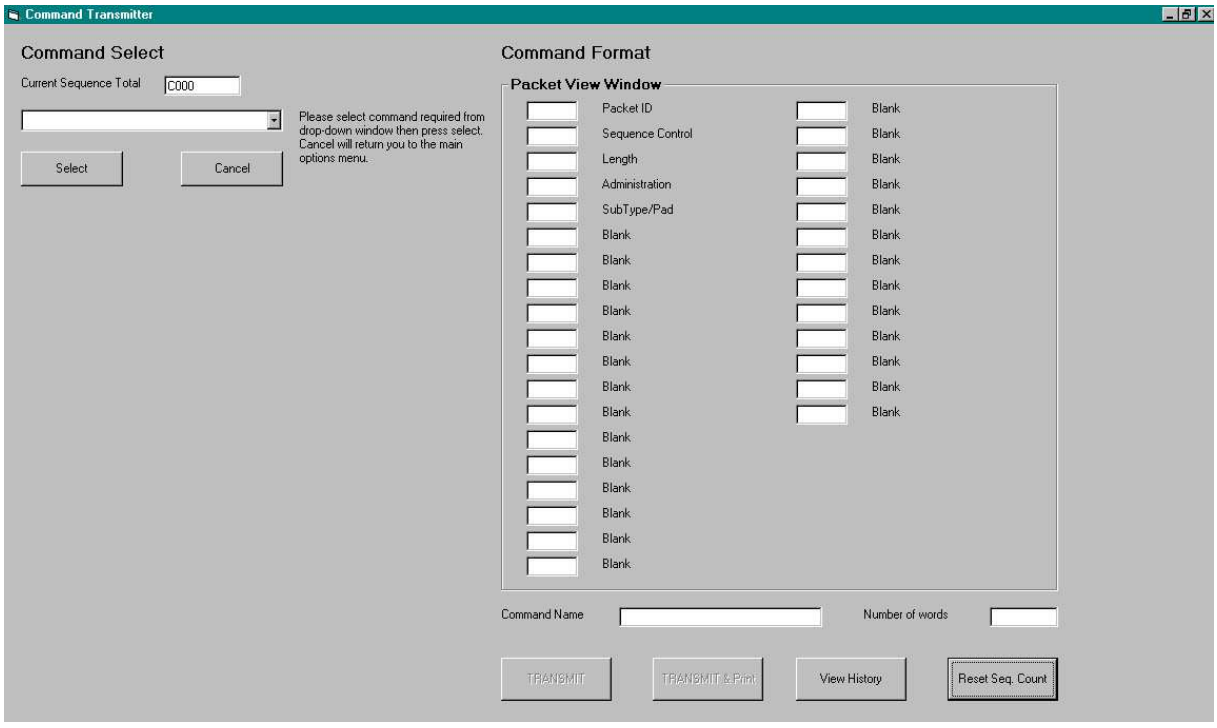


Figure 2-86 The Command Transmitter Form

The following 25 commands are available from the pull down menu in the top left had corner of the screen. Simply select the required function and press 'Select'. You will then be presented with a variety of options using a mixture of dropdown menus and data entry windows that will appear under the 'Select' and 'Cancel' buttons.

Some functions may lead to the opening of another form to enable data entry or the opening of a required file. The sequence for form, data entry boxes or drop down menus is shown in Table 2 Command Entry Sequences.

Command	1	2	3	4	5	6	Comments
1. Load Memory	M	M	*M	*D	*M	#D	Manual
	F	F	-	-	-	-	Prepared file
2. Dump Memory	M	M	*M	*D	*M	-	
3. Check Memory	M	M	*M	*D	*D	-	
4. Connection Test	-	-	-	-	-	-	
5. Copy Memory	M	*M	*D	*M	*D	*M	
6. Start Standby Mode (from safe mode)	M	D	-	-	-	-	
7. Select Ground Test Mode	M	-	-	-	-	-	Gas tank selection
8. Select Post Launch Mode	-	-	-	-	-	-	
9. Select Cruise Phase Mode	-	-	-	-	-	-	
10. Select Instrument Checkout Mode	-	-	-	-	-	-	
11. Select HTO Conditioning Mode							
12. Select MTO Conditioning Mode							
13. Select CASE Conditioning Mode							
14. Select Survival Evaluation Mode	-	-	-	-	-	-	
15. Select HE Rupture Mode	M	-	-	-	-	-	Gas tank selection
16. Select Calibration Mode	M	-	-	-	-	-	Gas tank selection
17. Select Dynamic PreOps Mode	M	-	-	-	-	-	Gas tank selection
18. Select Ice Core Analysis HTO Mode	M	-	-	-	-	-	Gas tank selection
19. Select Atmosphere Analysis Mode	M	-	-	-	-	-	Gas tank selection
20. Select Silicate Analysis Mode	M	-	-	-	-	-	Gas tank selection
21. Select Ice Core Analysis MTO Mode	M	-	-	-	-	-	Gas tank selection
22. Select Additional Science	M	-	-	-	-	-	Gas tank selection
23. Select Safe Mode	-	-	-	-	-	-	
24. Hazardous Function Enable	F	F	F	-	-	-	
25. Parameter Update	D	M	#D	-	-	-	

NB M = Menu, D = Data Entry Box, F = Form, * = For Each Block, # = For Each Word

Table 2 Command Entry Sequences

*** NOTE it should be noted that for ALL modes the number in the 'Current Sequence Total' text box can read any number between C000 and C7FF.***

2.8.1 Load Memory

Load Memory is the first item in the 'Command Select Window' as shown in Figure 2-87. Once selected fron the menu (by double clicking the required function and it appearing in the upper menu window) press the 'Select' button.

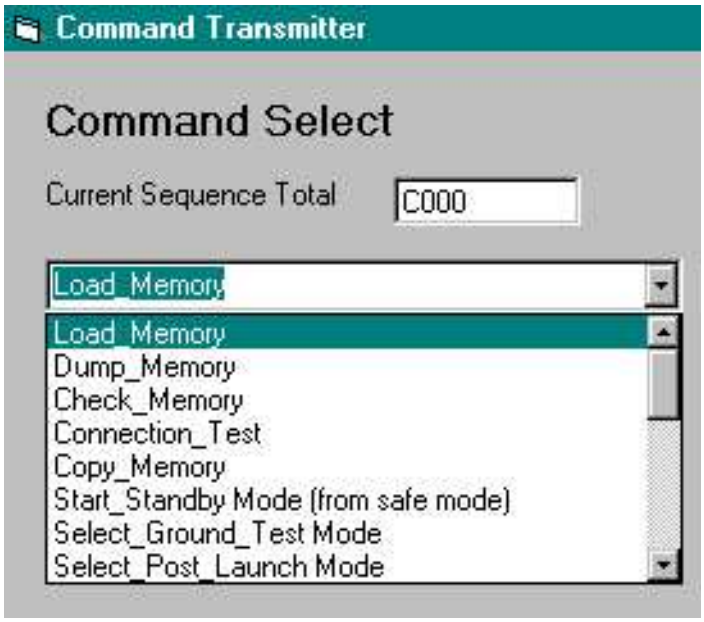


Figure 2-87 Command Select Window for Load Memory

Having selected load memory a message box will appear asking if you wish to send a previously prepared file as shown below in Figure 2-88.

Figure 2-88 File Send Message Box

- If you select NO (if you select yes go to page 80)

Having selected NO the format is similar to that of other functions. The administration message box will appear (as shown in Figure 2-89) asking if you wish to have an acknowledgement of this packet. If you select yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select no then no acceptance packet will be generated.

Figure 2-89 The Administration Message Box

Having either selected no or yes then the first of the options boxes will appear under the 'Select' and 'Cancel' buttons (see Figure 2-90). The list of data entry items you will be presented with are as follows:

- The Block Count
- The Memory ID
- The Memory Page
- The Memory Offset
- The Number of Words
- The Word Data (one for each of the number of words)

The block count is used to specify how many sections of memory you wish to load to. The select button (which starts off inactive) will be activated when an initial selection is made from the menu.

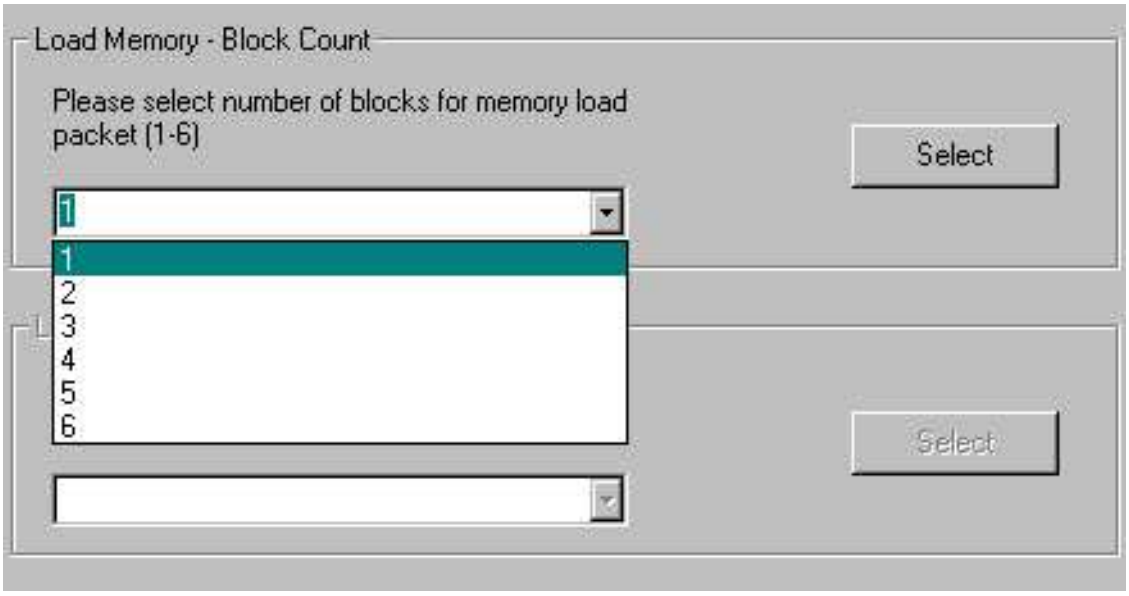


Figure 2-90 The Block Count Drop-Down Menu

Having selected the number of memory blocks you wish to load to, next you have to select the memory ID for the load memory command. This menu will appear under the block count drop-down menu (which will now go light grey indicating it is no longer active). You will have the option of loading to EEPROM or to RAM (obviously you cannot write to the PROM). For an example of the memory ID drop-down menu see Figure 2-91.

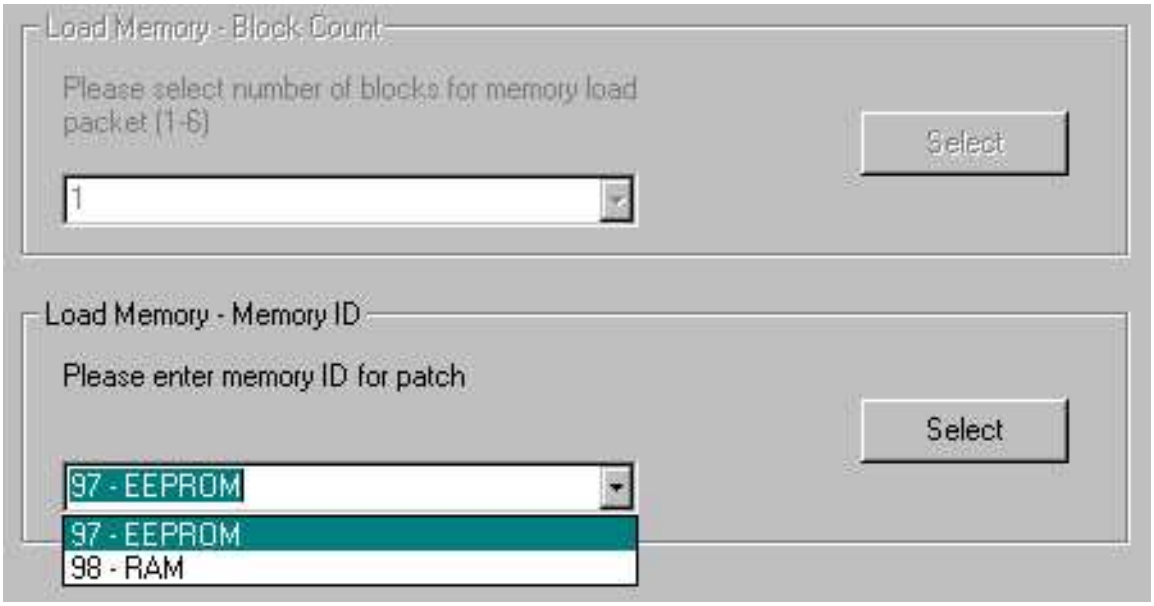


Figure 2-91 The Memory ID Drop-Down Menu

Having chosen the memory ID next choose the physical page number you wish to load to. The program automatically presents you with a drop-down menu giving the pages that correspond with the memory ID chosen (as shown in Figure 2-92). A full list of the memory IDs and associated page numbers is shown in Table 3:

Memory ID	Start Page	End Page
PROM	0	1
I/O Pages (reserved)	2	3
EEPROM	4	7
RAM	8	F

Table 3 Memory ID and Associated Page Numbers

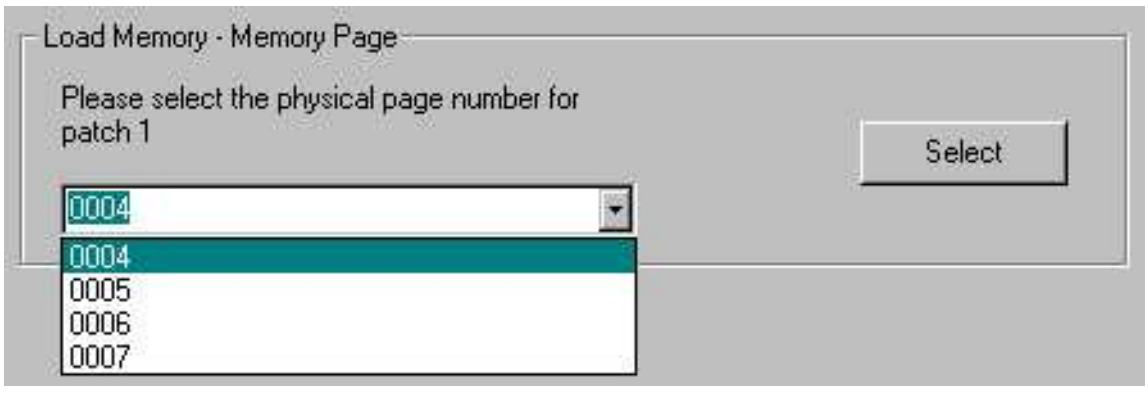


Figure 2-92 The Memory Page Drop-Down Menu

Once the physical page has been chosen, the next prompt will appear. This appears under the page number (which will go inactive). This drop-down menu defines the offset into the page for the load memory command.

The drop down menu will automatically calculate the number of words available to write in order to fit into one packet (reserving one word for the remaining number of blocks, if a number of large patches is required then it is advisable to use several load memory commands). The offset is selected by using a data entry box. The select button becomes active once four valid hexadecimal characters are entered (See Figure 2-93).

*** NOTE valid characters are the numbers 0-9 and the letters A-F; lowercase letters are automatically changed to uppercase.***

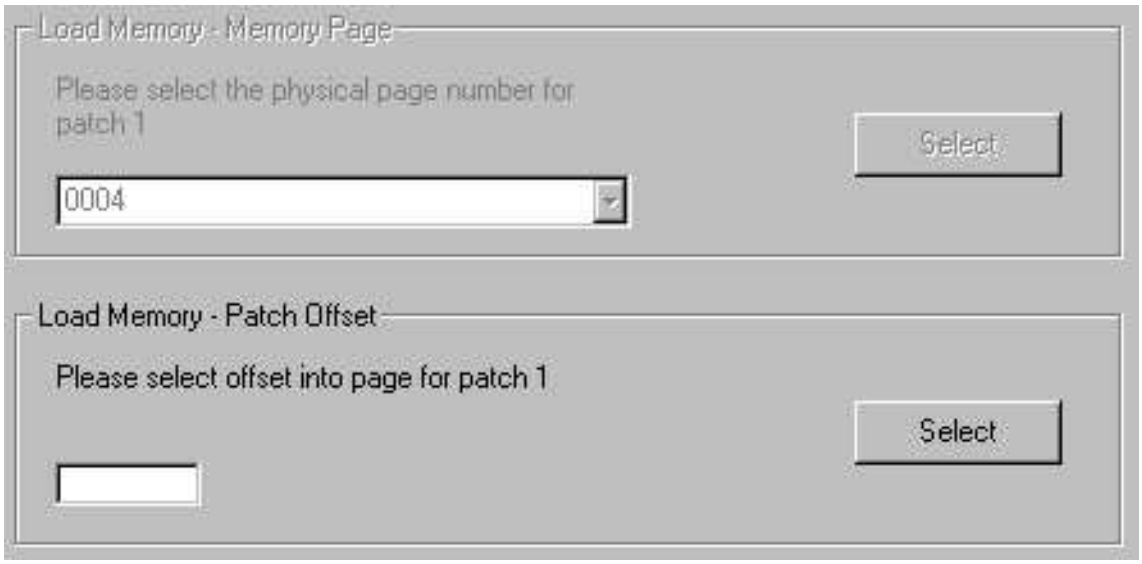


Figure 2-93 The Memory Offset Drop-Down Menu

Next comes the selection of the number of words to be loaded (see Figure 2-94). As mentioned above the program automatically reserves 1 word for each block initially. The total number of words available, assuming only one block, is **22**.

If a number greater than 1 is required for subsequent patches then 3 words (page, offset, number of words) should be reserved for each patch plus the one word minimum for data. For example:

If the load memory command has 3 blocks with the following number of words 10, 5, and 1 then:

The first word number will only present you with a maximum patch length of E (which is 15). However, knowing that the second patch you require is 5 words long you should only select up to A (which is 10). The third block already has 1 word reserved for it.

The second Word number will only let you select 5 as the maximum patch length.

The third word only lets you select 1 word as this is the number remaining to complete a packet and was automatically reserved by the program when you selected 3 blocks at the start

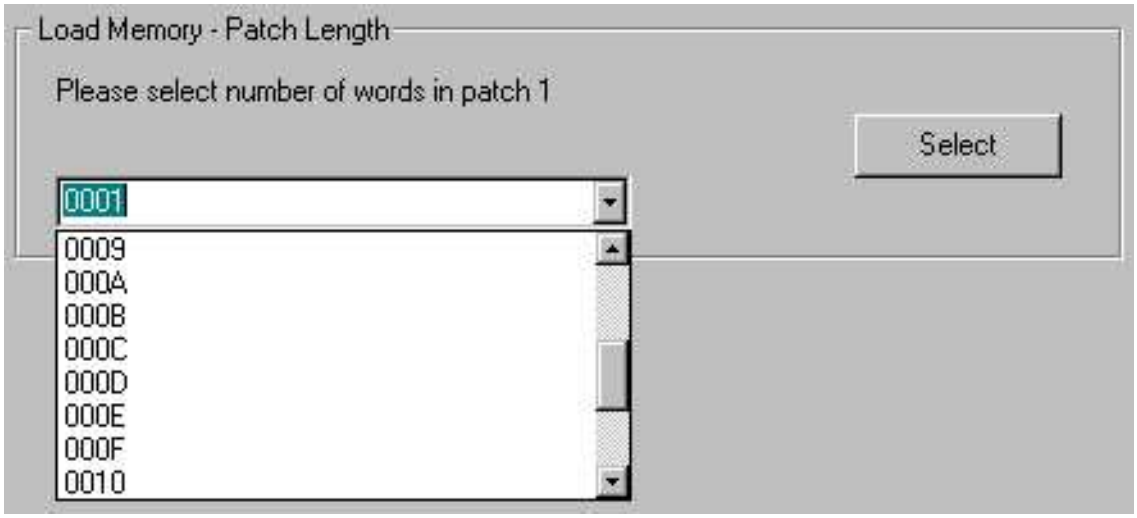


Figure 2-94 The Patch Length Drop-Down Menu

The last task is to enter data for each of the patch words. This is done in the 'patch data' data entry box shown below in Figure 2-95. As with the patch offset data entry box the select enables itself once four valid characters are entered.

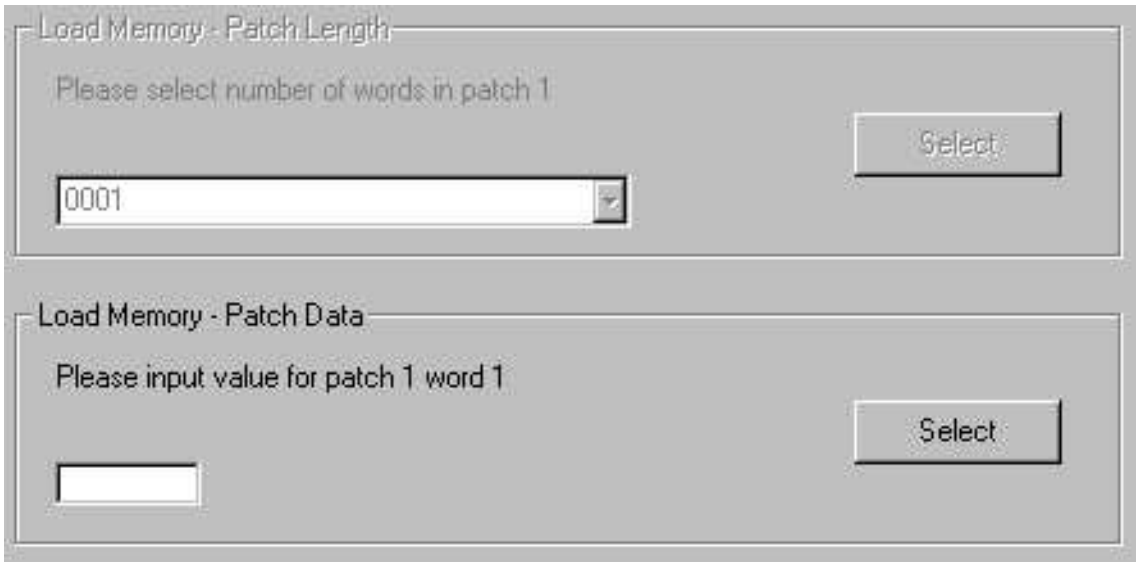


Figure 2-95 The 'Patch Data' Data Entry Box

Once all the data has been entered the Command Transmitter Form will look something like Figure 2-96. Once you have checked the contents all that remains is to press the 'Transmit' button to send the command to Ptolemy.

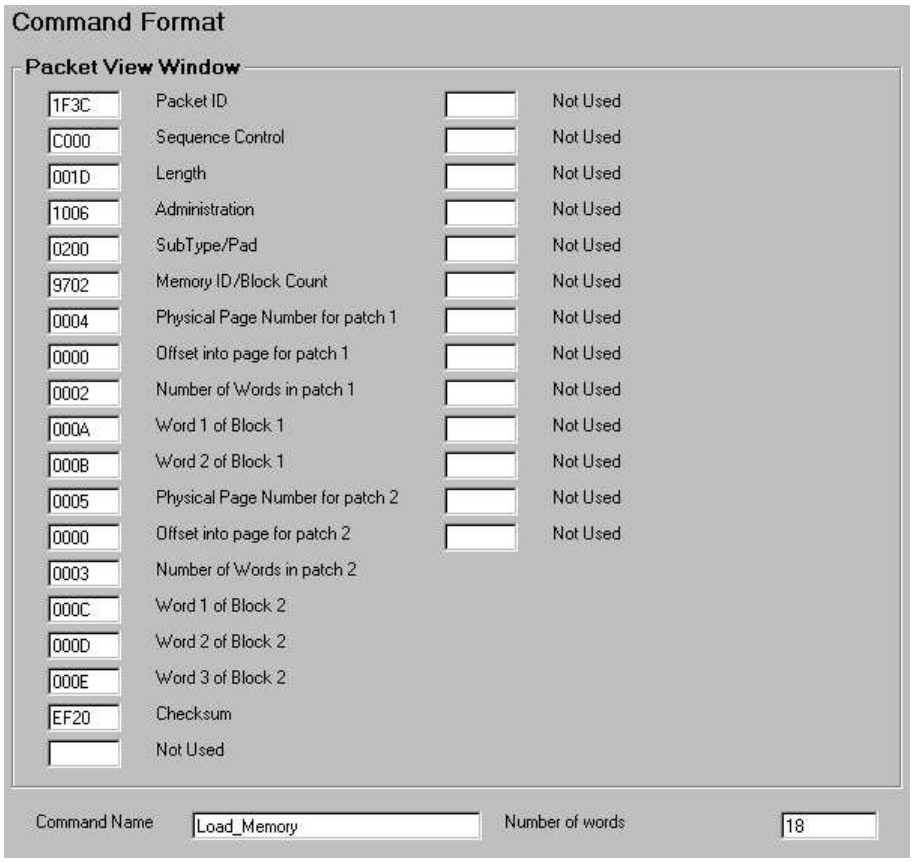


Figure 2-96 Example Command Transmitter Form for Load Memory

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-97.

Figure 2-97 The Transmission Confirmation Message Box

- If you selected YES (to the 'Do you wish to send a prepared file?' message box).

Having chosen to send a prepared file the first item that will appear is a common dialog form asking you to 'open' the file you wish to send (see Figure 2-98). The default directory is …\Working. To alter the directory simply pull down the drop-down menu shown next to the 'look in:' prompt. You may have to select the next highest level several times to see the prompt for the root directory (for example **C:**).

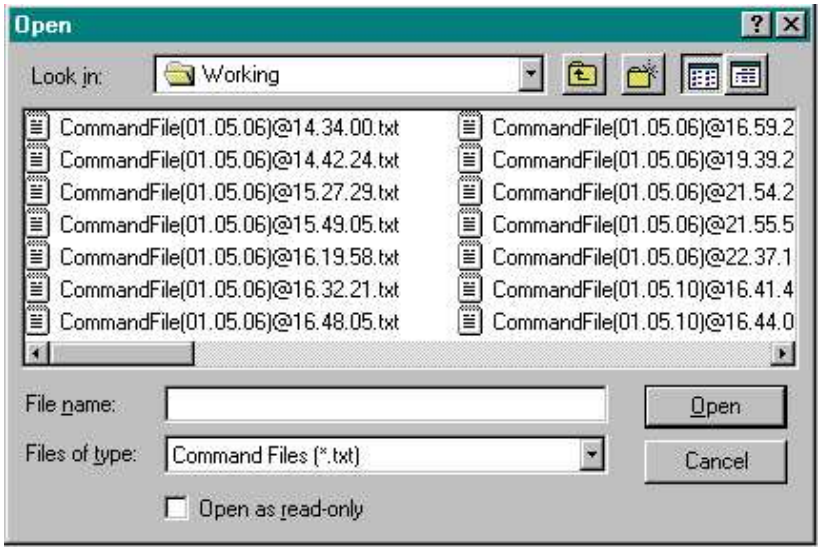


Figure 2-98 The 'Open' Common Dialog Form

Select the file you wish to send either by double clicking directly on the file name or selecting the file name as it appears in the 'File name:' box and pressing 'Open'. The next form to appear is the file transmit form shown in Figure 2-99. The information is an abbreviated form of the information you would be asked if you manually entered the data. First is the memory ID selected from a drop-down menu. The form selects the first item selected from the drop-down menu and automatically moves on the next item on the form.

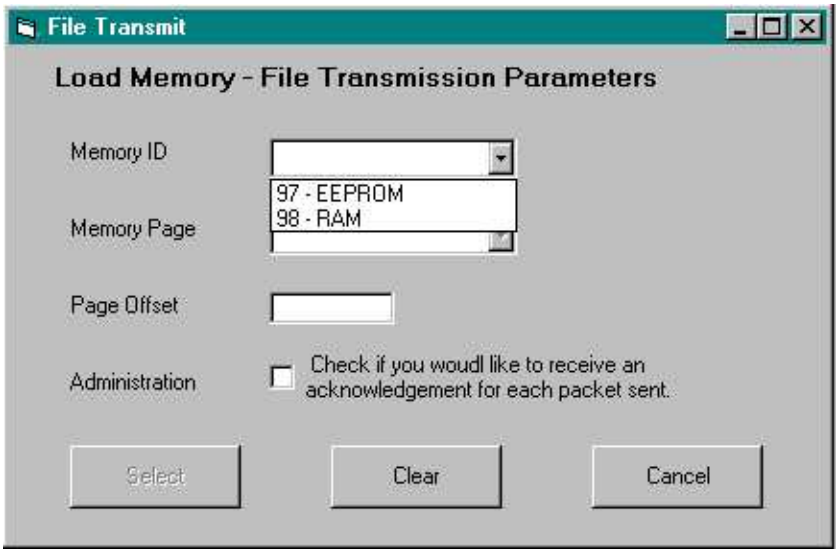


Figure 2-99 The File Transmit Form

Once the Memory ID is selected the next item is the Memory page. The program automatically populates the memory page drop-down menu with the appropriate pages (for further information see Table 3 Memory ID and Associated Page Numbers on page 77). The memory page drop-down menu can be seen in Figure 2-100. As with

the memory ID drop-down menu the form selects the first item chosen from the menu and moves to the last compulsory item which is the page offset.

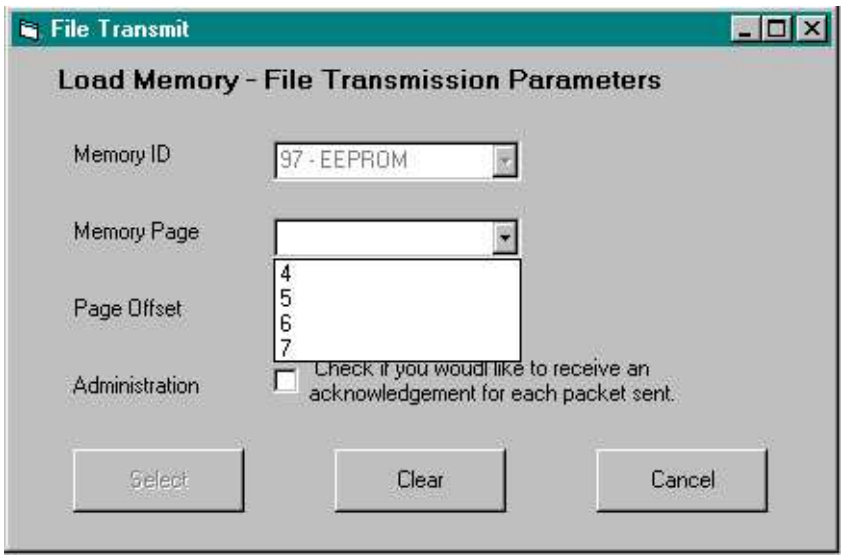


Figure 2-100 The Memory Page Drop-Down Menu

The page offset is a data entry box (see Figure 2-101) that becomes active once a memory page is selected. The administration tick box at the bottom of the form is an optional data field (select becomes active whether this is selected or not). If you require a confirmation of receipt packet then check (X) the box. Once 'Select' is pressed the rest of the process is automatic.

*** NOTE no transmit confirmation box will appear once 'Select' is pressed (for prepared files only).***

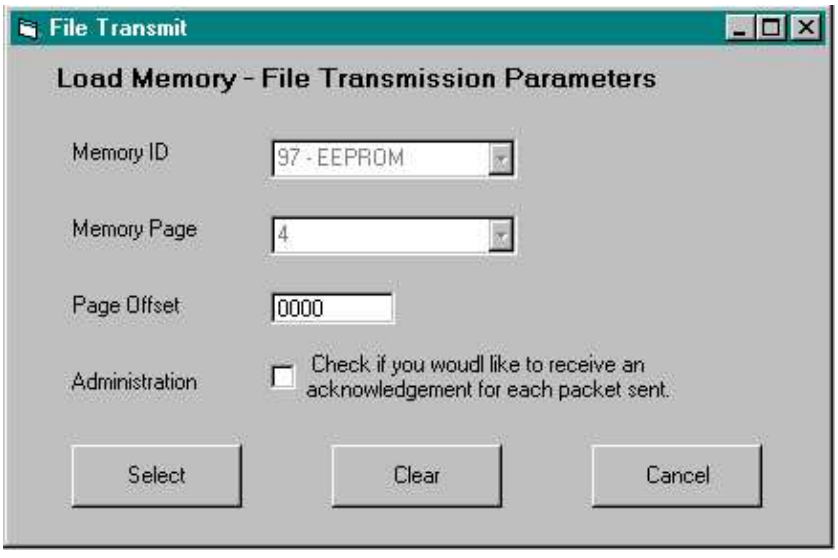


Figure 2-101 The Page Offset Data Entry Box

2.8.2 Dump Memory

Dump Memory is the second item in the 'Command Select Window' as shown in Figure 2-102. Once selected (by double clicking) press 'Select'.

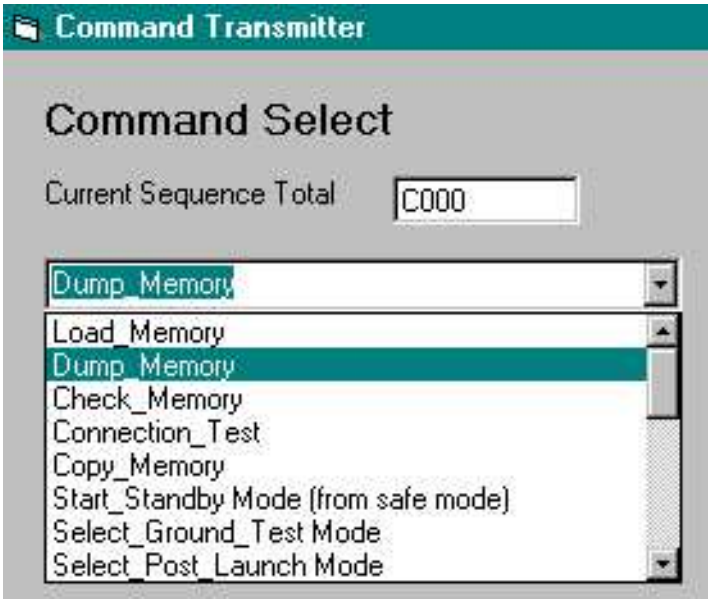


Figure 2-102 Command Select Window for Dump Memory

Once you have selected dump memory a message box will appear (see Figure 2-103) asking if you wish to have an acknowledgement of this packet. If you select yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select no then no acceptance packet will be generated.

Figure 2-103 The Administration Message Box

The first option box to appear will be one asking how many blocks of memory you wish to dump (1-8). The number is chosen from a drop-down menu as shown in Figure 2-104. The list of data entry items you will be presented with is as follows:

- The Block Count
- The Memory ID
- The Memory Page
- The Memory Offset
- The Length

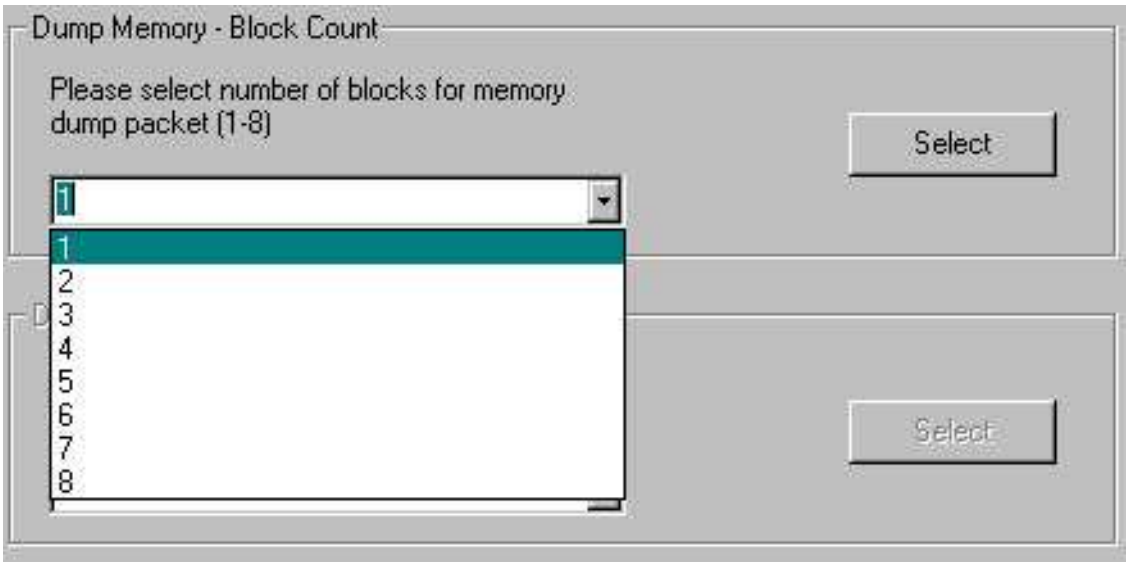


Figure 2-104 The Block Count Drop-Down Menu

The next option to appear after the block number (which will go inactive) is the Memory ID select. The Memory ID is selected from a drop-down menu like the one shown in Figure 2-105. The content of this drop-down menu is a slightly different from the one in Load memory in that you ran dump/copy from PROM (you are unable to load to it).

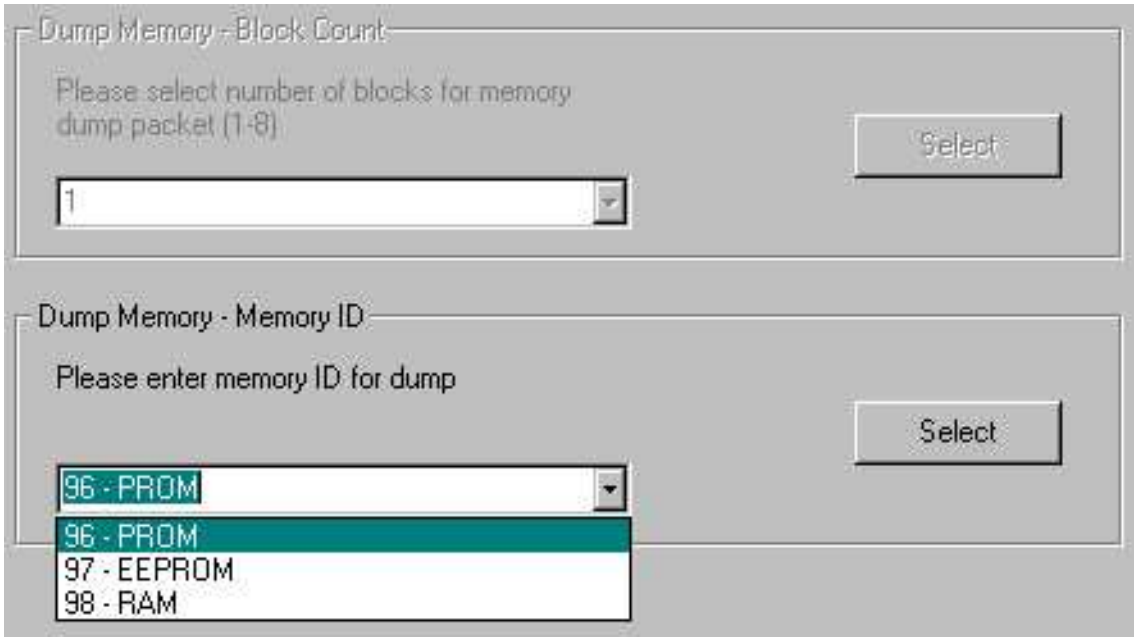


Figure 2-105 The Memory ID Drop-Down Menu

The next option to appear after the Memory ID select is the Physical Page for the first dump. The Physical Page is selected from a drop-down menu like the one shown in Figure 2-106 . The content of the drop-down menu is automatically generated in response to the Memory ID you selected (for more information see Table 3 Memory ID and Associated Page Numbers on page 77).

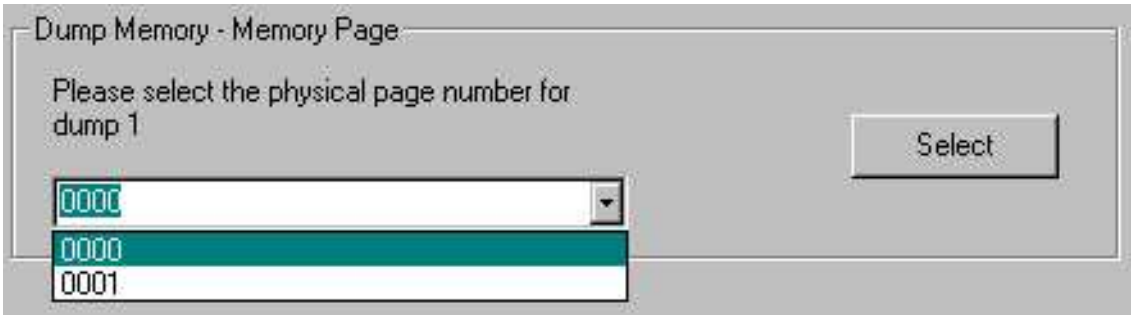


Figure 2-106 The Memory Page Drop-Down Menu

Having chosen the page from which to dump, the next menu lets you select the offset into the page from which you wish to dump. The offset is selected by entering the desired address (in hex) into the data entry window shown in Figure 2-107.

*** NOTE valid characters for addresses are the numbers 0-9 and the letters A-F, lowercase letters are automatically changed to uppercase.***

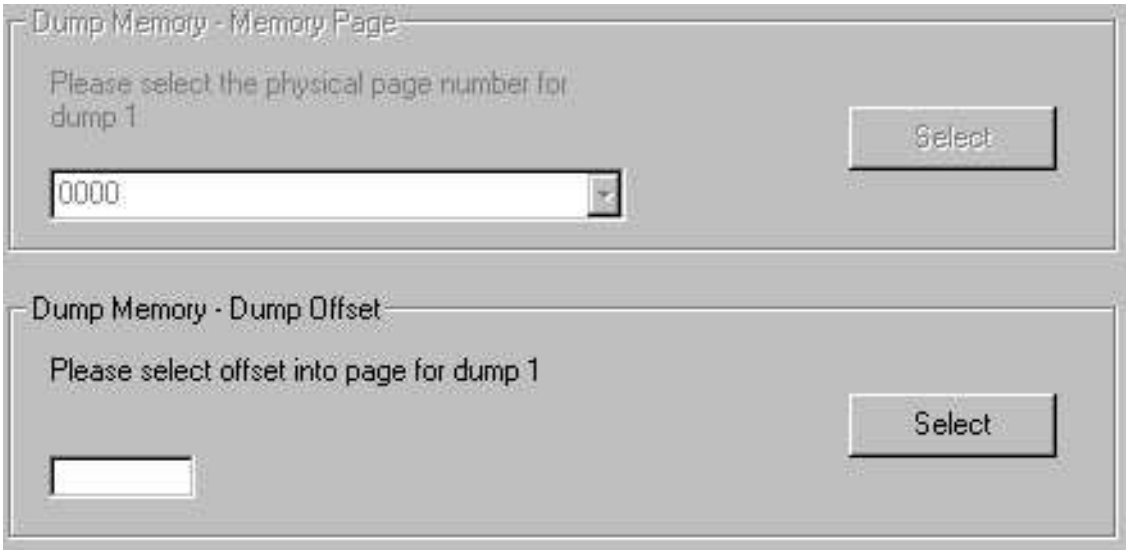


Figure 2-107 The Memory Offset Data Entry Menu

Once the offset has been typed in the length of the dump is the next piece of information requested. The drop-down menu for this will look similar to Figure 2-108.

*** NOTE that the FIRST four digits shown on a line are the hex numbers the next number after the '–' sign is the decimal equivalent.***

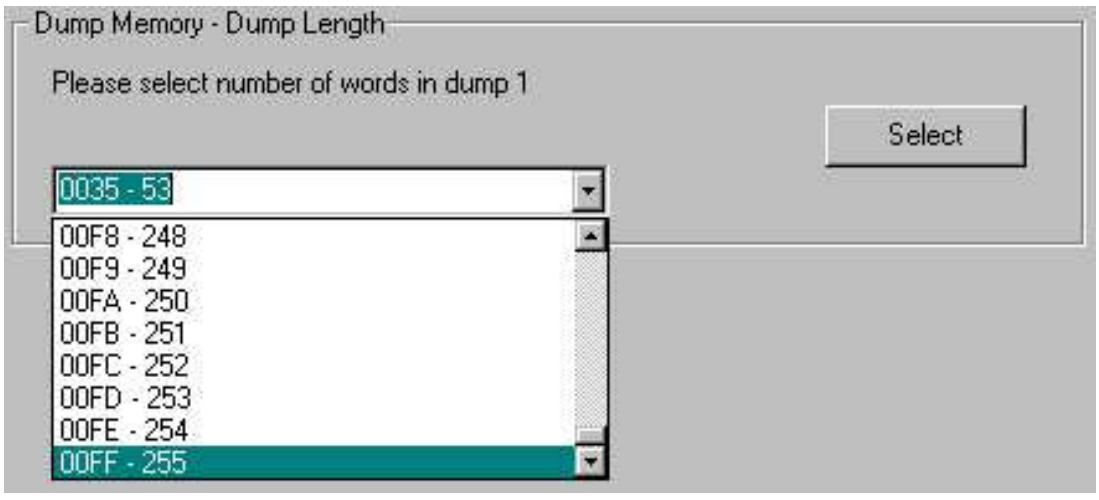


Figure 2-108 The Dump Length Drop-Down Menu

Once the length has been selected the Command Transmitter Form will look something like Figure 2-109. Once you have checked the contents all that remains is to press the 'Transmit' button to send the command to the instrument.

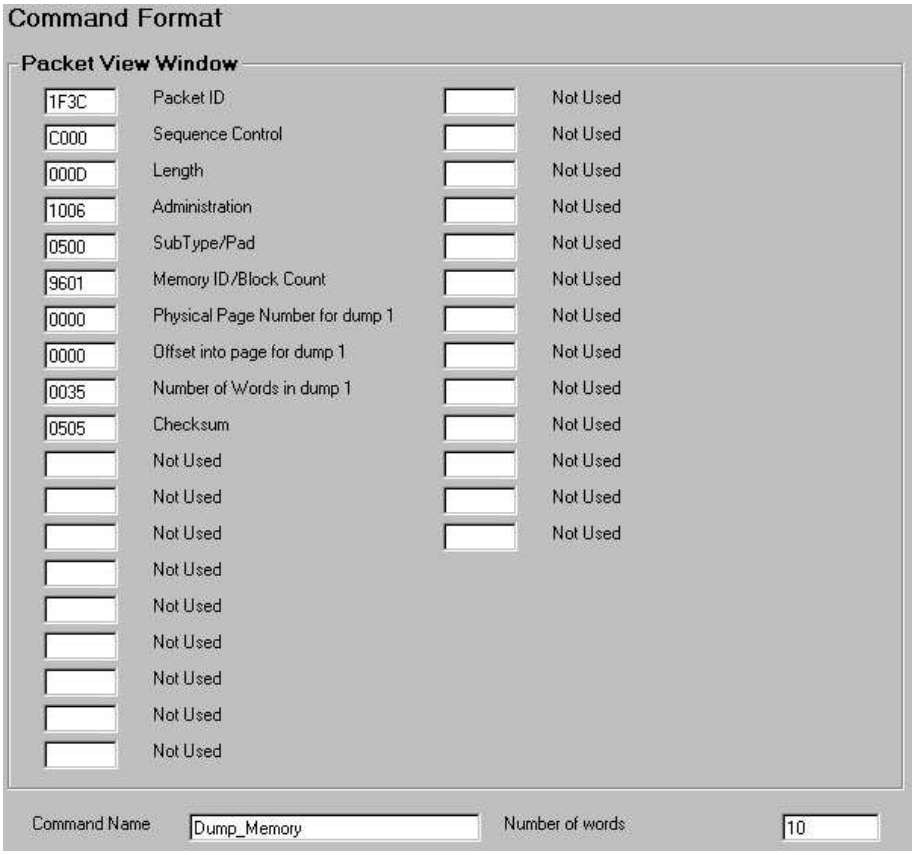


Figure 2-109 Example Command Transmitter Form for Dump Memory

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-110.

Figure 2-110 The Transmission Confirmation Message Box

2.8.3 Check Memory

Check Memory is the third item in the 'Command Select Window' as shown in Figure 2-111. Once selected (by double clicking) press 'Select'. The check memory command simply performs a checksum over the words in the specified block (ignoring carries).

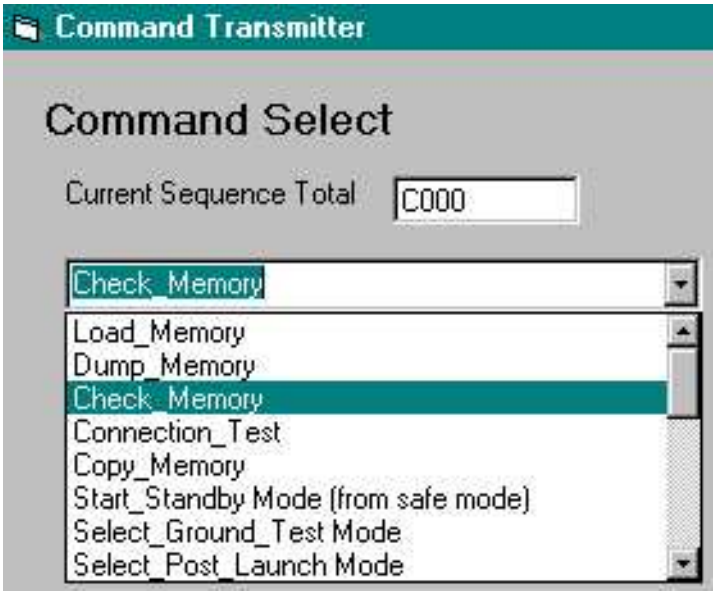


Figure 2-111 Command Select Window for Check Memory

Once you have the check memory mode a message box will appear (see Figure 2-112) asking if you wish to have an acknowledgement of this packet. If you select yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select no then no acceptance packet will be generated.

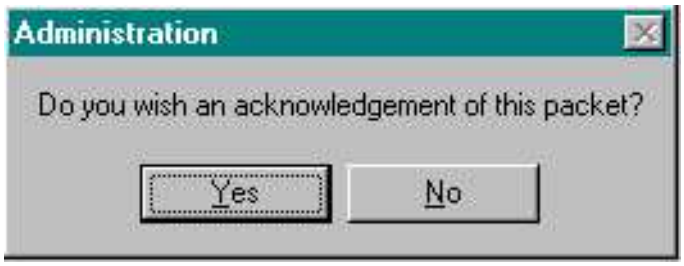


Figure 2-112 The Administration Message Box

Having selcted 'Yes' or 'No' from the administration message box the list of data entry items you will be presented with is as follows:

- The Block Count
- The Memory ID
- The Memory Page
- The Memory Offset
- The Length

The first thing to do is to choose the number of separate blocks you wish to check. The drop down menu that will automatically appear will look similar to Figure 2-113.

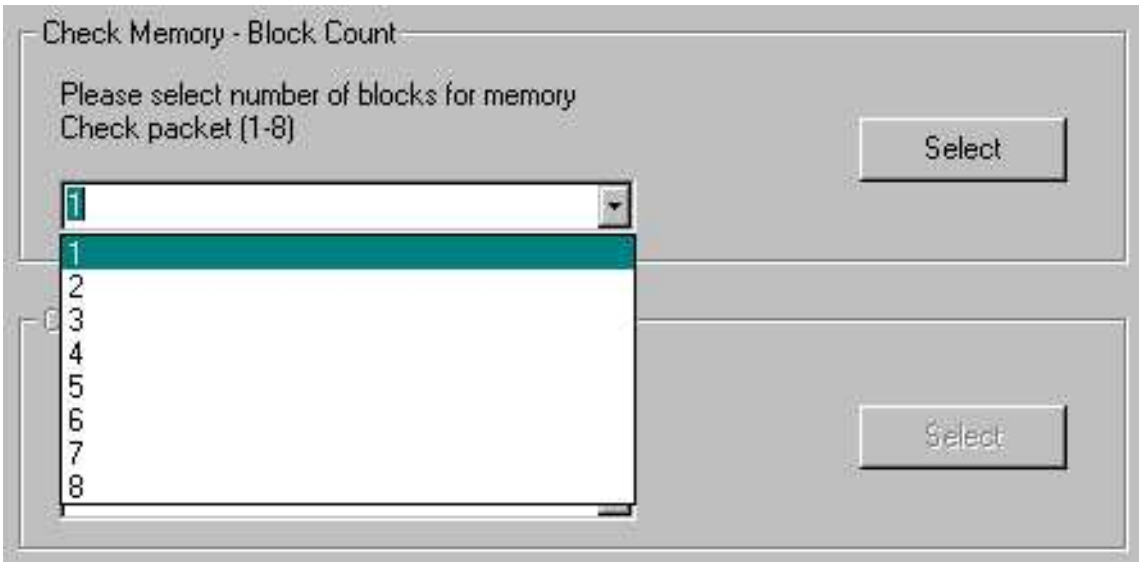


Figure 2-113 The Block Count Drop-Down Menu

You can specify up to eight blocks of memory to check. Next select the memory ID you wish to use this can either be PROM, EEPROM, or RAM. All checks performed in this command must be from the same memory ID (they can be different associated memory pages). The menu used to select the memory ID is shown in Figure 2-114.

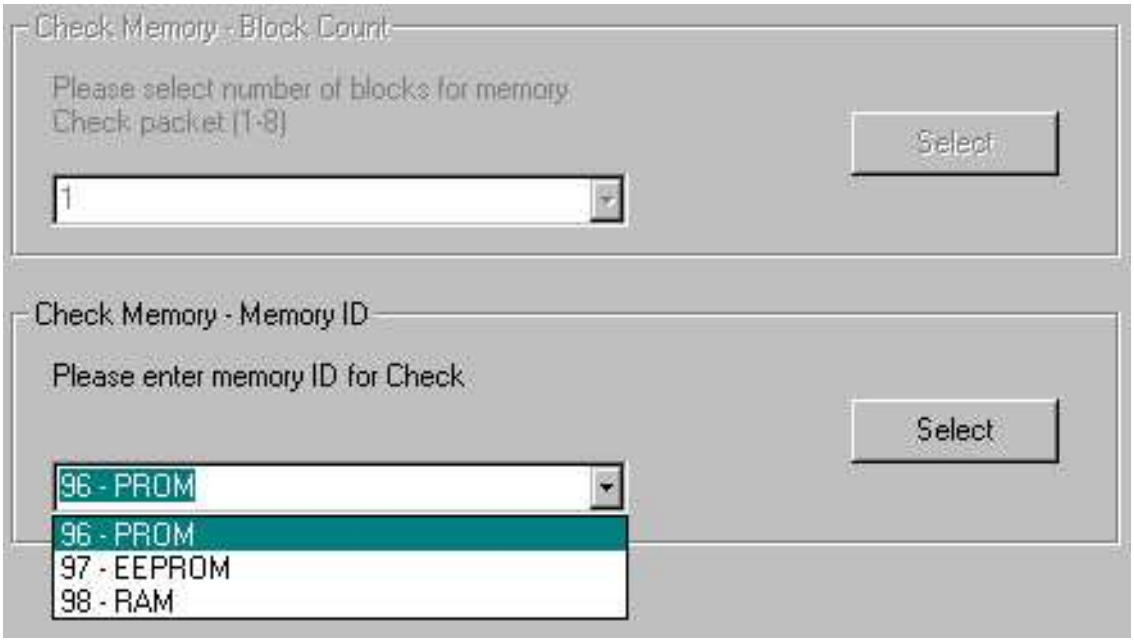


Figure 2-114 The Memory ID Drop-Down Menu

Once the memory ID has been chosen the next menu will appear automatically showing the pages that are available based on your choice of memory ID. This menu will appear once for each block you specify at the beginning and an example is shown in Figure 2-115.

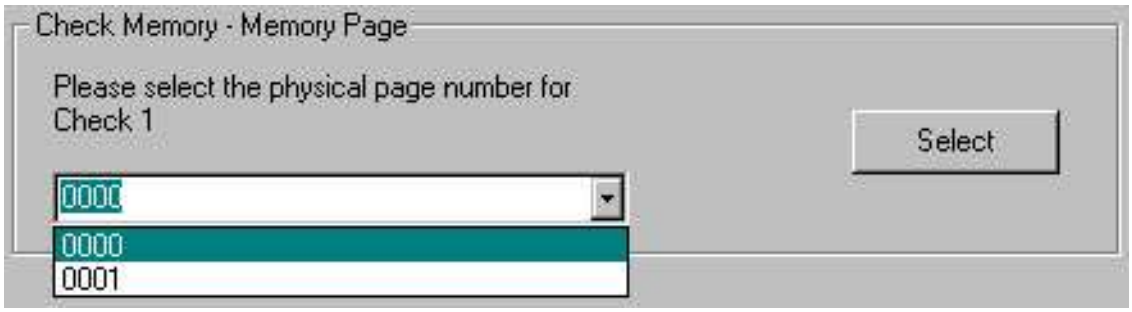


Figure 2-115 The Memory Page Drop-Down Menu

Having selected the page number the next menu allows you to select the offset into the page where you wish the check to start from (this menu also appears once for each block). The data entry window for the page off set will look similar to Figure 2-116.

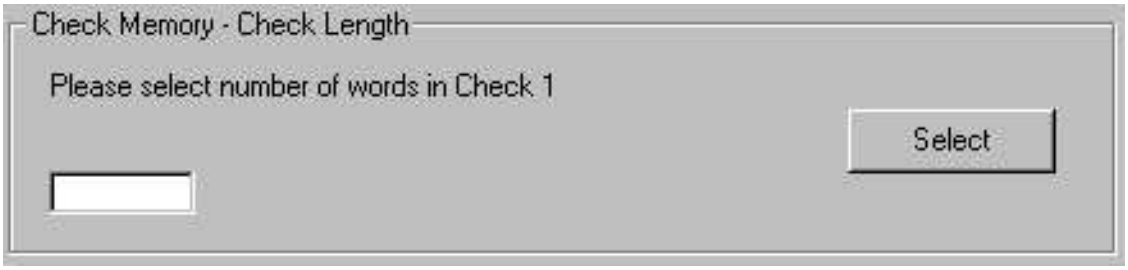


Figure 2-116 The Memory Offset Data Entry Menu

The final required filed for each specified block is the length. This is used to specify the number of words you wish the check to be performed over. The data entry window for number of words will look similar to Figure 2-117, this menu will appear once for each block you selected at the beginning.

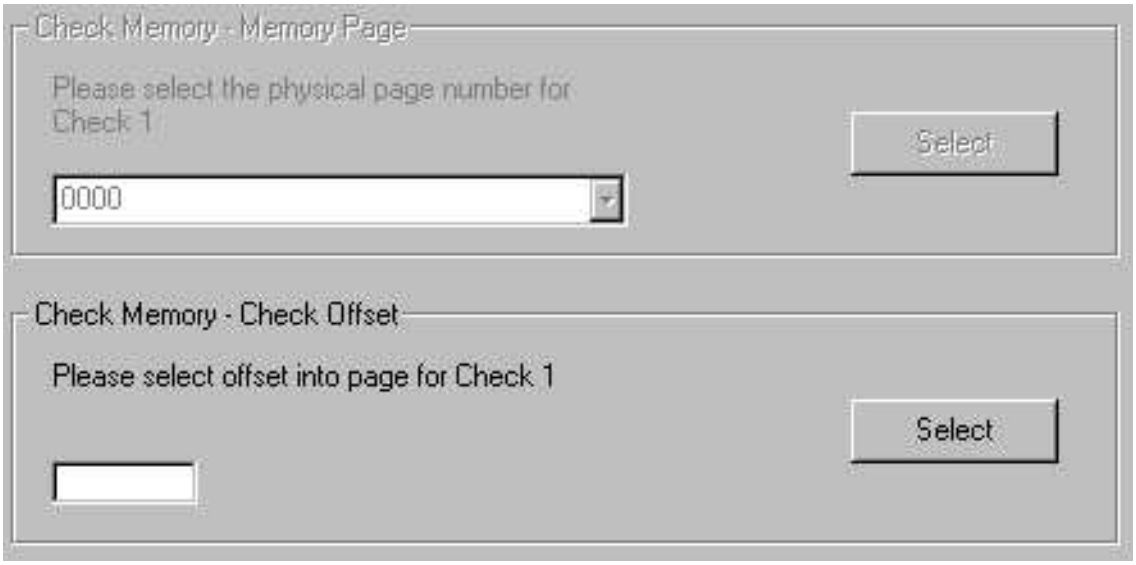


Figure 2-117 The Check Length Drop-Down Menu

Having completed the data entry for the number of blocks you specified at the start your completed form should look similar to Figure 2-118. Once you have checked the contents all that remains is to press the 'Transmit' button to send the command to the instrument. The example below shows one block of memory to be checked chosen from page zero of PROM. The check starts as word zero and is ten (A in hex) words long.

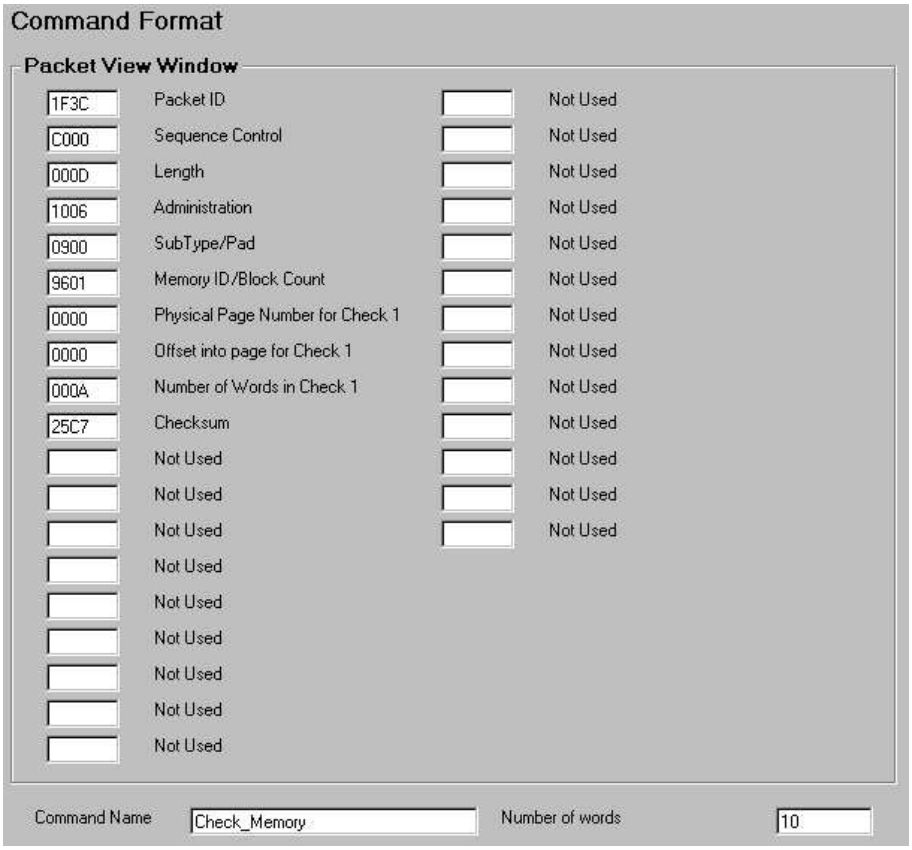


Figure 2-118 Example Command Transmitter Form for Check Memory

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-119.

Figure 2-119 The Transmission Confirmation Message Box

2.8.4 Connection Test

Connection Test is the fourth item in the 'Command Select Window' as shown in Figure 2-120. Once selected (by double clicking) press 'Select'.

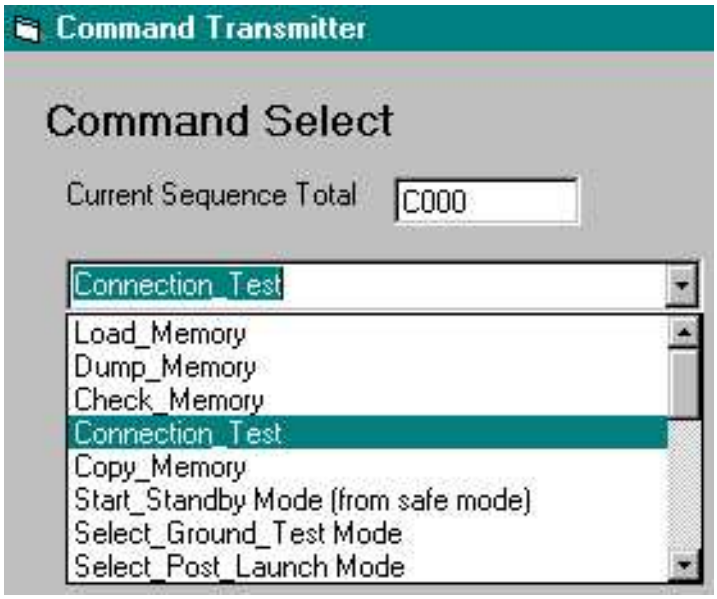


Figure 2-120 Command Select Window for Connection Test

Once you have the connection test mode selected a message box will appear (see Figure 2-121) asking if you wish to have an acknowledgement of this packet. If you select yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select no then no acceptance packet will be generated.

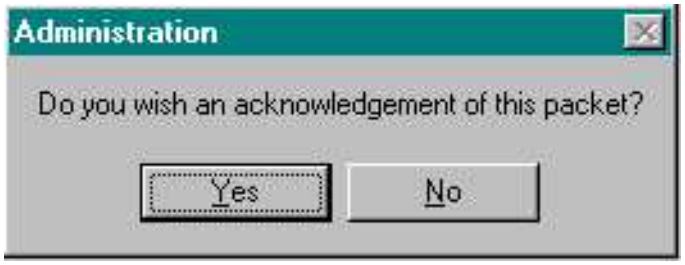


Figure 2-121 The Administration Message Box

The Connection test is a short command with no input menus associated with it. Once you have selected 'yes' or 'no' from the administration menu the Command Transmitter Form will look something like Figure 2-122. Once you have checked the contents all that remains is to press the 'Transmit' button to send the command to the instrument.

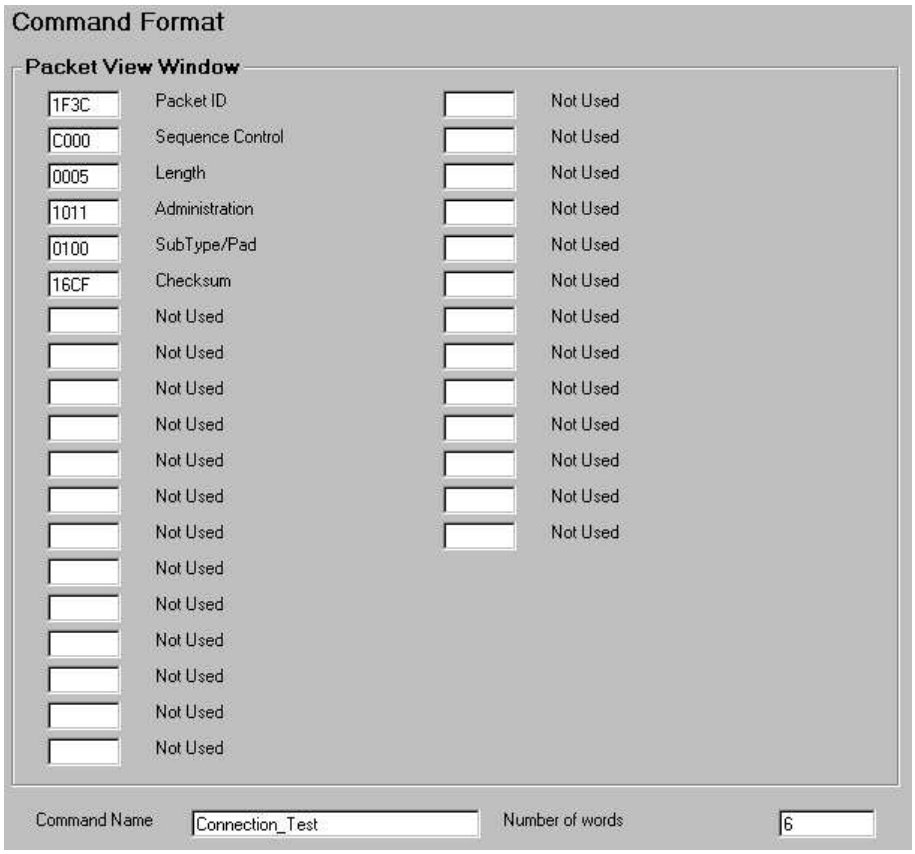


Figure 2-122 Example Command Transmitter Form for Connection Test

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-123.

Figure 2-123 The Transmission Confirmation Message Box

2.8.5 Copy Memory

Copy Memory is the fifth item in the 'Command Select Window' as shown in Figure 2-124. Once selected (by double clicking) press 'Select'.

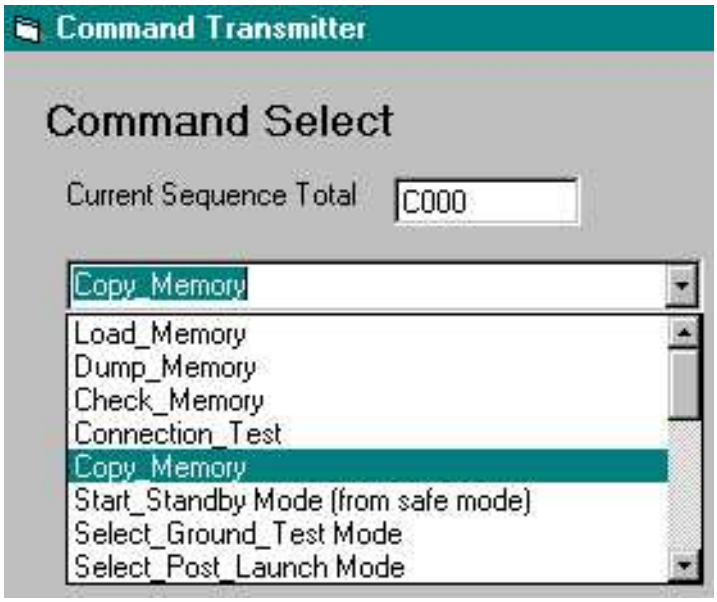


Figure 2-124 Command Select Window for Copy Memory

Once you have the copy memory mode selected a message box will appear (see Figure 2-125) asking if you wish to have an acknowledgement of this packet. If you select yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select no then no acceptance packet will be generated.

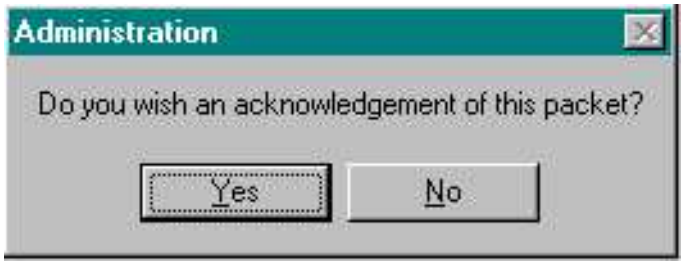


Figure 2-125 The Administration Message Box

Having chosen whether you wish to receive an acknowledgement, the list of data entry items you will be presented with is as follows:

- The Block Count
- The Memory Page – Source
- The Memory Offset – Source
- The Memory Page – Destination
- The Memory Offset – Destination
- The Number of Words

The first item is the block count, which is used to specify how many sections of memory you wish to copy from. The drop-down menu for the block count will look similar to the one shown Figure 2-126.

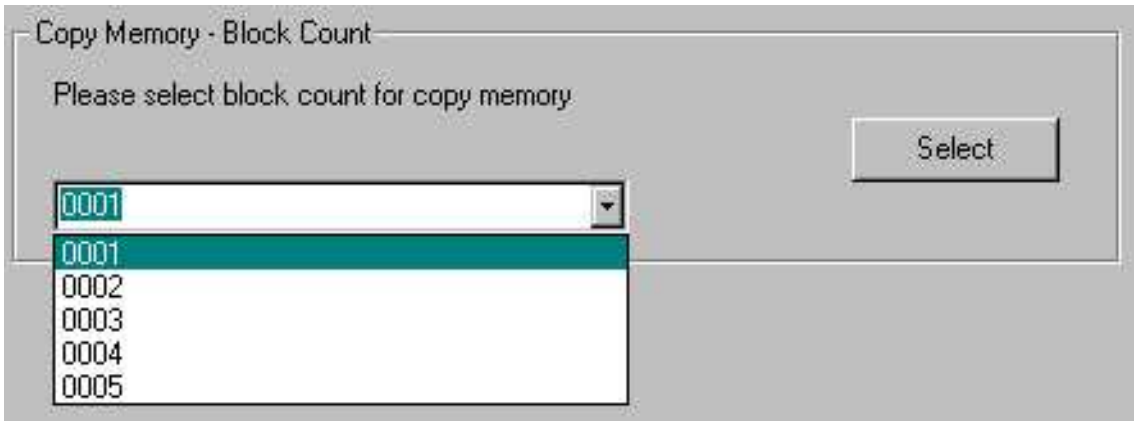


Figure 2-126 The Block Count Drop-down Menu

Having chosen how many blocks you wish to copy the next task is choose the source memory page from which to copy the required data. The drop-down menu for the source memory page will look similar to Figure 2-127.

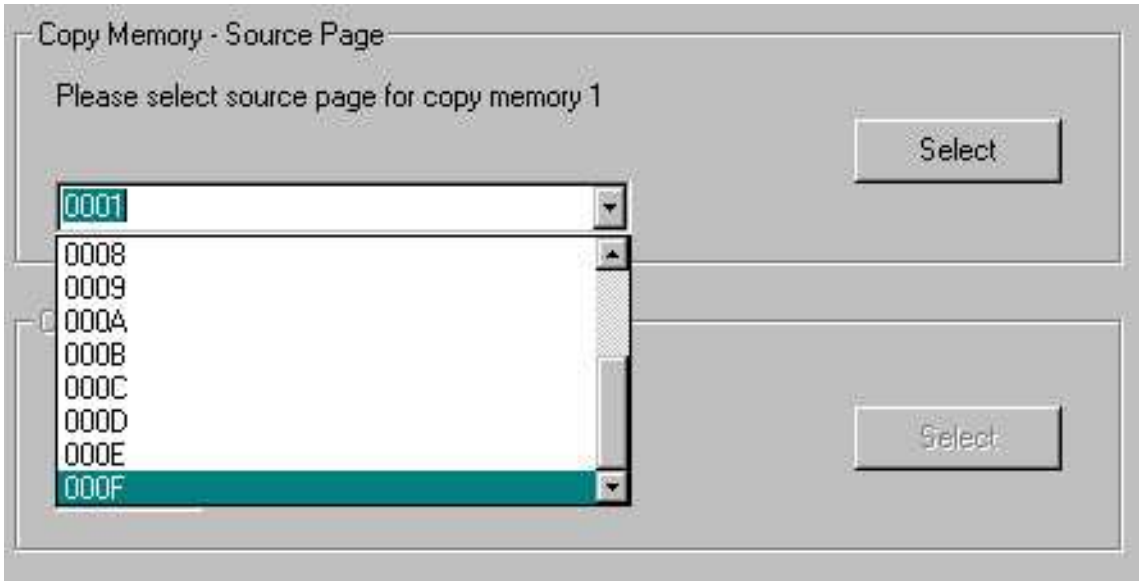


Figure 2-127 The Source Page Drop-down Menu

Once the source page is selected the next menu will request the offset in to the page, that the block to be copied from starts at. The data entry box for the source offset will look similar to Figure 2-128.

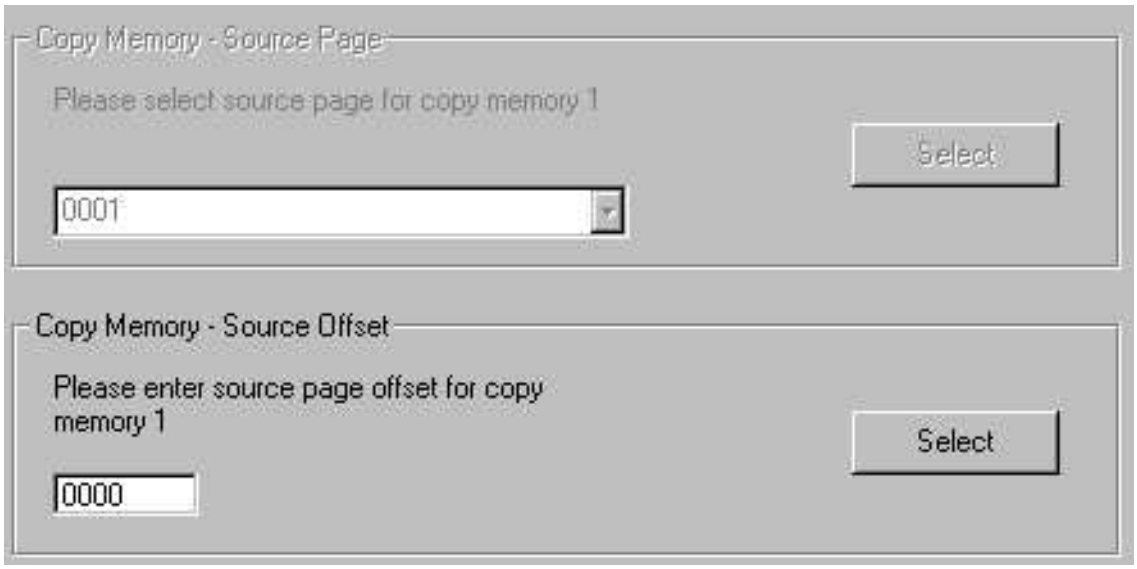


Figure 2-128 The Source Offset Data Entry Box

Next the destination page is chosen. The destination page drop down menu looks similar to Figure 2-129.

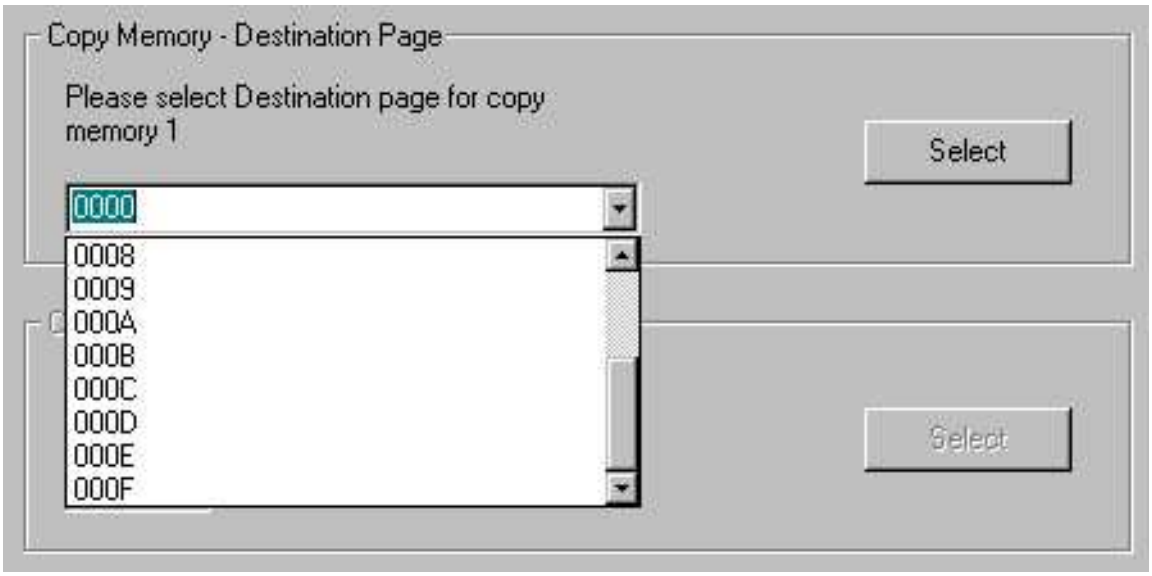


Figure 2-129 The Destination Page Drop-down Menu

After the destination page menu is the destination offset data entry window as shown in Figure 2-130.

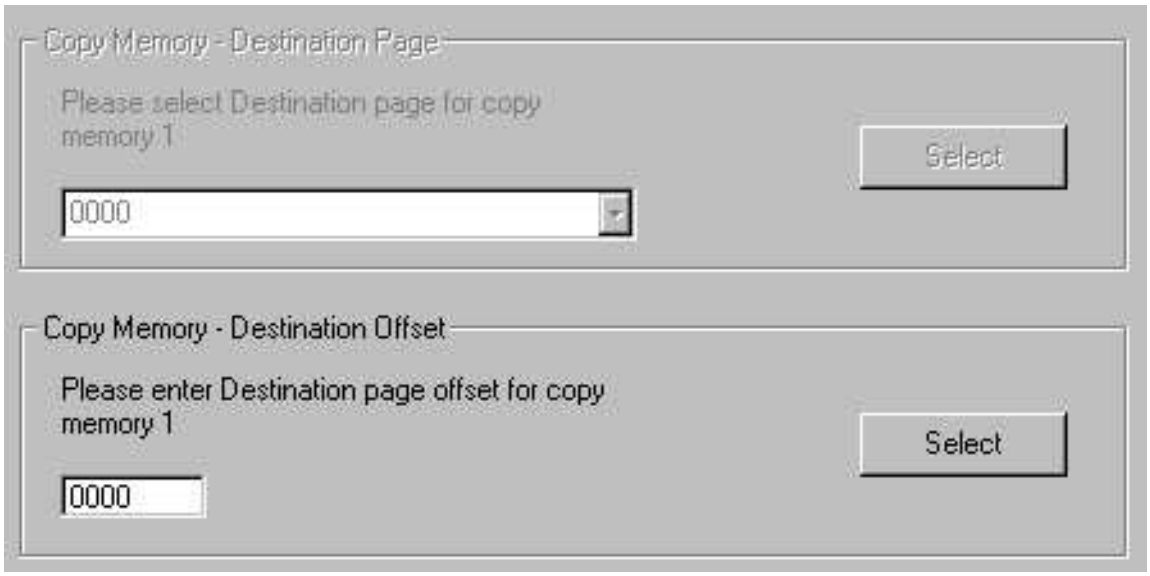


Figure 2-130 The Destination Offset Data Entry Box

The block length can be anything between 1 and 255; the list shows the decimal number on the right-hand side and the list and the resulting hexadecimal number on the left-hand side.

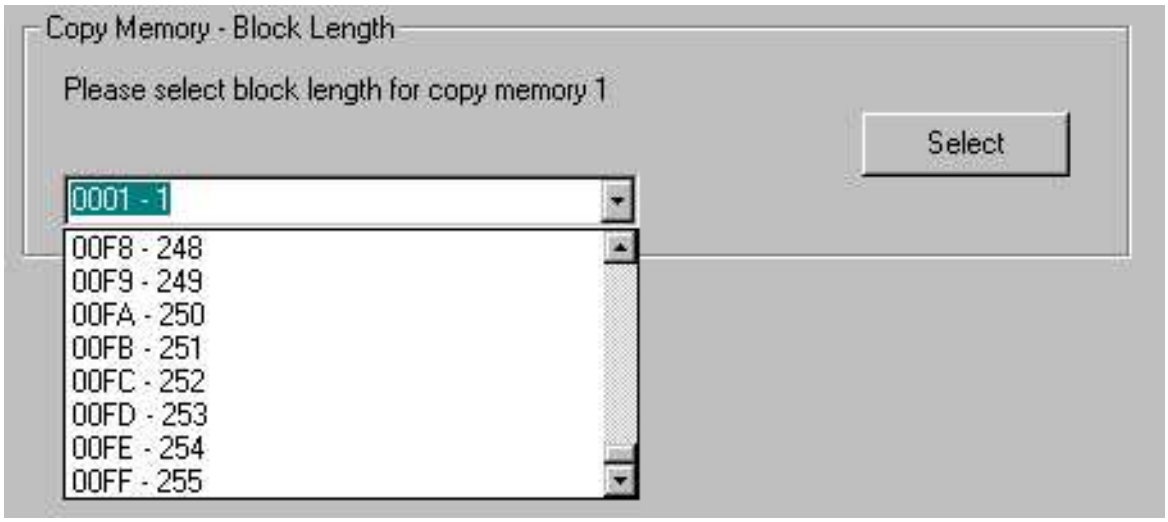


Figure 2-131 The Block Length Drop-down Menu

Once you have chosen the length of the block to copy (equal to the number of blocks you chose in the block count) the finished form should look similar to Figure 2-132. To transmit the command packet to the instrument press 'Transmit'.

In the following example (see Figure 2-132) two blocks were chosen:

The first is a six-word block that was copied from page 1 offset 0 to page 4 offset A (10)
The second was a C (12) word block copied from page 1 offset A (10) to page 6 offset B (11)

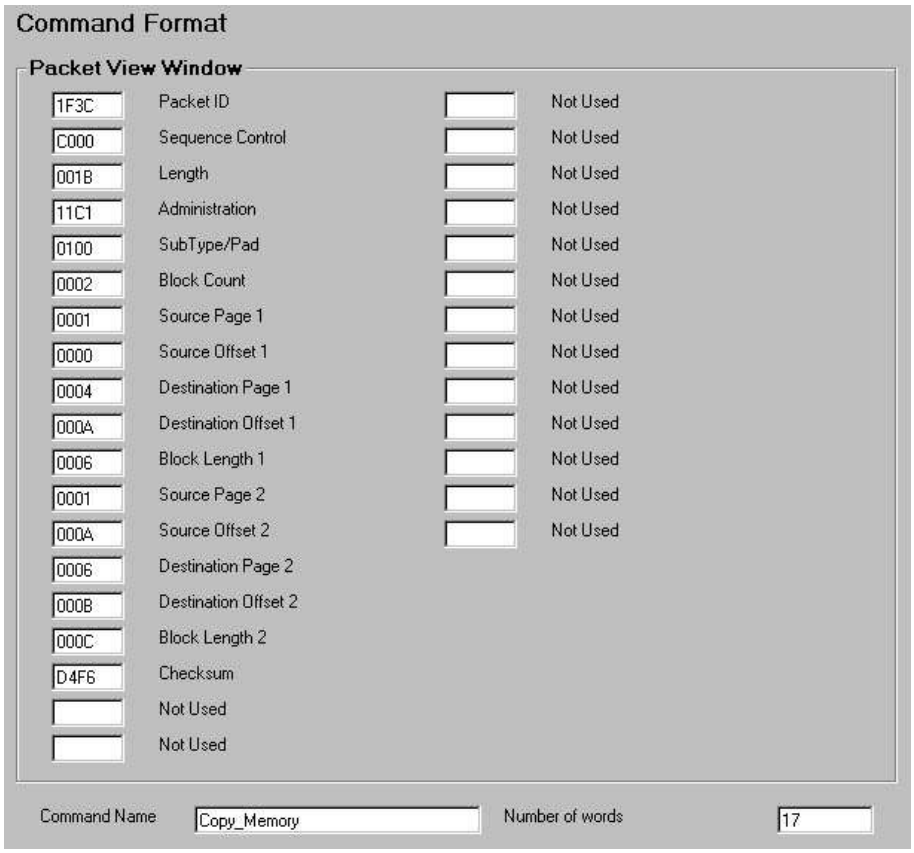


Figure 2-132 Example Command Transmitter Form for Copy Memory

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-133.

Figure 2-133 The Transmission Confirmation Message Box

2.8.6 Start Standby

Start Standby is the sixth item in the 'Command Select Window' as shown in Figure 2-134. Once selected (by double clicking) press 'Select'.

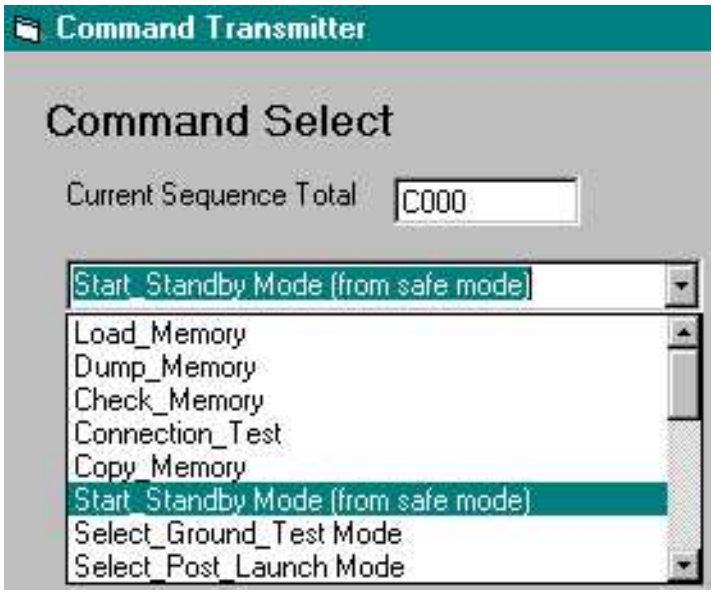


Figure 2-134 Command Select Window for Start Standby

Once you have selected start standby mode a message box will appear (see Figure 2-135) asking if you wish to have an acknowledgement of this packet. If you select yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select no then no acceptance packet will be generated.

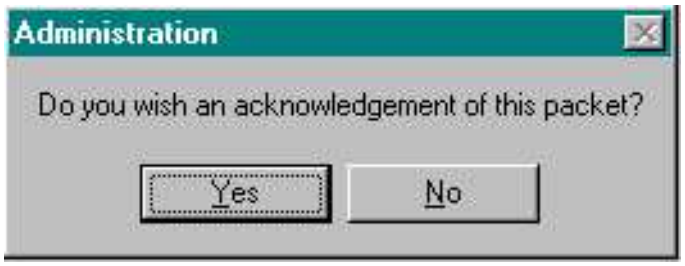


Figure 2-135 The Administration Message Box

Start standby is normally the first mode run and covers the transition from 'safe mode' to 'science mode'. The first menu you will be presented with will ask from which area of memory you wish the science mode software to start. The menu looks similar to Figure 2-136.

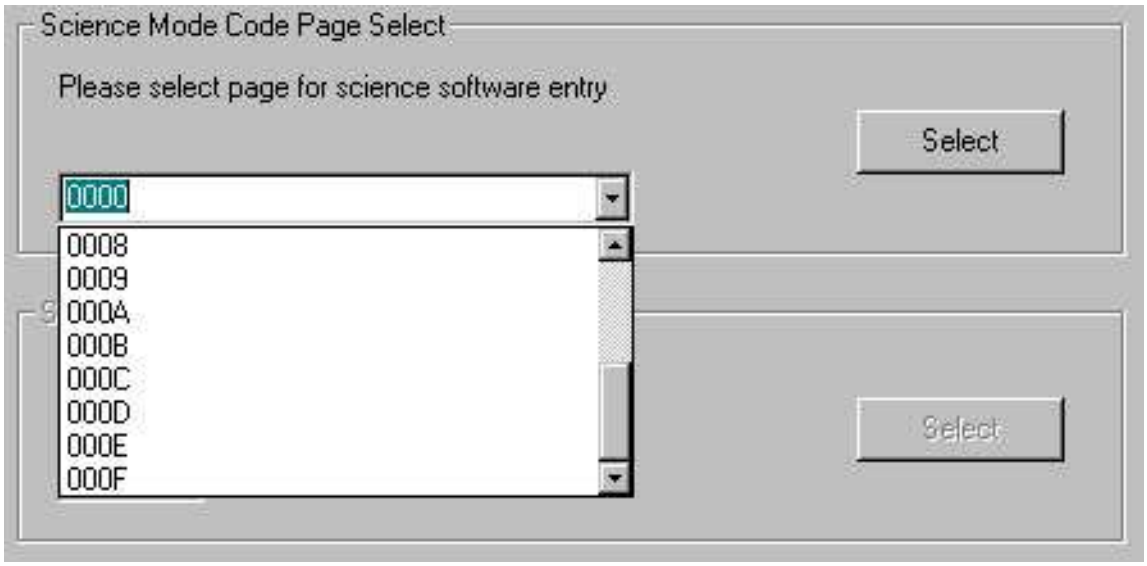


Figure 2-136 The Science Mode Code Page Entry Drop-down Menu

Once the code page has been selected the next item required is the offset into the selected page. This is selected from a data entry window similar to Figure 2-137.

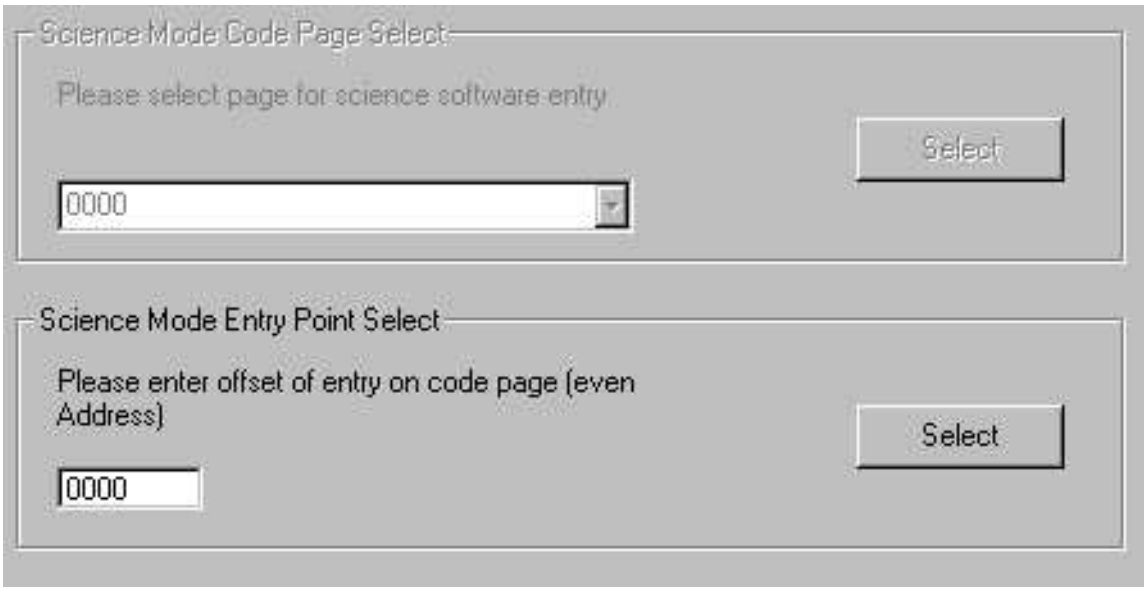


Figure 2-137 The Science Mode Code Page Offset Data Entry Window

After you have chosen the start code page offset a message box will appear asking if you wish to enable any stored telecommands. The message box will look like Figure 2-138.

Figure 2-138 The Stored TC's Query Message Box

One you have chosen 'Yes' or 'No' in the message box the command packet is complete and should look similar to Figure 2-139. To send the command press 'Transmit'.

In the following example (see Figure 2-139) the start page chosen was page 1 with an offset of zero and stored TCs were not enabled.

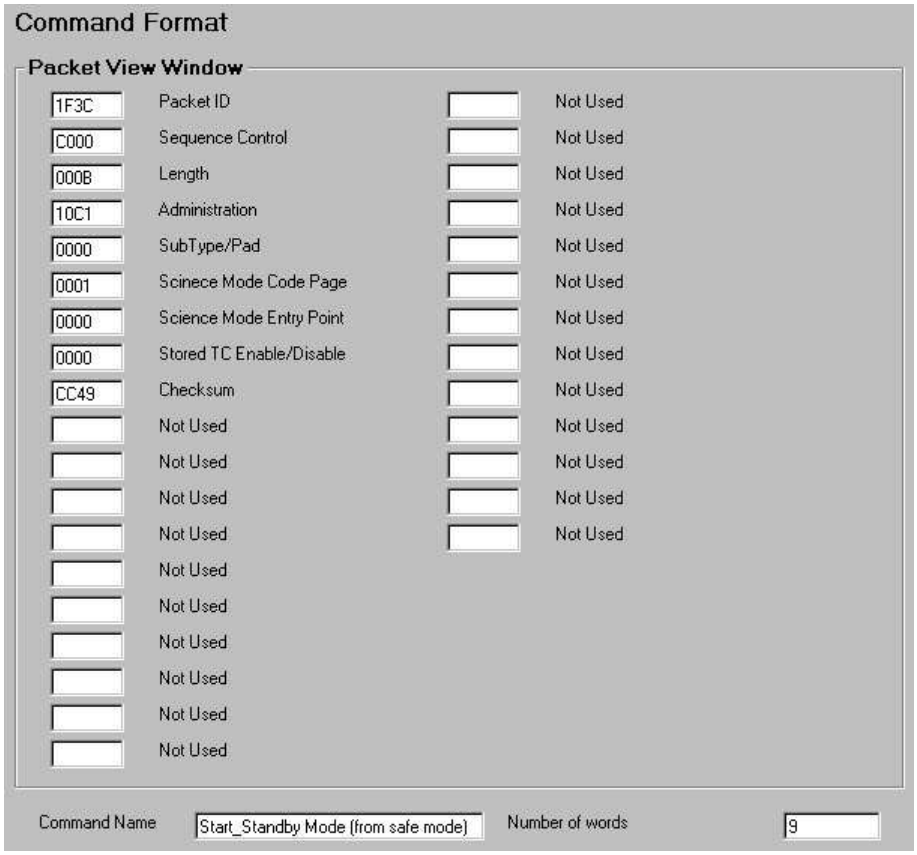


Figure 2-139 Example Command Transmitter Form for Start Standby

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-140.

Figure 2-140 The Transmission Confirmation Message Box

2.8.7 Ground Test Mode

Ground Test Mode is the seventh item in the 'Command Select Window' as shown in Figure 2-141. Once selected (by double clicking) press 'Select'.

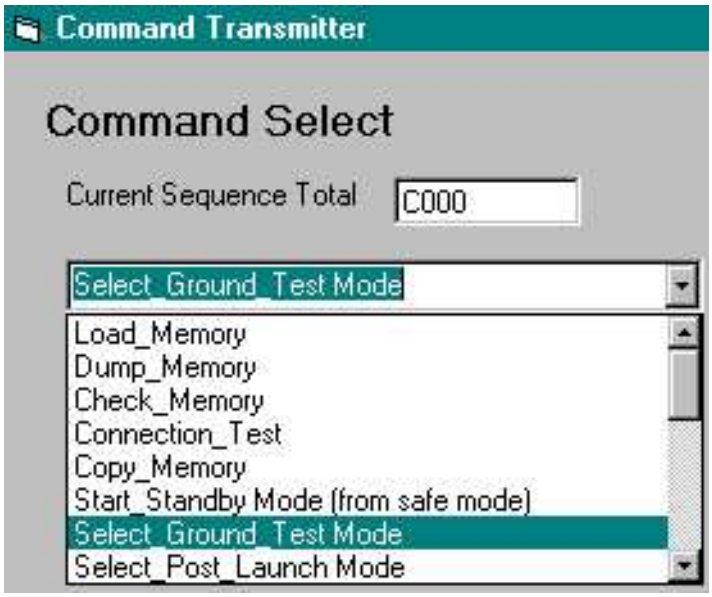


Figure 2-141 Command Select Window for Ground Test Mode

Once you have selected ground test mode a message box will appear (see Figure 2-142) asking if you wish to have an acknowledgement of this packet. If you select yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select no then no acceptance packet will be generated.

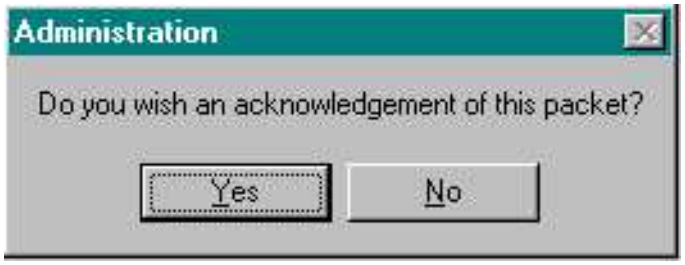


Figure 2-142 The Administration Message Box

Once you have chosen if you wish to receive an acknowledgement you will be asked which gas tank you wish to use (the choice is arbitrary). The drop-down menu box for gas tank selection is shown in Figure 2-143.

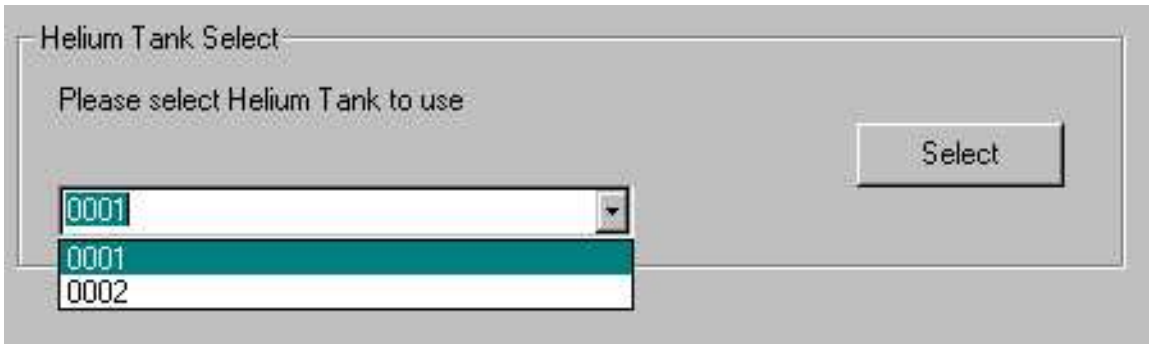


Figure 2-143 Helium Tank Select Option Box

Once you have selected the gas tank you wish to use the command is ready to be sent and should resemble Figure 2-144. To send the command press 'Transmit'.

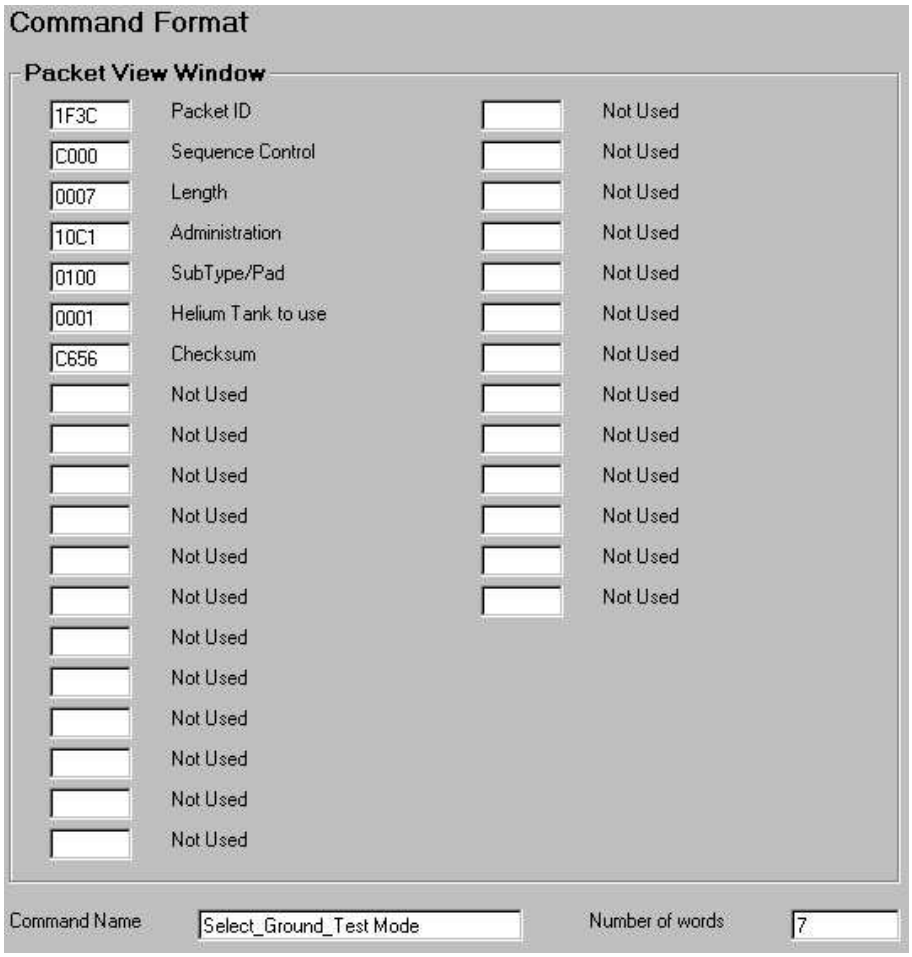


Figure 2-144 Example Command Transmitter Form for Ground Test Mode

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-145.

Figure 2-145 The Transmission Confirmation Message Box

2.8.8 Post Launch, Cruise Phase & Instrument Checkout

The Post Launch, Cruise Phase & Instrument Checkout modes are item numbers 8-10 respectively in the 'Command Select Window' as shown in Figure 2-146. The example shown is Post Launch Mode. Once selected (by double clicking) press 'Select'.

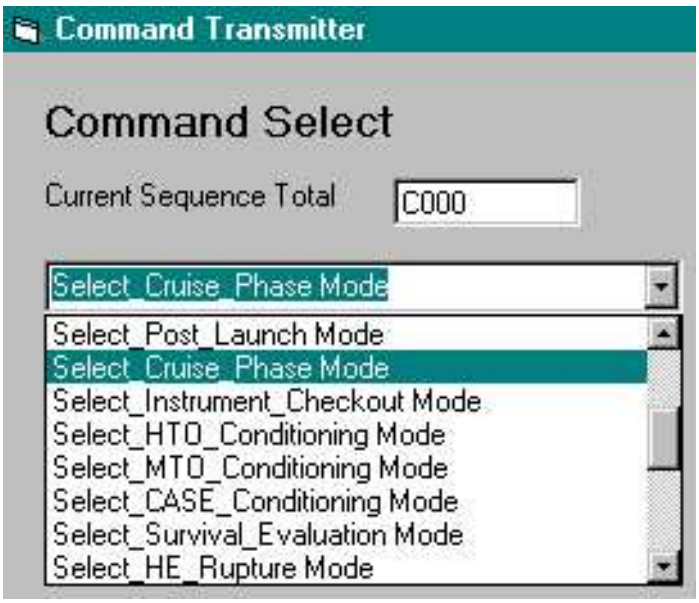


Figure 2-146 Command Select Window for Post Launch Mode

Once you have selected either post launch, cruise phase or instrument checkout mode a message box will appear (see Figure 2-147) asking if you wish to have an acknowledgement of this packet. If you select yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select no then no acceptance packet will be generated.

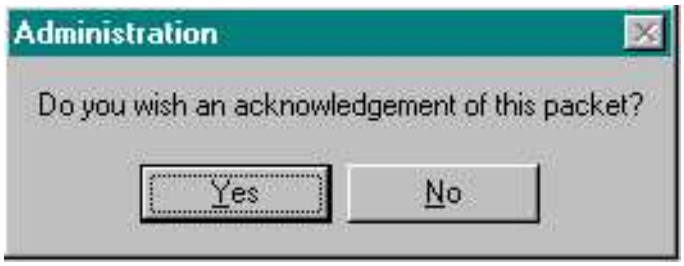


Figure 2-147 The Administration Message Box

For either post launch, cruise phase or instrument checkout mode there are no data entry screens and once 'Yes' or 'No' has been selected from the administration message box the command packet is complete and should look something like Figure 2-148.

The example command packet shown (see Figure 2-148) was for Cruise Phase Mode with no acknowledgement required (although the packets would look similar and be of a similar length for Post Launch, Cruise Phase & Instrument Checkout modes).

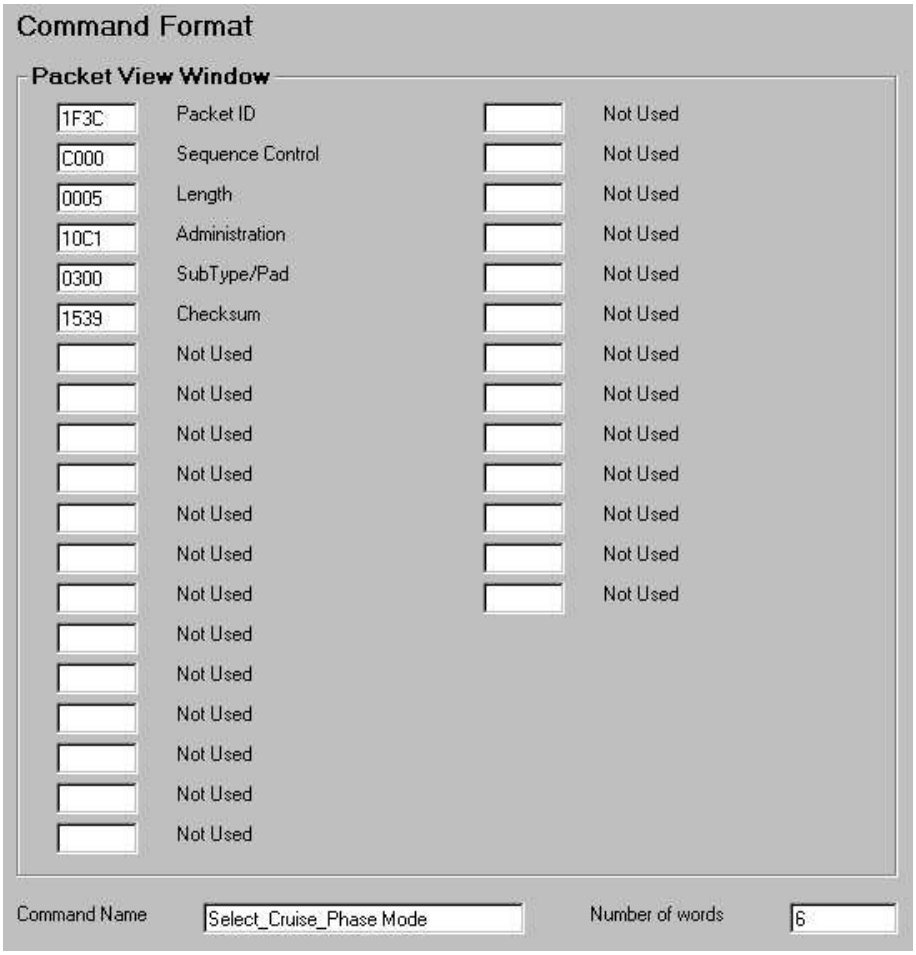


Figure 2-148 Example Command Transmitter Form for Cruise Phase

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-149.

Figure 2-149 The Transmission Confirmation Message Box

2.8.9 HTO Conditioning, MTO Conditioning & CASE Conditioning

The HTO Conditioning, MTO Conditioning & CASE Conditioning modes are item numbers 11-13 respectively in the 'Command Select Window' as shown in Figure 2-150. The example shown is select HTO conditioning mode. Once selected (by double clicking) press 'Select'.

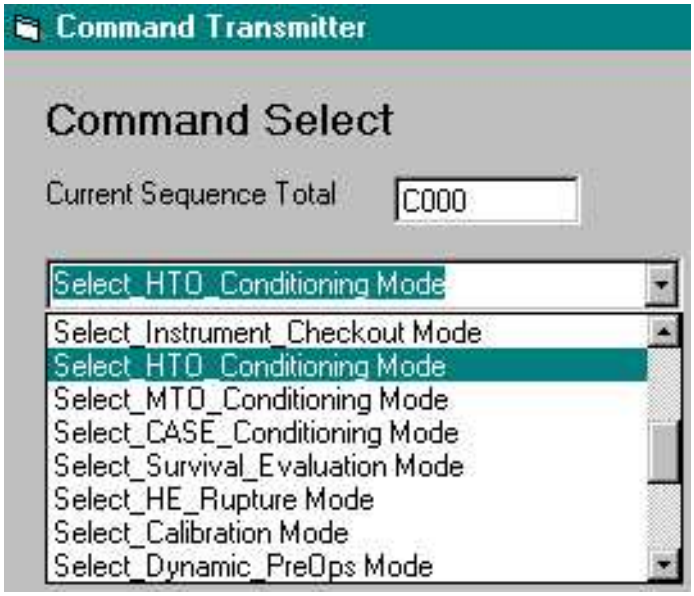


Figure 2-150 Command Select Window for HTO Conditioning Mode

Once you have selected either HTO Conditioning, MTO Conditioning or CASE Conditioning mode a message box will appear (see Figure 2-151) asking if you wish to have an acknowledgement of this packet. If you select yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select no then no acceptance packet will be generated.

Figure 2-151 The Administration Message Box

More information due to be added during the next software update

2.8.10 Survival Evaluation

Survival Evaluation is the fourteenth item in the 'Command Select Window' as shown in Figure 2-152. Once selected (by double clicking) press 'Select'.

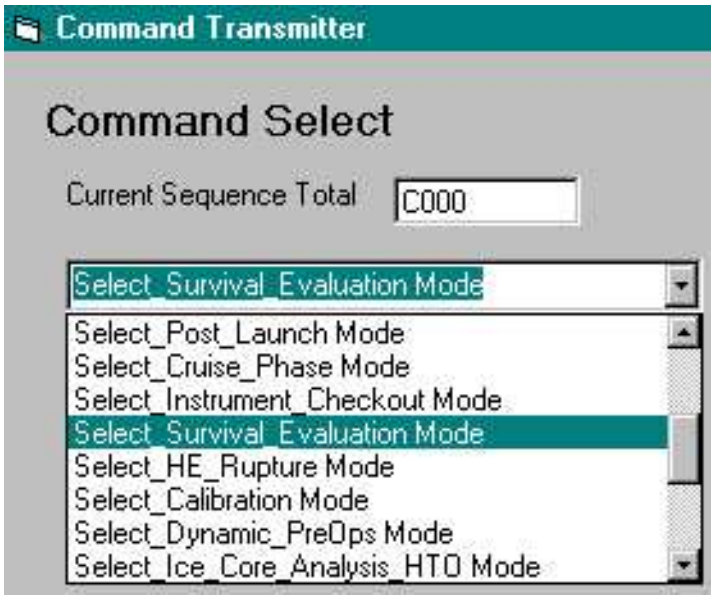


Figure 2-152 Command Select Window for Survival Evaluation Mode

Once you have selected Survival Evaluation mode a message box will appear (see Figure 2-153) asking if you wish to have an acknowledgement of this packet. If you select yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select no then no acceptance packet will be generated.

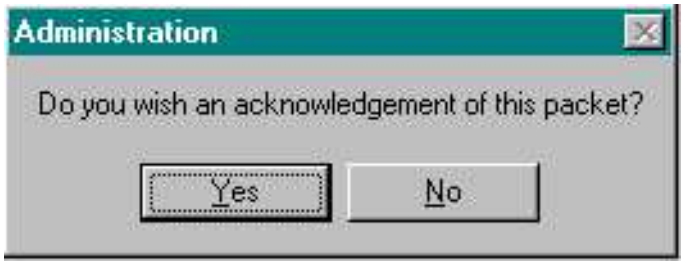


Figure 2-153 The Administration Message Box

For Survival Evaluation mode there are no data input boxes and once you have chosen from 'Yes' and 'No' in the administration message box the command packet form is complete and should look similar to Figure 2-154.

The example shown (see Figure 2-154) assumes you have requested confirmation of the command packet by selecting yes from the administration message box.

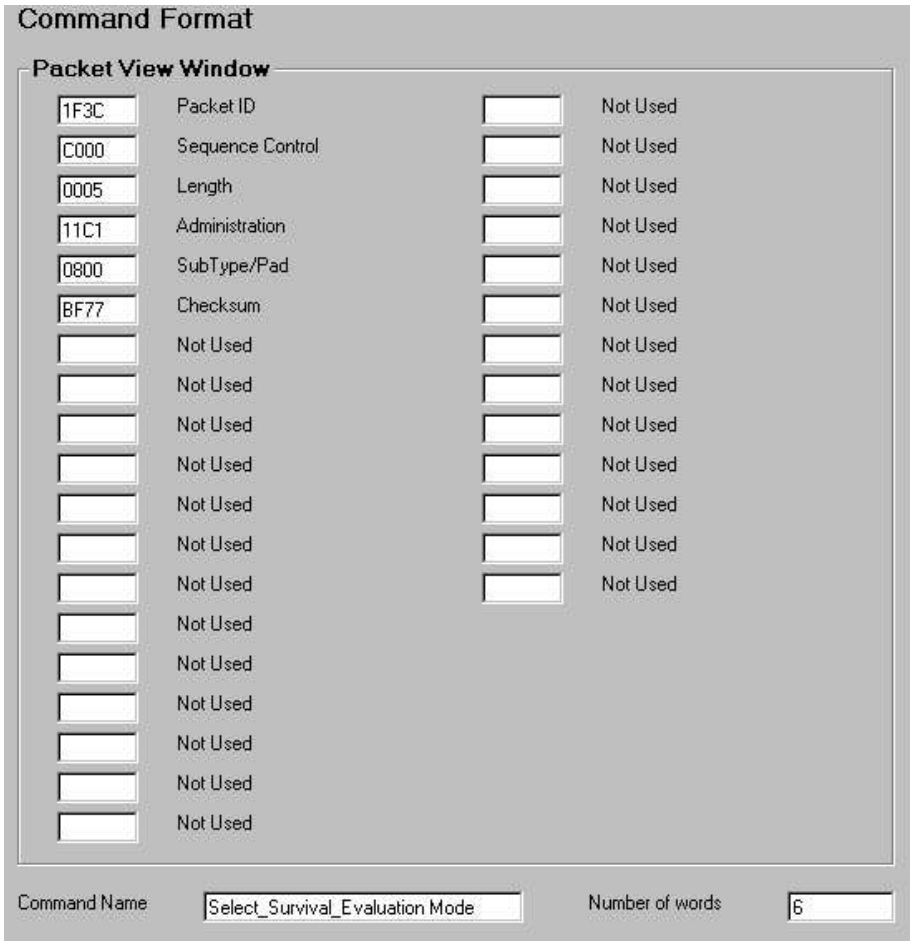


Figure 2-154 Example Command Transmitter Form for Survival Evaluation Mode

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-155.

Figure 2-155 The Transmission Confirmation Message Box

2.8.11 HE Rupture, Calibration, Dynamic PreOps, Ice Core Analysis HTO, Atmosphere Analysis, Silicate Analysis, Ice Core Analysis MTO & Additional Science

The above commands are item numbers 15-22 respectively in the 'Command Select Window' as shown in Figure 2-156. The example shown is He Rupture Mode.

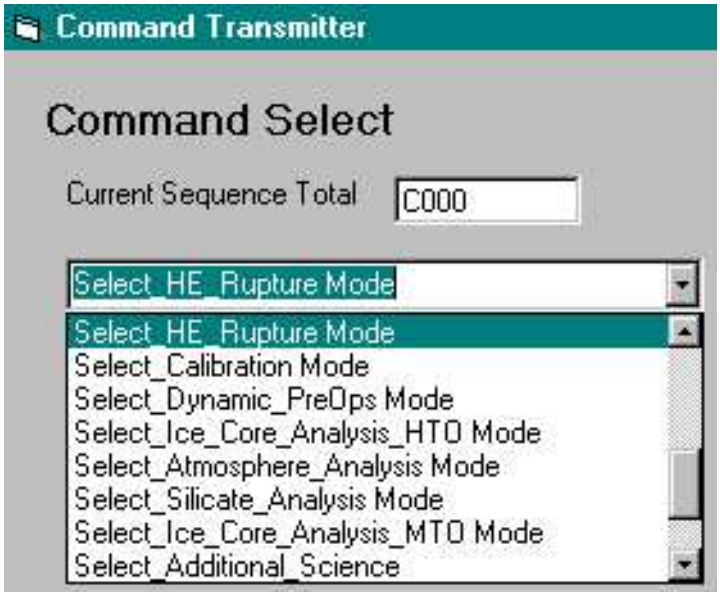


Figure 2-156 Command Select Window for He Rupture Mode

Whichever option is highlighted in the 'command select window' must then be chosen by pressing the 'Select' button Once you have selected this mode a message box will appear (see Figure 2-157) asking if you wish to have an acknowledgement of this packet. If you select Yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select No then no acceptance packet will be generated.

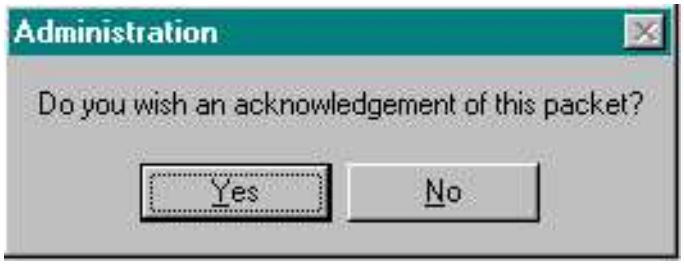


Figure 2-157 The Administration Message Box

Once this has been done you will be asked to select which gas tank you would like to use in your selected mode. The option window will look like Figure 2-158.

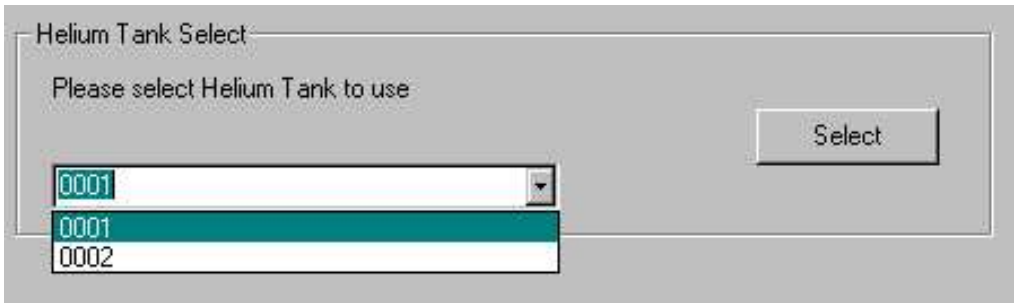


Figure 2-158 Helium Tank Select Option Box

Once you have chosen your gas tank the 'Packet View Window' should look something like Figure 2-159.

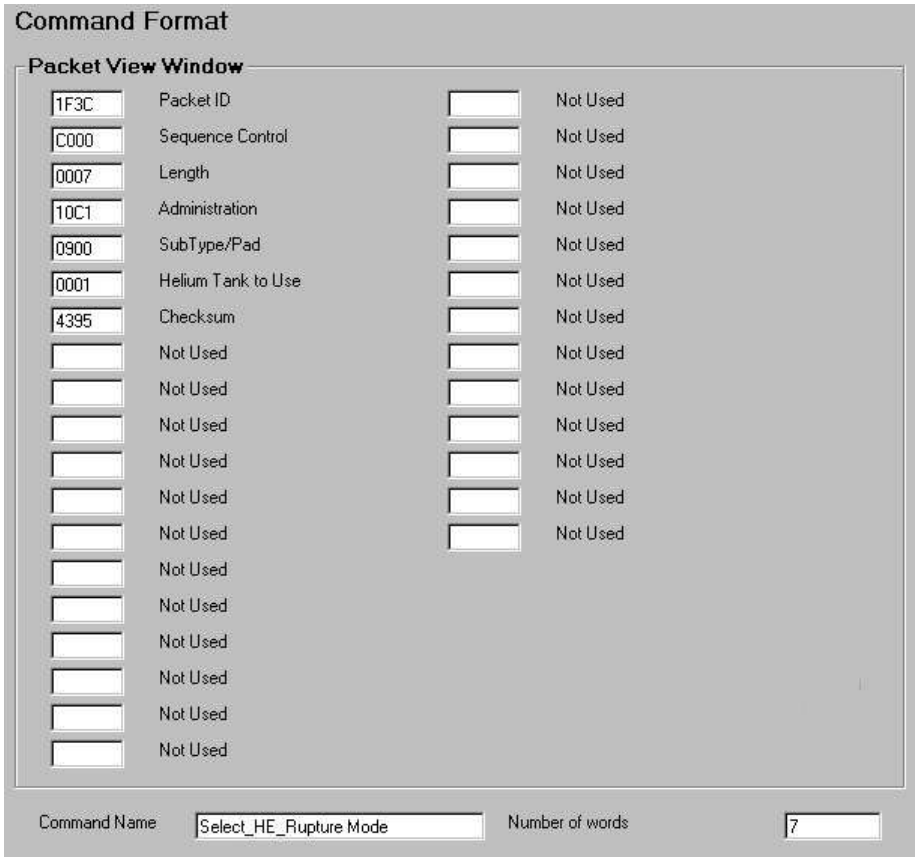


Figure 2-159 Example Command Transmitter Form for He Rupture Mode

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-160.

Figure 2-160 The Transmission Confirmation Message Box

2.8.12 Select Safe Mode

Select Safe Mode is the twenty-third item in the 'Command Select Window' as shown in Figure 2-161. Once selected (by double clicking) press 'Select'.

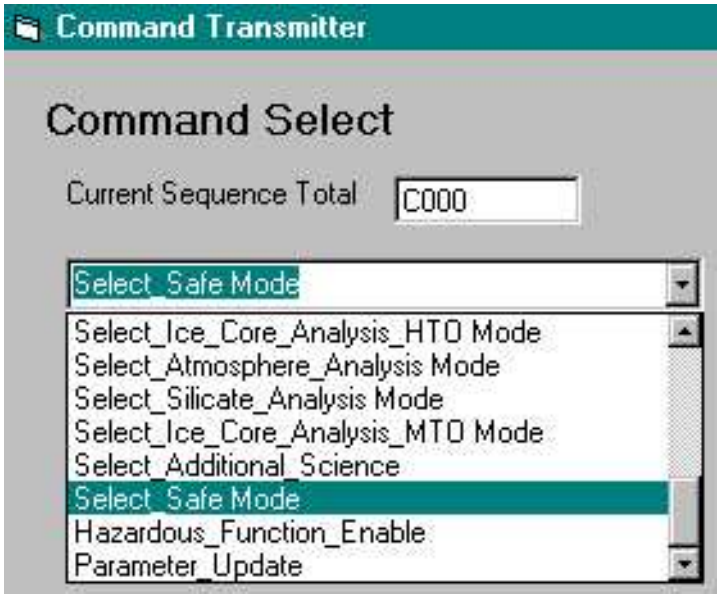


Figure 2-161 Command Select Window for Select Safe Mode

Once you have selected Select Safe Mode a message box will appear (see Figure 2-162) asking if you wish to have an acknowledgement of this packet. If you select Yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select No then no acceptance packet will be generated.

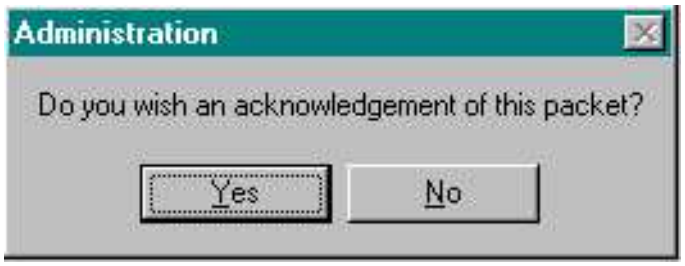


Figure 2-162 The Administration Message Box

Once 'Yes or 'No' have been chosen from the administration message box the command packet is complete and should look something like Figure 2-163. Apart from being commanded directly into Safe Mode the instrument should automatically enter Safe Mode, should a serious fault occur and at the end of an executed mode.

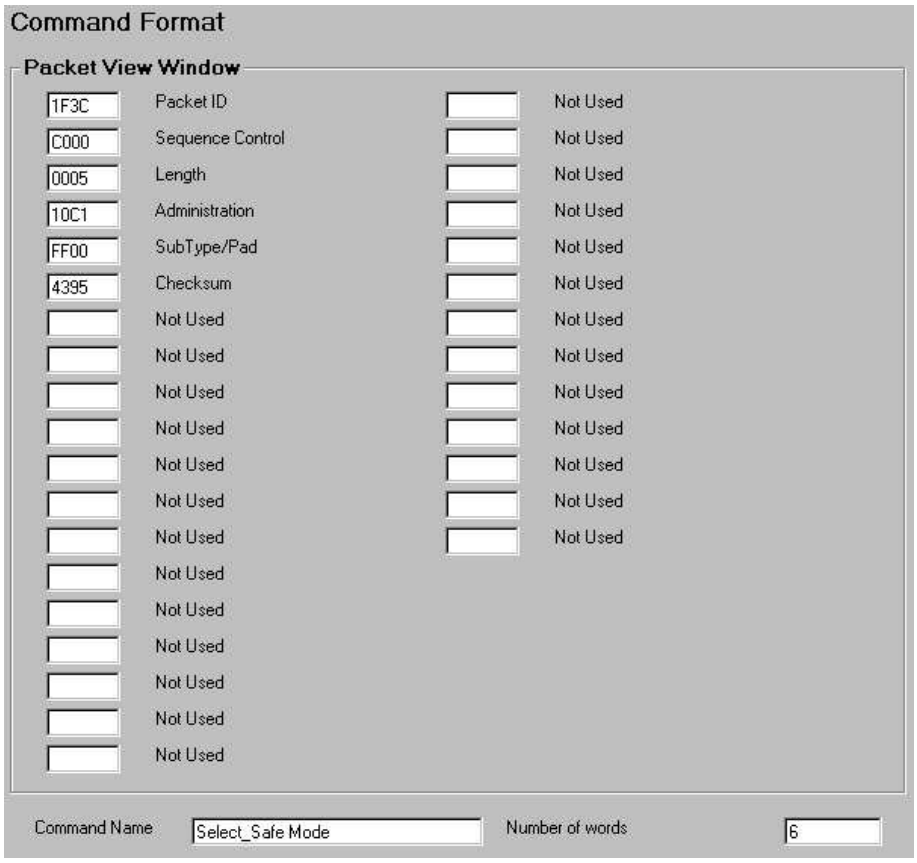


Figure 2-163 Example Command Transmitter Form for Select Safe Mode

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-164.

Figure 2-164 The Transmission Confirmation Message Box

2.8.13 Hazard Function Enable

Hazard Function Enable is the twenty-fourth item in the 'Command Select Window' as shown in Figure 2-165. Once selected (by double clicking) press 'Select'.

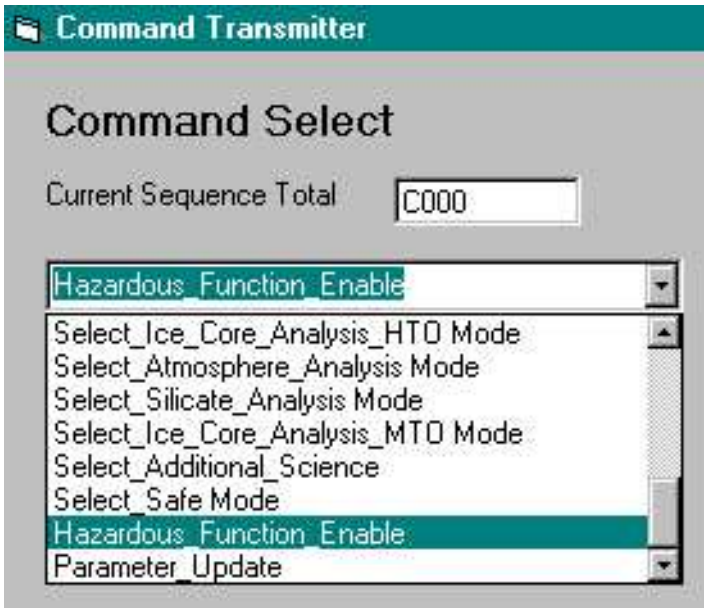


Figure 2-165 Command Select Window for Hazard Function Enable

Once you have selected this mode a message box will appear (see Figure 2-166) asking if you wish to have an acknowledgement of this packet. If you select yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select no then no acceptance packet will be generated.

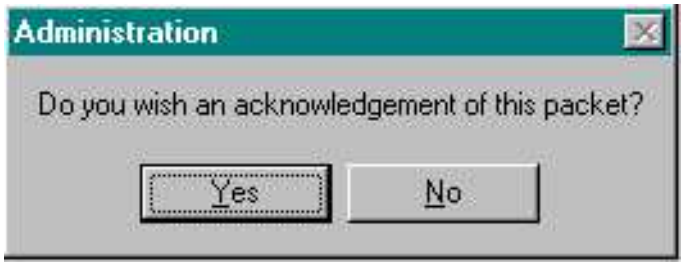


Figure 2-166 The Administration Message Box

Having selected Hazard Function Enable the first of three hazard select masks should appear. The order of the masks is; PWM – Valve - Critical. The masks contain check boxes that can be individually selected.
Once you have selected all the items you wish to enable (unchecked items will be disabled) press 'Select'. If you wish to start again at any time press 'Clear'. If you have accidentally selected an item click on the checkbox again and it will be deselected. For details of the Pulse Width Modulation mask (PWM) enable mask (see Figure 2-167) which covers the enabling of all the reactors and heaters in the instrument. The two windows at the bottom of the form show the binary mask and the resulting Hexadecimal value.

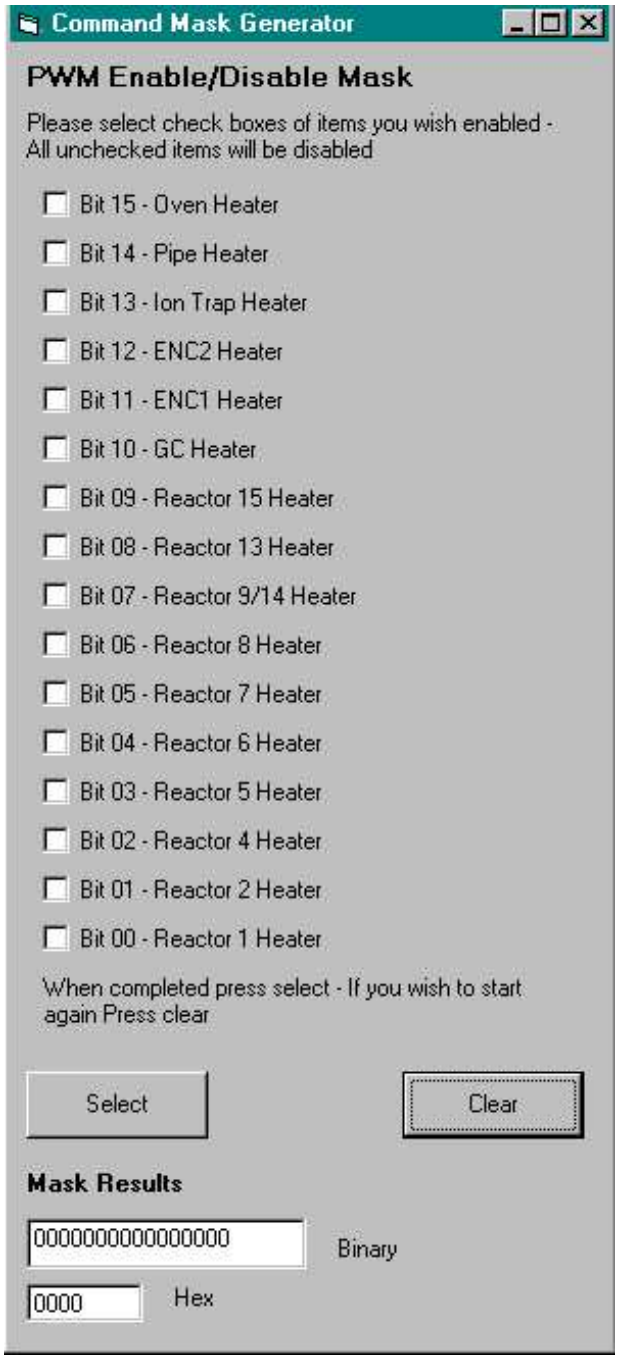


Figure 2-167 The PWM Enable Mask

The next mask to appear will be the Valve mask (see Figure 2-168).

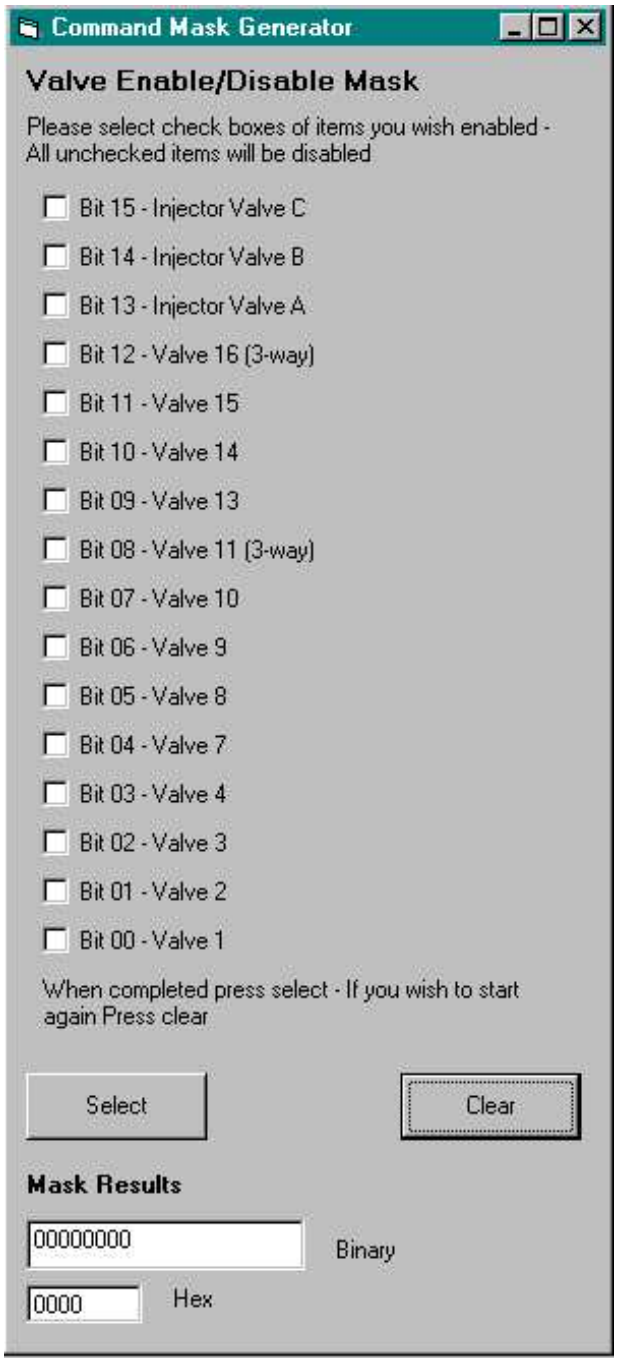


Figure 2-168 The Valve Enable Mask

The third and last mask to appear will be the critical items mask (see Figure 2-169). This mask covers mission critical items such as the docking station monitor, the ion trap high voltage and the Shape Memory Actuator (SMA) heaters responsible for opening the helium gas tanks.

*** NOTE if you select one SMA heater the other one is automatically disabled, to select a different SMA press 'Clear'.

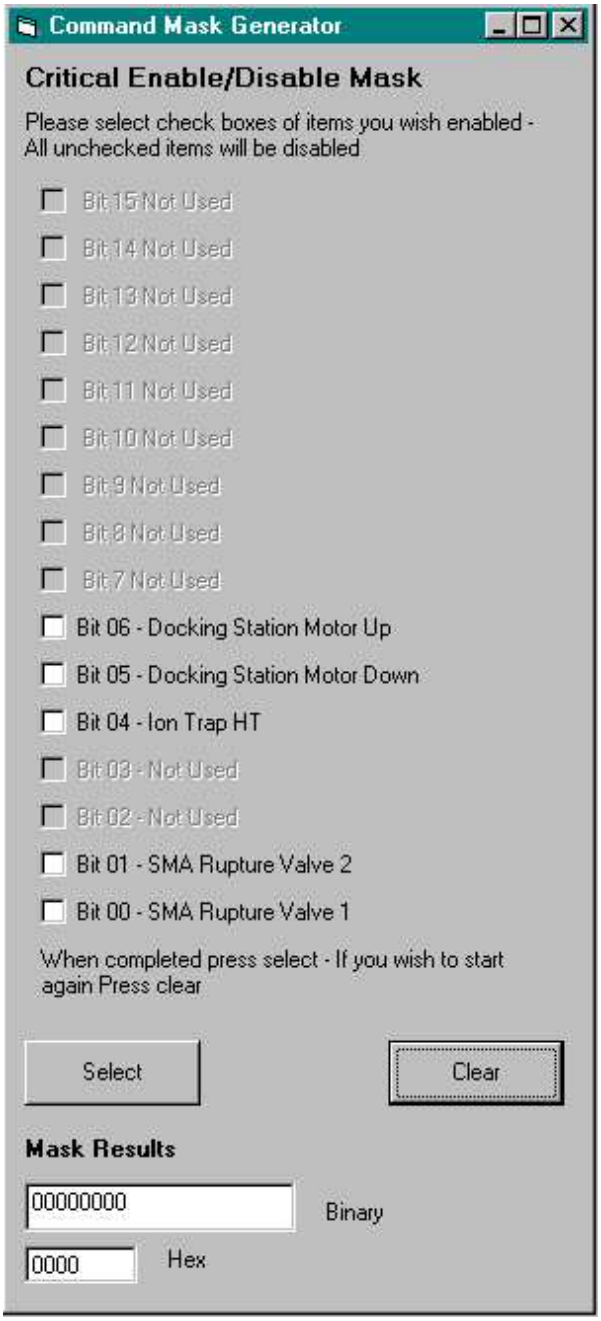


Figure 2-169 The Critical Items Mask

Having filled in the required masks the Command Transmitter Form will end up looking something like Figure 2-170. Now simply press the 'Transmit' button.

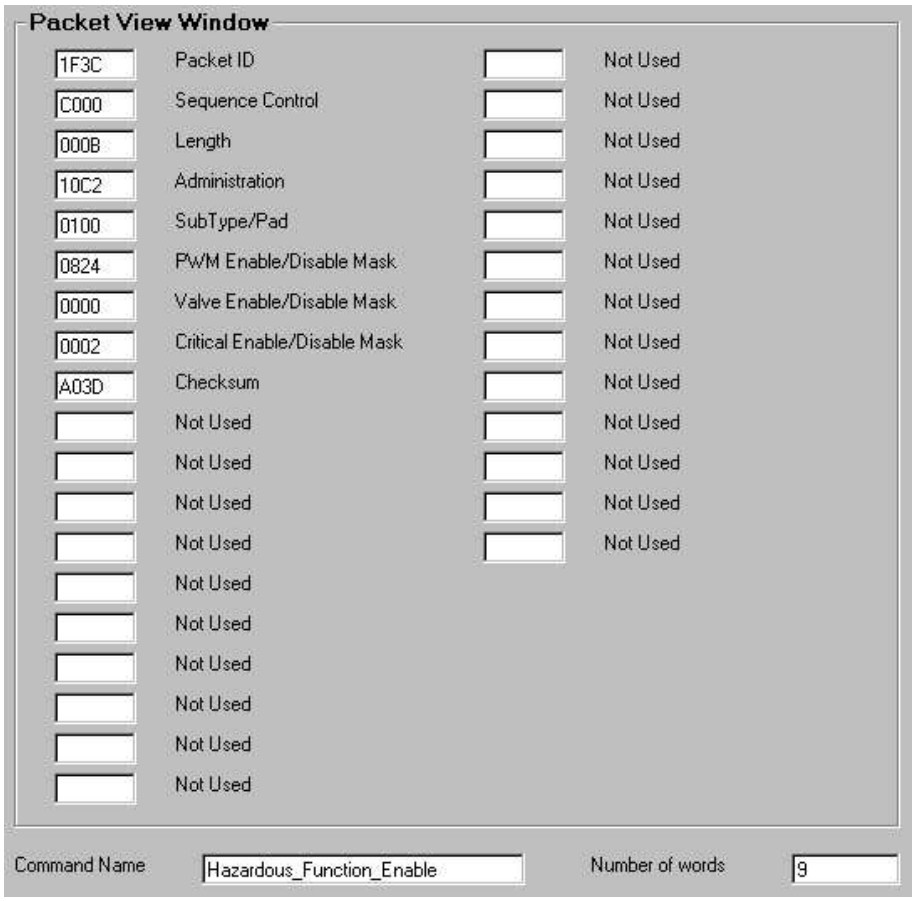


Figure 2-170 Example Command Transmitter Form for Hazard Enable.

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-171.

Figure 2-171 The Transmission Confirmation Message Box

2.8.14 Parameter Update

Parameter Update is the last item in the 'Command Select Window' as shown in Figure 2-172.

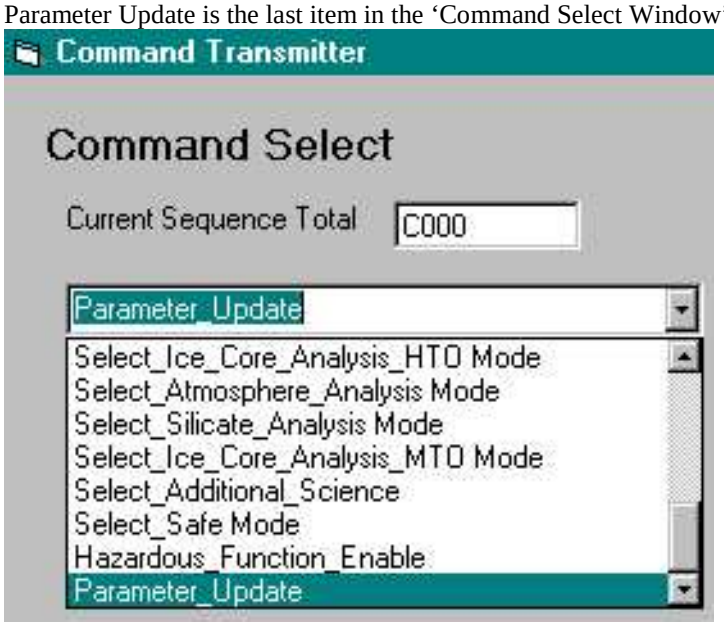


Figure 2-172 Command Select Window for Parameter Update

Once you have selected Parameter Update mode a message box will appear (see Figure 2-173) asking if you wish to have an acknowledgement of this packet. If you select Yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you select No then no acceptance packet will be generated.

Figure 2-173 The Administration Message Box

The first menu to appear after the administration box is the parameter table offset data entry box. This is shown in Figure 2-174. A list of the parameter table addresses is contained in an Appendix A.

Figure 2-174 The Parameter Table Offset Data Entry Box

The next menu to appear will request you to select the number of sequential parameters to be updated. The number of sequential parameters that can be updated in one command packet is 1-23.

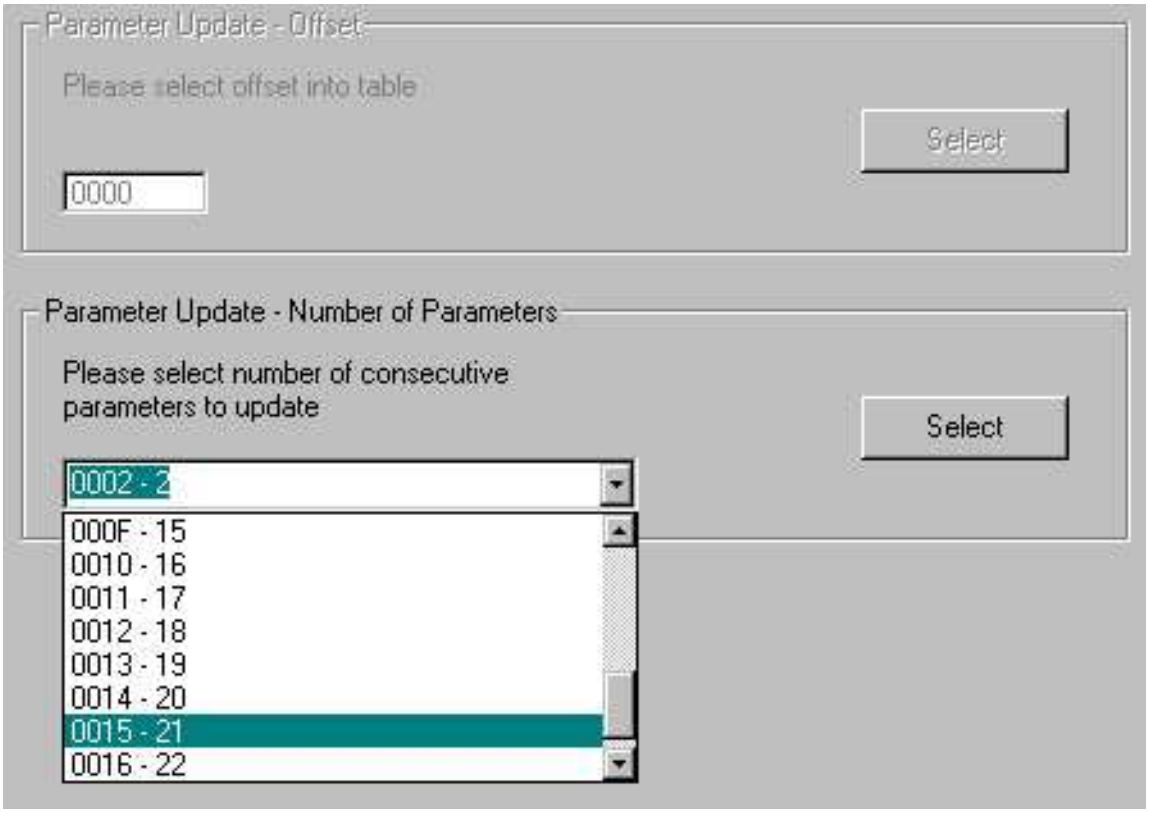


Figure 2-175 The Number of Parameters to Update Drop-down Menu

Lastly the values for the updated parameters are chosen from a data entry window as shown in Figure 2-176. One data window will appear for each of the parameters up to the number of parameters selected at the beginning.

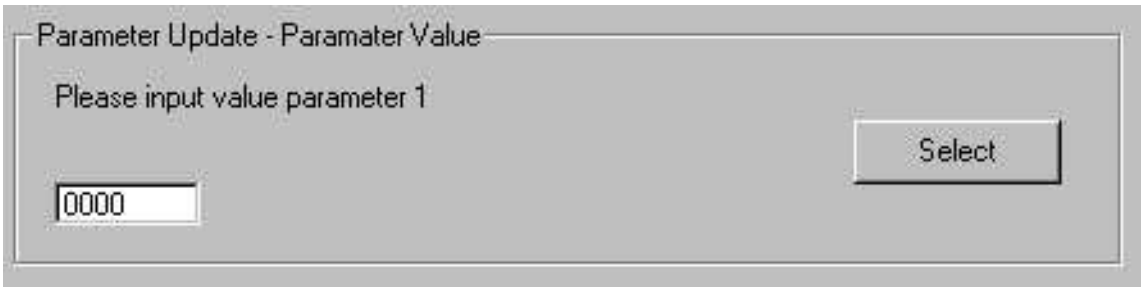


Figure 2-176 The Parameter Input Value Data Entry Box

Once the value of the chosen parameter/parameters are completed the completed packet should look similar to Figure 2-177. The example shown in Figure 2-177 assumes that you wish to change the first two words of the parameter table to '0000' and '0000' respectively.

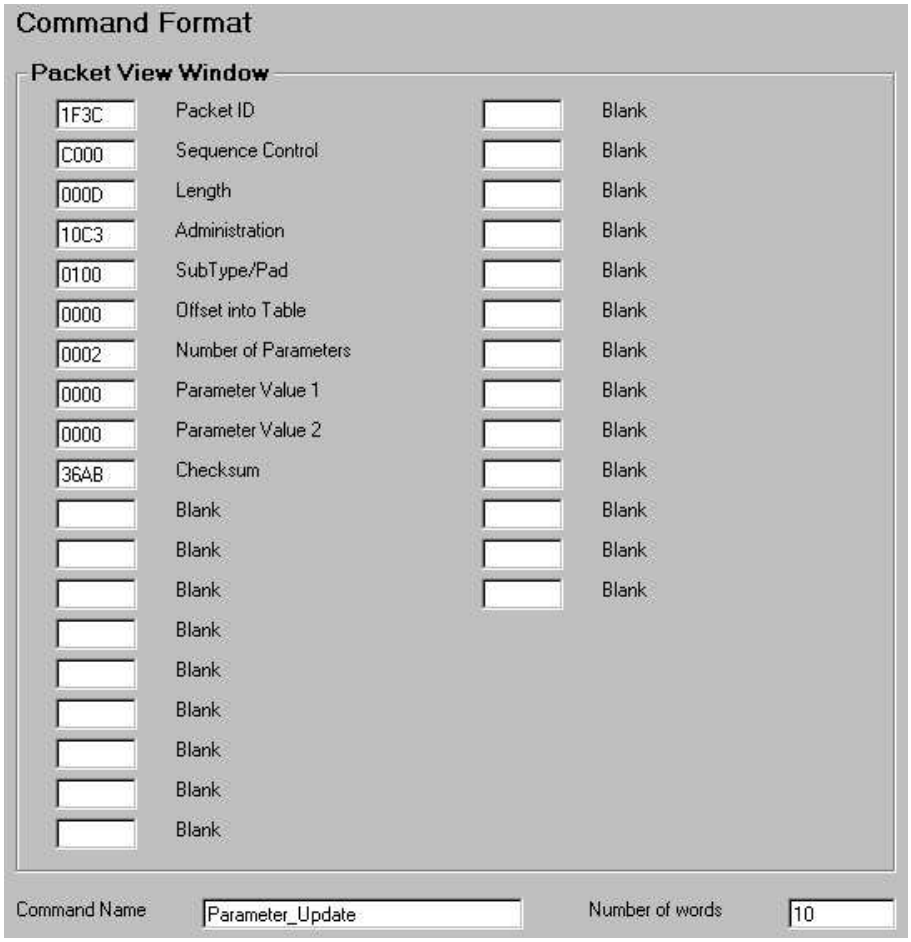


Figure 2-177 Example Command Transmitter Form for Parameter Update

Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-178.

Figure 2-178 The Transmission Confirmation Message Box

3 PTOEGSE1.1.EXE

3.1 House keeping and Science Data Packet Formats

3.1.1 House Keeping Packets

A lander housekeeping packet has a set size of 141 words; a tabular representation is shown in Figure 3-1. Of these 141 words 13 are used by the lander to provide routing information and error checking (shown as blue text). Inside each lander packet are four Ptolemy packets with a total word count of 128 words. The exact format of the Ptolemy packets has some flexibility contained in it to deal with Ptolemy packets of different lengths (see Table 4). The first 32 words of a complete housekeeping packet (including the header shown in red) are identical to an entire concise housekeeping packet. The use of a complete housekeeping packet allows the second Ptolemy packet to be a shorter 16-word packet.

1ACF	**FC1D**	Packet ID	Seq. ID	PKT Len.	T1	T2	T3
null/Type	Sub/Pad	Format ID	Packet ID	Seq. ID	PKT Len.	T1	T2
T3	null/Type	Sub/Pad	Format ID	C01	C02	C03	C04
C05	C06	C07	C08	C09	C10	C11	C12
C13	C14	C15	C16	C17	C18	C19	C20
C21	C22	C23	V01	V02	V03	V04	V05
V06	V07	V08	V09	V10	V11	V12	V13
V14	V15	V16	V17	V18	V19	V20	V21
V22	V23	V24	V25	V26	V27	V28	V29
V30	V31	V32	Packet ID	Seq. ID	PKT Len.	T1	T2
T3	null/Type	Sub/Pad	Format ID	C01	C02	C03	C04
C05	C06	C07	C08	C09	C10	C11	C12
C13	C14	C15	C16	C17	C18	C19	C20
C21	C22	C23	Packet ID	Seq. ID	PKT Len.	T1	T2
T3	null/Type	Sub/Pad	Format ID	C01	C02	C03	C04
C05	C06	C07	C08	C09	C10	C11	C12
C13	C14	C15	C16	C17	C18	C19	C20
C21	C22	C23	CRC1	CRC2			

*Each cell in the table represents 1 word (16-bits or 2 bytes where 1 byte equals 8 bits)

Figure 3-1 Template for Lander House Keeping Packet

Blue – Lander Packet Header/Footer:

- Packet ID
- Sequence ID
- Packet Length
- Lander Transmission Time 1, Time 2, Time 3
- Null/Packet Type
- Packet Sub Type/Pad
- Format ID
- CRC1 & CRC2 (shown in footer)

Red – Ptolemy Packet Header:

- Packet ID
- Sequence ID
- Packet Length
- Current Lander Time 1, Time 2, Time 3

- Null/Packet Type
- Packet Sub Type/Pad
- Format ID

Black – Fixed Content:

The first 23 words of a complete HK packet are identical to a concise HK packet. This allows some flexibility whilst ensuring that the first/third and fourth Ptolemy packets are HK.

Pink – Variable Content:

As the total length of a packet is fixed the variable content could be either (1) be a complete HK packet (48 words) followed by one of the smaller TC acceptance packets (16 words); (2) a concise HK packet (32 words) followed by any other 32-word packet (normally another concise HK packet at times of low activity).

Packet Name	Packet ID (hex)	Type dec (hex)	Sub Type	Length (Bytes)	Length (Words)	Structure ID
Concise HK	0F34	3 (03)	25 (19)	64	32	01
Complete HK	0F34	3 (03)	25 (19)	96	48	02
TC Acceptance	0F31	1 (01)	1 (01)	32	16	-
TC Acceptance Failure	0F31	1 (01)	2 (02)	32	16	-
Normal Progress Event	0F37	5 (05)	1 (01)	64	32	-
Warning Event	0F37	5 (05)	2 (02)	64	32	-
Memory Dump	0F39	6 (06)	6 (06)	64	32	-

Table 4 Ptolemy House Keeping Packet Information

3.1.2 Science Packets

A lander packet has a set size of 141 words; a tabular representation is shown in Figure 3-2. Of these 141 words 13 words are used by the lander to provide routing information and error checking (shown as blue text). Inside each lander packet is one Ptolemy science packet with a total word count of 128 words including the header. The exact format of the Ptolemy packet depends of the type of science data to be sent (see Table 5).

1ACF	**FC1D**	Packet ID	Seq. ID	PKT Len.	T1	T2	T3
null/Type	Sub/Pad	Format ID	Packet ID	Seq. ID	PKT Len.	T1	T2
T3	null/Type	Sub/Pad	Format ID	V01	V02	V03	V04
V05	V06	V07	V08	V09	V10	V11	V12
V13	V14	V15	V16	V17	V18	V19	V20
V21	V22	V23	V24	V25	V26	V27	V28
V29	V30	V31	V32	V33	V34	V35	V36
V37	V38	V39	V40	V41	V42	V43	V44
V45	V46	V47	V48	V49	V50	V51	V52
V53	V54	V55	V56	V57	V58	V59	V60
V61	V62	V63	V64	V65	V66	V66	V67
V68	V69	V70	V71	V72	V73	V74	V75
V76	V77	V78	V79	V80	V81	V82	V83
V84	V85	V86	V87	V88	V89	V90	V91
V92	V93	V94	V95	V96	V97	V98	V99
V100	V101	V102	V103	V104	V105	V106	V107
V108	V109	V110	V111	V112	V113	V114	V115
V116	V117	V118	CRC1	CRC2			

*Each cell in the table represents 1 word (16-bits or 2 bytes where 1 byte equals 8 bits)

Figure 3-2 Template for Lander Science Packet

Blue – Lander Packet Header/Footer:

- Packet ID
- Sequence ID
- Packet Length
- Lander Transmission Time 1, Time 2, Time 3
- Null/Packet Type
- Packet Sub Type/Pad
- Format ID
- CRC1 & CRC2 (shown in footer)

Red – Ptolemy Packet Header:

- Packet ID
- Sequence ID
- Packet Length
- Current Lander Time 1, Time 2, Time 3
- Null/Packet Type
- Packet Sub Type/Pad
- Format ID

Pink – Variable Content

Contains any one of the science packets (Auxiliary, summary spectrum, complete spectrum)

Packet Name	Packet ID (hex)	Type dec (hex)	Sub Type dec (hex)	Length (Bytes)	Length (Words)	Structure ID
Auxiliary Science Data	0F3C	20 (14)	3 (03)	256	128	01
Summary Spectrum	0F3C	20 (14)	3 (03)	256	128	02
Complete Spectrum	0F3C	20 (14)	3 (03)	256	128	03

Table 5 Ptolemy Science Packet Information

3.2 Starting PTOEGSE1.1.EXE

3.2.1 General

The information interpretation part of the EGSE program is performed by a file called 'ptoEgse1.1.exe'. It will appear on the desktop as an icon similar to the one shown in Figure 3-3. Double click this icon to start the program.

Figure 3-3 PTOEGSE1.1.EXE desktop icon.

Upon execution you will be presented by a screen similar to that shown in Figure 3-4. Each of the commands on the tool bar are covered as separate topics briefly in this chapter and more extensively in sections 3.2.2 to 3.2.7.

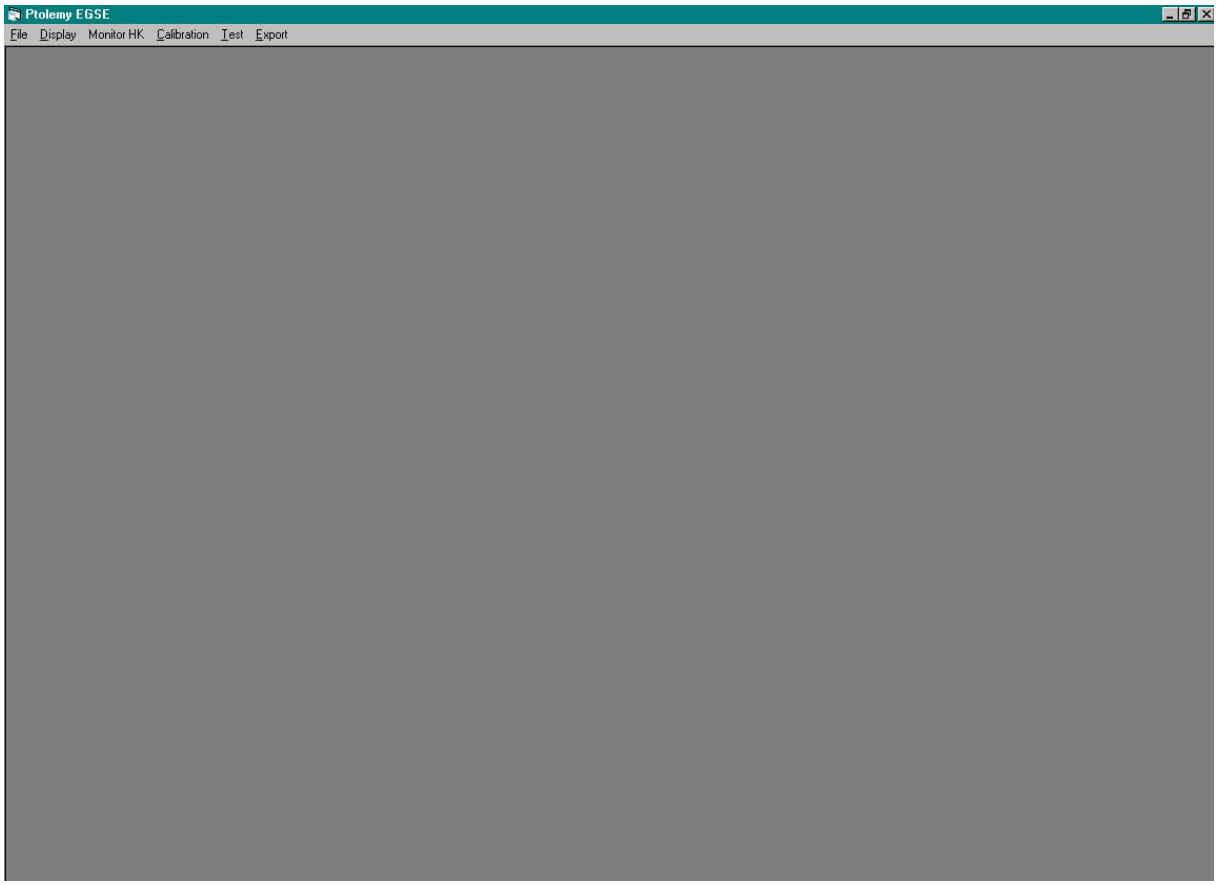


Figure 3-4 PTOEGSE1.1.EXE Start-up form.

Once opened there will be an option bar at the top of the form containing pull-down menus titled; File, Display, Monitor HK, Calibration, Test, and Export. This are dealt with individually in the following sections:

- **File**

The 'File Menu' shown in Figure 3-5 allows the user to load a source file for display if required (the alternative is to select real-time data collection – see the 'Display Menu'). When selected the 'File Menu' brings up three options that relate to the type of formatting to be employed on the file to be opened. The 'Exit' option closes the whole program.

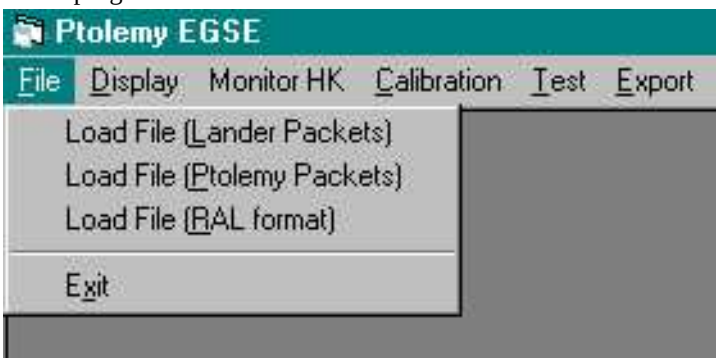


Figure 3-5 The File Menu

- **Display**

The 'Display Menu' shown in Figure 3-6 allows the user to select what parts of the source file/real time data they wish to display. When selected the 'Display Menu' brings up three options that relate to the type of data to be displayed plus two additional options.

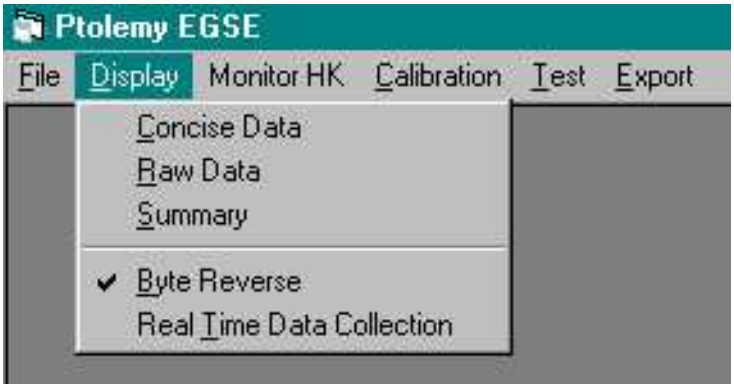


Figure 3-6 The Display Menu

The data types are:
Concise Data – This a small 8 element table that shows the type of each individual packet. Normally however a lander packet will either contain only 4 packets, of which numbers 1,2 and 4 should be housekeeping packets or one science packet
Raw Data – This window shows the entire Lander packet in hex including all header information without any processing of the contents.
Summary – This contains details on all the types of Ptolemy packets received. These are then sorted into Housekeeping. Information and Science. More information on most individual packets is available by double clicking on the required packet shown in the central list box.

The additional options are:
Byte Reverse – Changes the order the bytes are displayed e.g.:
1234 would be 4321 if byte reversed.
Real Time Data Collection – Instead of opening a named file this function opens the tlmlog.dat this is a shared file that stores telemetry received in real-time from the instrument.

- **Monitor HK**

The 'Monitor HK' menu shown in Figure 3-7 allows the user to select individual sensors and plot their readings on a graph over time. When selected the 'Monitor HK' menu brings up five component choice options that relate to the type of component to be plotted and four options relating to how the data will be displayed graphically.

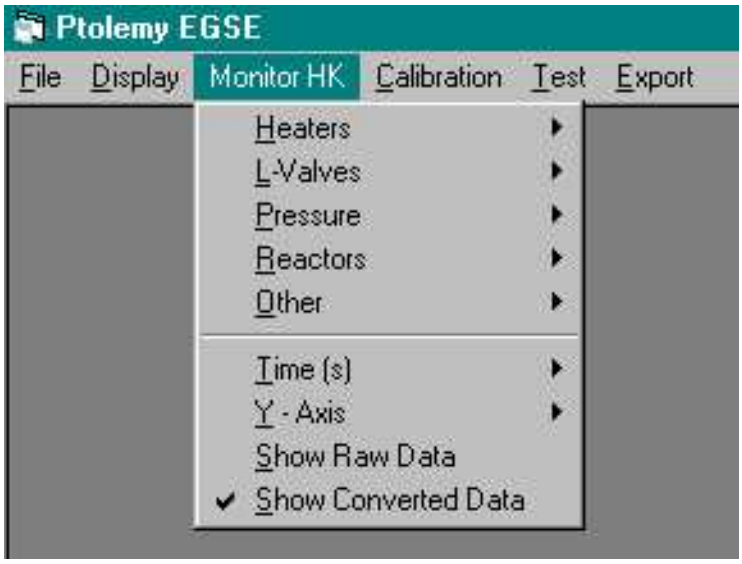


Figure 3-7 The Monitor HK Menu

- **Calibration**

The 'calibration' menu shown in Figure 3-8 allows the user to calibrate the values of all the pressure sensors and the AD590 thermocouple. The calibration values are applied to all the raw telemetry data prior to display.

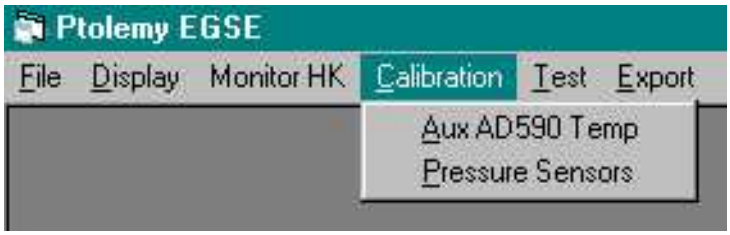


Figure 3-8 The Calibration Menu

- **Test**

The 'Test' menu shown in Figure 3-9 allows the user to display the results of either a short-form or long-form test in a custom Visual Basic form showing all the relevant information in a more accessible format.

Figure 3-9 The Test Menu

- **Export**

The 'Export' menu shown in Figure 3-10 allows the user to select individual sensors and export this information in a format capable of being used by programs such as MS Excel.

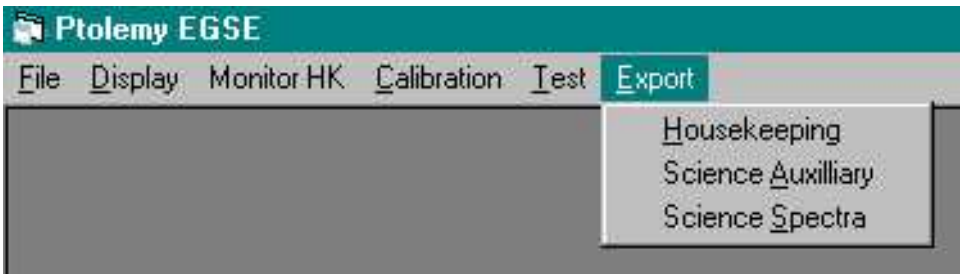


Figure 3-10 The Export Menu

3.2.2 File

The file types are:
Lander Packets – These are the same as the Ptolemy packets except that there is one less checksum word at the end. This only apples to packets that travel via the CDMS EGSE.

Ptolemy Packets – These are the standard packets as produced form the Ptolemy instrument and sent via the CDMS

RAL Format – These are files where some processing had already been done to the data in preparation for it to be displayed within MS Excel.
*** NOTE This format is no longer used but the facility has remained for re-processing of RAL formatted data.***

3.2.3 Display

The 'Concise Data' window, shown in Figure 3-11, contains an eight element table (this is the maximum number of Ptolemy packets that can be contained in a lander packet) that shows the type of each individual Ptolemy packet contained with a Lander packet. Normally a lander packet will either contain only 4 packets, of which numbers 1,2 and 4 should be housekeeping packets or 1 science packet.

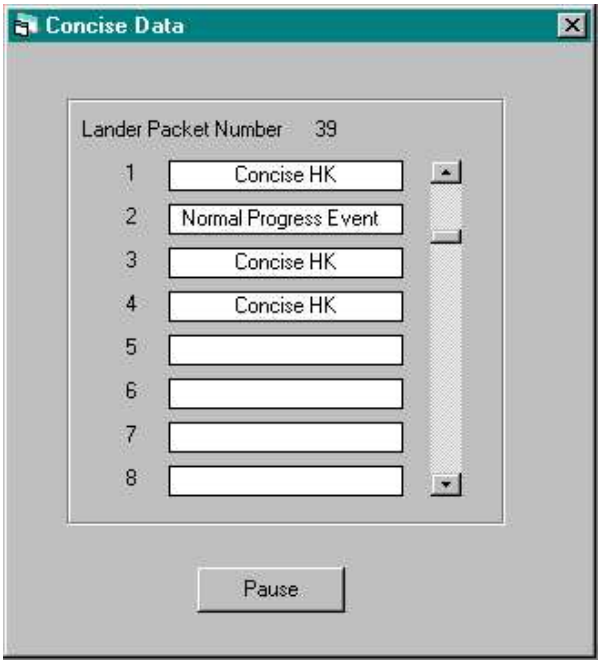


Figure 3-11 The Concise Data Window

The Raw Data window shown in Figure 3-12 contains the entire Lander packet in hex format including all header information without any processing of the contents. In the example below the Lander header is shown in red as is the error checking words at the end (there can be either one or two of these). As mentioned in section 3.2.1 the actual contents (shown in blue) of the packet can vary. The example shows four concise house keeping packets (the code for these is 0F34). Additional information shown on this form includes the current packet number shown as 'Lander Packet Number' and total number of lander packets shown as 'Number of Lander Packets'. The name of the currently open file is shown in the title bar of the form along with the path. To change the packet currently displayed in the central window simply use the scroll bar at the side of the window (scroll up for lower packet numbers and down for higher packet numbers).

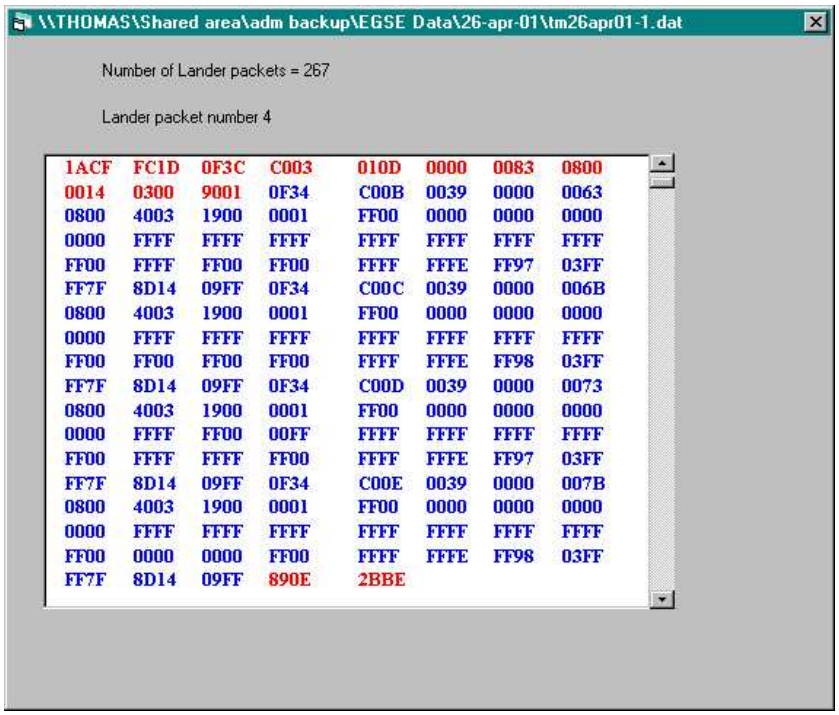


Figure 3-12 The Raw Data Window

Figure 3-13 shows the Summary form. This contains details on all the packets received in a session or all the packets contained in an opened file. Information is given on the source file at the top, the total number of lander packets is shown as well as breakdown of the number of 'Housekeeping', 'Science' and 'Information' packets. To obtain further information on any of these subcategories click on the tab with the required name.

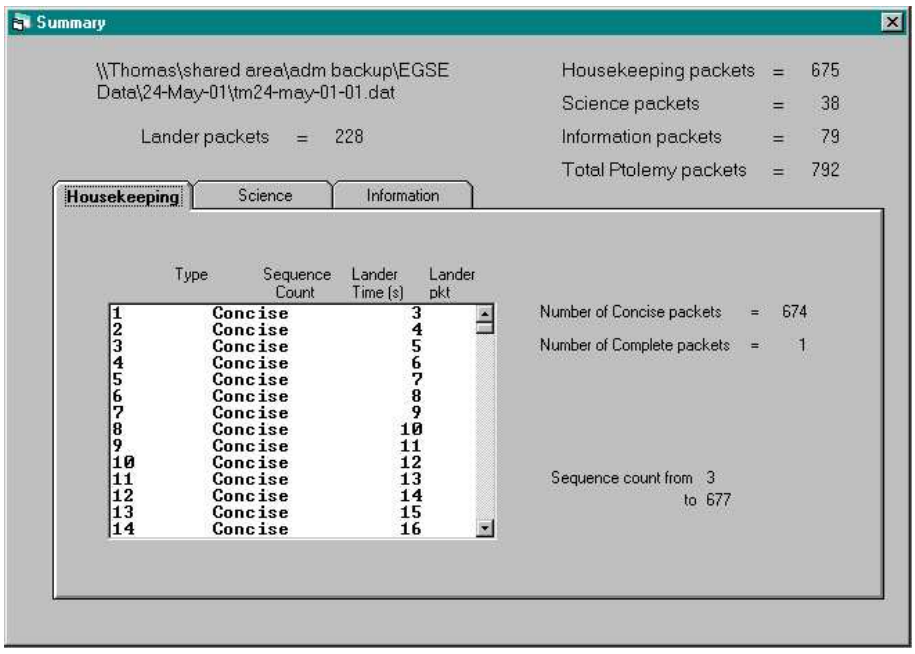


Figure 3-13 The Summary Window – Housekeeping

Having clicked on the 'Housekeeping' tab (if required – this tab is the default on opening) double clicking on the any of the lines (packets) appearing in the scrolling box in the centre of the form will cause other forms to appear giving further detail of the packet's contents:

- If you click on a line marked 'Concise' a form will appear similar to Figure 3-14. The concise packet shows temperature and pressure readings for the sensors distributed around the instrument as well as various voltage and current readings.

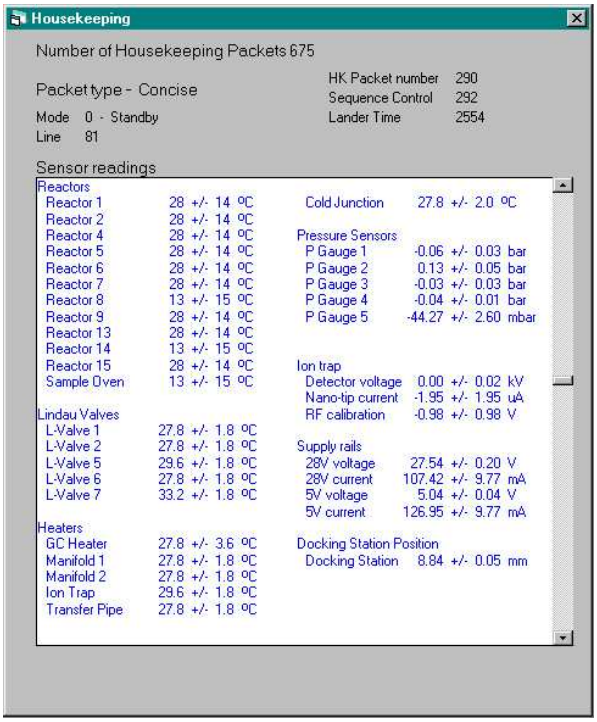


Figure 3-14 House keeping - Concise Packet

- If you click on a line marked 'Complete' a form will appear that look similar to the 'Concise' form and is shown in Figure 3-15. This again shows temperature and pressure readings for the sensors distributed around the instrument as well as various voltage and current readings. The only change is the 'More..' will be shown in the bottom right hand corner.

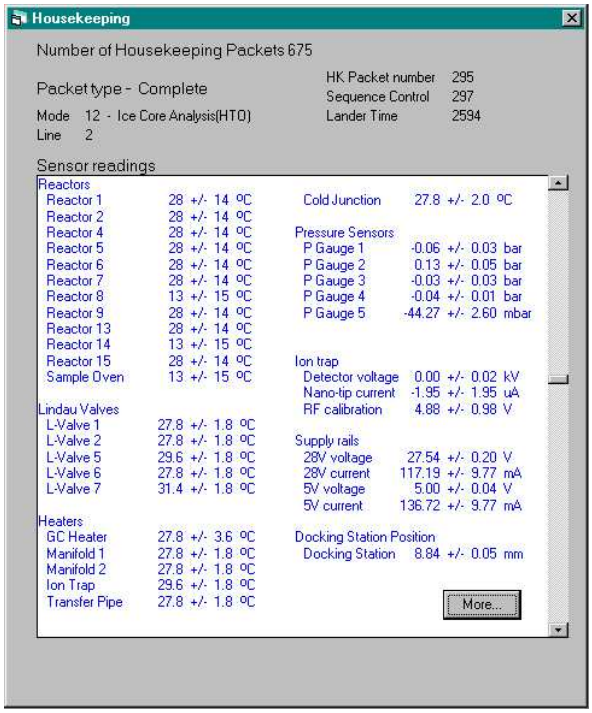


Figure 3-15 House keeping - Complete Packet 1

- By pressing the 'More…' button located at the bottom of the form you can see page 2 as shown in Figure 3-16. Page 2 shows the contents of the enable registers such as 'Valve Enable, 'Critical Function' and 'PWM Enable'. Those items enabled will show an 'En' below them, items not enabled will show a '-' below their names. Also shown are the contents of the control registers and other software variables. To find out which control lines are enabled look at the binary representation: channels enabled will show a '1' and channels disabled will show a '0'. Pressing the 'Sensors' button returns you to complete packet page 1 form.

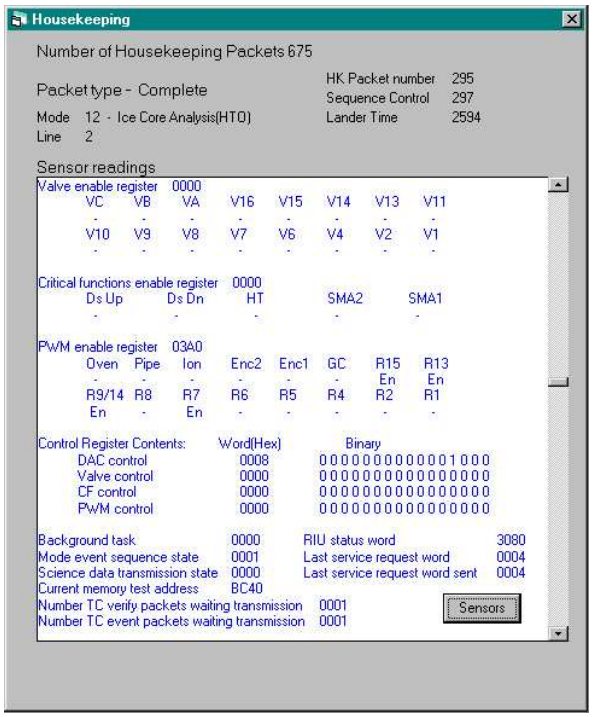


Figure 3-16 House keeping - Complete Packet 2

To view the science packets window press the 'Science' tab in the summary form. The layout of the science window is shown in Figure 3-17. You can navigate up and down the list of science packets using the scroll bar at the side of the packet list listbox in the centre of the form.

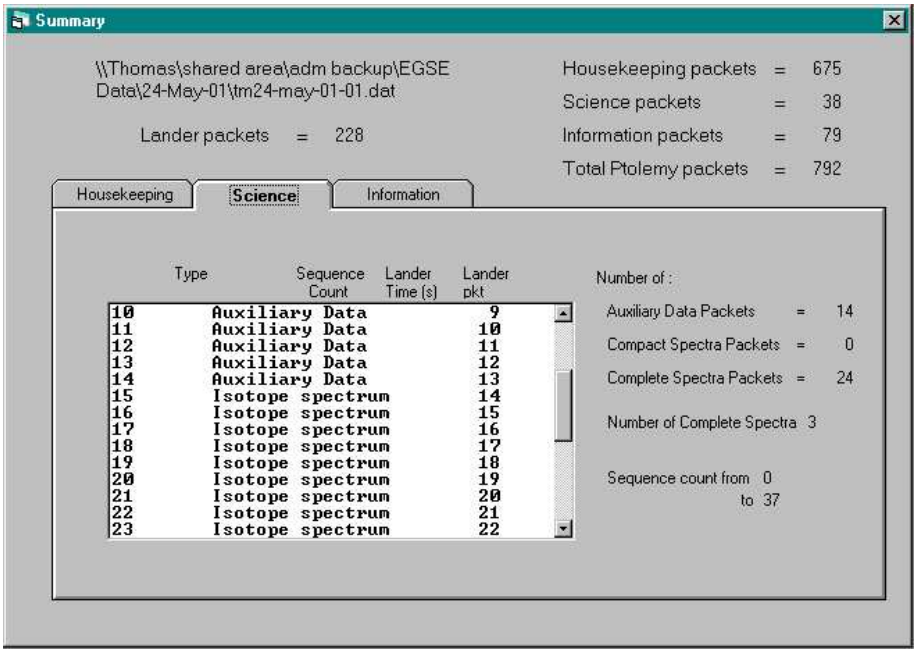
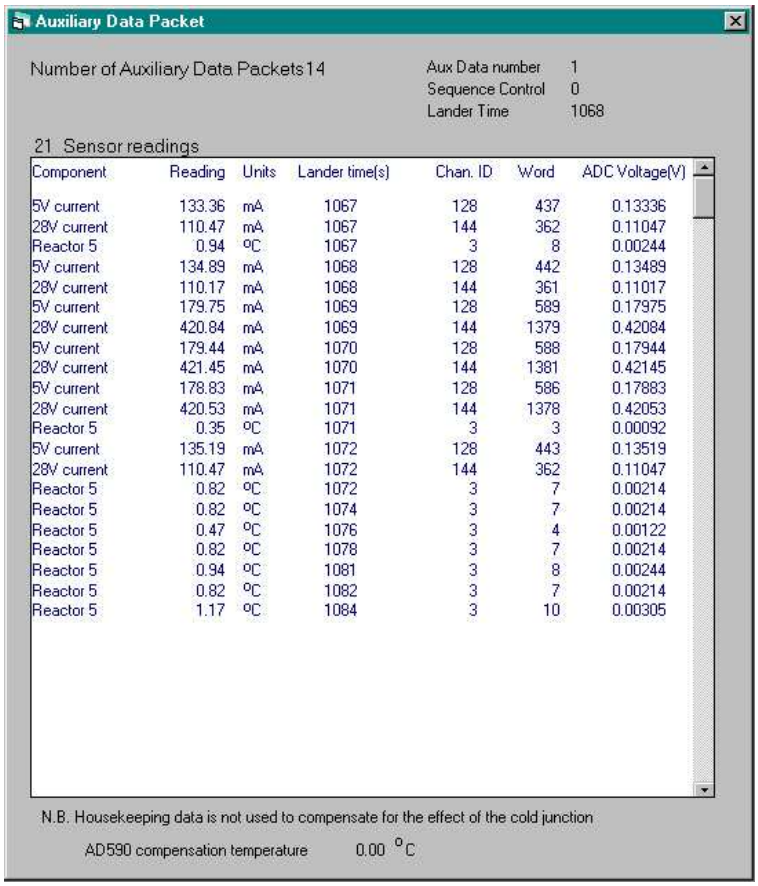


Figure 3-17 The Summary Window – Science

- Clicking on a packet marked 'Auxiliary data' brings up a window similar to Figure 3-18. The form has the packet number, sequence control number and lander time shown at the top right-hand side of the form. Also shown at the top left-hand side is the total of the available Auxiliary science data packets available. Just above the main window is the total number of readings in this auxiliary science packet. To navigate up and down the list use the scroll bars at the side. The main window contains info about the component name, the interpreted reading, units, the lander time when the reading was taken, the ADC channel, word number and the original ADC voltage.



Component	Reading	Units	Lander time(s)	Chan. ID	Word	ADC Voltage(V)
5V current	133.36	mA	1067	128	437	0.13336
28V current	110.47	mA	1067	144	362	0.11047
Reactor 5	0.94	°C	1067	3	8	0.00244
5V current	134.89	mA	1068	128	442	0.13489
28V current	110.17	mA	1068	144	361	0.11017
5V current	179.75	mA	1069	128	589	0.17975
28V current	420.84	mA	1069	144	1379	0.42084
5V current	179.44	mA	1070	128	588	0.17944
28V current	421.45	mA	1070	144	1381	0.42145
5V current	178.83	mA	1071	128	586	0.17883
28V current	420.53	mA	1071	144	1378	0.42053
Reactor 5	0.35	°C	1071	3	3	0.00092
5V current	135.19	mA	1072	128	443	0.13519
28V current	110.47	mA	1072	144	362	0.11047
Reactor 5	0.82	°C	1072	3	7	0.00214
Reactor 5	0.82	°C	1074	3	7	0.00214
Reactor 5	0.47	°C	1076	3	4	0.00122
Reactor 5	0.82	°C	1078	3	7	0.00214
Reactor 5	0.94	°C	1081	3	8	0.00244
Reactor 5	0.82	°C	1082	3	7	0.00214
Reactor 5	1.17	°C	1084	3	10	0.00305

Figure 3-18 Science – Auxiliary Data

- Clicking on a packet marked 'Isotope spectra' brings up a window similar to Figure 3-19. Listed in the top left-hand corner are totals for the number of GC and Isotope spectra. The top right-hand corner contains information relating to the graph lay-out including; the maximum X and Y axis points and a selector to choose the starting point for the X axis (default is zero). Centred directly above the main window is a scroll bar that allows the user to scroll through the available spectra. The number of the current spectrum is shown to the left of this. In a frame to the right of the main window is a scrollbar to allow display of the sub packets as well as information on the number of bins and information about the number and type of any errors detected in the data.

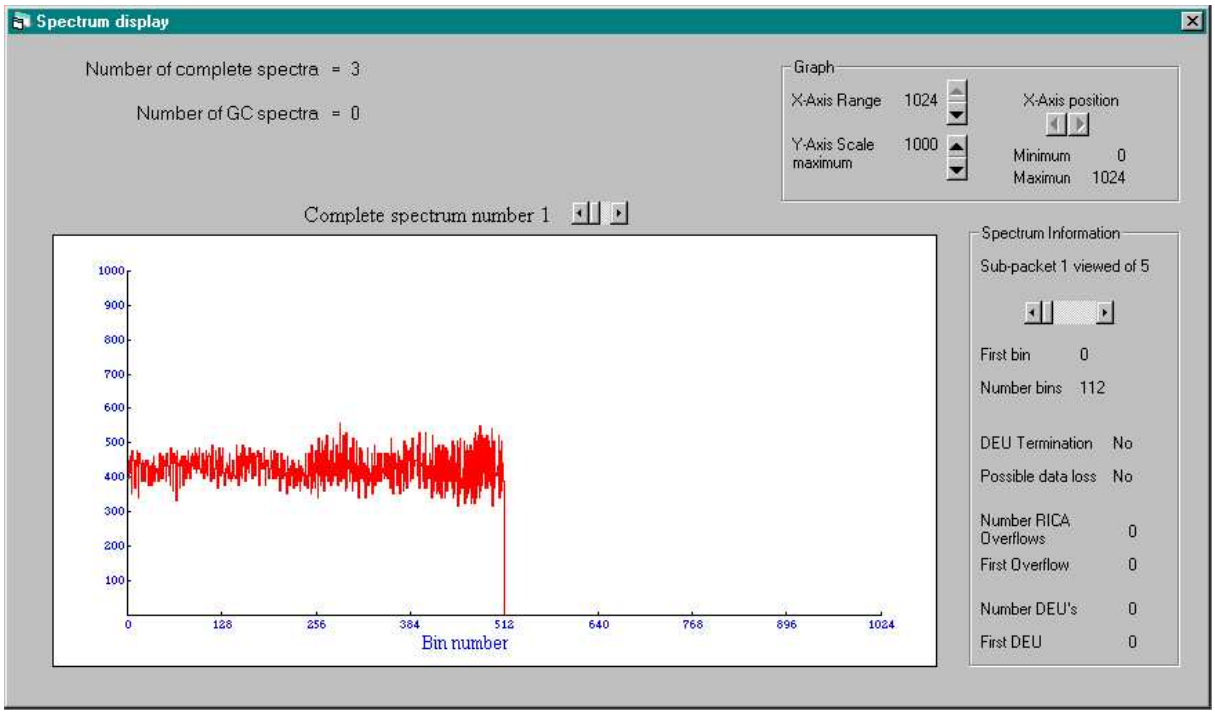


Figure 3-19 Science – Isotope Spectra

Having selected the 'Information' tab a page will appear similar to Figure 3-20.

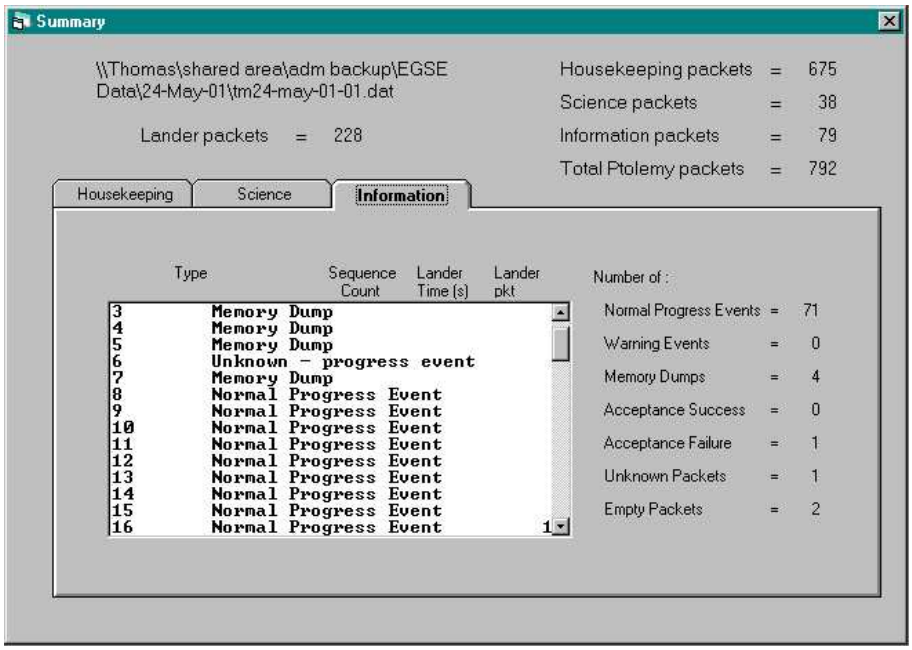


Figure 3-20 The Summary Window – Information

- Clicking on a line in the central window marked 'Normal Progress Event' brings up a form similar to the one shown in Figure 3-21. The top window contains the raw, hex, contents of the packet. The bottom window contains any interpreted information (not all packets have extra interpretable information inside).

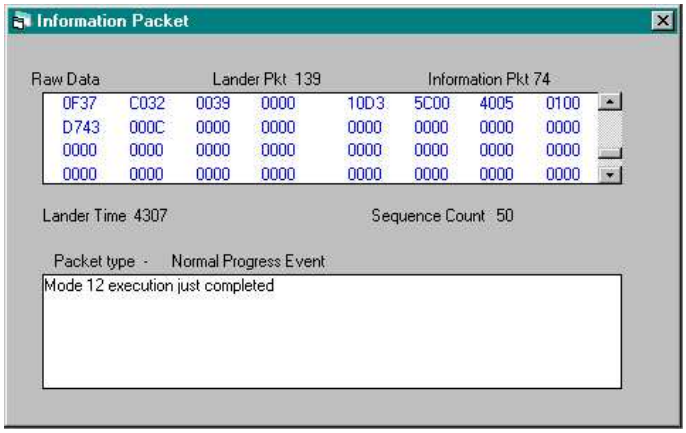


Figure 3-21 Information – Normal Progress Event

- Clicking on a line in the central window marked 'Warning Anomalous Event' brings up a form similar to the one shown in Figure 3-22. Again the top window displays the raw hex data. The bottom window shows any additional information provided about the nature of the anomaly.

.

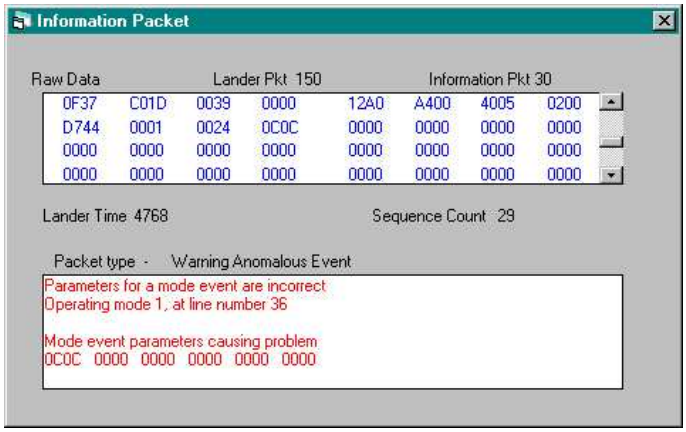


Figure 3-22 Information – Anomalous Event

- Occasionally an event packet may arrive for which the exact format has not been coded into the software. Such packets will appear in the list as 'Unknown – progress event'. This is perfectly normal and will present itself in a form similar to Figure 3-23.

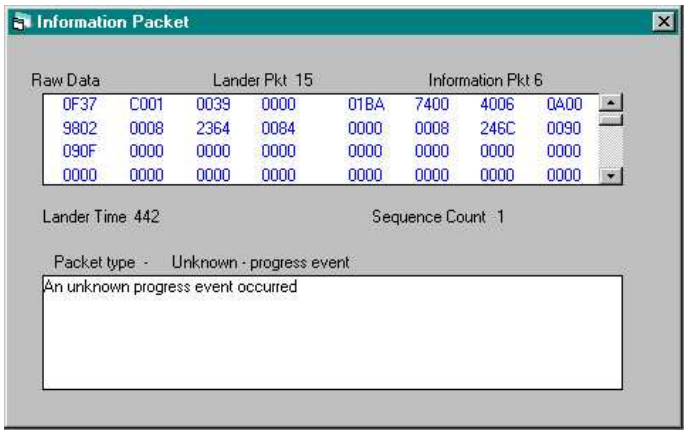


Figure 3-23 Information – Unknown Progress Event

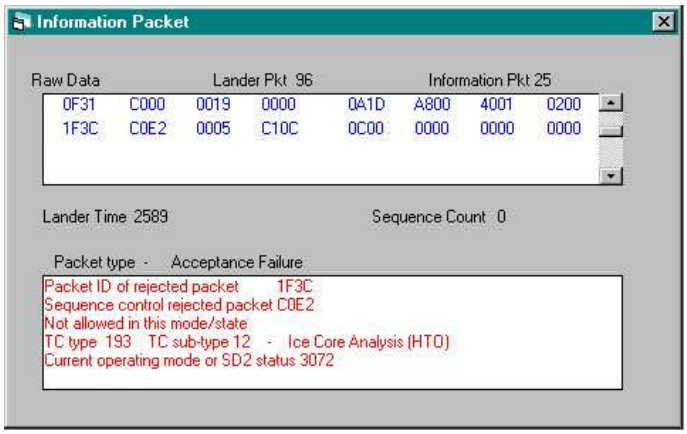


Figure 3-24 Information – TC Acceptance Failure

3.2.4 Monitor HK

Function due to be removed during the next software update

3.2.5 Calibration

If 'Aux AD590 Temp' is chosen from the drop-down menu then a form similar to the one in Figure 3-25 should appear. To change the current calibration temperature simply enter the new temperature in the text box provided and press 'Accept'. To close the form press the 'Cancel' button.

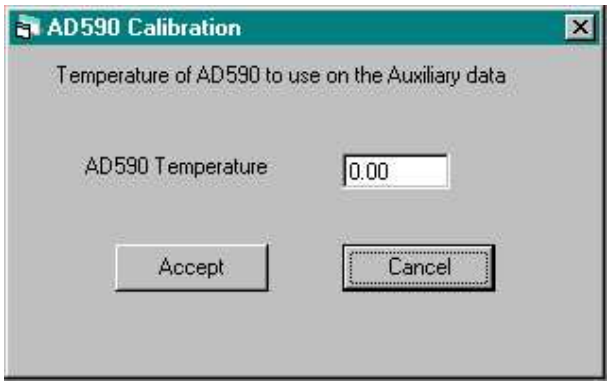


Figure 3-25 Calibration – AD590

Alternatively to change the pressure gauge calibration settings select 'Pressure Sensors' from the calibration menu and a form similar to Figure 3-26 should appear. To modify the current settings (shown in grey text) press the 'Modify' button. To return to the manufacturer's default settings press 'Reset' and to quit the form press 'Cancel'

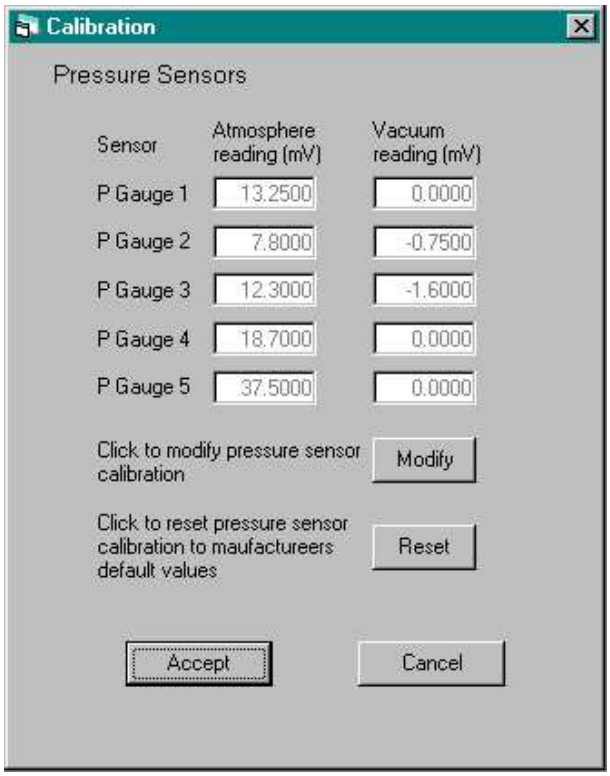


Figure 3-26 Calibration – Pressure Sensors

Having pressed the 'Modify' button or 'Reset' button the following warning message will appear (see Figure 3-27). To continue press the 'OK' button.

Figure 3-27 Calibration – Warning Message Box

Having selected 'Modify' the text will turn black and you will be able to enter your new settings. Once your changes are complete press 'Accept'. Having pressed Accept you will be presented with a final conformation message box as shown in Figure 3-28. To confirm your changes press 'Yes'; to reject your changes press 'No'.

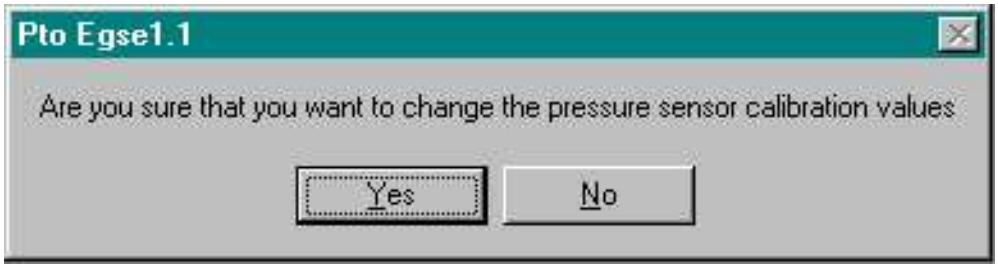


Figure 3-28 Calibration – Confirmation Message Box

3.2.6 Test

Long form Test [TBC]

Having chosen 'Short (air) test' a form similar to the one in Figure 3-29 should appear. This shows a list of all the short form tests run during the time the opened file was active. If there were no short form tests run a form similar to Figure 3-30 will appear instead.

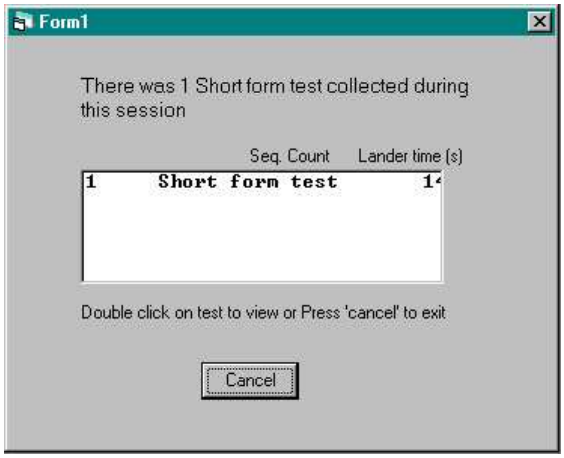


Figure 3-29 Short Form Test Selection Window - Example

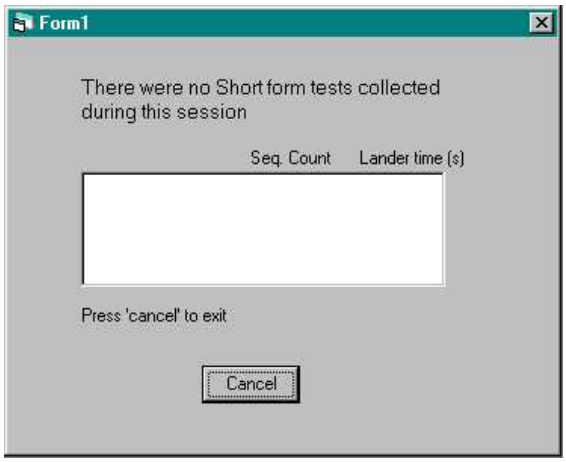


Figure 3-30 Short Form Test Selection Window - Error

Having double clicked on one of the short form tests shown in the scrolling list box similar to Figure 3-29 a different form will appear similar to the one shown in Figure 3-31. The first line of text at the top of the summary form will show if the test has passed or failed. If it has failed the word FAIL will appear in red text. Figure 3-32 shows the other seven pages available by selecting the appropriate tab 'Sensors', 'Valves', 'Injector Valves', 'Heaters', 'Large Reactors', 'Small Reactors' and 'Lindau Valves'. If you wish to return to the front summary page simply select the 'Summary' tab. Each of the tabs reveals more information about the individual sensors and the results for the test performed on them.

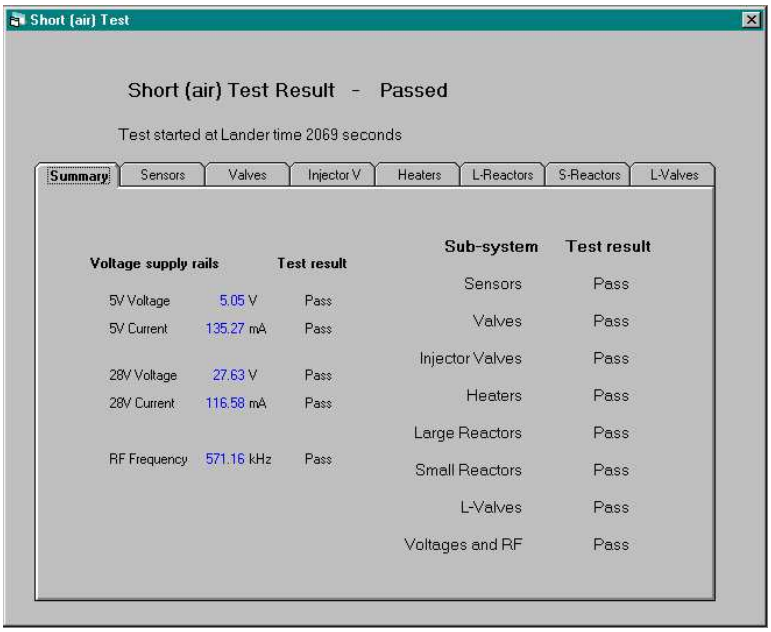
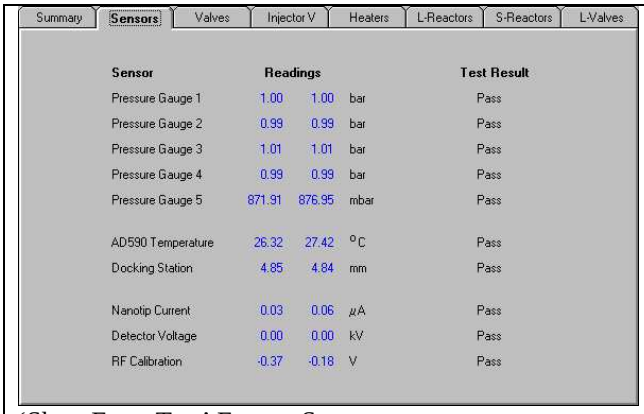
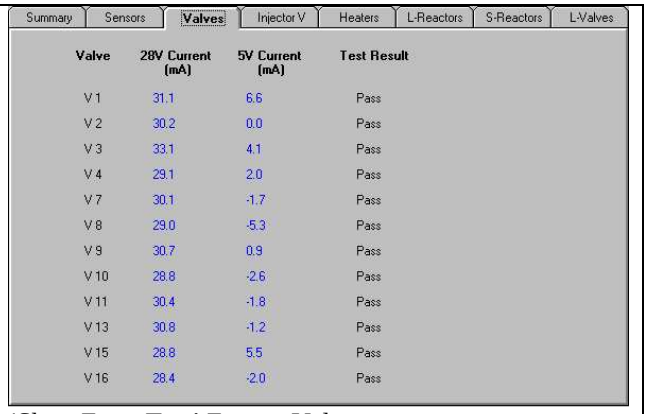


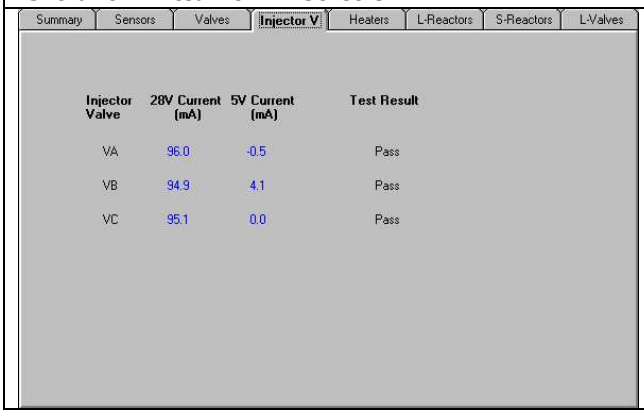
Figure 3-31 'Short Form Test' Form – Summary

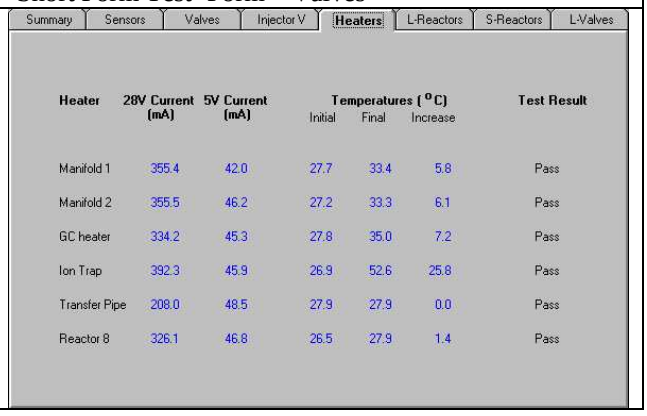


'Short Form Test' Form – Sensors

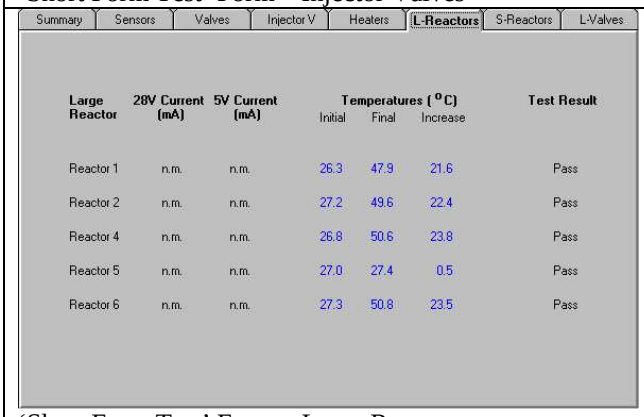


'Short Form Test' Form – Valves

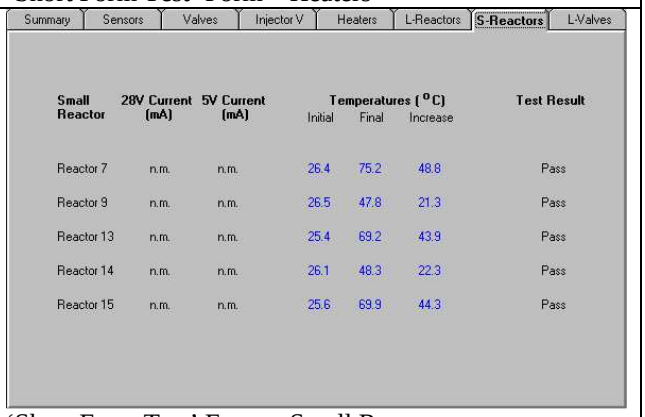




‘Short Form Test’ Form – Injector Valves

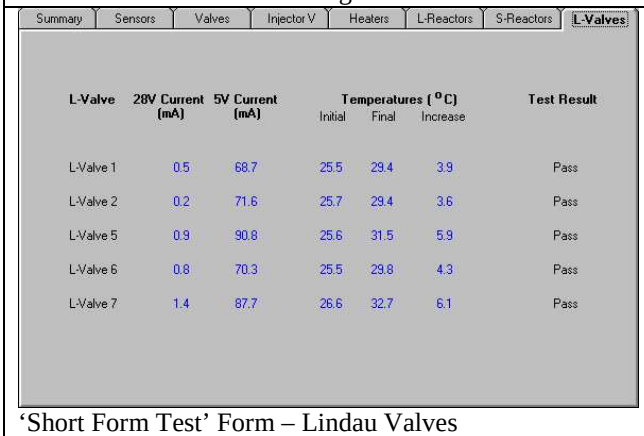


‘Short Form Test’ Form – Heaters



‘Short Form Test’ Form – Large Reactors

‘Short Form Test’ Form – Small Reactors



‘Short Form Test’ Form – Lindau Valves

Figure 3-32 ‘Short Form Test’ Form – Other Information Pages

3.2.7 Export

In order to export Housekeeping Data you must select the sensors you wish to include in your exported data as well as which packets you wish the data to be collected from. The options you have for exporting House keeping (HK) data are shown on the form in Figure 3-33. Under 'Data Format' you can select whether you want calibrated or uncalibrated data (an example of the calibration is the subtraction of the background temperature, taken from the AD590 reading, from the sensor readings). You can also specify the format the selected data is exported in under the 'Deliminator' heading. The range of packets you wish this sensor data to be taken from is selected under the 'HK Packets' heading. You can select all packets (using the tick box) or a specified range using the 'From' and 'To' text boxes (the numbers that automatically appear in the text boxes show the largest possible range - in this example 1 to 675). Having chosen the sensors, format and range to export the data press the 'Export' button at the bottom of the form or to quit press the 'Cancel' button.

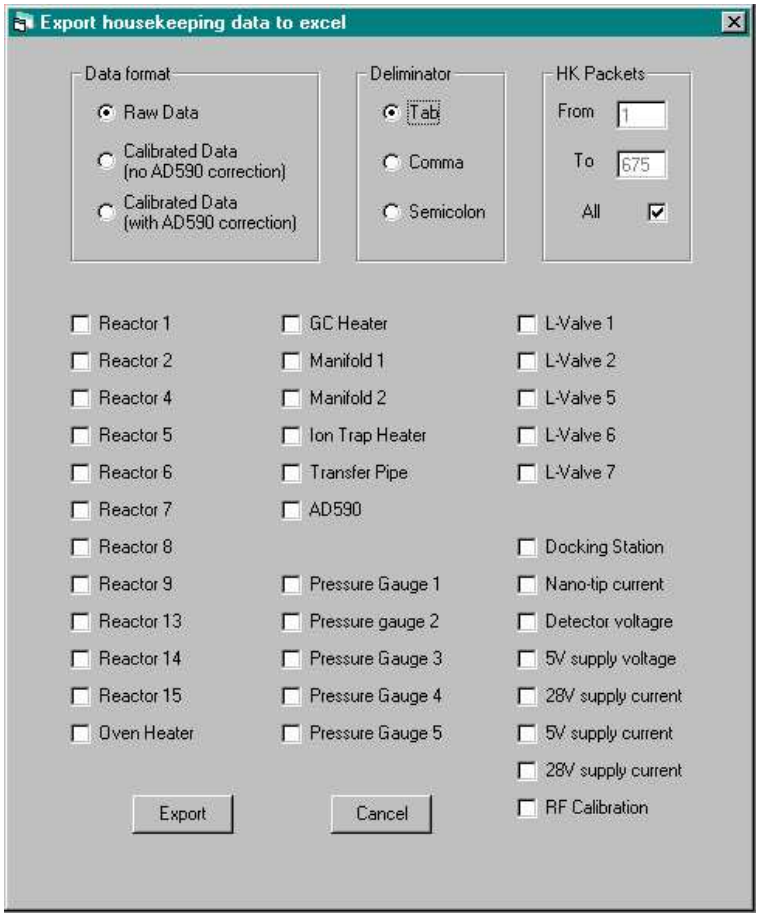


Figure 3-33 Export – House keeping Form

To export Auxiliary Data you must select the packets you wish the data to be collected from. The options you have for exporting Auxiliary data are shown on the form (see Figure 3-34) under 'Data Format'; you can select whether you want converted ADC values or voltages. Also you can specify calibrated or uncalibrated data (an example of the calibration is the subtraction of the background temperature, taken from the AD590 reading, from the sensor readings). You can also specify the format the selected data is exported in under the 'Deliminator' heading. The range of packets you wish this sensor data to be taken from is selected under the 'Aux Packets'

heading. You can select all packets (using the tick box) or a specified range using the 'From' and 'To' text boxes (the numbers that automatically appear in the text boxes show the largest possible range' in this example 1 to 38). For the purposes of calibration you can enter an AD590 reading in the AD590 textbox. Having chosen the format and range to export the data press the 'Export' button at the bottom of the form or to quit press the 'Cancel' button.

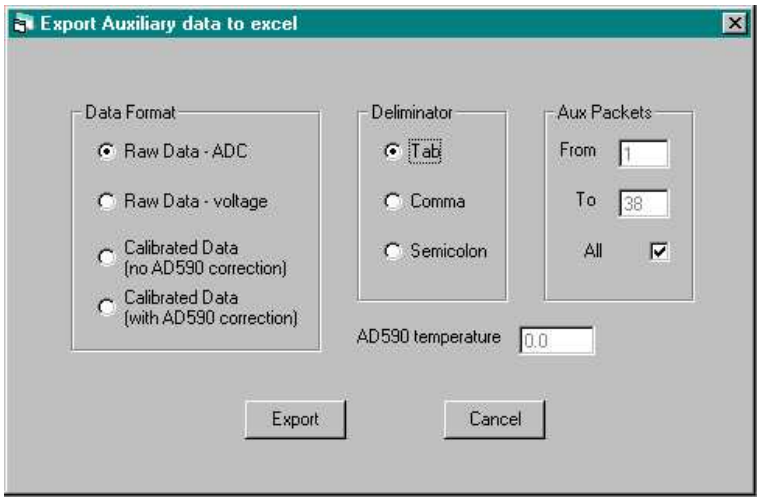


Figure 3-34 Export – Auxiliary Data Form

To export spectra to MS Excel you must select the spectra you wish the data to be collected from. The options you have for exporting spectra to MS Excel are shown on the form (see Figure 3-35) under 'Data Format'. You can select whether you want raw or processed data to be displayed as an MS Excel graph. You can also specify the format the selected data is exported in under the 'Deliminator' heading. The range of spectra you wish this data to be taken from is selected under the 'Spectra' heading. You can select all spectra (using the tick box) or a specified range using the 'From' and 'To' text boxes (the numbers that automatically appear in the text boxes show the largest possible range, in this example 1 to 3). Having chosen the format and range to export the data press the 'Export' button at the bottom of the form or to quit press the 'Cancel' button.

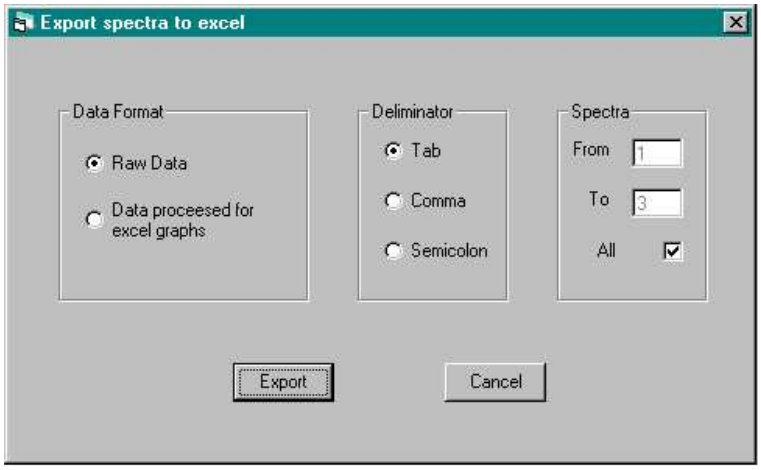


Figure 3-35 Export – Science Spectra Form

4 Procedures

4.1 EGSE Start-up Procedure

The EGSE software is a collection of programs designed to run Ptolemy. There are three processors that need to communicate in order to control Ptolemy throughout testing and characterising; these are shown in Figure 4-1.

Figure 4-1 EGSE Data Flow Diagram

The EGSE Start-up procedure is as follows:

1. Switch on Ptolemy EGSE computer.
2. OPTIONAL – Make a folder called "DD-MMMM-YY" in the 'C:\EGSE Data' folder, where DD it the current date, MMMM is the first four letters of the month (of the first 3 in the case of may) and YY is the last two digits of the year.
3. From the desktop double click of start "**STARTER*.exe**" (where * is the version number).
4. Select the "Command Formatter and Transmitter" option from menu and then press the 'Select' button.
5. Minimise the "Command Transmitter" form.
6. From the desktop select "**CDMS handler**.exe**" (where ** is the version number).

7. INSTIGATE POWER UP SEQUENCE FOR **CDMS** AND **PTOLEMY/CHEMISTRY SET SIMULATOR** – varies according to which items are selected.

8. From the "CDMS handler", choose the 'CDMS' menu and select "Load SW". Wait ~5 seconds until the green LED on the CDMS box lights up (very dim LED). This loads the software into the CDMS Simulator.
9. Choose the 'CDMS menu' and select 'Start TM'. After a couple of seconds the red LED on the CDMS box will begin to flash. This indicates that the CDMS has started transmitting data.
10. Choose the 'File' menu and select 'Start TM log O/W' (O/W indicates overwrite). This will start recording the data from the CDMS.
11. Choose the 'File' menu 'Start TC handling'. This prepares the CDMS to receive instructions from the EGSE.
12. From the desktop double click or run "**ADM EGSEvX.Y**" (where X.Y is the version number).
13. Choose the 'Display' menu and select 'Real Time Data Collection'. This loads data from the "CDMS Handler" into the a shared file accessed by the "ADM EGSE" this shared file updates the data every time a new packet is received from the CDMS.
14. Choose the 'Display' menu, and select 'Raw Data'. This displays the packet data in its raw form and is useful for diagnostic purposes (the first word in the window should always be 1ACF).
15. Choose the 'Display' menu, and select 'Summary'. This displays summary information on all the packets received during a session. It also sorts the packets out into housekeeping, science and information categories.
16. Choose the 'Display' menu, and select 'Concise'. This displays the contents of an individual lander packet showing which types of Ptolemy packets are contained within it. The 'Pause' button can be used to halt automatic updating as new packets are received from the CDMS. To continue auto-updating press the 'Continue' button.

17. To view a housekeeping packet double click on any of the housekeeping packets displayed in the 'Summary' form. Double clicking will display the 'Housekeeping' form, You should check to see if the data looks ok and that Ptolemy is in Safe Mode (mode 255) before continuing.

5 Appendix A- Parameter Table Addresses

```
            RTX-C Link Utility v1.2g
Copyright 1997 Highland Software, Inc.


  Section Summary

Code  10000 Size 0d01c
Init  00220 Size 05938
Strg  00220 Size 05938
Data  08000 Size 04c78
Entry 10000


  File Size Summary

Code  Init  Data  Strg  Name

0b850 00000 00000 00000 scimode.rel
00684 00000 00000 00000 riu.rel
00288 00000 00000 00000 sciint.rel
00172 00000 00000 00000 timer.rel
002b2 00000 00000 00000 lapse.rel
00032 00000 00000 00000 smapow.rel
00114 00000 00000 00000 utility.rel
00000 01cb8 006bc 01cb8 data.rel
00000 03c80 045bc 03c80 scmdata.rel
00178 00000 00000 00000 c:\rtx\lib\li0.rel
002de 00000 00000 00000 c:\rtx\lib\ll.rel
00500 00000 00000 00000 c:\rtx\lib\lf.rel
0d01c 05938 04c78 05938 Total


                Symbols by Address        |            Symbols by Name
                                          |
00000 __init_page                         | <                                 1C7EA
00000 __code_begin                        | <=                                1C7F8
00000 __strg_page                         | <>                                1C7BA
00000 __data_page                         | =                                 1C7B0
00001 __code_page                         | >                                 1C7E0
00220 __strg_begin                        | >=                                1C7F4
00220 _CommandMessages                    | _AcceptanceFailure                01E10
00220 __init_begin                        | _AcceptanceSuccess                01E0E
00AA6 _PtolemyPrivate                     | _AccumulatedBlockLength           0862C
00AA8 _Standby                            | _AcknowledgeAcceptance            00ABE
00AAA _GroundTest                         | _ActionCode                       085E2
00AAC _HTOConditioning                    | _AdditionalScience                00AB4
00AAE _MTOConditioning                    | _AddressWord                      085E0
00AB0 _CASEConditioning                   | _AuxiliaryData                    01EDE
00AB2 _HeliumTankRupture                  | _BackgroundTaskDuration           01ED4
00AB4 _AdditionalScience                  | _BackgroundTaskTimeout            01ED6
00AB6 _SafeMode                           | _BackupRAM                        08048
00AB8 _ConnectionTestRequest              | _BackupRAMRecordTransmitted       05B0E
00ABA _EnableDisable                      | _Bank1Correction                  00DD0
00ABC _Update                             | _Bank2Correction                  00DD2
00ABE _AcknowledgeAcceptance              | _BinCount                         0CAD0
00AC0 _IsolateAppID                       | _BinNumber                        0CACE
00AC2 _IsolateType                        | _BlockSize                        0B1B4
00AC4 _ExtractType                        | _CASEConditioning                 00AB0
00AC6 _IsolateSubType                     | _CalculateCRC                     1161E
00AC8 _ExtractSubType                     | _CannotBeExecuted                 01E1A
00ACA _IsolatePad                         | _CarouselRotationCompleted        05B04
```

```
00ACC _IsolateAck                       | _CheckCommand                    10606
00ACE _TCType                           | _CheckModeEventParameters        19338
00AD0 _TCSubtype                        | _Checksum                        08046
00AD2 _HKReport                         | _ClearCEFlag                     00D5C
00BD8 _StoredTelecommand                | _ClearEEPROMInterruptBit         00D46
00BE6 _ServiceRequest                   | _ClearMEFlag                     00D58
00C2C _SCMD                             | _ClearUpperByte                  01E34
00C2E _SRDY                             | _CodePageZero                    05AF4
00C30 _WRBF                             | _Command                         08000
00C32 _RDBF                             | _CommandMessages                 00220
00C34 _OCPL                             | _Complete                        01E36
00C36 _ScienceReport                    | _Concise                         01E38
00D3A _ControlLogicRegisterPage         | _ConnectionTestReport            01DD4
00D3C _ControlLogicRegisterUpper        | _ConnectionTestReporting         01DCC
00D3E _ControlLogicRegisterLower        | _ConnectionTestRequest           00AB8
00D40 _EnableEEPROMAccess               | _ContextEventData                081B2
00D42 _DisableEEPROMAccess              | _ControlAutonomousActions        19F28
00D44 _WatchdogTimerRestartBit          | _ControlCommandHandling          10536
00D46 _ClearEEPROMInterruptBit          | _ControlLogicRegisterLower       00D3E
00D48 _SetSoftwareNMI1                  | _ControlLogicRegisterPage        00D3A
00D4A _RIUPage                          | _ControlLogicRegisterUpper       00D3C
00D4C _RIUInterruptOffset               | _ControlModeEvent                121EE
00D4E _RIUStatusOffset                  | _ControlModeEventSequence        11C2C
00D50 _RIUIncomingDataOffset            | _ControlOperatingMode            1B39A
00D52 _RIUOutgoingDataOffset            | _ControlRIU                      1B850
00D54 _SelectInterruptBits              | _ControlScienceInterface         1BED4
00D56 _SetMEFlag                        | _ControlScienceMode              10000
00D58 _ClearMEFlag                      | _ConvertedData                   00E6A
00D5A _SetCEFlag                        | _ConverterAddressOffset          00DB4
00D5C _ClearCEFlag                      | _ConverterCycle                  00DC8
00D5E _SelectSRFlag                     | _ConverterDataOffset             00DB8
00D60 _SetSRFlag                        | _ConverterDelayCount             00DCC
00D62 _PowerPage                        | _ConverterPage                   00DB2
00D64 _VariablePowerControlOffset       | _ConverterTriggerOffset          00DB6
00D66 _PulsedPowerControlOffset         | _ConverterTriggerValue           00DCA
00D68 _ValvePowerControlOffset          | _CorrectTemperatureReading       15D7A
00D6A _CriticalPowerControlOffset       | _CriticalPower                   086BC
00D6C _ZeroPower                        | _CriticalPowerControlOffset      00D6A
00D6E _PulsedPowerEnableOffset          | _CriticalPowerEnableOffset       00D72
00D70 _ValvePowerEnableOffset           | _CurrentModeEvent                085DA
00D72 _CriticalPowerEnableOffset        | _CurrentModeEventData            01FDC
00D74 _NoEnable                         | _CurrentModeParameters           088E2
00D76 _VariablePowerEquipmentCount      | _CurrentOperatingMode            088E0
00D78 _VariablePowerEquipment           | _CurrentSpectrumData             0891E
00D98 _EquipmentSwitchOffPeriod         | _DEUCount                        0CADA
00D9C _EquipmentSwitchOffSignal         | _DataCollected                   0808A
00D9E _PowerCycle                       | _DataWord                        085DE
00DA2 _RICAFIFOPort1                    | _DefaultRFCalibration            09958
00DA4 _RICAFIFOPort2                    | _DefaultRFFrequency              0284E
00DA6 _RICAFIFOPort3                    | _DeltaRFFrequency                09954
00DA8 _RICAI2CPort1                     | _DestinationEndPage              0868E
00DAA _RICAI2CPort2                     | _DestinationOffset               08688
00DAC _RICASoftCtlPort                  | _DestinationPage                 08686
00DAE _RICADACCPort                     | _DetectCommandReception          1055E
00DB0 _RFFrequencyDAC                   | _DigitalOnOffRegister            0CAC4
00DB2 _ConverterPage                    | _DisableEEPROMAccess             00D42
00DB4 _ConverterAddressOffset           | _DisableInterrupts               1C5B2
00DB6 _ConverterTriggerOffset           | _DockingStation                  02852
00DB8 _ConverterDataOffset              | _DockingStationCalibrationData   01E08
00DBA _FirstSensor                      | _DockingStationSensorData        01E06
00DBC _LastBank1Sensor                  | _DockingStationTimeOut           01DF6
00DBE _LastBank2Sensor                  | _Dump                            01916
00DC0 _LastSensor                       | _EEPROM                          01E70
00DC2 _Item                             | _EEPROMBasePage                  010FC
00DC4 _FirstChannel                     | _EEPROMWrite                     085E8
```

```
00DC6 _LastChannel                      | _EEPROMWriteBuffer                0808C
00DC8 _ConverterCycle                   | _EEPROMWriteUninterrupted         085EA
00DCA _ConverterTriggerValue            | _EnableDisable                    00ABA
00DCC _ConverterDelayCount              | _EnableEEPROMAccess               00D40
00DCE _MaximumConverterDelayCount       | _EnableInterrupts                 1C5D2
00DD0 _Bank1Correction                  | _EquipmentSwitchOffPeriod         00D98
00DD2 _Bank2Correction                  | _EquipmentSwitchOffSignal         00D9C
00DD4 _SensorData                       | _ErrorCorrectionBits              05B42
00E6A _ConvertedData                    | _Event                            0110C
00F0A _SensorDataLUT                    | _EventReporting                   01DC8
00F4A _SafeLimit                        | _Extract11msb                     01E56
00FDA _OperatingLimit                   | _Extract5lsb                      01E5A
010FC _EEPROMBasePage                   | _Extract5msb                      01E58
010FE _PageSize                         | _ExtractActionCode                01E54
01100 _ProtectionAddress                | _ExtractID                        01E74
01106 _ProtectionData                   | _ExtractSubType                   00AC8
0110C _Event                            | _ExtractType                      00AC4
01916 _Dump                             | _FinishedServicingTriggerFlag     0CACA
0195A _TCVerify                         | _FirstChannel                     00DC4
01D64 _HK                               | _FirstSensor                      00DBA
01DC6 _PtolemyEvent                     | _FixedFormatTelemetryMode         085DC
01DC8 _EventReporting                   | _GenerateEventTMPacket            11094
01DCA _MemoryCheckReporting             | _GenerateHKTMPacket               1A90E
01DCC _ConnectionTestReporting          | _GenerateScienceDataPacket        162B0
01DCE _NormalProgress                   | _GenerateTCVerifyTMPacket         11428
01DD0 _WarningAnomalous                 | _GroundTest                       00AAA
01DD2 _MemoryCheckReport                | _HK                               01D64
01DD4 _ConnectionTestReport             | _HKReport                         00AD2
01DD6 _PtolemyPowerOnStart              | _HTOConditioning                  00AAC
01DD8 _PtolemyFailure                   | _HTStatus                         088E8
01DDA _PtolemyTimeout                   | _HTTimeToRamp                     01FD8
01DDC _RSSTChecksumFailure              | _HTTimeToRampTimeOut              01DF4
01DDE _OperatingModeSelection           | _HeapSort                         17764
01DE0 _MemoryCheckFailure               | _HeatingPIDConstants              02364
01DE2 _SafeLimitViolation               | _HeliumTankRupture                00AB2
01DE4 _OperatingLimitExcursion          | _HousekeepingDataReporting        01E28
01DE6 _OperatingLimitReturn             | _HousekeepingParameterReporting   01E2A
01DE8 _SD2BackupRAMReceived             | _ICVOpeningDurations              0CAD4
01DEA _PtolemyBackupRAMReceived         | _ICVScalingConstants              05B3E
01DEC _MonitorModeEventTimeOut          | _InUpperByte                      01E32
01DEE _WGACommunicationsFailure         | _IncompletePacket                 01E12
01DF0 _WGAMemoryCheckReport             | _IncorrectApplicationID           01E16
01DF2 _WGAMemoryIntegrityFailure        | _IncorrectChecksum                01E14
01DF4 _HTTimeToRampTimeOut              | _InjectorControlValveDesignation  0CABE
01DF6 _DockingStationTimeOut            | _InvalidCommandCode               01E18
01DF8 _ModeCompleted                    | _IonTrapECDataTableStartAddresse  02808
01DFA _ModeEventParameterError          | _IsolateAck                       00ACC
01DFC _NoPageForSpectraDataStorage      | _IsolateAppID                     00AC0
01DFE _SpectraDataPageFull              | _IsolateCount                     01E78
01E00 _ScienceDataPacketBufferFull      | _IsolateID                        01E76
01E02 _NoPageForSciencePacketBuffer     | _IsolatePad                       00ACA
01E04 _RFFrequencyCalibrationReport     | _IsolateSequenceCount             01E30
01E06 _DockingStationSensorData         | _IsolateSubType                   00AC6
01E08 _DockingStationCalibrationData    | _IsolateType                      00AC2
01E0A _PtolemyAcknowledge               | _Item                             00DC2
01E0C _TelecommandVerify                | _LastBank1Sensor                  00DBC
01E0E _AcceptanceSuccess                | _LastBank2Sensor                  00DBE
01E10 _AcceptanceFailure                | _LastChannel                      00DC6
01E12 _IncompletePacket                 | _LastSensor                       00DC0
01E14 _IncorrectChecksum                | _Length                           0868A
01E16 _IncorrectApplicationID           | _LindauDACChannelLUT              0258A
01E18 _InvalidCommandCode               | _LindauPIDConstants               02062
01E1A _CannotBeExecuted                 | _LongTime                         086B8
01E1C _PacketDataFieldInconsistent      | _LowerValidCodes                  01E50
01E1E _PtolemyDump                      | _MTOConditioning                  00AAE
```

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01E20 _MemoryManagementType              | _MaintainedModeEventsTable          02592
01E22 _MemoryDumpRequest                 | _ManageAddressWord                  1B89A
01E24 _SourceDataLength                  | _ManageAuxiliaryDataModeEvent       13B0A
01E26 _PtolemyHK                         | _ManageBackupRAMRequest             1B49C
01E28 _HousekeepingDataReporting         | _ManageCDMSCommandExecution         119B6
01E2A _HousekeepingParameterReporting    | _ManageClippardValveModeEvent       12486
01E2C _Segmentation                      | _ManageCommandWord                  1BD0E
01E2E _SequenceCountLimit                | _ManageCurrentModeEvent             11C82
01E30 _IsolateSequenceCount              | _ManageDockingStationCalibration    1802E
01E32 _InUpperByte                       | _ManageEndOfMode                    15522
01E34 _ClearUpperByte                    | _ManageEquipmentMonitoring          1A05E
01E36 _Complete                          | _ManageHKReportGeneration           1A386
01E38 _Concise                           | _ManageHeatingMaintainedModeEven    18D18
01E3A _MessageState                      | _ManageInitialisation               10030
01E48 _SelectActionCode                  | _ManageInjectorControlValveModeE    124FE
01E4A _SelectWordCount                   | _ManageLindauMaintainedModeEvent    188BC
01E4C _SelectTransmitBit                 | _ManageLindauValveandHeatingMode    12654
01E4E _RemoveTransmitBit                 | _ManageMaintainedModeEvent          187E8
01E50 _LowerValidCodes                   | _ManageMassSpectrometerActivatio    140D2
01E52 _UpperValidCodes                   | _ManageMassSpectrometerOperation    128B2
01E54 _ExtractActionCode                 | _ManageMemoryCheck                  19F40
01E56 _Extract11msb                      | _ManageMonitorModeEvent             1398E
01E58 _Extract5msb                       | _ManageRFFrequencyCalibrationMod    17B38
01E5A _Extract5lsb                       | _ManageSMAHeaterModeEvent           138F8
01E5C _MemoryType                        | _ManageSMAPower                     1C580
01E6E _PROM                              | _ManageSampleCollectorModeEvent     13CAC
01E70 _EEPROM                            | _ManageScienceDataTransmission      1B1BC
01E72 _RAM                               | _ManageSetICVOpeningDurationMode    125D0
01E74 _ExtractID                         | _ManageShutdown                     1B5F4
01E76 _IsolateID                         | _ManageSoftwareClock                1C2B8
01E78 _IsolateCount                      | _ManageStatusDataWord               1BDC4
01E7A _MemoryDump                        | _ManageStoredTelecommandRequest     1B412
01EB2 _MaximumBlockLength                | _ManageTelecommandExecution         11764
01EB6 _Select5Msb                        | _ManageTelemetryTimeReference       1C1D8
01EB8 _Select6Msb                        | _ManageTime                         1C15C
01EBA _Select11Lsb                       | _ManageTimeDelayModeEvent           13C42
01EBC _TimerPeriod                       | _ManageTimeLapse                    1C2CE
01EBE _TelemetryTimeReference            | _ManageTimerModeEvent               154AC
01EC4 _TelemetryTimeReferenceUpdate      | _ManageWGAMemoryCheckModeEvent      141FA
01ED0 _WatchdogRestartPeriod             | _MaximumBlockLength                 01EB2
01ED4 _BackgroundTaskDuration            | _MaximumConverterDelayCount         00DCE
01ED6 _BackgroundTaskTimeout             | _MaximumNumberOfValuesToRead        05B3C
01ED8 _SMAPowerCycle                     | _MemoryCheck                        08690
01EDA _SMAPulseFrequency                 | _MemoryCheckFailure                 01DE0
01EDC _PulsedPowerFrequency              | _MemoryCheckReport                  01DD2
01EDE _AuxiliaryData                     | _MemoryCheckReporting               01DCA
01FD4 _SoftwareClock                     | _MemoryCopy                         08630
01FD8 _HTTimeToRamp                      | _MemoryDump                         01E7A
01FDC _CurrentModeEventData              | _MemoryDumpRequest                  01E22
01FE2 _ModeEventSequenceStartAddresses   | _MemoryManagementType               01E20
02022 _OperatingLimitsStartAddresses     | _MemoryPatchData                    085EC
02062 _LindauPIDConstants                | _MemoryTestAccumulatedChecksum      09988
02364 _HeatingPIDConstants               | _MemoryTestAddress                  0998A
02574 _ReactorOrHeaterLUT                | _MemoryTestBank                     05B06
0258A _LindauDACChannelLUT               | _MemoryTestEndAddress               05B0C
02592 _MaintainedModeEventsTable         | _MemoryTestEventData                08194
027C4 _ScanFunctionDataTableStartAddre   | _MemoryTestExpectedChecksum         05B08
02808 _IonTrapECDataTableStartAddresse   | _MemoryTestStartAddress             05B0A
0284C _RFFrequencyCalibrationVoltage     | _MemoryType                         01E5C
0284E _DefaultRFFrequency                | _MessageState                       01E3A
02850 _RFCalResponseTime                 | _ModeCompleted                      01DF8
02852 _DockingStation                    | _ModeEventParameterError            01DFA
028BA _ScienceData                       | _ModeEventSequenceCompleted         05B10
04C78 __data_leng                        | _ModeEventSequenceFailure           05B12
05938 __init_leng                        | _ModeEventSequenceStartAddresses    01FE2
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05938 __strg_leng                       | _ModeEventSequenceState             09992
05AC4 _SafeModeVector                   | _ModeEventStatus                    09938
05AD6 _ScienceModeVector                | _ModeParameters                     09990
05AEE _ScienceModeInterruptMask         | _MonitorModeEventTimeOut            01DEC
05AF0 _Timer0Interval                   | _MonitorTimeReference               09946
05AF2 _Timer2Interval                   | _NextModeEventAddress               088E4
05AF4 _CodePageZero                     | _NoEnable                           00D74
05AF6 _SD2BackupRAM                     | _NoPageForSciencePacketBuffer       01E02
05B04 _CarouselRotationCompleted        | _NoPageForSpectraDataStorage        01DFC
05B06 _MemoryTestBank                   | _NormalProgress                     01DCE
05B08 _MemoryTestExpectedChecksum       | _NumberInFIFO                       0CACC
05B0A _MemoryTestStartAddress           | _NumberOfBins                       088EC
05B0C _MemoryTestEndAddress             | _NumberOfBytesToProcess             0CAE4
05B0E _BackupRAMRecordTransmitted       | _NumberOfSciencePacketsStored       0CAB4
05B10 _ModeEventSequenceCompleted       | _NumberOfServices                   0CAC6
05B12 _ModeEventSequenceFailure         | _NumberOfSpectraStored              0B1AE
05B14 _ReportBackupRAMState             | _OCPL                               00C34
05B16 _PtolemyBackupRAM                 | _OperatingLimit                     00FDA
05B28 _ValveDesignationToBitLUT         | _OperatingLimitExcursion            01DE4
05B3C _MaximumNumberOfValuesToRead      | _OperatingLimitReturn               01DE6
05B3E _ICVScalingConstants              | _OperatingLimitsStartAddresses      02022
05B42 _ErrorCorrectionBits              | _OperatingMode                      085D8
05B58 __init_end                        | _OperatingModeSelection             01DDE
05B58 __strg_end                        | _PROM                               01E6E
08000 __data_begin                      | _PacketDataFieldInconsistent        01E1C
08000 _Command                          | _PacketToTransmit                   0CAB6
08044 _TCWords                          | _PageSize                           010FE
08046 _Checksum                         | _PowerCycle                         00D9E
08048 _BackupRAM                        | _PowerPage                          00D62
0808A _DataCollected                    | _ProcessScienceData                 17242
0808C _EEPROMWriteBuffer                | _ProtectionAddress                  01100
0818C _SwitchOffEventData               | _ProtectionData                     01106
08194 _MemoryTestEventData              | _PtolemyAcknowledge                 01E0A
081B2 _ContextEventData                 | _PtolemyBackupRAM                   05B16
085D6 _WordsStored                      | _PtolemyBackupRAMReceived           01DEA
085D8 _OperatingMode                    | _PtolemyDump                        01E1E
085DA _CurrentModeEvent                 | _PtolemyEvent                       01DC6
085DC _FixedFormatTelemetryMode         | _PtolemyFailure                     01DD8
085DE _DataWord                         | _PtolemyHK                          01E26
085E0 _AddressWord                      | _PtolemyPowerOnStart                01DD6
085E2 _ActionCode                       | _PtolemyPrivate                     00AA6
085E4 _WordCount                        | _PtolemyTimeout                     01DDA
085E6 _StartupType                      | _PulsedPower                        086E0
085E8 _EEPROMWrite                      | _PulsedPowerControlOffset           00D66
085EA _EEPROMWriteUninterrupted         | _PulsedPowerEnableOffset            00D6E
085EC _MemoryPatchData                  | _PulsedPowerFrequency               01EDC
0862C _AccumulatedBlockLength           | _RAM                                01E72
08630 _MemoryCopy                       | _RDBF                               00C32
08682 _SourcePage                       | _RFCalData                          0995E
08684 _SourceOffset                     | _RFCalIndex                         0995C
08686 _DestinationPage                  | _RFCalResponseTime                  02850
08688 _DestinationOffset                | _RFCalibrationPoint1                09956
0868A _Length                           | _RFCalibrationPoint3                0995A
0868C _SourceEndPage                    | _RFFrequencyCalibrationModeEvent    0994E
0868E _DestinationEndPage               | _RFFrequencyCalibrationReport       01E04
08690 _MemoryCheck                      | _RFFrequencyCalibrationTimeRefer    0994A
086B8 _LongTime                         | _RFFrequencyCalibrationVoltage      0284C
086BC _CriticalPower                    | _RFFrequencyDAC                     00DB0
086C0 _VariablePower                    | _RFFrequencyPoint1                  09950
086E0 _PulsedPower                      | _RFFrequencyPoint3                  09952
088E0 _CurrentOperatingMode             | _RICADACCPort                       00DAE
088E2 _CurrentModeParameters            | _RICAFIFOPort1                      00DA2
088E4 _NextModeEventAddress             | _RICAFIFOPort2                      00DA4
088E8 _HTStatus                         | _RICAFIFOPort3                      00DA6
088EA _RunTableNumber                   | _RICAI2CPort1                       00DA8
```

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088EC _NumberOfBins                     | _RICAI2CPort2                     00DAA
088EE _ScanFunctionDuration             | _RICASoftCtlPort                  00DAC
088F2 _TransmitSpectrumasType           | _RIUIncomingDataOffset            00D50
088F4 _TABLEStartAddress                | _RIUInterruptOffset               00D4C
088F6 _WaveAddresses                    | _RIUOutgoingDataOffset            00D52
0891E _CurrentSpectrumData              | _RIUPage                          00D4A
09938 _ModeEventStatus                  | _RIUStatusOffset                  00D4E
0993A _TimeDelayTimeReference           | _RSSTChecksumFailure              01DDC
0993E _TimerTimeReference               | _ReactorOrHeaterLUT               02574
09942 _TimerDuration                    | _Read                             1C5C6
09946 _MonitorTimeReference             | _ReadFromMemory                   1C63C
0994A _RFFrequencyCalibrationTimeRefer  | _ReadIMR                          1C5BC
0994E _RFFrequencyCalibrationModeEvent  | _RemoveTransmitBit                01E4E
09950 _RFFrequencyPoint1                | _ReportBackupRAMState             05B14
09952 _RFFrequencyPoint3                | _ResetI2C                         17AC2
09954 _DeltaRFFrequency                 | _RunTableNumber                   088EA
09956 _RFCalibrationPoint1              | _SCMD                             00C2C
09958 _DefaultRFCalibration             | _SD2BackupRAM                     05AF6
0995A _RFCalibrationPoint3              | _SD2BackupRAMReceived             01DE8
0995C _RFCalIndex                       | _SMAPowerCycle                    01ED8
0995E _RFCalData                        | _SMAPulseFrequency                01EDA
09984 _ScienceModeCodePage              | _SRDY                             00C2E
09986 _SafeModeInterruptMask            | _SafeLimit                        00F4A
09988 _MemoryTestAccumulatedChecksum    | _SafeLimitViolation               01DE2
0998A _MemoryTestAddress                | _SafeMode                         00AB6
0998C _ScienceTransmissionActive        | _SafeModeInterruptMask            09986
0998E _SciencePacketTransmitted         | _SafeModeVector                   05AC4
09990 _ModeParameters                   | _ScanFunctionDataTableStartAddre  027C4
09992 _ModeEventSequenceState           | _ScanFunctionDuration             088EE
09994 _WGADataBuffer                    | _ScienceData                      028BA
0A198 _TemporaryStorage                 | _ScienceDataPacketBufferFull      01E00
0B1AE _NumberOfSpectraStored            | _ScienceModeCodePage              09984
0B1B0 _StartAddressofSpectra            | _ScienceModeInterruptMask         05AEE
0B1B4 _BlockSize                        | _ScienceModeVector                05AD6
0B1B6 _SpectrumToProcess                | _SciencePacketTransmitted         0998E
0B1B8 _StoreSpectrumHere                | _ScienceReport                    00C36
0B1BA _SortStatus                       | _ScienceTransmissionActive        0998C
0C9BE _SpectrumStorage                  | _Segmentation                     01E2C
0CAB4 _NumberOfSciencePacketsStored     | _Select11Lsb                      01EBA
0CAB6 _PacketToTransmit                 | _Select5Msb                       01EB6
0CABA _StorePacketHere                  | _Select6Msb                       01EB8
0CABE _InjectorControlValveDesignation  | _SelectActionCode                 01E48
0CAC0 _TimeUntilCloseANDFlags           | _SelectInterruptBits              00D54
0CAC4 _DigitalOnOffRegister             | _SelectSRFlag                     00D5E
0CAC6 _NumberOfServices                 | _SelectTransmitBit                01E4C
0CACA _FinishedServicingTriggerFlag     | _SelectWordCount                  01E4A
0CACC _NumberInFIFO                     | _SensorData                       00DD4
0CACE _BinNumber                        | _SensorDataLUT                    00F0A
0CAD0 _BinCount                         | _SequenceCountLimit               01E2E
0CAD2 _loopcounter                      | _ServiceRequest                   00BE6
0CAD4 _ICVOpeningDurations              | _SetCEFlag                        00D5A
0CAD8 _WGAMemoryCheckStatus             | _SetMEFlag                        00D56
0CADA _DEUCount                         | _SetSRFlag                        00D60
0CADC _TestTableStartAddress            | _SetSoftwareNMI1                  00D48
0CADE _TestWaveStartAddress             | _SoftwareClock                    01FD4
0CAE0 _TestTableAddress                 | _SortStatus                       0B1BA
0CAE2 _WGAAddressToStartAt              | _SourceDataLength                 01E24
0CAE4 _NumberOfBytesToProcess           | _SourceEndPage                    0868C
0CAE6 _WGATestWord                      | _SourceOffset                     08684
0CAE8 _WGAMask1                         | _SourcePage                       08682
0CAEA _WGAMask2                         | _SpectraDataPageFull              01DFE
0CAEC _StatusByte                       | _SpectrumStorage                  0C9BE
0CAEE _WGAMemoryCheckResults            | _SpectrumToProcess                0B1B6
0CC78 __data_end                        | _Standby                          00AA8
0D01C __code_leng                       | _StartAddressofSpectra            0B1B0
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0D01C __code_end                          | _StartupType                        085E6
10000 __entry                             | _StatusByte                         0CAEC
10000 _ControlScienceMode                 | _StorePacketHere                    0CABA
10030 _ManageInitialisation               | _StoreSpectrumHere                  0B1B8
10536 _ControlCommandHandling             | _StoreTMPacket                      1AC52
1055E _DetectCommandReception             | _StoredTelecommand                  00BD8
10606 _CheckCommand                       | _SwitchOffEventData                 0818C
11094 _GenerateEventTMPacket              | _TABLEStartAddress                  088F4
11428 _GenerateTCVerifyTMPacket           | _TCSubtype                          00AD0
1161E _CalculateCRC                       | _TCType                             00ACE
1165C _word_crc                           | _TCVerify                           0195A
11764 _ManageTelecommandExecution         | _TCWords                            08044
119B6 _ManageCDMSCommandExecution         | _TelecommandVerify                  01E0C
11C2C _ControlModeEventSequence           | _TelemetryTimeReference             01EBE
11C82 _ManageCurrentModeEvent             | _TelemetryTimeReferenceUpdate       01EC4
121EE _ControlModeEvent                   | _TemporaryStorage                   0A198
12486 _ManageClippardValveModeEvent       | _TestTableAddress                   0CAE0
124FE _ManageInjectorControlValveModeE    | _TestTableStartAddress              0CADC
125D0 _ManageSetICVOpeningDurationMode    | _TestWaveStartAddress               0CADE
12654 _ManageLindauValveandHeatingMode    | _TimeDelayTimeReference             0993A
128B2 _ManageMassSpectrometerOperation    | _TimeUntilCloseANDFlags             0CAC0
138F8 _ManageSMAHeaterModeEvent           | _Timer0Interval                     05AF0
1398E _ManageMonitorModeEvent             | _Timer2Interval                     05AF2
13B0A _ManageAuxiliaryDataModeEvent       | _TimerDuration                      09942
13C42 _ManageTimeDelayModeEvent           | _TimerPeriod                        01EBC
13CAC _ManageSampleCollectorModeEvent     | _TimerTimeReference                 0993E
140D2 _ManageMassSpectrometerActivatio    | _TransmitSpectrumasType             088F2
141FA _ManageWGAMemoryCheckModeEvent      | _Update                             00ABC
154AC _ManageTimerModeEvent               | _UpperValidCodes                    01E52
15522 _ManageEndOfMode                    | _ValveDesignationToBitLUT           05B28
15634 _WriteandVerifyScanFunction         | _ValvePowerControlOffset            00D68
15D7A _CorrectTemperatureReading          | _ValvePowerEnableOffset             00D70
15DF6 _WGARead                            | _VariablePower                      086C0
15F92 _WGAWrite                           | _VariablePowerControlOffset         00D64
160FC _WGAReadFromAddress                 | _VariablePowerEquipment             00D78
161D4 _WGAReadFromRegister                | _VariablePowerEquipmentCount        00D76
162B0 _GenerateScienceDataPacket          | _WGAAddressToStartAt                0CAE2
17242 _ProcessScienceData                 | _WGACommunicationsFailure           01DEE
17764 _HeapSort                           | _WGADataBuffer                      09994
17AC2 _ResetI2C                           | _WGAMask1                           0CAE8
17B38 _ManageRFFrequencyCalibrationMod    | _WGAMask2                           0CAEA
1802E _ManageDockingStationCalibration    | _WGAMemoryCheckReport               01DF0
187E8 _ManageMaintainedModeEvent          | _WGAMemoryCheckResults              0CAEE
188BC _ManageLindauMaintainedModeEvent    | _WGAMemoryCheckStatus               0CAD8
18D18 _ManageHeatingMaintainedModeEven    | _WGAMemoryIntegrityFailure          01DF2
19338 _CheckModeEventParameters           | _WGARead                            15DF6
19F28 _ControlAutonomousActions           | _WGAReadFromAddress                 160FC
19F40 _ManageMemoryCheck                  | _WGAReadFromRegister                161D4
1A05E _ManageEquipmentMonitoring          | _WGATestWord                        0CAE6
1A386 _ManageHKReportGeneration           | _WGAWrite                           15F92
1A90E _GenerateHKTMPacket                 | _WRBF                               00C30
1AC52 _StoreTMPacket                      | _WarningAnomalous                   01DD0
1B1BC _ManageScienceDataTransmission      | _WatchdogRestartPeriod              01ED0
1B39A _ControlOperatingMode               | _WatchdogTimerRestartBit            00D44
1B412 _ManageStoredTelecommandRequest     | _WaveAddresses                      088F6
1B49C _ManageBackupRAMRequest             | _WordCount                          085E4
1B5F4 _ManageShutdown                     | _WordsStored                        085D6
1B850 _ControlRIU                         | _Write                              1C5E0
1B89A _ManageAddressWord                  | _WriteIMR                           1C5DA
1BD0E _ManageCommandWord                  | _WriteTimerPreloads                 1C5BE
1BDC4 _ManageStatusDataWord               | _WriteToMemory                      1C5F0
1BED4 _ControlScienceInterface            | _WriteandVerifyScanFunction         15634
1C15C _ManageTime                         | _ZeroPower                          00D6C
1C1D8 _ManageTelemetryTimeReference       | __code_begin                        00000
1C2B8 _ManageSoftwareClock                | __code_end                          0D01C
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1C2CE _ManageTimeLapse                | __code_leng                   0D01C
1C4A8 _read_rica                      | __code_page                   00001
1C580 _ManageSMAPower                 | __data_begin                  08000
1C5B2 _DisableInterrupts              | __data_end                    0CC78
1C5BC _ReadIMR                        | __data_leng                   04C78
1C5BE _WriteTimerPreloads             | __data_page                   00000
1C5C6 _Read                           | __entry                       10000
1C5D2 _EnableInterrupts               | __init_begin                  00220
1C5DA _WriteIMR                       | __init_end                    05B58
1C5E0 _Write                          | __init_leng                   05938
1C5F0 _WriteToMemory                  | __init_page                   00000
1C63C _ReadFromMemory                 | __strg_begin                  00220
1C6C6 iu/                             | __strg_end                    05B58
1C6D2 umod                            | __strg_leng                   05938
1C6DE i/                              | __strg_page                   00000
1C710 mod                             | _loopcounter                  0CAD2
1C770 i*                              | _read_rica                    1C4A8
1C776 i*~                             | _word_crc                     1165C
1C77C iu*                             | c>i                           1C808
1C782 ui*~                            | cdshl                         1C84C
1C788 cshl                            | cdshr                         1C83E
1C792 cshr                            | cdshru                        1C85A
1C79C cshru                           | cshl                          1C788
1C7A8 not_                            | cshr                          1C792
1C7B0 =                               | cshru                         1C79C
1C7BA <>                              | d*                            1C896
1C7C4 u<=                             | d+                            1C87A
1C7CC u>                              | d-                            1C886
1C7D2 u>=                             | d/                            1C9B2
1C7DA u<                              | d/mod                         1C8F0
1C7E0 >                               | d<                            1CA46
1C7EA <                               | d<=                           1CA50
1C7F4 >=                              | d<>                           1CA5A
1C7F8 <=                              | d=                            1CA6E
1C7FC dnegate                         | d>                            1CA36
1C806 i>d                             | d>=                           1CA08
1C808 c>i                             | d>f                           1CF50
1C81C strass                          | d>i                           1C878
1C83E cdshr                           | d>r                           1CAA4
1C84C cdshl                           | dand                          1CA78
1C85A cdshru                          | dmod                          1C9EE
1C86A ptlong                          | dnegate                       1C7FC
1C86E gtlong                          | dnot_                         1CA9C
1C874 duplong                         | dor                           1CA84
1C878 d>i                             | dr>                           1CAB2
1C87A d+                              | dswap                         1CABE
1C886 d-                              | du/                           1CB0A
1C896 d*                              | du<                           1CAD8
1C8F0 d/mod                           | du<=                          1CAFC
1C9B2 d/                              | du>                           1CAE8
1C9EE dmod                            | du>=                          1CAEE
1CA08 d>=                             | dumod                         1CB16
1CA36 d>                              | dupfloat                      1CFEE
1CA46 d<                              | duplong                       1C874
1CA50 d<=                             | dxor                          1CA90
1CA5A d<>                             | f*                            1CD12
1CA6E d=                              | f+                            1CC54
1CA78 dand                            | f-                            1CCCA
1CA84 dor                             | f/                            1CE70
1CA90 dxor                            | f<                            1CF46
1CA9C dnot_                           | f<=                           1CF2E
1CAA4 d>r                             | f<>                           1CEE8
1CAB2 dr>                             | f=                            1CF0C
1CABE dswap                           | f>                            1CF16
1CAD0 rot                             | f>=                           1CF38
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1CAD8 du<                | f>d                 1CF66
1CAE8 du>                | f>i                 1CFDC
1CAEE du>=               | fnegate             1CCDA
1CAFC du<=               | gtfloat             1CFE6
1CB0A du/                | gtlong              1C86E
1CB16 dumod              | i*                  1C770
1CC54 f+                 | i*~                 1C776
1CCCA f-                 | i/                  1C6DE
1CCDA fnegate            | i>d                 1C806
1CD12 f*                 | i>f                 1CFBC
1CE70 f/                 | iu*                 1C77C
1CEE8 f<>                | iu/                 1C6C6
1CF0C f=                 | mod                 1C710
1CF16 f>                 | not_                1C7A8
1CF2E f<=                | ptfloat             1CFE0
1CF38 f>=                | ptlong              1C86A
1CF46 f<                 | rot                 1CAD0
1CF50 d>f                | strass              1C81C
1CF66 f>d                | u<                  1C7DA
1CFBC i>f                | u<=                 1C7C4
1CFDC f>i                | u>                  1C7CC
1CFE0 ptfloat            | u>=                 1C7D2
1CFE6 gtfloat            | ui*~                1C782
1CFEE dupfloat           | umod                1C6D2
```