User's Manual

G-Code CONVERTER

For XPS Controllers

V3.00
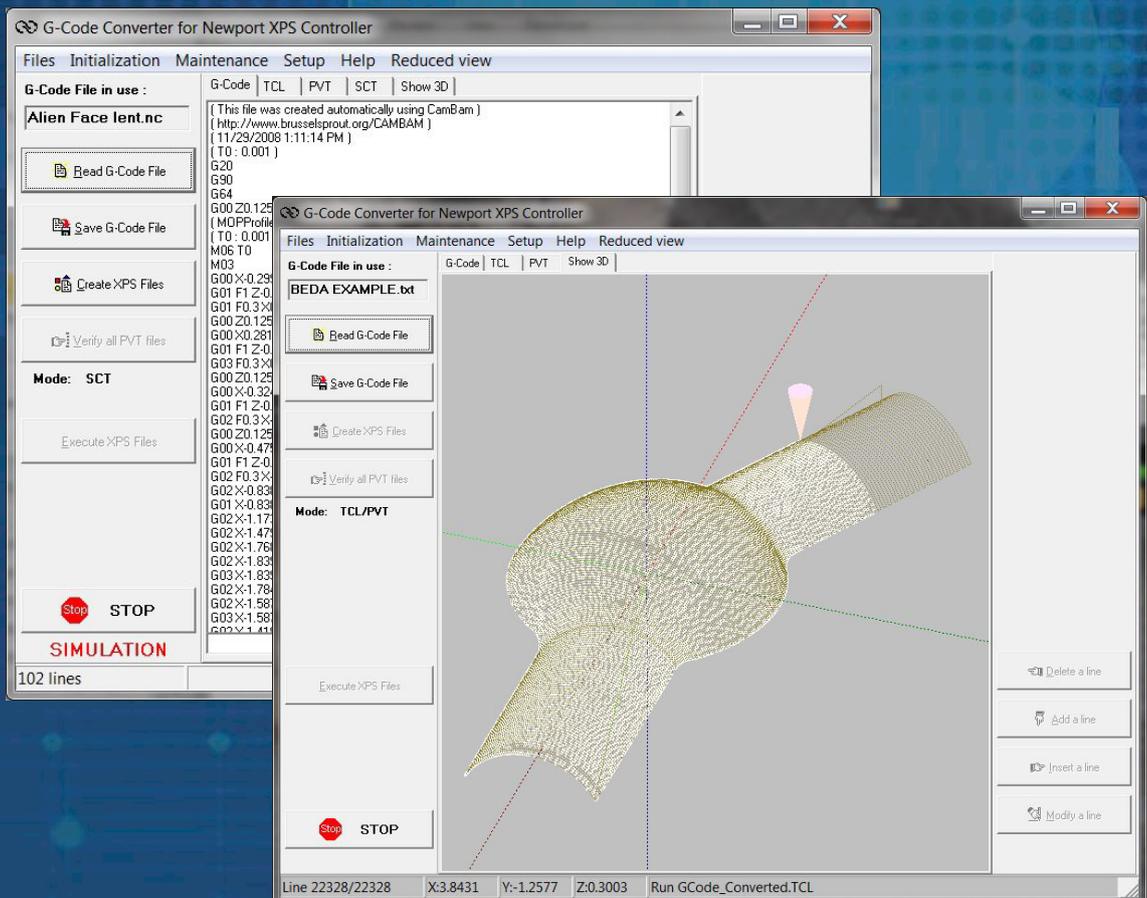
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- Description of problem.
- Environment in which the system is used.
- State of the system before the problem.
- Frequency and repeatability of problem.
- Can the product continue to operate with this problem?
- Can you identify anything that may have caused the problem?

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Materials being returned under an RMA must be securely packaged for shipment. If possible, reuse the original factory packaging.

1 XPS-GCODE
G-Code CONVERTER for the XPS Controller

1.1 Introduction

XPS-GCODE was developed to enable the use of G-Code files on a 2 or 3-axis positioning system controlled by Newport XPS Controller/Driver.

XPS-GCODE reads and converts G-Code commands, allowing 3-dimensional objects to be previewed and generated according to routines defined by the source G-Code.

This includes multi-axis motion, defined along lines and arcs, as well as tool (on/off) control, speed control and Digital/Analog output control, with process calculations. TheG-Code is read, filtered and optimized for the XPS Controller. See the G-Code Command List chapter for supported commands (all other commands are not included).

XPS-GCODE converts G-Code files into XPS native file formats. These formats "*.Tcl" and "*.PVT", can be easily edited in standard text editing software and allow the software to take full-advantage of XPS advanced capabilities such as Trajectory Mode.

XPS-GCODE default Graphic User Interface offers efficient and simple access to necessary commands. The extended view gives access to parameter setup, file editing and trajectory viewing.

A built-in TCP-IP Server allows XPS-GCODE to be controlled from a TCP-IP Client. An example of TCP-IP client is provided.

Note	**G-Code files have been primarily developed for CNC machines. Although the Newport XPS controller does not behave exactly like a CNC machine, most motion commands will be converted and executed. The XPS-GCODE allows G-Code files editing to take advantage of XPS features.**

1.2 Environment

XPS-GCODE works in Windows 7, 8 and 10 operating environments.

Note	**As XPS-GCODE is a 32-bit application, XPS-GCODE.EXE file properties must be set to:** • **Run this program in compatibility mode for Windows XP (service Pack 3)** • **Run this program as an administrator** **(Right click on XPS-GCODE.EXE, select Properties, Compatibility tab and then change settings for all users)**

1.3   Requirements

1.3.1   Computer

PC compatible computer with 2 GB RAM and at least 20 MB free hard disk space, Windows 7, 8 or 10.

1.3.2   Motion Controller

XPS-GCODE software supports the Newport/MICRO-CONTROLE XPS types: "C", "Q", "RL", "RL-D" and "D" Universal Motion Controller.

Note   **XPS controller must be configured with at least one "multi" type of group containing 2 or 3 axes. Refer to Chapter 7.3 (motion Groups) of the XPS Controller User's Manual.**

1.3.3   License Key Number

XPS-GCODE software requires a valid license key number (LKN). One LKN is required per XPS controller. The LKN is issued by Newport tech support.

Note   **Several PCs can run XPS-GCODE using the same LKN if they control the same XPS.**

1.3.4   Software Installation

From the Newport Website:

- Download the compressed XPS_GCODE Software Package.
- Extract the G-CODE directory to your preferred location (recommended path is: C\Newport\XPS-GCODE).

1.3.5   Connections

- Ethernet link: PC computer to Newport XPS controller (Host).
- Newport stages to XPS controllers: Consult the XPS User's Manual.
- XPS-GCODE will automatically detect the MAC address of the attached XPS and prompt a License Key Entry (LKN).
- License Keys are provided by Newport Tech Support after purchase.
- Enter Key to access full-feature set of XPS-GCODE.

2 Launching XPS_GCODE

Using XPS-GCODE is very simple. However, it requires some parameters to be set when used for the first time (see chapter below). Once these parameters are set, just proceed as follows:

- Connect the XPS controller to the PC, power on and wait for the controller to complete the boot process (approximately one minute, the XPS emits a final beep).

- Launch XPS-GCODE and wait for communication to be established.

Note   **With Windows-7, XPS-GCODE has to be given rights to communicate with the Ethernet port. To do so, right click on XPS-GCODE icon and then select "Run as administrator", then click "Yes" to proceed.**

2.1 Setting Parameters

Using **XPS-GCODE** EXEC on a Newport XPS controller for the first time requires several steps to set some parameters.

Note   **These parameters must be set only once as they are memorized by XPS-GCODE.**

- Computer Ethernet TCP/IP communication setting.
- Establishing communication with Newport XPS controller.
- XPS-GCODE License Key Number (LKN) setting.

Note   **XPS-GCODE LKN is granted for the use with ONLY ONE XPS controller. However, it can be installed on multiple computers.**

- XPS Communication DLL date verification.
- XPS group and axes name settings in XPS-GCODE.

Note   **XPS controller must be set with a "multi" type of group containing three axes.**
Add dummy stages to the XPS as needed since XPS-GCODE requires 3 stages to run.

2.2 Computer TCP/IP Address

To establish communication with the XPS controller, the computer Ethernet TCP/IP address must be set correctly according to hardware communication configuration.

Note　　　**User must have computer administrator right to modify these parameters.**
Refer to the XPS manual as needed.

2.2.1　Computer linked directly to XPS "Remote" port.

In this case, a cross-over Ethernet cable must be used.

Computer TCP/IP address must be set at "192.168.254.X" (with X different from254).
Subnet mask must be set at "255.255.255.0".

2.2.2　Computer linked directly to XPS "Host" port.

In this case, a cross-over Ethernet cable must be used.

Computer TCP/IP address must be set at an address corresponding to XPS "Host"TCP address.
The first 3 sets of numbers must be the same, but the last one different.
i.e.: "150.10.23.45" for XPS and "150.10.23.44" for computer.

Subnet mask must be set to "255.255.255.255".

Note　　　**Consult XPS user's manual for XPS "Host" port address setting.**

2.2.3　Computer linked to XPS "Host" port though a network.

In this case, a straight through Ethernet cable must be used.

Computer and XPS TCP/IP addresses must be set at different addresses compatible with the current network settings (consult your network administrator).

Recommended Subnet mask setting is: "255.255.255.0".

2.3 Establishing communication with Newport XPS controller

Double click XPS_GCODE.EXE to launch G-CODE (When XPS_GCODE is launched for the first time, Windows may prompt you to set permissions). The connection window appears.

2.3.1　Connection established:

When XPS_GCODE can establish the connection with the XPS controller using the saved parameters (in the XPS_GCODE.INI file), the connection window appears displaying the detected XPS controller type and allowing:

- Connection to the detected port and address
- Running the program in simulation mode
- Quit XPS_GCODE
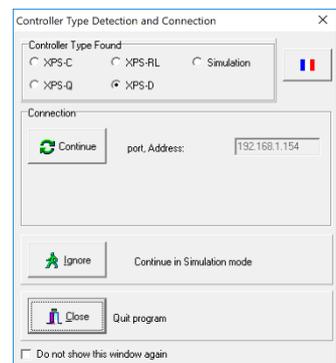
Note　　　**Checking the "Do not show this window again" box allows skipping this step when running XPS_GCODE the next time. It must be checked when using window direct commands.**

2.3.2 Connection not established:

When launching XPS_GCODE for the first time or when the connection with the controller cannot be established with the last used parameters (saved in the XPS_GCODE.INI file), after an error message (acknowledge it), a new window appears allowing the following:

- Connection through the HOST port after entering its address

- Connection through the REMOTE port

- Running the program in simulation mode

- Quit XPS_GCODE
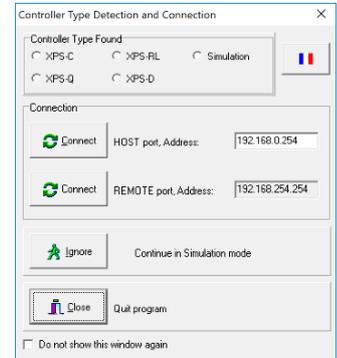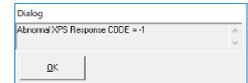
2.3.3 Troubleshooting:

Although the Port 5001 communication channel will be ultimately use by XPS_GCODE, there is a possibility to change the detection method to verify that any firewall or anti-virus is not blocking the communication.

A right click on the Connection panel allows:

- Selecting the Detection method (Never, Always, Ping, FTP, TELNET, Port 5001 or Port 80)

- XPS Present? verifies the presence of a controller at the selected address through the selected method. A message window informs:

  o If the controller cannot be reached an error message appears. Check IP address…

  o Once the controller is detected, press the "Connect" button to access XPS-GCODE main window.
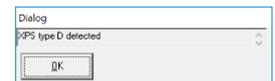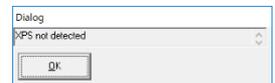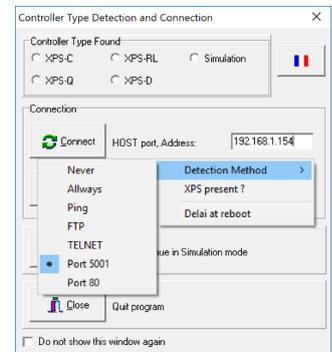
Note   **Controller can be determined only using the "Port 5001" method.**

              Detection method is memorized in the XPS-GCODE.INI file and will be used at the next start

              Set a delay for the program to wait for controller rebooting is not used in XPS-GCODE

a) XPS-D Particularity:

XPS-D controller scripts can be accessed directly from windows (7 and higher) through a mapped drive.

After detecting and connecting to an XPS_D, XPS-GCODE will ask for the letter associated to the mapped drive through a new window (default: "Z:"). Enter the correct letter and press "OK".

If the drive can be accessed, XPS-GCODE starts.
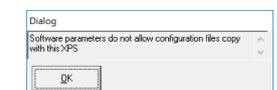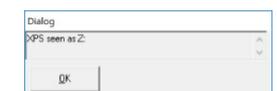
Note   **A message reminds you that this version of GCODE_XPS does not communicate through SFPD protocol therefore XPS configuration files cannot be accessed for maintenance purpose**

.

XPS type and mapped

Otherwise, an error message appears and then XPS-GCODE runs in SIMULATION Mode.

Mapping a XPS	Disconnected Drive	Connected Drive
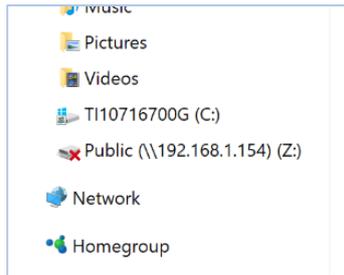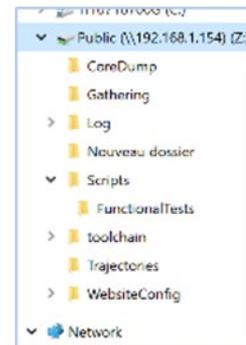
2.4 License Key Number (LKN) setting

XPS-GCODE will automatically detect the MAC address of the attached XPS.

For the first connection, XPS-GCODE as the License Key (LKN) is not registered a message is displayed,

> **Note**   License Keys are provided by Newport Tech Support after purchase.

Click OK to access the License Key

> **Note**   Give the XPS Mac address to Newport Tech Support to purchase the License Key and get the Key.

> **Note**   In case of error check the mapped drive state on your file explorer, you may have to re-connect it… (Especially when the controller has been rebooted…)
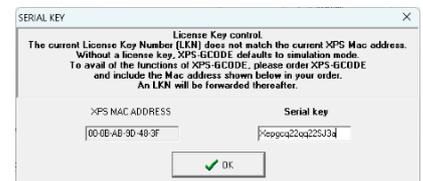
Type the Key to access all features of XPS-GCODE.
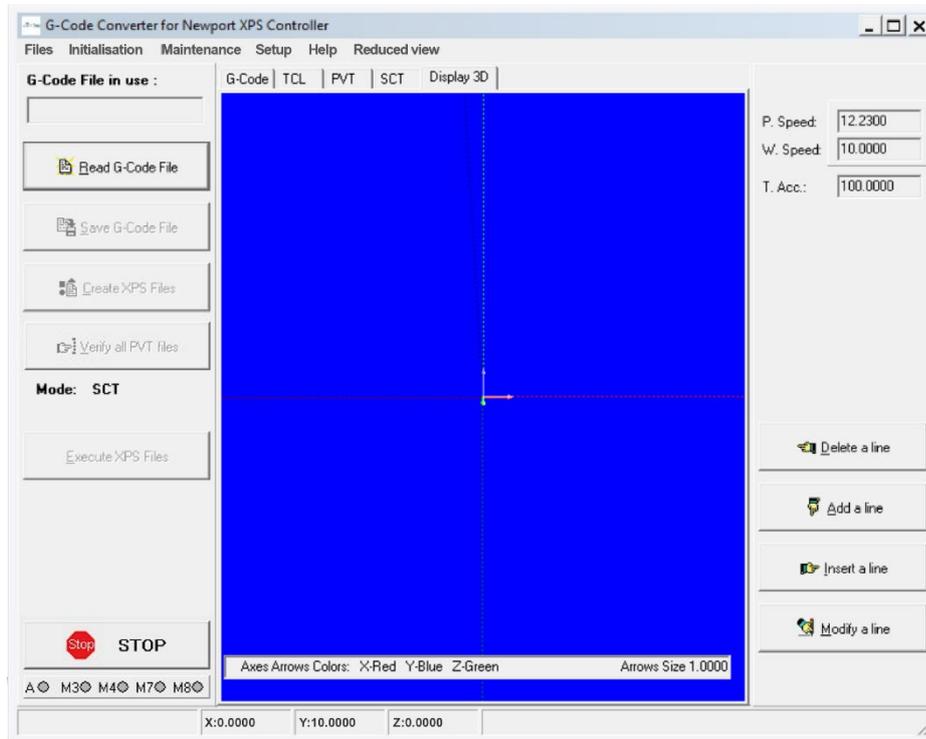
3 Main Window Description

3.1 Extended View

Current speed and acceleration parameters

File type and display tab selection

File display area

G-Code file edit buttons

XPS Axes Status bar

XPS output state
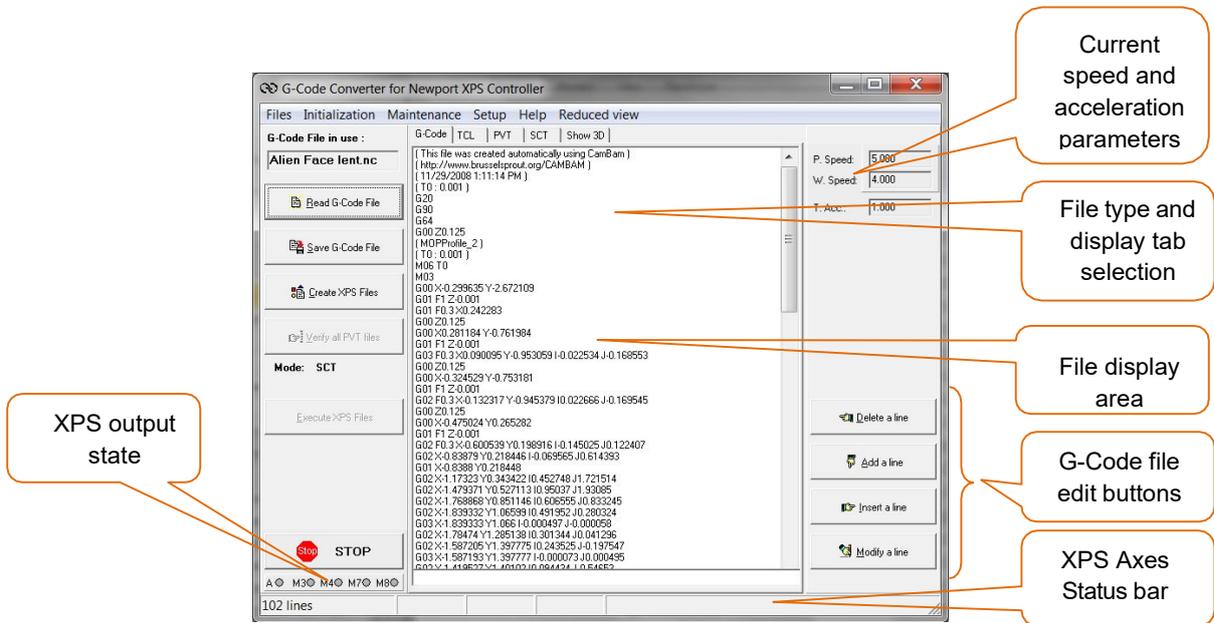
Note   A click on the "**Reduced view**" menu switches back to XPS-GCODE basic features.

Extended view can be re-sized by grabbing and dragging the bottom right corner of the main window.

If the command "**Use Feed Rate Codes ("F")**" in the setup menu has been checked, positioning and working speeds will be set by the G-code file and are not displayed.

3.2 Reduced View

Main menu

File management buttons

Emergency stop button
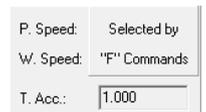
Note   A click on "**Extended view**" menu provides access to XPS-GCODE editing and displays features.
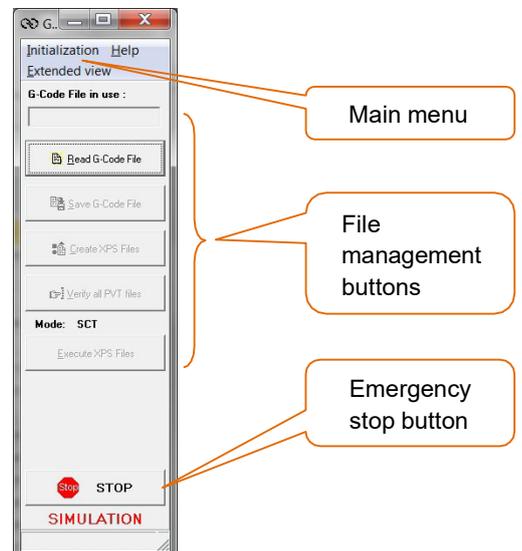
3.3　Main Menu Description

3.3.1　Files

This menu provides access to basic features such as:

Edit:　　　　　　　　To read, edit and save any text file through XPS-GCODE editor.

Print G-Code File:　To print the current G-Code file.

Print TCL File:　　　To print the current TCL file.

Exit:　　　　　　　　To Quit XPS-GCODE software.

3.3.2　Initialization

This menu launches XPS stage initialization and group homing sequence.

3.3.3　Setup

This menu allows setting XPS-GCODE parameters with:

XPS IP Address setting:

XPS Axes / G-Code name association:
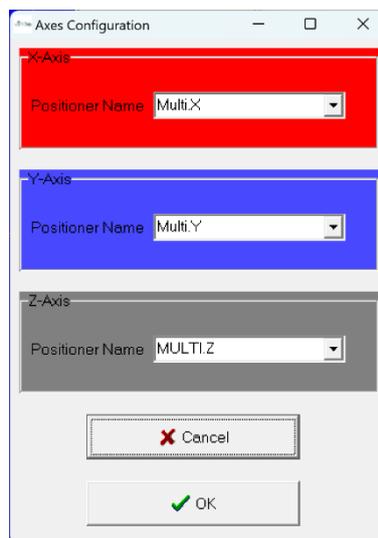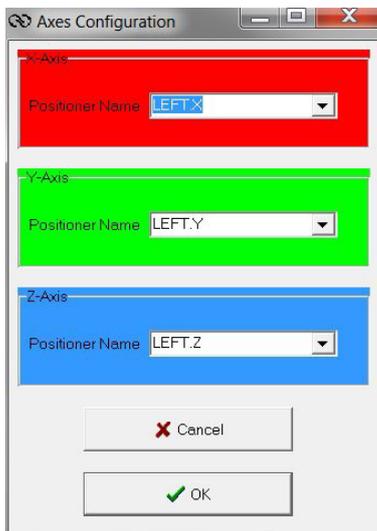
Note　　　**XPS-GCODE version 3.00 controls 2 or 3 motorized axes which MUST be in a "Multi" type of group.**

　　　　　　With a 2-axis configuration, The Z-axis name selection disabled

G-Code "M" Commands / **XPS Output** association:
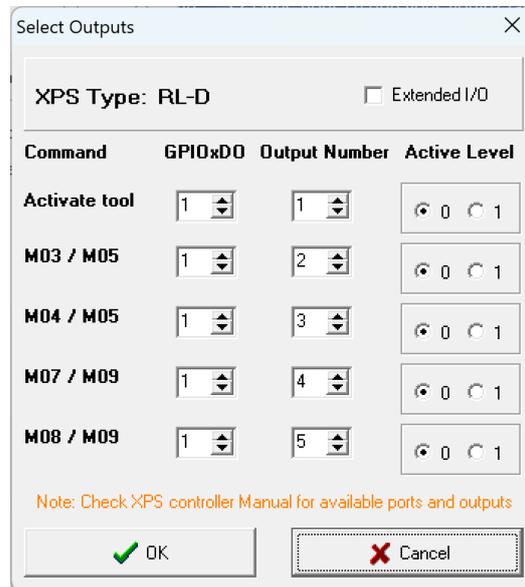
Default values: are shown in the picture.

Note   **Available GPIO ports depend on XPS_C, Q, D, RL or RL-D type**

- **M3 and M4 set outputs which are reset by M5.**

- **M7 and M8 set outputs which are reset by M9.**

- **XPS outputs are associated with Tool Activation (A) G-Code "M" commands through the outputs window of setup menu.**

- **Purple color of an indicator corresponds to a level "1" of the XPS output Examples:**

- **Tool activated (GPIO1.DO1 and level set at 1)**

   M3 activated (GPIO1.DO2 and level set at 1
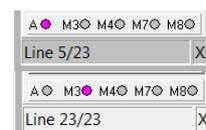
Conversion Mode: "SCT", "TCL/PVT" or "XPS Direct"
                             (see Conversion Modes Description chapter for details).

Positioning Speed: To set the default speed for "G0" commands.

Trajectory acceleration: To set trajectory acceleration/deceleration for "G1", "G2" and "G3" commands.

Default Working Speed: To set the default speed for "G1", "G2" and "G3" commands.

Use Feed Rate codes (F): To enable/disable the use of "F" commands (speed on trajectory).

Max Angular discontinuity: To set the discontinuity threshold in trajectories.

Angular Step Size: To set the angular value of the arc element used in circular parts of trajectories.

Number of Digits for PVT: To set the number of digits used in "PVT" files creation.

Language: To select the display language (French, English or other).

Display: To select the display parameters with:

Number of Displayed Digits: To set the number of digits displayed in the status bar.

Sample Rate: To set the XPS position feedback reading period.

Background Color: To set the 3DShow tab background color.

Zoom (Max & Min) :   To set trajectories display zoom limits.

Erase Step by Step: To erase the wire frame as soon as it's executed.

Note   **Parameters values are memorized and reloaded when restarting XPS-GCODE. When using XPS-GCODE for the first time, parameters default values are:**

- **Positioning Speed: 10 (XPS axes unit/s)**

- **Trajectory acceleration: 100 (XPS axes unit/s)**

- **Default Working Speed: 1 (XPS axes unit/s)**

- **Max Angular discontinuity: 2 degrees**

- **Angular Step Size: 5 degrees**

- **Number of Digits: 4**

- **Sample Rate: 100 ms**

Server TCP-IP: To Enable/Disable TCP-IP control (see chapter 7.0)

Server Port: To Select TCP-IP port # (default : 8000)
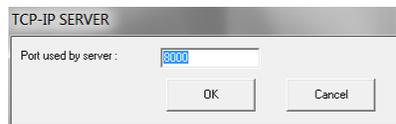
3.3.4   Maintenance

This menu allows saving all current files (SCT, TRJ and PVT) into the XPS through the

Save all files command. This is especially critical after file modification.

3.3.5   Help

This menu provides information on XPS-GCODE current version with:

About: To display:
                        XPS-GCODE Software version information.
                        XPS MAC address
                        License Key

User's manual: To open this file.
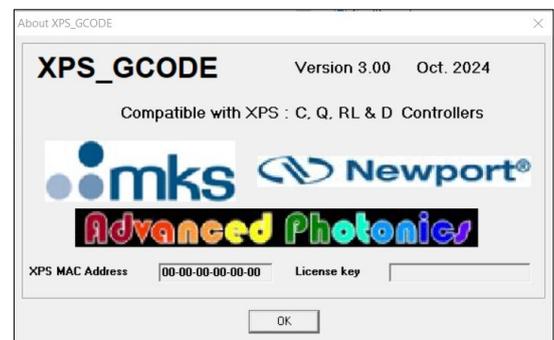
3.4 Extended View/Reduced View

These commands allow switching between main window display modes.

3.5 Status Bar

- Provides information on axes state:

- Red: Axis not connected, or Not initialized or Not referenced (XPS States: 0..9,42).

- Light Grey: Axis Ready (XPS States: 10 …18).

- Yellow: Axis Disabled (XPS States: 20..38).

- Fuchsia: Emergency braking (XPS State: 40).

- Blue: Initializing (XPS State: 41).

- Dark Grey: Homing, Positioning or Trajectory motion (XPS States: 43, 44, 45).

- Navy Blue: (Other XPS States).
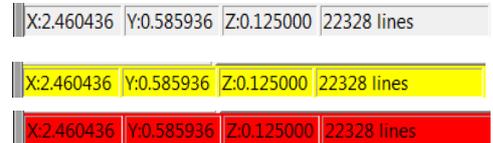
3.5.1 Stop Button

Note   **Stop button kills the XPS group and so stops any motion or conversion.**

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4 Simulation Mode

Three conditions are required to access all XPS-GCODE executable features: An established Ethernet communication, correct setting of XPS controller parameters and valid License Key Number.

If one of these conditions is not met, XPS-GCODE will automatically switch to 'SIMULATION" mode with limited features.

Mode Features	Executable	Simulation	Notes for sim. mode
Parameters setting	Yes	Yes	May require restart
XPS controller dialog	Yes	**No**	
Reduced/Extended views	Yes	Yes	With a limited command set
Reading G-Code files	Yes	Yes	
"SCT" conversion mode	Yes	Yes	
"Tcl/Pvt" conversion mode	Yes	Yes	
"XPS Direct" conversion mode	Yes	**No**	
Editing files	Yes	**No**	
"SCT" trajectories display	Yes	Yes	
Executed trajectories display	Yes	**No**	
Saving converted files	Yes	**No**	In PC Computer
TCP-IP Server	Yes	**Limited**	No trajectory execution
Status bar information	Full	**Limited**	File line number only

5 Conversion Modes Description

XPS-GCODE reads, filters (unrecognized commands are ignored) and converts all G-Code file types for up to 3 axes of motion on the Newport XPS controller.

One of the Newport XPS Multi-axis controller's great features is to allow 3-axis trajectory execution while controlling the speed vector. This can be done using "PVT"motion files.

To take full advantage of Newport XPS Multi-axis controller capabilities, XPS-GCODE provides THREE conversion modes which can be selected depending on the G-Code file's content (size, type of motion, etc.).
The three modes are named: "**SCT**" mode, "**TCL/PVT**" mode and '**PVT Direct**" mode.

5.1 "SCT" Mode

In "SCT" mode, G-Code file conversion is done through 2 steps:

- Line per line conversion into an "SCT" text file.

- Multiple line conversion of the "SCT" file into XPS compatible text files ("TCL"and "PVT").

During conversion, a **"TCL" script is created**, containing sequentially:

- Tool control (change from "G0" to "G1, G2 or G3" and back) and Output control("M") commands are converted into XPS controller output control commands ("GPIOxSet…").

- Inactive tool motion commands ("G00") are converted into standard single or multi-axis "Relative" motion. ("GroupMoveRelative").

- Active tool commands ("G01, G02 and G03") are converted into corresponding "PVT" trajectories files.

Note   **In case of an angular discontinuity between consecutive elements higher than the value set in "Setup/Angular discontinuity", the current trajectory will continue but with a "0" speed point.**

A change in working speed ("Fx" command) will be included in the trajectory.The TCL script name is always: "GCODE_Converted.TCL".

After transferring all files ("TCL" and "PVT"s) to the XPS, the "TCL" script can then be launched from XPS-GCODE or from any other program connected to the XPS.

Note   **In SCT mode, all motions in TCL and PVT files are converted in relative mode.**

5.2 "TCL/PVT" Mode

Note   G-Code includes two type of tool state:

- **Inactivated tool state ("G0" command) with motions executed at default speed.**
- **Activated tool state ("G1, G2 or G3" commands) with motions executed at feed rate speed.**

In "TCL/PVT" mode, G-Code file conversion is done in a single step. XPS_GCODE analyzes the G-Code file commands and creates **a 'TCL" script** sequentially containing three types of XPS commands:

- Change in tool state and Output control ("M") commands are converted into XPS controller output control commands ("GPIOxSet…").
- Inactivated tool motion commands ("G00") are converted in standard single or multi-axis "Relative" or "Absolute" motion. ("GroupMoveRelative…", "GroupMoveAbsolute…").
- Activated tool **consecutive commands maintaining angular continuity** ("G01,G02 and G03") are converted into corresponding "PVT" trajectories files.

Note   **In case of angular discontinuity between consecutive elements higher than the value set in** Setup**/Angular discontinuity", the current trajectory ends and a new one is created.**

A change in working speed ("Fx" command) will be included in the trajectory.The TCL script name is always: "GCODE_Converted.TCL"

After transferring all files ("TCL" and "PVT"s) to the XPS, the "TCL" script can then be executed from XPS-GCODE or from any other program connected to the XPS.

5.3 "XPS Direct" Mode

In "Direct" mode, the conversion principle is similar as in "TCL/PVT" mode. However,each converted XPS command (Tool control, Absolute or relative move and output control) and Trajectories ("PVT" files) are executed immediately.

Note   **No TCL is created and only one "temporary" trajectory is loaded in the XPS and executed immediately.**

5.4　Conversion Modes Comparison

Mode	Advantages	Limits
SCT	SCT file creation allows: Keeps an image of the converted file Compatible with 3rd party software GOL3D 3D display (option) Can be re-launched from XPS Allows verification before execution	May take a little bit longer due to the 2 steps Relatively large trajectories (more difficult to troubleshoot/modify)
TCL/PVT	Multiple shorter trajectories (easier to troubleshoot/modify) Can be re-launched from XPSAllows verification before execution	No image of the trajectory
XPS Direct	Faster	No verification before execution. Cannot be re-launched from XPS.

5.5　Conversion Errors

In case of incoherence in G-Code file arc definition an error message will be displayed.

XPS_GCODE.exe

Incoherence in G-Code file, line : 6

Ok
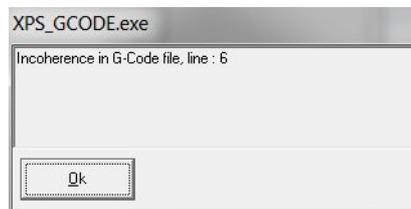
6 Using XPS-GCODE

6.1 XPS Address in XPS-GCODE

In the case of an incorrect TCP/IP address setting, XPS-GCODE displays an error message.
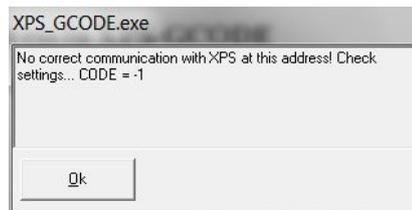
After error acknowledgment, XPS-GCODE automatically starts in "**SIMULATION**"mode.

In "**Extended View**" select "**XPS Address**" command of the "**Setup**" menu.
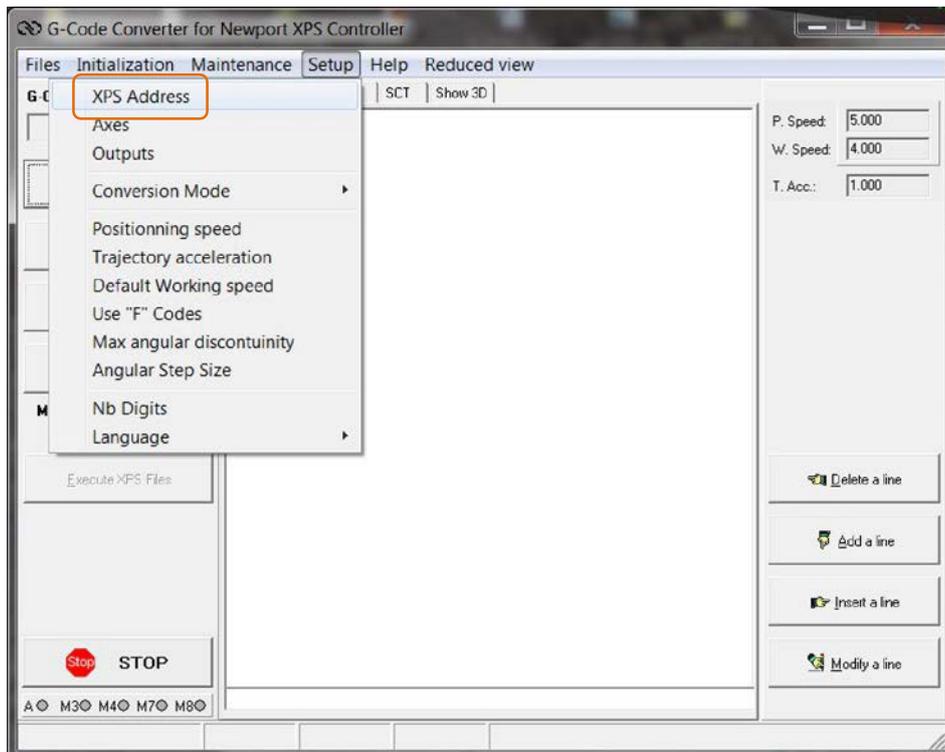
Enter the current XPS address.

Then exit and re-launch XPS-GCODE software (to memorized parameters).

6.2 Axes configuration

Note   **XPS-GCODE requires the XPS to be configured with (at least) one "multi" type of group containing 3 axes.**

If a "multi" 3-axis group is not detected, an error message appears. Consult the XPS User's Manual for group setting.
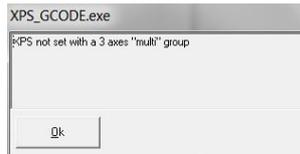
Note   **When using XPS-GCODE for the first time with an XPS, even though no error message appears, XPS axes group and positioner names must be set in XPS- GCODE. (XPS may contain several "multi" groups…).**

To do so proceed as follows:

- Select "**Extended View**" to access the "**Setup/Axes**" command of the "**Setup**"menu.

- In the newly opened window, select the desired group name and axis names in the corresponding drop-down lists. Then click "**Ok**".

Note   **Axes color matches arrow color in the 3D show tab.**
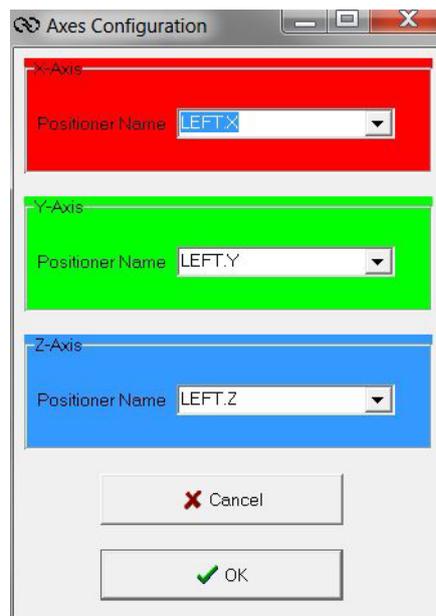
Note   **In case of incorrect axis number setting, an error message is displayed.**
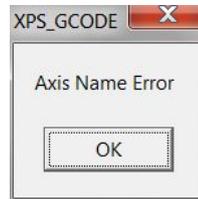
6.3 XPS Stages Initialization

To be able to be controlled, all 3 axes need to be initialized. If XPS axes are not initialized, XPS-GCODE status bar color turns red indicating the need for initialization which can be done by clicking on "**Initialization**" in the main menu.

Warning

Ensure that stages are not obstructed and can move freely before launching initialization.

Note   **The initialization sequence depends on an XPS parameter setting (together at the same time or one after the other, consult XPS user's manual for more information).**

During initialization, the status bar displays "**Initialization in Progress**".

After completion, the status bar color is set to light grey.

6.4 Basic Use

Although XPS-GCODE also offers advanced features such as editing G-Code and converted files, XPS trajectory file verification and Trajectories display, basic use requires only 2 or 3-step processes: Loading and Direct Execution steps or Loading, Converting , and Executing XPS Files steps.

6.4.1 Setting Parameters

Prior to reading and converting G-Code files, various parameters must be set. These are located in the "Setup" menu accessible in the "extended view" mode: Positioning speed,Trajectory acceleration, Default working speed, Use "F" codes, Maximum angular discontinuity and Angular step size. See Setup chapters for details.

6.4.2   Loading a G-Code File

Click on "Read G-Code File" to open the file selection window, and then select the file (".nc").

Note   **Default recommended directory: C/…/XPS_Code/GCODE.**
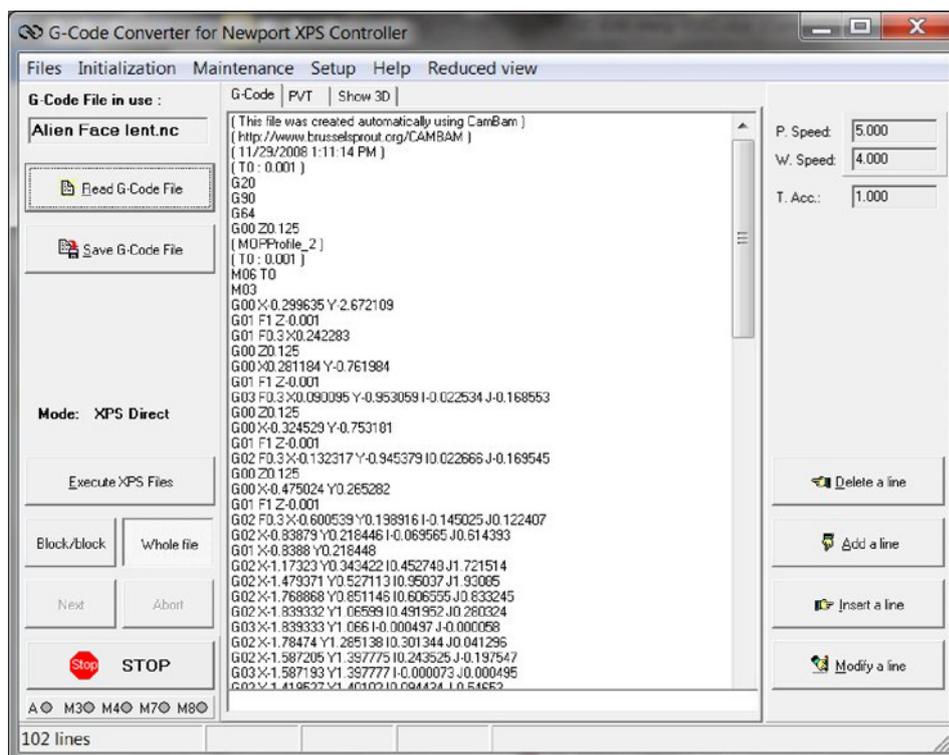
Selected G-Code file is displayed in the editor window.

Note   **This enables "Save G-Code File" and "Create XPS files" buttons.**

6.4.3   Direct Execution

"XPS Direct" Conversion Modes Description is part of the 2-step process allowing simultaneous G-Code file "block" conversion and execution.

Note   See **XPS Files Generation** chapter for details
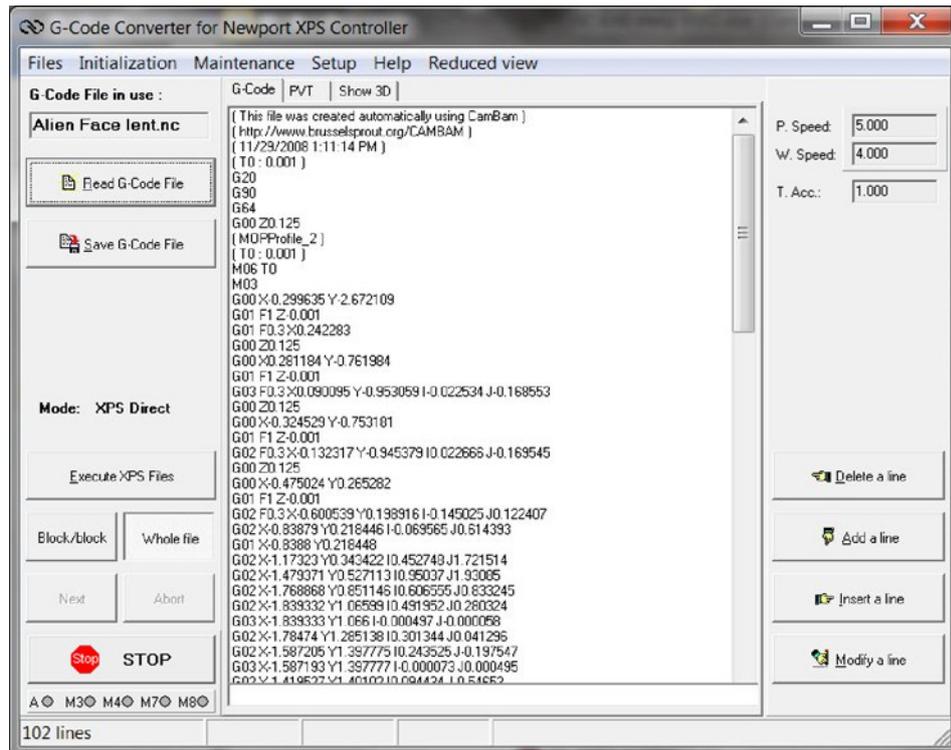
To launch this step, proceed as follows:

- Select the execution mode: "**Block/Block**" or "**Whole File**".

- Then click on "**Execute XPS Files**" to launch the execution.

- In "**Block/Block**" mode, the first block will be converted and executed while the conversion of the next block starts.

- When both tasks are completed, "**Next**" button allows execution of the converted block and conversion of the next one.

- In "**Whole File**" mode, each block is executed as soon as it is converted.

- "**Abort**" button stops the current process.

Note   Execution mode "**Block/Block**" or "**Whole File**" can be changed during process execution.

During conversion, status bar displays the number of the first line of the block being converted and the total number of lines.

In extended view mode, the display area provides the following information:

- G-Code file tab: the current block will be highlighted during execution.

- 3D Display shows the current block frame and the executed trajectory (see Trajectories Display chapter).
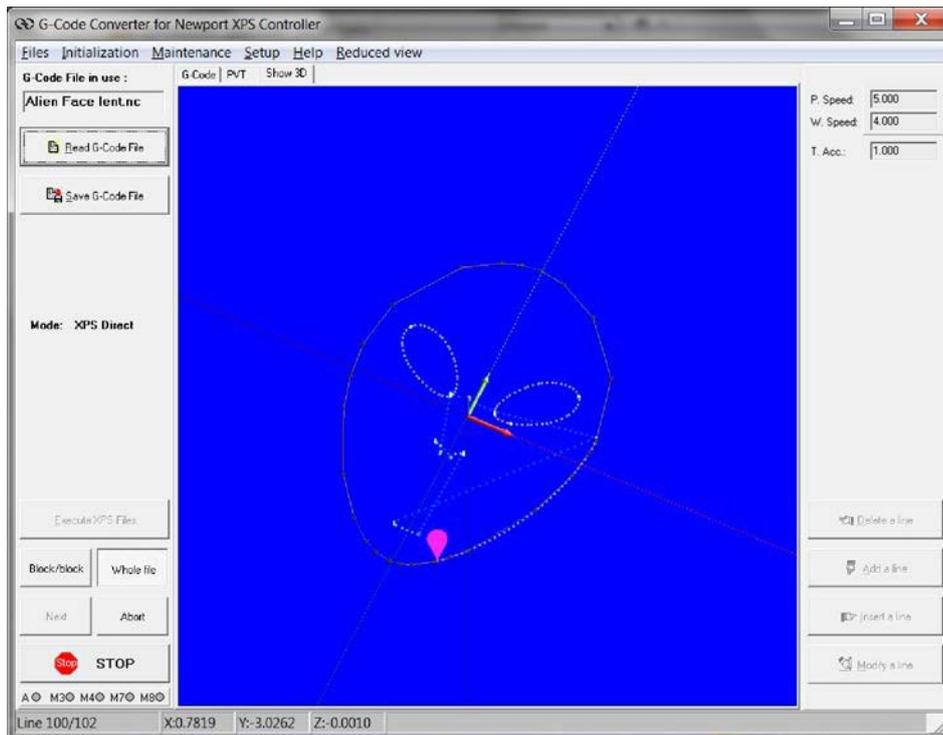
6.4.4   Converting

"SCT" and "TCL/PVT" Conversion Modes are part of the 3-step process allowing display, editing and saving converted files before launching the execution.

To create converted files, proceed as follows;

Click on "Create XPS Files" to launch the conversion.

Status bar displays several messages indicating on-going conversion steps (including line number).

Wait until a message announces the end of conversion and provides information on how many files have been created.
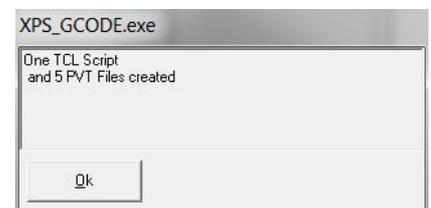
Note	**Type and number of files created depends on the conversion mode. See XPS Files Generation for details.**

Display area tabs show the created files: TCL and PVT files (if any).

If several PVT files are created, selection is done by the drop down menu (upper right corner of the display area):
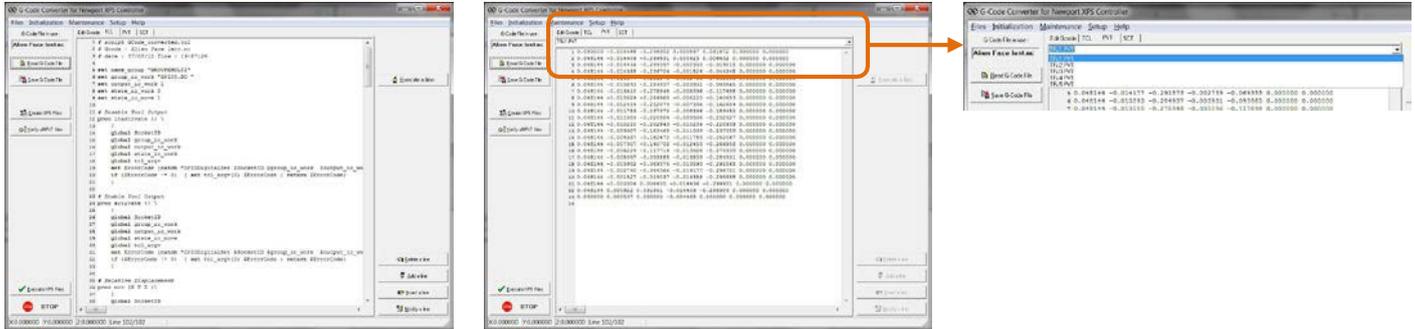
3D Show tab can display either the converted:

            Trajectory (SCT mode)   or   Wire frame (TCL/PVT mode)
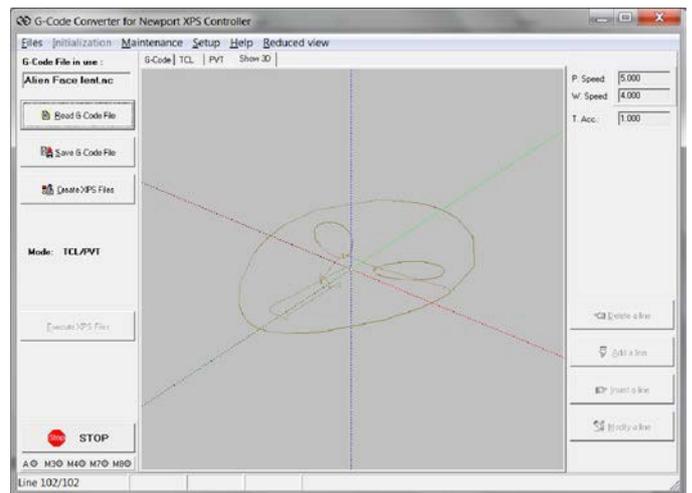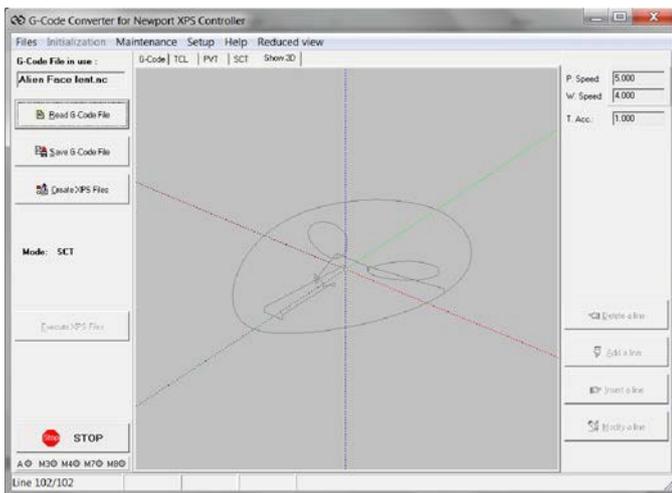
After conversion "Verify All PVT files" and "Execute XPS Files" buttons are enabled.

Note   **Number of elements in a trajectory file is limited to 500000.**

6.4.5 Verifying XPS Files

Click on "Verify all PVT files" to verify the compatibility of the converted files with the XPS axes parameters (Range, speed. Acceleration, etc…).

If compatible, a message informs the user that all PVT files have been checked successfully and the files can be executed by the XPS controller.
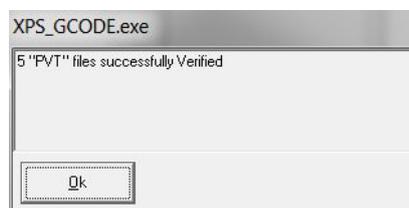
In case of incompatibility, a new window appears providing information on:

- Trajectory number (TRJx.PVT)

- XPS reported error number and description

- For each axis: Min and Max position, Max Velocity and Max acceleration with:

  o Extrema : Trajectory extremes values
  o Limit: XPS Axes parameters.
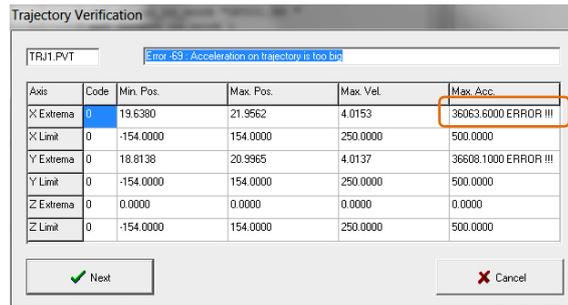
The trajectory value exceeding the corresponding axis parameter is highlighted by an "ERROR !!!" message

The "Next" button allows verifying other trajectories (if the G-code conversion created more than one).
The "Cancel" button exits the verification mode.

TROUBLESHOOTING:

- In case of Min and Max position error:

  o Verify the G-code file to ensure the size of the expected work fits within the stage mechanical limits
  o Change the starting point to re-center the work.

- In case of Max velocity error:

  o If G-code "F" commands are not used, reduce the Working speed parameter
  o If G-code "F" commands are used, modify the G-code file.

- In case of Max acceleration error:

  o Reduce the Trajectory acceleration parameter
  o If G-code "F" commands are not used, reduce the Working speed parameter

If G-code "F" commands are used, modify the G-code file.
This means that a too highvelocity is requested on too short of a move.

6.4.6   Executing XPS Files

This is the 3rd step of "SCT" and "TCL/PVT" Conversion Mode processes.

After conversion, click on "Execute XPS Files" to launch "TCL" and "PVT" filesexecution.

During execution, the status bar displays:
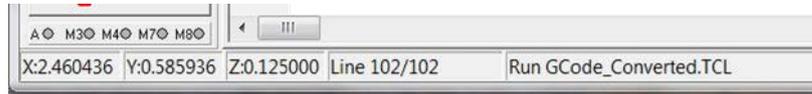
In extended view mode, the display area provides the following information:

3D Display shows converted trajectory and executed trajectory (see Trajectories Display chapter).
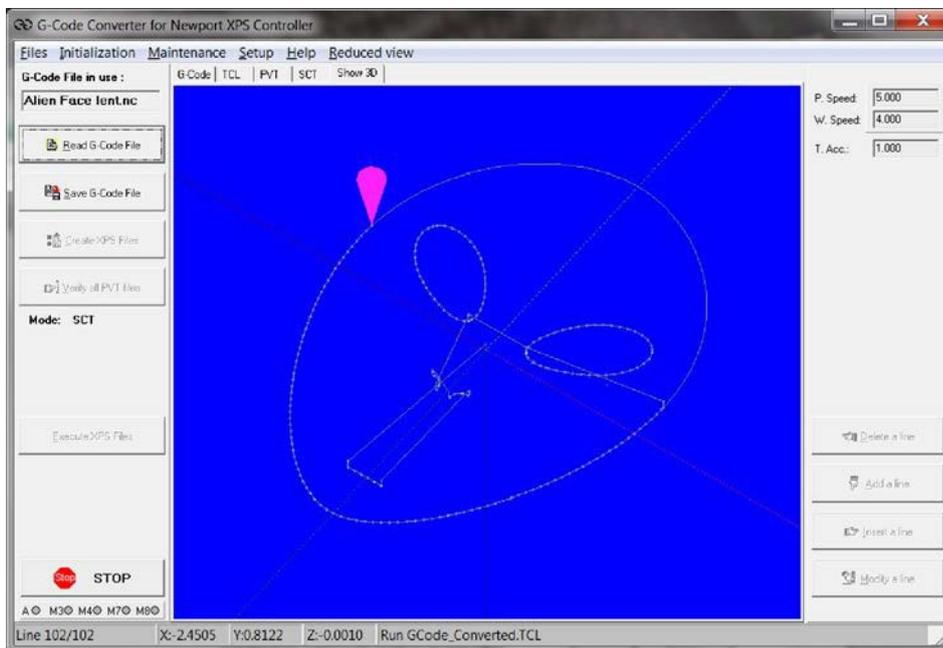
Upon completion, a window notifies the user of the TCL execution result code (0 = NO error).
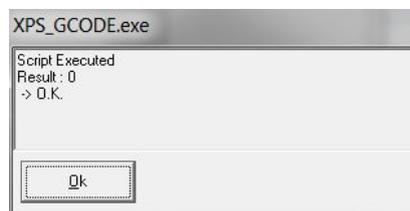
6.5 G7-Code Files Edition

XPS-GCODE allows G-Code file editing through a dedicated line located at the bottom of the display area. This limits the risk of error as G-Code is not very "descriptive" …
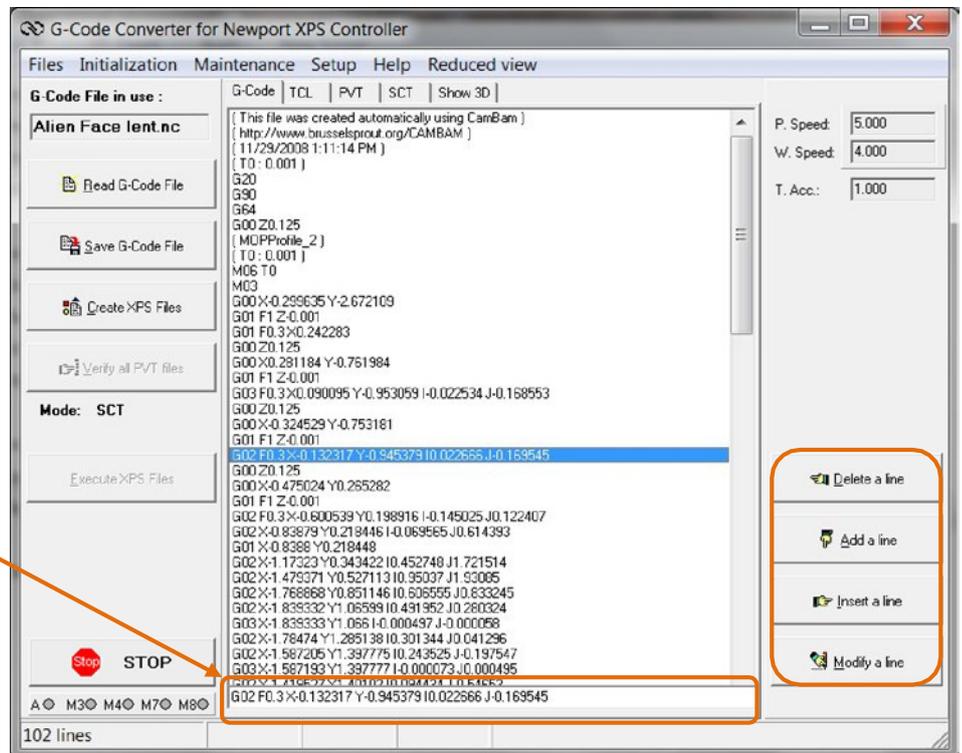
XPS-GCODE allows: deleting, adding, modifying and inserting a line through four buttons as described below:

- **Deleting a line:** In the G-Code display area, click on the line to be deleted.
  This line is highlighted in the list and copied in the editing line.
  Then click "**Delete a line**" button.

- **Adding a line:** Prepare the line to be added in the editing line, then click "**Add aline**" button, the line is added **at the end of the file.**

- **Inserting a line:** In the G-Code display area, click on the line immediately below the point of insertion.
  This line is highlighted in the list and copied to the editing line where you can modify it, to prepare the line you want to insert.
  Then click "**Insert a line**" button to insert it above the highlighted line in the list.

- **Modifying a line:** In the G-Code display area, click on the line to be modified.
  This line is highlighted in the list and copied in the editing line where you can modify it.
  Then click "**Modify a line**" button to replace the highlighted line.

Note   **After modification, a G-Code file must be saved by clicking "Save G-Code file" button before starting conversion.**

6.6   Converted Files Edition

After conversion, all converted files (SCT, TCL and PVT) are "text" files.
XPS-GCODE allows editing by directly modifying them in the display area.

Select the corresponding tab (SCT, TCL or PVT) to access the desired file.
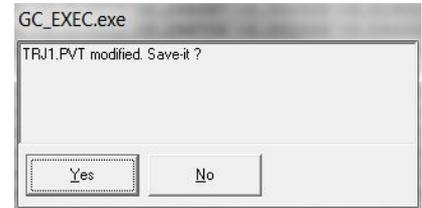
Note   **After modification, user will be prompted to save the modified file(s)**

6.7   Trajectories Display

6.7.1   Display Control

3D Display area is controlled by the mouse:

- Left click and drag: 3D display rotation.

- Right click and drag: 3D display translation.

- Scroll: Zoom.

- Left double click shows the extended menu allowing display control with:

  o Erase displayed trajectories and skeletons.
  o Draw SCT trajectory ("Sct" mode only).
  o Center display to 0,0,0 or current position or selected position

  o Extend Z axis zoom (x10).
  o Set Nodes (points between trajectory elements) size.
  o Set Axes Arrows size (X=Red, Y=Blue, Z=Green).
  o Set Cone size (representing current stage position during trajectory execution, Green ="G0", Red = "G1").
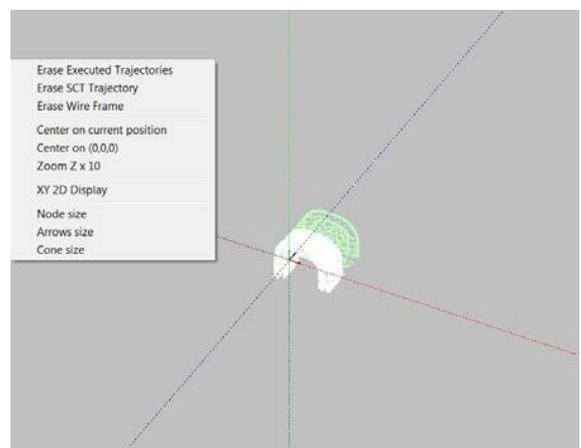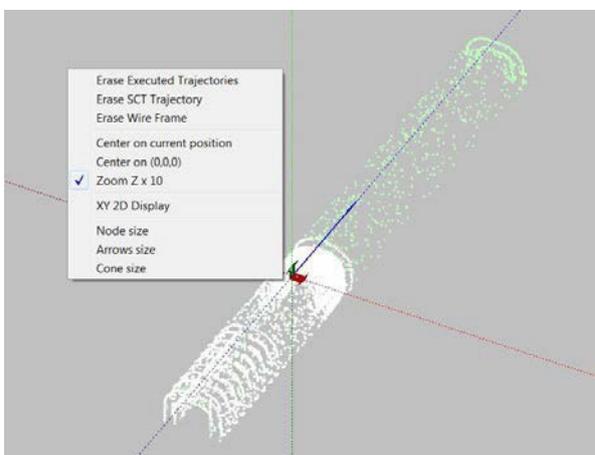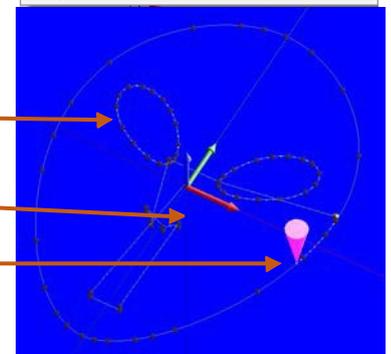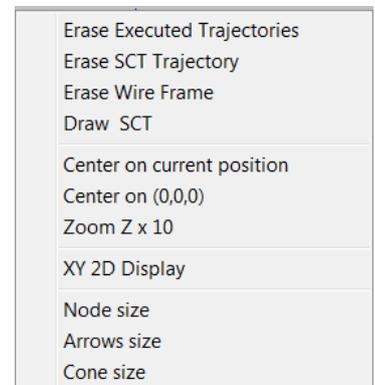
Note   **Background color can be set through Setup main menu (display command).**

Axes arrows colors and sized are displayed at the bottom.

Axes Arrows Colors: X-Red Y-Blue Z-Green   Arrows Size 1.000
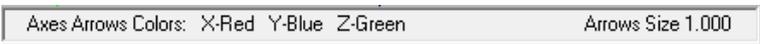
6.7.2   General Information

Depending on the conversion mode, the main window display area provides information on conversion results through different tabs.

Note   **All converted files (SCT, TCL and PVT) are in a "text" file format.**

Frames and Trajectories display as follows:

Mode	Action	Listing tabs	Display tab
SCT	Conversion	Creation of SCT, TCL and PVT	Theoretical trajectory display (through mouse right click/display SCT command) during and after XPS files creation
	Execution	-	Real time executed trajectory display
TCL/PVT	Conversion	Creation of TCL andPVT	Momentary display of converted block skeleton
	Execution		Real time executed trajectory display
XPSDirect	Conversion/Execution	The first line of the current block being converted/executed is highlighted	Converted block skeleton and real time executed trajectory display

Note   **XPS direct mode offers the possibility of executing the file "block by block" (see Direct Execution chapter.**

6.8 SCT Mode

In this mode, as the whole G-Code file has been converted into an "SCT" file, it is possible to visualize the trajectory before execution.
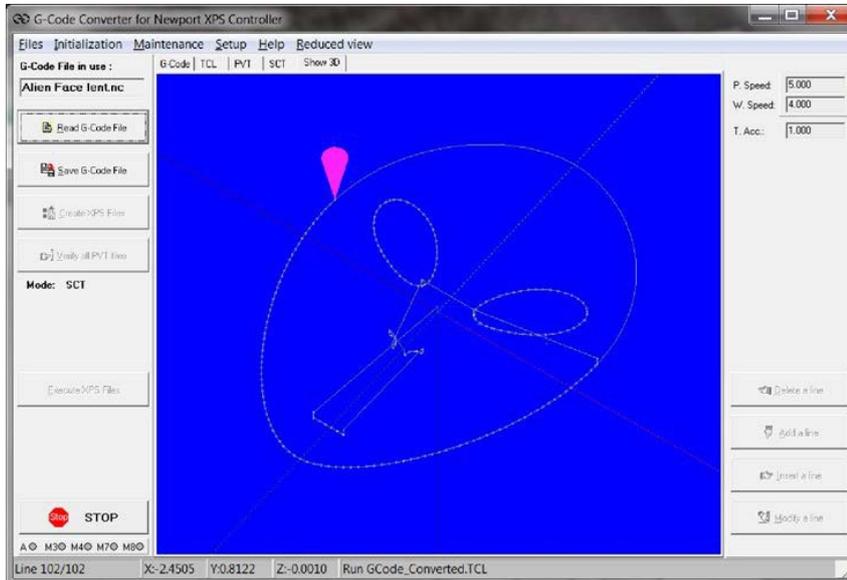
A mouse right click on the "Show 3D" tab displays the trajectory from the newly created "SCT" file.

During execution, the stages' encoder position feedback are used to draw the actualtrajectory executed by the stages.

A cone appears indicating the current position of the stages. The cone color indicates the state of the XPS output associated with the G-Code "G0" and "G1" commands:

- Green: "G0"
- Red: "G1"
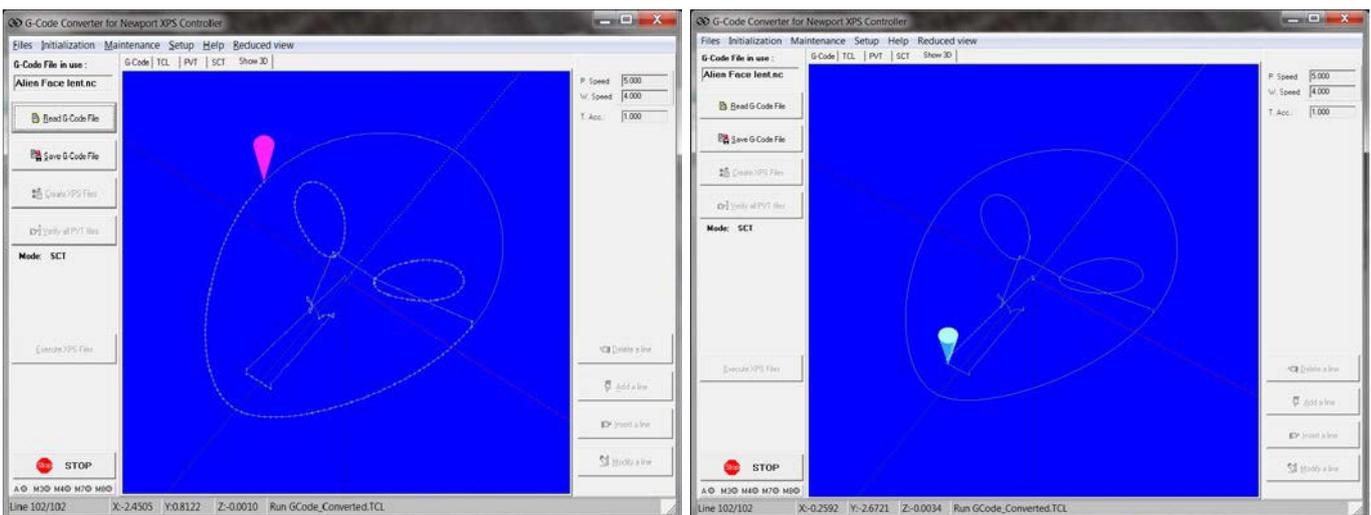
Note **Executed trajectory is represented by dots. Distance between dots depends on trajectory speed, sampling rate and available Windows resources. Changing the 3D display with the mouse will interrupt the drawing process and may result in missing dots. However the executed trajectory is correct.**

6.9 TCL/PVT Mode

In this mode, as the whole G-Code file is converted into a TCL and several PVT files, at the end of conversion, the trajectory wire frame is automatically displayed in the 3D show tab.
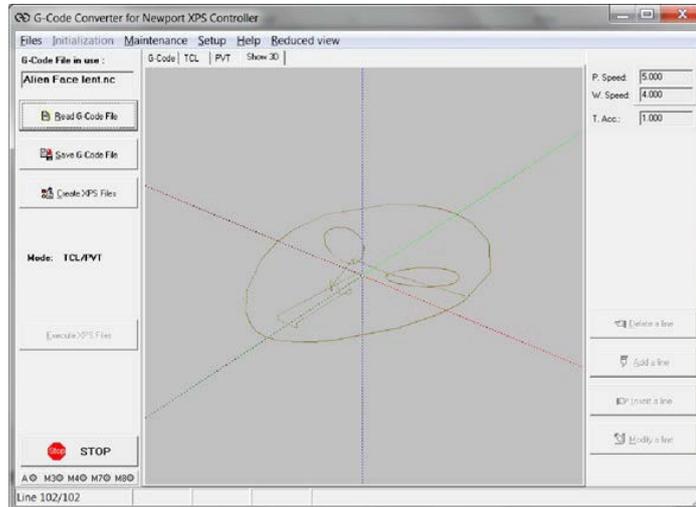
During execution, the stages' encoder position feedbacks are used to draw the actual trajectory executed by the stages.

A cone appears indicating the current position of the stages. The color indicates the state of the XPS output associated with the G-Code "G0" and "G1" command:

- Green: "G0"
- Red : "G1"
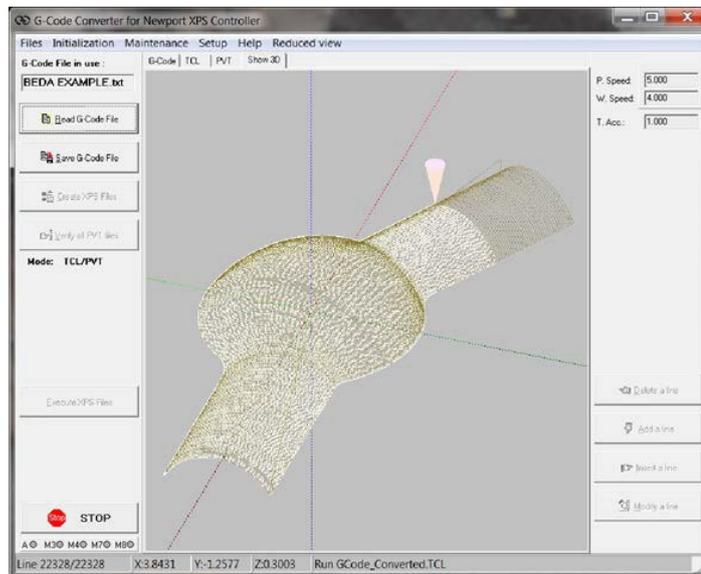
Note   **Executed trajectory is represented by dots. Distance between dots depends on trajectory speed, sampling rate and available Windows resources. Changing the 3D display with the mouse will interrupt the drawing process and may result in missing dots. However, the executed trajectory is correct.**

6.10 XPS Direct Mode

In this mode, as the G-Code file is converted "block by block", it is not possible to visualize the whole trajectory before execution.

However, the most recent converted block frame is displayed just before execution.

During execution, the stages' encoder position feedbacks are used to draw the actual trajectory executed by the stages.

A cone appears indicating the current position of the stages. The color indicates the state of the XPS output associated with the G-Code "G0" and "G1" command:

- Green: "G0"
- Red: "G1"
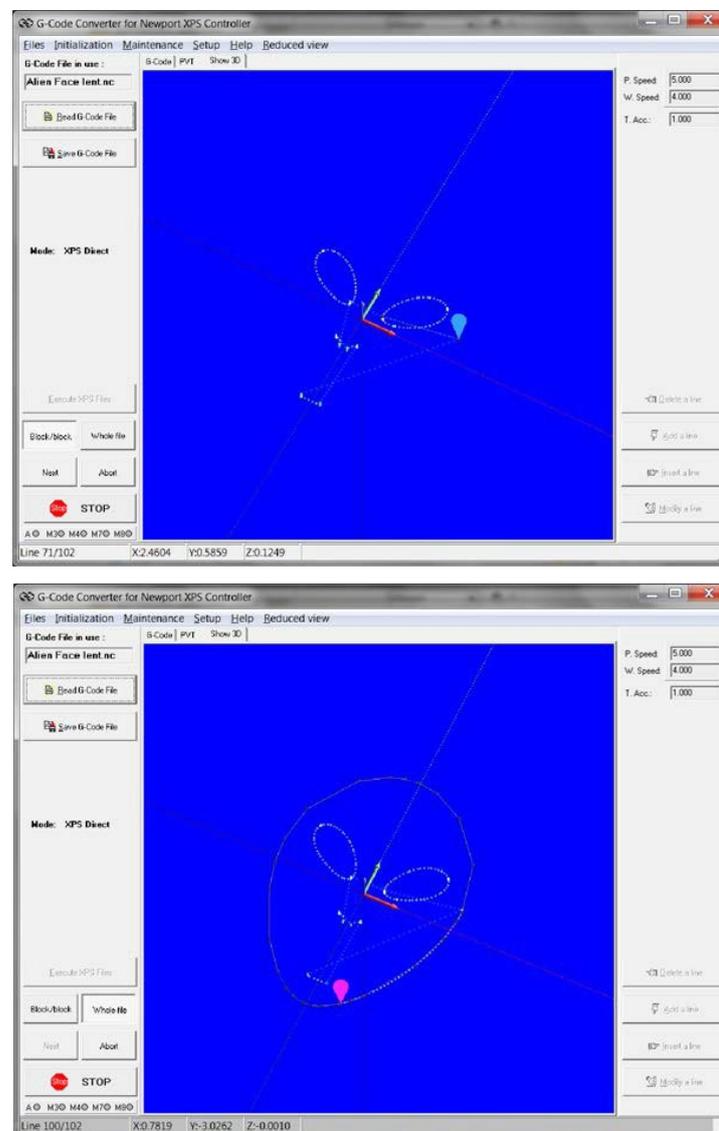
| *Note* | Executed trajectory is represented by dots. Distance between dots depends on trajectory speed, sampling rate and available Windows resources. Changing the 3D display with the mouse may cause interruptions in the drawing process and may result in missing dots. However, the executed trajectory is correct. |

7 TCP-IP Server

7.1 Remote Commands List

A built-in TCP-IP server allows a client to remote control XPS_GCODE.

Once enabled in the **Setup/TCP-IP Server** menu, this communication enables the following command list:

Command	Action	Description
INIT	XPS axes initialization	Initialization [§ 3.3.2]
HIDE / SHOW	Hide/ show XPS-GCODE	
REDUCE / EXTEND	Displays XPS-GCODE in Reduced or Extended view(if in SHOW and EXTENDED view modes)	Extended View/Reduced View [§ 3.4]
3D	Displays the 3D tab (if in SHOW and EXTENDED view modes)	Direct ExecutionD Display [§ 6.4.3]
MODE x	Conversion mode selection with: x = 1: SCT, x = 2: TCL/PVT, x = 3: Direct	Conversion Modes [§5]
READ name.ext	Reads "name" GCode file with "ext" extension. (Gcode file must be placed in the Gcode subdirectory)	Loading a File [§ 6.4.2]
CREATE	Converts current and creates XPS file	Converting [§ 6.4.4]
EXECUTE	Launch converted files execution	Executing [§ 6.4.6]
DRAW name.ext	Reads "name" GCode file with "ext" extension, Converts, Creates and then Execute XPS file	
VERIFY	Verify all current PVT files	Verifying [§ 6.4.5]
STOP	Aborts any motion and Kills all XPS axes (requires INIT command)	Stop [§ 3.5.1]

Note   **TCP-IP Client must be connected prior to send any command**

XPS-GCODE Server IP address is defined by the network board installed in the PC or by the local address (127.0.0.1) if the client is in the same computer as XPS-GCODE. Recommended default communication port# is 8000.

7.2 Remote Commands List

A "CLIENT_GCODE.EXE" is provided to demonstrate XPS-GCODE TCP-IP remote control.

Note   **As CLIENT_GCODE is a 32-bit application, CLIENT_GCODE.EXE file properties must be set to:**

- **Run this program in compatibility mode for: Windows XP (service Pack 3)**

- **Run this program as an administrator**

(Right click on CLIENT_GCODE.EXE, select Properties, Compatibility tab and then Change settings for all users)

To use CLIENT_GCODE, proceed as follow:

- Launch XPS-GCODE

- In XPS-GCODE Setup menu, check "TCP-IP Server

- Launch CLIENT_GCODE.EXE.

- Verify Server IP address and port# compatibility with XPS=GCODE settings

- Click "Connect"

- Client window enlarges and message "connected" appears

- Select a command in one of the drop down lists and then click on the corresponding"SEND" button

- After completion of a command, XPS-GCODE returns DONE or FAILED in case of any error
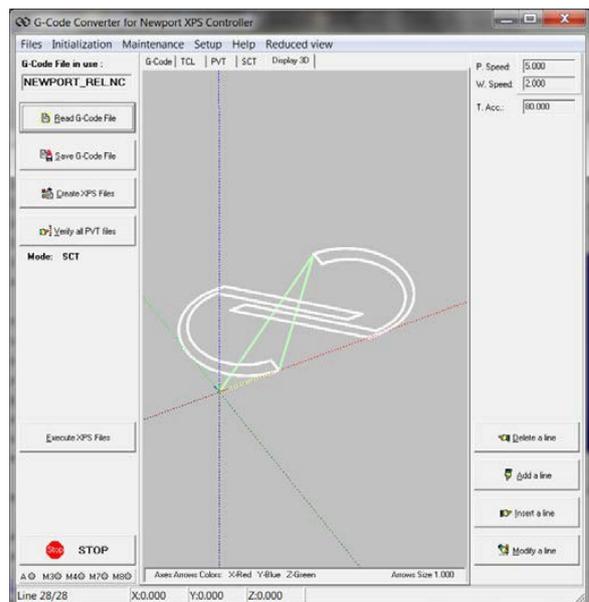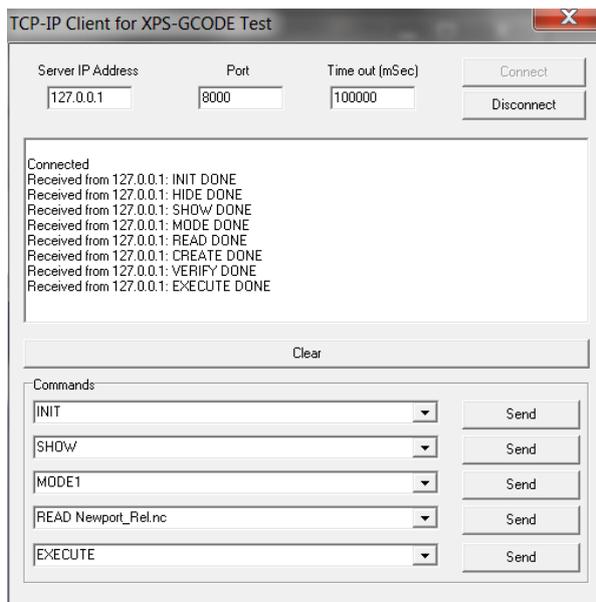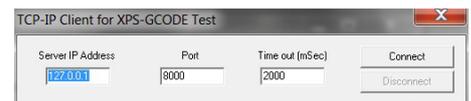
Note   **As execution time depends on the command, Time out value must be set accordingly prior to send the command. In case of time out too short, the response might be displayed with the following command response.**

7.3　Windows Direct Command

The following tasks can be automatically executed when launching XPS-GCODE:

- Setting parameters:
    - Positioning speed: V=
    - Drawing speed: U=
    - Acceleration: A=
    - Discontinuity: D=
    - Angular Step: A=
- Setting conversion mode:
    - SCT: /S or /1
    - Direct: /X or /3
    - TCL: /T or /2
- Display mode
    - Hide messages: /H
    - Display extended view: /E
    - Display reduced view: /R
    - Keep Display after drawing completion: /V
- Gcode file reading, conversion and execution
    - Gcode.file_name

Exemple : XPS_GCODE "Test Jeff.nc"　/V　/X　/R　V=12.23 A=2456.

Launches Gcode, reads « GcodeFileName », converts it in TCL Mode and executes it in the reduced view while hiding messages and keeps the display after completion.

Note	**XPS IP address must have been set correctly prior to use these commands and the "Do not show this window again" box in the connection window must be checked.** **« GcodeFileName » must be located in the "Gcode" subdirectory** **Separator can be "space" or ";"** **Sending "/V=20" is equivalent to send "/V" and "V=20"**

8 Appendix

8.1 G-Code Command List (Version 3.00)

G codes	Description	Notes
G0	Rapid Linear Motion	Default speed
G1	Linear Motion at Feed Rate	-
G2 & G3	Arc at Feed Rate	-
G4	Dwell Time in seconds	i.e., G4P1 for 1 s delay
G28	Return to Home	Move absolute 0,0,0
G53 &G90	Absolute Mode	-
G91	Relative Mode	-

M codes	Description	Notes
M3	Selectable XPS output ON	Reset by M5
M4	Selectable XPS output ON	Reset by M5
M5	Reset XPS outputs	M3 and M5
M7	Selectable XPS output ON	Reset by M9
M8	Selectable XPS output ON	Reset by M9
M9	Reset XPS outputs	M7 and M8

Other codes	Description	Note
F	Set Feed Rate	-
VARIABLES and calculations	Almost all mathematical functions…	-
N	Line numbers	No effect
(….)	Comment	No effect

Note **In case of missing parameter in a command, the last value will be taken in account**

In case of multiple "G" commands on the same line, XPS-GCODE will separate them into different lines. It is then recommended to save the Gcode file for future use.

8.2   Variables

XPS-GCODE understands G-Code variables (I.e.: "#A25", "[A]) and calculation on variables (almost all mathematical functions…)

8.3   TCL Format (SCT & TCL/PVT) Modes

During conversion in "SCT" and "TCL/PVT" modes, a TCL is created with a default name **GCODE_Converted.TCL**".
This file includes 3 parts:

- A first part includes:

  o   Comments (TCL name, G-Code file name, date and time).

  o   Variable definitions (XPS group name, GPIO number, etc…).

  o   Procedures (enable/disable tool output, Change speed, Relative displacement,Close socket, etc.).

  o   Setting tool inactive mode (equivalent to "G0" command").

  o   Loading X, Y and Z default position speed into XPS.

  o   Mode absolute to position 0,0,0.

- A separator to ease file reading.
  ```
  ####################################################################
  #        Program start
  ####################################################################
  ```

- A third part including all G-Code converted commands which will call the procedures defined in the first part.

This format simplifies reading the TCL while minimizing its size.

8.4   Default Speed on Trajectory

Setup Menu includes following parameters: "**Positioning speed**", "**working speed**","**Trajectory acceleration**" and "**Use F codes**".

By default, Positioning speed is used for all "G0" commands and working speed for all "G1", "G2" or "G3" commands and "**Trajectory acceleration**" is used for all commands.

If "**Use F codes**" is checked in the setup menu, and an "F" command is included in a trajectory, the current working speed will be modified to reach the new speed using "**Trajectory acceleration**" parameter

8.5   XPS Files Generation

XPS-GCODE converts G-Code files using the following rules:

A "TCL" is created including 3 types of commands:

- "Absolute move": If G-Code file includes a "G0" command using "**positioning speed**" parameter.

- "Output setting": If G-Code file includes an "M" command.

- "PVT execution": for all "G1", "G2" and "G3" commands using default working speed parameter to start with "F" command speeds.

As many "PVT" files as necessary:

- As soon as "G1", "G2" and "G3" commands are found, a trajectory file (PVT) is created. Then:

  o   If "G0" or "M" commands are found, this PVT file is ended and a new one is opened.

  o   This is repeated until the end of the G-Code file.

> *Note* **Inside each PVT file, XPS-GCODE checks for continuity between G-Code command lines.**

- If there is continuity (below the "**angular discontinuity**" parameter), PVT will keep the current speed constant.
- If there is a discontinuity, PVT will stop and restart axes using "**Trajectory acceleration**" parameter.

> *Note* **Only one TCL and PVT set of files can be memorized in the XPS.**

8.6 Comments in "PVT" Files

TRJx.PVT tabs include comments to ease trajectory reading.
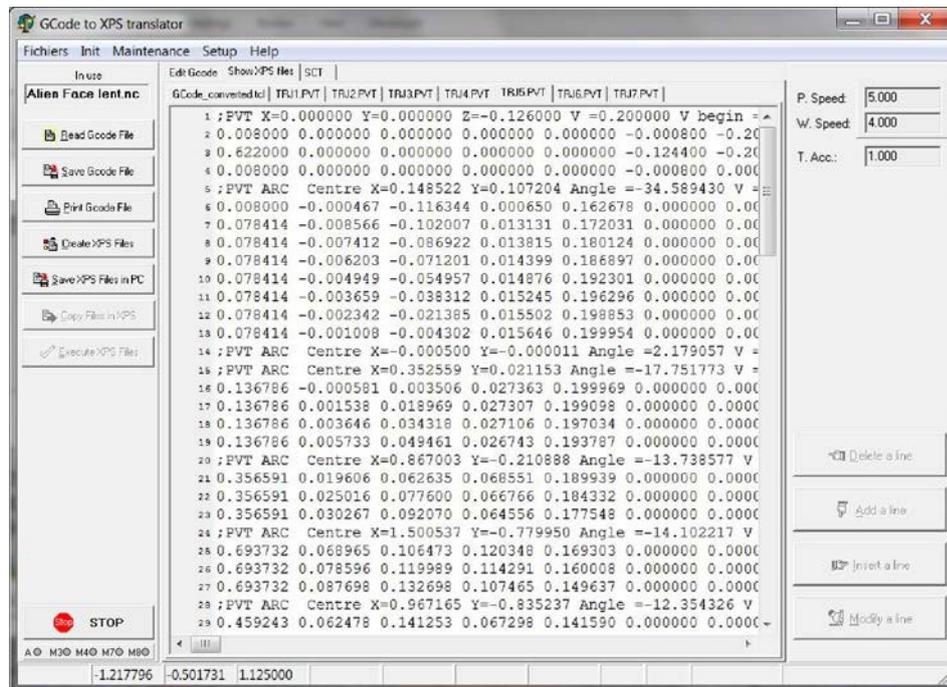
> *Note* **These comments are not saved in the XPS, nor in the PC computer.**

8.7 Notes on the Quality of Executed Trajectories

The quality or accuracy of executed trajectories converted by XPS-GCODE depends on several parameters:

- G-Code file quality or accuracy (positioning resolution, line, arcs, etc.).

- Mechanical system quality (stage performance like resolution, maximum acceleration, etc.).

- XPS-GCODE setting parameters such as:

  o Trajectory acceleration: Exceed the mechanical system capabilities will result in overshoot during sharp angle execution.

  o Default working speed: Exceeding the mechanical system capabilities will result in positioning inaccuracy.

  o Max. Angular discontinuity: allowing too large an angular discontinuity may create stage vibrations at "corners".

  o Angular step size: setting a too large angular step size may create angular discontinuity and create stage vibration at "corners".

  o Number of digits: limiting the number of digits displayed and transferred to the XPS may cause positioning values rounding and create inaccuracy.

8.8 "SCT" Format Description

In "SCT" mode, the G-Code file is first converted to an "SCT" format, then to XPS compatible files (SCT and PVT).
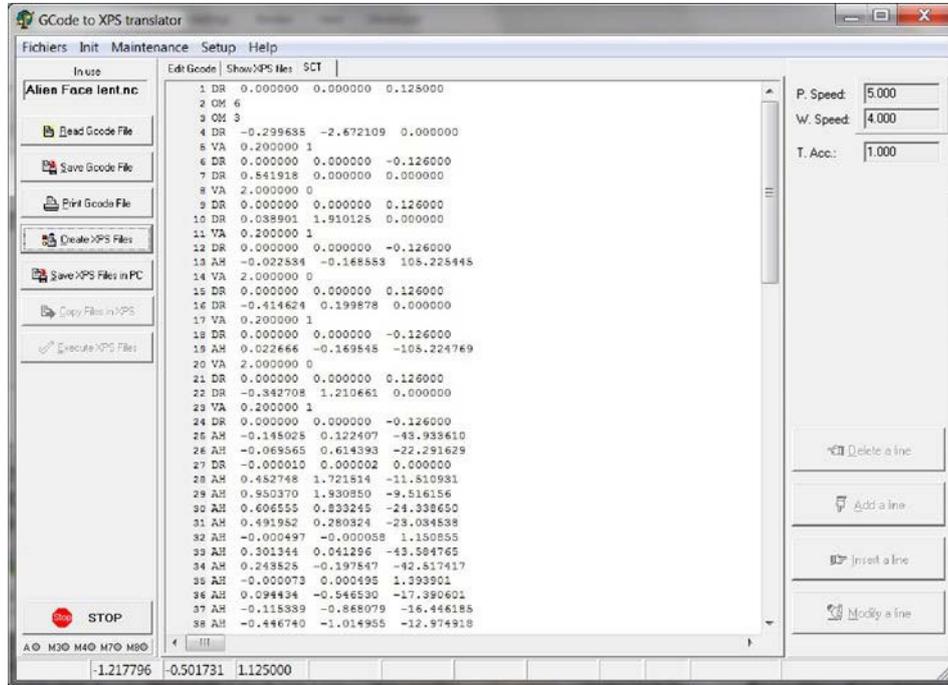
SCT format is a simple way to describe trajectory elements. Each line represents a move or an action.

A line always starts with 2 letters indicating the type of element, followed by values corresponding to the element parameters.

List of elements:

Element letters	Element type	Number of parameters
DR	Relative line	3
OM	Set Output	1
VA	Set Velocity	2
AH	Horizontal arc	3

Service Form

Your Local Representative

Tel.:

Fax:

Name: _____

Company: _____

Address: _____

Country:_____

P.O. Number: _____

Item(s) Being Returned: _____

Model#: _____

Return authorization #: _____

(Please obtain prior to return of item)

Date:_____

Phone Number: _____

Fax Number:_____

Serial #: _____

Description: _____

Reasons of return of goods (please list any specific problems): _____

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North America & Asia

Newport Corporation
1791 Deere Ave.
Irvine, CA 92606, USA

Sales

Tel.: +1 (949)-863-3144
e-mail: sales@newport.com

Technical Support

Tel.: +1 (949)-863-3144
e-mail: tech@newport.com

Service, RMAs & Returns

Tel.: +1 (949)-863-3144
e-mail: service@newport.com

Europe

MICRO-CONTROLE Spectra-Physics S.A.S
7 rue des Plantes
45340 Beaune-la-Rolande
France

Sales Europe (EMEAI)

Tel.: +49 (0) 6151-708-0
e-mail: germany@newport.com

Sales France

Tel.: +33 (0)1 60 91 68 68
e-mail: france@newport.com

Sales UK

Tel.: +44 (0)1235 432 710
e-mail: uk@newport.com

Technical Support

e-mail: tech_europe@newport.com

Service & Returns

Tel.: +33 (0)2 38 40 51 55
DST-BEA-RMA-service@newport.com