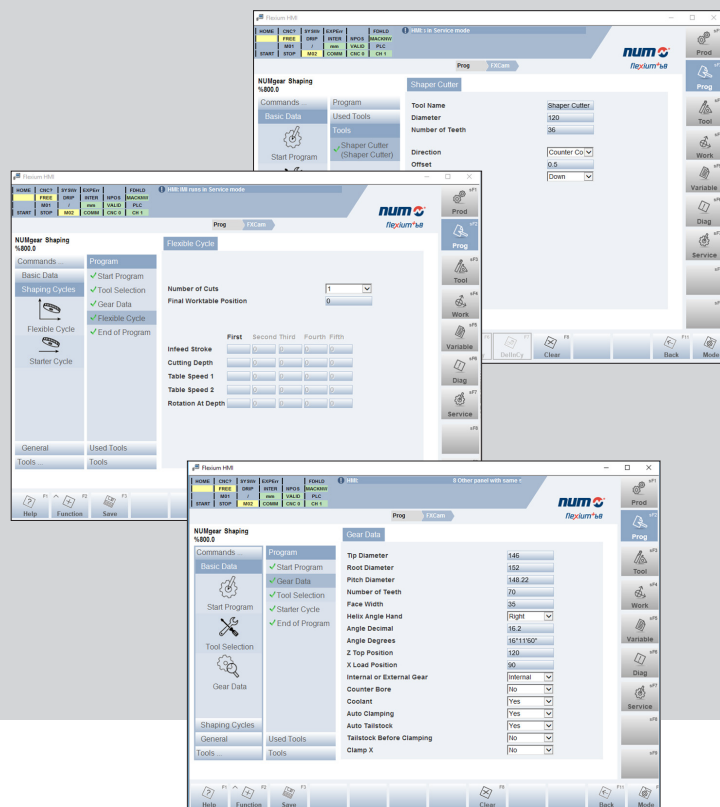


Flexium⁺ NUMgear Shaping

Instruction manual

M00063EN-00

Edition 3.2019



flexium⁺

www.num.com

NUM
CNC HighEnd Applications

Despite the care taken in the preparation of this document, NUM cannot guarantee the accuracy of the information it contains and cannot be held responsible for any errors therein, nor for any damage which might result from the use or application of the document.

The physical, technical and functional characteristics of the hardware and software products and the services described in this document are subject to modification and cannot under any circumstances be regarded as contractual.

The programming examples described in this manual are intended for guidance only. They must be specially adapted before they can be used in programs with an industrial application, according to the automated system used and the safety levels required.

All rights reserved. No part of this manual may be copied or reproduced in any form or by any means whatsoever, including photographic or magnetic processes. The transcription on an electronic machine of all or part of the contents is forbidden.

© Copyright NUM 2009 software

This software is the property of NUM. Each memorized copy of this software sold confers upon the purchaser a non-exclusive licence strictly limited to the use of the said copy. No copy or other form of duplication of this product is authorized.

Summary +Appendix

1	Foreword	7
1.1	Introduction	7
1.2	Use of the manual	8
1.3	How to read the manual	8
1.4	Document revisions	9
1.5	NUM Agencies	9
2	NUMgear Shaping	13
2.1	User Interface Features	13
2.2	Get Started with the NUMgear GUI	14
2.2.1	Create a Project	14
2.3	Get Around in NUMgear	15
2.3.1	Input Devices	15
2.3.2	Mouse and touch panel	15
2.3.3	Keyboard	15
2.3.4	Error Messages	15
2.3.5	Predefined Patterns	16
2.3.6	Calculations	16
2.4	Put Together a Program	17
2.4.1	Create a Project	17
2.4.2	Options Column	18
2.4.3	Tools	18
2.4.4	Commands	19
2.5	Details Pages Description	20
2.5.1	Tool Definition - Shaper Cutter	20
2.5.2	Start Program Page	21
2.5.3	Tool Selection Page	22
2.5.4	Gear Data Page	23
2.5.5	Shaping Cycles	25

Page deliberately empty

Summary

1	Foreword	7
1.1	Introduction	7
1.2	Use of the manual	8
1.3	How to read the manual	8
1.4	Document revisions	9
1.5	NUM Agencies	9

Page deliberately empty

1 Foreword

1.1 Introduction

This software runs on NUM Flexium+.

Using *NUMgear Shaping* allows the operator to create and run gear shaping programs by entering data into the graphic user interface without programming CNC code.

The *NUMgear Shaping GUI* is fully integrated into the Flexium+ HMI making use of the Flexium+ soft keys. It allows data entry while the machine is running.

Switching between the NUMgear screens and the other Flexium+ screens is possible without data loss.

All data necessary to define the machine setup, the gear setup, the gear itself, the tool, and the actual shaping process can be set using the entry masks.

NUMgear can be used on a variety of shaping machines. The basic configuration however has the shaping tool mounted on a spindle or an axis and the workpiece on a C table with the A axis used to set the angle of the shaping tool.

The Z axis moves the shaping tool axially along the gear teeth.

X moves the shaping tool in and out of the gear teeth and allows Z to move in to cut and to move back without the tool touching the gear.

1.2 Use of the manual

This manual is for use by qualified personnel only.

To reduce the risk due to an improper use of the product, do not perform any servicing other than that contained in this manual unless you are qualified to do so.

To ensure proper use of these products, please always read this User's manual carefully and retain for future reference. Should the unit require maintenance, please contact a NUM authorized service center only.

1.3 How to read the manual

This manual provides information about the NUMgear HMI.

Chapter	Description
1	Foreword This chapter introduces: - NUMgear Shaping introduction. - Use of the manual. - Document revision.
2	NUMgear Shaping This chapter introduces: - User Interface Features. - Get Around in NUMgear: Input Devices, Error Messages, Predefined Patterns and Calculations. - Put Together a Program: Create a Project, Tools and Commands. - Details Pages Description: Tool Definition - Shaper Cutter, Start Program Page, Tool Selection Page, Gear Data Page and Shaping Cycles.

1.4 Document revisions

Date	Index	Reason for revision	See chapter
03 - 2019	00	Document creation	-

1.5 NUM Agencies

The list of NUM agencies is given click here <http://www.num.com>

Page deliberately empty

Summary

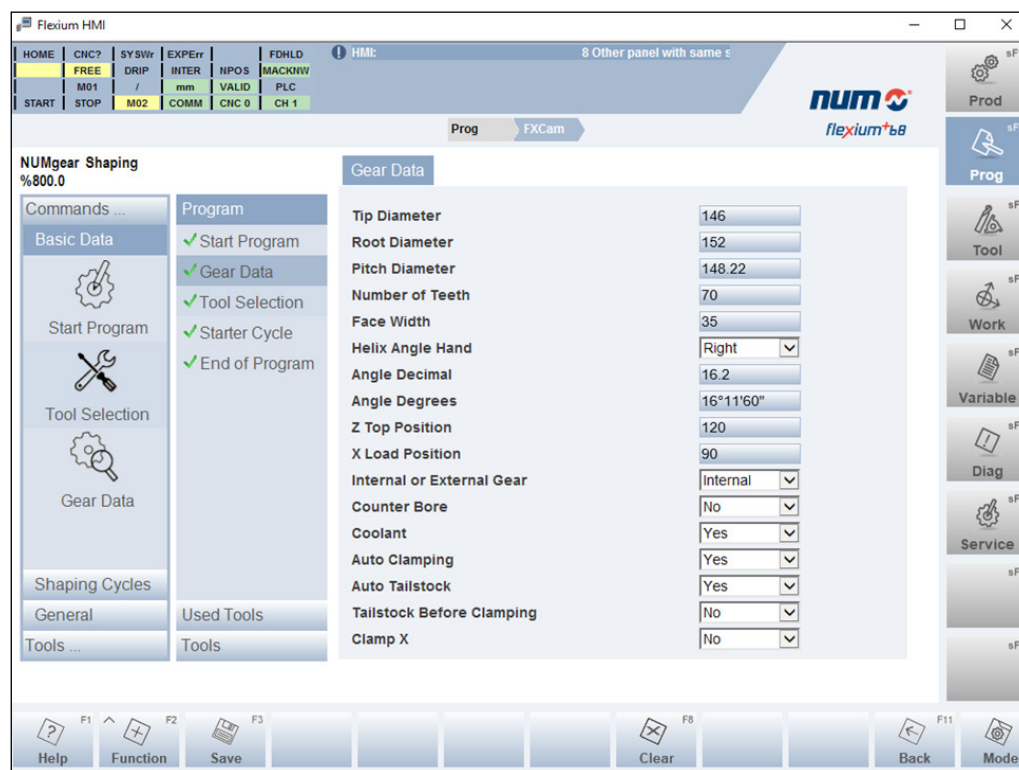
2	NUMgear Shaping	13
2.1	User Interface Features	13
2.2	Get Started with the NUMgear GUI	14
2.2.1	Create a Project	14
2.3	Get Around in NUMgear	15
2.3.1	Input Devices	15
2.3.2	Mouse and touch panel.....	15
2.3.3	Keyboard.....	15
2.3.4	Error Messages.....	15
2.3.5	Predefined Patterns	16
2.3.6	Calculations.....	16
2.4	Put Together a Program.....	17
2.4.1	Create a Project	17
2.4.2	Options Column	18
2.4.3	Tools.....	18
2.4.4	Commands.....	19
2.5	Details Pages Description.....	20
2.5.1	Tool Definition - Shaper Cutter	20
2.5.2	Start Program Page	21
2.5.3	Tool Selection Page	22
2.5.4	Gear Data Page	23
2.5.5	Shaping Cycles	25

Page deliberately empty

2 NUMgear Shaping

2.1 User Interface Features

- All the data that pertains to one particular workpiece is called a project in *NUMgear*.
- The project is stored in a file and can be edited with the *NUMgear GUI*.
- You can create projects, delete or save, edit projects, copy projects and finally generate the CNC code that will let the machine shape the part defined.
- A project remains in the project directories - only the CNC program generated from the project will be transferred to the NC.
- Projects can be saved and reloaded for further editing.
- Project files can also be created on a PC connected to a Flexium+ controller. In addition, project files can be copied and used between different machines of the same type.
- Changes made to the NC program will not be reflected in the project.
- The basic structure of a project is very simple.

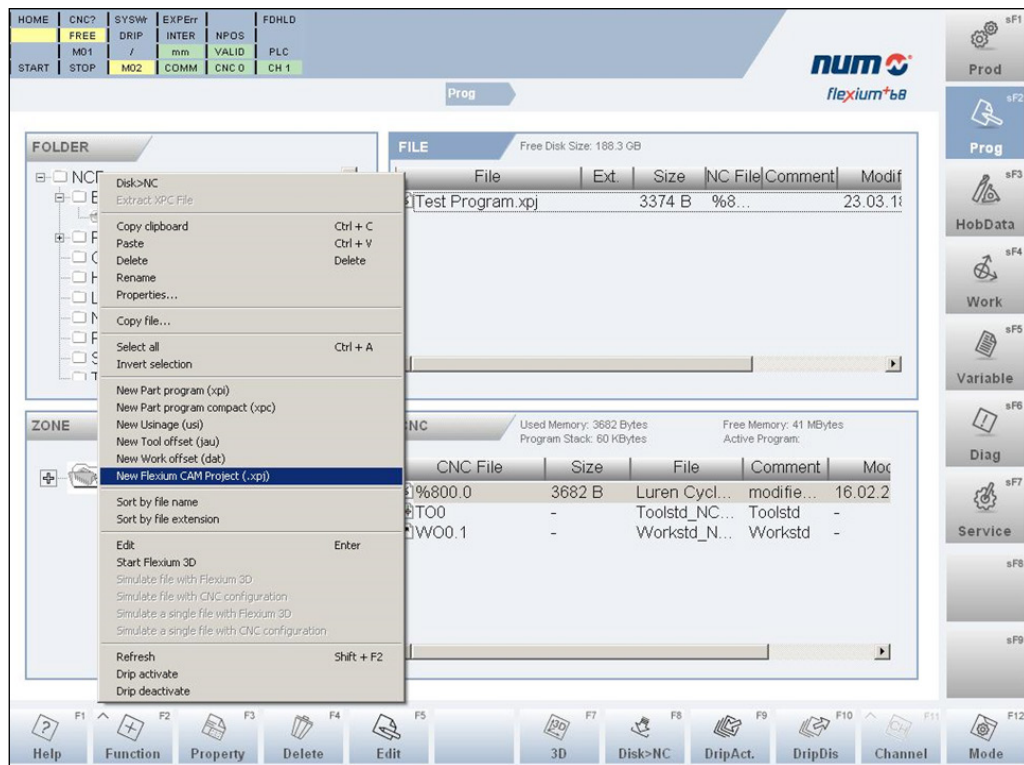


- Start Program - General machine parameters.
- Gear Data.
- Tool Definition.
- Tool Selection.
- Shaping cycle.
- End Program.

2.2 Get Started with the NUMgear GUI

2.2.1 Create a Project

- Go to the programming page of the Flexium+ by using the soft key *sF2 Prog*.
- You create a new project by selecting the *soft key F2 Function*, create new *Flexium CAM* project.
- Enter the required data and save. Setting of the NC program number can be by default or set individually for each project depending on the setting in the *Flexium CAM settings* on the service page.



- A new project file will be generated into the *NC Data folder* selected.
- To edit a project, select the *project file*.

2.3 Get Around in NUMgear

2.3.1 Input Devices

This program can be used with a variety of input devices such as keyboard, mouse, or touch panel as well as a combination of them.

2.3.2 Mouse and touch panel

With mouse and touch panel, every item on the screen can be reached directly.

A single tap or a single click will activate the corresponding page or entry control. To add items to the program flow, double tap or double click are necessary.

2.3.3 Keyboard

With a keyboard, you use the tab key to switch between page areas. Use the arrow keys to move the focus between items in both left hand columns - the options and the program flow column.

To get to the controls of a details page, activate that page using the tab keys, and use the arrow down once to set the focus to the first control on the page. Then move between the controls using the tab keys.

2.3.4 Error Messages

Some entry fields have rules specified for them. The value for module e.g. cannot be 0 or negative. If you enter an invalid value, the system will display an error message.

That error message will let you know that there are errors on the specific page as long as the focus is on an entry field with a correct value or without any rule defined.

If the entry field that causes an error message gets the focus, the message displayed will change to the message defined for that entry field.

2.3.5 Predefined Patterns

Some entry fields have predefined patterns that will not let you enter invalid keys, like characters for a numerical value.

- Some entry fields provide patterns that make data entry simpler.
- There are fields that require an angle as 00°00'00".
- The signs °, ' and " are given, so that entering 000000 will result in the value defined.

Helix Angle Hand	Right
Angle Decimal	16.2000
Angle Degrees	16°11'60" x

2.3.6 Calculations

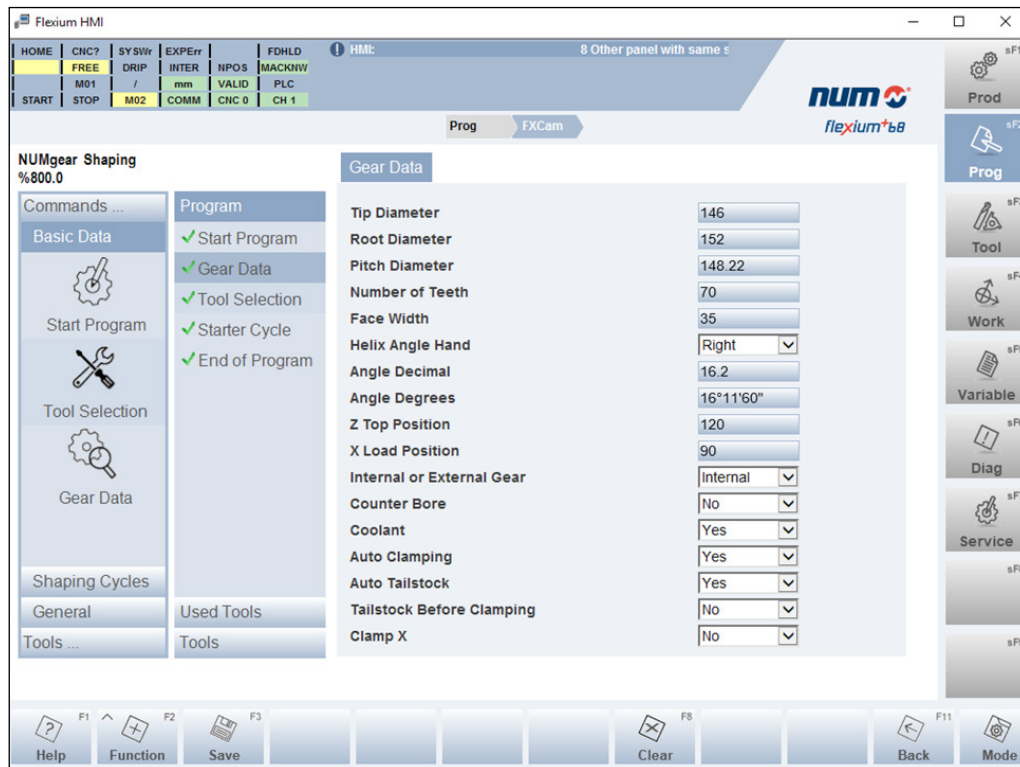
Also, entry fields have calculations included, that will change the values of other fields.

Angles can be entered in decimal or with minutes and seconds.

Only one type needs to be entered, the other will be calculated automatically as soon as the field loses the focus.

2.4 Put Together a Program

2.4.1 Create a Project



Here we will go over the process of putting together a program in a project file ready to be used to create the NC code.

For the description of each details page and its controls please see the next chapter. The details page will open automatically once an item is created or selected.

Please note that to add items to the program flow, double tap or double click are necessary.

The *NUMgear GUI* is made up of three elements. From left to right they are:

- Options Column.
- Program Column
- Details Pages.

2.4.2 Options Column

The Options Column is made up of two major categories:

- Commands.
- Tools.

2.4.3 Tools

The Tools category contains:

- Shaping Tool.

The first step for this project would be to define a tool. Tools that have already been defined in other projects don't have to be redefined.

Double click a tool and edit the appropriate values in the details page.

2.4.4 Commands

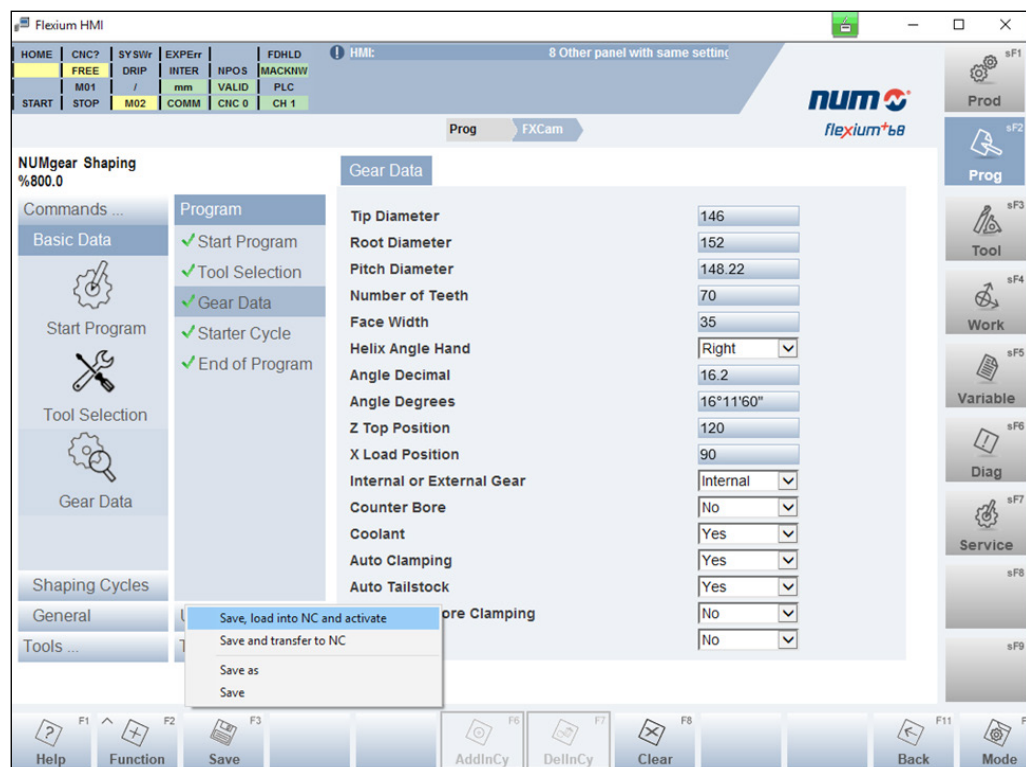
The Commands category consists of four subdivisions:

- Basic Data.
 - Shaping Cycles.
 - General.
 - Tools.
- Open the *Basic Data* - select *Start Program* and edit the values.
 - Add *End Program*. No data entry required.
You can always review the data you entered by selecting the entry in the program flow.
 - Go to *Tool Selection* and select the tool you previously created.
 - Select *Gear Data* and edit the details pages.
 - Now open the *Shaping Cycles* and select a cycle. Set up the values for *Shaping*.

This is the program flow:

1. Start Program.
2. Tool Selection.
3. Gear Data.
4. Shaping cycle.
5. End Program.

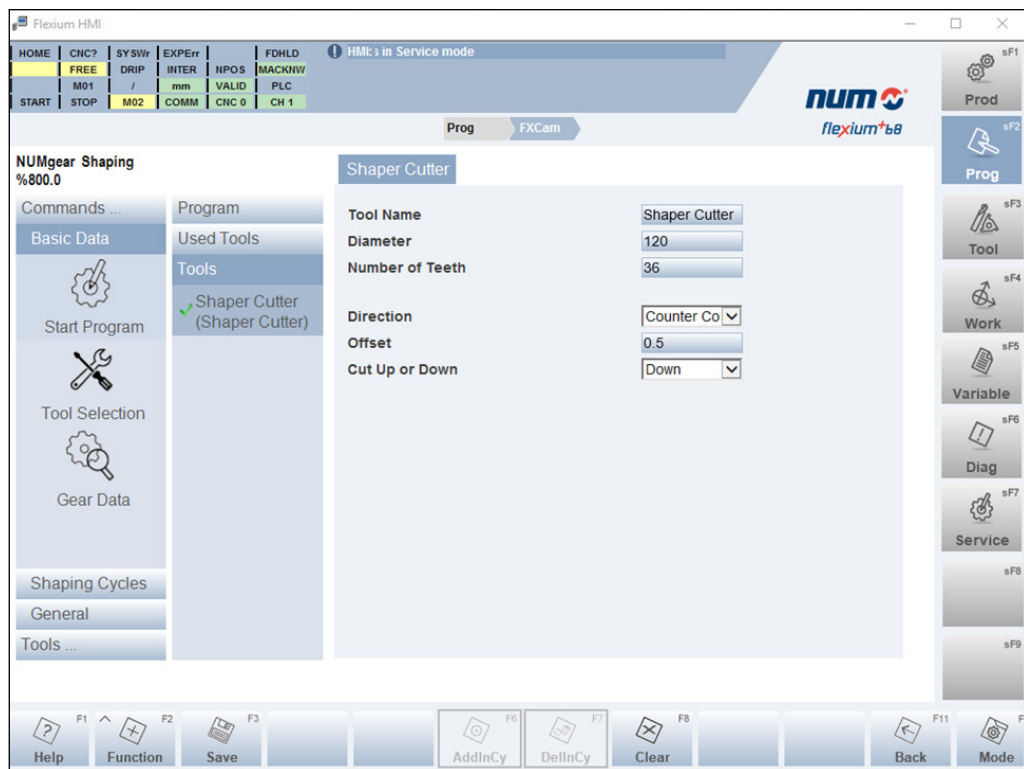
Entries in the program flow can be added and deleted, and the order of entries can be changed. The program flow reflects the CNC program that will be created and sent to the NC.



And that is all that is required to create a program.
Now select *Save, load into NC and activate*.

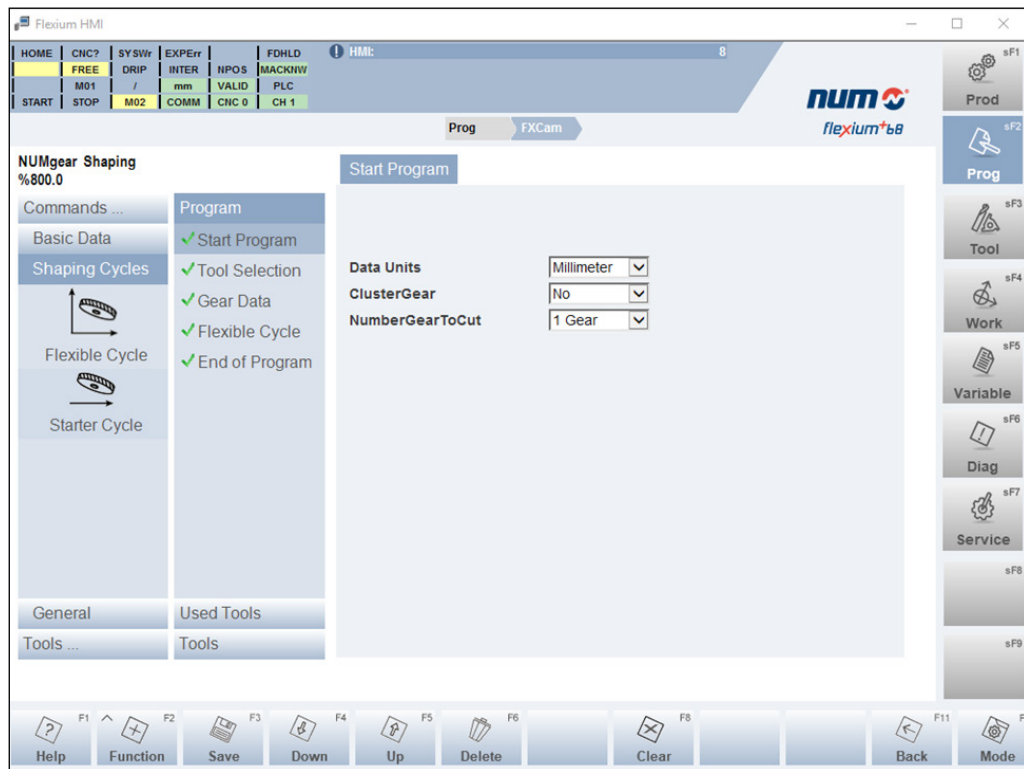
2.5 Details Pages Description

2.5.1 Tool Definition - Shaper Cutter



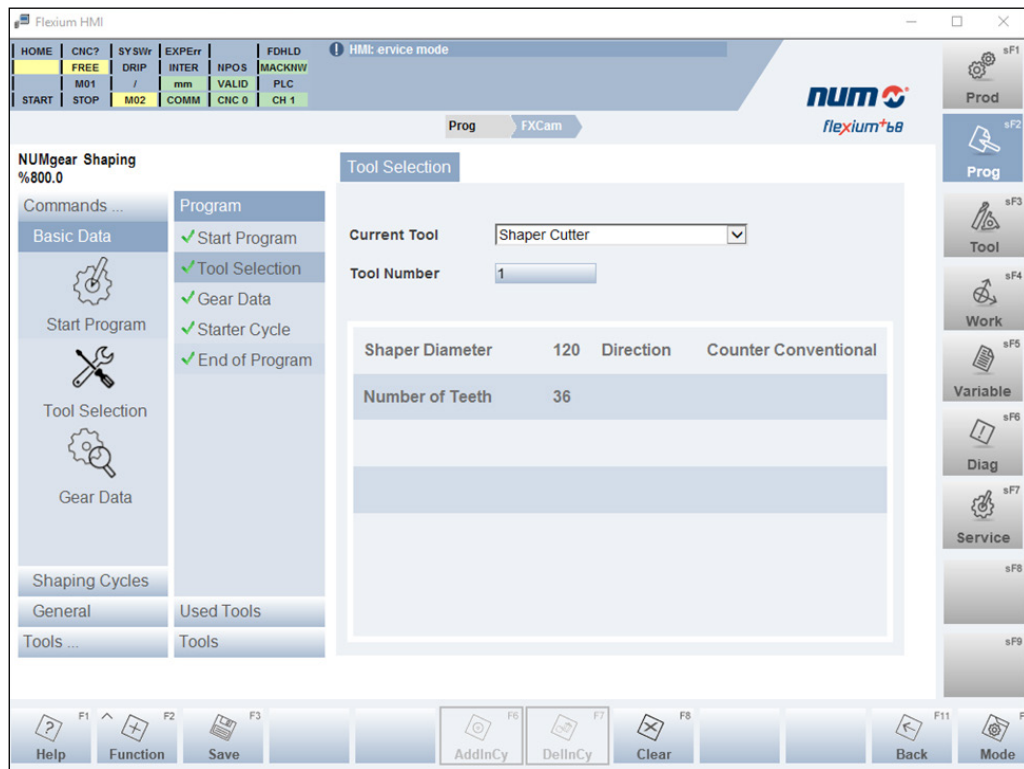
Tool Name	Used to identify a tool across several projects.
Diameter	Outer diameter of cutter.
Number of Teeth	Number of teeth of the cutter.
Direction	Conventional or counter conventional.
Offset	Offset of the shaper cutter.
Cut up or down	Cutting direction.

2.5.2 Start Program Page



Data Units	Set to millimeter or inches.
Cluster Gear	Select Yes if there are more than one gears to be cut on the blank.
Number Gears to Cut	If you have a cluster gear, select the number of the gear. Default is one.

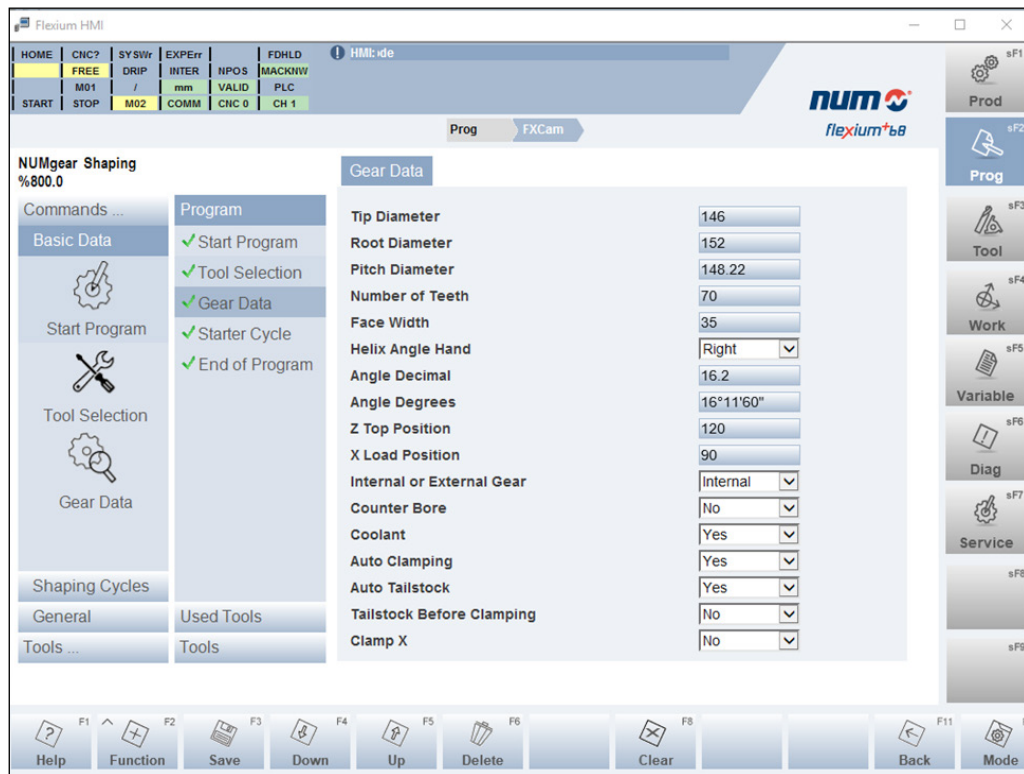
2.5.3 Tool Selection Page



On the Tool Selection Page, you select one of the tools you have created previously.
A tool selected in your project will be shown in the column Used Tools.

Current Tool	A selection of all tools available. Select the appropriate tool for the Shaping process.
Tool Number	The number of the tool in the sF3 Tool Management.

2.5.4 Gear Data Page



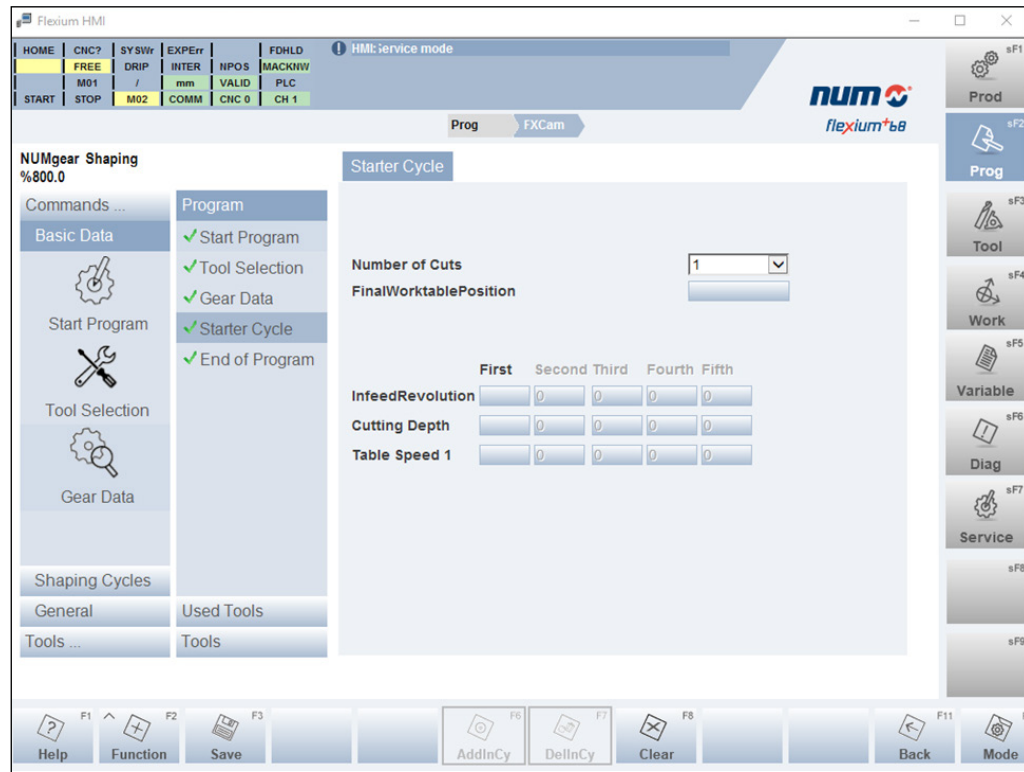
Tip Diameter	It is the inner diameter of the ring gear.
Root Diameter	It is the diameter of the gear at the tooth root.
Pitch Diameter	It is the imaginary circle at which the gear rolls without slipping with a pitch circle of a mating gear.
Number of Teeth	Number of teeth to be cut on this gear blank. Minimum is three, maximum number is 9990.
Face Width	Refers to the length of the gear tooth. You must define exactly how long the teeth on the gear are. If is not a spline or shaft gear, then the value you enter here must be the face width of the gear blank.
Helix Angle Hand	You can select spur gear - no helix angle, right hand or left hand. If you think of the gear as an internal screw, a right hand gear when turned clockwise will screw in, and a left hand gear when turned clockwise will screw out.
Helix Angle	This field is displayed only for helical, not for spur gears. The angle can be entered in decimal degrees, or in degrees°minutes'seconds" and is always positive, as the sign is determined by the helix hand - right hand results in a positive and left hand results in a negative value.
Z Top Position	Defines the distance between the face of the machine's table and the top position of the tool. This controls the position of the cycle in the Z (axial) direction. The location of the entire cycle depends on this data. Changing this data moves the entire cycle plus or minus along the Z axis.
X Load	Position of the tool when loading the gear.
Internal or External	Shaping can be used for disks (external) and internals (rings). Internal is the default.

Counter Bore	Set if there is a counter bore for clamping.
Coolant	Set if there is a coolant system for the process.
Auto Clamping	Set if the workpiece is being clamped automatically before shaping.
Auto Tailstock	Set if the workpiece is being fixed by a tailstock automatically before shaping.
Tailstock Before Clamping	Set if the tailstock is being engaged before clamping.
Clamp X	Set if the workpiece is to be clamped during dwell rotation.

2.5.5 Shaping Cycles

There are two predefined Shaping cycles available for selection:

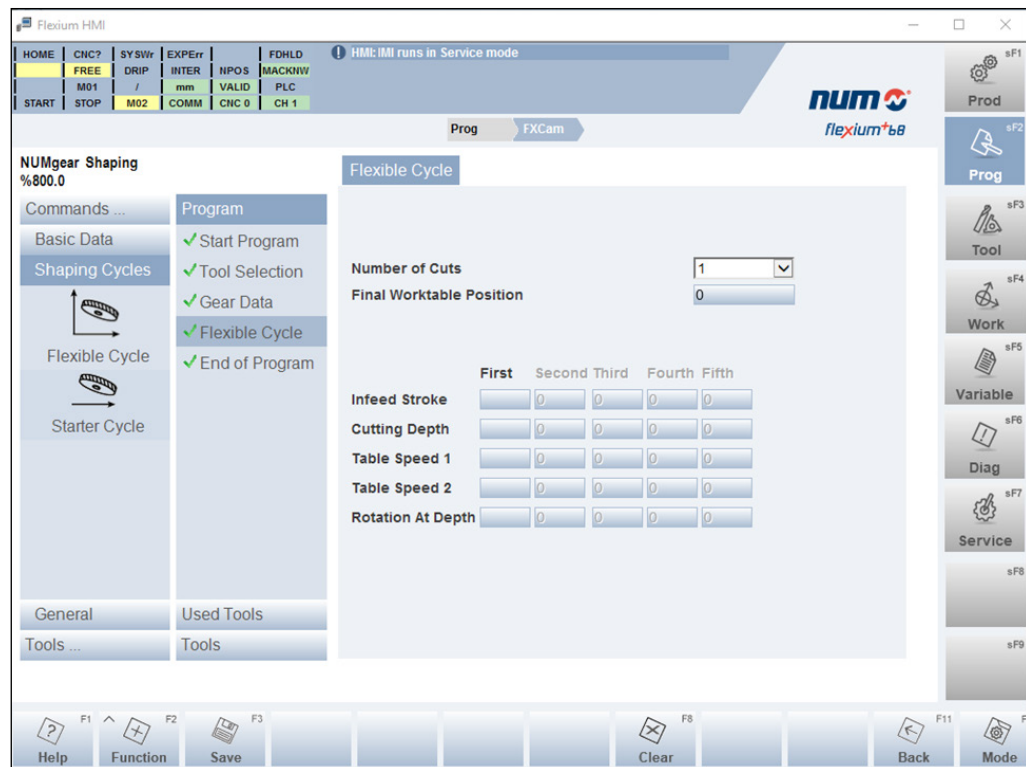
Starter Cycle



In the *Starter Cycle* you define the following values:

Number of Cuts	Number of times the cutting tool will need to run one pass in X down to the final tooth depth.
Final Worktable Position	Position of the worktable after shaping.
Infeed Revolution	Revolution of the tool per cut.
Cutting Depth	Cutting Depth is the total distance the cutting tool travels in X direction to reach the final tooth depth. If there is more than one cut selected, the distance to the final cutting depth must be divided up between the cuts.
Table Speed 1	Table rotational speed for one cut.

Flexible Cycle



In the Flexible Cycle you define the following values:

Number of Cuts	Number of times the cutting tool will need to run one pass in X down to the final tooth depth.
Final Worktable Position	Position of the worktable after shaping.
Infeed Stroke	Length of the movement of the tool in Z along the gear tooth flank per cutting stroke.
Cutting Depth	Cutting Depth is the total distance the cutting tool travels in to reach the final tooth depth. If there is more than one cut selected, the distance to the final cutting depth must be divided up between the cuts.
Table Speed 1/2	Table speed refers to the rotation of the work piece table during processing. Table Speed 1 specifies the rotation during the cut. Table Speed 2 specifies the rotation after the cut during dwell.
Rotation At Depth	Position of the tool after one stroke before it is going to be retracted to be repositioned for the next stroke.

Published by NUM Spa

Via F. Somma 62
20012 Cuggiono (MI) (Italy)
Tel. : +39 02 979 691
website: www.num.com

Printed March 2019