

# MODULUS – Ptolemy

## EGSE Software User Manual (SUM)

**Document no.:** RO-LPT-OU-MA-3101

**Issue:** 1.0

**Date:** 11<sup>th</sup> May 2001

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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<br>Issue 5 26 <sup>th</sup> February 2001 |
| AD2 | RO-LPT-OU-TN-3401  | Ptolemy Hardware/Software Interface Document<br>Issue 5 3 <sup>rd</sup> April 2001      |

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### 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.

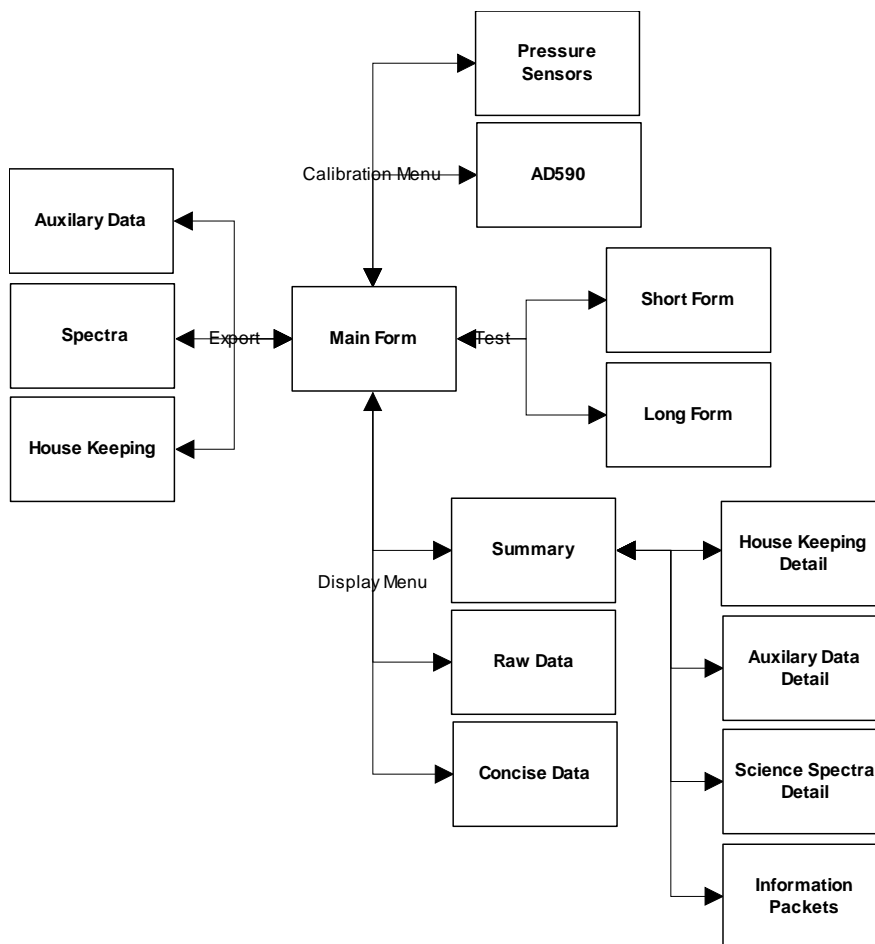


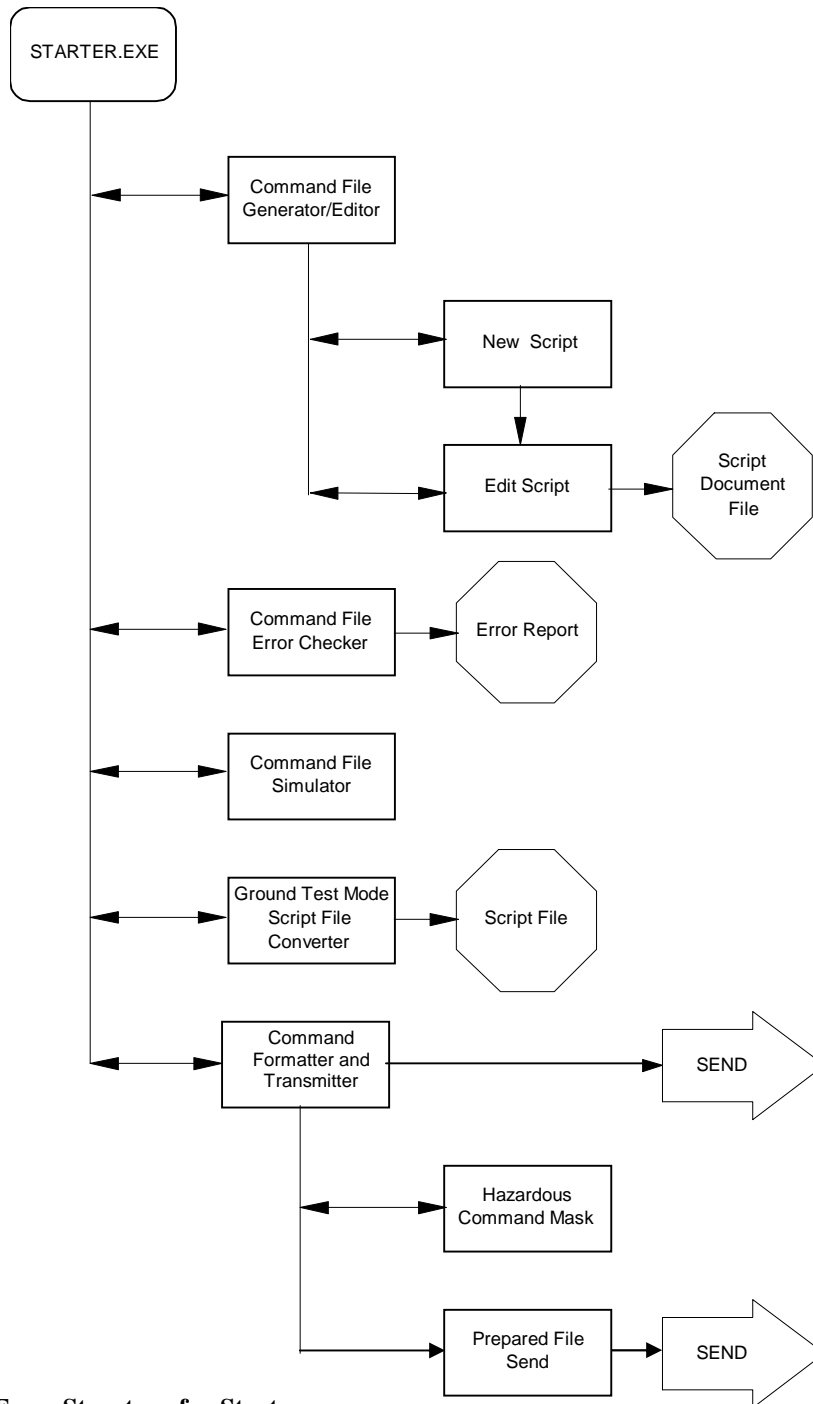
Figure 1-1 Form Structure for Pto Egse1.1.exe

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**Figure 1-2 Form Structure for Starter.exe**

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## 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 safety 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.

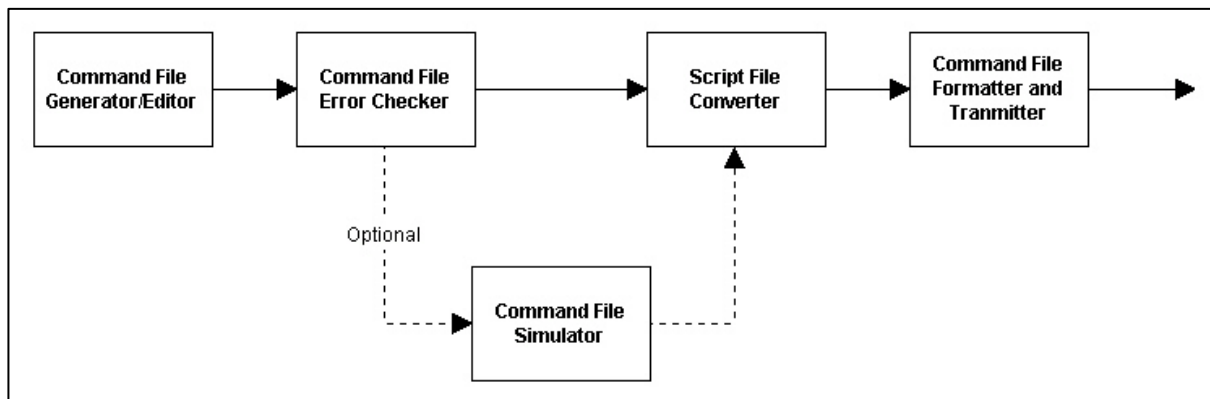
#### Warning and Safety Information

\*\*\*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.

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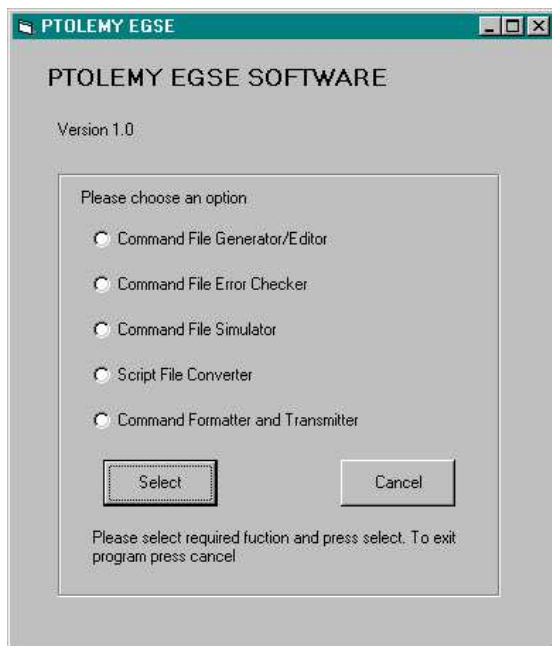
### 2.3 Starting STARTER.EXE

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.

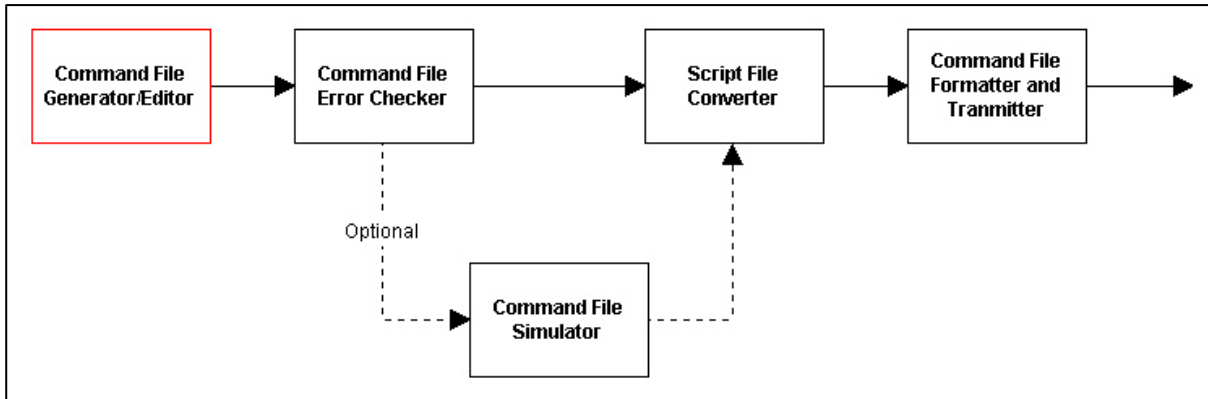
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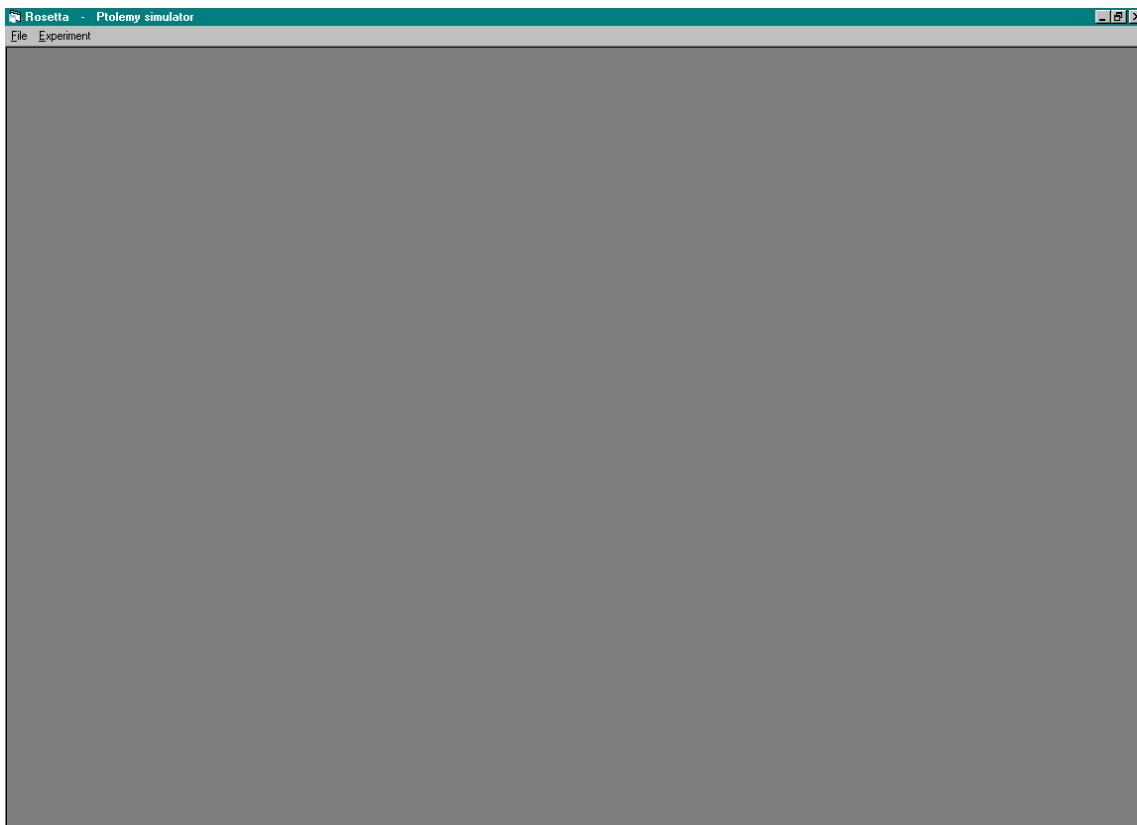
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### 2.4 Command File Generator/Editor



**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.

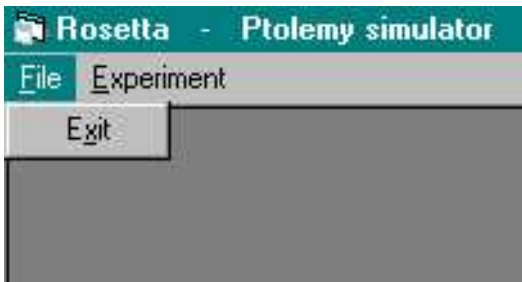


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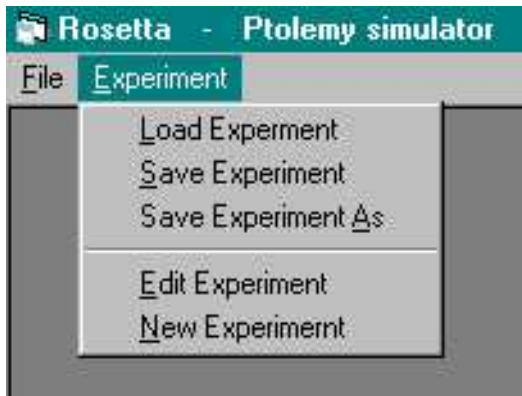
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**Figure 2-7 The File Drop-down Menu**

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**

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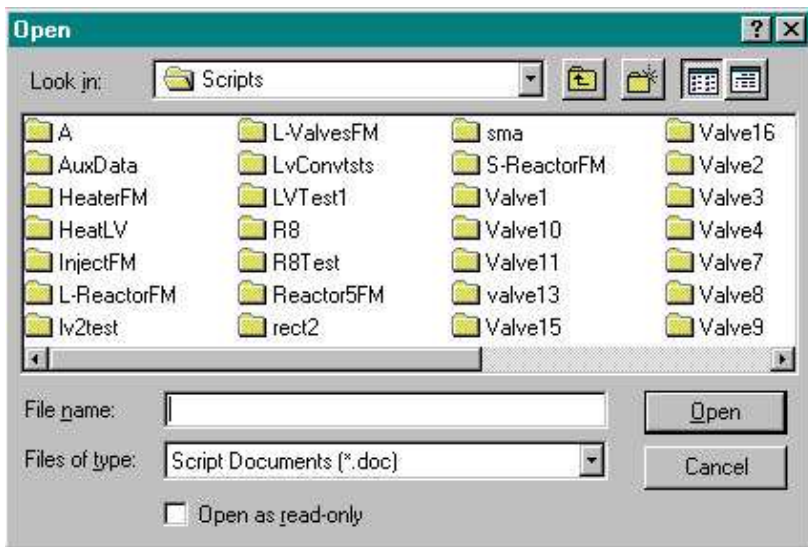
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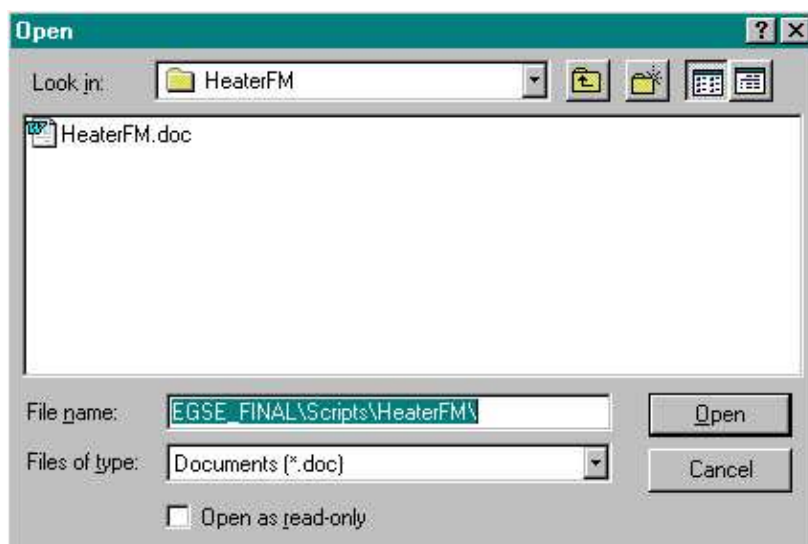
### ➤ Load Experiment

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).

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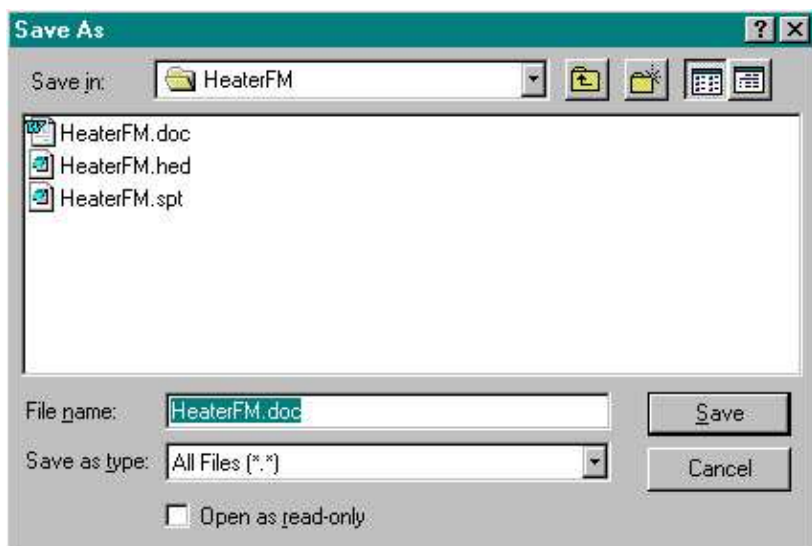
### ➤ Save Experiment

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**



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Once this has been completed the menu shown in Figure 2-14 will appear. This is essentially the same form used in 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.\*\*\*

Script Name - Test1

Component Type	Name	Action	Command	Wait
Valve	V1	Close		
Inject	V2	Open		
L-Valve	V3			
Reactor	V4			
Heater (pwm)	V7			
Heater (dac)	V8			
SMA Heater	V9			
Monitor P	V10			
Monitor T	V11			
Aux Data	V13			
Time Delay	V15			
Timer	V16			
Sample Coil				
Set MS				
MS Acquire				
Set Inject				
WGA Check				
RF Cal				

No. Commands: 81

List Name:

Type:

Number: 0

Action:

Param 1:

Param 2:

Param 3:

Add

Remove

Clear

Command No.

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

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

**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, LV3, 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

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<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 °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	

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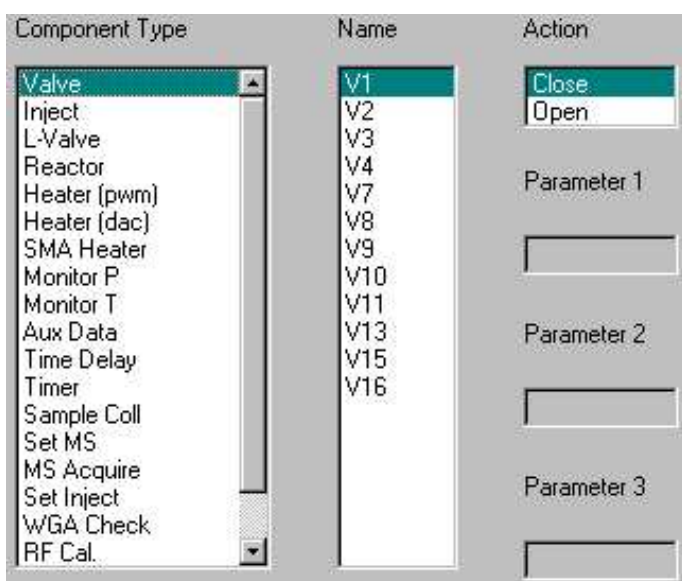
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### 2.4.1 Valve

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**



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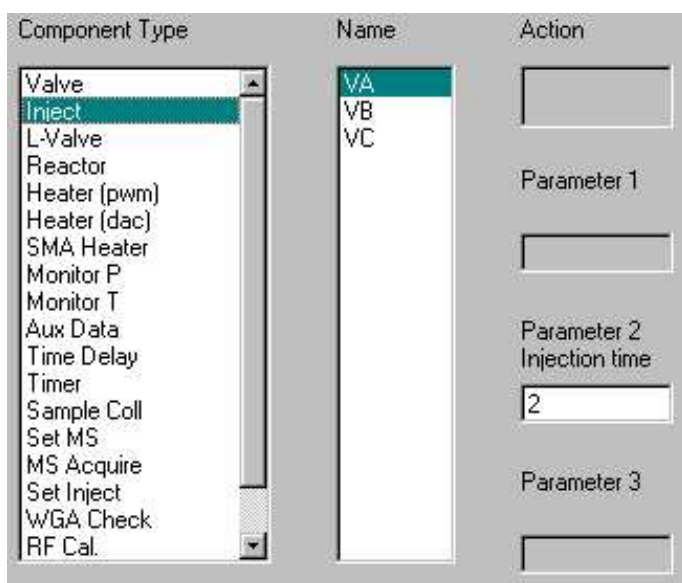
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### 2.4.2 Inject

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**

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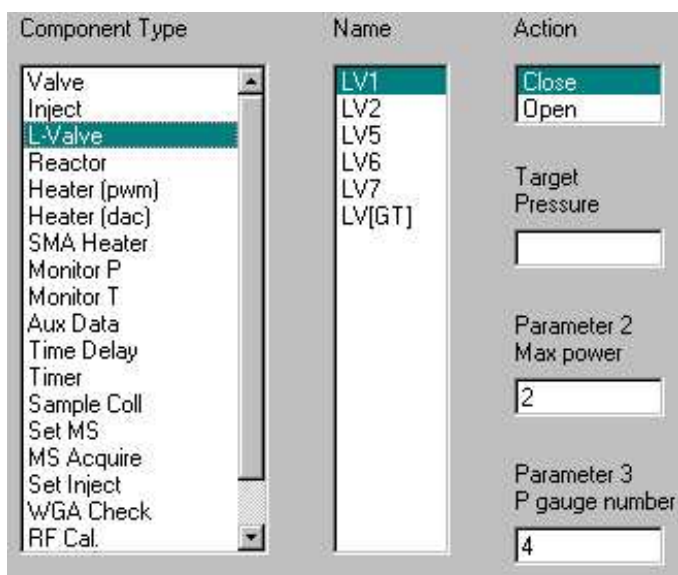
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### 2.4.3 L-Valve

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**

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### 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.

Component Type	Name	Action
Valve	R1	End
Inject	R2	Begin
L-Valve	R4	
Reactor	R5	
Heater (pwm)	R6	Target Temperature
Heater (dac)	R7	
SMA Heater	R8	
Monitor P	R9	
Monitor T	R13	
Aux Data	R15	Parameter 2 PWM start
Time Delay	OVEN	
Timer		
Sample Coll		0
Set MS		
MS Acquire		
Set Inject		
WGA Check		
RF Cal.		10

Figure 2-18 Option Menus for the Reactor Command

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### 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.

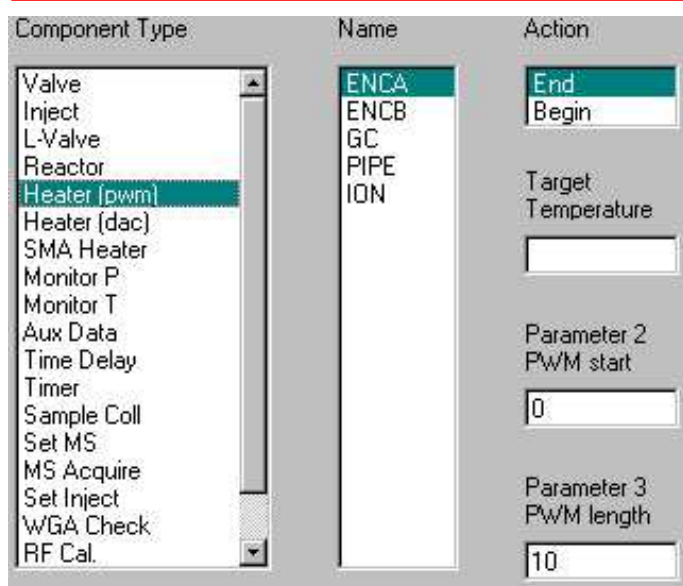


Figure 2-19 Option Menus for the Heater (pwm) Command

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### 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.

Component Type	Name	Action
Valve	LV1	End
Inject	LV2	Begin
L-Valve	LV5	
Reactor	LV6	
Heater (pwm)	LV7	Target Temperature
<b>Heater (dac)</b>	LV[GT]	
SMA Heater		
Monitor P		Parameter 2
Monitor T		Max power
Aux Data		2
Time Delay		
Timer		Parameter 3
Sample Coll		
Set MS		
MS Acquire		
Set Inject		
WGA Check		
RF Cal.		

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

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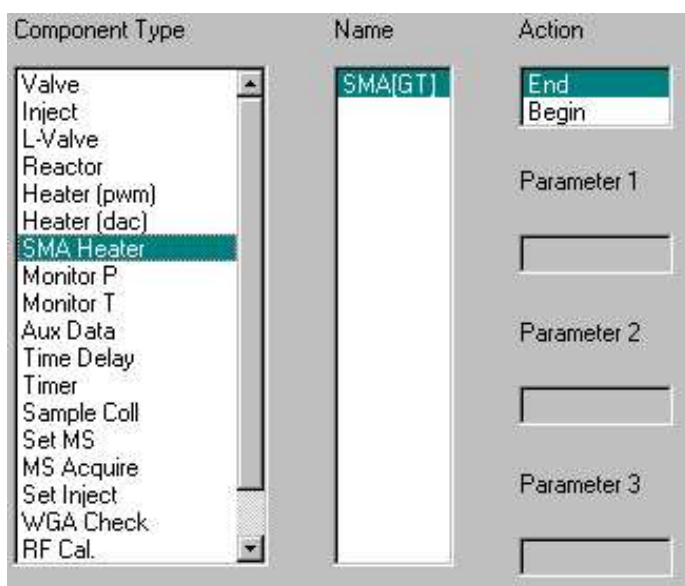
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### 2.4.7 SMA Heater

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  $>-50^{\circ}\text{C}$  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**

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### 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.

Component Type	Name	Action
Valve	pG1	
Inject	pG2	
L-Valve	pG3	
Reactor	pG4	
Heater (pwm)	pG5	
Heater (dac)		Target Pressure
SMA Heater		
Monitor P		
Monitor T		Parameter 2 Time
Aux Data		
Time Delay		
Timer		
Sample Coll		
Set MS		
MS Acquire		
Set Inject		
WGA Check		
RF Cal.		

Figure 2-22 Option Menus for the Monitor P Command

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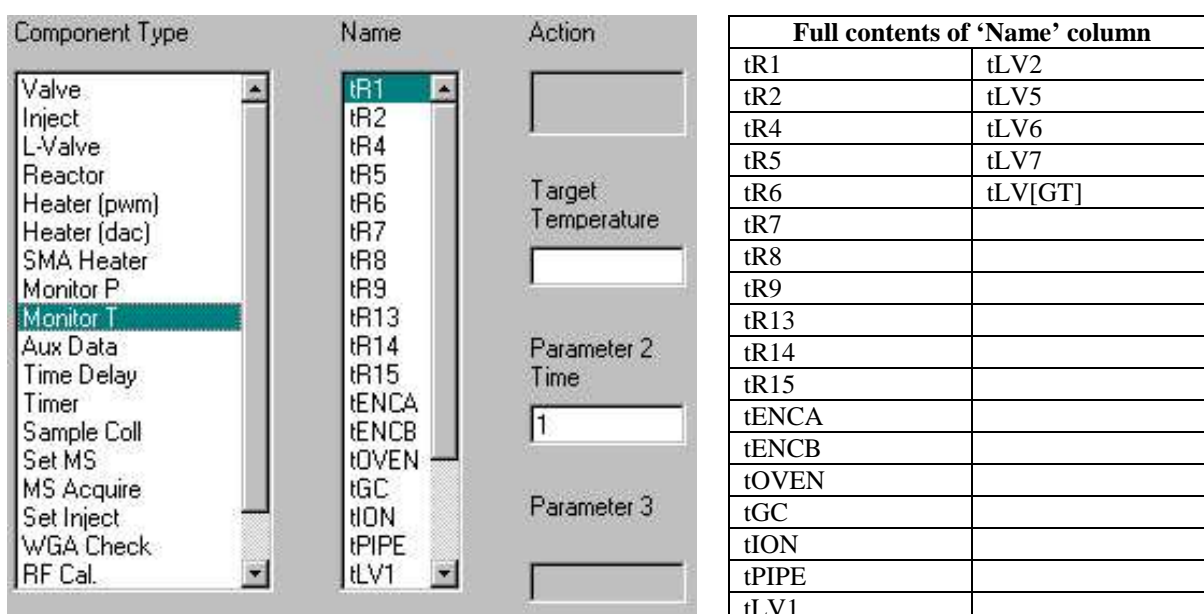
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### 2.4.9 Monitor T

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.



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



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### 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.

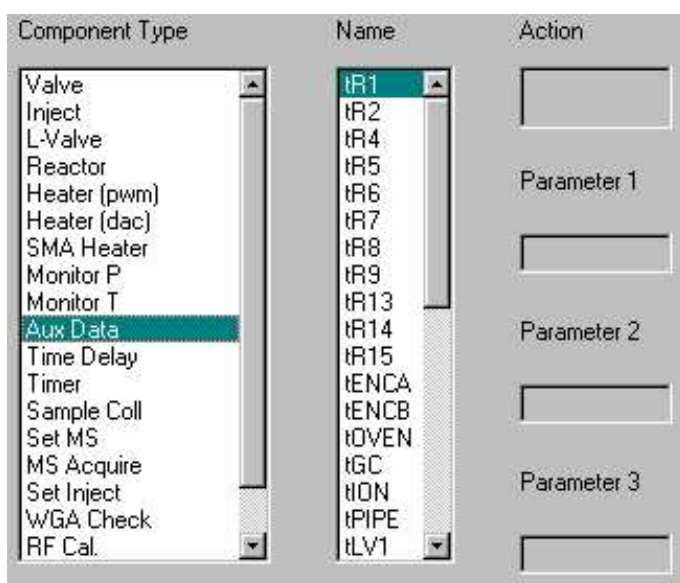


Figure 2-24 Option Menus for the Aux Command

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

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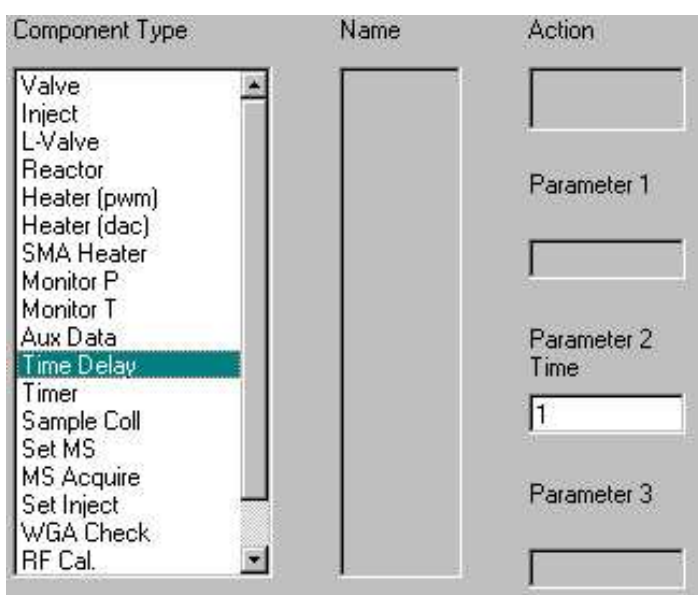
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### 2.4.11 Time Delay

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**

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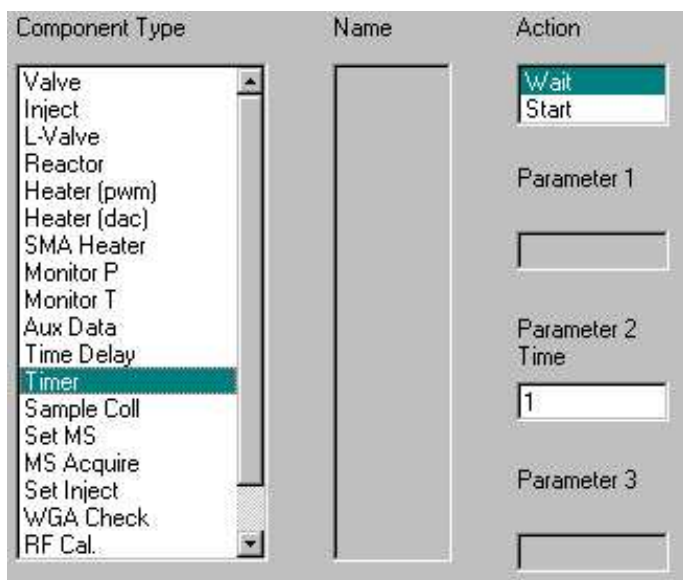
### 2.4.12 Timer

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**

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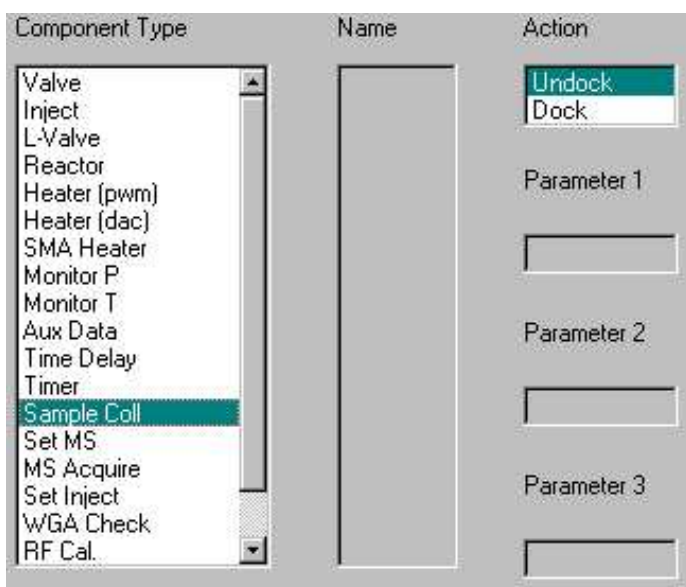
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### 2.4.13 Sample Coll

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\*\*\*

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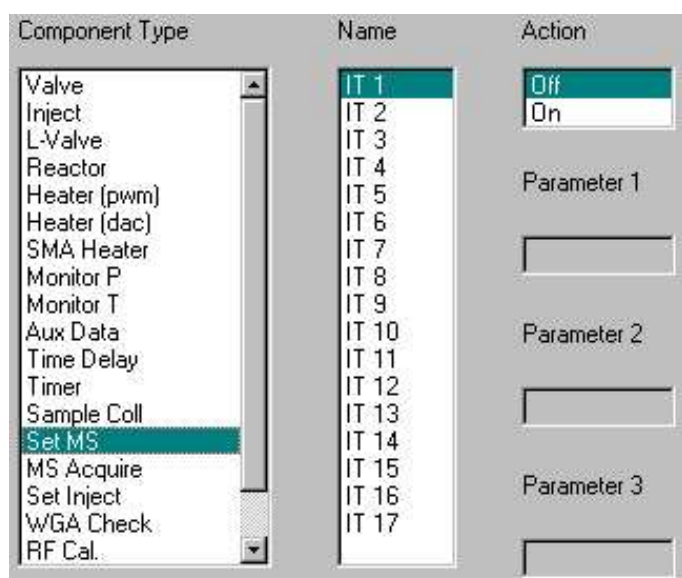
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### 2.4.14 Set MS

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**

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### 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<sup>th</sup>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  $\leq 1 \times 10^{-6}$  mbar
- The instrument has been in vacuum  $\leq 1 \times 10^{-6}$  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

Component Type	Name	Action
Valve	IT 1	
Inject	IT 2	
L-Valve	IT 3	
Reactor	IT 4	
Heater (pwm)	IT 5	WGA table number
Heater (dac)	IT 6	
SMA Heater	IT 7	
Monitor P	IT 8	
Monitor T	IT 9	
Aux Data	IT 10	Parameter 2
Time Delay	IT 11	Number of spectra
Timer	IT 12	10
Sample Coll	IT 13	
Set MS	IT 14	
MS Acquire	IT 15	Parameter 3
Set Inject	IT 16	Repeat period
WGA Check	IT 17	1.5
RF Cal.		

Figure 2-29 Option Menus for the Sample Coll Command

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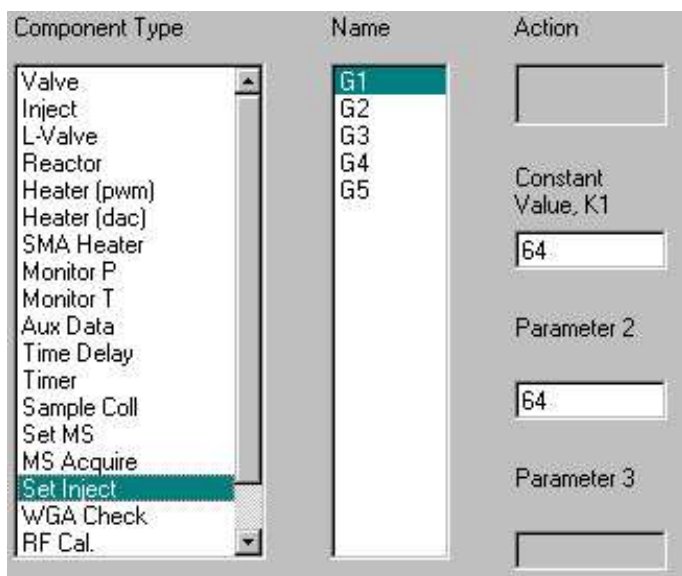
### 2.4.16 Set Inject

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 K1 in 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**

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### 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.

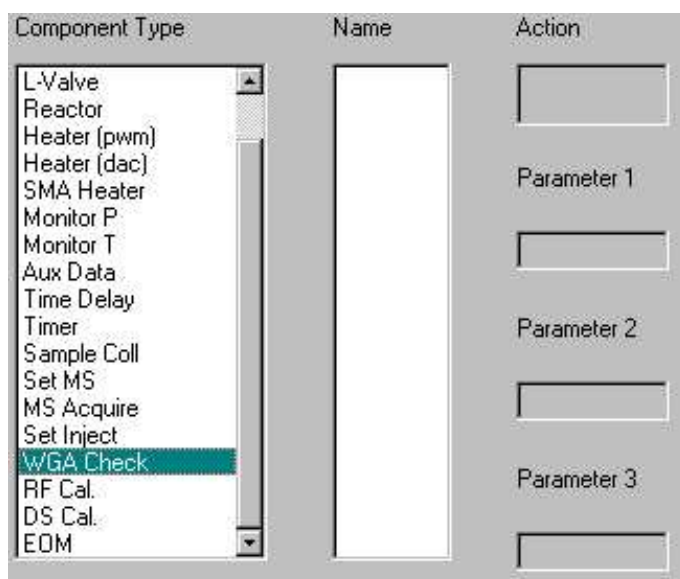


Figure 2-31 Option Menus for the WGA Check Command



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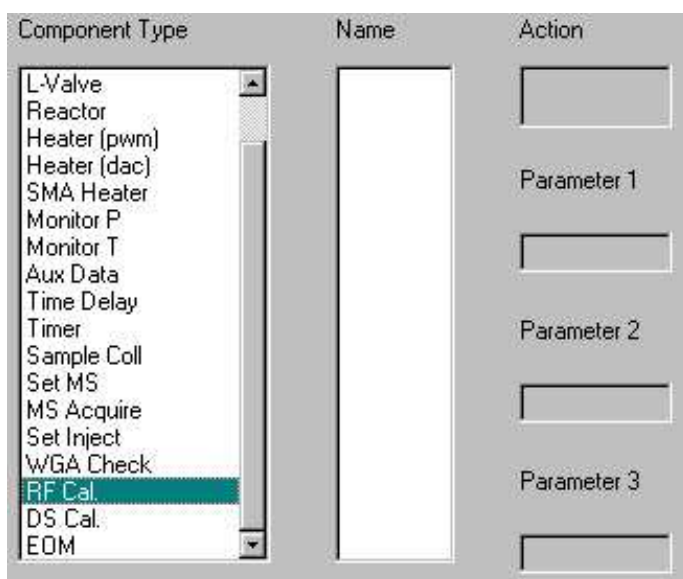
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### 2.4.18 RF Cal.

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**

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### 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\*\*\*

Component Type	Name	Action
L-Valve		
Reactor		
Heater (pwm)		
Heater (dac)		Parameter 1
SMA Heater		
Monitor P		
Monitor T		
Aux Data		
Time Delay		
Timer		Parameter 2
Sample Coll		
Set MS		
MS Acquire		
Set Inject		
WGA Check		
RF Cal.		Parameter 3
DS Cal.		
EOM		

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

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### 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.

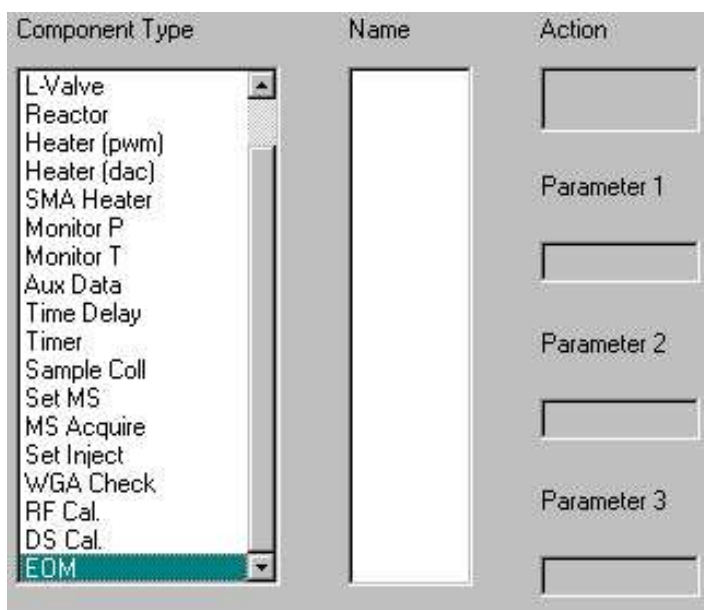


Figure 2-34 Option Menus for the EOM Command

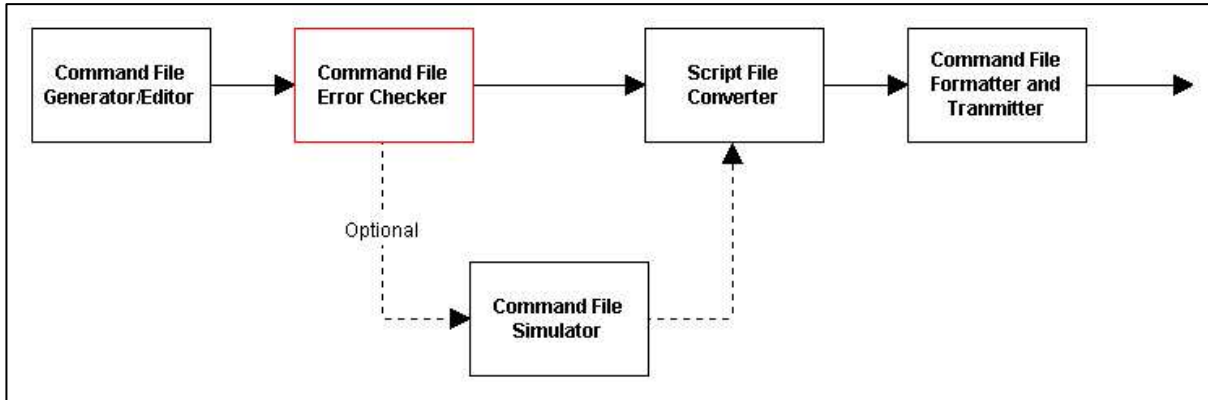
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### 2.5 Command File Error Checker



**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.

The screenshot shows the 'Command List Error Checker' window. It features a 'List of Commands' table with columns for No., Command, Designator, Action, Param 1, Param 2, and Param 3. Below the table are 'Load', 'Clear', and 'Exit' buttons. On the right, there is a 'List of Errors' area, followed by input fields for 'Number of Commands in Source File' and 'Number of Errors Generated in Checking'. Below these are sections for 'Error Log File Information' (with 'Save' and 'Print' buttons) and 'Source File Information' (with input fields for 'Name of source file' and 'Date and time of source file'). At the bottom right, there are input fields for 'Name of error log file Generated' and 'Date and time of error log file'.

**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'.

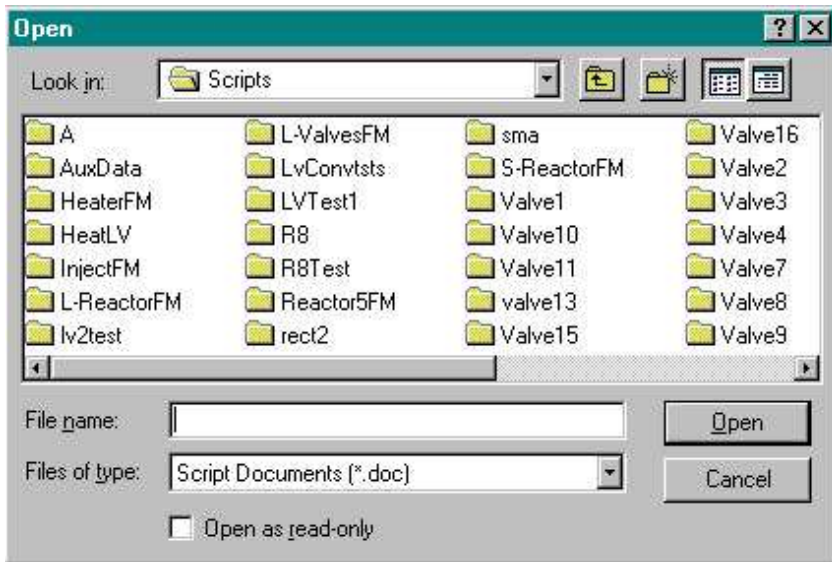
The default directory of this form is \Scripts\. To change the directory use the drop-down menu located near the text saying 'Look in:'

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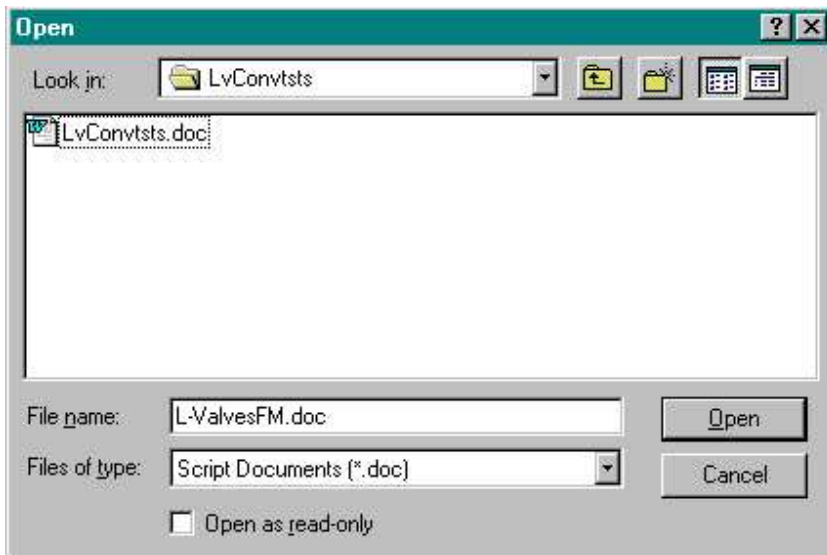
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**Figure 2-37 The Source Sub-directory Select Form**

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 LvConvts (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).

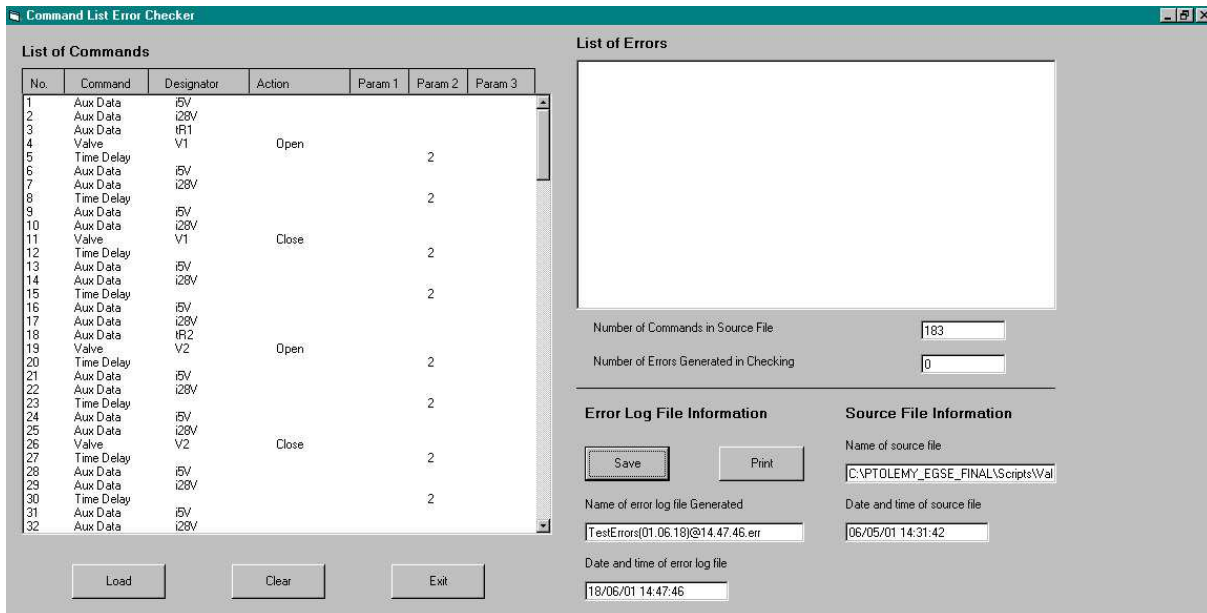
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Once a file is opened it is scanned for errors automatically. If no red text appears in the 'List of Errors' box and zero is displayed in the text box next to the label 'Number of Errors generated in Checking' then your source file is error free and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

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No.	Command	Designator	Action	Param 1	Param 2	Param 3
1	Aux Data	G1				
2	Aux Data	G2				
3	Heater (dac)	LV[GT]	Begin	85	255	
4	Monitor T	ILV[GT]		85	180	
5	SMA Heater	SMA[GT]	Begin			
6	Monitor P	G2		0.5	120	
7	Aux Data	G2				
8	SMA Heater	SMA[GT]	End			
9	Time Delay				60	
10	Aux Data	G2				
11	Heater (dac)	LV[GT]	Begin	60	255	
12	Monitor T	ILV[GT]		60	120	
13	Heater (dac)	LV[GT]	End			
14	L-Valve	LV[GT]	Open	1	255	1
15	Monitor P	G2		1	60	
16	Time Delay				10	
17	L-Valve	LV[GT]	Open	2	255	2
18	Monitor P	G2		2	60	
19	Time Delay				10	
20	L-Valve	LV[GT]	Open	3	255	2
21	Monitor P	G2		3	60	
22	Time Delay				10	
23	L-Valve	LV[GT]	Open	4	255	2
24	Monitor P	G2		4	60	
25	Time Delay				10	
26	L-Valve	LV[GT]	Open	5	255	2
27	Monitor P	G2		5	60	
28	Time Delay				10	
29	L-Valve	LV[GT]	Open	6	255	2
30	Monitor P	G2		6	60	
31	L-Valve	LV[GT]	Close			
32	L-Valve	LV[GT]	Open	1	255	1

**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\.

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```
"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**



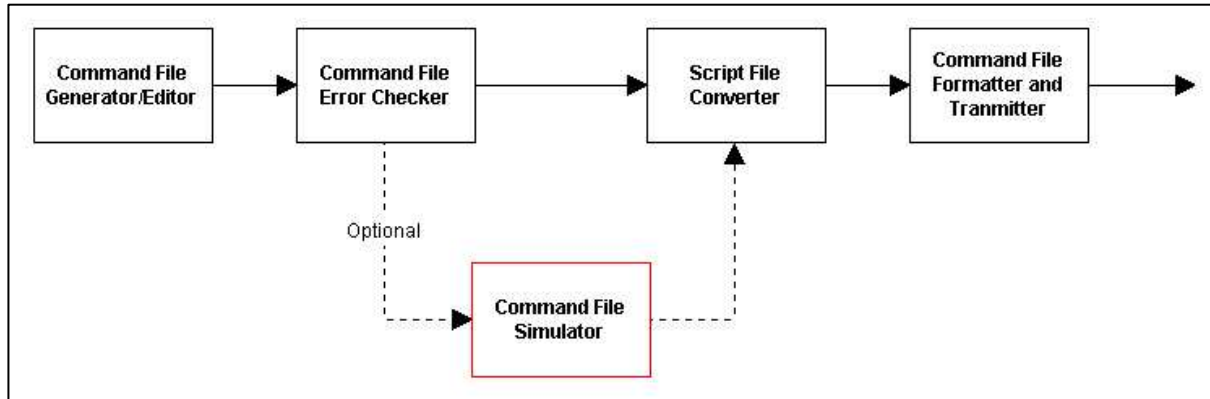
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### 2.6 Command File Simulator



**Figure 2-43 Module Flow Diagram – Command File Simulator**

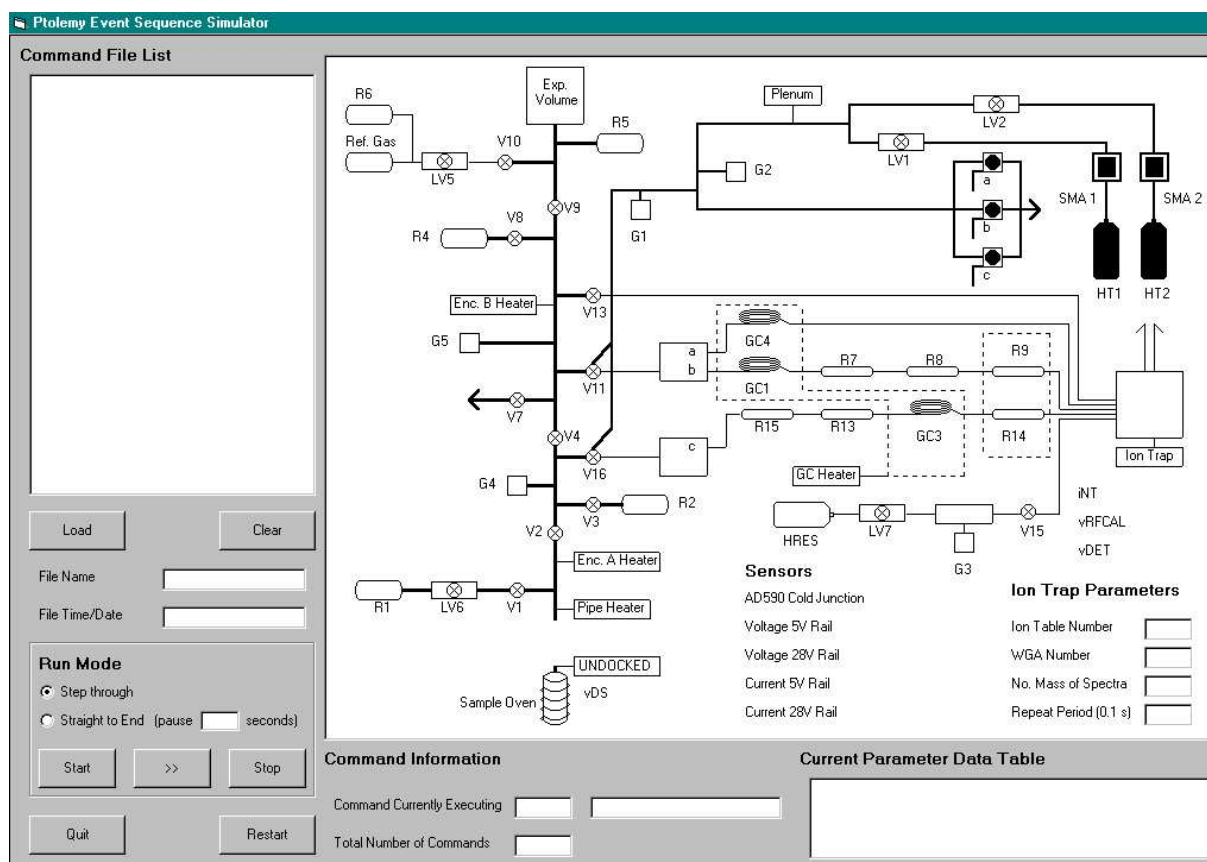
The third step of the process (see Figure 2-43) is to select 'Command File Simulator' from the 'Starter.exe' main menu (see Figure 2-4) the following screen will appear (see Figure 2-44). The 'Command File Simulator' is used to check the script do what is expected and to identify superfluous commands. 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.

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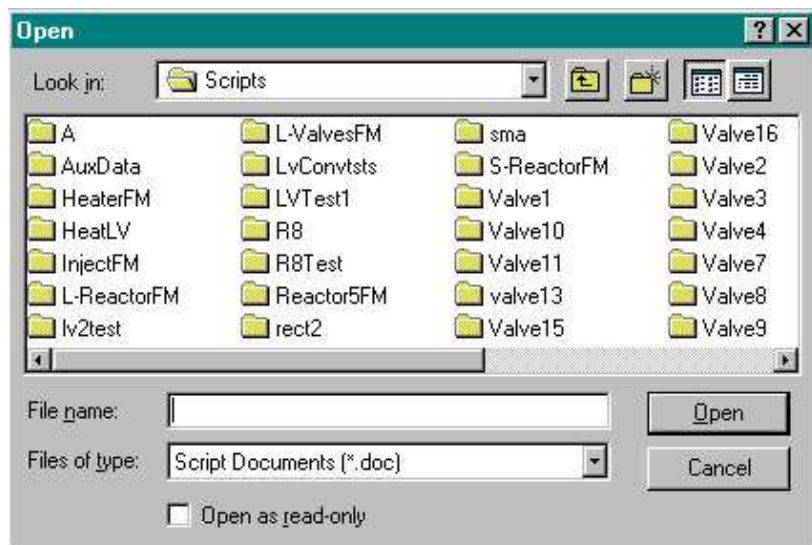
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**Figure 2-44 The Command File Simulator Form**

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



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

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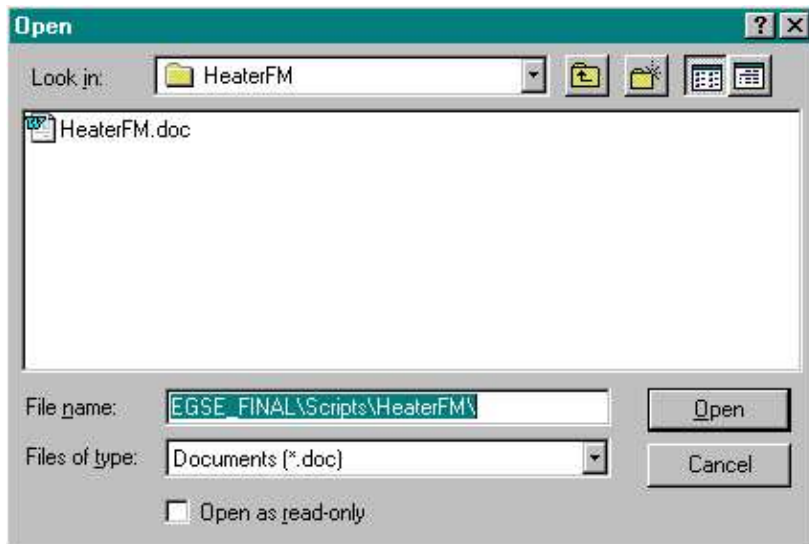
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Once the First common dialog box appears simply select the sub-directory corresponding to the file name you wish to check. Say, for example, you clicked the subdirectory HeaterFM (third item in the first column). A form similar to Figure 2-46 would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



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

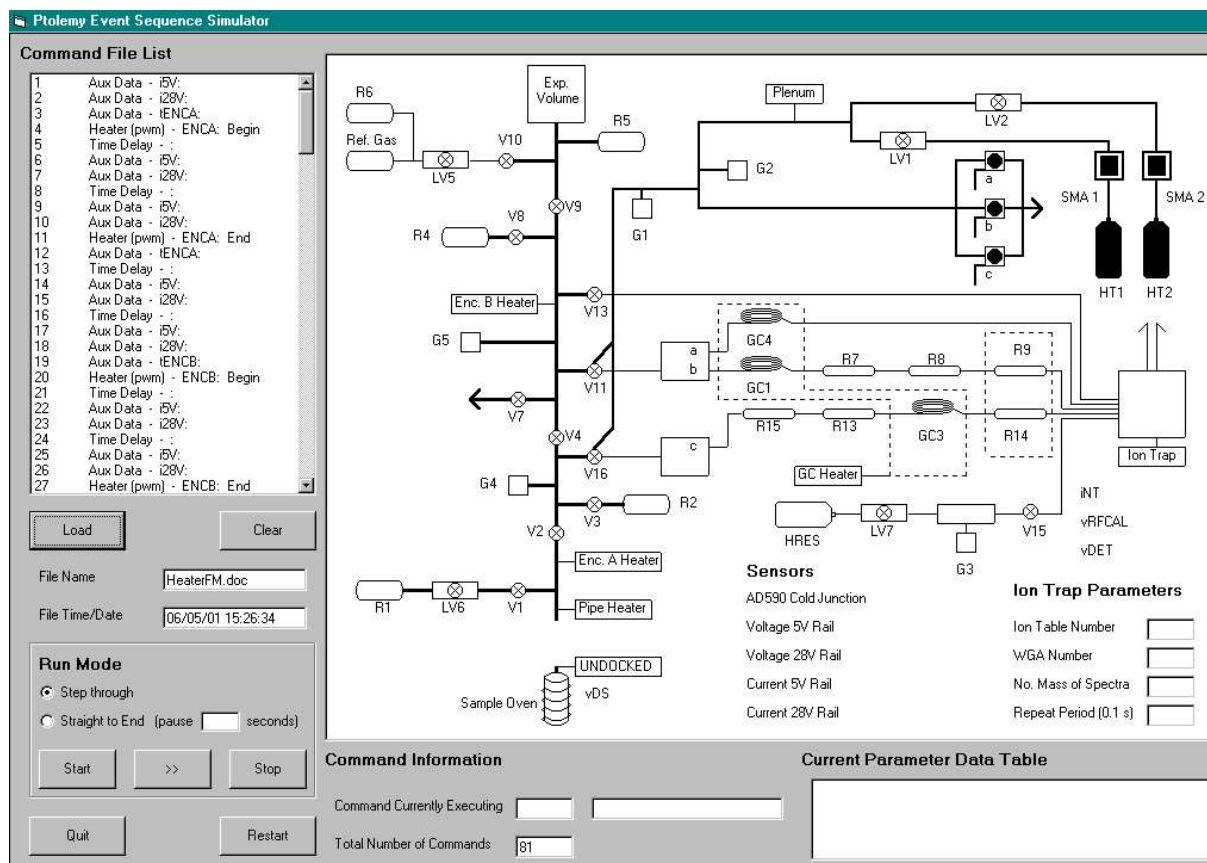
To open a file simply click on the file with \*.doc extension (there should only be one per sub-directory directory but more than one is possible if they were saved as different names)

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**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.

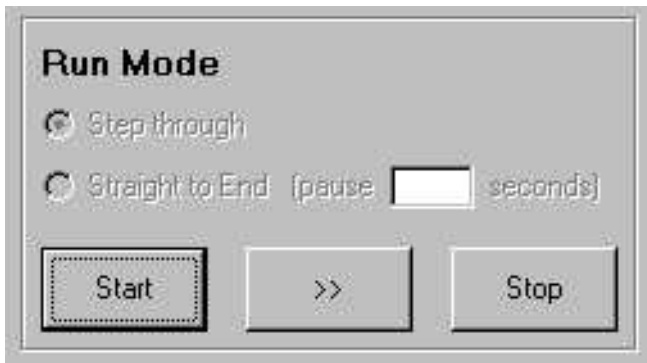
Step through mode is selected by selecting the appropriate option button and pressing 'Start' as shown in Figure 2-48. Once selected movement through the commands is accomplished by pressing '>>' once for each command you wish to execute from 1 up to the total as shown in the 'Total Number of Commands'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

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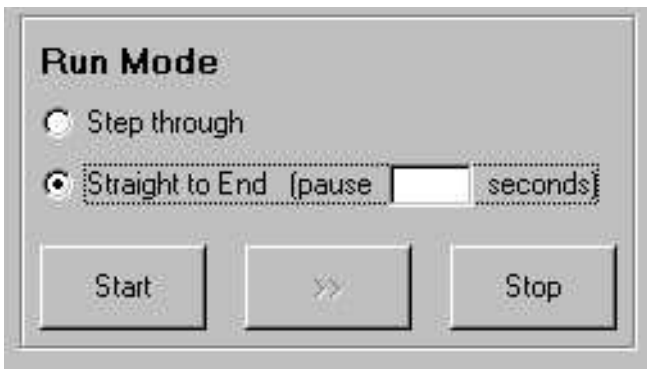
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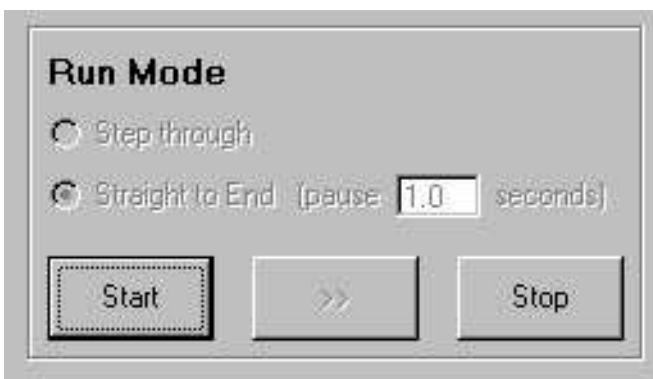
**Figure 2-48 Run Mode – Step Through Selected**

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).

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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.

Command Information		Current Parameter Data Table
Command Currently Executing	4	Heater (pwm) ENCA Begin
Total Number of Commands	81	4 ENCA Target Temp. 50 Pw/ Start 0 Pw Length 255

**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

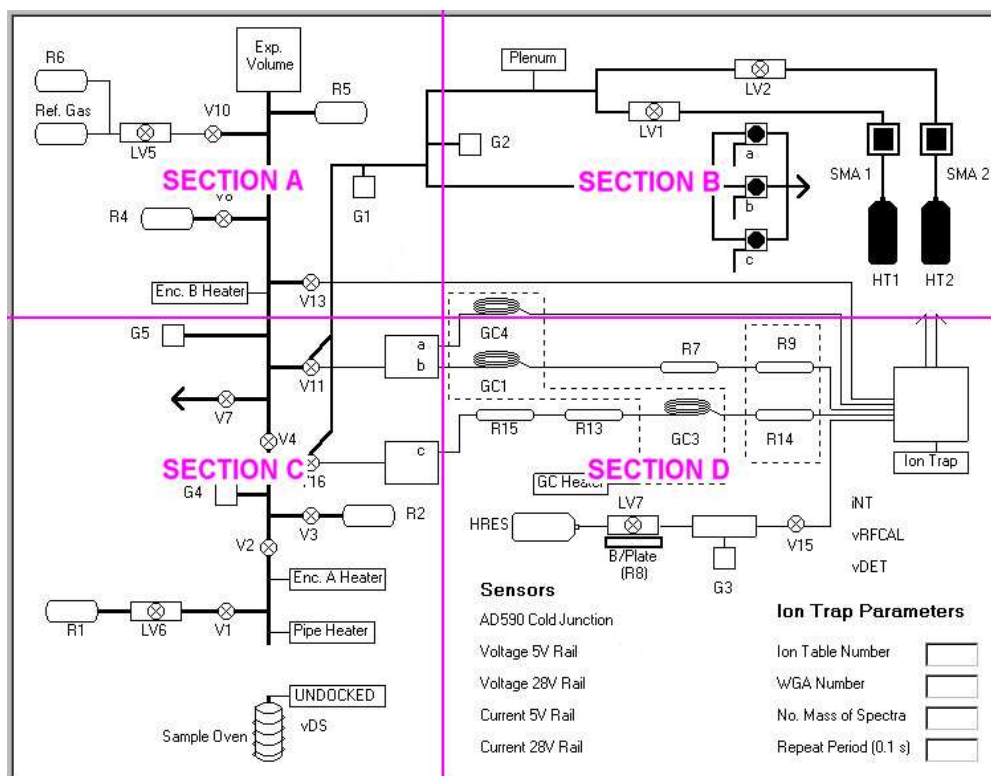
In the following examples the simulator window is divided into four sections A-D, which help relate the location of the graphical feedback the user will receive for each command (see Figure 2-52). Purple arrows will also assist these close-up views.

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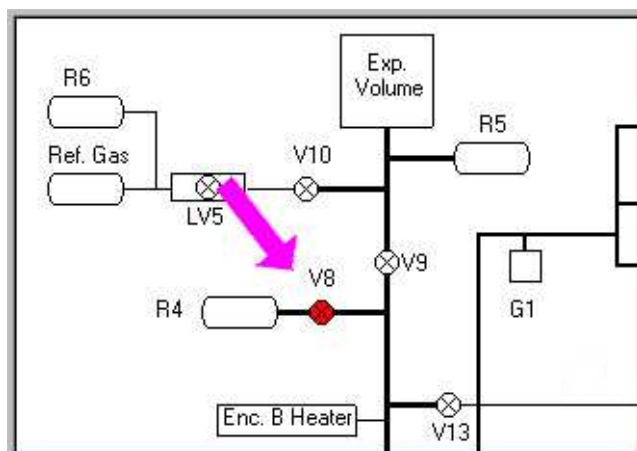
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**Figure 2-52 Close-up of the Simulator Window**

### 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**

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### 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).\*\*\*

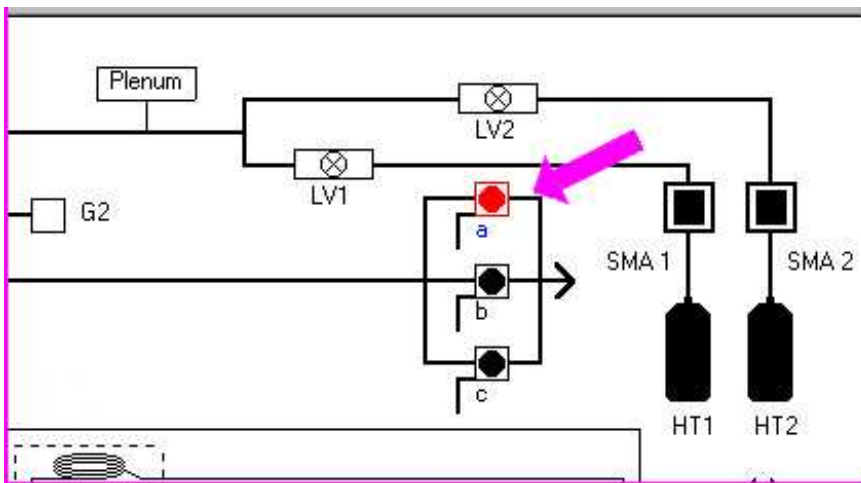


Figure 2-54 Section B View of the Inject Command

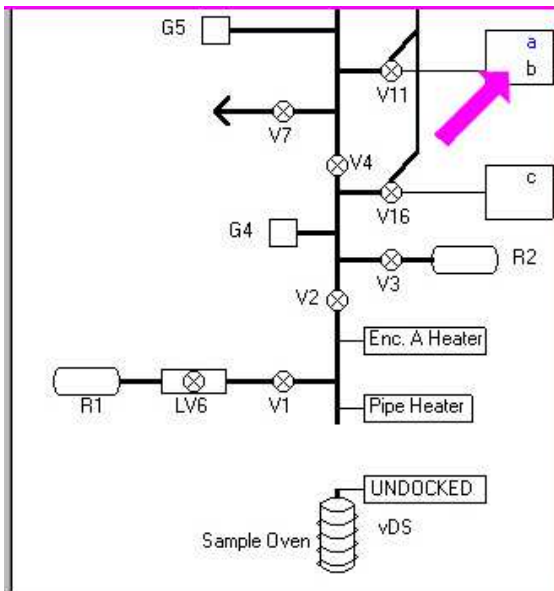


Figure 2-55 Section C View of the Inject Command



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### 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.

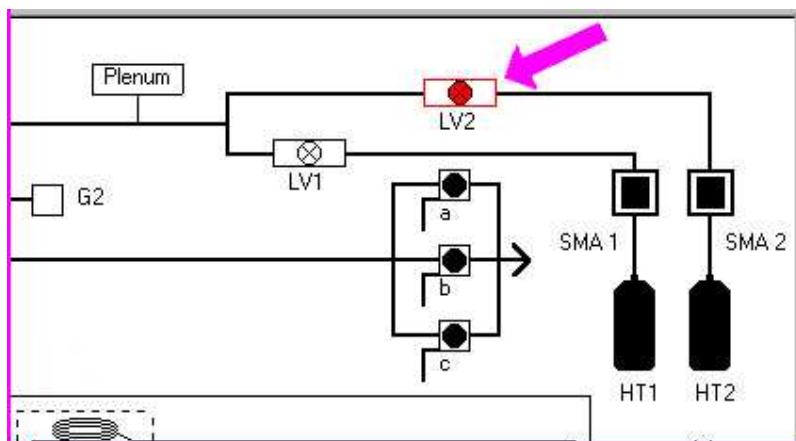


Figure 2-56 Section B View of the L-Valve Command

### 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).

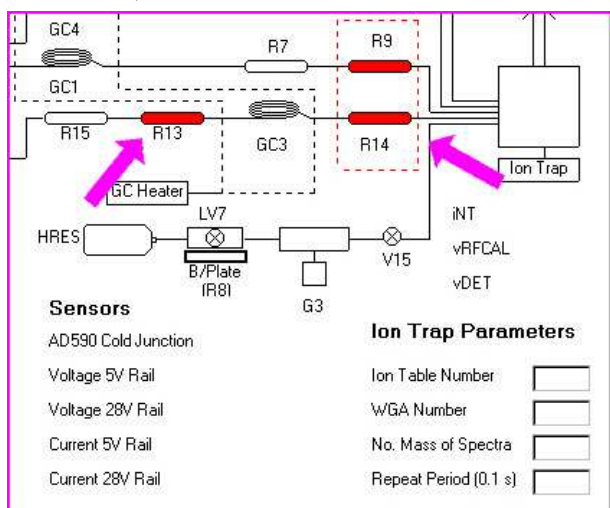


Figure 2-57 Section D View of the Reactor Command

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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).

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### 2.6.6 Heater (dac)

This command controls the Digital to Analogue Converter-controlled heaters of which there are 5 (LV1, LV2, LV5, LV6, LV7). The options for these are 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 assume LV2 is used.

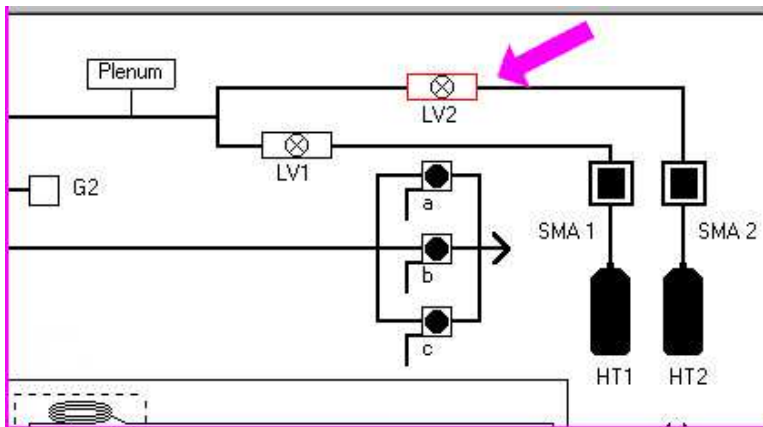


Figure 2-60 Section B View of the Heater (dac) Command

### 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 it is no longer sealed (as shown in Figure 2-61). This example assumes the heater SMA2 is used opening HT 2.

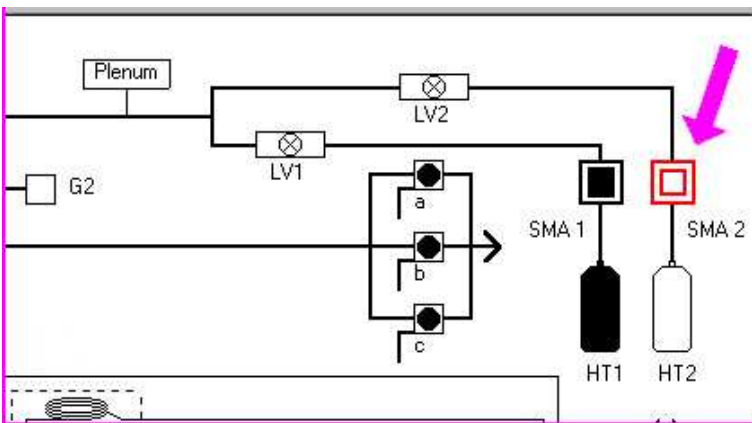


Figure 2-61 Section B View of the SMA Heater Command

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### 2.6.8 Monitor T

This command monitors temperature from the temperature sensors of which there are 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 to the icon representing the temperature sensor will turn blue (as shown in Figure 2-62). This example assumes the temperature of R4 is required.

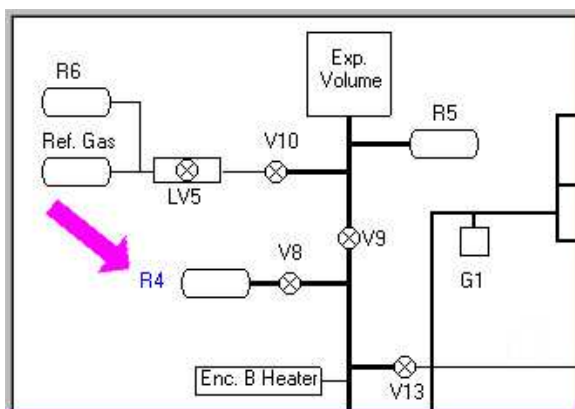


Figure 2-62 Section A View of the Monitor T Command

### 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 to the icon representing the pressure sensor will turn blue (as shown in Figure 2-63). This example assumes the temperature of R4 is required.

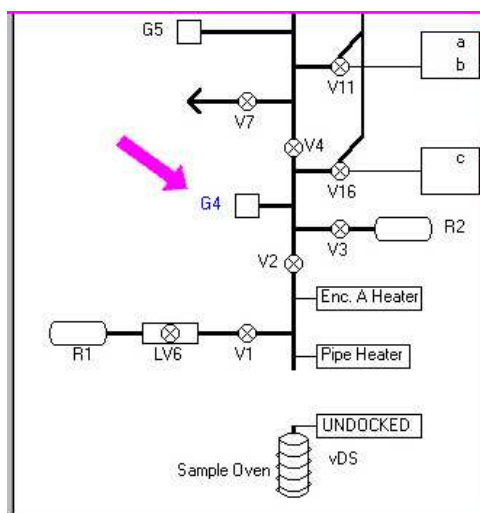


Figure 2-63 Section C View of the Monitor P Command

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### 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.

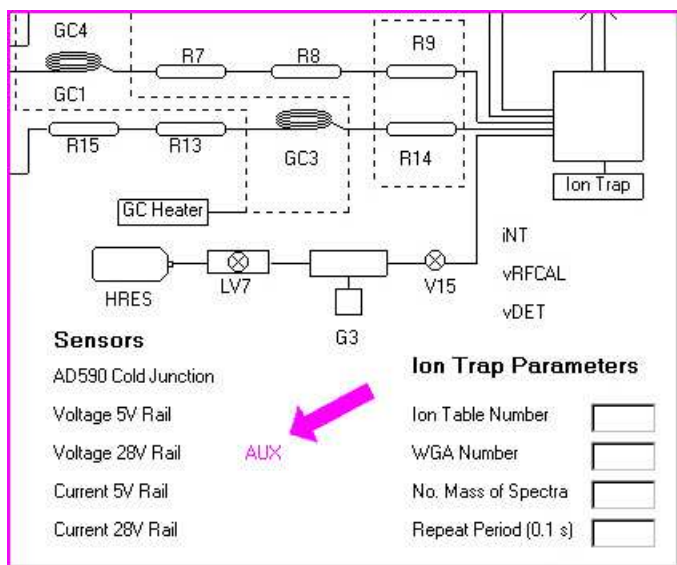


Figure 2-64 Section D View of AUX Command

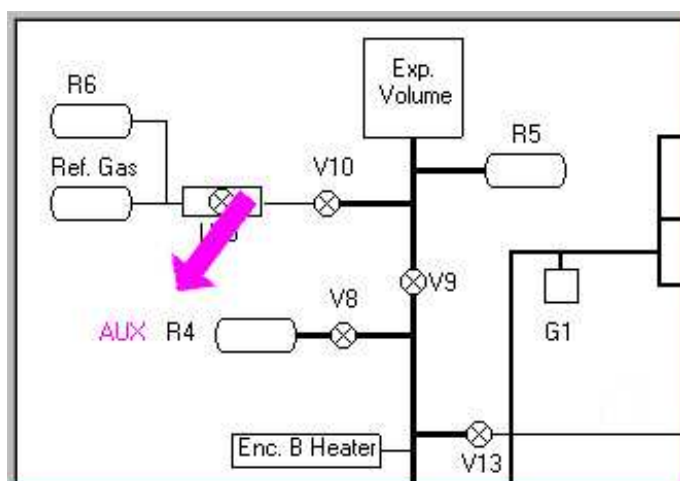


Figure 2-65 Section A View of AUX Command

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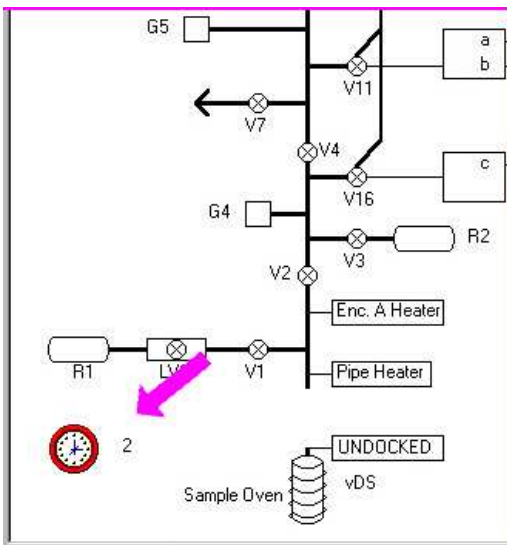
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### 2.6.11 Time Delay

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.\*\*\*

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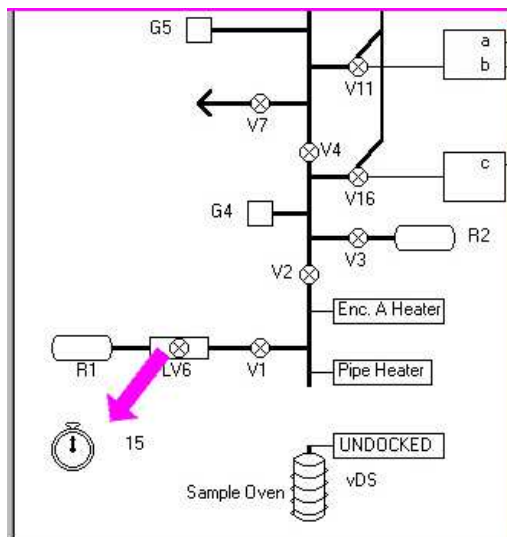
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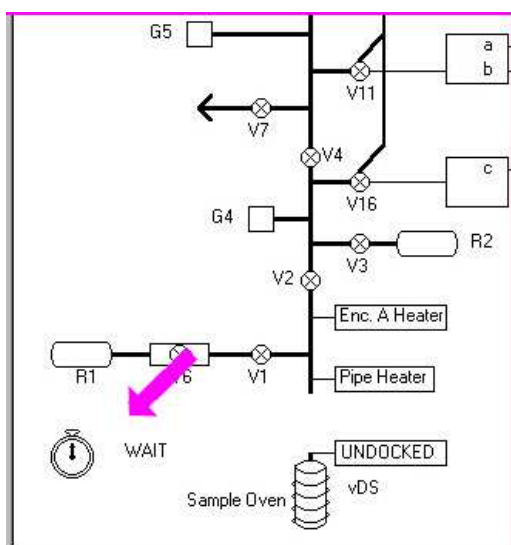
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**Figure 2-67 Section C View of the Timer – Start Command**



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

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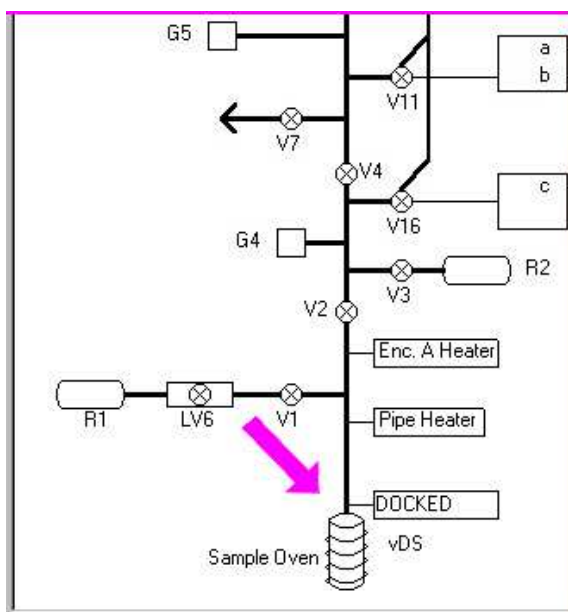
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### 2.6.13 Sample Coll

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.

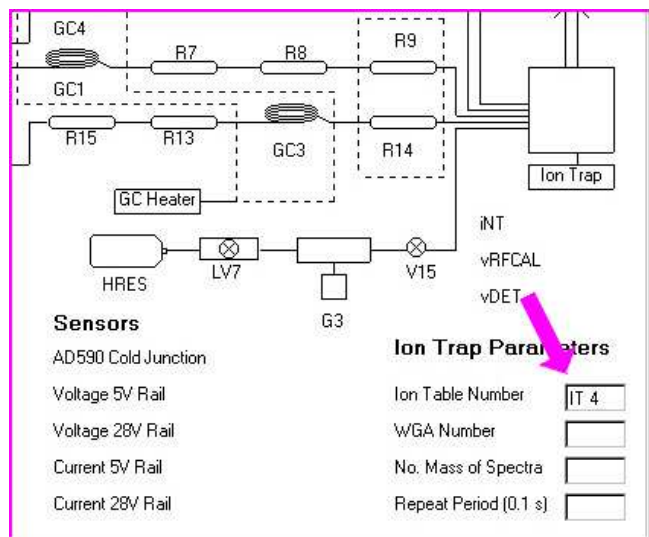


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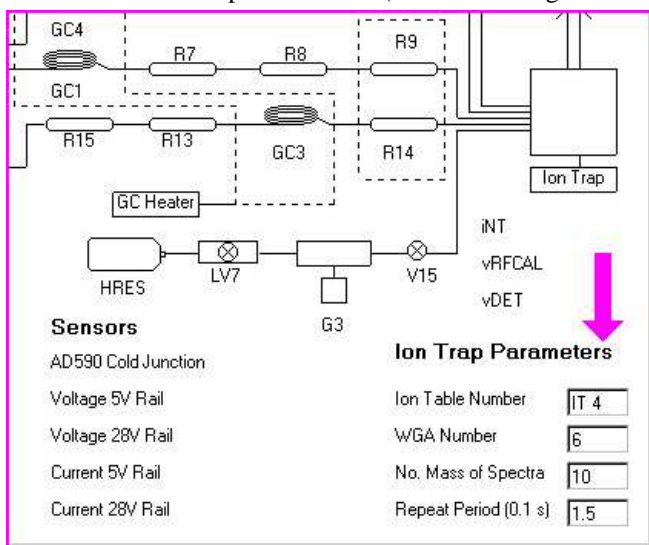
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**Figure 2-70 Section D View of the Set MS Command**

### 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

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

Command Information		Current Parameter Data Table
Command Currently Executing	10	10 G1 Constant K1 64 Constant K2 32
Total Number of Commands	10	

**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**

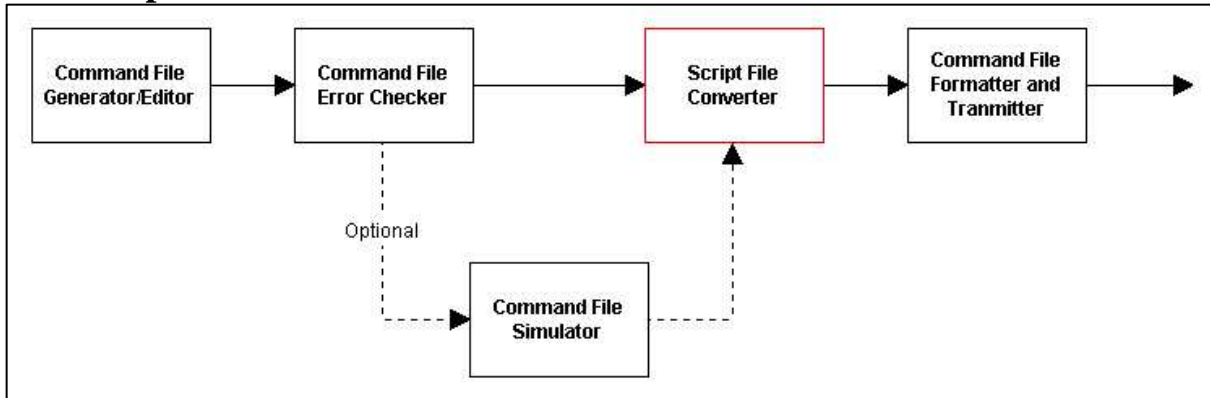
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### 2.7 Script File Converter



**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.

The screenshot shows the 'Event Mode Command Script Converter' window. It features a 'Command File List' table with columns for Command, Designator, Action, P1, P2, and P3. Below this table are 'Load' and 'Quit' buttons. To the right is a 'Code File List' area. In the center, there are buttons for 'Convert Mode', 'Start', 'Clear All', and 'View Constants'. A text box provides instructions: 'Please load a file using the 'Load' button. Upon completion please select the 'Start' button to begin the conversion process.' At the bottom, there are sections for 'Command Information' (Number of Commands), 'File Information' (Command File Name), 'Conversion Information' (Number of Commands, Number of Words), and 'File Information' (Converted File Name). 'Save', 'Clear', and 'Print' buttons are also present.

**Figure 2-75 The File Converter Form**

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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.

	Value at Atmosphere	Value at Vacuum
Pressure Sensor 1	13.25	0
Pressure Sensor 2	7.8	0.75
Pressure Sensor 3	12.3	-1.6
Pressure Sensor 4	18.7	0
Pressure Sensor 5	37.5	0

Cancel

**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 box will appear similar to the one shown in Figure 2-77.

Look in: Scripts

File name:

Files of type: Script Documents (\*.doc)

☐ Open as read-only

Open Cancel

**Figure 2-77 The Source Sub-directory Select Form**

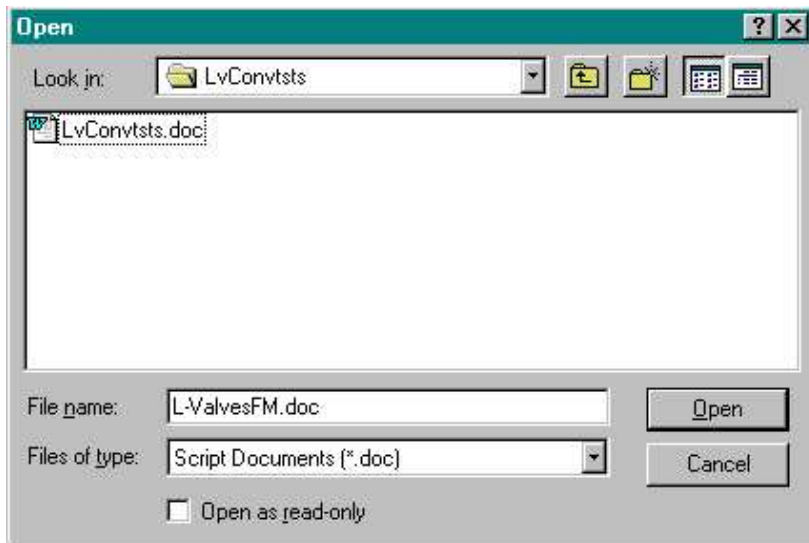
Once the First common dialog box appears simply select the sub-directory corresponding to the file name you wish to convert. Say, for example, you double-clicked the subdirectory HeaterFM (third item in the first column). A form similar to Figure 2-78 would then appear.

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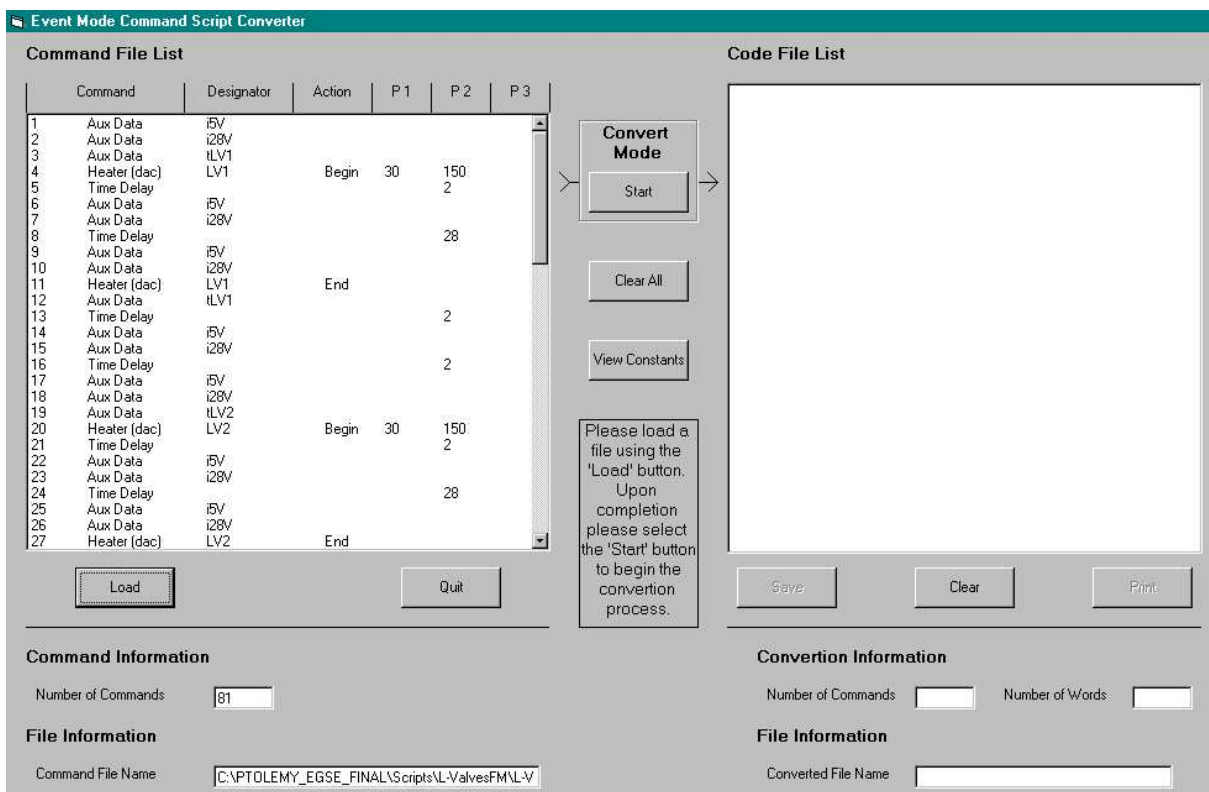
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**Figure 2-78 The Source File Select Form**

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**

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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

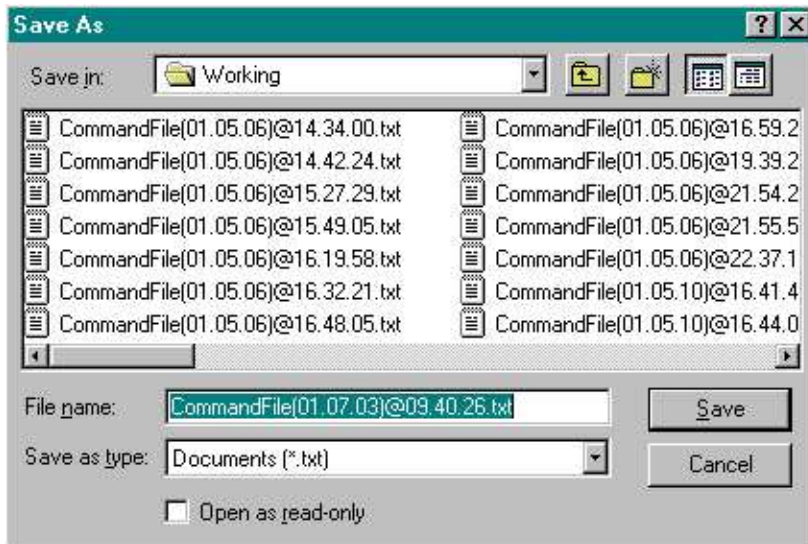


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**Figure 2-81 The Converted Code File Saving Form**

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\LvConvts\LvConvts.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 this 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 remove 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.

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The screenshot shows the 'Event Mode Command Script Converter' window. It has two main panes: 'Command File List' on the left and 'Code File List' on the right. The 'Command File List' contains a table with 3 rows of command data. The 'Code File List' shows a list of 3 hexadecimal values. A pink arrow points to the 'Save' button in the 'Code File List' pane. Another pink arrow points to the 'Number of Words' field in the 'Conversion Information' section, which displays '4.5'. The 'Command Information' section shows 'Number of Commands' as 3. The 'File Information' section shows the 'Command File Name' as 'C:\PTOLEMY\_EGSE\_FINAL\Scripts\AVA.doc'.

Command	Designator	Action	P 1	P 2	P 3
1	Set MS	IT 4	On		
2	Timer	Wait	6	10	1.5
3	MS Acquire	IT 4			

Code File List
1 4504
2 50
3 120604000A0F

**Command Information**  
Number of Commands: 3

**File Information**  
Command File Name: C:\PTOLEMY\_EGSE\_FINAL\Scripts\AVA.doc

**Conversion Information**  
Number of Commands: 3  
Number of Words: 4.5

**File Information**  
Converted File Name:

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

The screenshot shows the 'Event Mode Command Script Converter' window. It has two main panes: 'Command File List' on the left and 'Code File List' on the right. The 'Command File List' contains a table with 5 rows of command data. The 'Code File List' shows a list of 6 hexadecimal values. A pink arrow points to the 'Save' button in the 'Code File List' pane. Another pink arrow points to the 'Number of Words' field in the 'Conversion Information' section, which displays '5'. The 'Command Information' section shows 'Number of Commands' as 5. The 'File Information' section shows the 'Command File Name' as 'C:\PTOLEMY\_EGSE\_FINAL\Scripts\sma\sma.doc'.

Command	Designator	Action	P 1	P 2	P 3
1	Time Delay			10	
2	SMA Heater	SMA 1	Begin		
3	Time Delay			30	
4	SMA Heater	SMA 2	Begin		
5	EDM				

Code File List
1 30000A
2 19
3 30001E
4 19
5 FF
6 FF

**Command Information**  
Number of Commands: 5

**File Information**  
Command File Name: C:\PTOLEMY\_EGSE\_FINAL\Scripts\sma\sma.doc

**Conversion Information**  
Number of Commands: 6  
Number of Words: 5

**File Information**  
Converted File Name:

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

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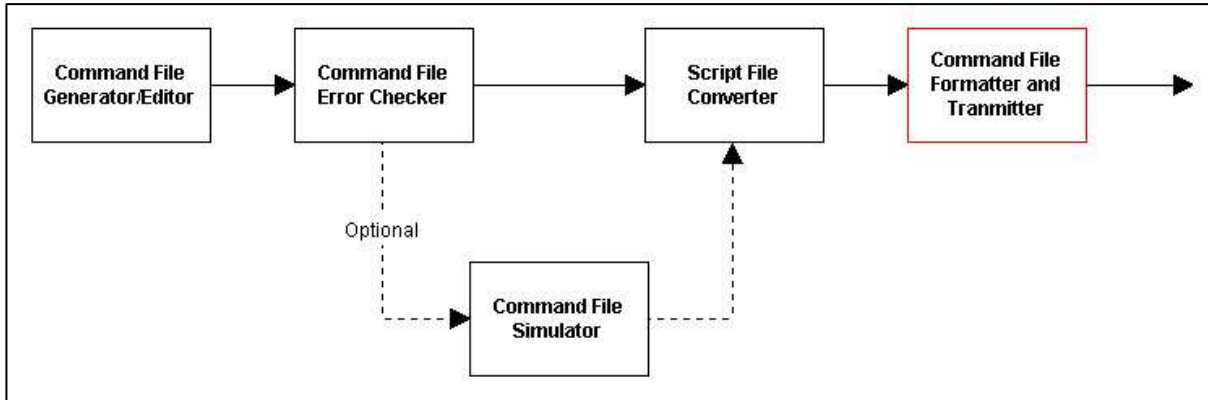
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### 2.8 Command Formatter and Transmitter



**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.

The screenshot shows the 'Command Transmitter' application window. It is divided into two main sections: 'Command Select' on the left and 'Command Format' on the right. The 'Command Select' section includes a 'Current Sequence Total' field with the value 'C000', a dropdown menu, and 'Select' and 'Cancel' buttons. A note states: 'Please select command required from drop-down window then press select. Cancel will return you to the main options menu.' The 'Command Format' section features a 'Packet View Window' with a list of 25 items, each with a checkbox and a label: Packet ID, Sequence Control, Length, Administration, SubType/Pad, and 19 'Blank' entries. Below this window are fields for 'Command Name' and 'Number of words'. At the bottom of the window are four buttons: 'TRANSMIT', 'TRANSMIT & Print', 'View History', and 'Reset Seq. Count'.

**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.

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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	-	-	-	

<sup>NB</sup> 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.\*\*\*

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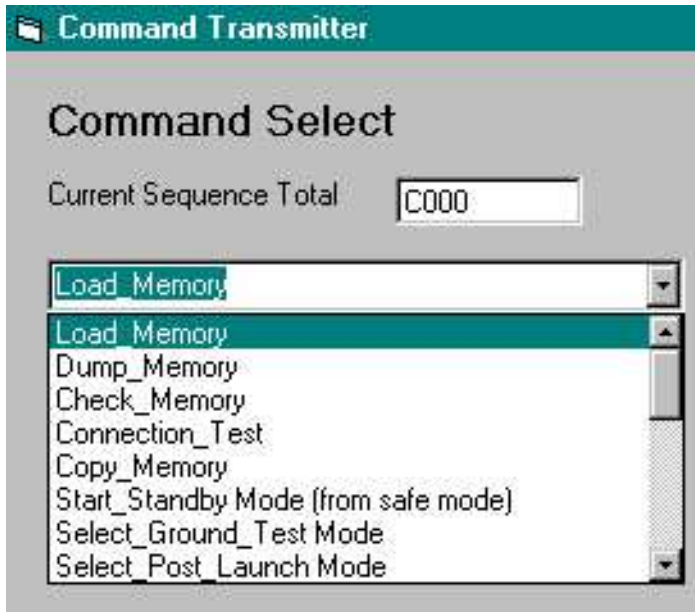
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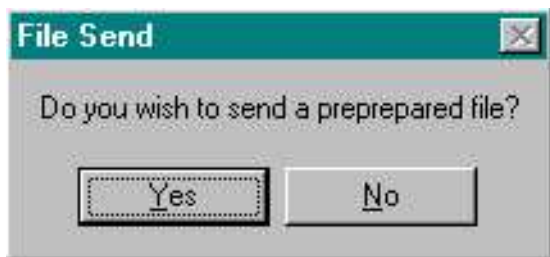
### 2.8.1 Load Memory

Load Memory is the first item in the 'Command Select Window' as shown in Figure 2-87. Once selected from 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)

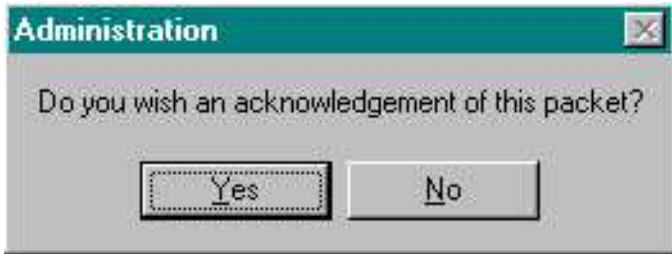
Having selected NO the format is similar to that of other functions. The administration message box will appear (as shown in Figure 2-89) asking if you wish to have an acknowledgement of this packet. If you select yes a TC Acceptance packet will be generated and sent upon receipt of this packet. If you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

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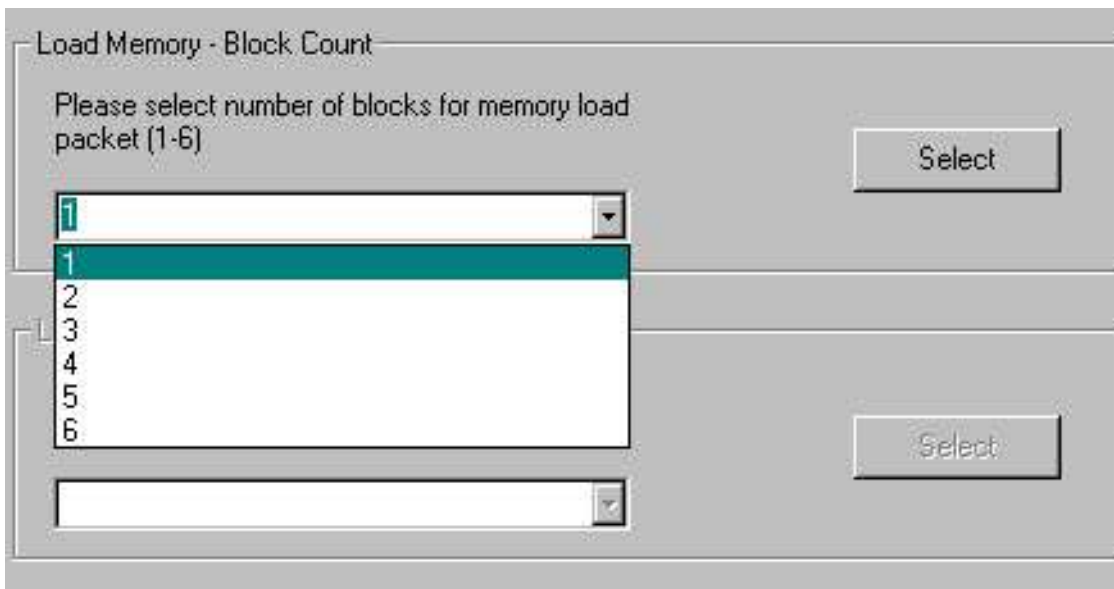


**Figure 2-89 The Administration Message Box**

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.

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The image shows two stacked dialog boxes from the EGSE software. The top dialog, titled 'Load Memory - Block Count', contains the text 'Please select number of blocks for memory load packet (1-6)' and a text input field with the value '1'. To the right is a 'Select' button. The bottom dialog, titled 'Load Memory - Memory ID', contains the text 'Please enter memory ID for patch' and a drop-down menu. The menu is open, showing a list with '97 - EEPROM' selected, followed by '97 - EEPROM' and '98 - RAM'. To the right of the menu is another 'Select' button.

**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**

The image shows a dialog box titled 'Load Memory - Memory Page'. It contains the text 'Please select the physical page number for patch 1' and a text input field with the value '0004'. To the right is a 'Select' button. Below the input field is a drop-down menu that is open, showing a list with '0004' selected, followed by '0005', '0006', and '0007'.

**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.

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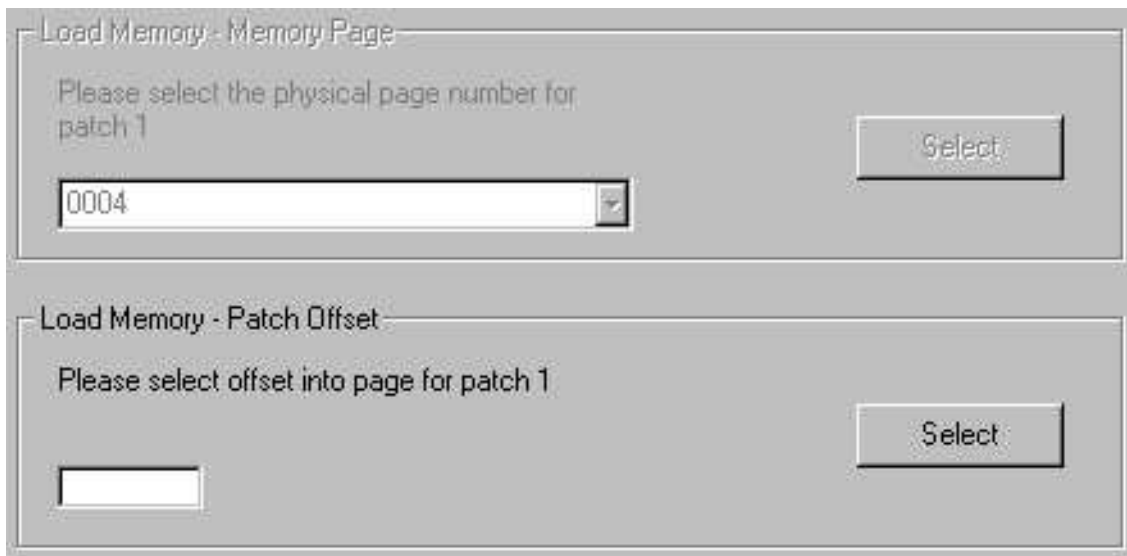
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The drop down menu will automatically calculate the number of words available to write in order to fit into one packet (reserving one word for the remaining number of blocks, if a number of large patches is required then it is advisable to use several 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.

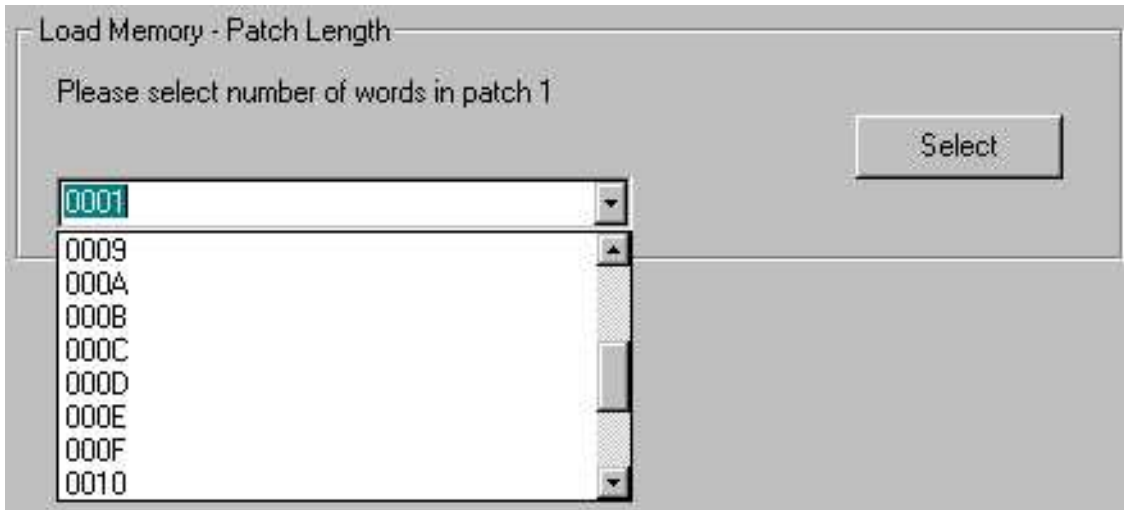
The third word only lets you select 1 word as this is the number remaining to complete a packet and was automatically reserved by the program when you selected 3 blocks at the start

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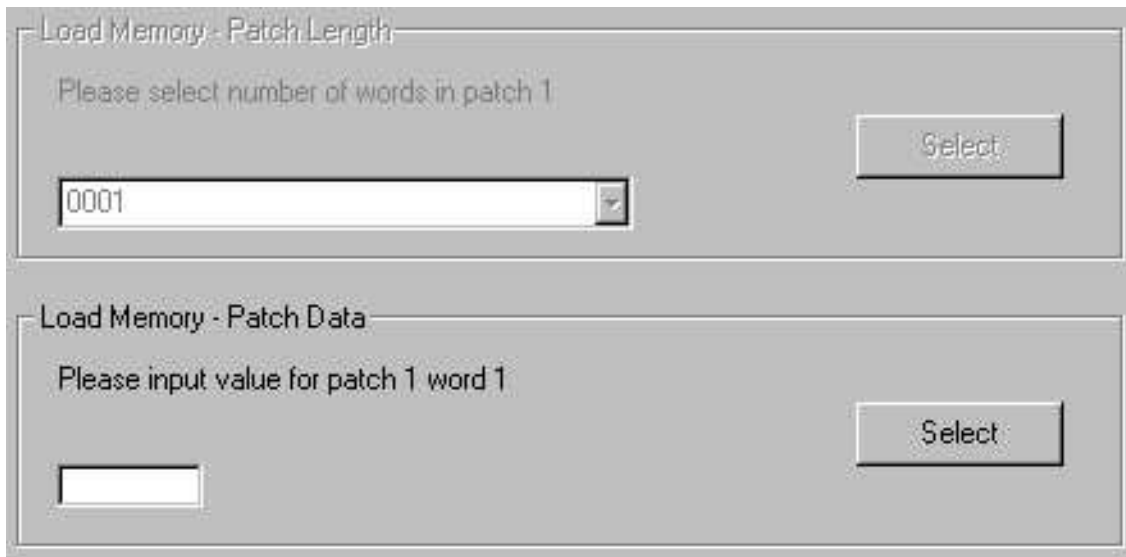
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**Figure 2-94 The Patch Length Drop-Down Menu**

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**

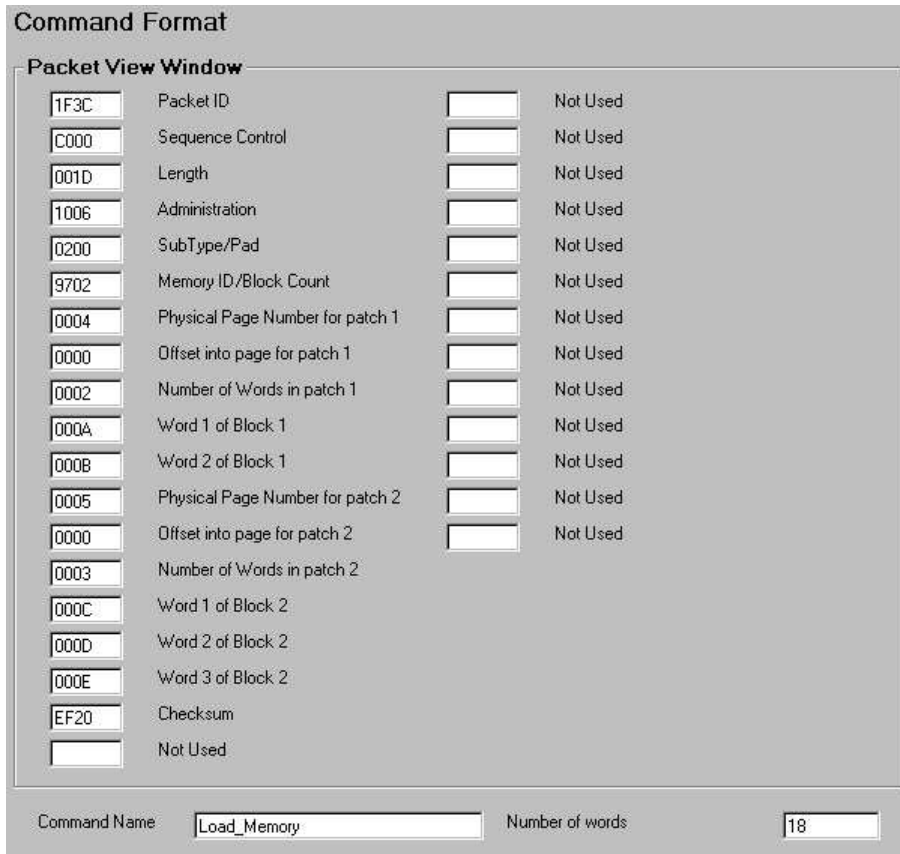
Once all the data has been entered the Command Transmitter Form will look something like Figure 2-96. Once you have checked the contents all that remains is to press the 'Transmit' button to send the command to Ptolemy.

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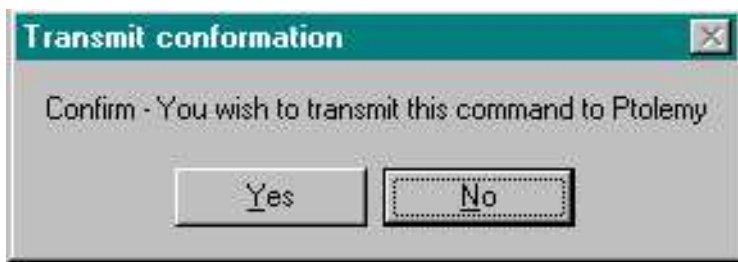
The image shows a 'Command Format' window with a 'Packet View Window' tab. It contains a table of fields for a command packet. The fields are as follows:

Field	Description	Value	Status
1F3C	Packet ID		Not Used
C000	Sequence Control		Not Used
001D	Length		Not Used
1006	Administration		Not Used
0200	SubType/Pad		Not Used
9702	Memory ID/Block Count		Not Used
0004	Physical Page Number for patch 1		Not Used
0000	Offset into page for patch 1		Not Used
0002	Number of Words in patch 1		Not Used
000A	Word 1 of Block 1		Not Used
000B	Word 2 of Block 1		Not Used
0005	Physical Page Number for patch 2		Not Used
0000	Offset into page for patch 2		Not Used
0003	Number of Words in patch 2		Not Used
000C	Word 1 of Block 2		Not Used
000D	Word 2 of Block 2		Not Used
000E	Word 3 of Block 2		Not Used
EF20	Checksum		Not Used
	Not Used		Not Used

At the bottom, there is a 'Command Name' field with the text 'Load\_Memory' and a 'Number of words' field with the value '18'.

**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:\\).

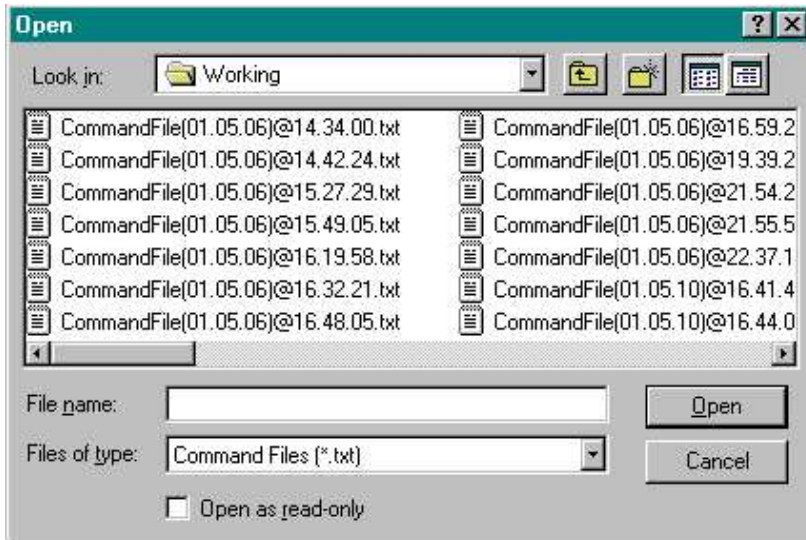


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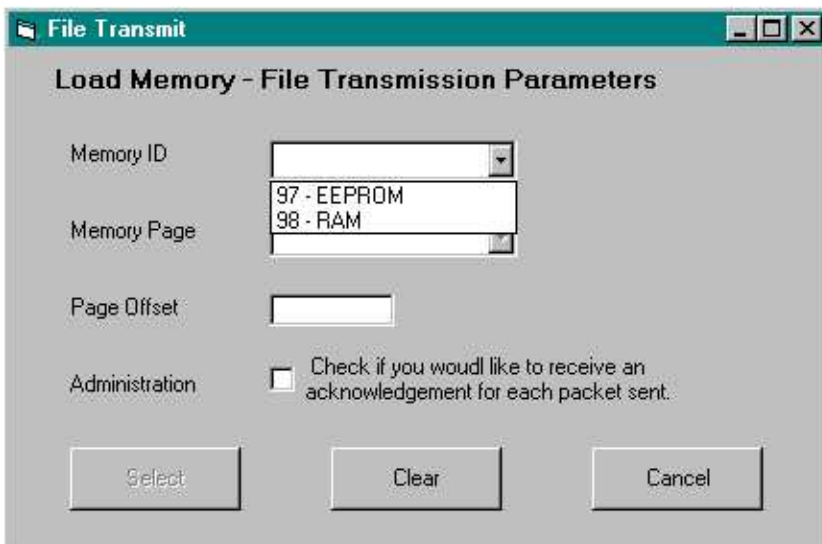
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**Figure 2-98 The 'Open' Common Dialog Form**

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

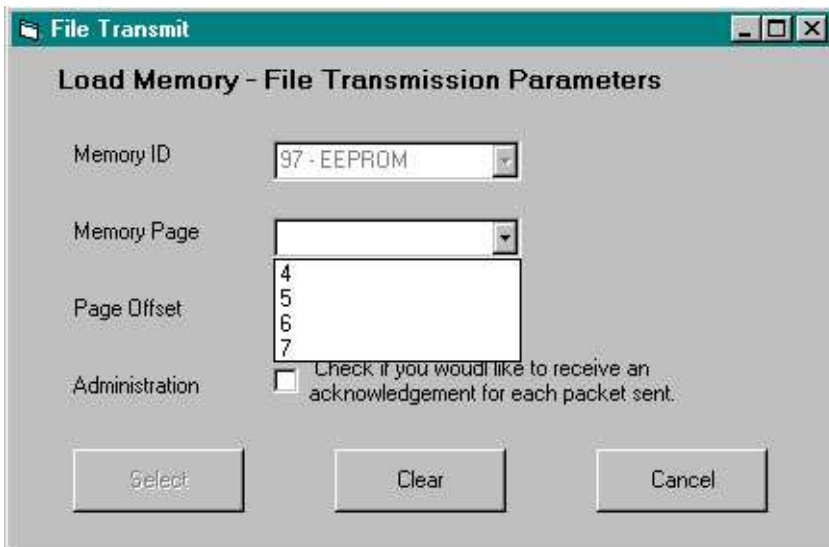
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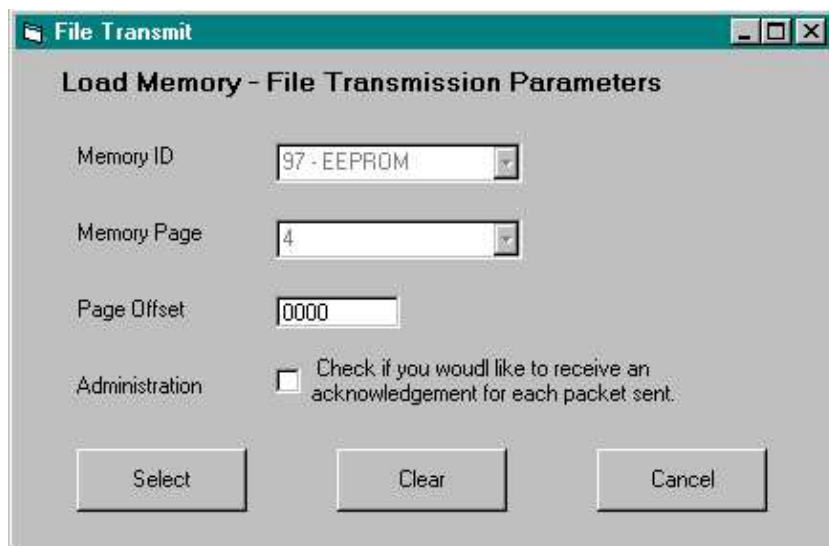
the memory ID drop-down menu the form selects the first item chosen from the menu and moves to the last compulsory item which is the page offset.



**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**

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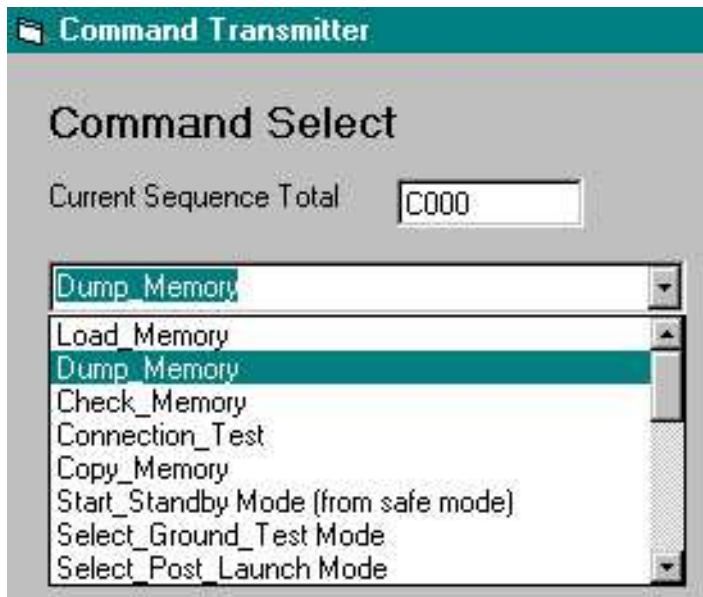
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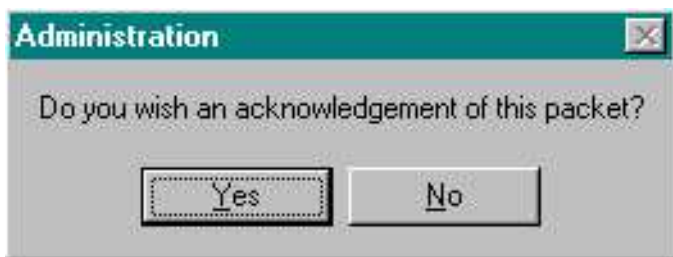
### 2.8.2 Dump Memory

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**

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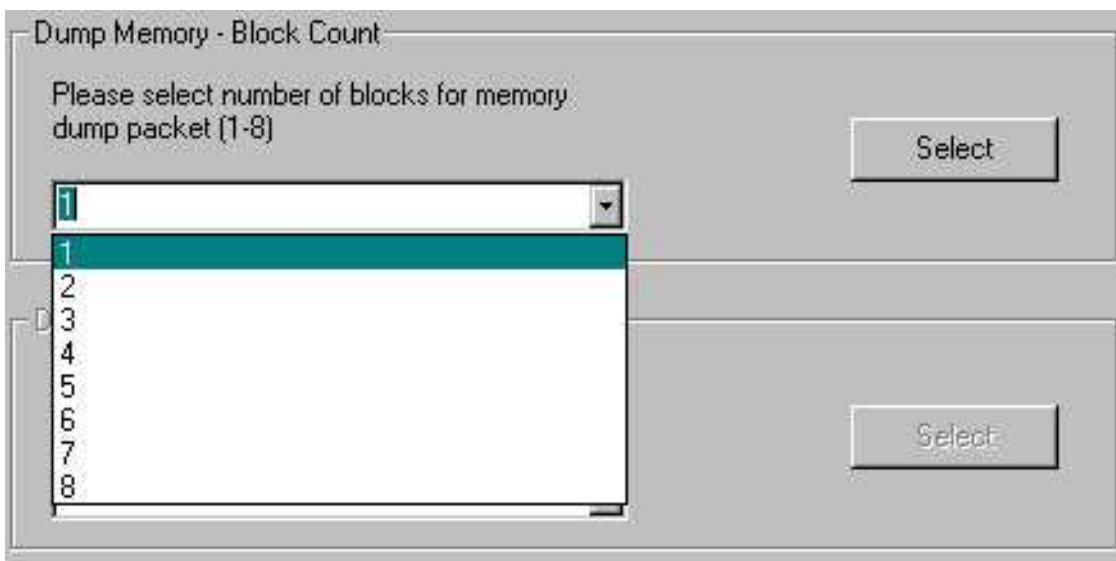
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The first option box to appear will be one asking how many blocks of memory you wish to dump (1-8). The number is chosen from a drop-down menu as shown in Figure 2-104. The list of data entry items you will be presented with is as follows:

- 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).

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The image shows two stacked dialog boxes from the EGSE software. The top dialog box is titled 'Dump Memory - Block Count' and contains the text 'Please select number of blocks for memory dump packet (1-8)'. It has a text input field with the value '1' and a 'Select' button. The bottom dialog box is titled 'Dump Memory - Memory ID' and contains the text 'Please enter memory ID for dump'. It has a dropdown menu showing '96 - PROM' selected, with a list of options: '96 - PROM', '97 - EEPROM', and '98 - RAM'. It also has a 'Select' button.

**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).

The image shows a dialog box titled 'Dump Memory - Memory Page'. It contains the text 'Please select the physical page number for dump 1'. There is a text input field with the value '0000' and a 'Select' button. Below the input field is a dropdown menu showing '0000' selected, with a list of options: '0000' and '0001'.

**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.

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

The image shows two stacked dialog boxes from the EGSE software. The top dialog box is titled 'Dump Memory - Memory Page' and contains the text 'Please select the physical page number for dump 1'. It features a text input field with '0000' and a dropdown arrow on the right, and a 'Select' button. The bottom dialog box is titled 'Dump Memory - Dump Offset' and contains the text 'Please select offset into page for dump 1'. It features an empty text input field and a 'Select' button.

**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.\*\*\*

The image shows a dialog box titled 'Dump Memory - Dump Length' with the text 'Please select number of words in dump 1'. It features a 'Select' button and a drop-down menu. The menu is open, showing a list of options: '0035 - 53', '00F8 - 248', '00F9 - 249', '00FA - 250', '00FB - 251', '00FC - 252', '00FD - 253', '00FE - 254', and '00FF - 255'. The first option, '0035 - 53', is highlighted in green.

**Figure 2-108 The Dump Length Drop-Down Menu**

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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.

**Command Format**

**Packet View Window**

1F3C	Packet ID		Not Used
C000	Sequence Control		Not Used
000D	Length		Not Used
1006	Administration		Not Used
0500	SubType/Pad		Not Used
9601	Memory ID/Block Count		Not Used
0000	Physical Page Number for dump 1		Not Used
0000	Offset into page for dump 1		Not Used
0035	Number of Words in dump 1		Not Used
0505	Checksum		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used

Command Name:  Number of words:

**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.

**Transmit conformation**

Confirm - You wish to transmit this command to Ptolemy

**Figure 2-110 The Transmission Confirmation Message Box**



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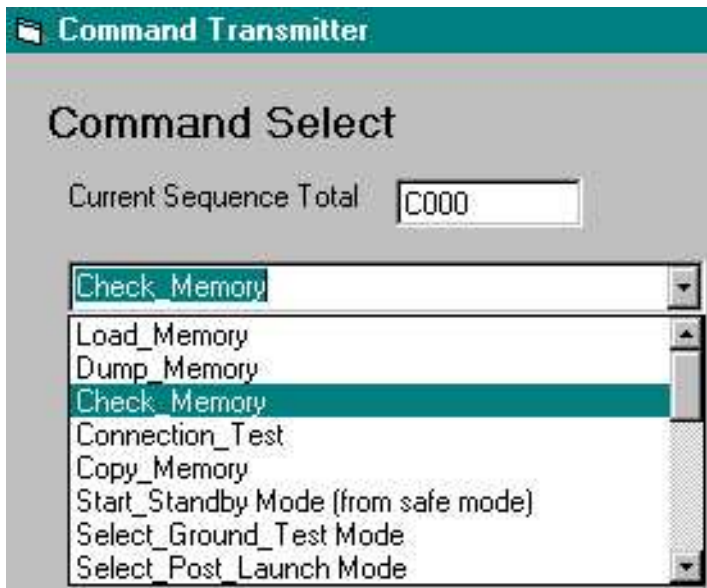
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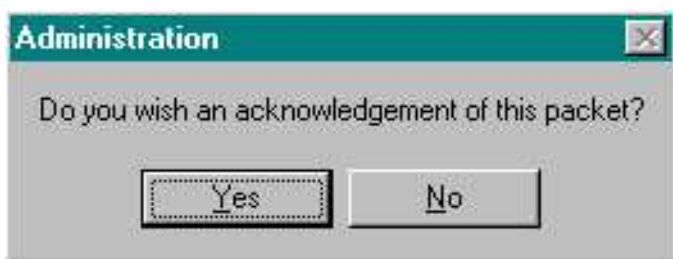
### 2.8.3 Check Memory

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**



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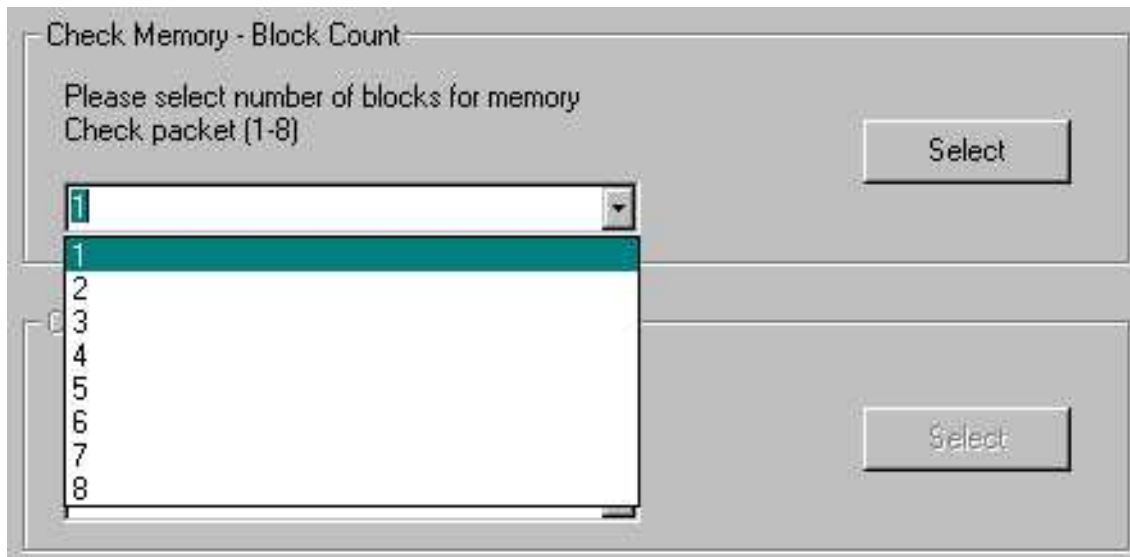
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Having selected 'Yes' or 'No' from the administration message box the list of data entry items you will be presented with is as follows:

- 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.

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The image shows two stacked dialog boxes from the EGSE software. The top dialog box is titled 'Check Memory - Block Count' and contains the text 'Please select number of blocks for memory. Check packet (1-8)'. It has a text input field with the number '1' and a 'Select' button. The bottom dialog box is titled 'Check Memory - Memory ID' and contains the text 'Please enter memory ID for Check'. It has a drop-down menu showing '96 - PROM' selected, with a list of options: '96 - PROM', '97 - EEPROM', and '98 - RAM'. It also has a 'Select' button.

**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.

The image shows a dialog box titled 'Check Memory - Memory Page' with the text 'Please select the physical page number for Check 1'. It features a text input field with '0000' and a 'Select' button. Below the input field is a drop-down menu showing '0000' selected, with a list of options: '0000' and '0001'.

**Figure 2-115 The Memory Page Drop-Down Menu**

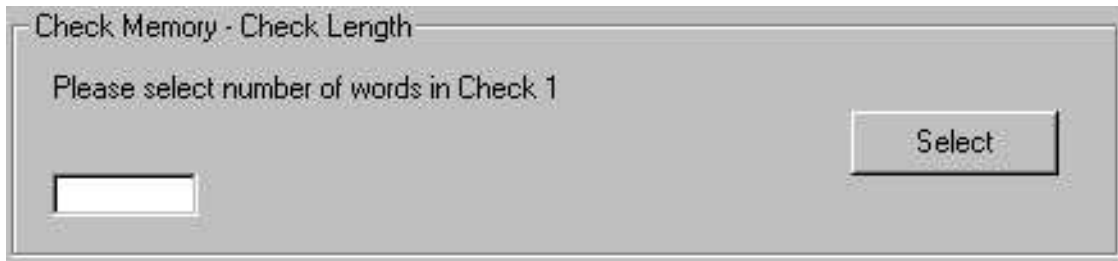
Having selected the page number the next menu allows you to select the offset into the page where you wish the check to start from (this menu also appears once for each block). The data entry window for the page off set will look similar to Figure 2-116.

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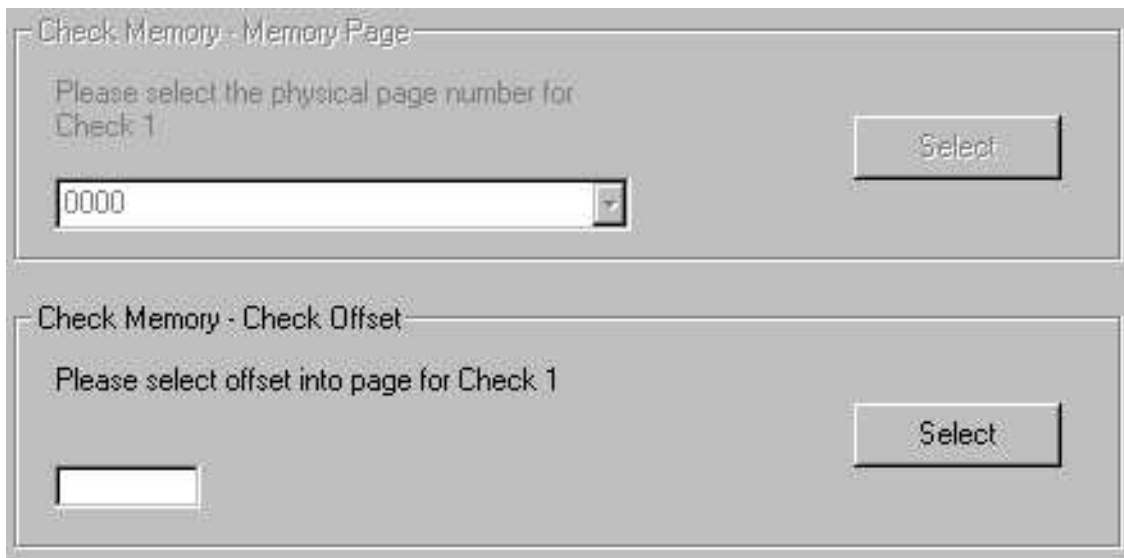
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**Figure 2-116 The Memory Offset Data Entry Menu**

The final required field 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.

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**Command Format**

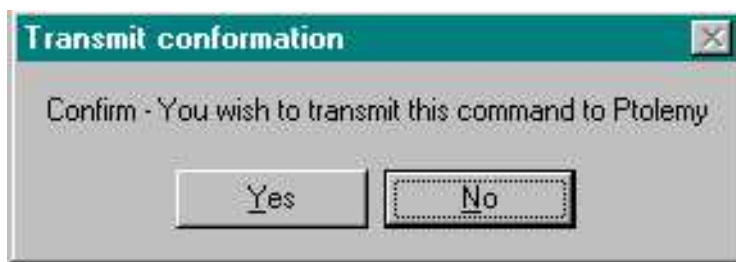
**Packet View Window**

1F3C	Packet ID		Not Used
C000	Sequence Control		Not Used
000D	Length		Not Used
1006	Administration		Not Used
0900	SubType/Pad		Not Used
9601	Memory ID/Block Count		Not Used
0000	Physical Page Number for Check 1		Not Used
0000	Offset into page for Check 1		Not Used
000A	Number of Words in Check 1		Not Used
25C7	Checksum		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used

Command Name:  Number of words:

**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**

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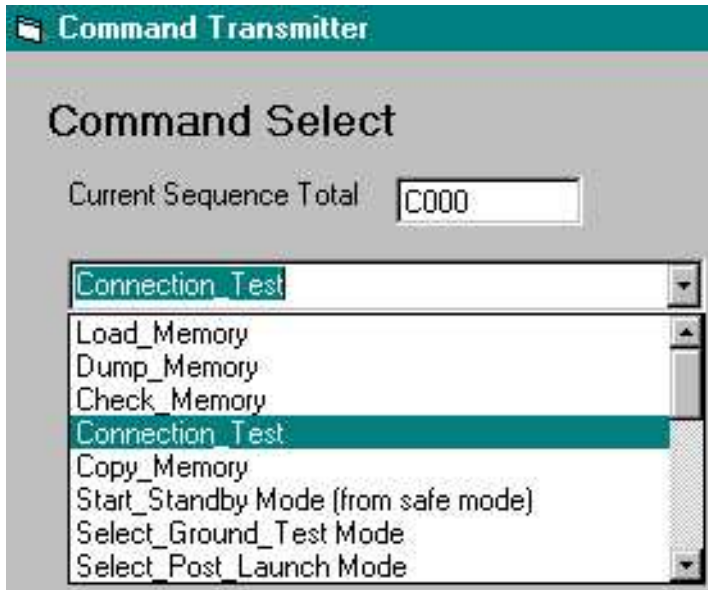
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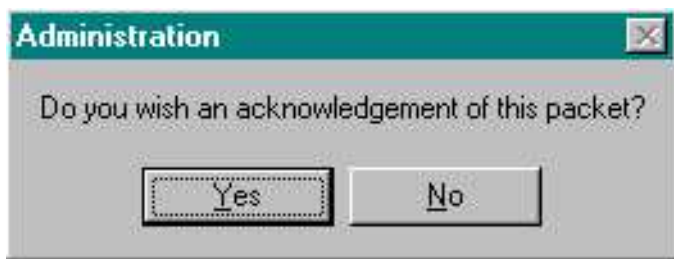
### 2.8.4 Connection Test

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.



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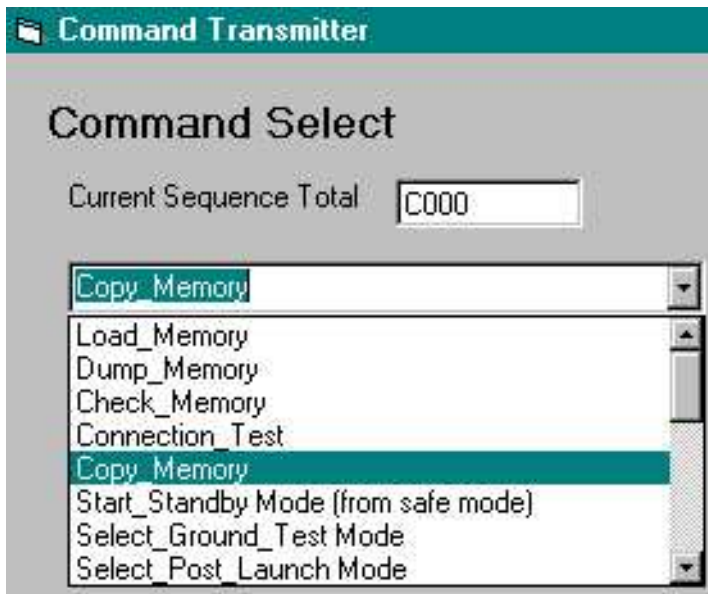
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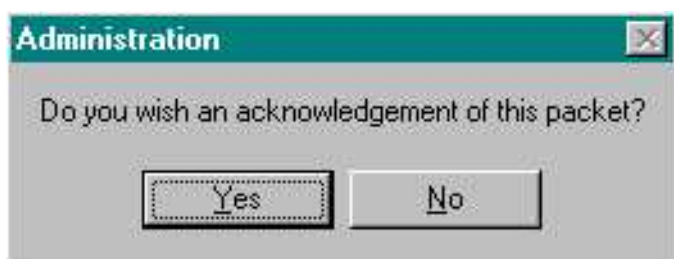
### 2.8.5 Copy Memory

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

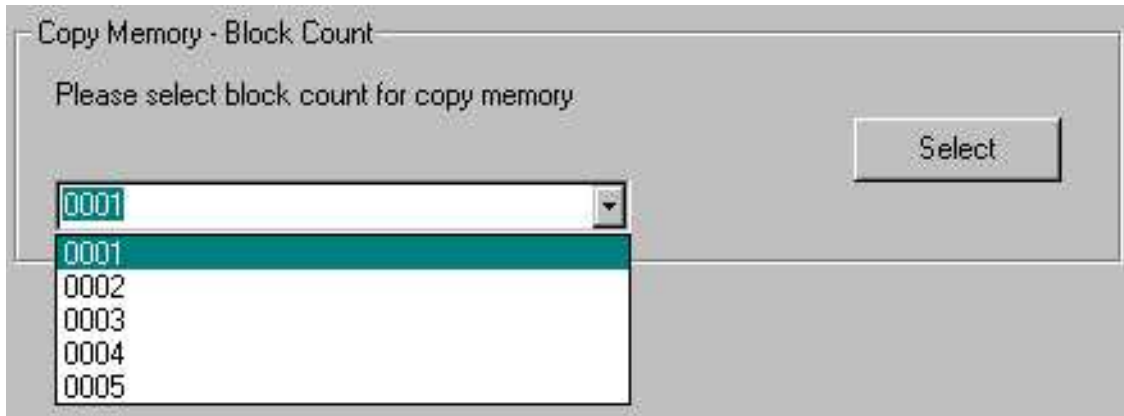
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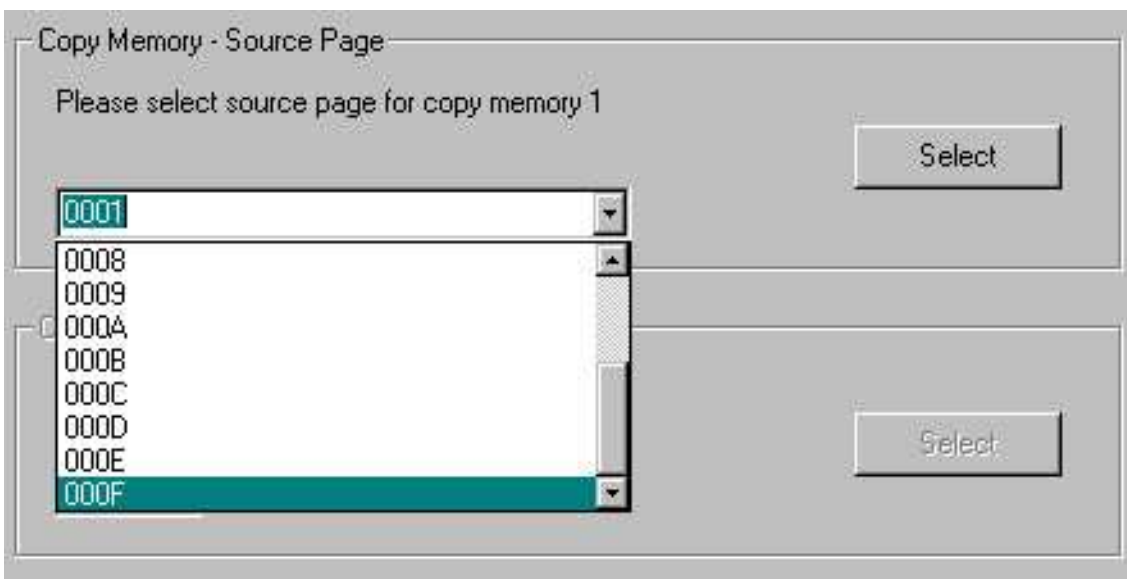
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The first item is the block count, which is used to specify how many sections of memory you wish to copy from. The drop-down menu for the block count will look similar to the one shown Figure 2-126.



**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.



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Copy Memory - Source Page

Please select source page for copy memory 1

0001

Select

Copy Memory - Source Offset

Please enter source page offset for copy memory 1

0000

Select

**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.

Copy Memory - Destination Page

Please select Destination page for copy memory 1

0000

0008

0009

000A

000B

000C

000D

000E

000F

Select

Select

**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.

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The image shows two stacked dialog boxes. The top box is titled 'Copy Memory - Destination Page' and contains the text 'Please select Destination page for copy memory 1'. It has a text input field with '0000' and a 'Select' button. The bottom box is titled 'Copy Memory - Destination Offset' and contains the text 'Please enter Destination page offset for copy memory 1'. It also has a text input field with '0000' and a 'Select' button.

**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.

The image shows a dialog box titled 'Copy Memory - Block Length' with the text 'Please select block length for copy memory 1'. It features a drop-down menu with '0001 - 1' selected. Below the menu is a list of hexadecimal values and their corresponding decimal values: 00F8 - 248, 00F9 - 249, 00FA - 250, 00FB - 251, 00FC - 252, 00FD - 253, 00FE - 254, and 00FF - 255. A 'Select' button is located to the right of the menu.

**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'.

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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)

Packet View Window			
1F3C	Packet ID		Not Used
C000	Sequence Control		Not Used
001B	Length		Not Used
11C1	Administration		Not Used
0100	SubType/Pad		Not Used
0002	Block Count		Not Used
0001	Source Page 1		Not Used
0000	Source Offset 1		Not Used
0004	Destination Page 1		Not Used
000A	Destination Offset 1		Not Used
0006	Block Length 1		Not Used
0001	Source Page 2		Not Used
000A	Source Offset 2		Not Used
0006	Destination Page 2		Not Used
000B	Destination Offset 2		Not Used
000C	Block Length 2		Not Used
D4F6	Checksum		Not Used
	Not Used		Not Used
	Not Used		Not Used

Command Name:  Number of words:

**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**

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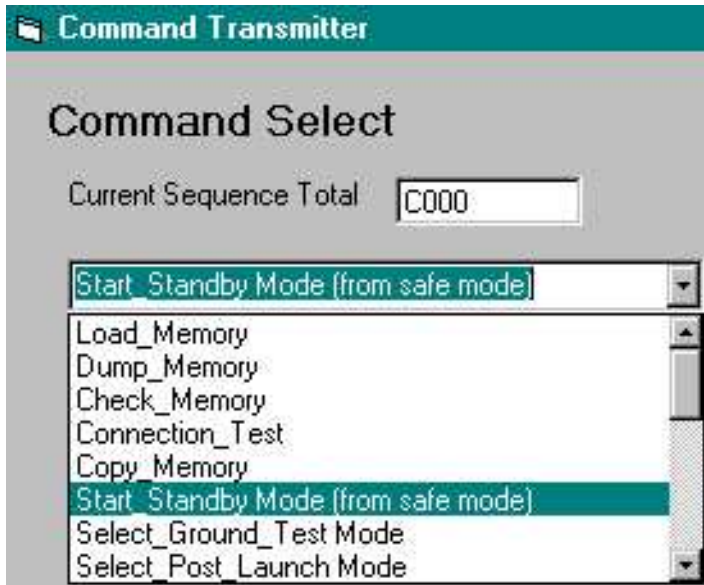
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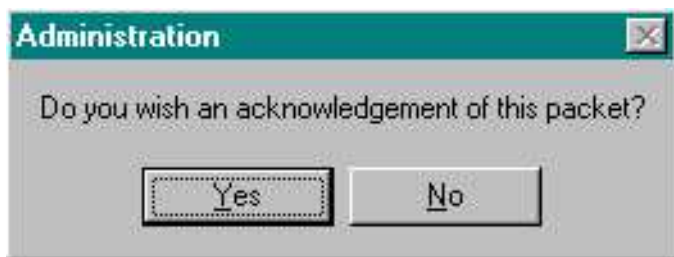
### 2.8.6 Start Standby

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**

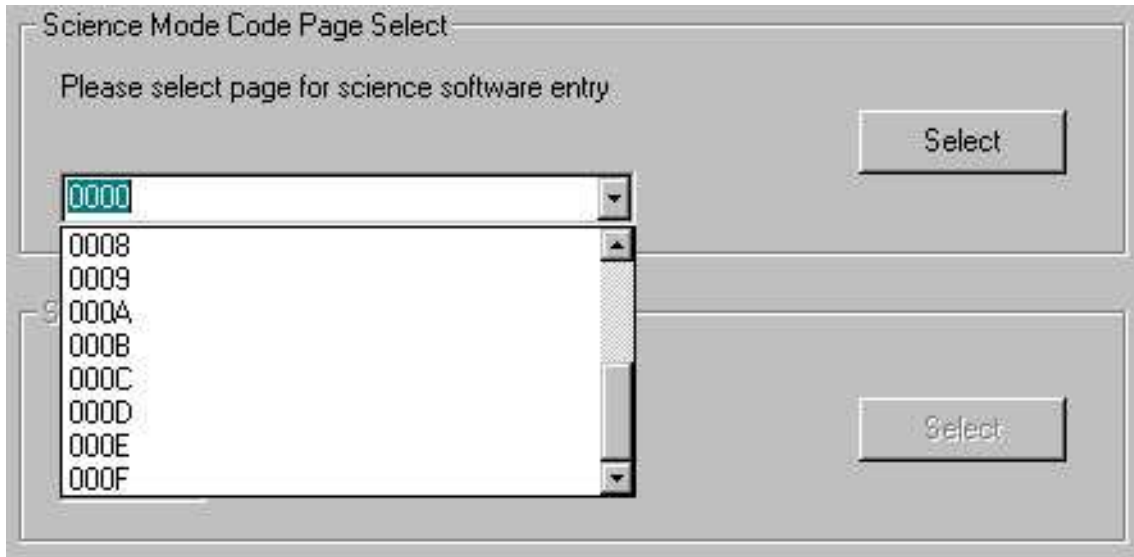
Start standby is normally the first mode run and covers the transition from 'safe mode' to 'science mode'. The first menu you will be presented with will ask from which area of memory you wish the science mode software to start. The menu looks similar to Figure 2-136.

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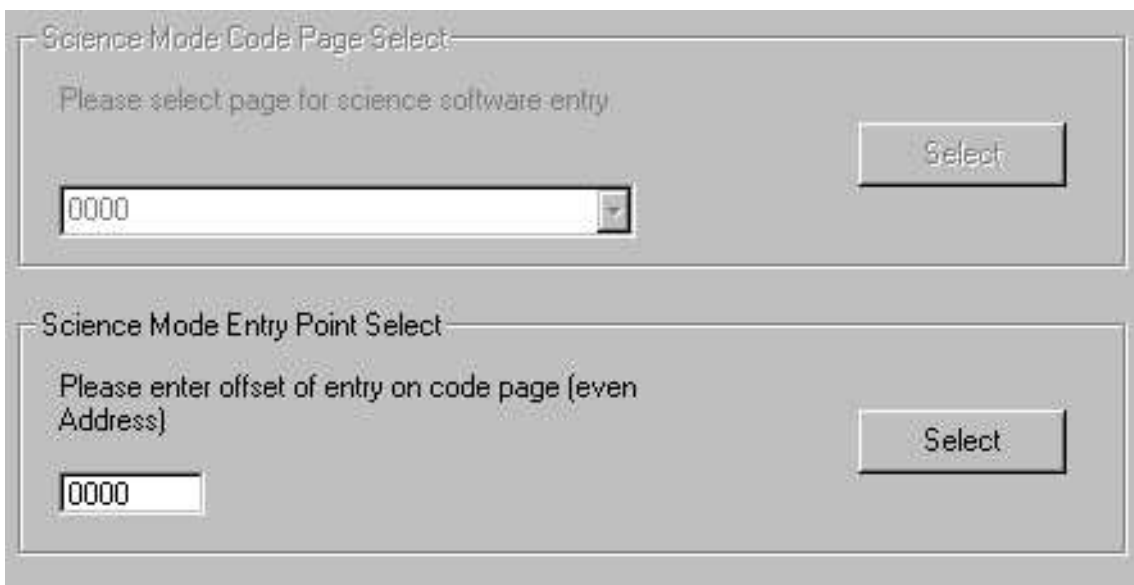
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**Figure 2-136 The Science Mode Code Page Entry Drop-down Menu**

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**

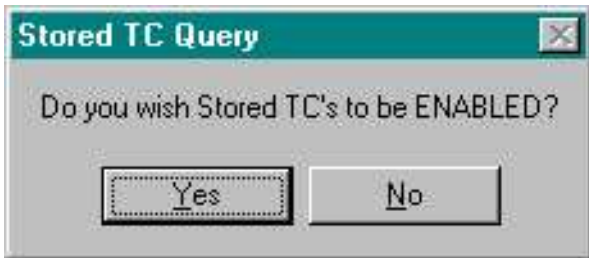
After you have chosen the start code page offset a message box will appear asking if you wish to enable any stored telecommands. The message box will look like Figure 2-138.

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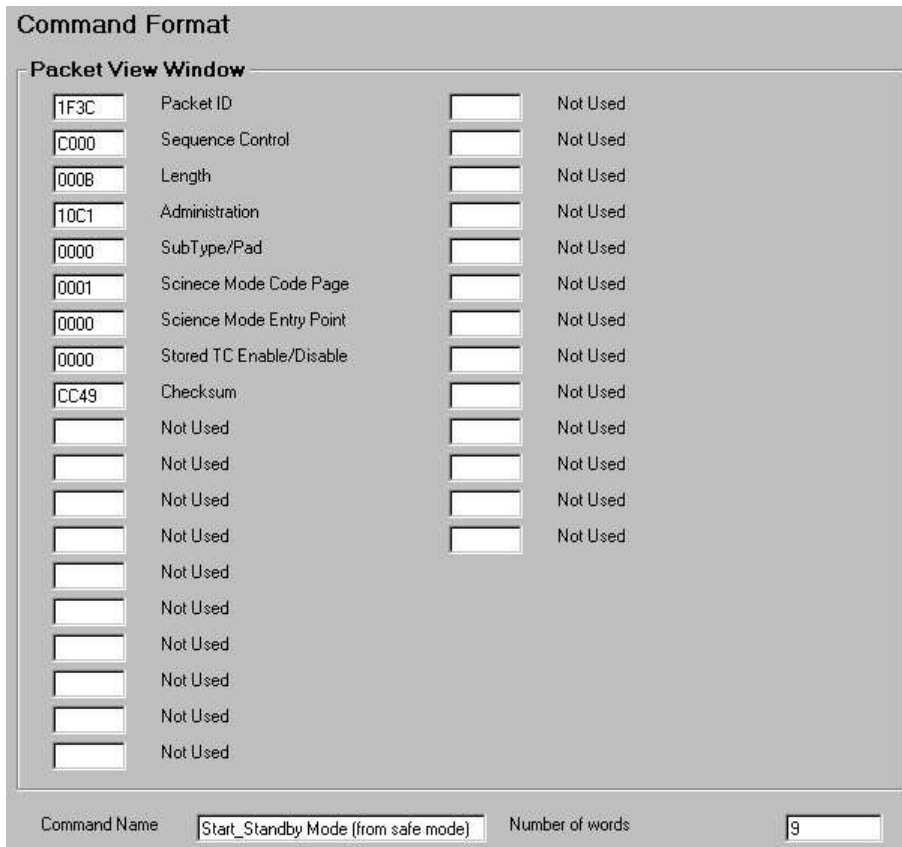
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**Figure 2-138 The Stored TC's Query Message Box**

Once 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.



Field	Value	Field	Value
Packet ID	1F3C		Not Used
Sequence Control	C000		Not Used
Length	000B		Not Used
Administration	10C1		Not Used
SubType/Pad	0000		Not Used
Science Mode Code Page	0001		Not Used
Science Mode Entry Point	0000		Not Used
Stored TC Enable/Disable	0000		Not Used
Checksum	CC49		Not Used
			Not Used
			Not Used
			Not Used
			Not Used
			Not Used
			Not Used
			Not Used
			Not Used
			Not Used
			Not Used
			Not Used

Command Name: Start\_Standby Mode (from safe mode)      Number of words: 9

**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.

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**Figure 2-140 The Transmission Confirmation Message Box**

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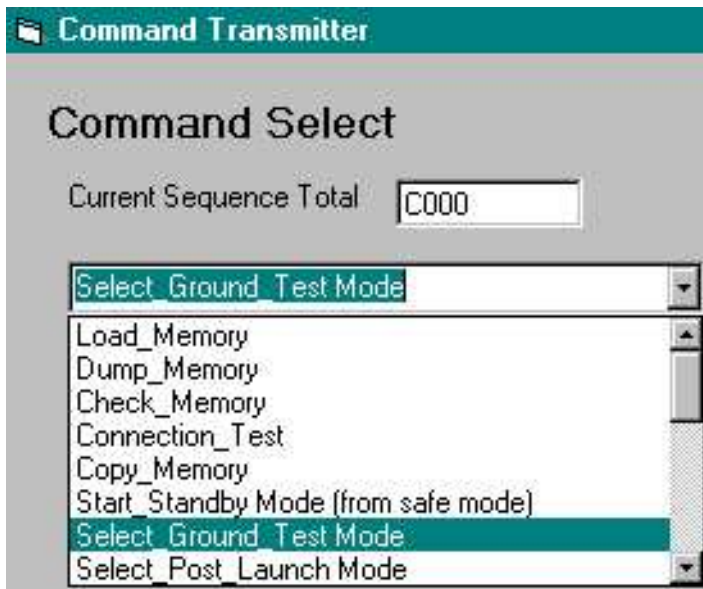
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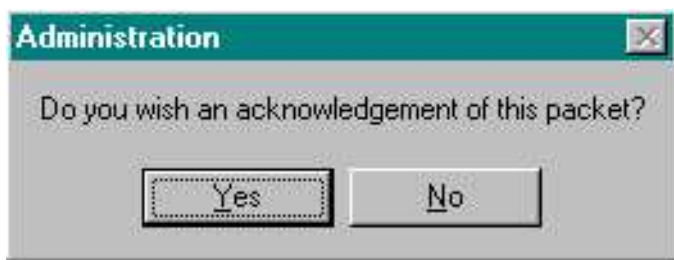
### 2.8.7 Ground Test Mode

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.

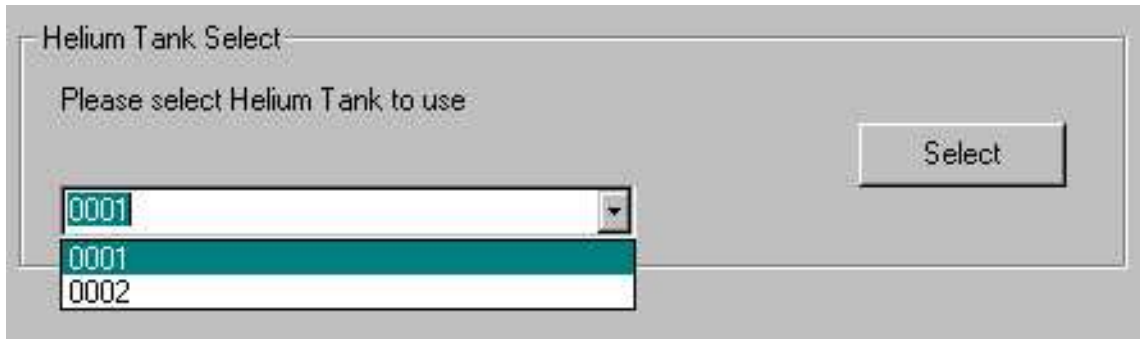


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Helium Tank Select

Please select Helium Tank to use

Select

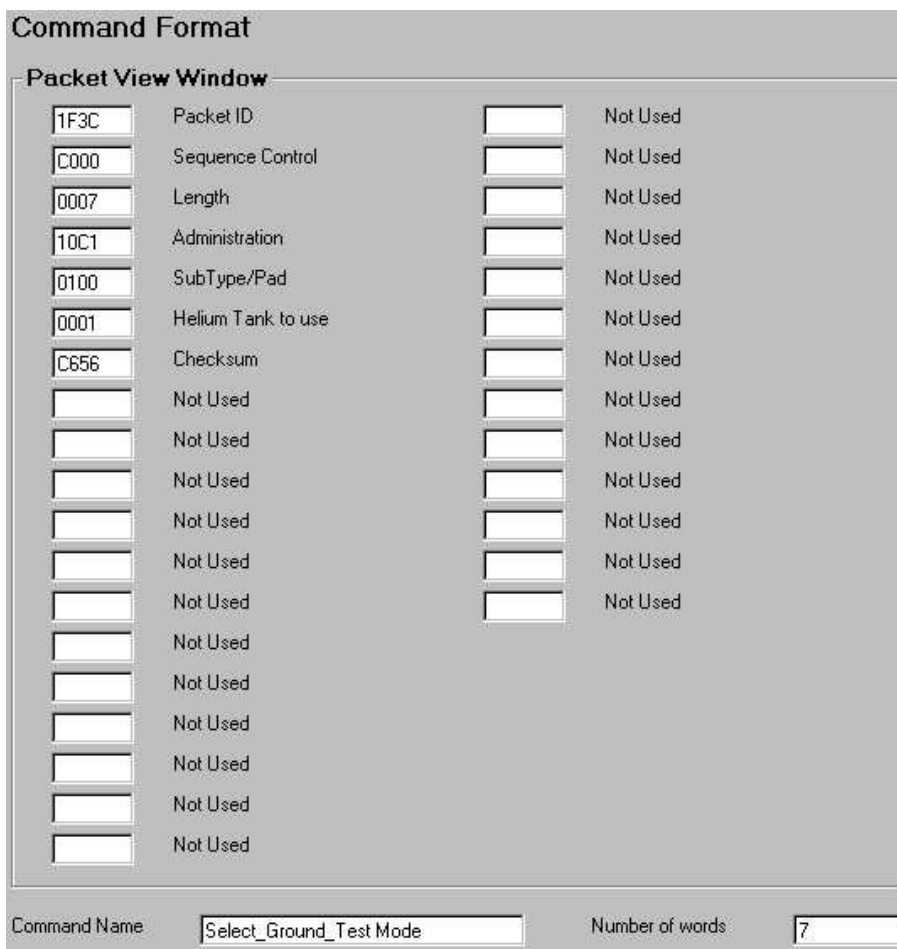
0001

0001

0002

**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’.



Command Format

Packet View Window

1F3C	Packet ID		Not Used
C000	Sequence Control		Not Used
0007	Length		Not Used
10C1	Administration		Not Used
0100	SubType/Pad		Not Used
0001	Helium Tank to use		Not Used
C656	Checksum		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used

Command Name: Select\_Ground\_Test Mode

Number of words: 7

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

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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**

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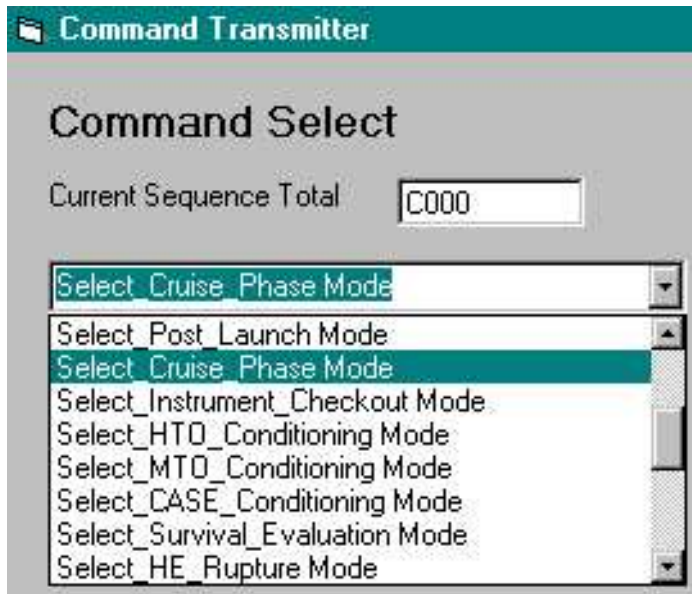
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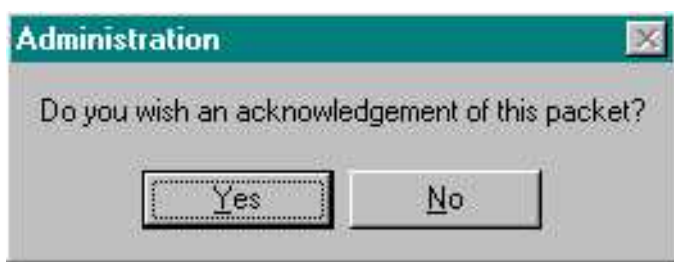
### 2.8.8 Post Launch, Cruise Phase & Instrument Checkout

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).

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**Command Format**

**Packet View Window**

1F3C	Packet ID		Not Used
C000	Sequence Control		Not Used
0005	Length		Not Used
10C1	Administration		Not Used
0300	SubType/Pad		Not Used
1539	Checksum		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used

Command Name  Number of words

**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.

**Transmit conformation**

Confirm - You wish to transmit this command to Ptolemy

**Figure 2-149 The Transmission Confirmation Message Box**

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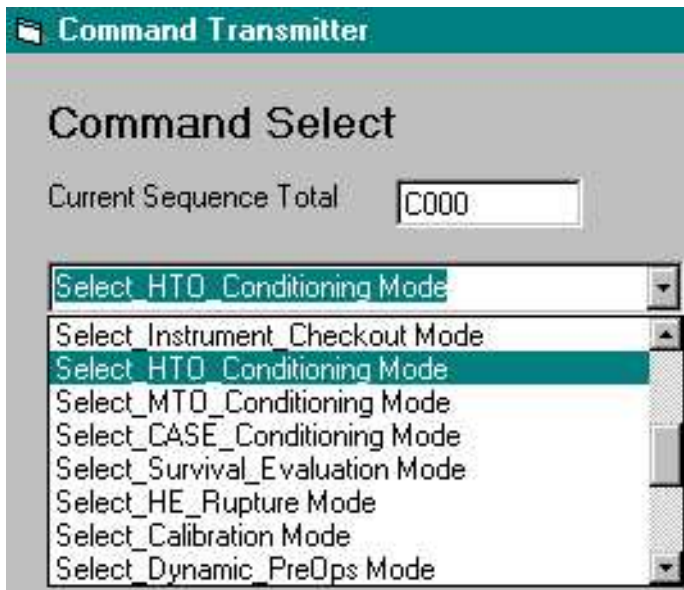
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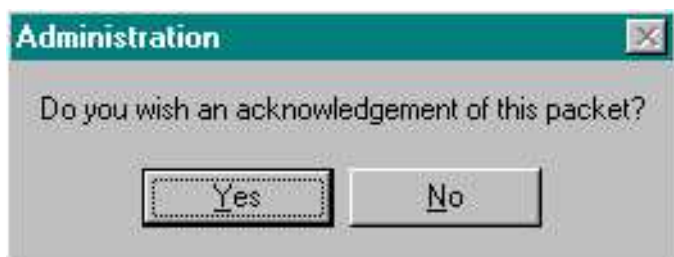
### 2.8.9 HTO Conditioning, MTO Conditioning & CASE Conditioning

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**

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\*\*\*More information due to be added during the next software update\*\*\*

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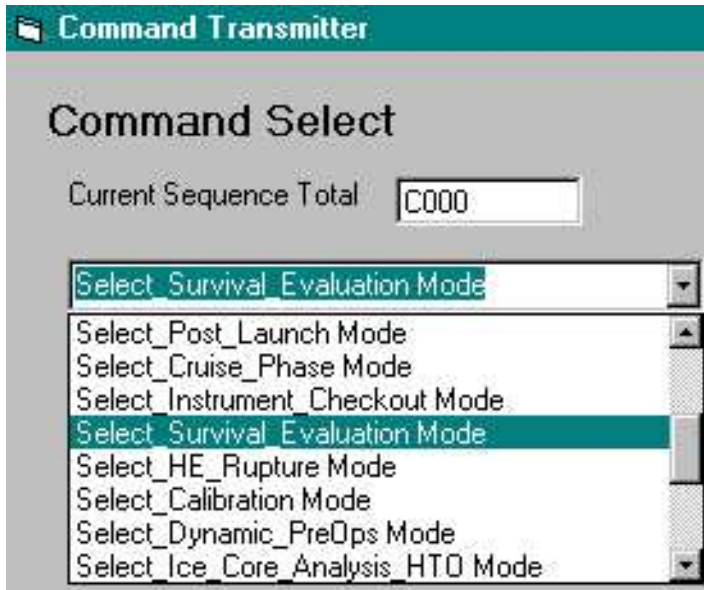
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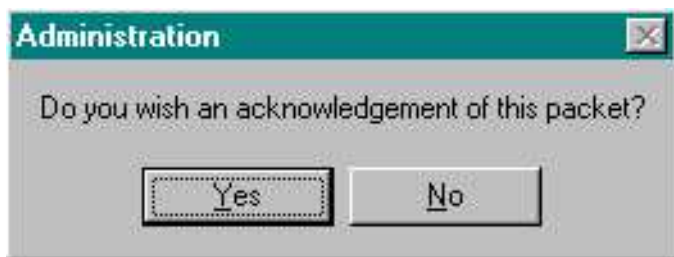
### 2.8.10 Survival Evaluation

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.

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**Command Format**

**Packet View Window**

1F3C	Packet ID		Not Used
C000	Sequence Control		Not Used
0005	Length		Not Used
11C1	Administration		Not Used
0800	SubType/Pad		Not Used
BF77	Checksum		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used

Command Name  Number of words

**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.

**Transmit conformation**

Confirm - You wish to transmit this command to Ptolemy

**Figure 2-155 The Transmission Confirmation Message Box**



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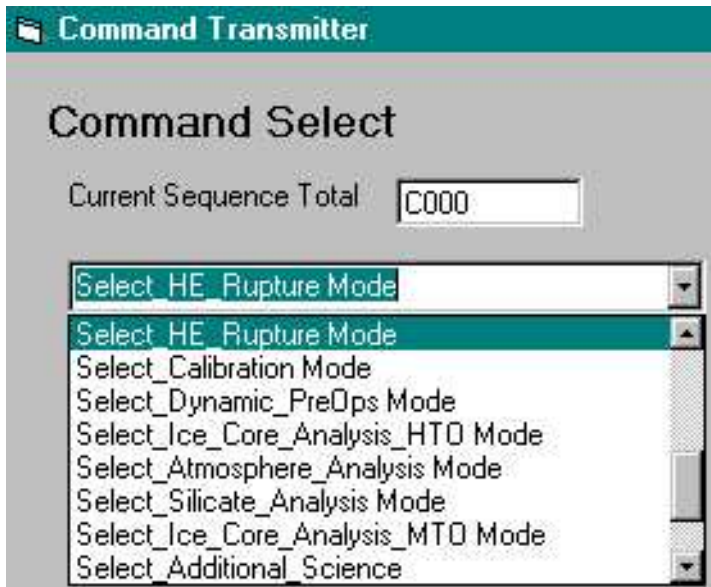
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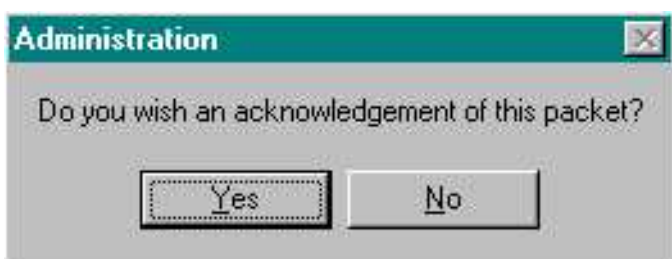
### 2.8.11 HE Rupture, Calibration, Dynamic PreOps, Ice Core Analysis HTO, Atmosphere Analysis, Silicate Analysis, Ice Core Analysis MTO & Additional Science

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**

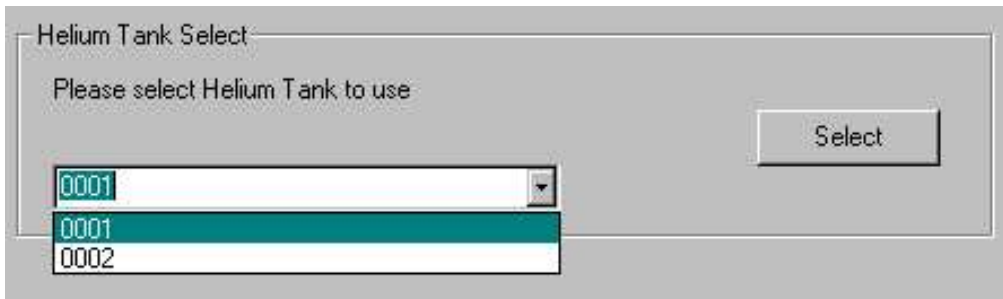
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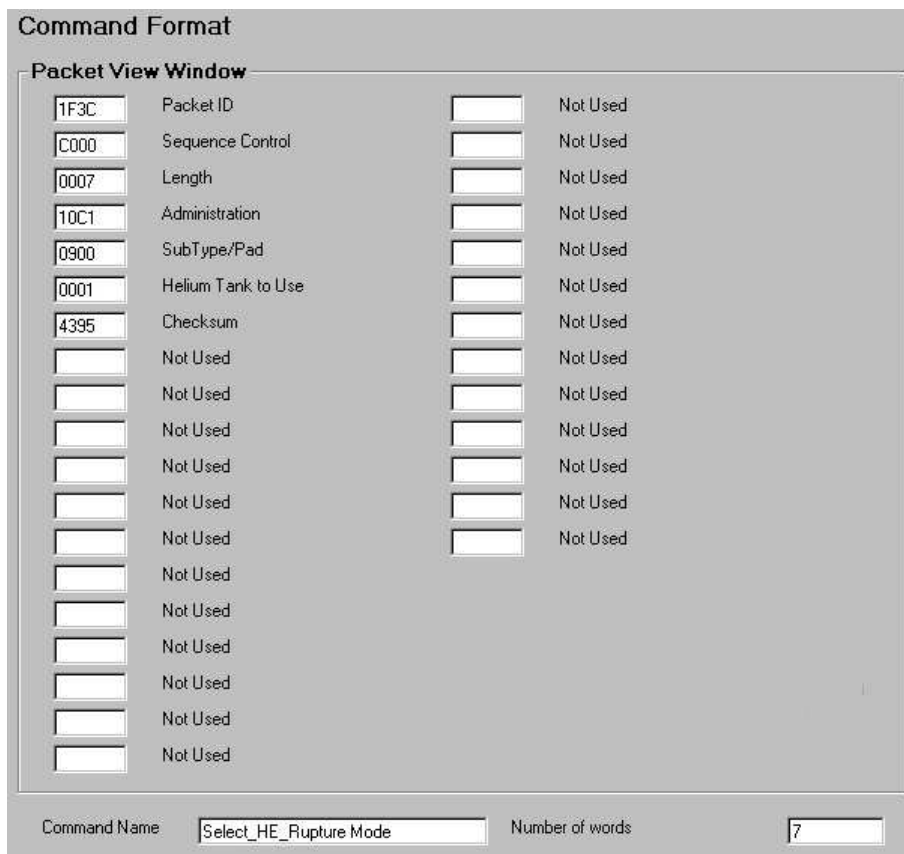
Once this has been done you will be asked to select which gas tank you would like to use in your selected mode. The option window will look like Figure 2-158.



The image shows a software window titled "Helium Tank Select". Inside the window, there is a text prompt "Please select Helium Tank to use". Below the prompt is a list box containing three items: "0001", "0001", and "0002". The first "0001" is highlighted. To the right of the list box is a button labeled "Select".

**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.



The image shows a software window titled "Command Format". Inside, there is a sub-window titled "Packet View Window". This sub-window contains a table with four columns: a text input field, a label, another text input field, and a status label. The first row is pre-filled with "1F3C", "Packet ID", an empty field, and "Not Used". The second row is "C000", "Sequence Control", an empty field, "Not Used". The third row is "0007", "Length", an empty field, "Not Used". The fourth row is "10C1", "Administration", an empty field, "Not Used". The fifth row is "0900", "SubType/Pad", an empty field, "Not Used". The sixth row is "0001", "Helium Tank to Use", an empty field, "Not Used". The seventh row is "4395", "Checksum", an empty field, "Not Used". The remaining eight rows have empty input fields and the label "Not Used".

Input Field	Label	Input Field	Status
1F3C	Packet ID		Not Used
C000	Sequence Control		Not Used
0007	Length		Not Used
10C1	Administration		Not Used
0900	SubType/Pad		Not Used
0001	Helium Tank to Use		Not Used
4395	Checksum		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used

Below the table, there are two fields: "Command Name" with the value "Select\_HE\_Rupture Mode" and "Number of words" with the value "7".

**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.

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**Figure 2-160 The Transmission Confirmation Message Box**

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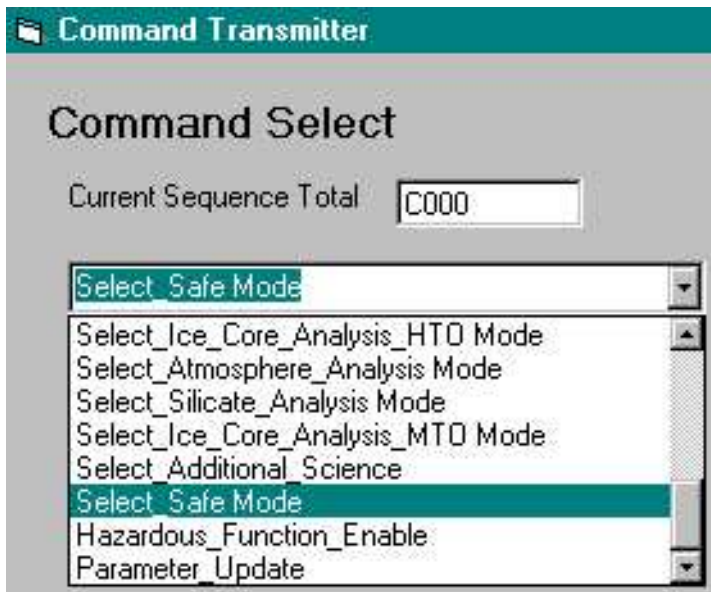
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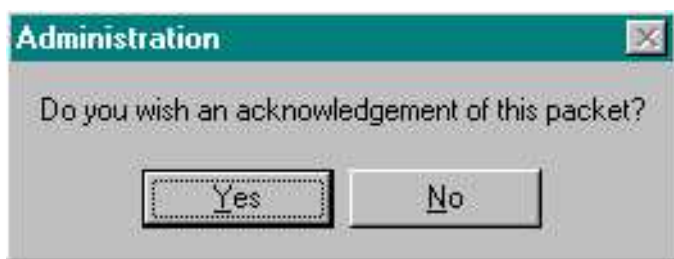
### 2.8.12 Select Safe Mode

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.

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**Command Format**

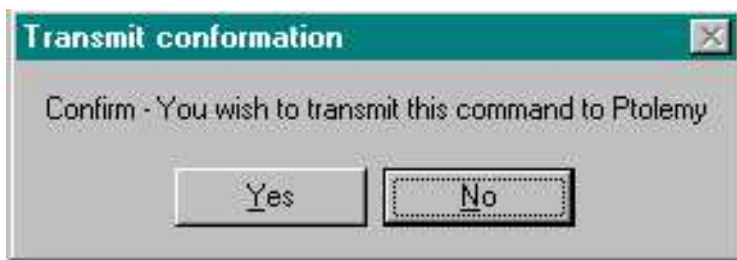
**Packet View Window**

1F3C	Packet ID		Not Used
C000	Sequence Control		Not Used
0005	Length		Not Used
10C1	Administration		Not Used
FF00	SubType/Pad		Not Used
4395	Checksum		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used
	Not Used		Not Used

Command Name:  Number of words:

**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**

# MODULUS – Ptolemy

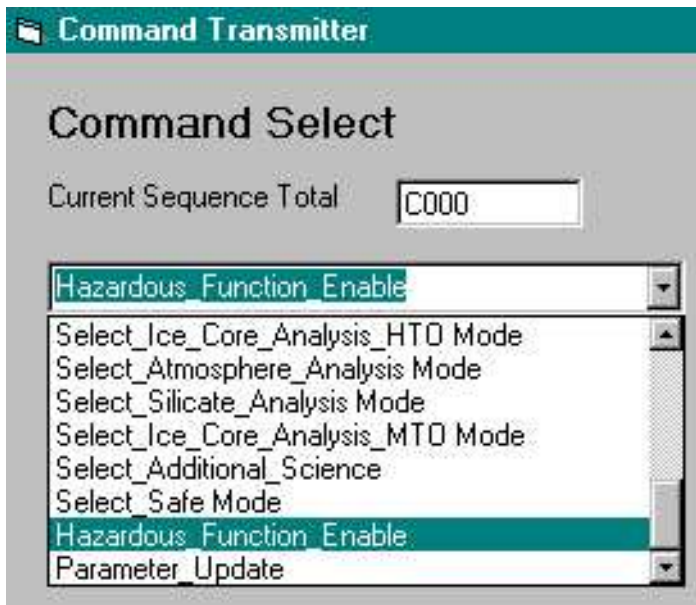
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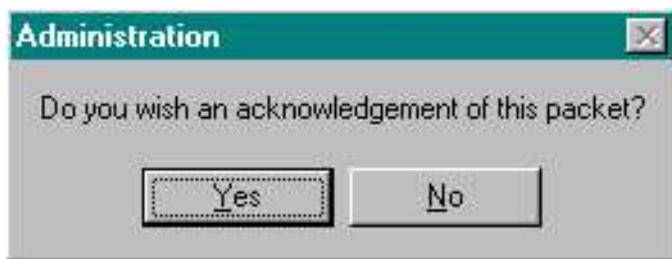
### 2.8.13 Hazard Function Enable

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.

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**Command Mask Generator**

**PWM Enable/Disable Mask**

Please select check boxes of items you wish enabled -  
All unchecked items will be disabled

- ☐ Bit 15 - Oven Heater
- ☐ Bit 14 - Pipe Heater
- ☐ Bit 13 - Ion Trap Heater
- ☐ Bit 12 - ENC2 Heater
- ☐ Bit 11 - ENC1 Heater
- ☐ Bit 10 - GC Heater
- ☐ Bit 09 - Reactor 15 Heater
- ☐ Bit 08 - Reactor 13 Heater
- ☐ Bit 07 - Reactor 9/14 Heater
- ☐ Bit 06 - Reactor 8 Heater
- ☐ Bit 05 - Reactor 7 Heater
- ☐ Bit 04 - Reactor 6 Heater
- ☐ Bit 03 - Reactor 5 Heater
- ☐ Bit 02 - Reactor 4 Heater
- ☐ Bit 01 - Reactor 2 Heater
- ☐ Bit 00 - Reactor 1 Heater

When completed press select - If you wish to start again Press clear

**Mask Results**

Binary

Hex

**Figure 2-167 The PWM Enable Mask**

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



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The screenshot shows a window titled "Command Mask Generator". Inside, the section "Valve Enable/Disable Mask" has a text box stating: "Please select check boxes of items you wish enabled - All unchecked items will be disabled". Below this is a list of 16 items, each with an unchecked checkbox:

- Bit 15 - Injector Valve C
- Bit 14 - Injector Valve B
- Bit 13 - Injector Valve A
- Bit 12 - Valve 16 (3-way)
- Bit 11 - Valve 15
- Bit 10 - Valve 14
- Bit 09 - Valve 13
- Bit 08 - Valve 11 (3-way)
- Bit 07 - Valve 10
- Bit 06 - Valve 9
- Bit 05 - Valve 8
- Bit 04 - Valve 7
- Bit 03 - Valve 4
- Bit 02 - Valve 3
- Bit 01 - Valve 2
- Bit 00 - Valve 1

Below the list, a text box says: "When completed press select - If you wish to start again Press clear". At the bottom of this section are two buttons: "Select" and "Clear".

Below the buttons is the "Mask Results" section. It contains two input fields: one for "Binary" showing "00000000" and one for "Hex" showing "0000".

**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.



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

**Command Mask Generator**

**Critical Enable/Disable Mask**

Please select check boxes of items you wish enabled - All unchecked items will be disabled

- ☐ Bit 15 Not Used
- ☐ Bit 14 Not Used
- ☐ Bit 13 Not Used
- ☐ Bit 12 Not Used
- ☐ Bit 11 Not Used
- ☐ Bit 10 Not Used
- ☐ Bit 9 Not Used
- ☐ Bit 8 Not Used
- ☐ Bit 7 Not Used
- ☐ Bit 06 - Docking Station Motor Up
- ☐ Bit 05 - Docking Station Motor Down
- ☐ Bit 04 - Ion Trap HT
- ☐ Bit 03 - Not Used
- ☐ Bit 02 - Not Used
- ☐ Bit 01 - SMA Rupture Valve 2
- ☐ Bit 00 - SMA Rupture Valve 1

When completed press select - If you wish to start again Press clear

Select Clear

**Mask Results**

00000000 Binary

0000 Hex

**Figure 2-169 The Critical Items Mask**

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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.

The screenshot shows a 'Packet View Window' with a list of fields for command transmission. Each field has a text input box, a label, a small empty box, and a status 'Not Used'.

Field	Label	Status
1F3C	Packet ID	Not Used
C000	Sequence Control	Not Used
000B	Length	Not Used
10C2	Administration	Not Used
0100	SubType/Pad	Not Used
0824	PWM Enable/Disable Mask	Not Used
0000	Valve Enable/Disable Mask	Not Used
0002	Critical Enable/Disable Mask	Not Used
A03D	Checksum	Not Used
	Not Used	Not Used
	Not Used	Not Used
	Not Used	Not Used
	Not Used	Not Used
	Not Used	Not Used
	Not Used	Not Used
	Not Used	Not Used
	Not Used	Not Used
	Not Used	Not Used
	Not Used	Not Used

At the bottom, there are two input fields: 'Command Name' with the text 'Hazardous\_Function\_Enable' and 'Number of words' with the value '9'.

**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.

The screenshot shows a 'Transmit conformation' dialog box with a title bar. The main text reads 'Confirm - You wish to transmit this command to Ptolemy'. Below the text are two buttons: 'Yes' and 'No'.

**Figure 2-171 The Transmission Confirmation Message Box**

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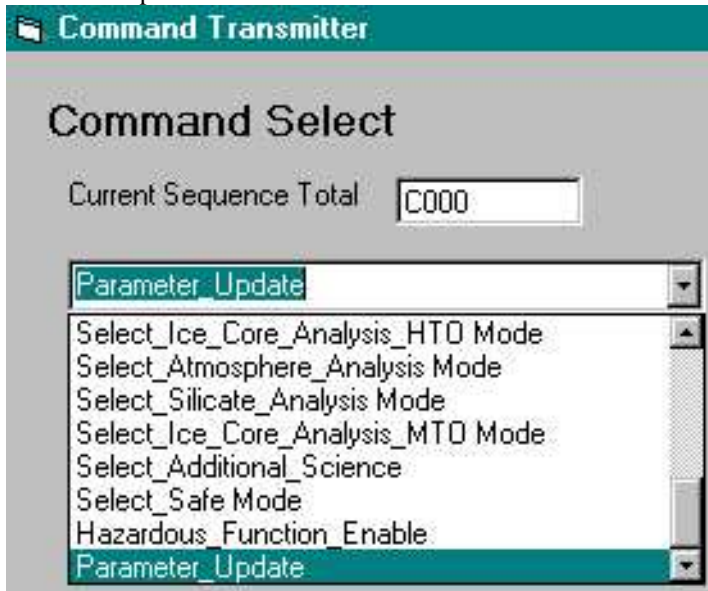
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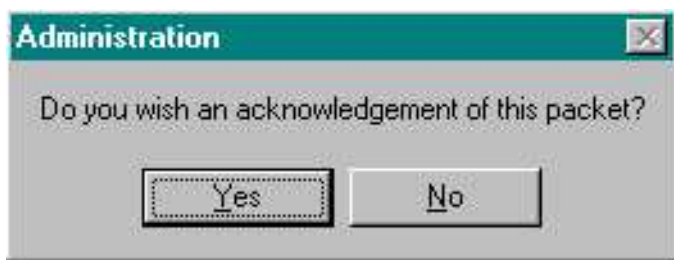
### 2.8.14 Parameter Update

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.

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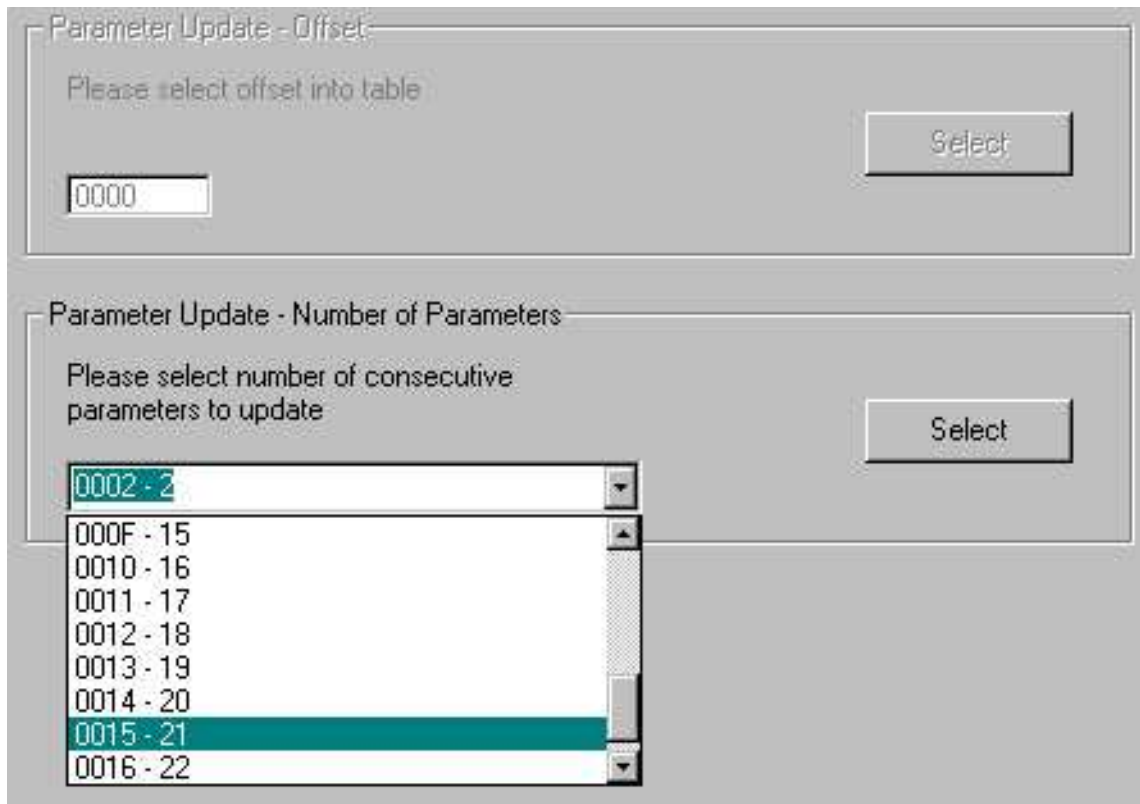
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**Figure 2-174 The Parameter Table Offset Data Entry Box**

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**

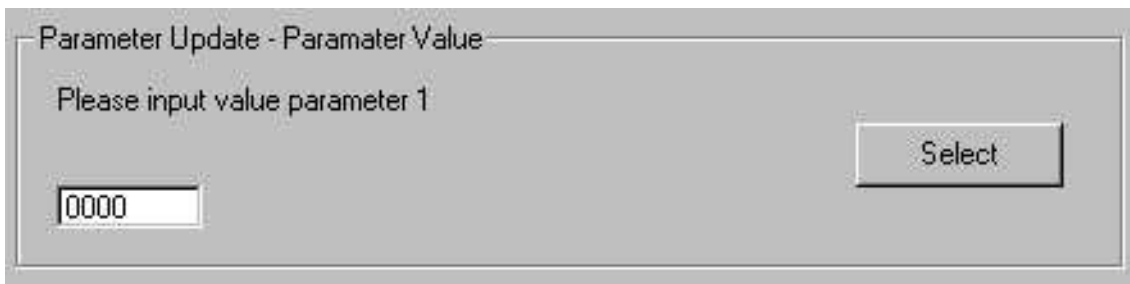
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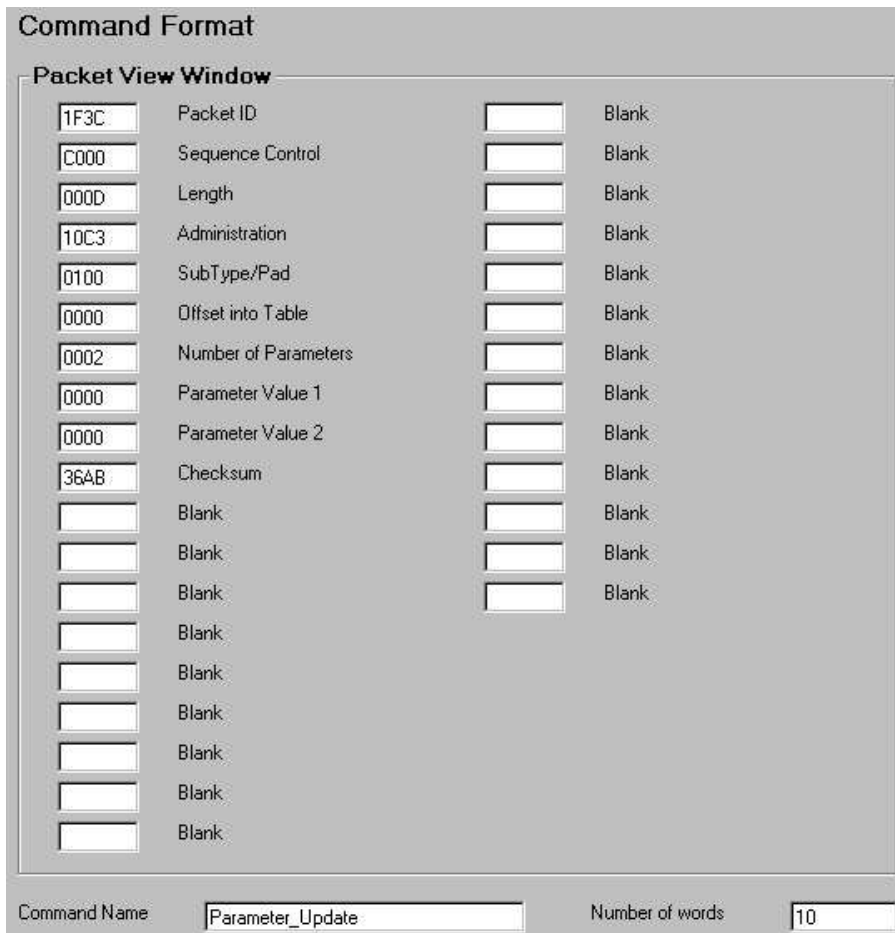
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Lastly the values for the updated parameters are chosen from a data entry window as shown in Figure 2-176. One data window will appear for each of the parameters up to the number of parameters selected at the beginning.



**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.



Parameter	Value
Packet ID	1F3C
Sequence Control	C000
Length	000D
Administration	10C3
SubType/Pad	0100
Offset into Table	0000
Number of Parameters	0002
Parameter Value 1	0000
Parameter Value 2	0000
Checksum	36AB
Blank	
Blank	
Blank	
Blank	
Blank	
Blank	
Blank	
Blank	
Blank	
Blank	

Command Name: Parameter\_Update      Number of words: 10

**Figure 2-177 Example Command Transmitter Form for Parameter Update**

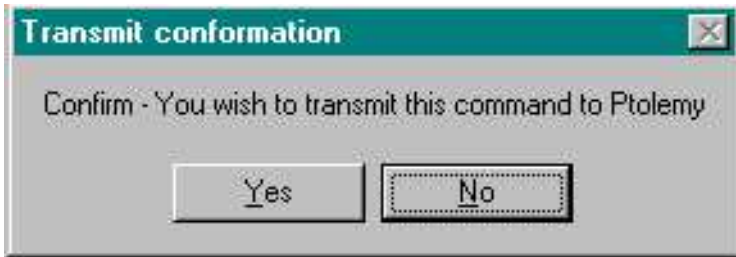
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Having pressed the 'Transmit' button you will be given the option of transmitting the command file to Ptolemy (by pressing 'Yes') or not transmitting (by pressing 'No') see Figure 2-178.



**Figure 2-178 The Transmission Confirmation Message Box**

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### 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.

IACF	FCID	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

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- 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**



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### 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).

IACF	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/Package 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/Package Type
- Packet Sub Type/Pad
- Format ID

Pink – Variable Content

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

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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**

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### 3.2 Starting PTOEGSE1.1.EXE

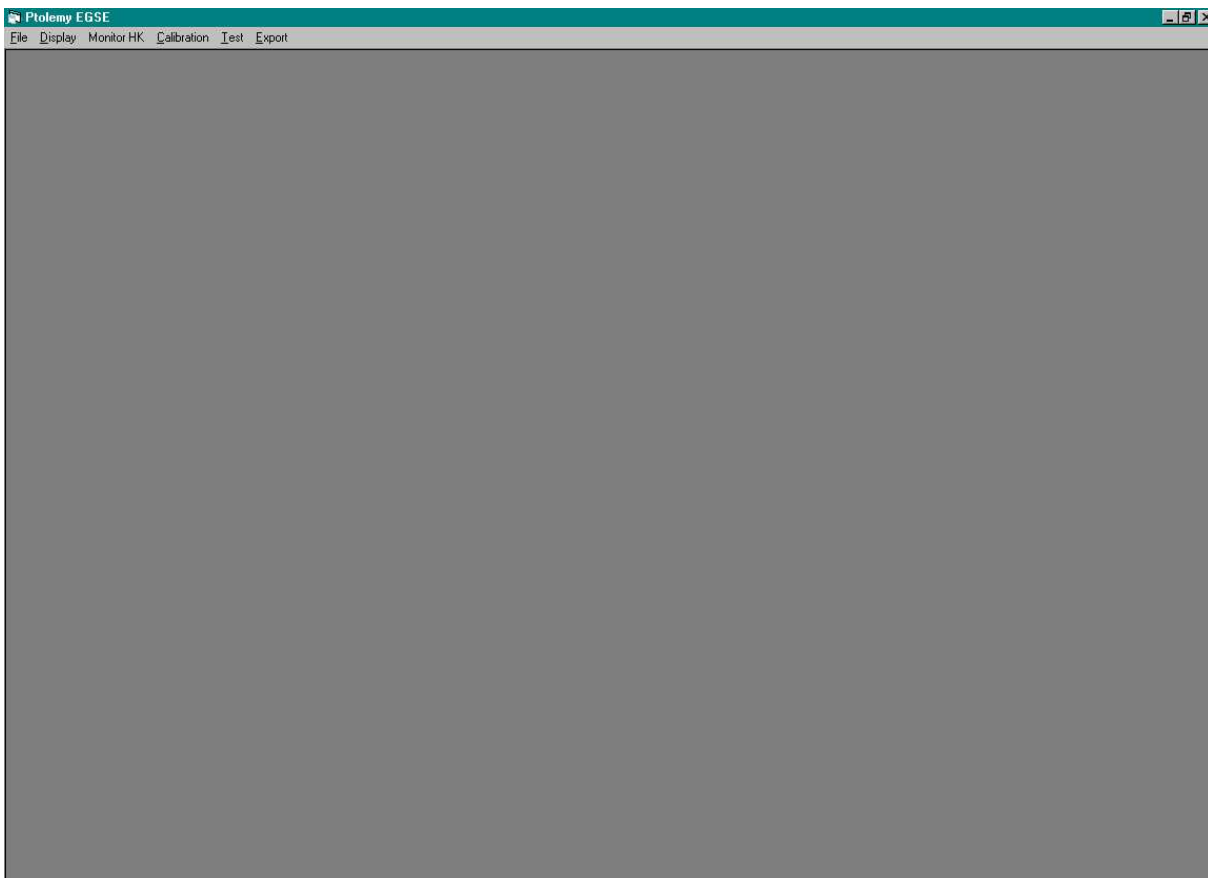
#### 3.2.1 General

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.**

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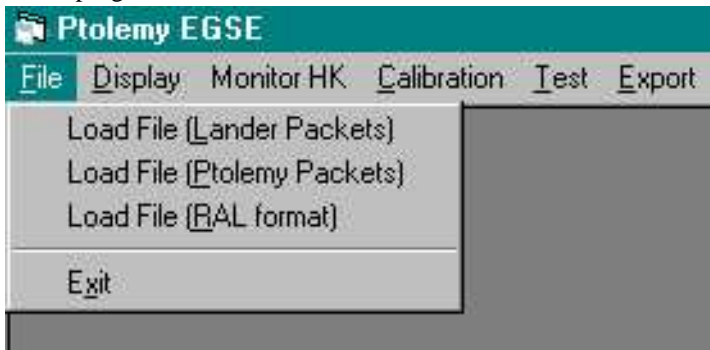
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Once opened there will be an option bar at the top of the form containing pull-down menus titled; File, Display, Monitor HK, Calibration, Test, and Export. This are dealt with individually in the following sections:

### ➤ File

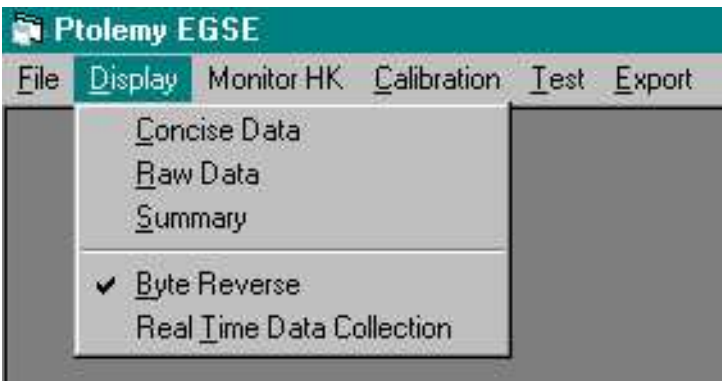
The 'File Menu' shown in Figure 3-5 allows the user to load a source file for display if required (the alternative is to select real-time data collection – see the 'Display Menu'). When selected the 'File Menu' brings up three options that relate to the type of formatting to be employed on the file to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

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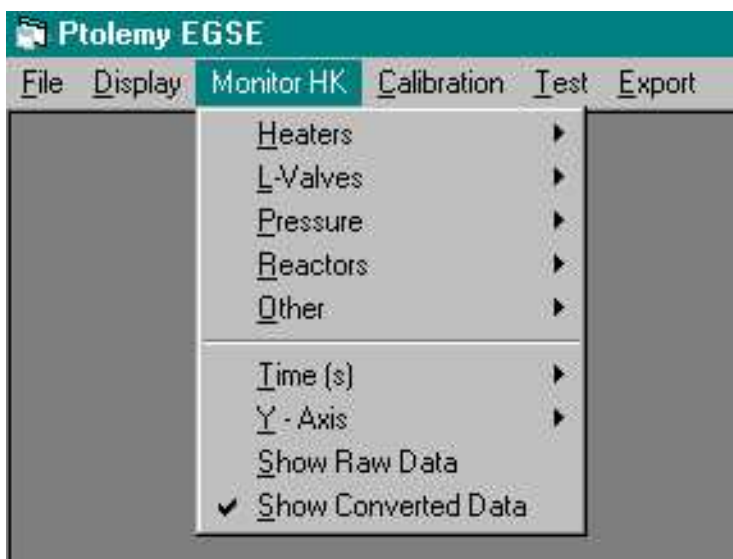
The additional options are:

**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.

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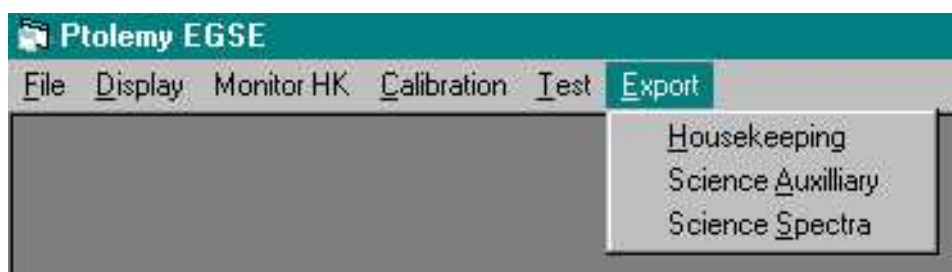
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**Figure 3-9 The Test Menu**

### ➤ 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**

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### 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 applies to packets that travel via the CDMS EGSE.

*Ptolemy Packets* – These are the standard packets as produced from 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.\*\*\*

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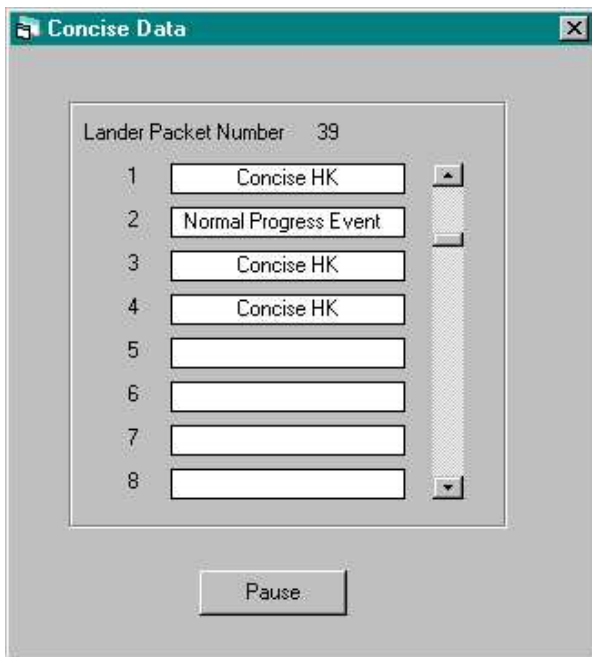
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### 3.2.3 Display

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).



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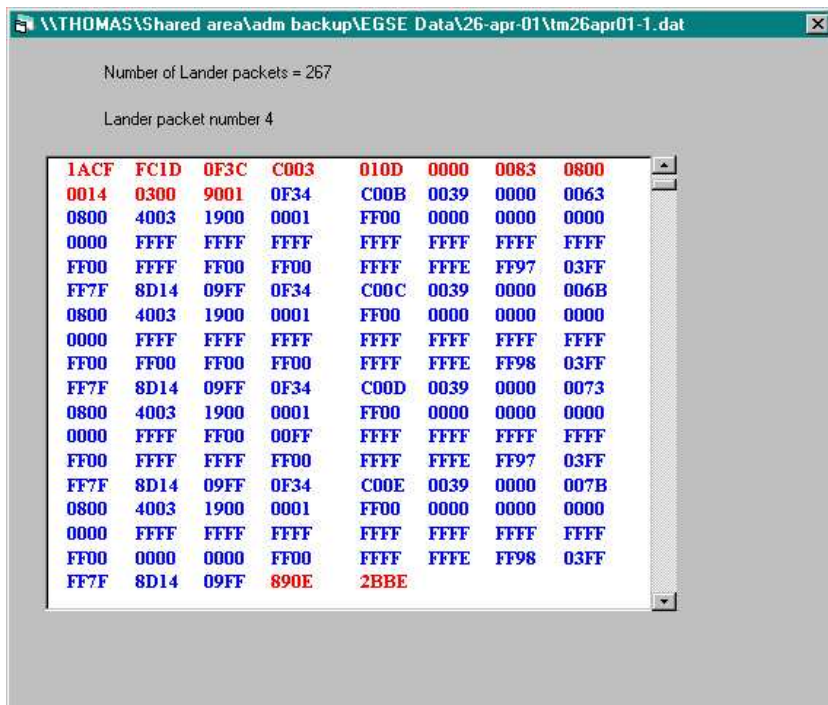
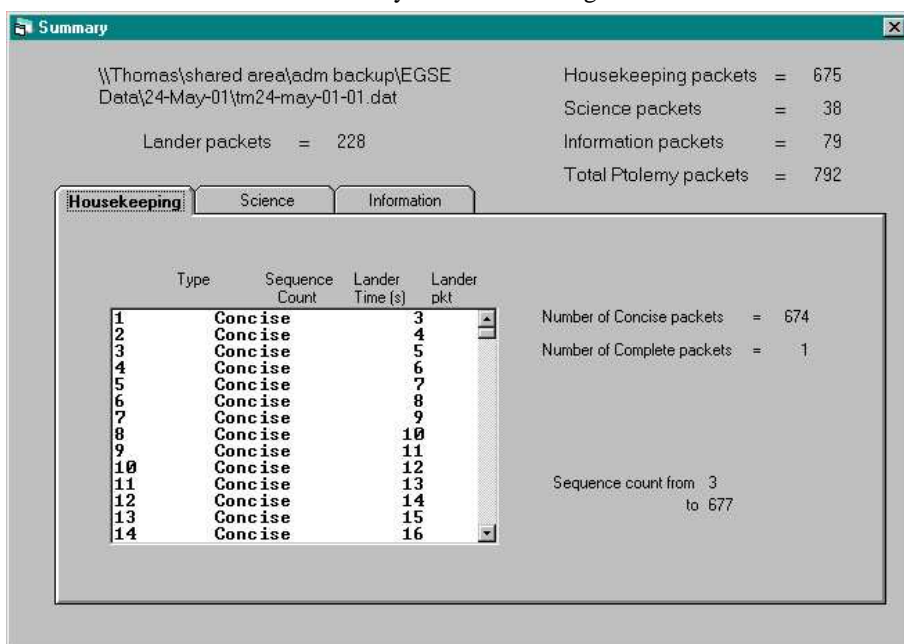


Figure 3-12 The Raw Data Window

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.



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**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.

The screenshot shows a window titled 'Housekeeping' with a close button. It displays the following information:

Number of Housekeeping Packets 675

Packet type - Concise      HK Packet number 290  
Mode 0 - Standby      Sequence Control 292  
Line 81      Lander Time 2554

**Sensor readings**

Reactors		Cold Junction	
Reactor 1	28 +/- 14 °C	Cold Junction	27.8 +/- 2.0 °C
Reactor 2	28 +/- 14 °C		
Reactor 4	28 +/- 14 °C		
Reactor 5	28 +/- 14 °C		
Reactor 6	28 +/- 14 °C		
Reactor 7	28 +/- 14 °C		
Reactor 8	13 +/- 15 °C		
Reactor 9	28 +/- 14 °C		
Reactor 13	28 +/- 14 °C		
Reactor 14	13 +/- 15 °C		
Reactor 15	28 +/- 14 °C		
Sample Oven	13 +/- 15 °C		

Lindau Valves		Pressure Sensors	
L-Valve 1	27.8 +/- 1.8 °C	P Gauge 1	-0.06 +/- 0.03 bar
L-Valve 2	27.8 +/- 1.8 °C	P Gauge 2	0.13 +/- 0.05 bar
L-Valve 5	29.6 +/- 1.8 °C	P Gauge 3	-0.03 +/- 0.03 bar
L-Valve 6	27.8 +/- 1.8 °C	P Gauge 4	-0.04 +/- 0.01 bar
L-Valve 7	33.2 +/- 1.8 °C	P Gauge 5	-44.27 +/- 2.60 mbar

Heaters		Ion trap	
GC Heater	27.8 +/- 3.6 °C	Detector voltage	0.00 +/- 0.02 kV
Manifold 1	27.8 +/- 1.8 °C	Nano-tip current	-1.95 +/- 1.95 uA
Manifold 2	27.8 +/- 1.8 °C	RF calibration	-0.98 +/- 0.98 V
Ion Trap	29.6 +/- 1.8 °C		
Transfer Pipe	27.8 +/- 1.8 °C		

Supply rails		Docking Station Position	
28V voltage	27.54 +/- 0.20 V	Docking Station	8.84 +/- 0.05 mm
28V current	107.42 +/- 9.77 mA		
5V voltage	5.04 +/- 0.04 V		
5V current	126.95 +/- 9.77 mA		

**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.

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The screenshot shows a window titled 'Housekeeping' with a close button. Inside, it displays 'Number of Housekeeping Packets 675'. Below this, it shows 'Packet type - Complete', 'Mode 12 - Ice Core Analysis(HTO)', and 'Line 2'. To the right, it lists 'HK Packet number 295', 'Sequence Control 297', and 'Lander Time 2594'. The main section is 'Sensor readings', which is divided into several categories: Reactors (15 items), Linaur Valves (7 items), Heaters (5 items), Cold Junction (1 item), Pressure Sensors (5 items), Ion trap (3 items), Supply rails (4 items), and Docking Station Position (1 item). Each item shows a value with a range and units. A 'More...' button is located at the bottom right of the sensor readings section.

Number of Housekeeping Packets 675	
Packet type - Complete	HK Packet number 295
Mode 12 - Ice Core Analysis(HTO)	Sequence Control 297
Line 2	Lander Time 2594
<b>Sensor readings</b>	
<b>Reactors</b>	
Reactor 1	28 +/- 14 °C
Reactor 2	28 +/- 14 °C
Reactor 4	28 +/- 14 °C
Reactor 5	28 +/- 14 °C
Reactor 6	28 +/- 14 °C
Reactor 7	28 +/- 14 °C
Reactor 8	13 +/- 15 °C
Reactor 9	28 +/- 14 °C
Reactor 13	28 +/- 14 °C
Reactor 14	13 +/- 15 °C
Reactor 15	28 +/- 14 °C
Sample Oven	13 +/- 15 °C
<b>Linaur Valves</b>	
L-Valve 1	27.8 +/- 1.8 °C
L-Valve 2	27.8 +/- 1.8 °C
L-Valve 5	29.6 +/- 1.8 °C
L-Valve 6	27.8 +/- 1.8 °C
L-Valve 7	31.4 +/- 1.8 °C
<b>Heaters</b>	
GC Heater	27.8 +/- 3.6 °C
Manifold 1	27.8 +/- 1.8 °C
Manifold 2	27.8 +/- 1.8 °C
Ion Trap	29.6 +/- 1.8 °C
Transfer Pipe	27.8 +/- 1.8 °C
Cold Junction	27.8 +/- 2.0 °C
<b>Pressure Sensors</b>	
P Gauge 1	-0.06 +/- 0.03 bar
P Gauge 2	0.13 +/- 0.05 bar
P Gauge 3	-0.03 +/- 0.03 bar
P Gauge 4	-0.04 +/- 0.01 bar
P Gauge 5	-44.27 +/- 2.60 mbar
<b>Ion trap</b>	
Detector voltage	0.00 +/- 0.02 kV
Nano-tip current	-1.95 +/- 1.95 uA
RF calibration	4.88 +/- 0.98 V
<b>Supply rails</b>	
28V voltage	27.54 +/- 0.20 V
28V current	117.19 +/- 9.77 mA
5V voltage	5.00 +/- 0.04 V
5V current	136.72 +/- 9.77 mA
<b>Docking Station Position</b>	
Docking Station	8.84 +/- 0.05 mm

**Figure 3-15 House keeping - Complete Packet 1**

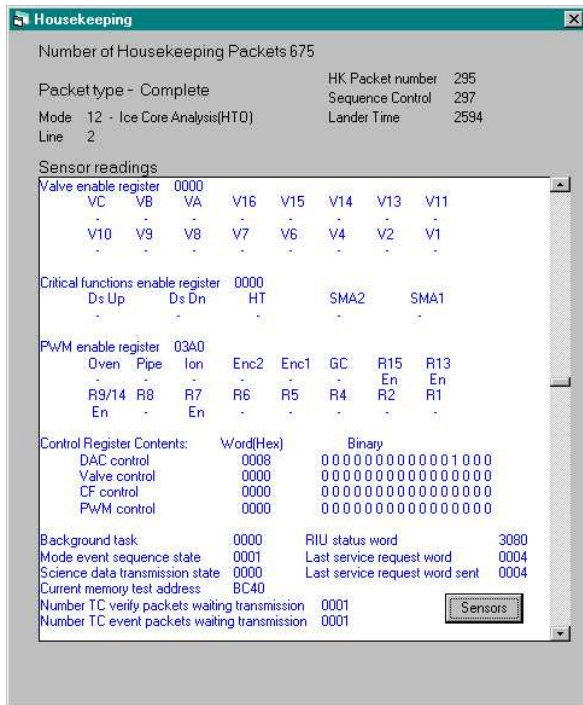
- By pressing the 'More...' button located at the bottom of the form you can see page 2 as shown in Figure 3-16. Page 2 shows the contents of the enable registers such as 'Valve Enable', 'Critical Function' and 'PWM Enable'. Those items enabled will show an 'En' below them, items not enabled will show 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.

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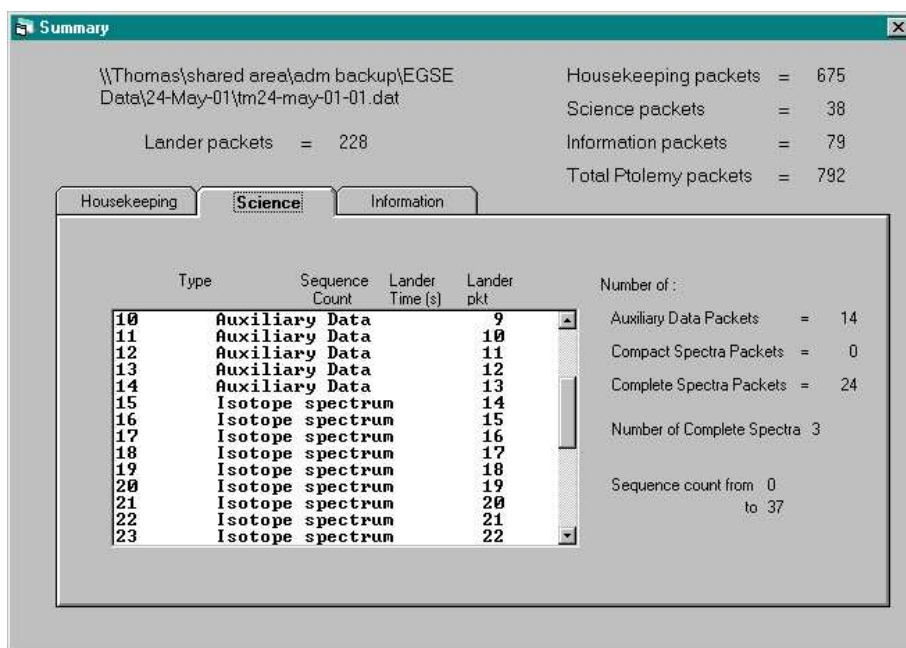
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**Figure 3-16 House keeping - Complete Packet 2**

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**

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- 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.

The screenshot shows a window titled 'Auxiliary Data Packet'. At the top left, it says 'Number of Auxiliary Data Packets 14'. At the top right, it shows 'Aux Data number: 1', 'Sequence Control: 0', and 'Lander Time: 1068'. Below this, it says '21 Sensor readings'. The main part of the window is a table with the following columns: Component, Reading, Units, Lander time(s), Chan. ID, Word, and ADC Voltage(V). The table contains 21 rows of data, including readings for 5V current, 28V current, and Reactor 5 temperature. At the bottom, there is a note: 'N.B. Housekeeping data is not used to compensate for the effect of the cold junction' and 'AD590 compensation temperature 0.00 °C'.

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

N.B. Housekeeping data is not used to compensate for the effect of the cold junction  
AD590 compensation temperature 0.00 °C

**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.

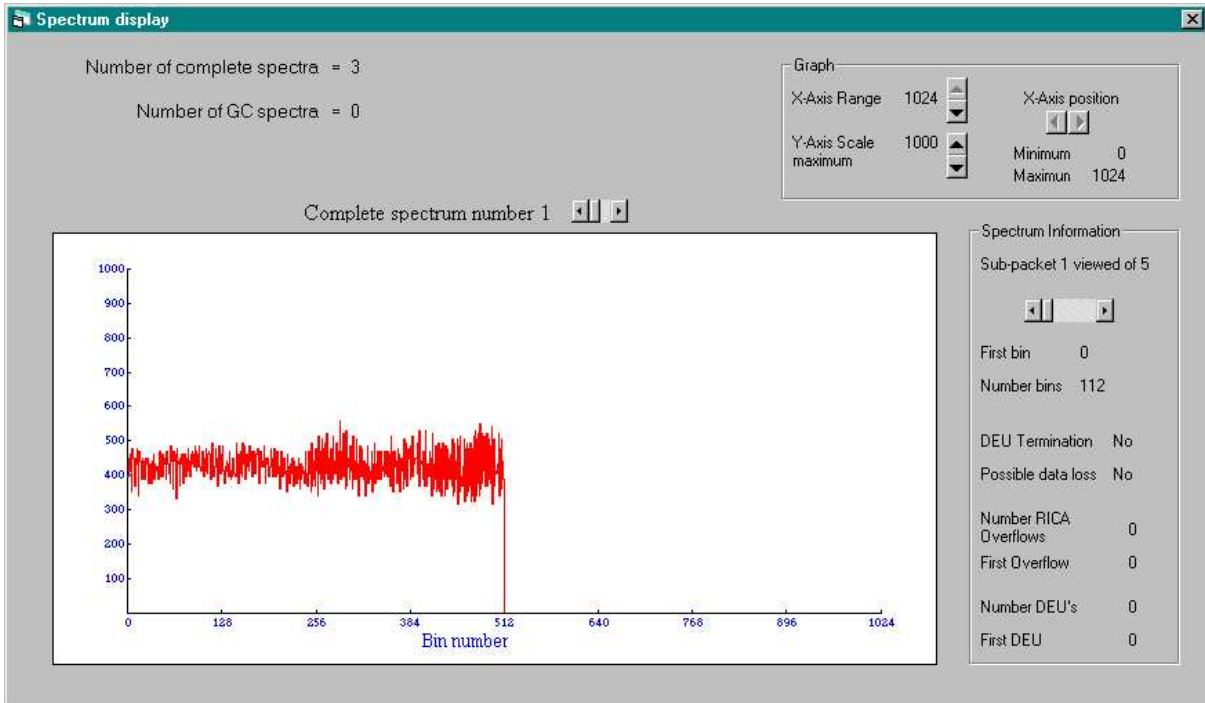


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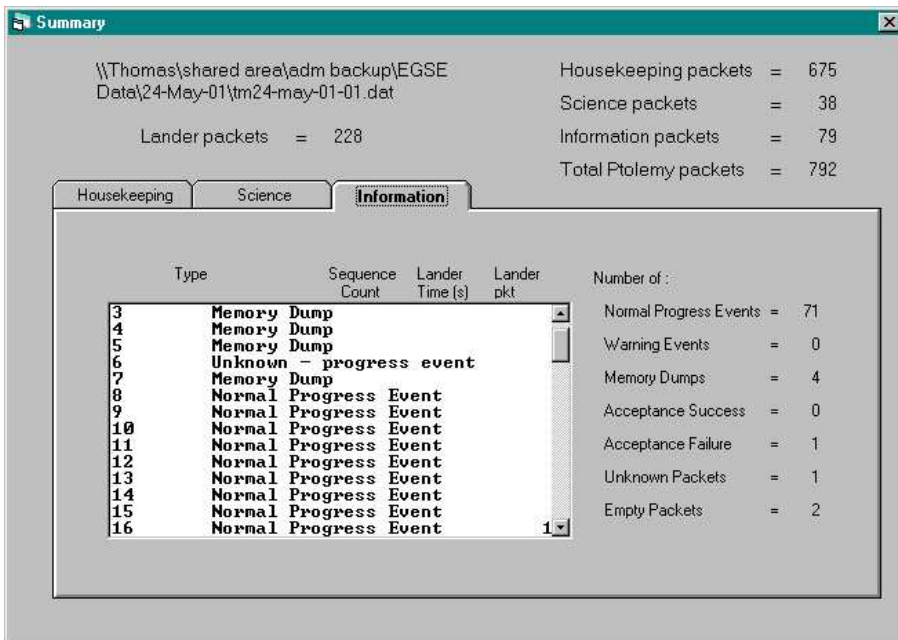
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**Figure 3-19 Science – Isotope Spectra**

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



**Figure 3-20 The Summary Window – Information**

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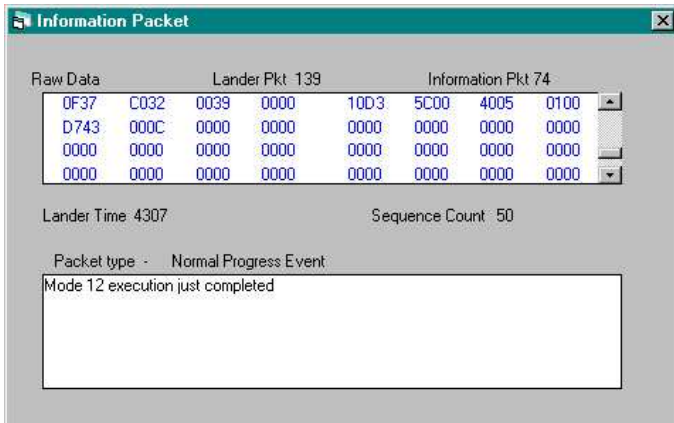
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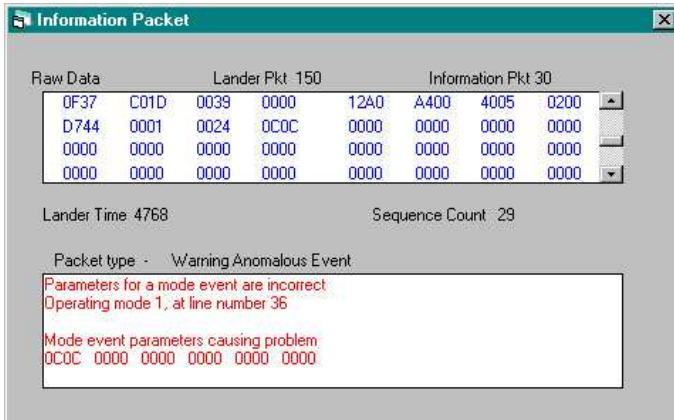
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- Clicking on a line in the central window marked 'Normal Progress Event' brings up a form similar to the one shown in Figure 3-21. The top window contains the raw, hex, contents of the packet. The bottom window contains any interpreted information (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**

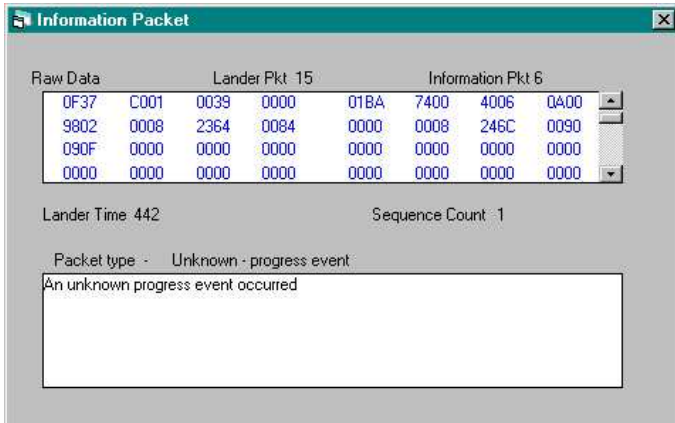
- Occasionally an event packet may arrive for which the exact format has not been coded into the software. Such packets will appear in the list as 'Unknown – progress event'. This is perfectly normal and will present itself in a form similar to Figure 3-23.

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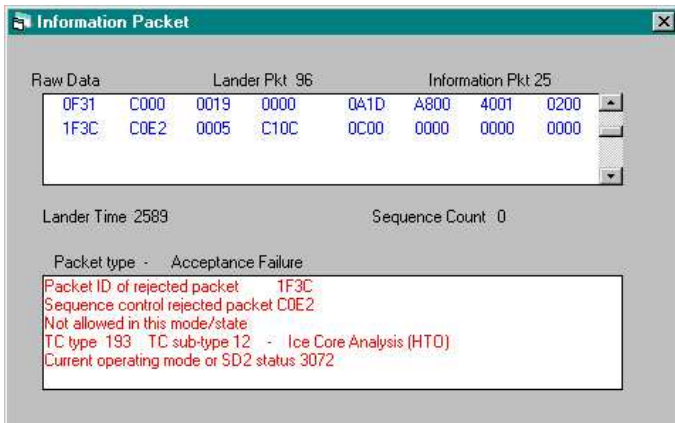
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**Figure 3-23 Information – Unknown Progress Event**



**Figure 3-24 Information – TC Acceptance Failure**



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### **3.2.4 Monitor HK**

\*\*\*Function due to be removed during the next software update\*\*\*

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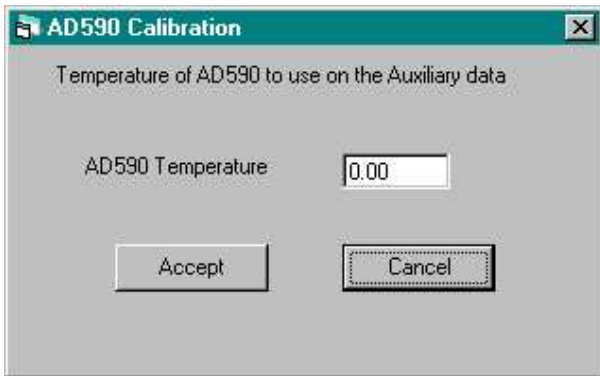
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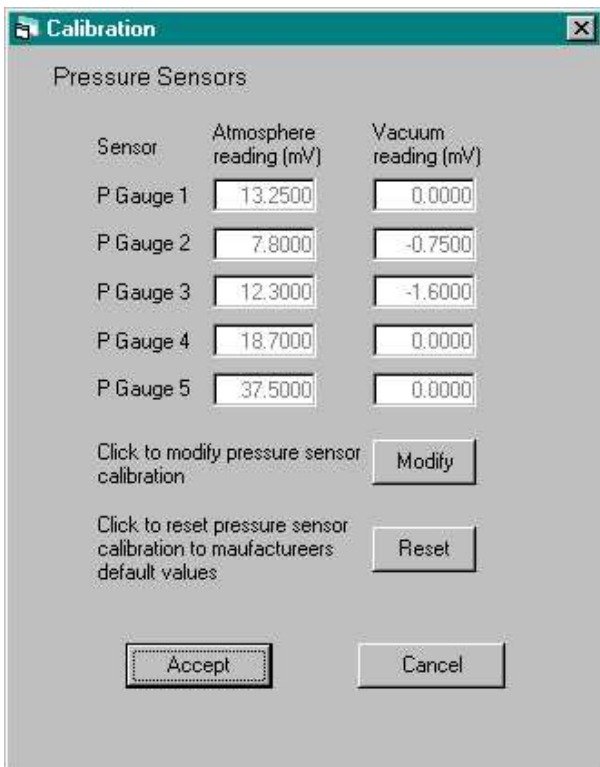
### 3.2.5 Calibration

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'.



Sensor	Atmosphere reading (mV)	Vacuum reading (mV)
P Gauge 1	13.2500	0.0000
P Gauge 2	7.8000	-0.7500
P Gauge 3	12.3000	-1.6000
P Gauge 4	18.7000	0.0000
P Gauge 5	37.5000	0.0000

**Figure 3-26 Calibration – Pressure Sensors**

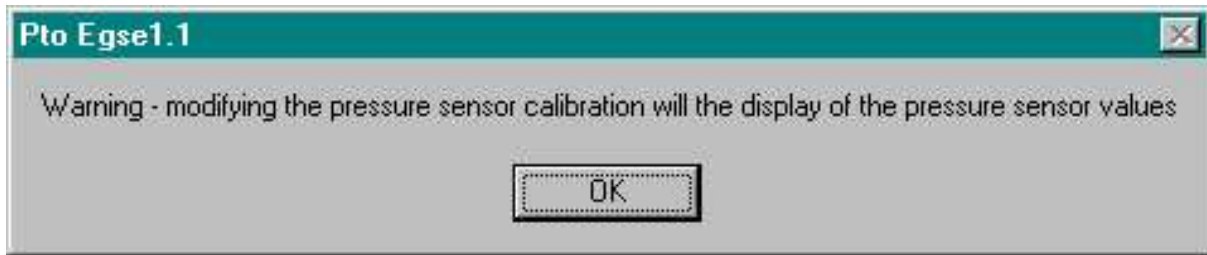
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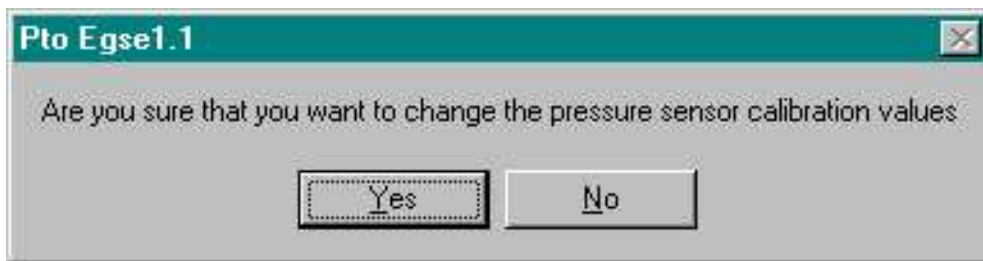
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Having pressed the 'Modify' button or 'Reset' button the following warning message will appear (see Figure 3-27). To continue press the 'OK' button.



**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**

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### 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.

Seq. Count	Lander time (s)
1	Short form test

Figure 3-29 Short Form Test Selection Window - Example

Seq. Count	Lander time (s)
------------	-----------------

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.

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Voltage supply rails	Test result	Sub-system	Test result
5V Voltage	5.05 V	Sensors	Pass
5V Current	135.27 mA	Valves	Pass
28V Voltage	27.63 V	Injector Valves	Pass
28V Current	116.58 mA	Heaters	Pass
RF Frequency	571.16 kHz	Large Reactors	Pass
		Small Reactors	Pass
		L-Valves	Pass
		Voltages and RF	Pass

Figure 3-31 ‘Short Form Test’ Form – Summary

Sensor	Readings	Test Result
Pressure Gauge 1	1.00 1.00 bar	Pass
Pressure Gauge 2	0.99 0.99 bar	Pass
Pressure Gauge 3	1.01 1.01 bar	Pass
Pressure Gauge 4	0.99 0.99 bar	Pass
Pressure Gauge 5	871.91 876.95 mbar	Pass
AD590 Temperature	26.32 27.42 °C	Pass
Docking Station	4.85 4.84 mm	Pass
Nanotip Current	0.03 0.06 µA	Pass
Detector Voltage	0.00 0.00 kV	Pass
RF Calibration	-0.37 -0.18 V	Pass

‘Short Form Test’ Form – Sensors

Valve	28V Current (mA)	5V Current (mA)	Test Result
V 1	31.1	6.6	Pass
V 2	30.2	0.0	Pass
V 3	33.1	4.1	Pass
V 4	29.1	2.0	Pass
V 7	30.1	-1.7	Pass
V 8	29.0	-5.3	Pass
V 9	30.7	0.9	Pass
V 10	28.8	-2.6	Pass
V 11	30.4	-1.8	Pass
V 13	30.8	-1.2	Pass
V 15	28.8	5.5	Pass
V 16	28.4	-2.0	Pass

‘Short Form Test’ Form – Valves

Injector Valve	28V Current (mA)	5V Current (mA)	Test Result
VA	96.0	-0.5	Pass
VB	94.9	4.1	Pass
VC	95.1	0.0	Pass

Heater	28V Current (mA)	5V Current (mA)	Temperatures (°C)	Test Result
			Initial Final Increase	
Manifold 1	355.4	42.0	27.7 33.4 5.8	Pass
Manifold 2	355.5	46.2	27.2 33.3 6.1	Pass
GC heater	334.2	45.3	27.8 35.0 7.2	Pass
Ion Trap	392.3	45.9	26.9 52.6 25.8	Pass
Transfer Pipe	208.0	48.5	27.9 27.9 0.0	Pass
Reactor 8	326.1	46.8	26.5 27.9 1.4	Pass

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‘Short Form Test’ Form – Injector Valves								‘Short Form Test’ Form – Heaters							
Summary	Sensors	Valves	Injector V	Heaters	L-Reactors	S-Reactors	L-Valves	Summary	Sensors	Valves	Injector V	Heaters	L-Reactors	S-Reactors	L-Valves
Large Reactor	28V Current (mA)	5V Current (mA)	Temperatures (°C)			Test Result		Small Reactor	28V Current (mA)	5V Current (mA)	Temperatures (°C)			Test Result	
			Initial	Final	Increase						Initial	Final	Increase		
Reactor 1	n.m.	n.m.	26.3	47.9	21.6	Pass		Reactor 7	n.m.	n.m.	26.4	75.2	48.8	Pass	
Reactor 2	n.m.	n.m.	27.2	49.6	22.4	Pass		Reactor 9	n.m.	n.m.	26.5	47.8	21.3	Pass	
Reactor 4	n.m.	n.m.	26.8	50.6	23.8	Pass		Reactor 13	n.m.	n.m.	25.4	69.2	43.9	Pass	
Reactor 5	n.m.	n.m.	27.0	27.4	0.5	Pass		Reactor 14	n.m.	n.m.	26.1	48.3	22.3	Pass	
Reactor 6	n.m.	n.m.	27.3	50.8	23.5	Pass		Reactor 15	n.m.	n.m.	25.6	69.9	44.3	Pass	

‘Short Form Test’ Form – Large Reactors								‘Short Form Test’ Form – Small Reactors							
Summary	Sensors	Valves	Injector V	Heaters	L-Reactors	S-Reactors	L-Valves								
L-Valve	28V Current (mA)	5V Current (mA)	Temperatures (°C)			Test Result									
			Initial	Final	Increase										
L-Valve 1	0.5	68.7	25.5	29.4	3.9	Pass									
L-Valve 2	0.2	71.6	25.7	29.4	3.6	Pass									
L-Valve 5	0.9	90.8	25.6	31.5	5.9	Pass									
L-Valve 6	0.8	70.3	25.5	29.8	4.3	Pass									
L-Valve 7	1.4	87.7	26.6	32.7	6.1	Pass									

‘Short Form Test’ Form – Lindau Valves															
Summary	Sensors	Valves	Injector V	Heaters	L-Reactors	S-Reactors	L-Valves								

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

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### 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.

**Export housekeeping data to excel**

**Data format**

- ☒ Raw Data
- ☐ Calibrated Data (no AD590 correction)
- ☐ Calibrated Data (with AD590 correction)

**Deliminator**

- ☒ Tab
- ☐ Comma
- ☐ Semicolon

**HK Packets**

From:

To:

All: ☒

☐ Reactor 1    ☐ GC Heater    ☐ L-Valve 1

☐ Reactor 2    ☐ Manifold 1    ☐ L-Valve 2

☐ Reactor 4    ☐ Manifold 2    ☐ L-Valve 5

☐ Reactor 5    ☐ Ion Trap Heater    ☐ L-Valve 6

☐ Reactor 6    ☐ Transfer Pipe    ☐ L-Valve 7

☐ Reactor 7    ☐ AD590

☐ Reactor 8    ☐ Docking Station

☐ Reactor 9    ☐ Pressure Gauge 1    ☐ Nano-tip current

☐ Reactor 13    ☐ Pressure gauge 2    ☐ Detector voltage

☐ Reactor 14    ☐ Pressure Gauge 3    ☐ 5V supply voltage

☐ Reactor 15    ☐ Pressure Gauge 4    ☐ 28V supply current

☐ Oven Heater    ☐ Pressure Gauge 5    ☐ 5V supply current

☐ 28V supply current

☐ RF Calibration

**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'

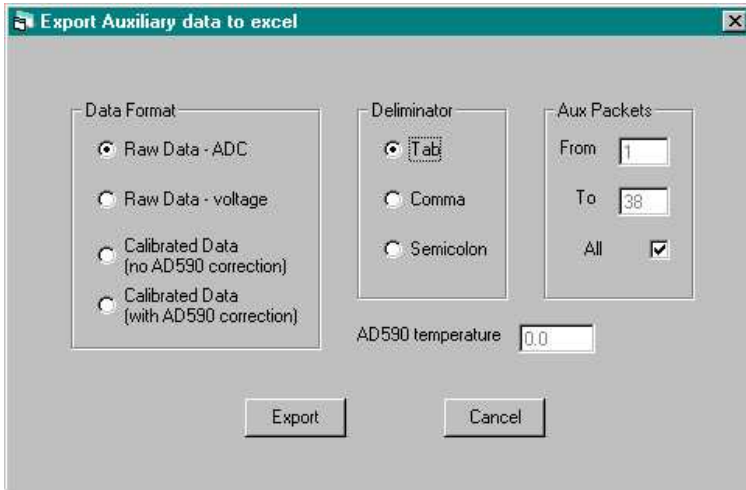
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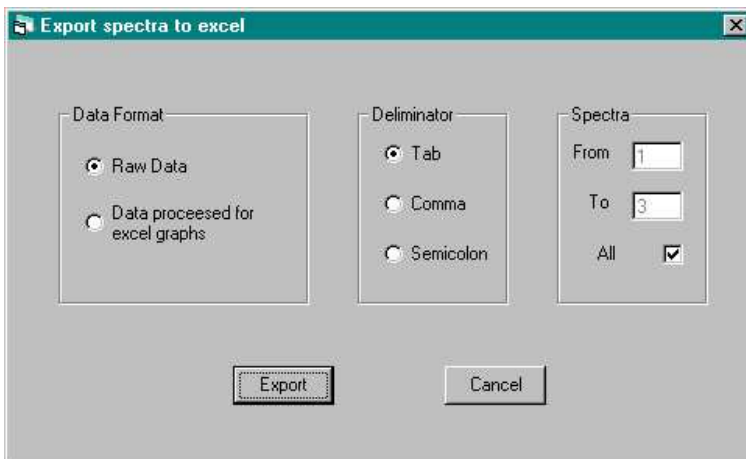
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heading. You can select all packets (using the tick box) or a specified range using the 'From' and 'To' text boxes (the numbers that automatically appear in the text boxes show the largest possible range' in this example 1 to 38). For the purposes 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 'Delimiter' 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**



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## 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 is 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.

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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.

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## 5 Appendix A- Parameter Table Addresses

RTX-C Link Utility v1.2g  
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### 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

00000	__init_page
00000	__code_begin
00000	__strg_page
00000	__data_page
00001	__code_page
00220	__strg_begin
00220	_CommandMessages
00220	__init_begin
00AA6	_PtolemyPrivate
00AA8	_Standby
00AAA	_GroundTest
00AAC	_HTOConditioning
00AAE	_MTOConditioning
00AB0	_CASEConditioning
00AB2	_HeliumTankRupture
00AB4	_AdditionalScience
00AB6	_SafeMode
00AB8	_ConnectionTestRequest
00ABA	_EnabledDisable
00ABC	_Update
00ABE	_AcknowledgeAcceptance
00AC0	_IsolateAppID
00AC2	_IsolateType
00AC4	_ExtractType
00AC6	_IsolateSubType
00AC8	_ExtractSubType
00ACA	_IsolatePad

### Symbols by Name

<	1C7EA
<=	1C7F8
<>	1C7BA
=	1C7B0
>	1C7E0
>=	1C7F4
_AcceptanceFailure	01E10
_AcceptanceSuccess	01E0E
_AccumulatedBlockLength	0862C
_AcknowledgeAcceptance	00ABE
_ActionCode	085E2
_AdditionalScience	00AB4
_AddressWord	085E0
_AuxiliaryData	01EDE
_BackgroundTaskDuration	01ED4
_BackgroundTaskTimeout	01ED6
_BackupRAM	08048
_BackupRAMRecordTransmitted	05B0E
_Bank1Correction	00DD0
_Bank2Correction	00DD2
_BinCount	0CAD0
_BinNumber	0CACE
_BlockSize	0B1B4
_CASEConditioning	00AB0
_CalculateCRC	1161E
_CannotBeExecuted	01E1A
_CarouselRotationCompleted	05B04

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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	_SetSoftwareNMIL	_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	0CAD4
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

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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
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125D0	_ManageSetICVOpeningDurationMode	_TestWaveStartAddress	0CADE
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13B0A	_ManageAuxiliaryDataModeEvent	_TimerDuration	09942
13C42	_ManageTimeDelayModeEvent	_TimerPeriod	01EBC
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18D18	_ManageHeatingMaintainedModeEven	_WGAMemoryIntegrityFailure	01DF2
19338	_CheckModeEventParameters	_WGARead	15DF6
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1B412	_ManageStoredTelecommandRequest	_WaveAddresses	088F6
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1B5F4	_ManageShutdown	_WordsStored	085D6
1B850	_ControlRIU	_Write	1C5E0
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1BDC4	_ManageStatusDataWord	_WriteToMemory	1C5F0
1BED4	_ControlScienceInterface	_WriteandVerifyScanFunction	15634
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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
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1C782	ui*~	cdshl	1C84C
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1C792	cshr	cdshru	1C85A
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1C7B0	=	cshru	1C79C
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1C7CC	u>	d-	1C886
1C7D2	u>=	d/	1C9B2
1C7DA	u<	d/mod	1C8F0
1C7E0	>	d<	1CA46
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1C7F4	>=	d<>	1CA5A
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1C808	c>i	d>f	1CF50
1C81C	strass	d>i	1C878
1C83E	cdshr	d>r	1CAA4
1C84C	cdshl	dand	1CA78
1C85A	cdshru	dmod	1C9EE
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1C874	duplong	dor	1CA84
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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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# MODULUS – Ptolemy

## EGSE Software User Manual (SUM)

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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