Post Parameter Reference

Mastercam® X3

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Contents

chapter 1

Introduction

Welcome to the *Mastercam X3 Post Parameter Reference*. This guide documents the NCI Gcodes and operation parameters that together encapsulate Mastercam operations and toolpaths. It serves two main purposes:

- A reference to all the parameters and NCI Gcodes.
- Guidelines and examples for reading operation parameters, including parameters for machine definitions, control definitions, and machine groups.

This edition incorporates new features for Mastercam X3, introduced in July 2008. It includes the additional parameters used by new toolpaths, as well as new parameter read functions.

IMPORTANT: This book does not include information about event-based posts (EMP). It is intended to be used in connection with Mastercam's regular Mill, Lathe, Router, and Wire toolpaths, not Mastercam MultiTasking.

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Use the following Web sites to find information on Mastercam X3:

www.emastercam.com	Mastercam global user forum
www.mastercam.com	CNC Software, Inc. corporate Web site
www.mastercamedu.com	CNC Software, Inc. Educational Division Web site

For assistance with installing Mastercam X3, its SIM or NetHASP, or to obtain more information on using Mastercam X3, contact your local Mastercam X3 Reseller. If your Reseller is unavailable, you can call CNC Technical Support Services Monday through Friday, 8:00 a.m.–5:30 p.m., USA Eastern Standard Time.

When calling CNC Software for technical support, please follow these guidelines:

- Be sure you have already tried to contact your Mastercam X3 Reseller.
- Provide the serial number of your SIM HASP or NetHASP.
- Be ready to describe the problem in detail. Write down what happened, particularly if you cannot call immediately after the problem occurs.
- Be in front of your computer when you call.

- If possible, try to duplicate the problem before calling. Our Support Services technician may require you to duplicate the problem while you are on the phone.
- When you call, have ready a complete description of your hardware, including your operating system (OS), central processing unit (CPU), graphics card and settings, and memory.

You can also leave a message for CNC Support Services twenty-four hours a day, seven days a week via our e-mail or Web site addresses. When sending e-mail, please include:

- The serial number of your SIM HASP or NetHASP
- Telephone number and contact information where you can be reached
- Files required to reproduce an issue, such as .MCX and post files

TIP: Use Mastercam's Zip2Go utility to gather Mastercam part data into a compressed .Z2G file. This utility makes it easy to provide your Reseller or CNC Support Services with a file attachment that contains the information they need. Zip2Go scans the machine groups in your current part file and captures information such as your Mastercam configuration, machine definition, and post files. For more information on using Zip2Go, please refer to the Mastercam Help.

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chapter 2

Working with Parameters

Post parameters provide a way for the post writer to have direct access to settings and values from Mastercam dialog boxes, tool definitions, and other toolpath/operation settings. These parameters can be read by the post processor and stored in a user-defined variable, and then used like any other post variable.

Operation parameters supplement the information that is read from the NCI file. Operation parameters are provided to MP by MPParamX.dll. The following types of data are available:

- toolpath and operation settings, as entered in toolpath parameter dialog boxes (numbers 10000–16999)
- machine definition settings (numbers 17000–17999)
- control definition settings (numbers 18000–18999)
- machine group properties (numbers 19000–19999)

Tool parameters are written directly to the NCI file. They provide information about the selected tool, from the tool definition (numbers 20000–29999).

This chapter also discusses the regular NCI data and Gcodes, so you can get a complete picture of your toolpath data and the different methods for accessing it.

This chapter contains the following sections:

- An introduction to the different types of parameters and NCI data and how their values are passed to the post.
- Descriptions and examples of how to access operation parameters in your post.
- Descriptions and examples of how to access machine definition, control definition, and machine group parameters in your post.
- A visual reference which maps the dialog box controls to parameter numbers for machine definition, control definition, and machine group parameters.

The “Parameter Reference” on page 87 contains a complete list of all the parameters and NCI codes used in Mastercam X3.

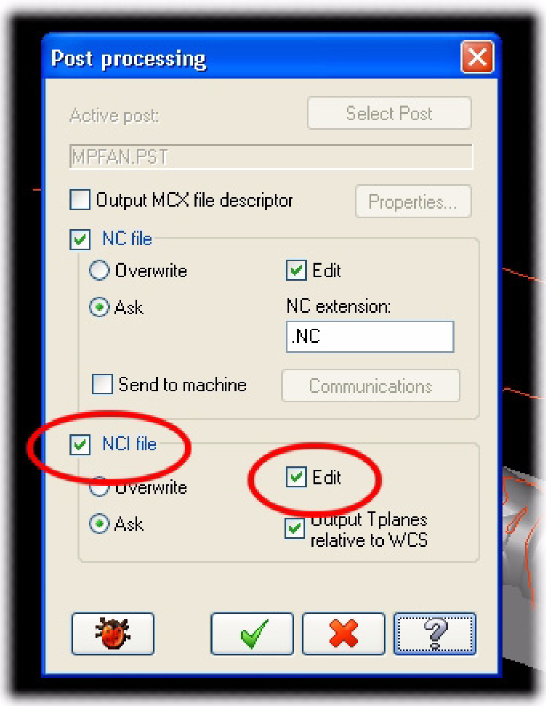
How does an MP post work?

MP posts get information about your part in two ways:

- Toolpath data. This consists of individual tool motions, feeds and speeds, and other commands, such as spindle on/off and coolant on/off.
- Operation parameters. These are the original values entered in your toolpath dialog boxes and machine group property dialog boxes.

The toolpath data is by far the most important. This information is stored in a format called NCI (NC Intermediate). NCI format is a generic machine-neutral format. When you create toolpaths in your part file, Mastercam generates NCI data for each toolpath or other operation and stores it in your MCX file as binary NCI data. When you post your operations, Mastercam writes this data to a separate ASCII file with a .NCI extension. It is read from here by the post executable.

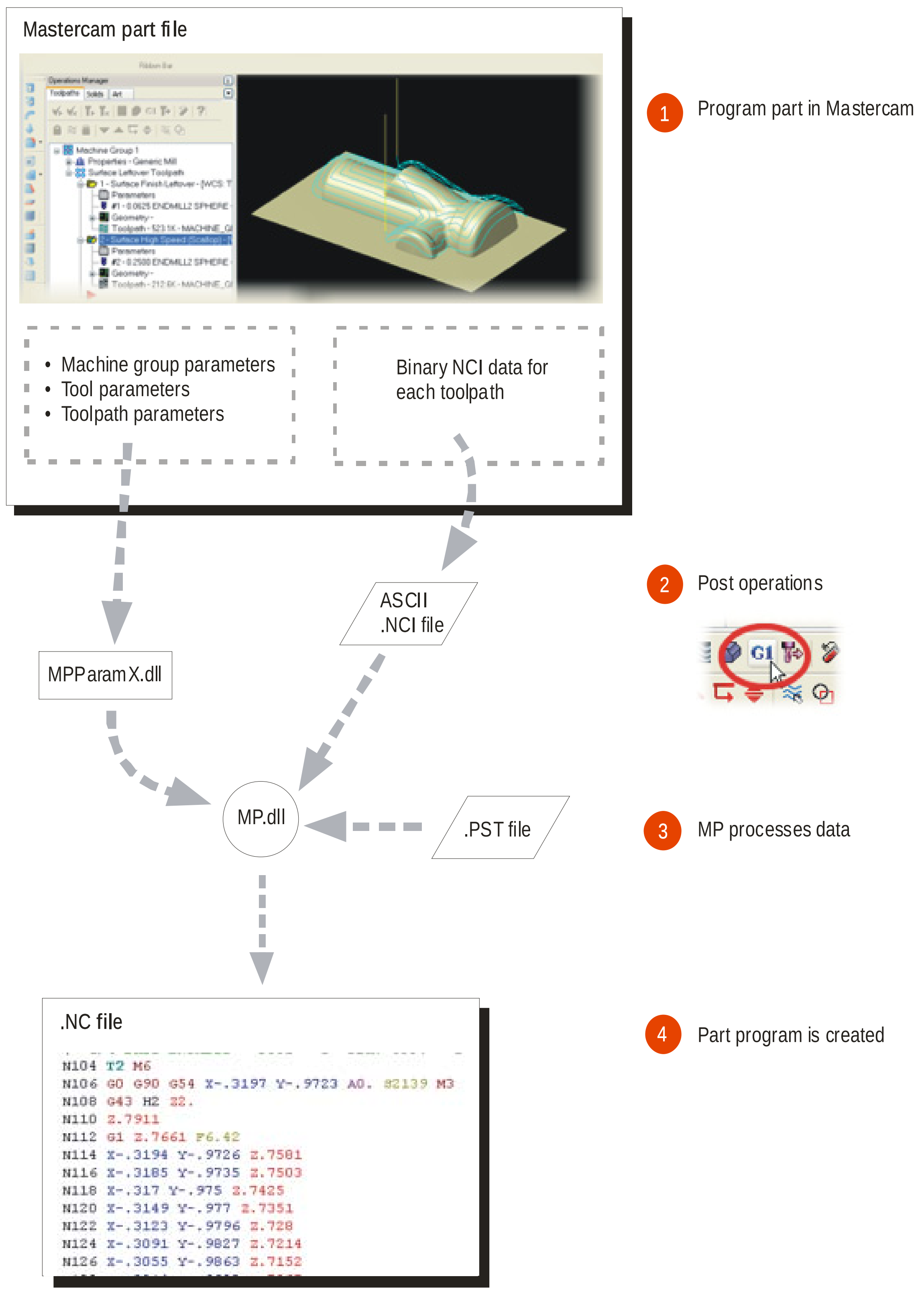
Typically, you do not need to see the NCI file, so Mastercam automatically deletes it after your NC file is created, but if you wish, you can view the file by selecting the **NCI file** option when you post. (Choose **Edit** to have the NCI file open up in your default editor.) This can be useful when you are debugging a post problem and want to see the raw numbers that are being read by the post.



Operation parameters are read by the MPParamX.DLL and the information is made available to MP.DLL. This happens behind the scenes and is typically invisible to you.

The post executable then creates an NC file with Gocde from the NCI data. It uses the instructions in the .PST file to customize the output for your specific machine. Figure 2-1 on page 5 illustrates this process.

Figure 2-1: From part file to NC file



Your part program stores two kinds of data: binary NCI data describes the toolpath movements, and operation parameters capture your machine group and toolpath settings. MP reads this data and uses the instructions in the .PST file to customize the NC output for your machine. The NCI data is first saved to an ASCII file so you can review it, if desired, for troubleshooting.

Reading the NCI file

The NCI file is organized in two-line groups.

- The first line contains a single value. This is the ***NCI Gcode***. It tells Mastercam what type of command this is and how to interpret the second line."NCI Gcodes" on page 298 lists all of the possible NCI Gcodes.
- The second line contains parameters for the NCI Gcode—for example, the X, Y, Z position and feed rate for a motion command.

This example shows an actual NCI line set for a linear move at rapid feed rate:

```
0
0 2.375 2.375 2.5 -2. 0
```

Definition:

```
g (NCI Gcode)
1 2 3 4 5 6 (six parameters)
```

Where:

```
g   0: Linear Move at Rapid Feed Rate (NCI Gcode)
1   Cutter Compensation
2   Final X position
3   Final Y position
4   Final Z position
5   Feed rate settings
6   Contour flag
```

The post executable stores these parameter values in the appropriate predefined MP variables, performs additional calculations to generate values for other predefined variables that are commonly used for the NCI Gcode type being processed, and performs any routines enabled by the post customization file for the NCI Gcode type—for example, breaking an arc at its quadrants.

Operation (10000s) parameters

Operation parameters are numbered from 10000–19999. In addition to toolpath settings, they include machine definition, control definition, and machine group settings. Operation parameter values can be integers, real values, or strings. "Parameter Reference" on page 87 lists all the possible parameters.

The MPPARAMX.DLL makes the operation parameters directly available to MP. This is a change in Mastercam X3 from earlier versions of Mastercam, in which parameters needed to be written to an .OPS file before they could be read by the post. MP includes a number of functions that you can use to query the value of the parameters that you are interested in. These are described in "Reading operation and tool parameters" on page 8.

Tool information (20000s) parameters

The 20000s parameters are written in the tool change series of NCI lines. Beginning with Mastercam X, these are also written for null tool changes; in previous versions, these were only written for actual tool changes. The information is written just prior to the actual tool change NCI Gcodes (1000, 1001 and 1002) as a "two line sets" of NCI lines. The first line gives the parameter number, and the second line gives the value of the parameter. For example:

```
20001
1/4 FLAT ENDMILL
20002
```

```
20003
20004
1 10 1 0 0.25 0. 0. 180. 1 1 6.4176 6.4176 6.4176 2139 1 4
20006
0 50. 50. 25. 25. 0. 0. 0.
20007
0. 2. 3. 2.5 0.25 2. 1. 0 100. 25. 0
20008
0. 0. 1. 0 0. 0. 0 0. 0.
```

Like operation parameters, tool parameter values can be either integers, real values, or strings. One difference between operations and tool parameters is that tool parameters might be defined to contain an entire series of values, whereas operations parameters typically only contain a single value. In the example above, the 20001 parameter contains only a single value, a string that is the tool name. However, the 20004 parameter, which encodes the tool definition, contains a series of 16 values. Each value represents a different tool definition parameter. The Parameter Reference in the next chapter describes the data structure for each parameter as well as the type of value it can contain.

Note: Strings are always passed as a single parameter.

Another change introduced with Mastercam X is how Mastercam Wire uses these parameters. In previous versions of Mastercam, 20000 parameters were not output for Wire operations.

Reading operation and tool parameters

The following sections describe how to access parameter values for tool and operation parameters using the **pparameter$** postblock. These sections apply to operation parameters in the 10000–16999 range, and the 20000s tool parameters. See “Machine definition, control definition, and machine group parameters” on page 16 to learn about accessing the 17000–19990 parameters.

Extracting string and numeric data

Since most parameters do not have predefined variables associated with them, your post needs to have a routine to extract the parameter values from the .ops file or NCI file before you can use them. Mastercam provides the following building blocks that you can use to construct these routines:

- a single common postblock **pparameter$**
- a numeric variable **prmcode$** that holds the NCI Gcode or parameter number, as described in “Parameter Reference” on page 87
- a string variable **sparameter$** that holds the parameter(s) as a single string

In addition, you need to create a user-defined variable to store the value of each parameter. This should be either numeric or string to match the parameter.

The postblock **pparameter$** is called repeatedly for each set of **prmcode$** and **sparameter$** that is read from the NCI file or the .ops file. The parameter value is then copied from **sparameter$** to the user-defined variable. If the data type of the desired parameter is numeric, the string returned from **sparameter$** will need to be conveted to a number. The following sections show numerous techniques of accessing parameter values.

IMPORTANT: Beginning with Mastercam X3, operation parameters are no longer output in a fixed sequential order. This means that routines in your PST file that depend on parameter output order can no longer be relied upon. Such routines need to be modified so that they do not rely on this logic. Use the new post functions described in “Mastercam X3 parameter read functions” on page 10 to directly query parameter values.

Mastercam X2 and earlier

The techniques in this section use the parameter tools from Mastercam X2. They all work in Mastercam X3, and generally apply to older versions of Mastercam as well.

Extracting a common string variable

This example shows how to get a string value from a parameter — in this case, from parameter number 10000, which is the name of the operation type.

```
string_user       # Define a string
pparameter$       # Predefined parameter postblock
if prmcode$ = 10000, string_user = sparameter$
# Capture the parameter string
```

Extracting a numeric variable

To extract a numeric value from the parameter, first get the string from **sparameter$**, then use the **rpar** function to convert it to a number. The target of **rpar** is the numeric variable that will store the parameter value. This can be either a user-defined variable or a predefined variable.

This example shows how to get the value of parameter 10042, which is the program number.

```
# Define a numeric variable to store the parameter value
my_prog_num : 0

pparameter$      # Predefined parameter postblock
if prmcode$ = 10042, my_prog_num = rpar(sparameter$, 1)
# Capture the 1st numeric value in the parameter string
```

Unfortunately, common NC parameters might have different numbers —and therefore, different **prmcode$** identifier values—depending on the operation type. Therefore, it is necessary to select the **prmcode$** based on the operation type. Typically, the numeric variable **opcode$** is used to accomplish this.

In the following example, a lookup table function **fprmtbl** and the formula **fprm** are used to extract the parameters. The lookup table consists of two columns:

- The first column contains the **prmcode$** identifier value that is to be captured.
- The second column contains the numeric or string variable that the parameter value will be stored in. You must create the user-defined numeric or string variables, or use predefined variables.

The lookup table function **fprmtbl** consists of the label **fprmtb**, a unique table number (usually this is the **opcode$** that contains the **prmcode$** identifier values you are looking for) and the number of entries in the table. For example:

```
string1 : 0     # User-defined string variables
string2 : 0
var1 : 0        # User-defined numeric variables
var2 : 0
var3 : 0
result : 0

fprmtbl 2    5        # Table Number, Size
     10000   string1  # Toolpath ID (string)
     10001   string2  # Tool String
     10002   var1      # Tool Number
     10003   var2      # Tool Dia. Offset Number
     10004   var3      # Tool Length Number
```

The lookup table call is performed by the formula function **fprm**. It returns a value of **1** if the table is found or **0** if the table was not found. The parameter in the function is keyed to the table number. In this example, if the **opcode$** value is **2**, then the table is called. If any **prmcode$** value matches a value in the table, Mastercam will copy the parameter value to the associated variable.

```
pparameter$      # Predefined parameter postblock
         result  =  fprm(opcode$)
```

Extracting numeric values from 20000s parameters

Recall that tool (20000s) parameters can contain a series of values, which can be either integer or real values. In this case, the value of **sparameter$** will be a string that containes a series of values delimited by spaces. Use the **rpar** function to extract the individual values from the string so they can be stored in separate variables.

The following example shows how to parse a parameter string which contains 5 separate values. First, create a series of unique, user-defined numeric variables to store the results. When you call **rpar**, set the target variable to the first variable in the list. The second parameter in the **rpar** function call indicates the number of entries in the list—in this case,

5. Mastercam then automatically populates the five variables with the first five values from the parameter string.

```
# User-defined numeric variables (defined in order for an implied
array)
var1 : 0
var2 : 0
var3 : 0
var4 : 0
var5 : 0

pparameter$     # Predefined parameter postblock
# Capture the numeric values in the parameter string
if prmcode$ = 20004, var1 = rpar(sparameter$, 5)
```

An example of an actual NCI line for this parameter might be

```
20004
1.1 2.2 3.3 4.4 5.5
```

So in this example, **`var1 = 1.1`**, **`var2 = 2.2`**, **`var3 = 3.3`**, **`var4 = 4.4`**, and **`var5 = 5.5`**.

Mastercam X3 parameter read functions

Mastercam X3 post developers have two additional parameter read functions at their disposal: **`rparsngl`** and **`rparsprm`**. These are versions of the **`rpar`** function discussed in the previous sections.

- Use **`rparsngl`** to retrieve a single parameter value. It works similar to **`rpar`**, except that you do not need to reserve an entire implied array of variables.
- Use **`rparsprm`** to retrieve a specific range of parameters.

IMPORTANT: These functions will not work with Mastercam X2 or earlier versions.

Here are some examples that compare the new functions to **`rpar`**. Example 1 is an example from a current X2 MR2 post. It uses **`rpar`** to retrieve the ninth value from the 20008 line. You need to create a predefined implied array to store all nine values.

Example 1: Parameter read example—legacy functions

```
# Numeric variables to hold '20008' tool parameters
# Do NOT change the order of these (9) variable definitions !
agg_val1    : 0      #Head axis in X
agg_val2    : 0      #Head axis in Y
agg_val3    : 0      #Head axis in Z
agg_val4    : 0      #Head body type
agg_val5    : 0      #Head body diameter
agg_val6    : 0      #Head body length
agg_val7    : 0      #Station body type
agg_val8    : 0      #Station body diameter
gauge_length : 0    #Station body length
pparameter$     #Read operation parameters
if prmcode$ = 20008,  #Aggregate head parameters
[
    #Reinitialize Var before parameter read
    gauge_length = 0  #"Tool Axis Length"
    #Get shift value, pivot to collet face
    agg_val1 = rpar(sparameter$, 9)
]
```

Example 2 uses the **rparsngl** to get the same parameter. Since it gets the desired value directly, there is no need for the predefined array. You only need to define a single variable for the value you are retrieving.

Example 2: Parameter read example—rparsngl function

```
gauge_length : 0    #Station body length
pparameter$         #Read operation parameters
   if prmcode$ = 20008, gauge_length = rparsngl(sparameter$, 9)
```

The general form of the function is

```
return = rparsngl(string, val)
```

where

- **return** is the variable that will store the desired parameter value.
- **string** is the string to get the parameter value from.
- **val** is the index number of the parameter to read.

Example 3 uses the **rparsprm** to get the fourth through seventh values from the 20007 line. Using **rpar**, you would have needed to define seven variables to store all seven values. Using **rparsprm**, you only need to define variables for just the four values that you want to retrieve.

Example 3: Parameter read example—rparsngl function

```
tl_shoulder_length : #Shoulder length
tl_arbor_diam      : #Arbor diameter
tl_holder_diam     : #Holder diameter
tl_holder_length   : #Holder length
pparameter$      #Read operation parameters
    if prmcode$ = 20007, tl_shoulder_length = rparsprm(4, 4)
```

The general form of the function is

```
return = rparsprm(val1, val2)
```

where

- **return** is the first variable in the implied array that will store the desired parameter values.
- **val1** is the index position of the first parameter in sparameter$ that you want to retrieve.
- **val2** is the total number of parameters to retrieve.

Those of you who attended the Reseller Conference will recognize these new functions from the Posts Department presentations. These functions should be working in the current Mastercam X3 Beta 2 software.

Techniques for reading operation parameters

This section discusses several specialized topics and techniques related to reading parameters. It also shows a more complete example of capturing operation parameters.

The examples in this section can be used in both Mastercam X3 and earlier versions of Mastercam.

Example: Capturing operation parameters

This example captures both string and numeric parameters. The operation type is a string value; the number of roughing cuts and their spacing are numeric values. See “Operation &

toolpath parameters" on page 88 for a comprehensive reference of all the operation parameters.

```
sop_type_name       # Define string variable for the operation type
num_rough_cuts : 0  # Define numeric variable for the
                    number of rough cuts
spcng_rough_cuts : 0  # Define numeric variable for
                        # the spacing between the rough cuts

psof$         # Start of file postblock
rd_prm_op_no$ = 0   # The number of the operation whose
            # parameters you want to retrieve
rd_params$      # Get the parameters - call pparameter$

pparameter$     # Parameter capture postblock

# Get operation type string
if prmcode$ = 10000, sop_type_name = sparameter$

# Capture numeric data for component ID and type
if prmcode$ = 10106, num_rough_cuts = rpar(sparameter$, 1)
if prmcode$ = 10107, spcng_rough_cuts = rpar(sparameter$, 1)
```

NC parameters with the pre-read routine

The preparatory or pre-read routine used in the post executable file can read NC parameter information. This capability is enabled when the post customization file has the predefined numeric variable **tooltable$** set to 1 or 3 to activate the pre-read routine for calls to the **pwrtt$** and **pwrttparam$** postblocks. The postblocks must both be declared in the post customization file. The procedure is the same as in "Extracting string and numeric data" on page 8 except that the postblock **pwrttparam$** is called during the pre-read routine instead of **pparameter$**. During the pre-read routine, the comment NCI Gcodes (1005, 1006, 1007 and 1008) are read and passed through the numeric variable **prmcode$** and the string variable **sparameter$**.

Determining the prmcode$ for a specific parameter

Sometimes it can be difficult to determine exactly which parameter code contains the parameter that you need for a specific application. Use the techniques described in this section as a "brute force" approach to isolating the parameter code.

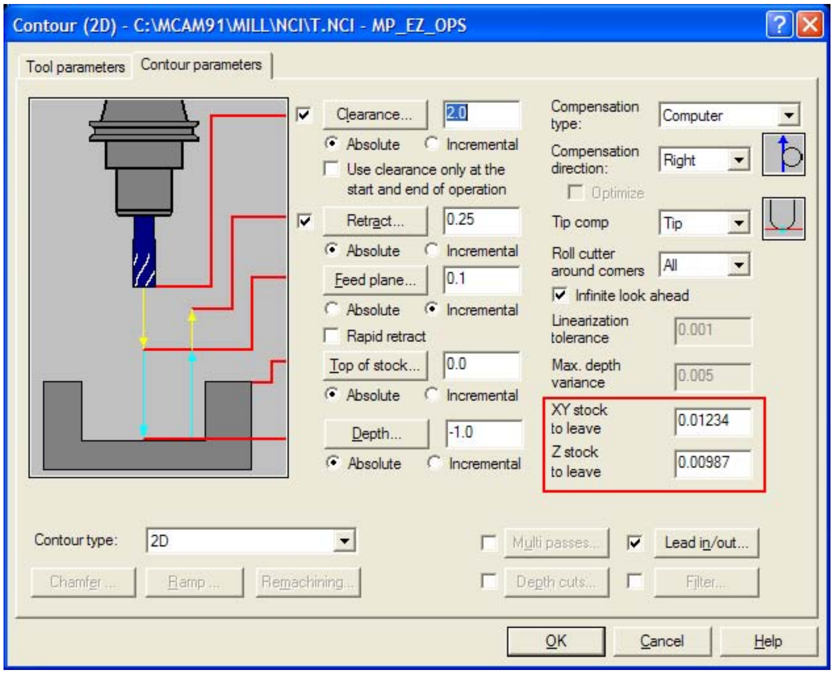
Add the **pparameter$** postblock to the post customization file (.PST), if it does not already exist.

```
pparameter$  #Information from parameters

# This is the line that "dumps" the data
 ~prmcode$, " = ", sparameter$, e$
```

Make sure that options to create the .OPS file are set in the control definition.

Create a toolpath of the type that has the parameter you are looking for. This example will demonstrate finding the **prmcode$** values for the **XY Stock to leave** and Z **stock to leave** parameters on a contour toolpath. For this example, create a 2D contour toolpath with the following settings:



For the two fields that you are interested in, enter distinctive values that are not likely to be used anywhere else.

The following line in the post processor:

```
# This is the line that “dumps” the data
~prmcode$, " = ", sparameter$, e$
```

will cause *all* the parameters for this 2D contour toolpath to be “dumped” into the NC output file. This can be a very long list of numbers. The distinctive values that were entered for the two fields should make them easier to locate in the NC file.

Open the NC output file into a text editor and do a search for the “unique” values for **XY Stock to leave** and Z **stock to leave**.

The search for **0.01234** finds this line in the NC file:

```
prmcode$ 10010. = 0.01234
```

The search for **0.00987** finds this line in the NC file:

```
prmcode$ 10068. = 0.00987
```

These are most likely the desired `prmcode$` values.

To verify that these are the correct `prmcode$` values, go back to the **Contour parameters tab** in Mastercam and change one of them to a new value. Re-post the operation and search the NC file for the new value. If you find the new value with the same `prmcode$,` you can be confident that you have found the `prmcode$` value that you can use to retrieve this specific parameter.

Following is the altered postblock and some user-defined numeric variables that these parameter values will be saved into.

```
xy_stock : 0 # Declare a numeric variable to hold
       # the "XY stock to leave" setting
z_stock : 0 # Declare a numeric variable to hold
       # the "Z stock to leave" setting

fmt "XY stock= " 2 xy_stock # Assign an output format
fmt "Z stock= "  2 z_stock # Assign an output format
```

```
pparameter$    # Information from parameters

# Capture parameter values
   if prmcode$ = 10010, xy_stock = rpar(sparameter$, 1)
   if prmcode$ = 10068, z_stock = rpar(sparameter$, 1)
```

Now you can use the values from the user-defined variables **xy_stock and z_stock** however you wish in your post processor.

For example, if you add the postline shown below to a **ptoolcomment$** postblock:

```
ptoolcomment$  #Comment for tool
 tnote = t$
 toffnote = tloffno$
 tlngnote = tlngno$
 "(", pstrtool, *tnote, *toffnote, *tlngnote, *tldia$, ")",e$
# ADDED THIS LINE
 "(", "Stock: ", ~xy_stock, " , ", ~z_stock, ")", e$
```

The NC output will look like the following example:

```
O0001
(PROGRAM NAME - OPS_PARAMETERS_EXAMPLE)
(DATE, Day-Month-Year - 08-06-03  TIME, Hr:Min - 11:30)
N10G20
N12G0G17G40G49G80G90
(3/8 FLAT ENDMILL TOOL - 1 DIA. OFF. - 1 LEN. - 1 DIA. - .375)
(Stock: XY stock= .0123 , Z stock= .0099)
N14T1M6
```

Accessing parameter information with C-Hooks

C-Hook developers who want to read the parameters from the operation parameter file can include the mpparam.dll as an implicit DLL. The developer must create a `while` loop and process each operation that was written to the parameter file. The DLL generates a Gcode and string as though NCI data were being presented from the NCI file.

The .ops file contains all the data in the actual operation structures associated with each toolpath operation in Mastercam. It contains an operation-by-operation record of the toolpath and operation settings as they are entered in the various toolpath parameter dialog boxes. The data in the .ops file is organized according to the definition of the structure `operation,` as found in the header file `m_vars.h` . (This file is part of the C-Hook Developer's Kit).

See the file header **mpparam.h** and the C-Hook operations header **m_vars.h** for the structures contained in the operation parameter file.

Example 4: Using C to read parameter information inside a C-Hook

```
if (bDoParamRead)
    {
    while (!opsTerminate)
    {
    fnMpparam(szFnam, &psGcode, szString, 80, &nOpsReset,
    &nOpsTerminate, nOpsRead);
    //Your code here
    }
    nOpsTerminate = 0;
    }
 This is the interface from mpparam.h:
//Remove extern "C" in C files
```

```
extern "C" MPPARAM_API int fnMpparam  // 0 for normal termination
char* sopername,    // I: The .ops file path and name to be read
short* gcode,       // O: 10000's gcode
char* sparameter,   // O: String conversion of data
int str_length,     // I: Maximum string length
int* reset,         // I: Reset the input file
int* terminate,     // O: Terminate the current read section
int view_all);      // I: Write all parameters from database
```

Note: Beginning with Mastercam X3, Mastercam includes a block of parameter numbers that are reserved for C-Hook developers; see page 162. These include parameters number 30000–31999.

Other useful variables

Using the strtool_v7$ variable

The numeric variable **`strtool_v7$`** was introduced in Mastercam Version 7 when the tool name in Mill became generic based on the tool type, and the tool definition index became the tool identifier. This variable was added to allow the tool description to appear as in Mastercam Version 6.

`strtool_v7$` is used to capture the description from the tool definition (NCI Gcode 20001 in the NCI file) to replace the tool name that is on the NCI Gcode 1013 line. This description is entered in the Define Tool dialog box, in the Tool name field on the Parameters tab. The tool name is replaced if **`strtool_v7$`** is **`1`**. The string is copied into the predefined string variables **`strtool$, strtoolpath$`**, and **`strtoolext$`**.

Machine definition, control definition, and machine group parameters

Mastercam X introduced a number of new data structures to expose the new parameters from the machine definition, control definition, and machine group. These three sets of parameters are in addition to the sets of tool and operation parameters used in earlier versions of Mastercam. The new parameters have NCI Gcodes in the 17000–19999 range. In this section you can learn about:

- Postblocks and variables introduced with Mastercam X to read these new groups of parameters.
- Sample code that illustrates how to access the new parameters.
- A catalog of screen captures from the Machine Definition Manager, Control Definition Manager, and machine group properties pages showing which parameters store the value of each field.

Reading the parameters

Unlike the operation and tool parameters, use the **pmachineinfo$** postblock to access all the parameters from the machine group, machine definition, and control definition. There are no pre-defined variables for most of this data; the post writer needs to create and define numeric and string variables to hold the data from the desired parameters, and then rely on calls to **pmachineinfo$** to read the parameter values to be stored in them.

Use the following commands:

- **rd_cd$** is used to call **pmachineinfo$** and read the parameters for the active control definition. See "Capturing control definition parameters" on page 18.
- **rd_tlpathgrp$** is used to call **pmachineinfo$** and read the parameters for the active machine group. See "Capturing machine group parameters" on page 18.
- **rd_md$** is used to call **pmachineinfo$** and read the parameters for the active machine definition. It uses the **rd_mch_ent_no$** variable. This is an integer that represents a specific entity in the machine definition. **rd_md$** returns the parameters for the machine entity specified by the current value of **rd_mch_ent_no$**. Therefore, to get all the parameters for the entire machine definition, **rd_md$** needs to be called multiple times, once for each distinct entity in the machine definition. Each entity corresponds to an individual component in the machine definition tree, such as a single axis, spindle, chuck, etc. See "Capturing machine definition parameters" on page 17.

A similar function can be used for reading operation parameters:

- **rd_params$** is used to call the **pparameter$** postblock to read operation parameters. It uses another variable called **rd_param_op_no$**, which is an integer that specifies the operation whose parameters will be read.

The following sections show examples of how to capture each of the parameter types. In general, this is done in three stages:

- Create and initialize the variables you will use to store the parameter values.
- Use **rd_cd$**, **rd_md$**, **rd_tlpathgrp$**, or **rd_params$** to call the proper postblock.
- Use **prmcode$** to find the desired parameter, and **sparameter/rpar$** to read its value and store it in your variable.

Each of these sections also includes a series of pictures showing which parameters are set by each machine definition, control definition, and machine group field.

Every control and machine definition field referenced in these pages is available as a post parameter. In cases where the value of the field is available as a pre-defined variable in addition to a parameter, MP automatically sets the value of the variable to the value stored in the control or machine definition, and the post writer has the choice of reading either the parameter value or the variable value.

Capturing machine definition parameters

This example finds the name of a machine component (a string value), and its ID and component type (numeric values). See "Machine definition parameters" on page 210 for a comprehensive reference of all the machine definition parameters.

Example 5: Capturing machine definition parameters

```
scomp_name         # Define string variable for the component name
mch_comp_idno : 0 # Define numeric variable for component ID
mch_comp_type : 0 # Define numeric var for component type

psof$       # Start of file postblock
rd_mch_ent_no$ = 0 # The number of the machine entity to retrieve
rd_md$       # Get the machine entity parameters - call pmachineinfo$

pmachineinfo$   # Parameter capture postblock

# Get component name string
if prmcode$ = 17201, scomp_name = sparameter$

# Capture numeric data for component ID and type
if prmcode$ = 19959, mch_comp_idno = rpar(sparameter$, 1)
if prmcode$ = 19958, mch_comp_type = rpar(sparameter$, 1)
```

Note that **rd_mch_ent_no$** can be used to reference either an axis combination or a specific component. Since machine definitions can have redundant components among different axis combinations, this lets you know precisely which component is being referred to. The value of **rd_mch_ent_no$** is interpreted according to the following table:

Value	Interpretation
–2	Uses the value of **sparameter$** to find the axis combination. For example, **sparameter$** might equal "Upper Left." (The value of **sparameter$** needs to be set before this call.)
–1	Reads the entire machine definition file. The order is base parameters, axis combinations, and then components.
0	Reads only the machine base.
any positive number	Represents the entity ID of the component. First the axis combinations are checked for a match and then the components.

The value of the axis combination ID is written to the G950 line and is available via the **syncaxis$** variable. You can use the expression **rd_mch_ent_no$ = syncaxis$** to get the ID of the current axis combination. The following example uses **syncaxis$** to get the name of the current axis combination.

Example 6: Getting the axis combination

```
my_axis_combo    # Define string variable for axis combo name
```

```
psof$            # Start of file postblock
rd_mch_ent_no$ = syncaxis$

rd_md$       # Get the machine entity parameters - call pmachineinfo$
pmachineinfo$   # Parameter capture postblock


# Get axis combo name string
if prmcode$ = 17201, my_axis_combo = sparameter$
```

Capturing control definition parameters

This example finds the name of the setup sheet (a string value), and the inch and metric machine tolerances (numeric values). See “Control definition parameters” on page 250 for a complete list of all the control definition parameters. and “Control definition pages” on page 53 for a visual catalog of the pages in the Control Definition Manager.

Example 7: Capturing control definition parameters

```
ssetup_sheet    # Define string variable for setup sheet string
cd_mtol_in : 0  # Define numeric variable for mtol – inches
cd_mtol_mm : 0  # Define numeric variable for mtol – metric


psof$       # Start of file postblock
rd_cd$      # Get the control parameters - call pmachineinfo$


pmachineinfo$   # Parameter capture postblock


# Capture string data for the name of the setup sheet
if prmcode$ = 18160, ssetup_sheet = sparameter$


# Capture numeric data for mtol, inch and metric
if prmcode$ = 18055, cd_mtol_in = rpar(sparameter$, 1)
if prmcode$ = 10856, cd_mtol_mm = rpar(sparameter$, 1)
```

Capturing machine group parameters

This example finds the file name of the machine definition associated with the machine group of the operations being posted, together with the name of the machine group and its number. See “Machine group parameters” on page 279 for a comprehensive reference of all the machine group parameters.

Example 8: Capturing machine group parameters

```
smd_file_name      # Define string variable for name of
                   # the machine definition file
stp_grp_name       # Define string variable for name of
                   # the machine group
tp_grp_number : 0  # Define numeric variable for the
                   # machine group number


psof$              # Start of file postblock
rd_tlpathgrp$      # Get the toolpath group parameters -
                   # call pmachineinfo


pmachineinfo$      # Parameter capture postblock


# Capture numeric data for toolpath group number
if prmcode$ = 18500, tp_grp_number = rpar(sparameter$, 1)


# Capture string data for machine filename and group name
if prmcode$ = 18501, stp_grp_name = sparameter$
if prmcode$ = 18601, smd_file_name = sparameter$
```

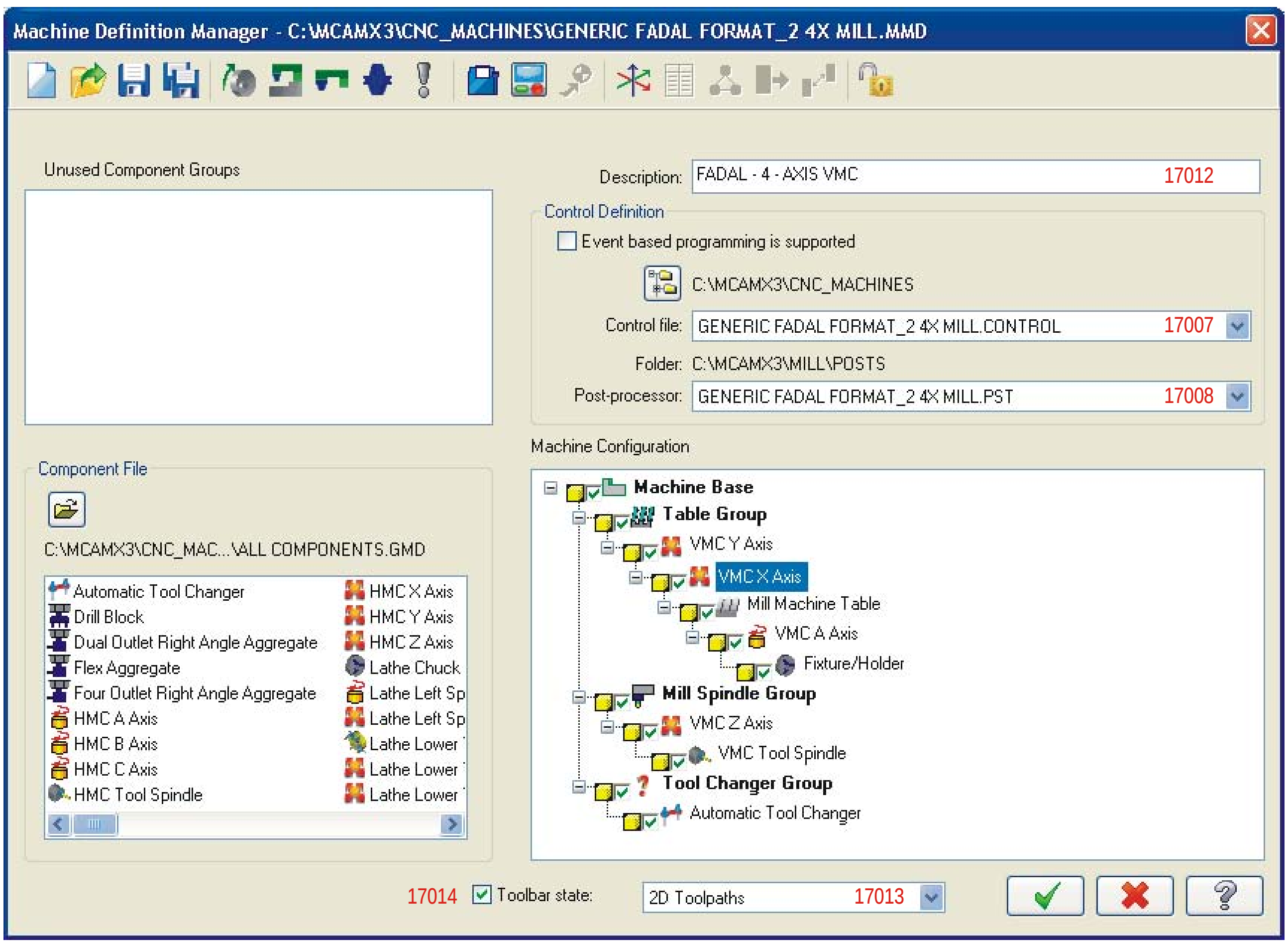
Machine definition pages

Most of the fields shown in the following pages use parameters to store their values, but the values for some fields are available as pre-defined variables, or even directly in the NCI G-code. Use the following color key to determine the type of value:

- Red labels indicate parameter numbers
- Blue labels indicate pre-defined variable names
- Green labels indicate NCI G-codes

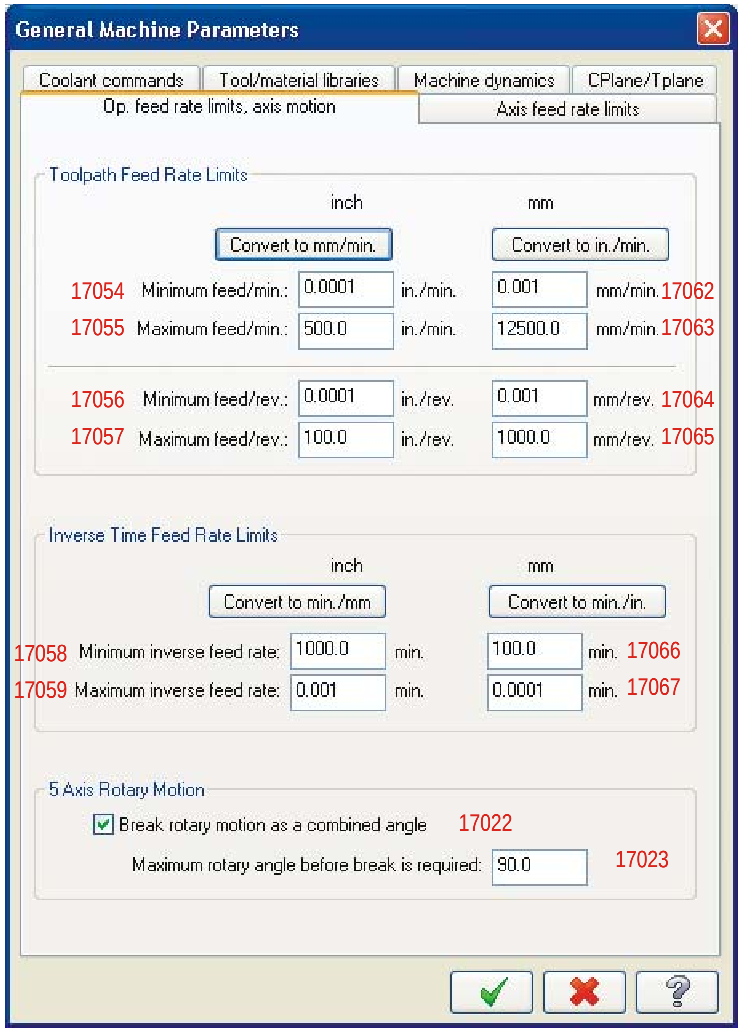
Some fields are available as both parameters and pre-defined variables. In these cases, you can use whichever method is most convenient. Typically, this will be the pre-defined variable.

Machine Definition Manager

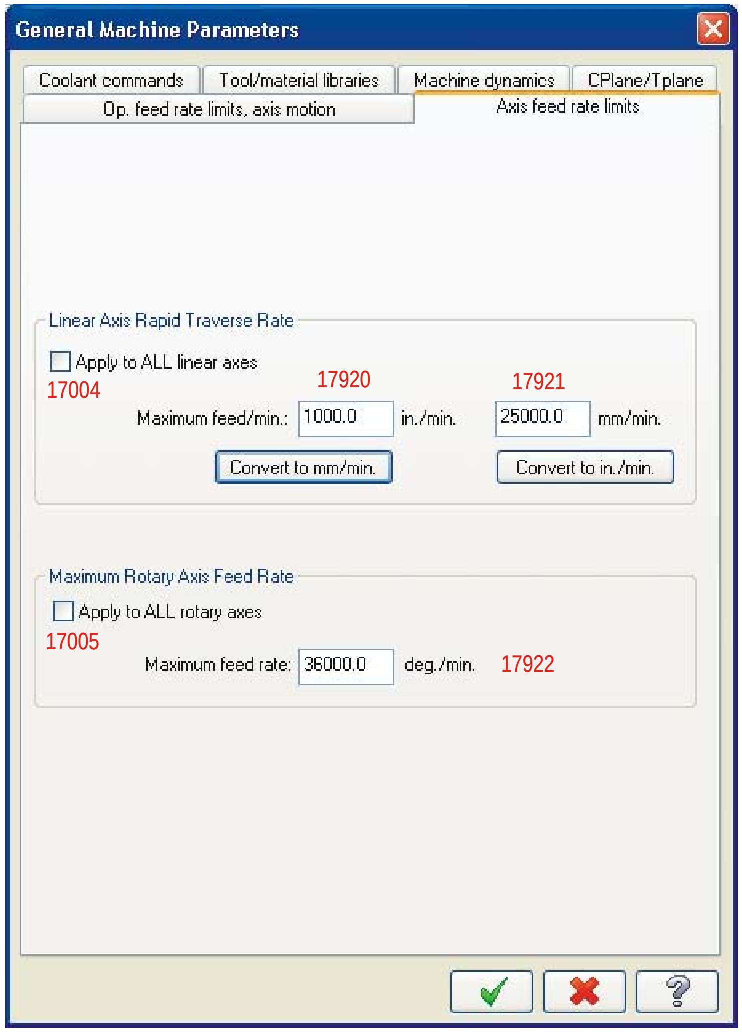


General machine parameters

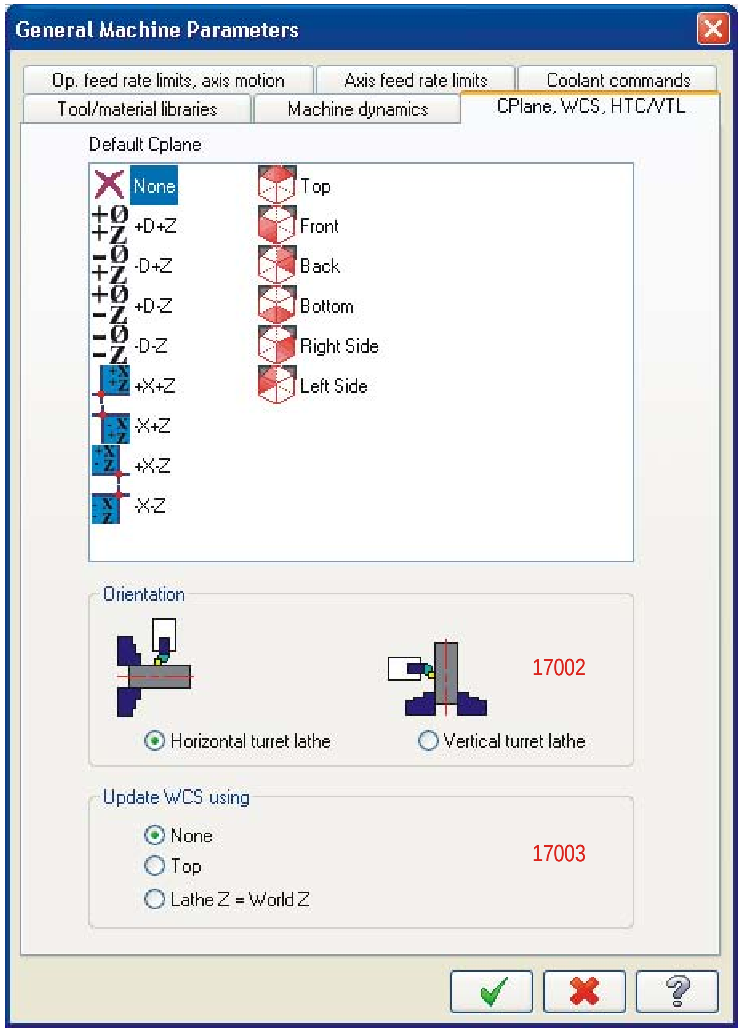
Op. feed rate limits /axis motion/orientation tab



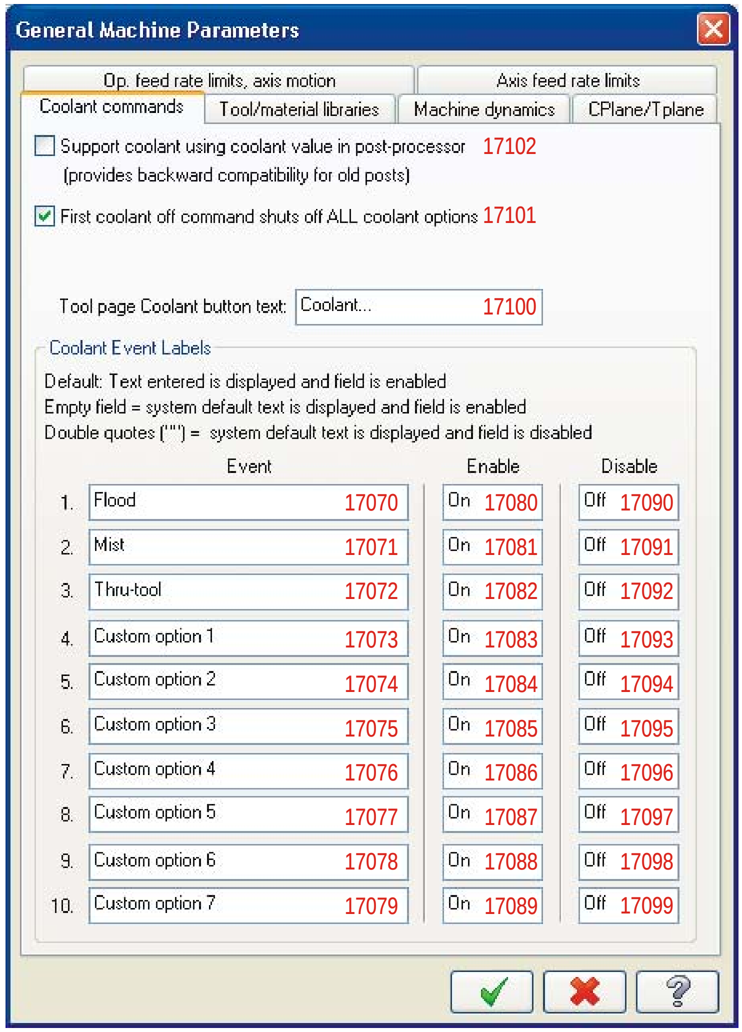
Axis feed rate limits tab



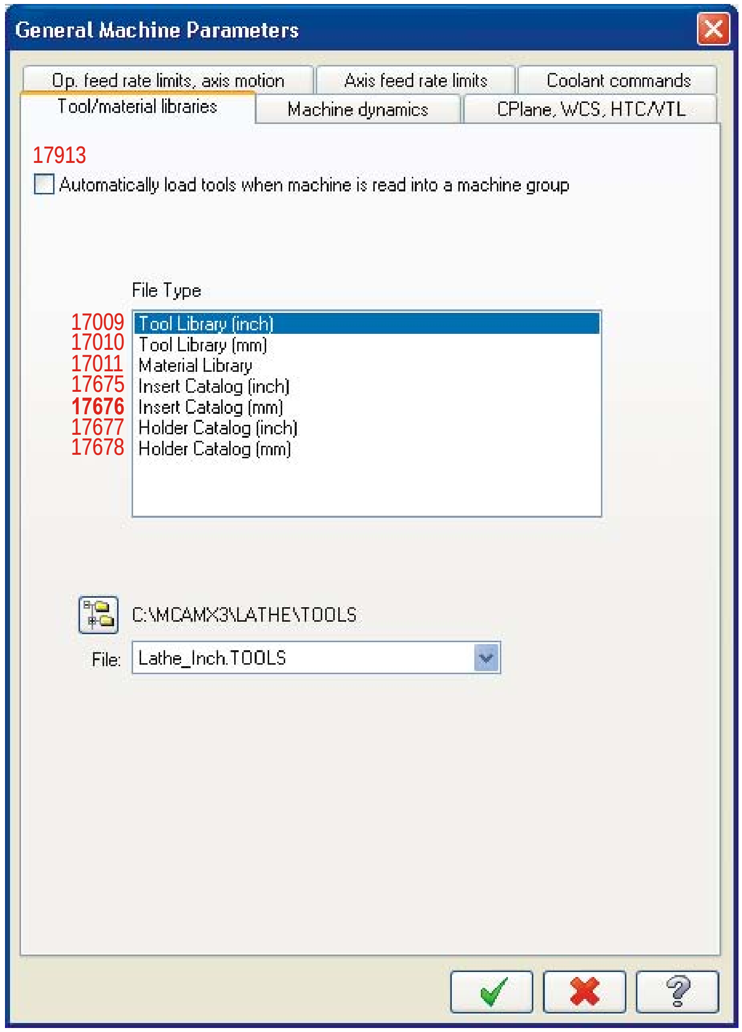
CPlane, WCS, HTC/VTL tab



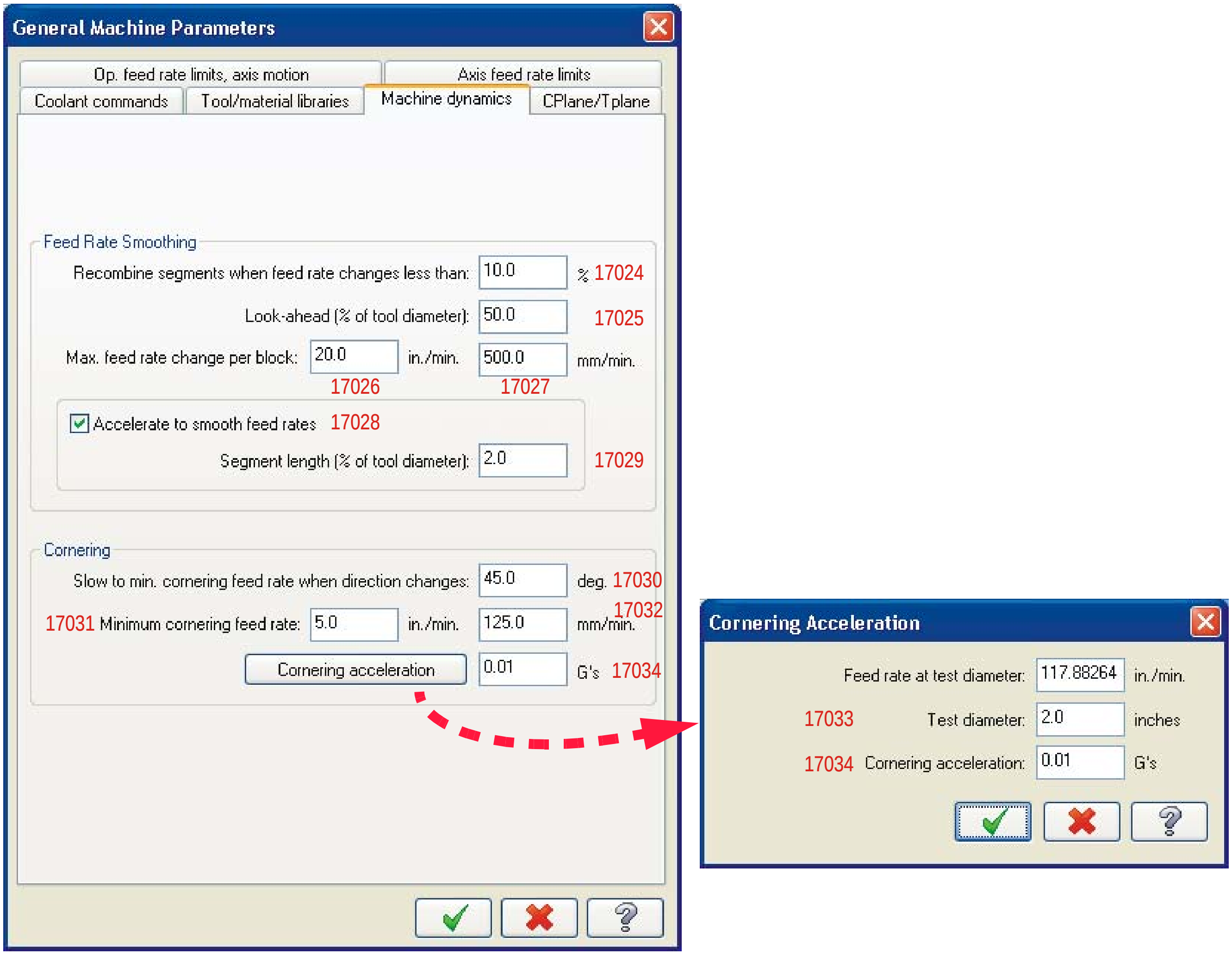
Coolant/Flushing/Options tab



Tool/material libraries tab

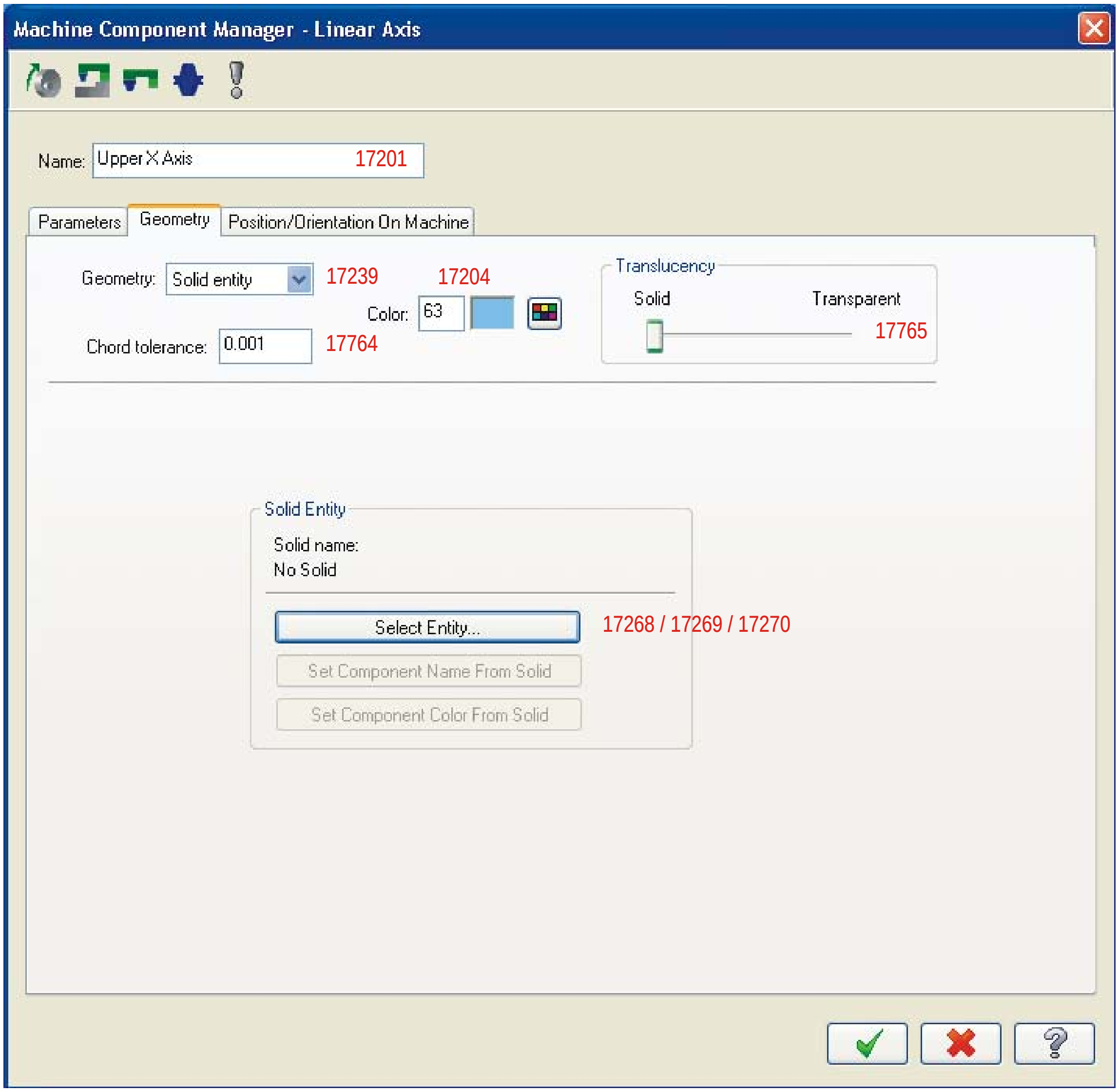


Machine dynamics tab

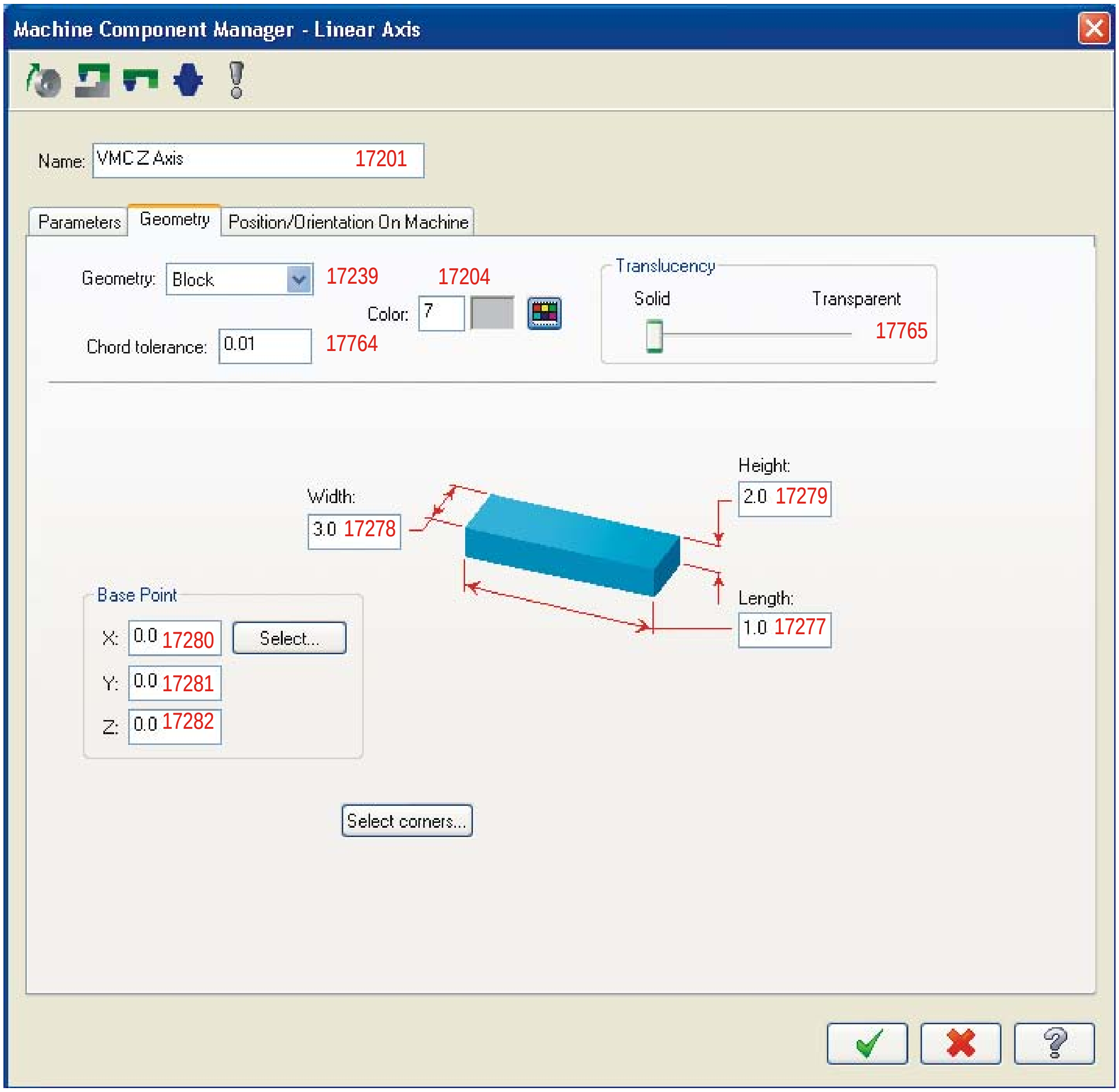


Component geometry (common)

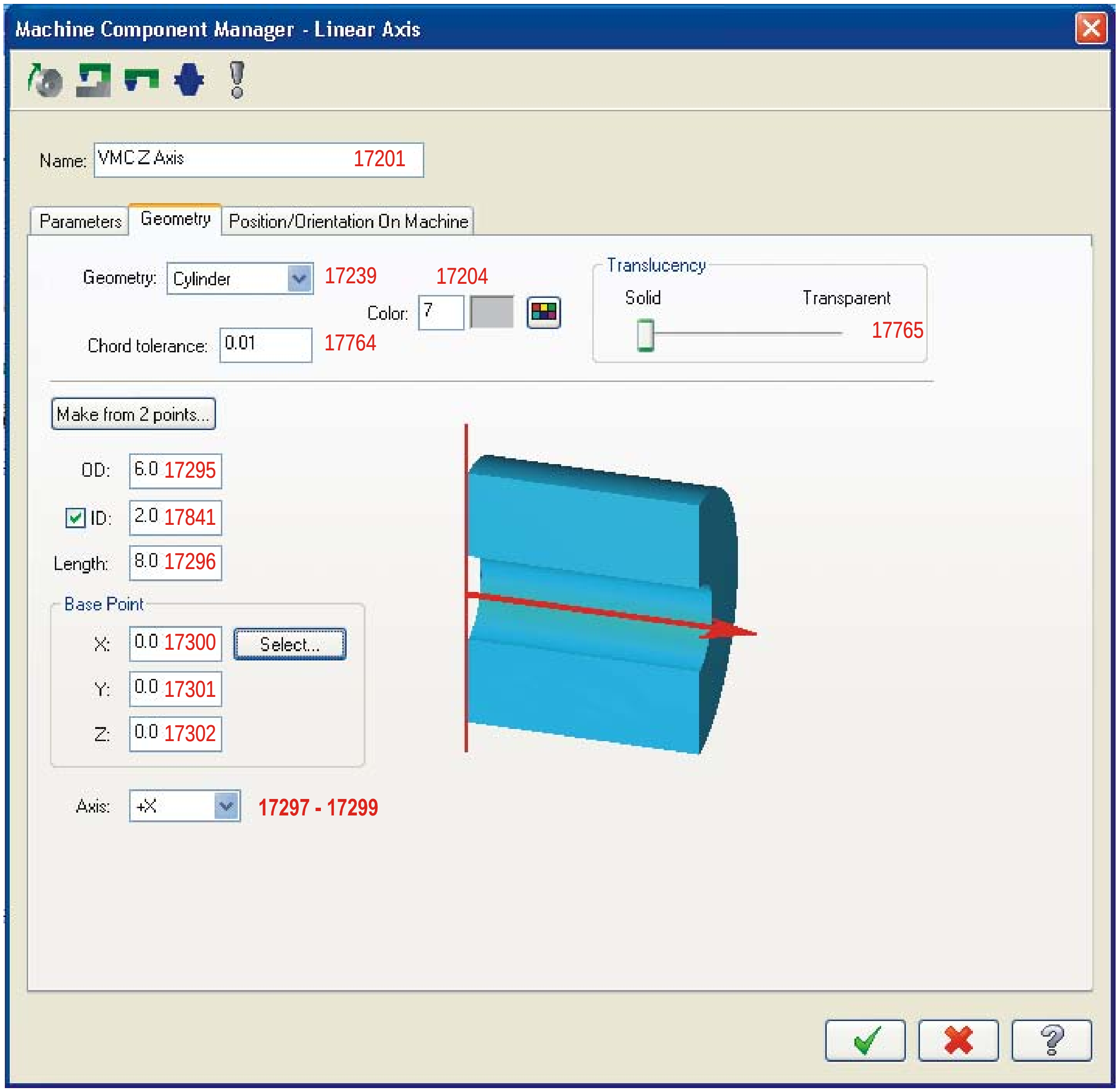
Solid geometry



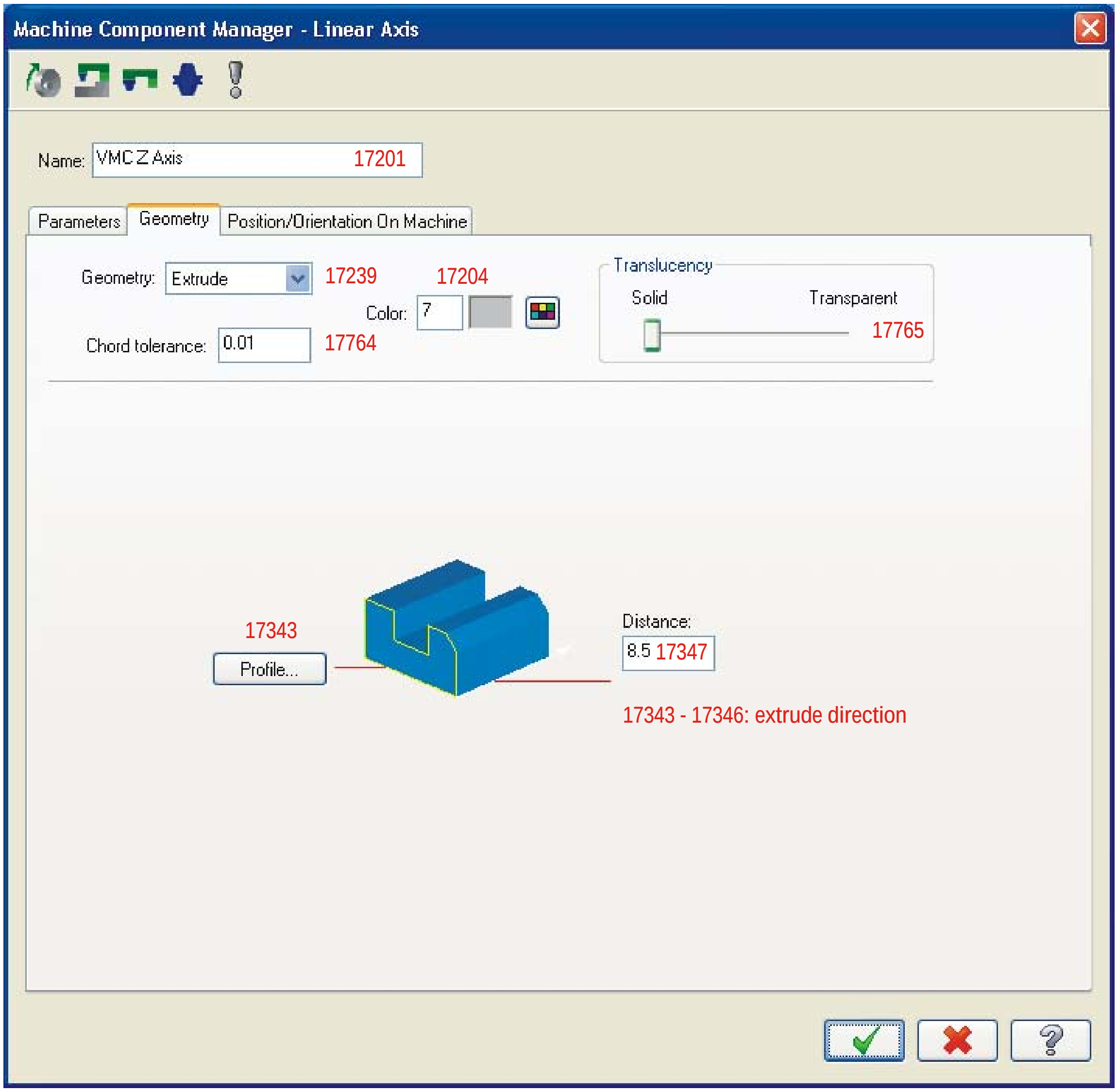
Block geometry



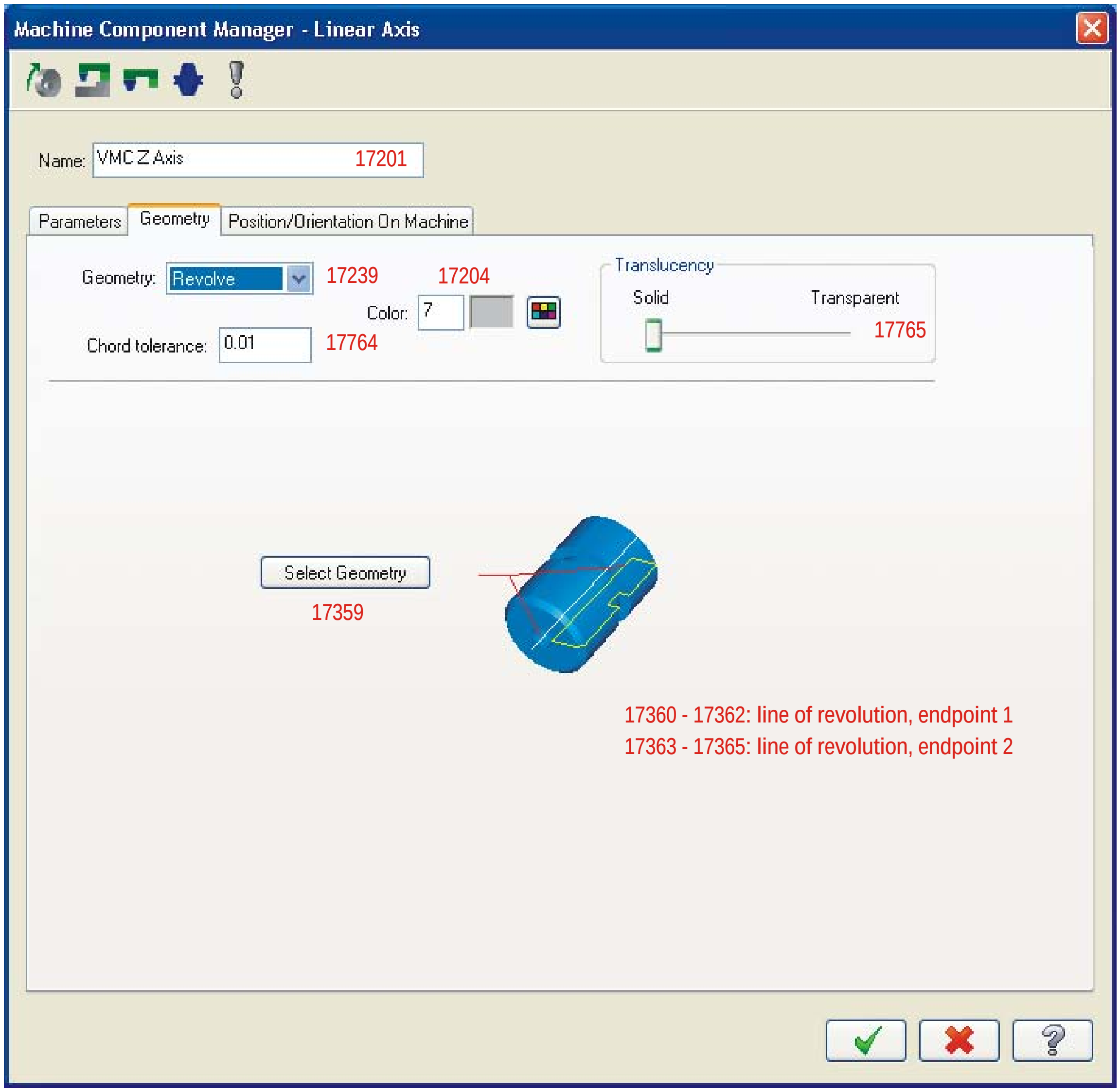
Cylinder geometry



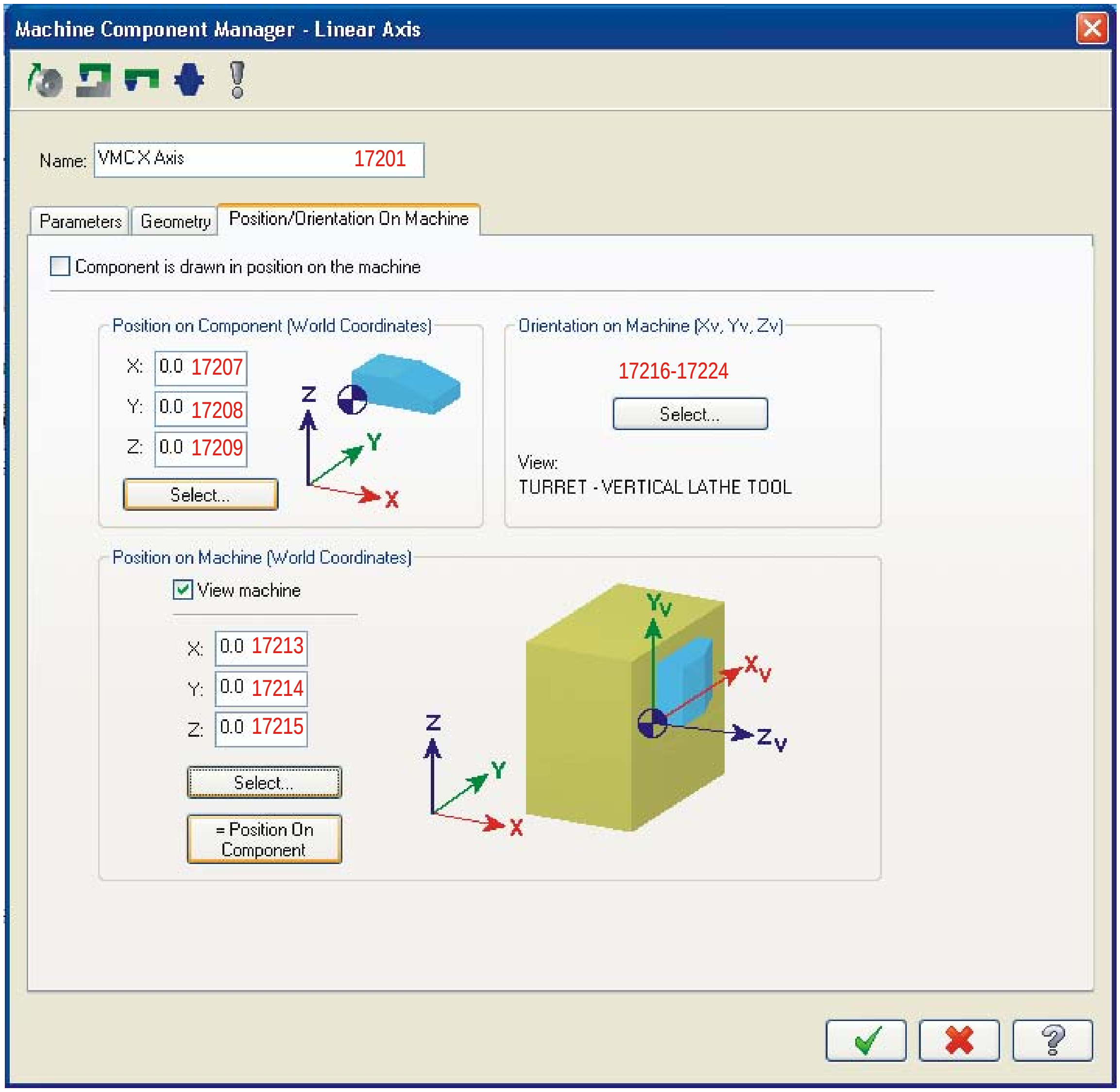
Extruded geometry



Revolved geometry

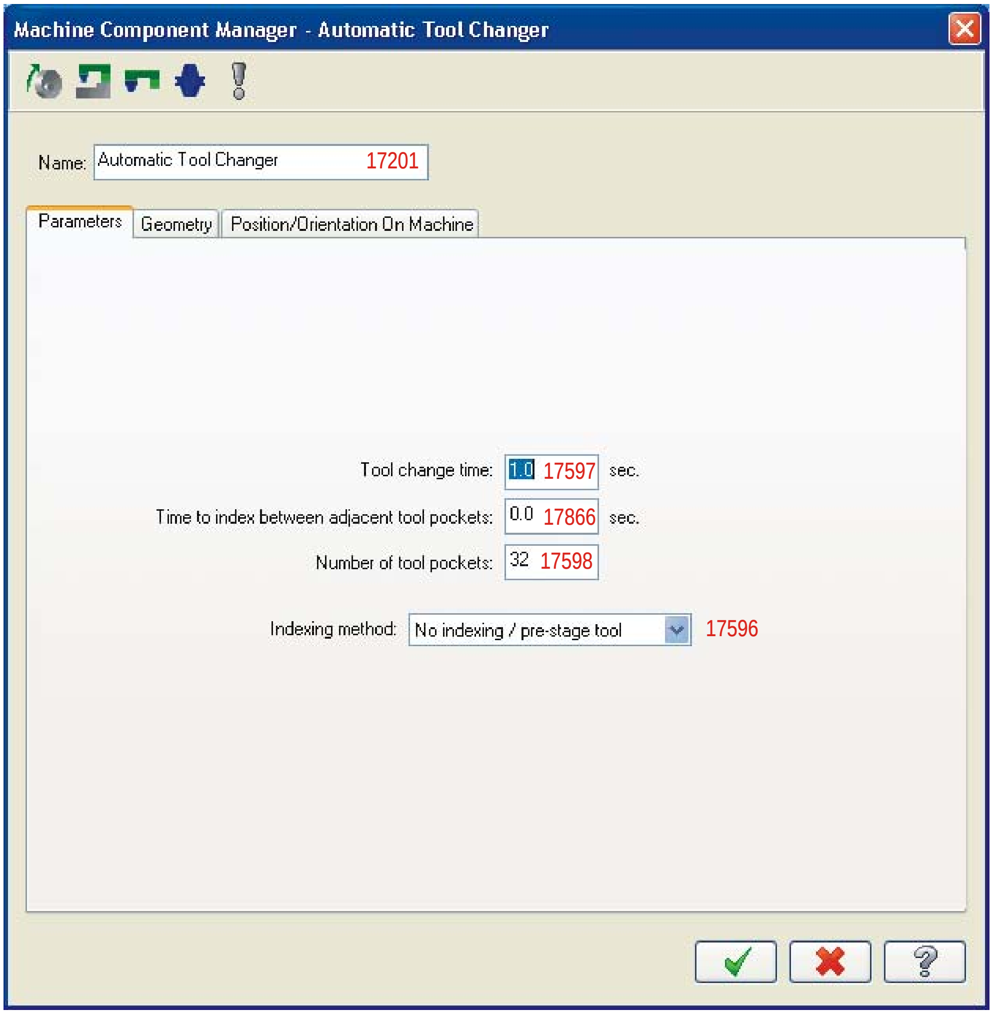


Position/Orientation tab

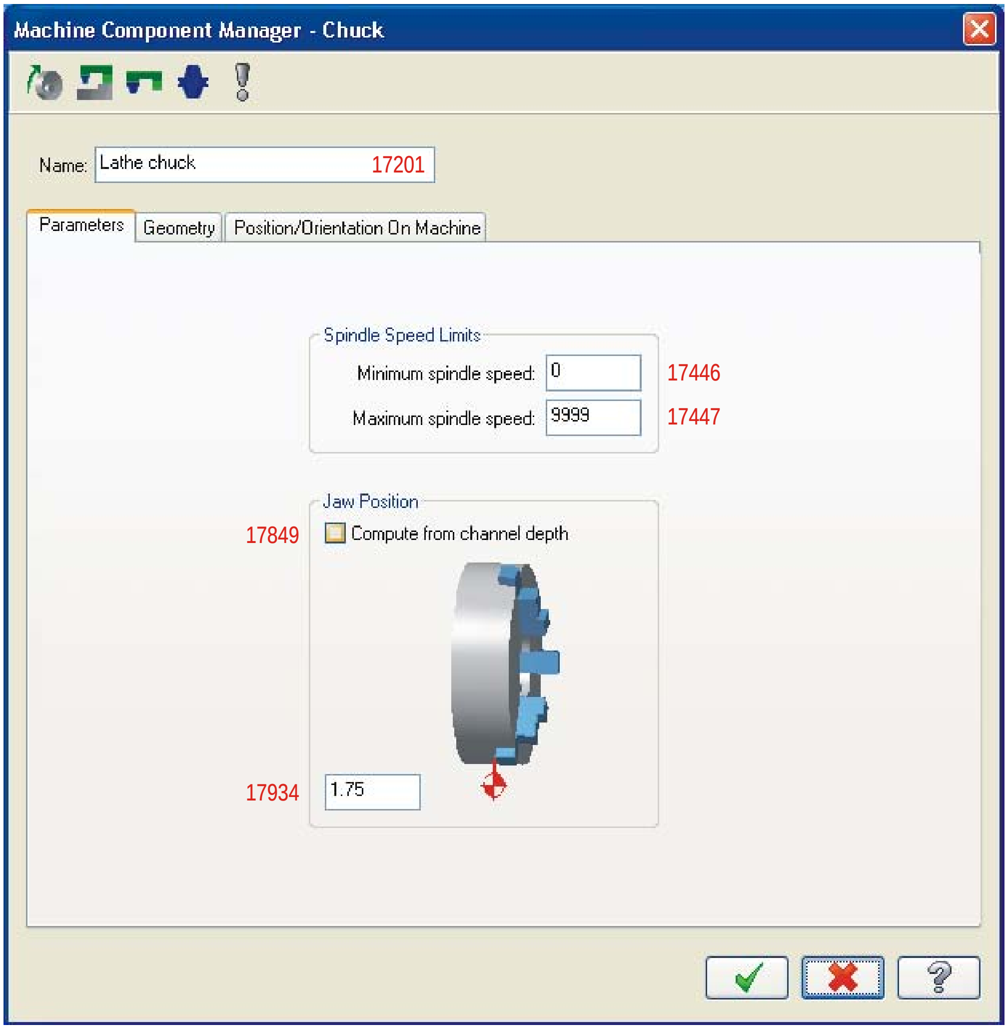


Component properties (individual)

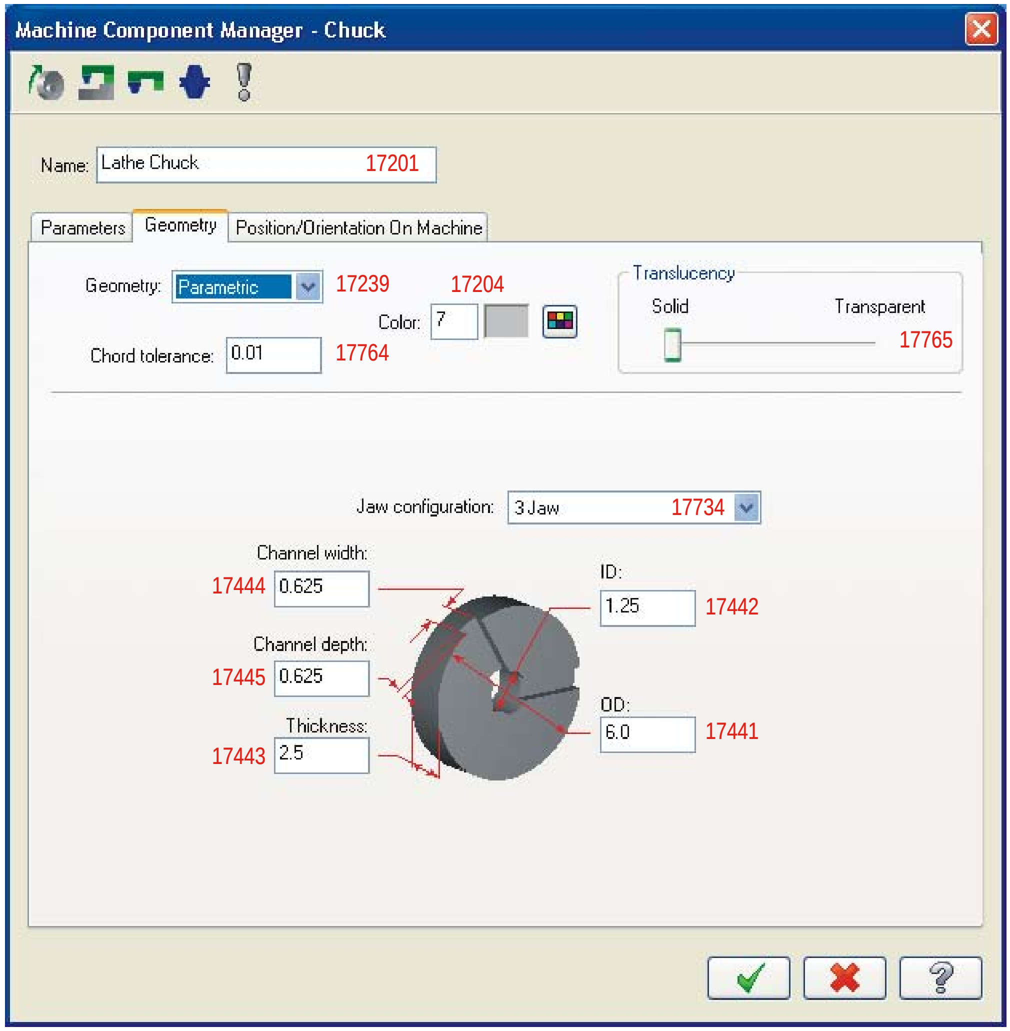
Automatic tool changer parameters



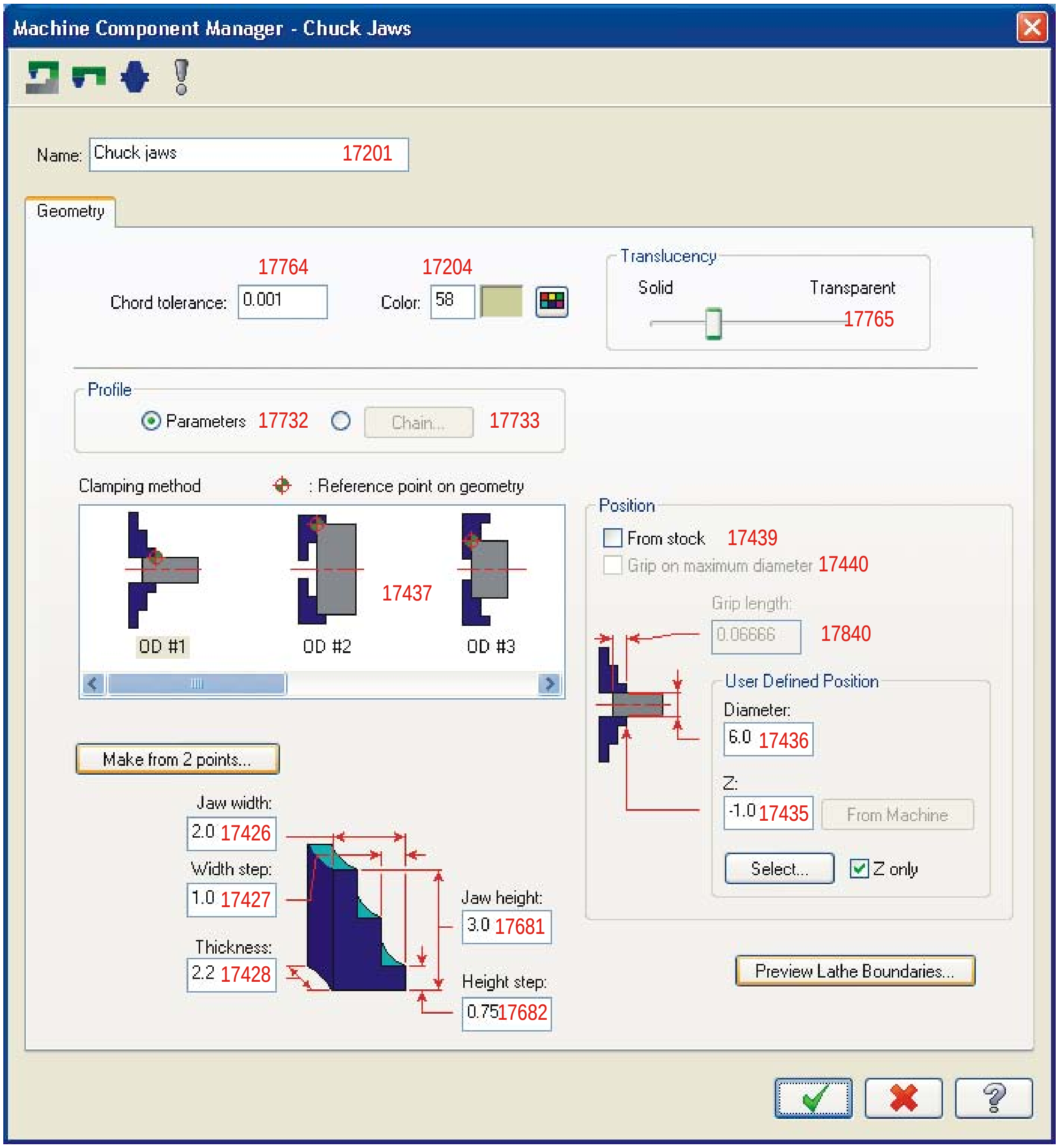
Chuck parameters



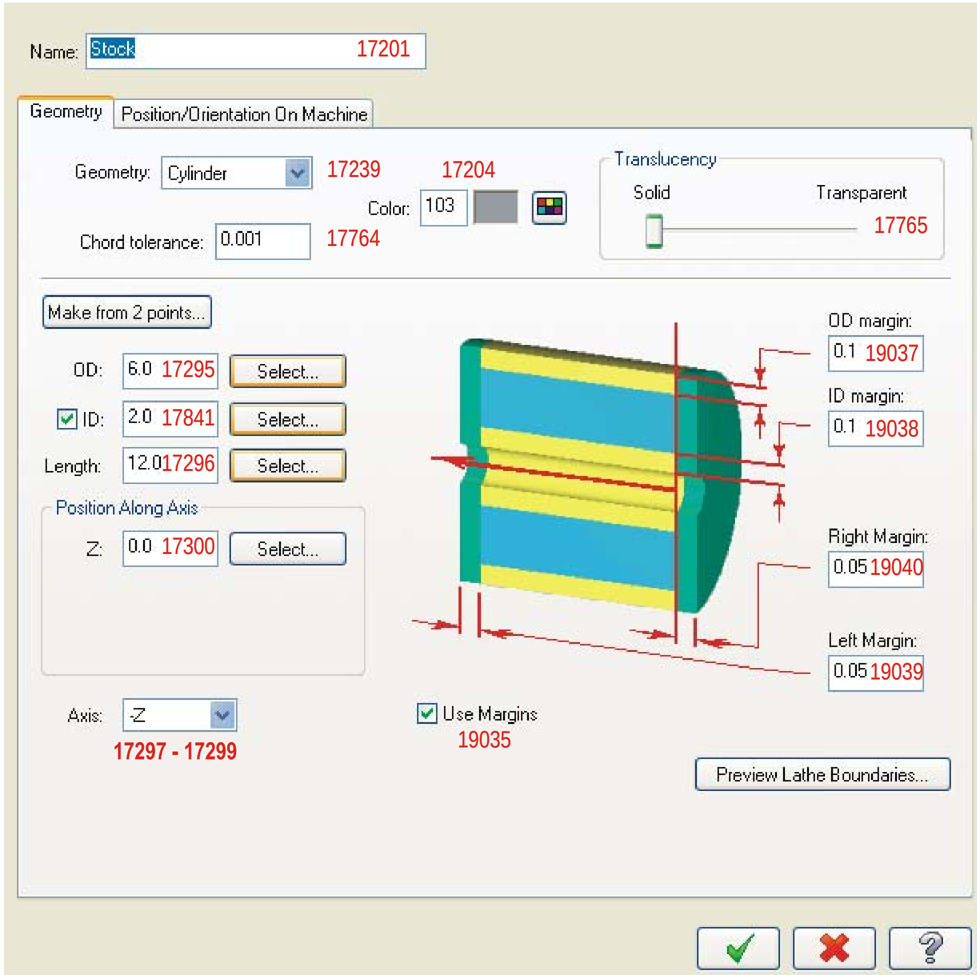
Chuck geometry (parametric) dialog box



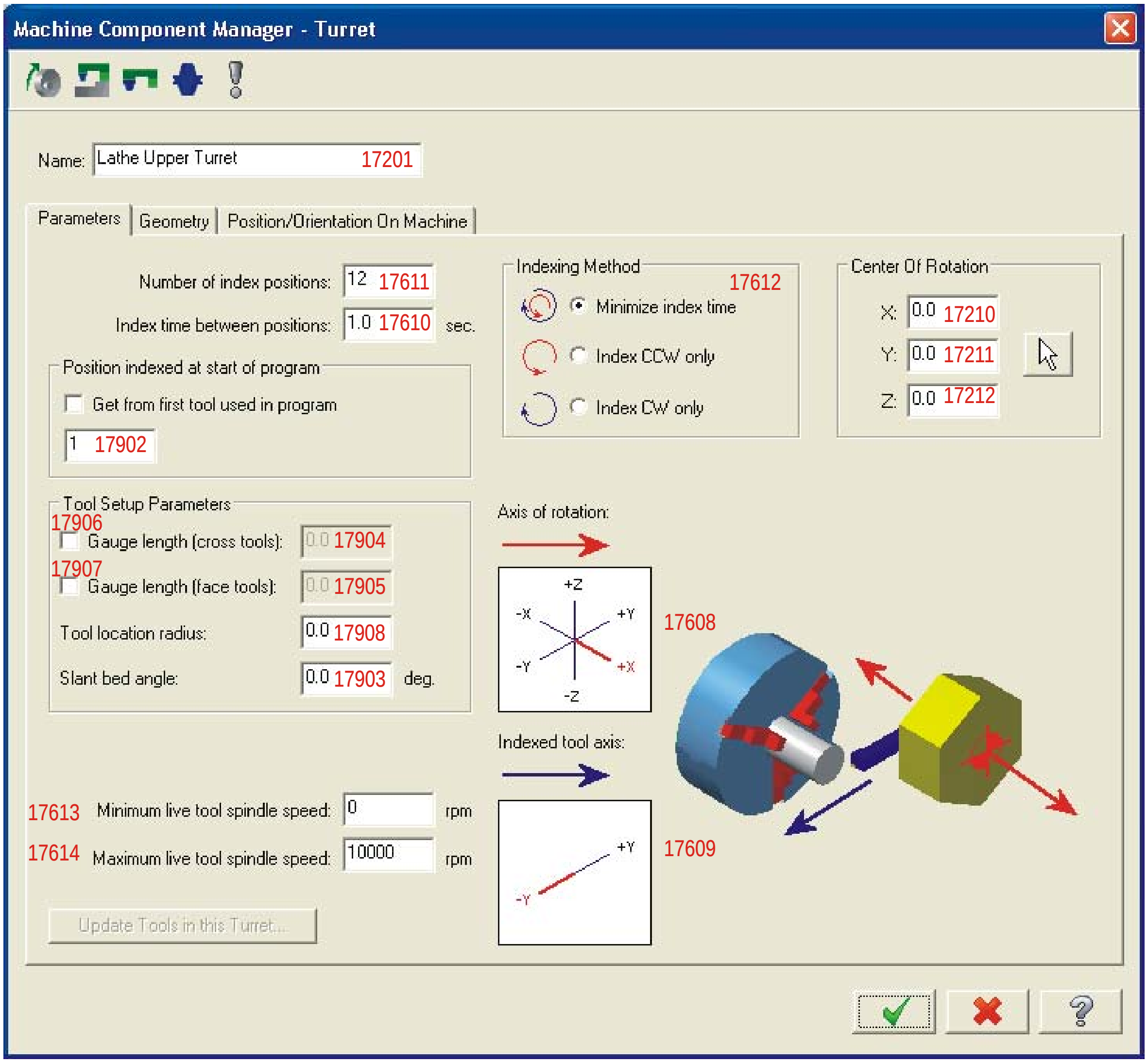
Chuck jaws parameters



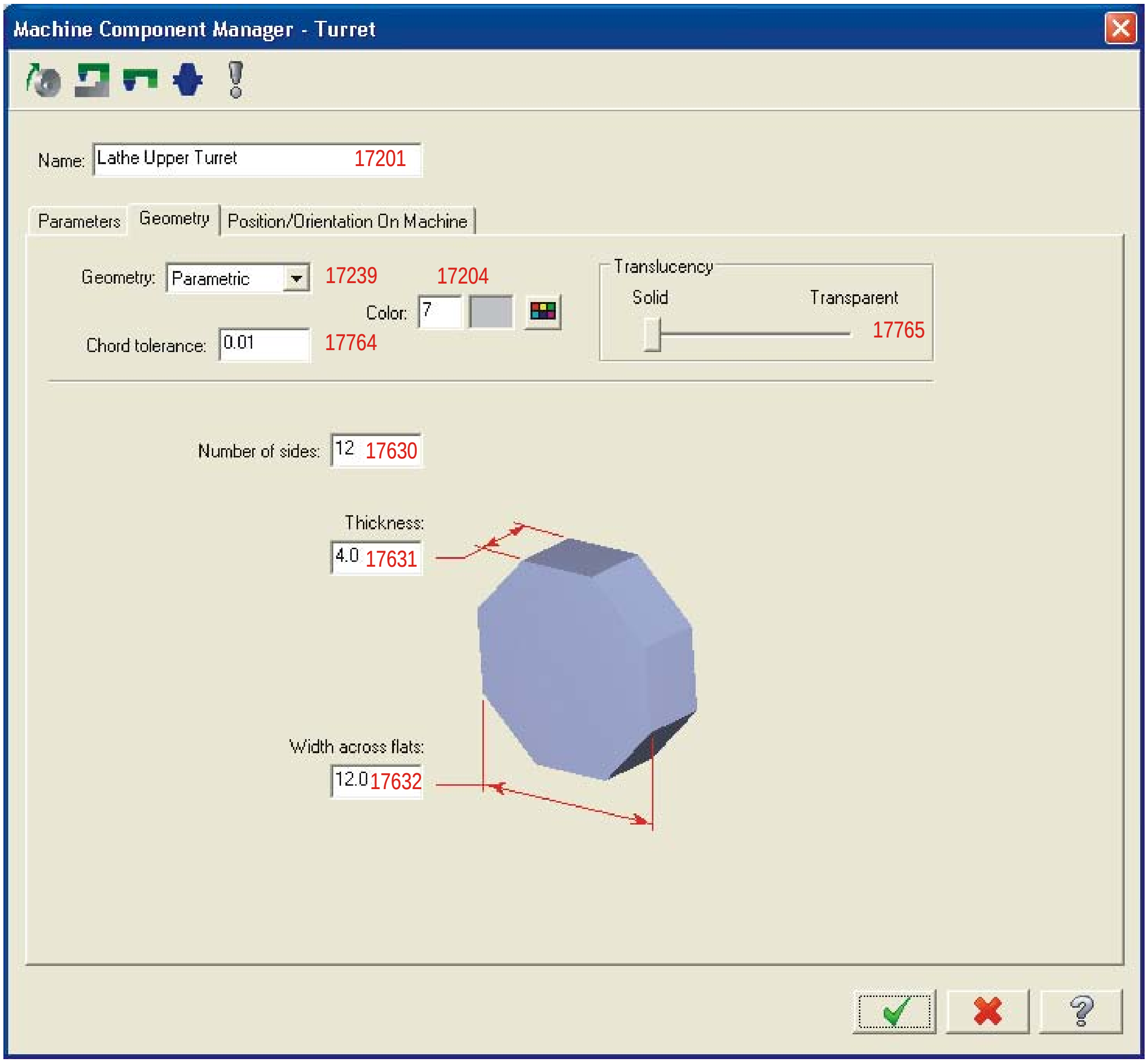
Bar stock parameters



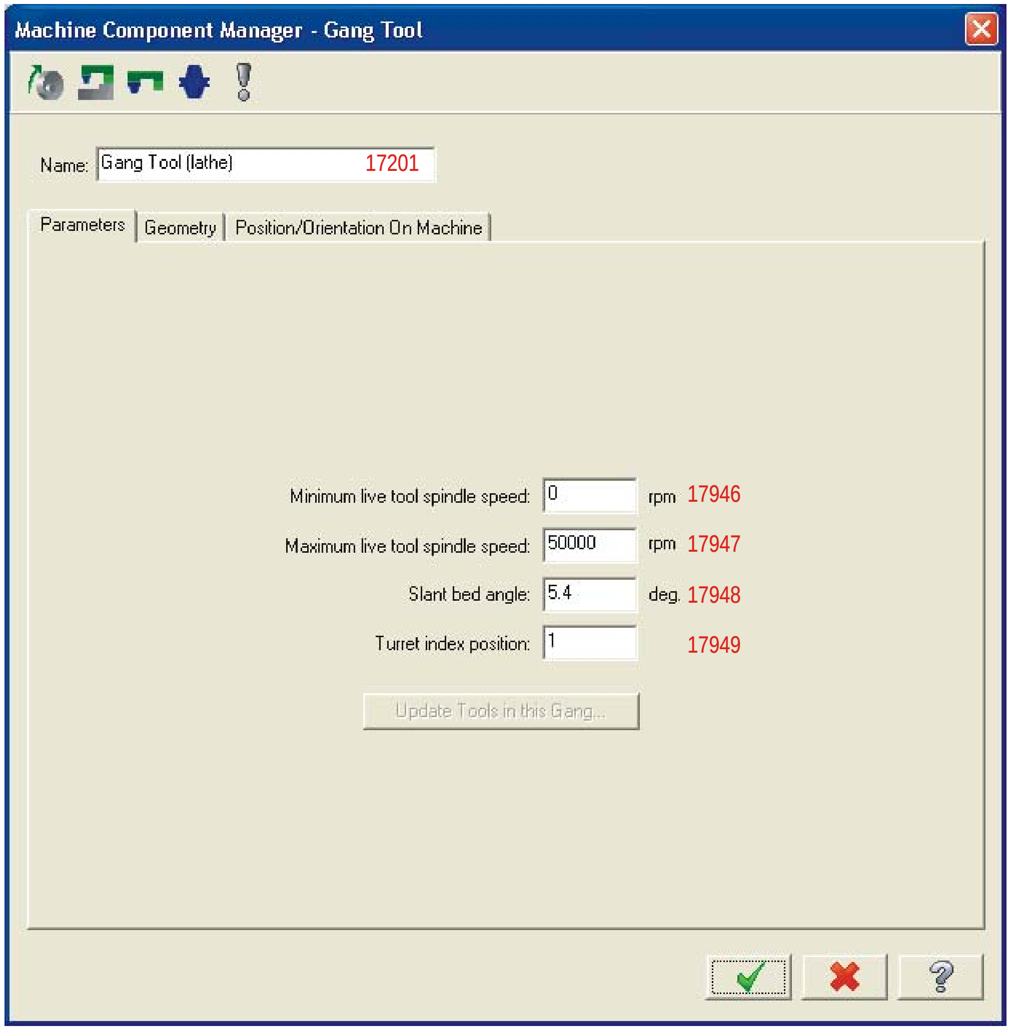
Turret parameters



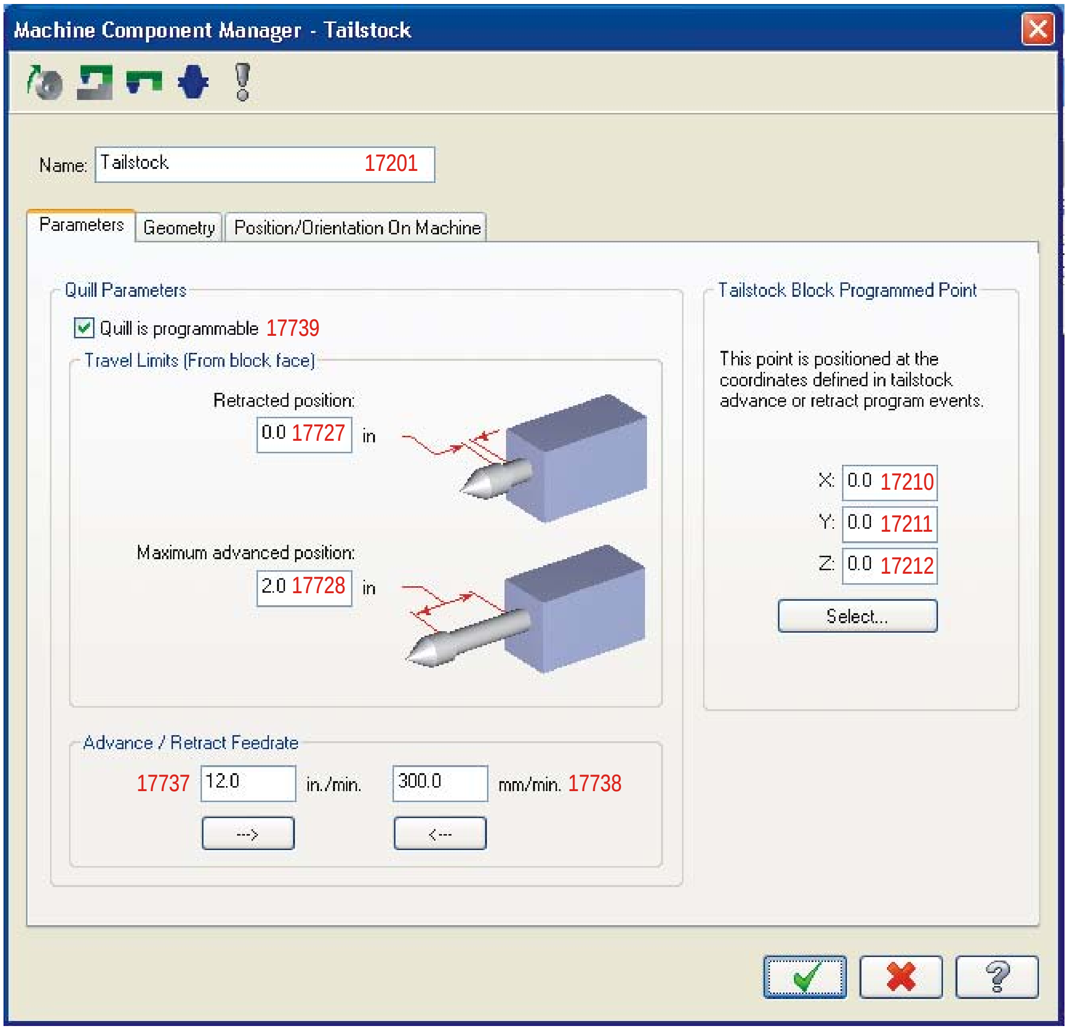
Turret geometry (parametric) dialog box



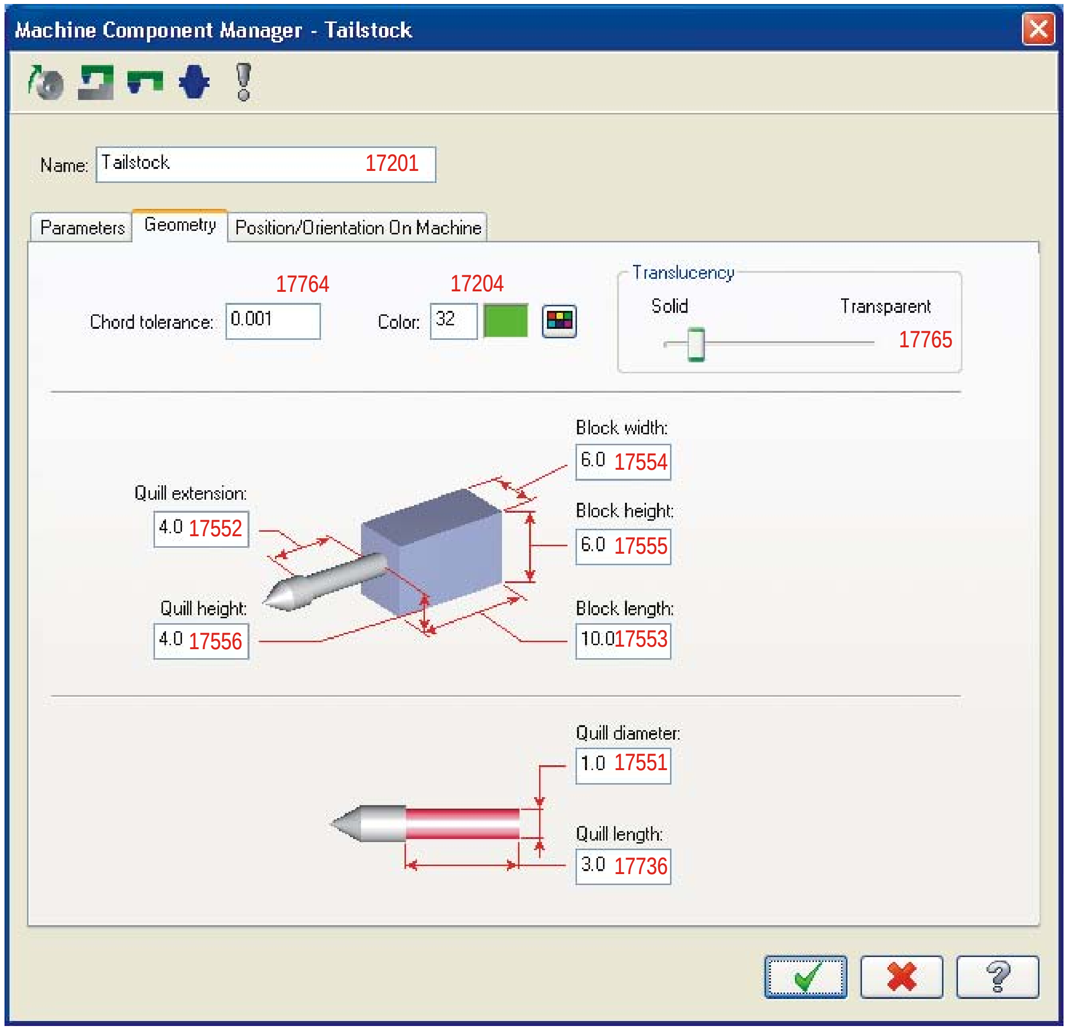
Gang tool parameters



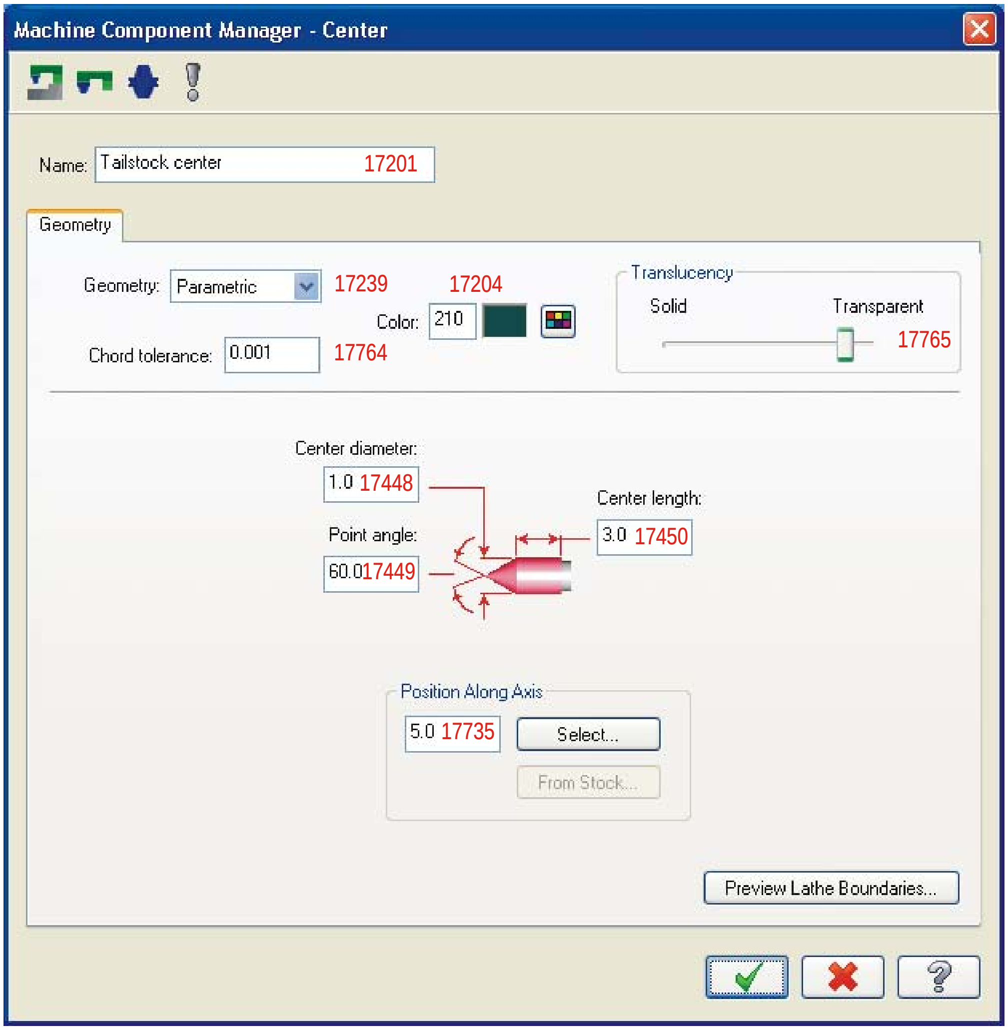
Tailstock parameters



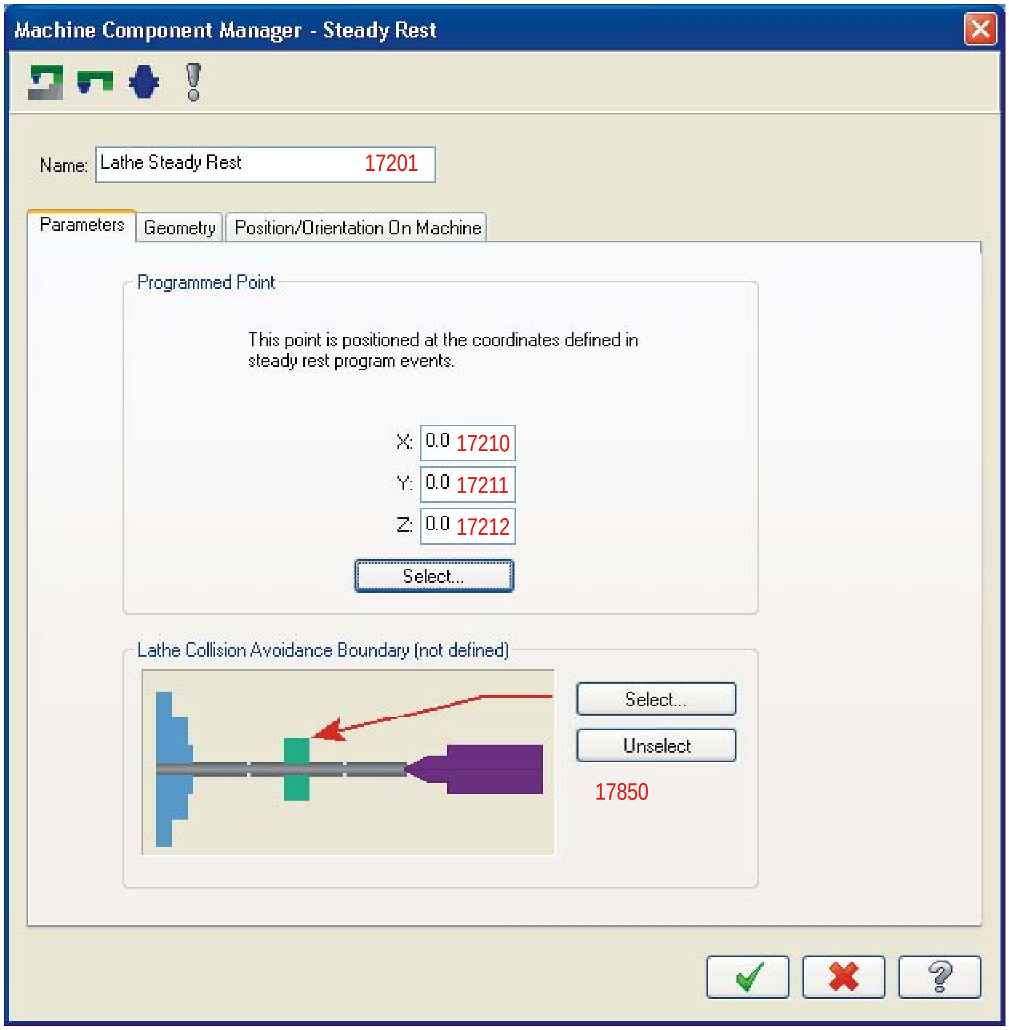
Tailstock geometry



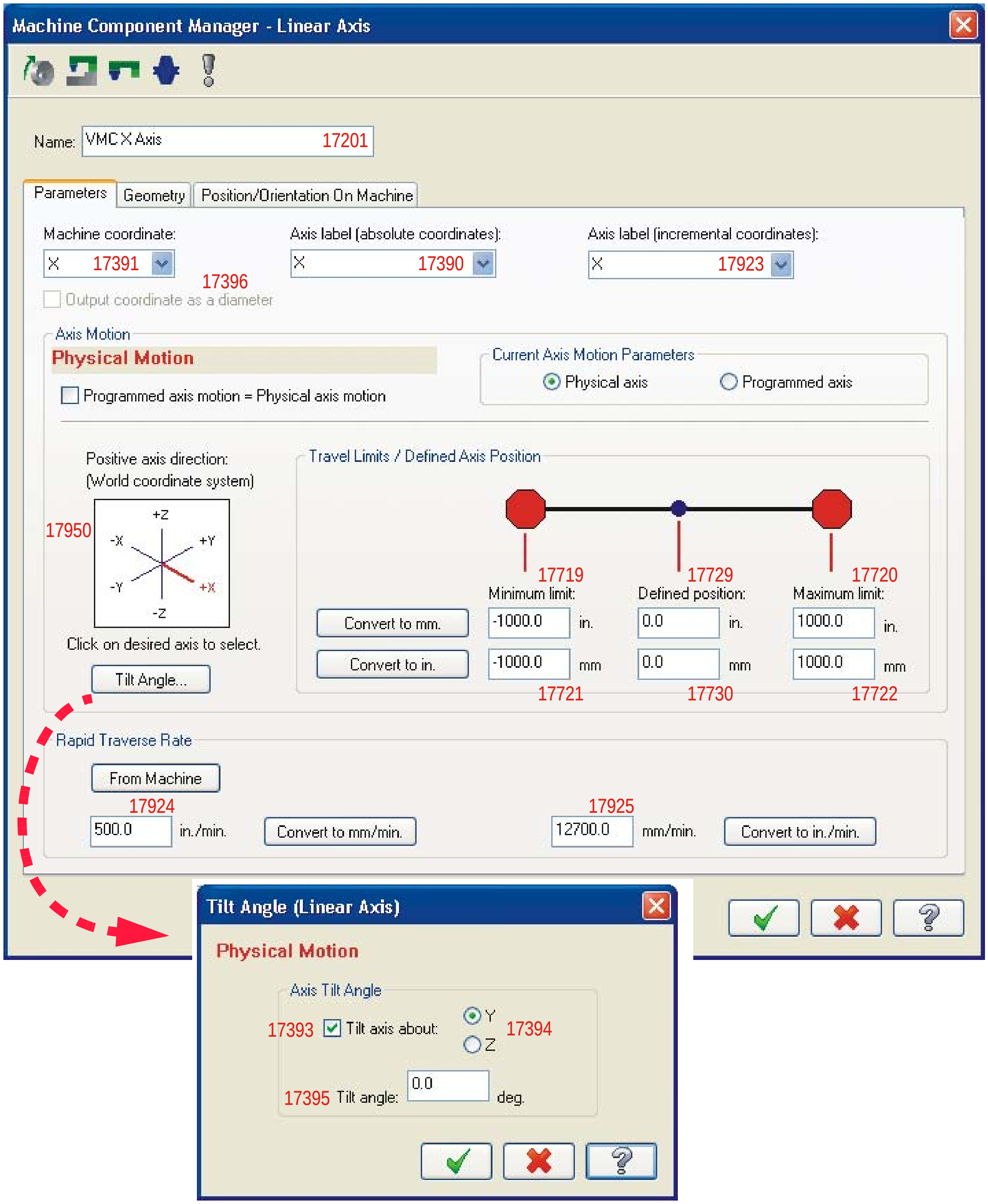
Tailstock center parameters



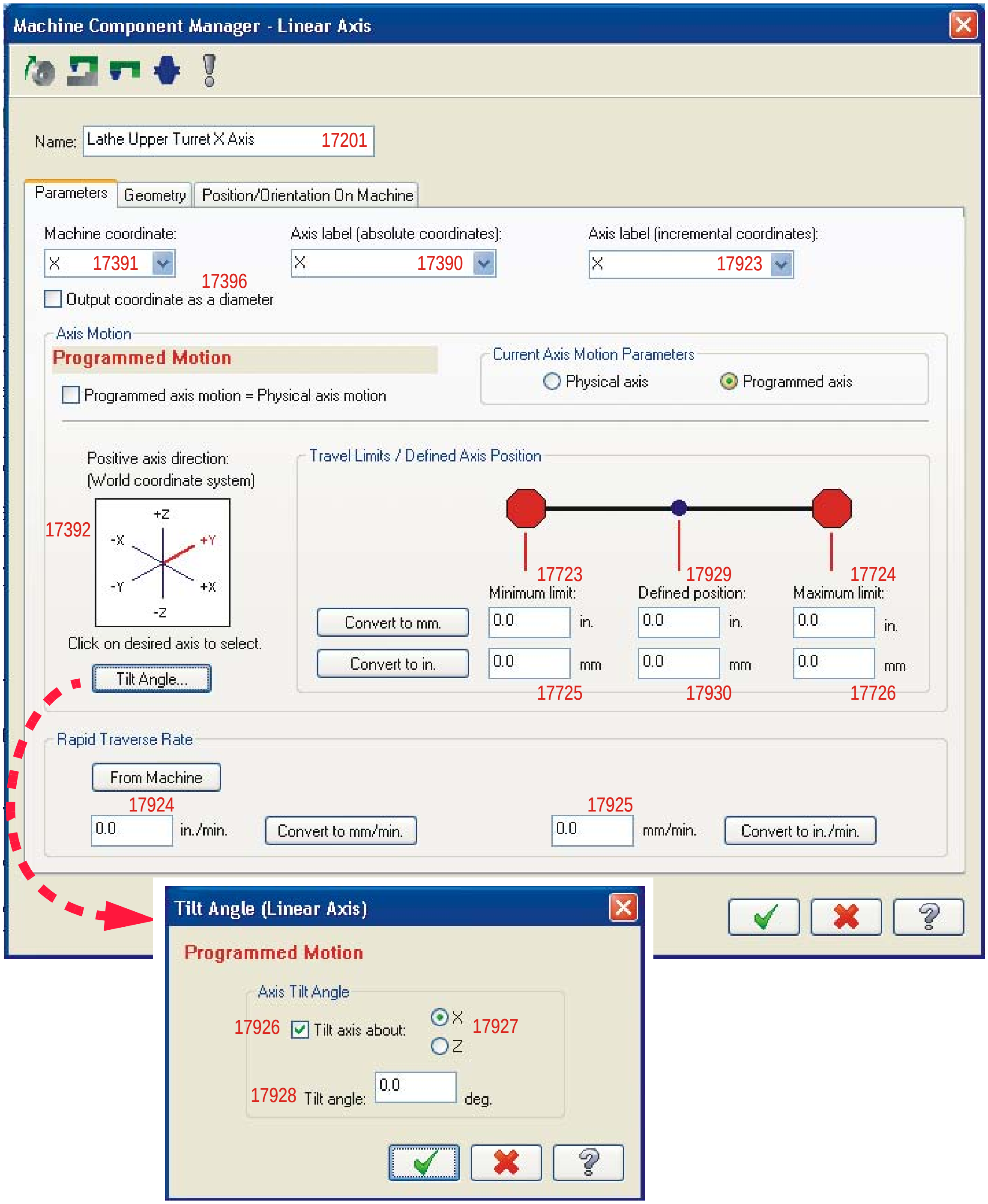
Steady rest parameters



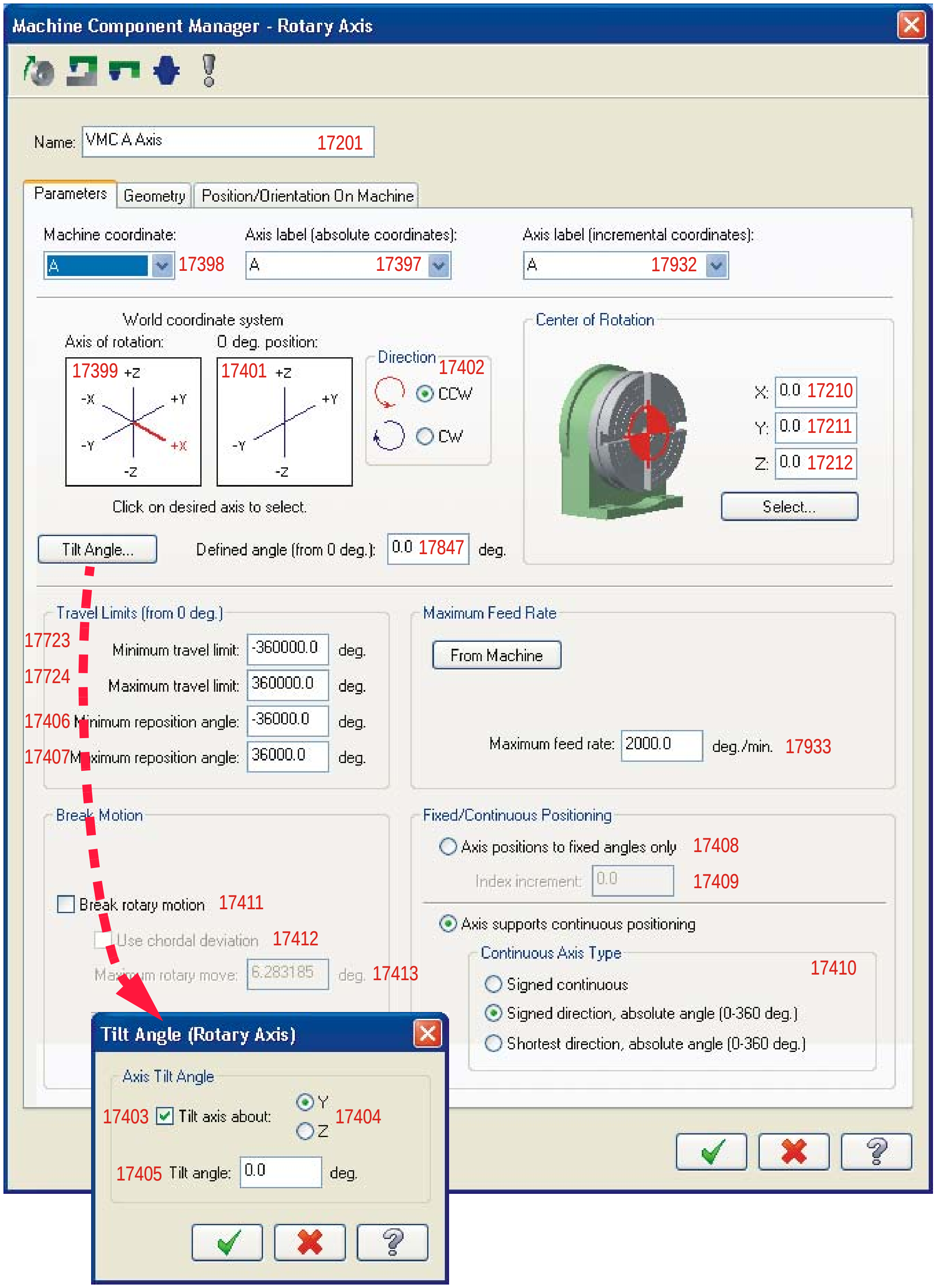
Linear axis parameters



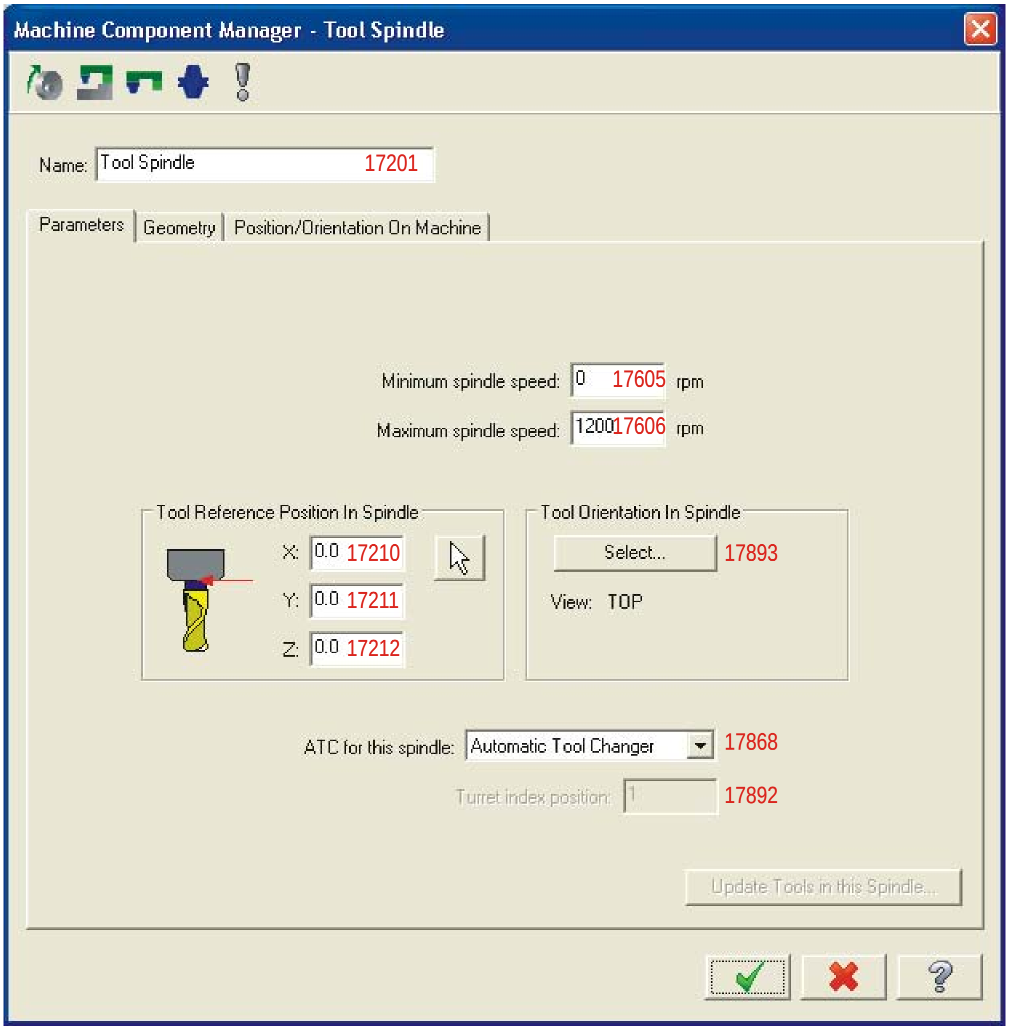
Linear axis parameters (programmed motion)



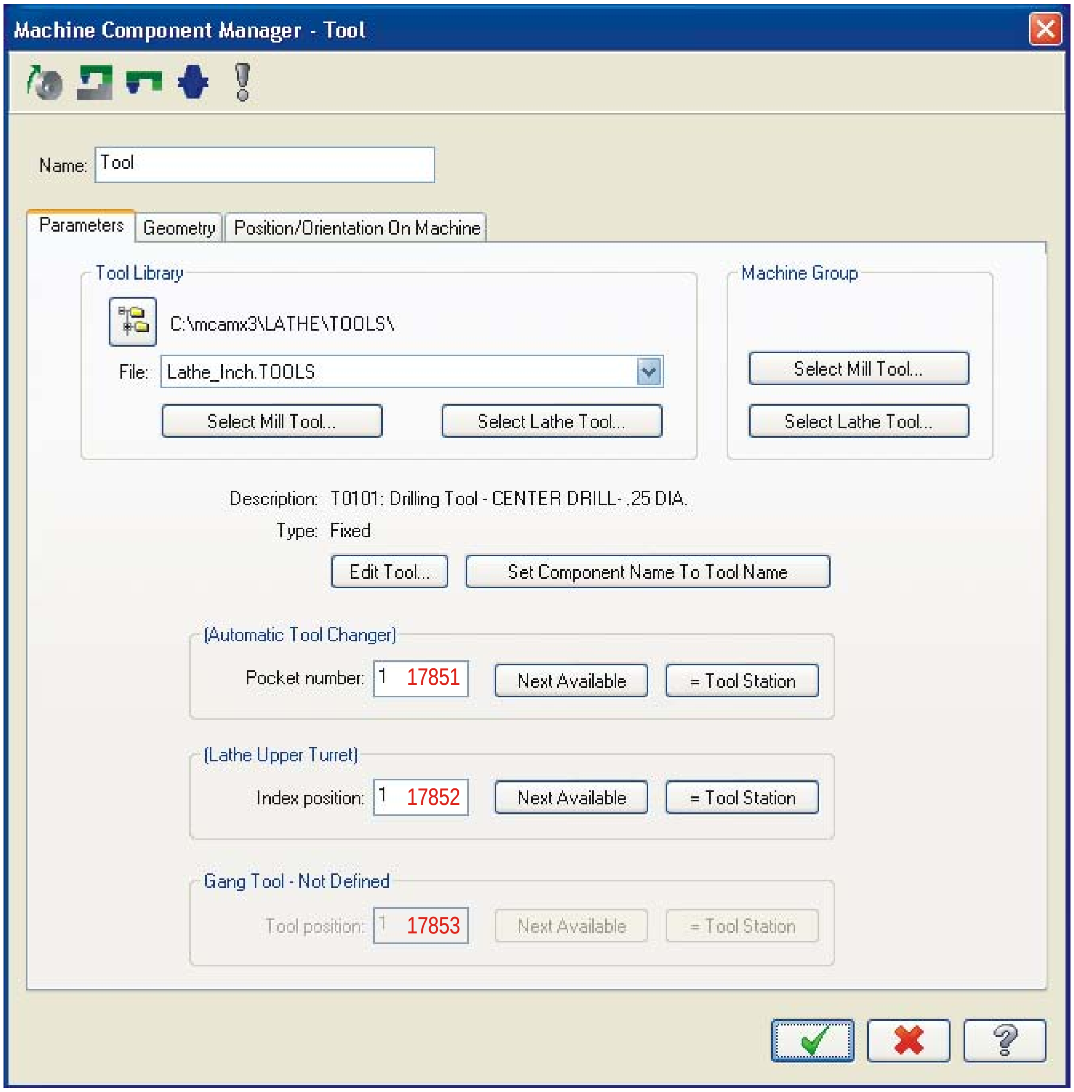
Rotary axis parameters



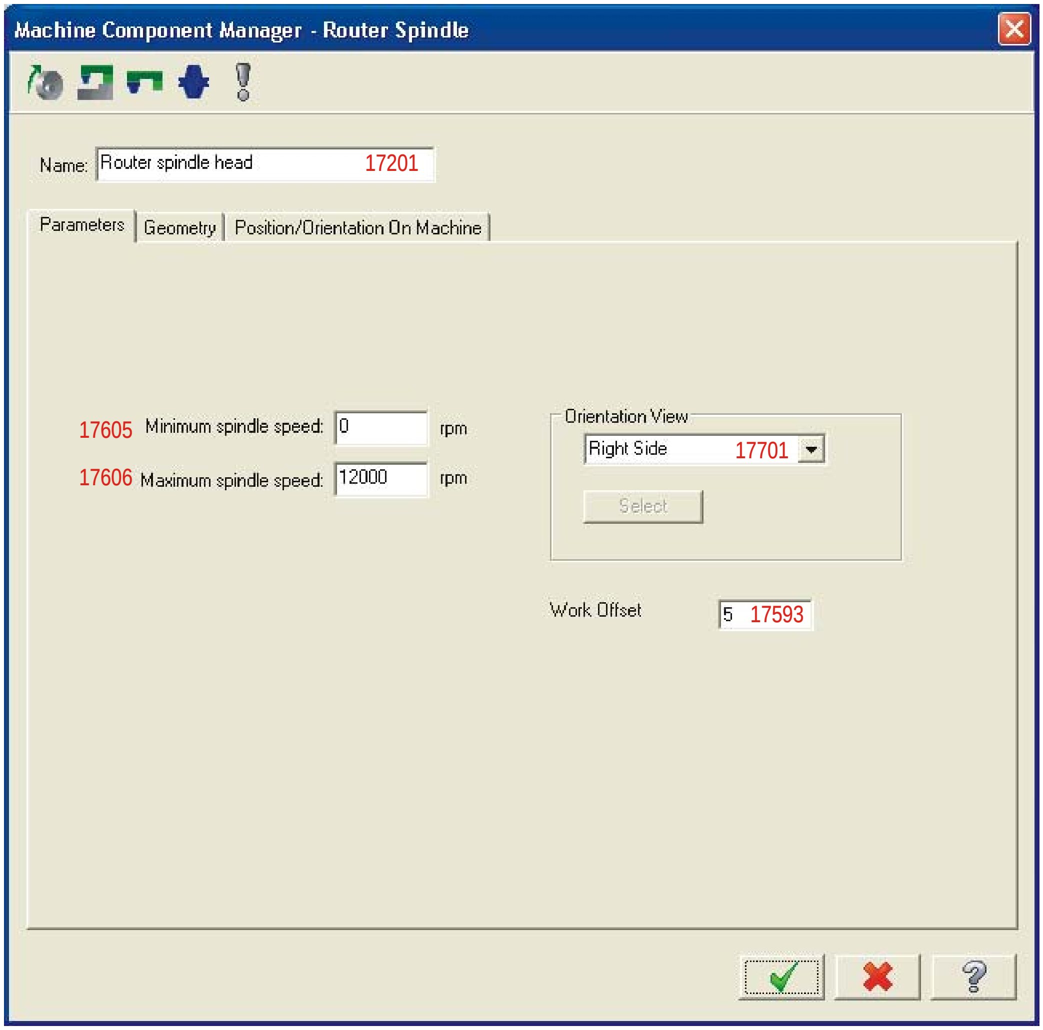
Tool spindle parameters



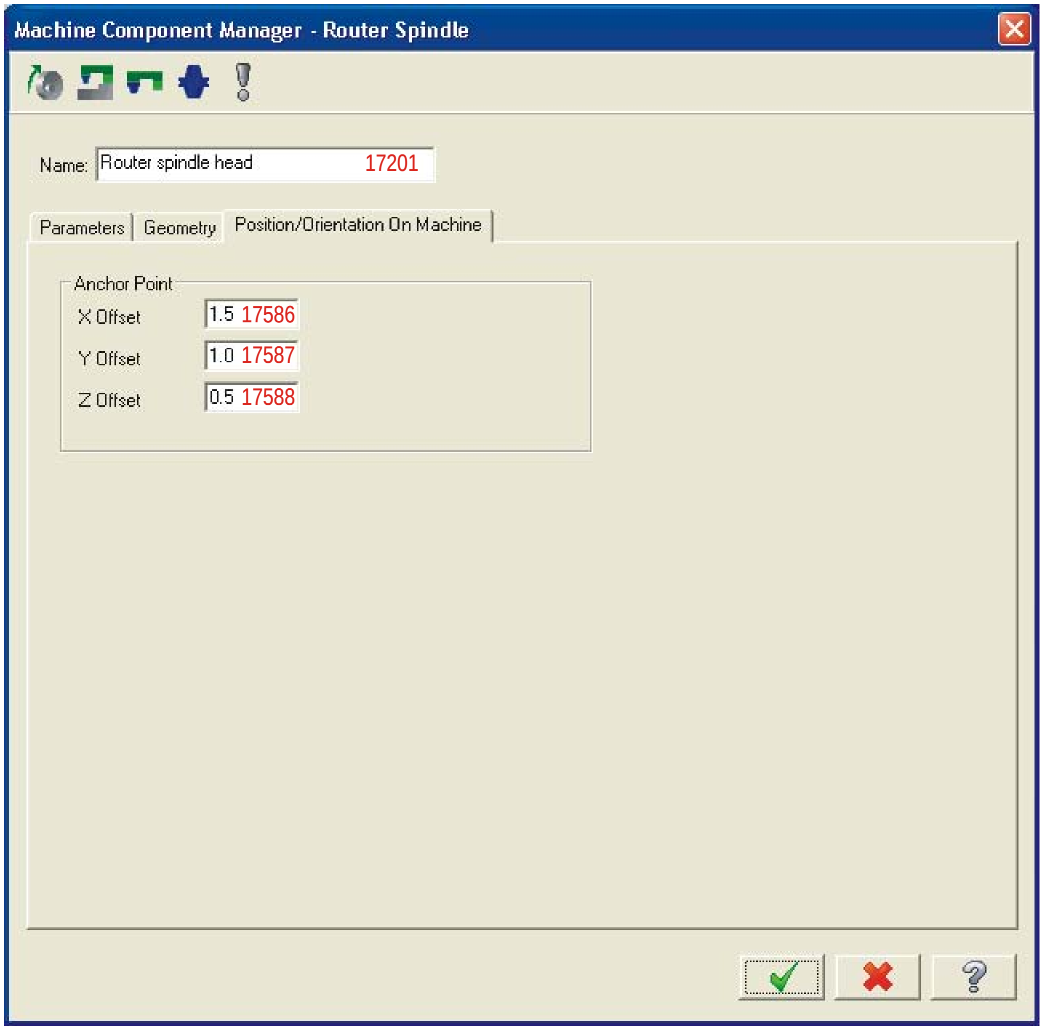
Tool component parameters



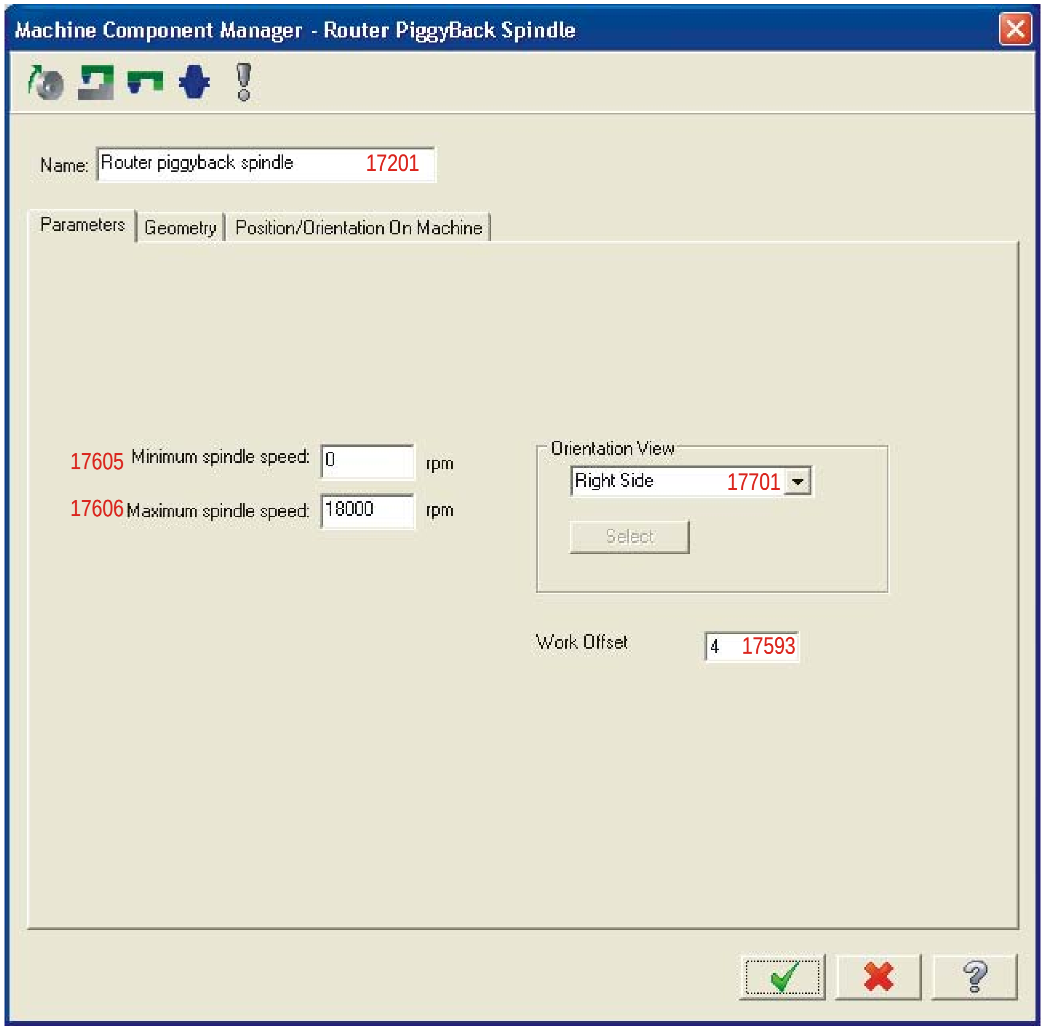
Router spindle parameters



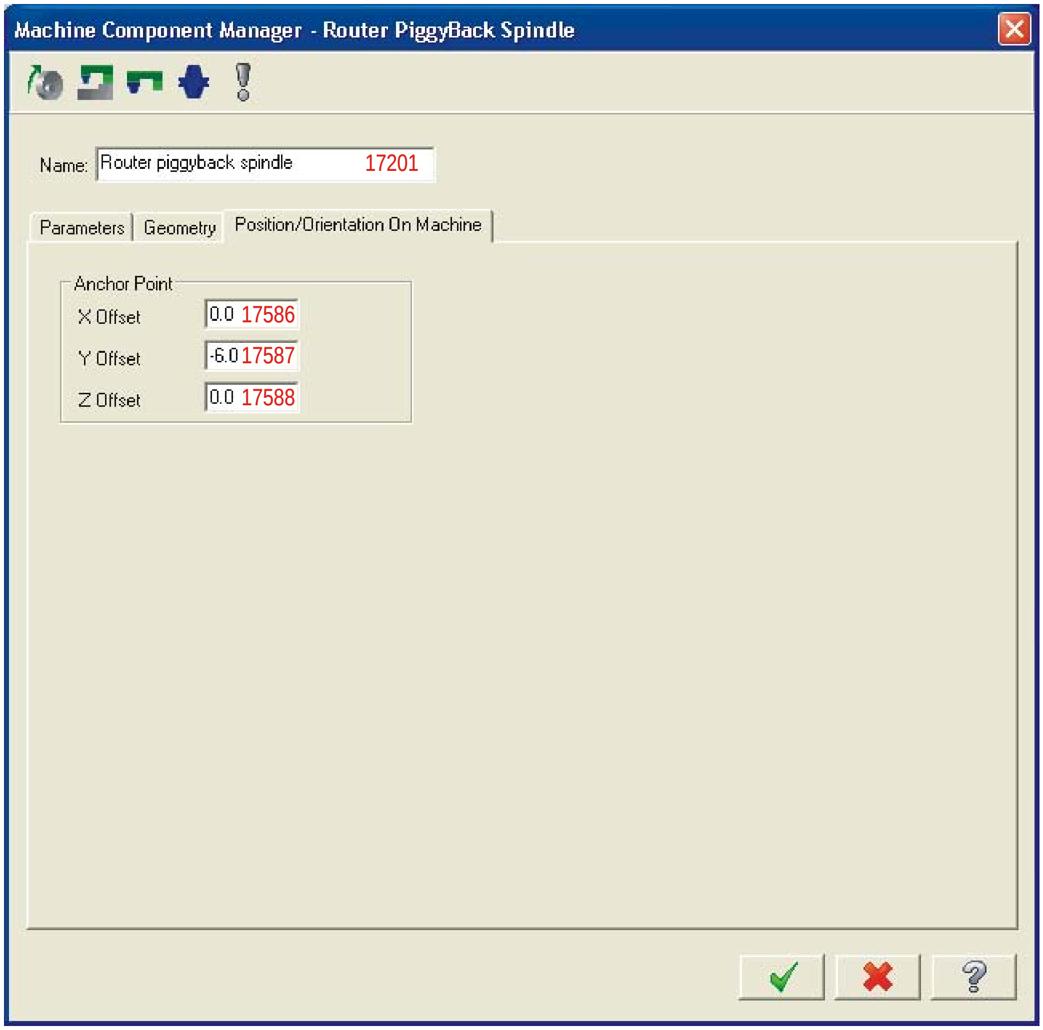
Router spindle position



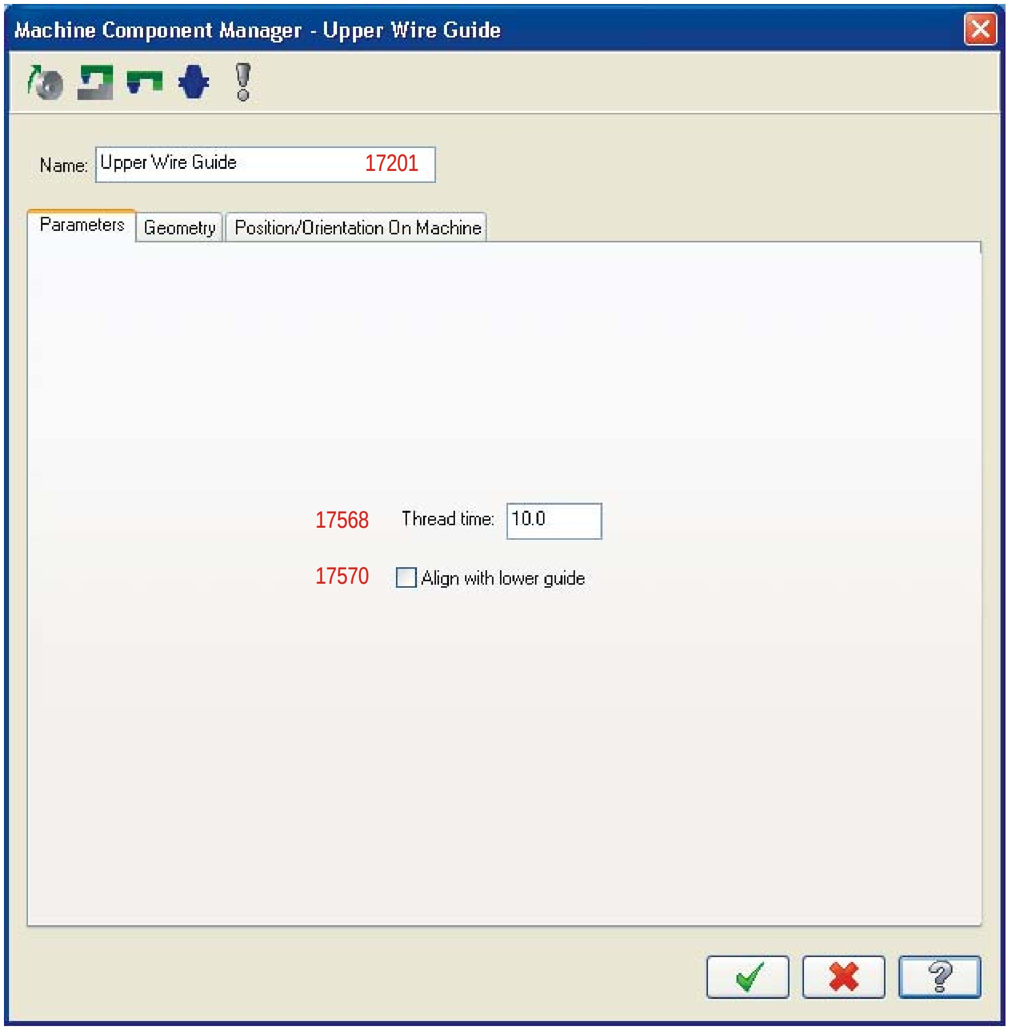
Router piggyback spindle parameters



Router piggyback spindle position



Wire guide parameters



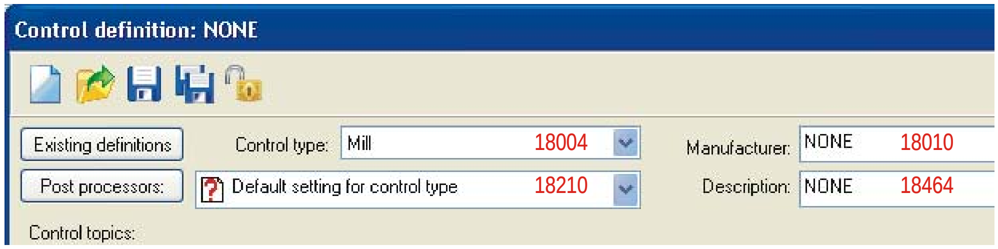
Control definition pages

Most of the fields shown in the following pages use parameters to store their values, but the values for some fields are available as pre-defined variables, or even directly in the NCI G-code. Use the following color key to determine the type of value:

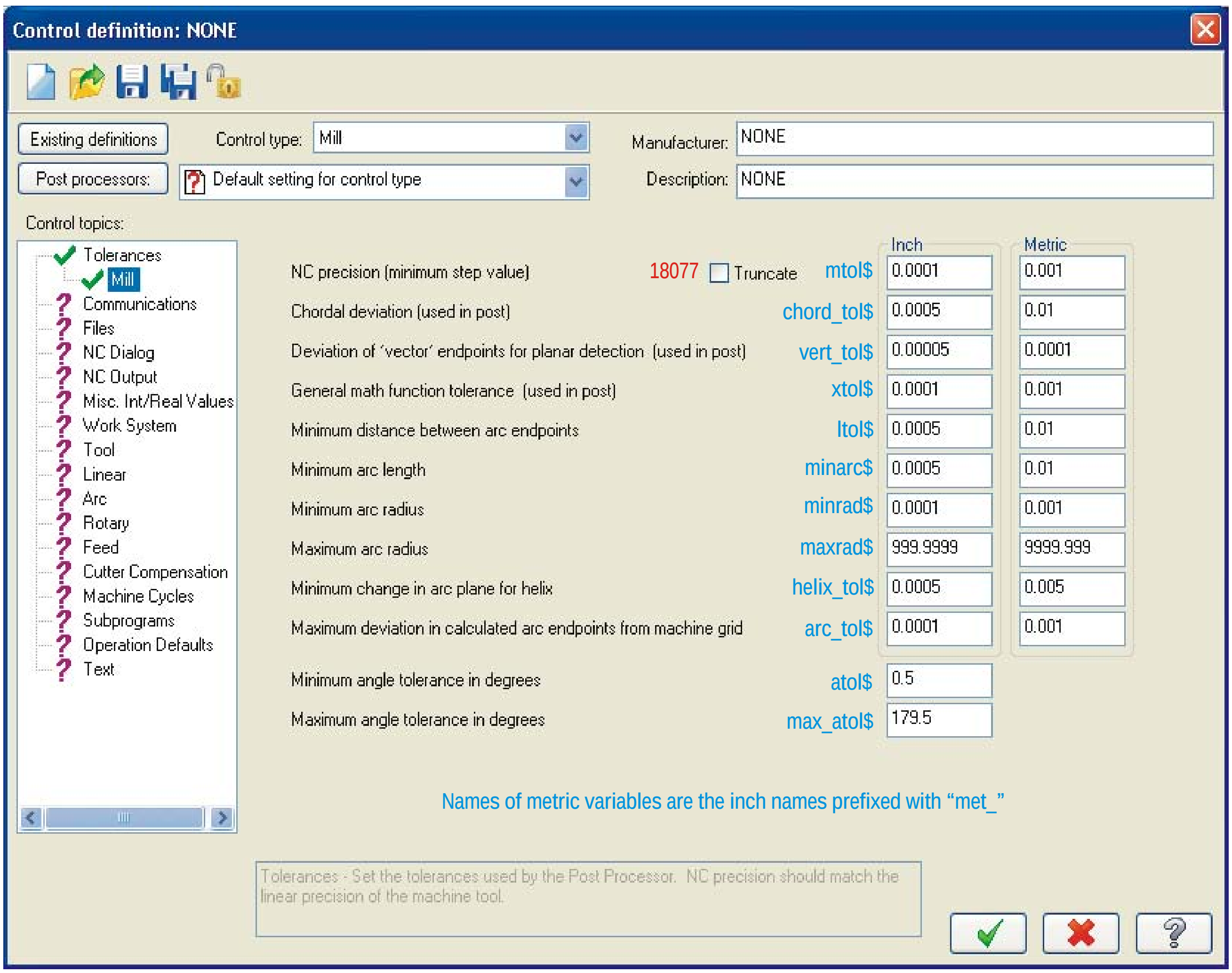
- Red labels indicate parameter numbers
- Blue labels indicate pre-defined variable names
- Green labels indicate NCI G-codes

Some fields are available as both parameters and pre-defined variables. In these cases, you can use whichever method is most convenient. Typically, this will be the pre-defined variable.

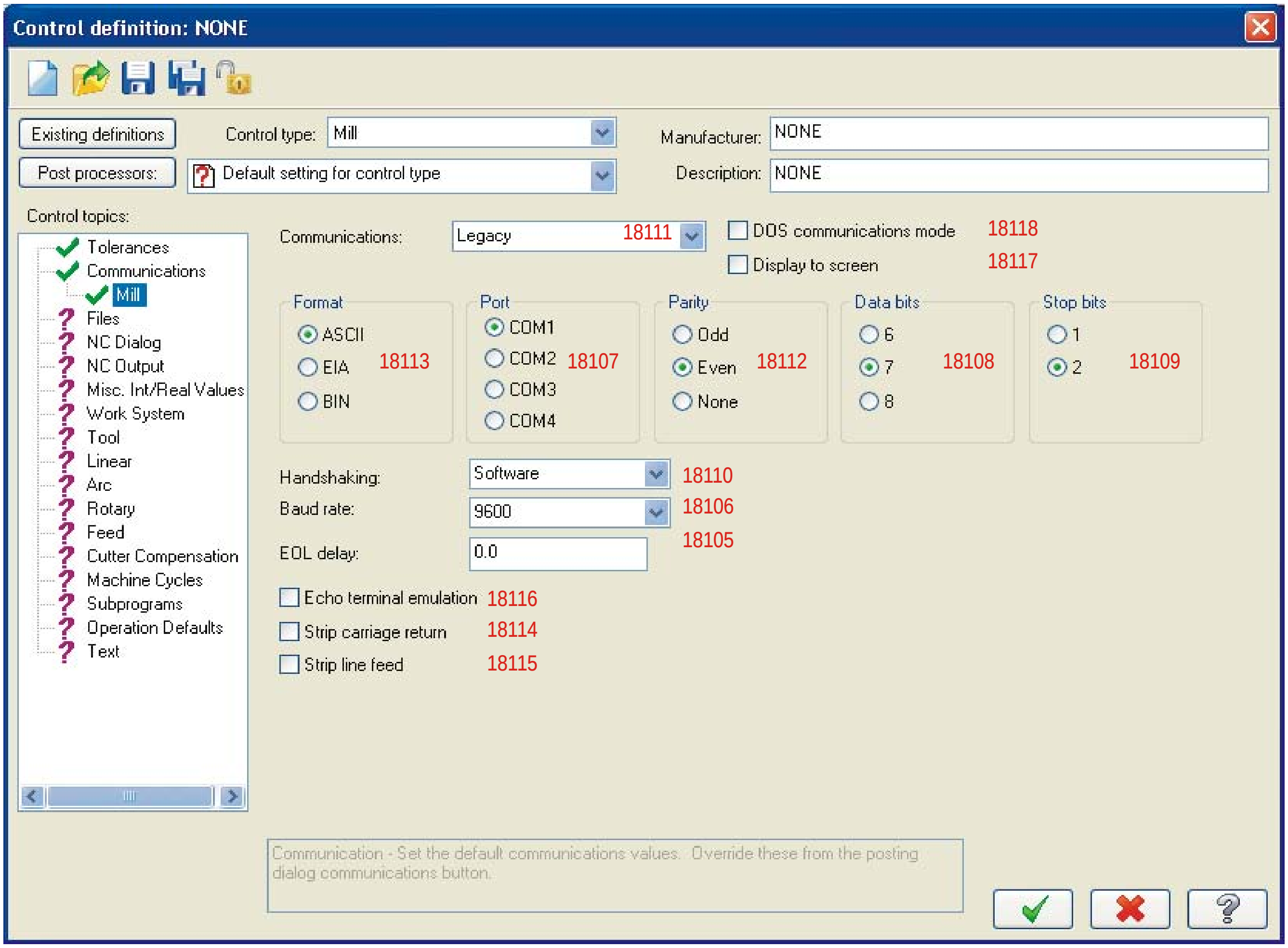
Overall parameters



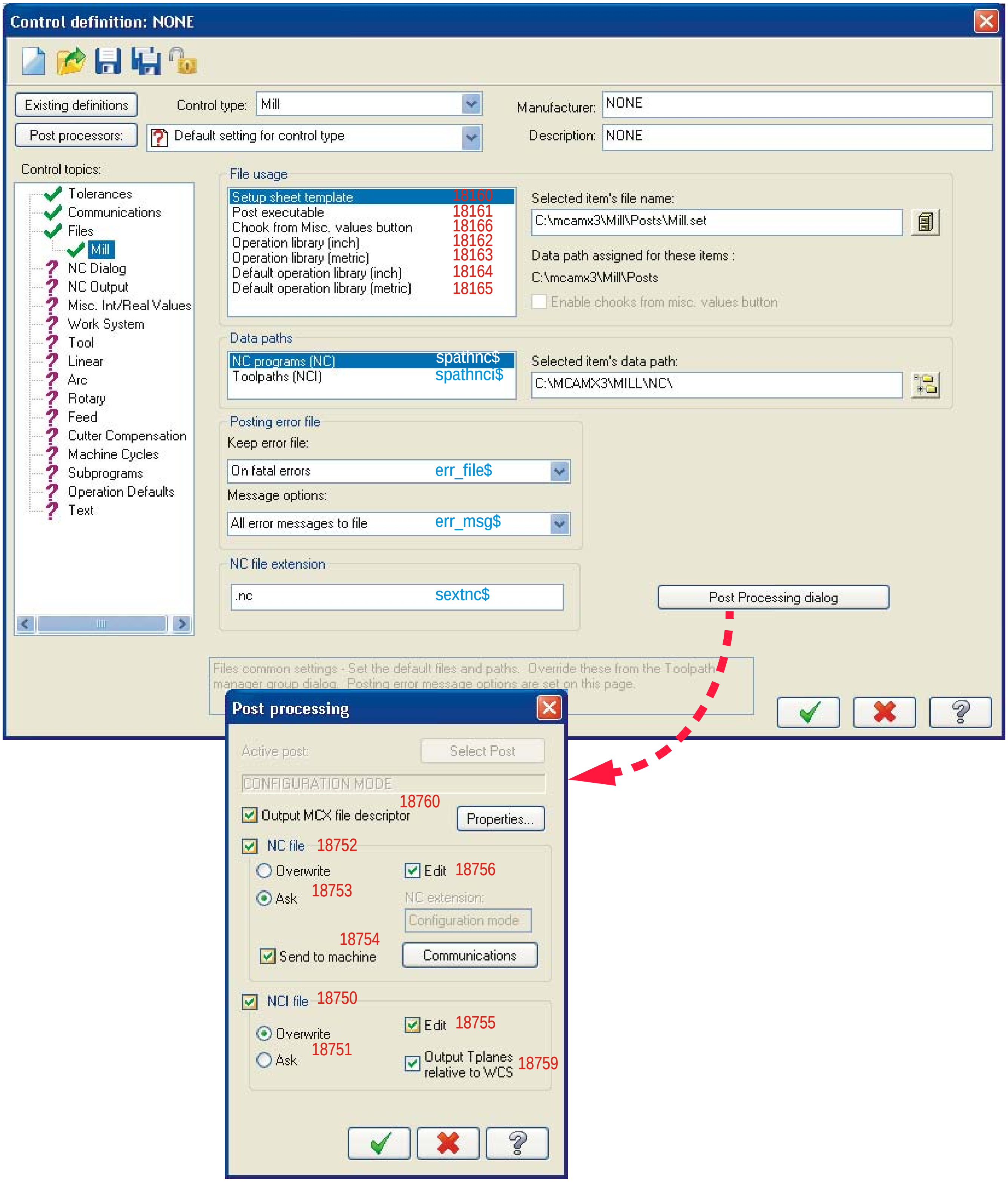
Tolerance page



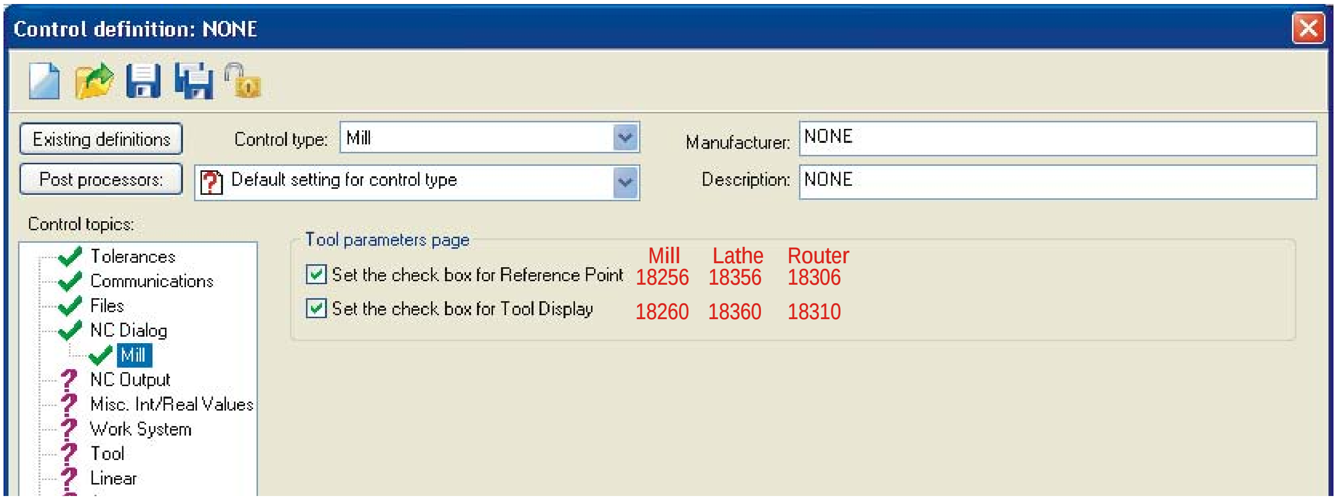
Communications page



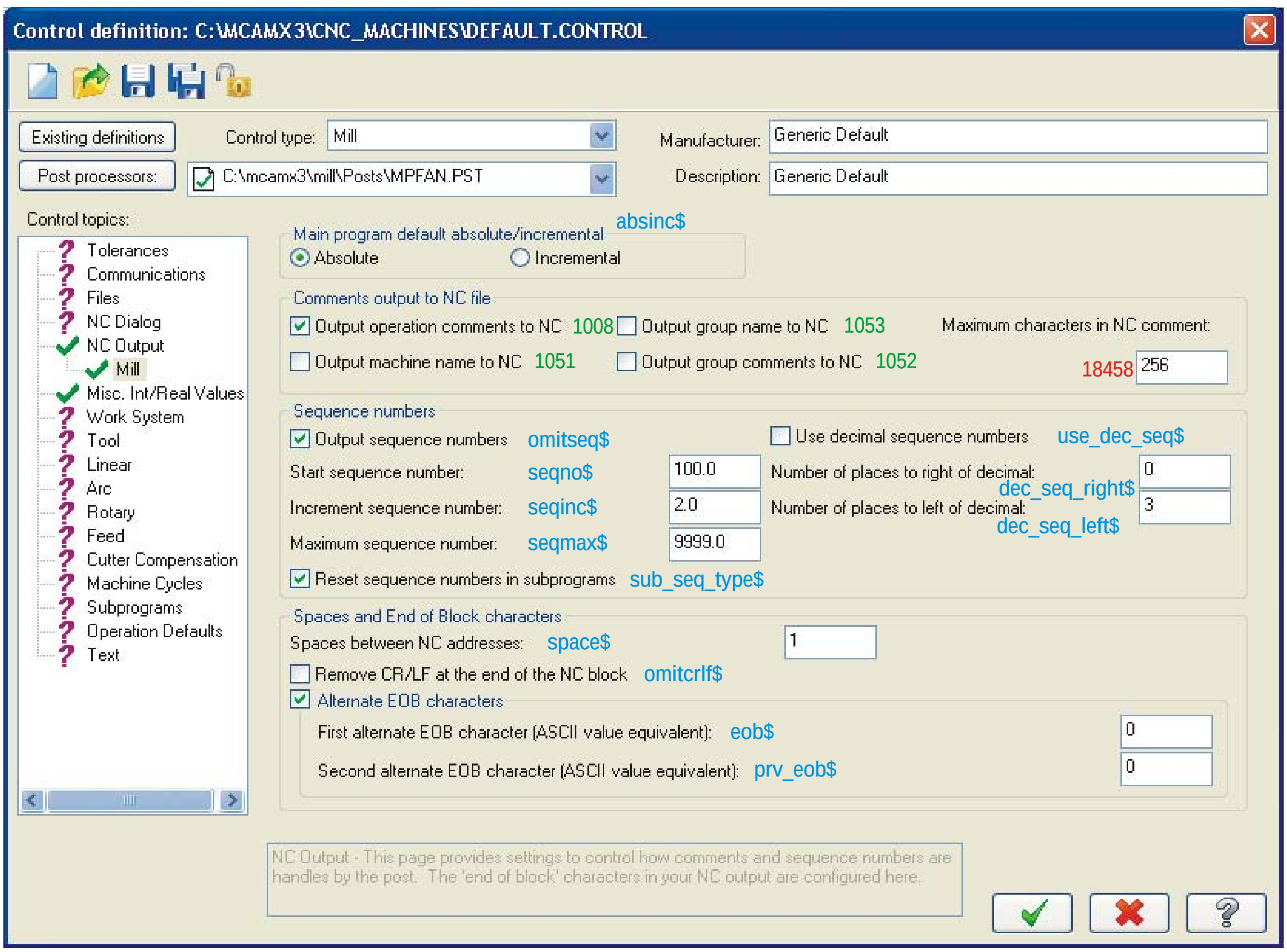
Files page


Control definition: NONE
Existing definitions
Post processors:
Control type: Mill
Default setting for control type
Manufacturer: NONE
Description: NONE
Control topics:
Tolerances
Communications
Files
Mill
NC Dialog
NC Output
Misc. Int/Real Values
Work System
Tool
Linear
Arc
Rotary
Feed
Cutter Compensation
Machine Cycles
Subprograms
Operation Defaults
Text
File usage
Setup sheet template 18160
Post executable 18161
Chook from Misc. values button 18166
Operation library (inch) 18162
Operation library (metric) 18163
Default operation library (inch) 18164
Default operation library (metric) 18165
Selected item's file name:
C:\mcamx3\Mill\Posts\Mill.set
Data path assigned for these items :
C:\mcamx3\Mill\Posts
Enable chooks from misc. values button
Data paths
NC programs (NC) spathnc$
Toolpaths (NCI) spathnci$
Selected item's data path:
C:\MCAMX3\MILL\NC\
Posting error file
Keep error file:
On fatal errors err_file$
Message options:
All error messages to file err_msg$
NC file extension
.nc sextnc$
Post Processing dialog
Files common settings - Set the default files and paths. Override these from the Toolpath manager group dialog. Posting error message options are set on this page.
Post processing
Active post:
Select Post
CONFIGURATION MODE
18760
Output MCX file descriptor
Properties...
NC file 18752
Overwrite
Ask 18753
Edit 18756
NC extension:
Configuration mode
18754
Send to machine
Communications
NCI file 18750
Overwrite
Ask 18751
Edit 18755
Output Tplanes relative to WCS 18759

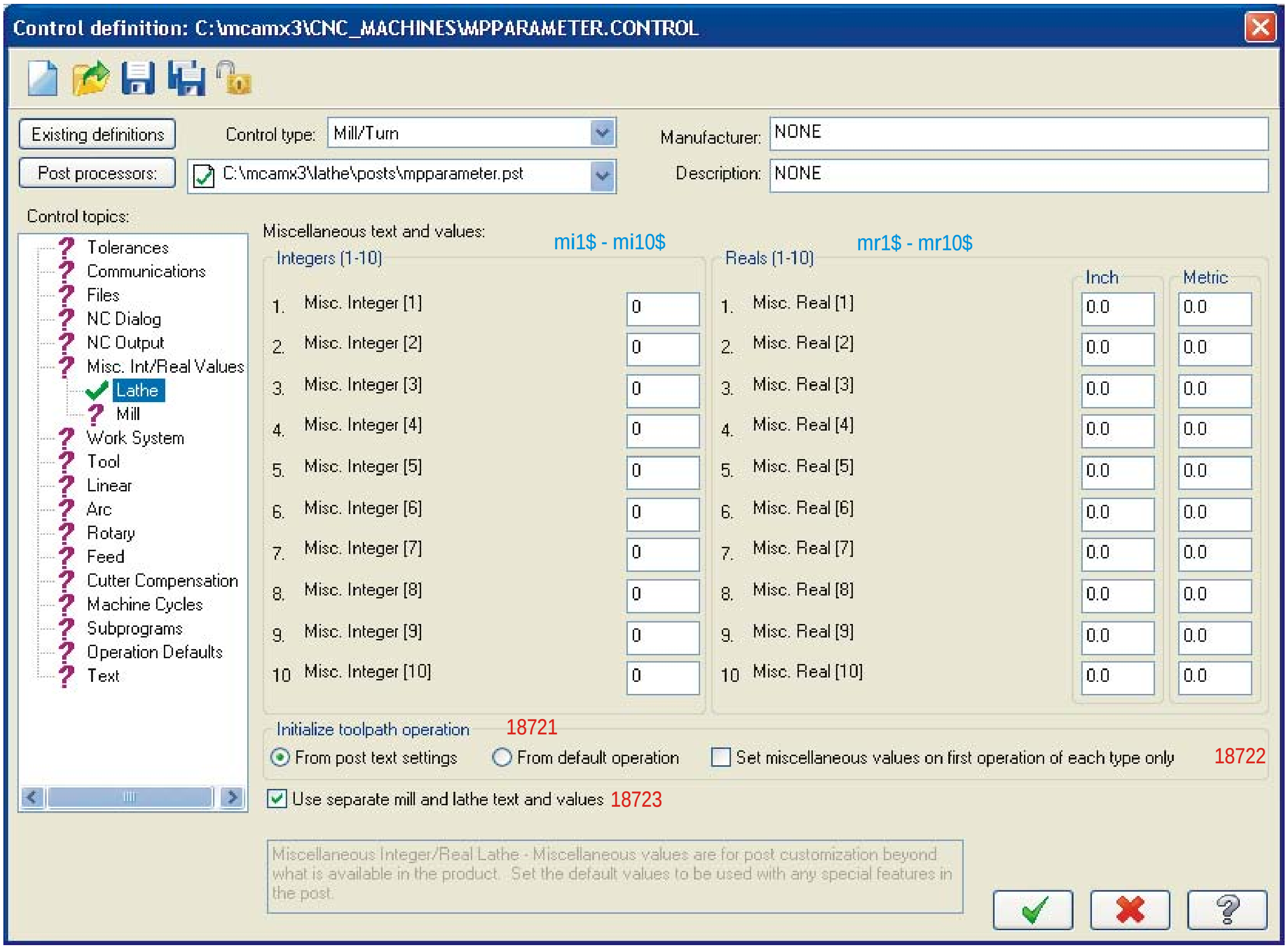
NC Dialog page (Mill–Lathe–Router)



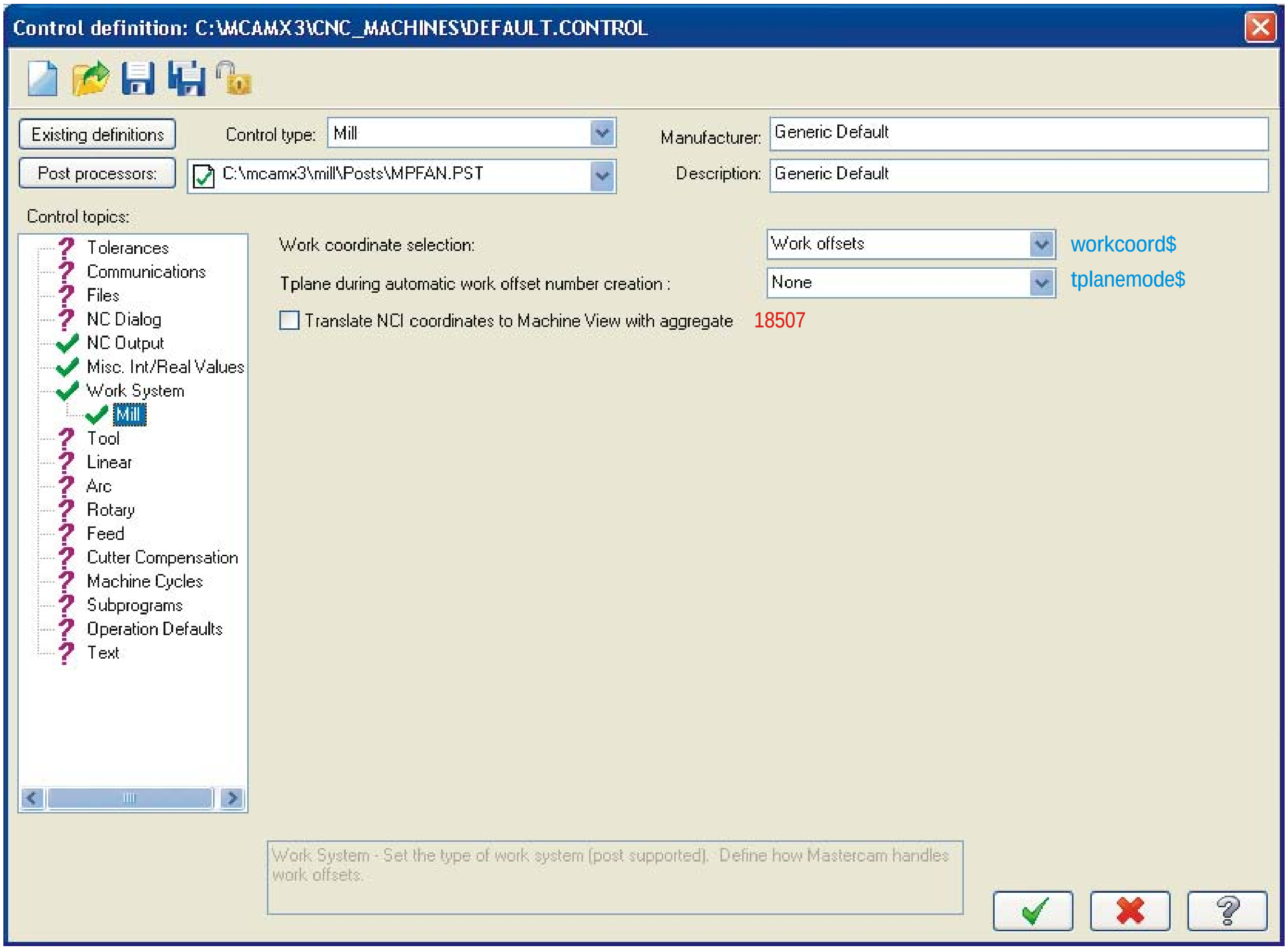
NC Output page



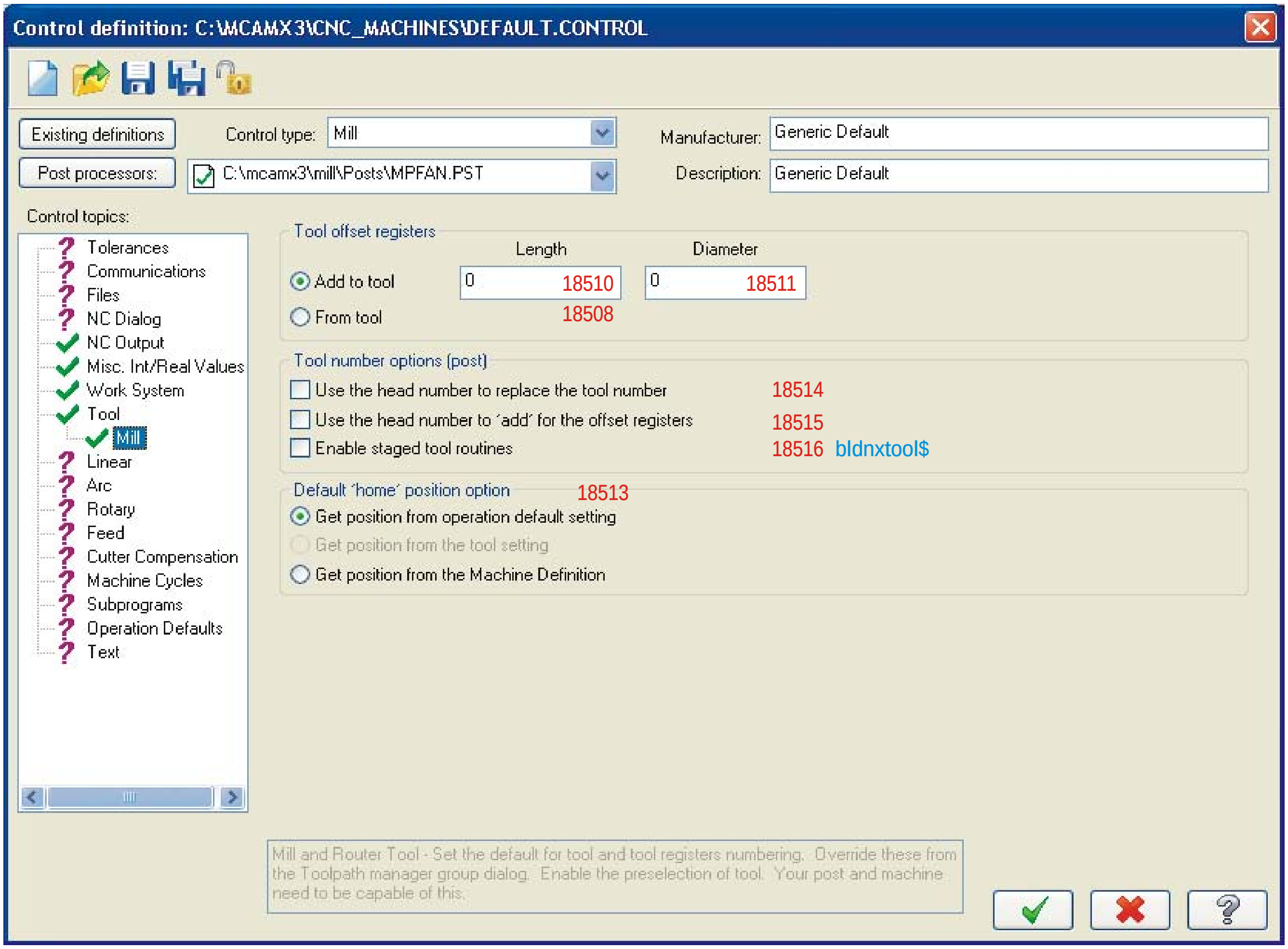
Misc. Int/Real Values page



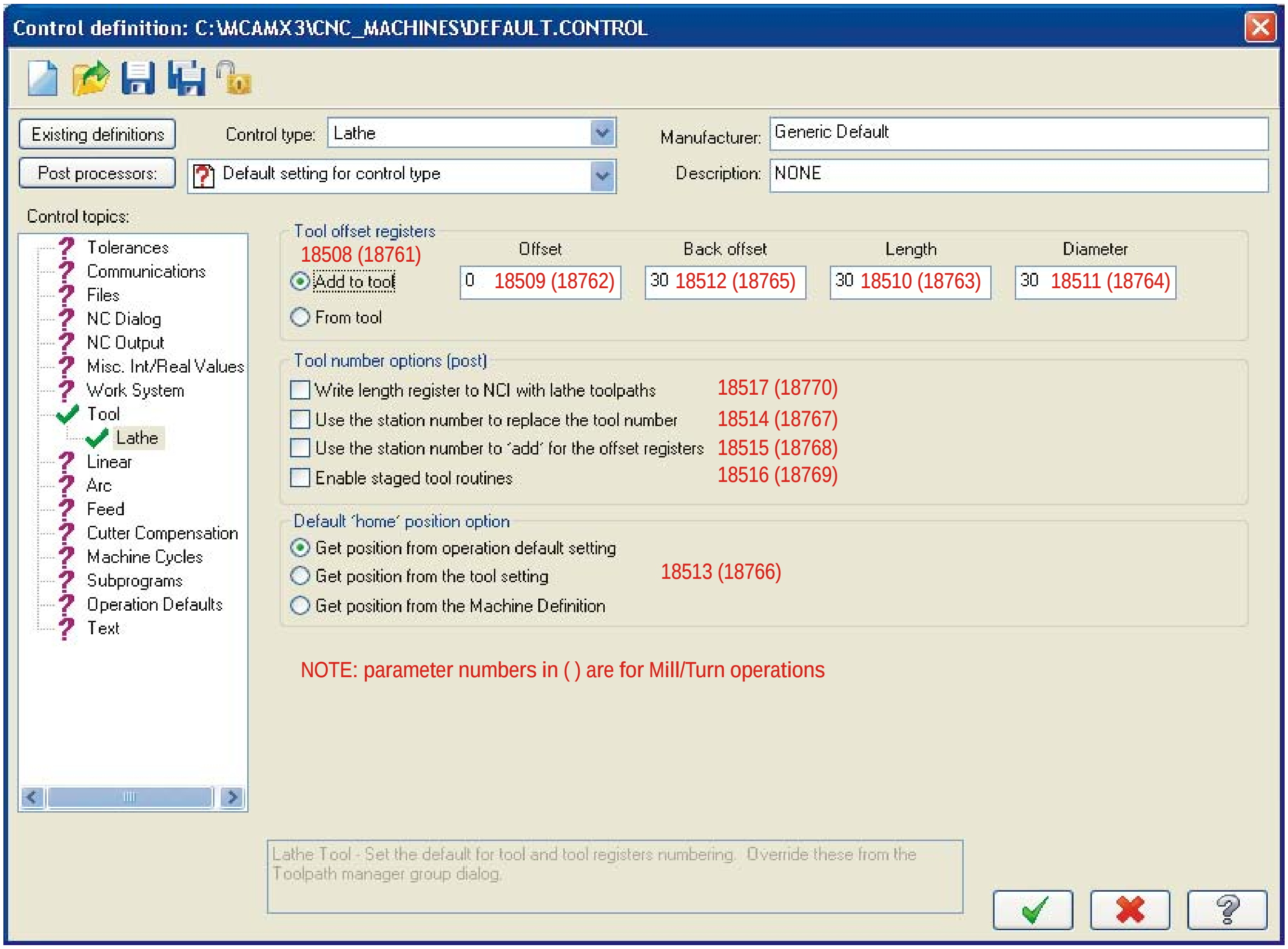
Work System page



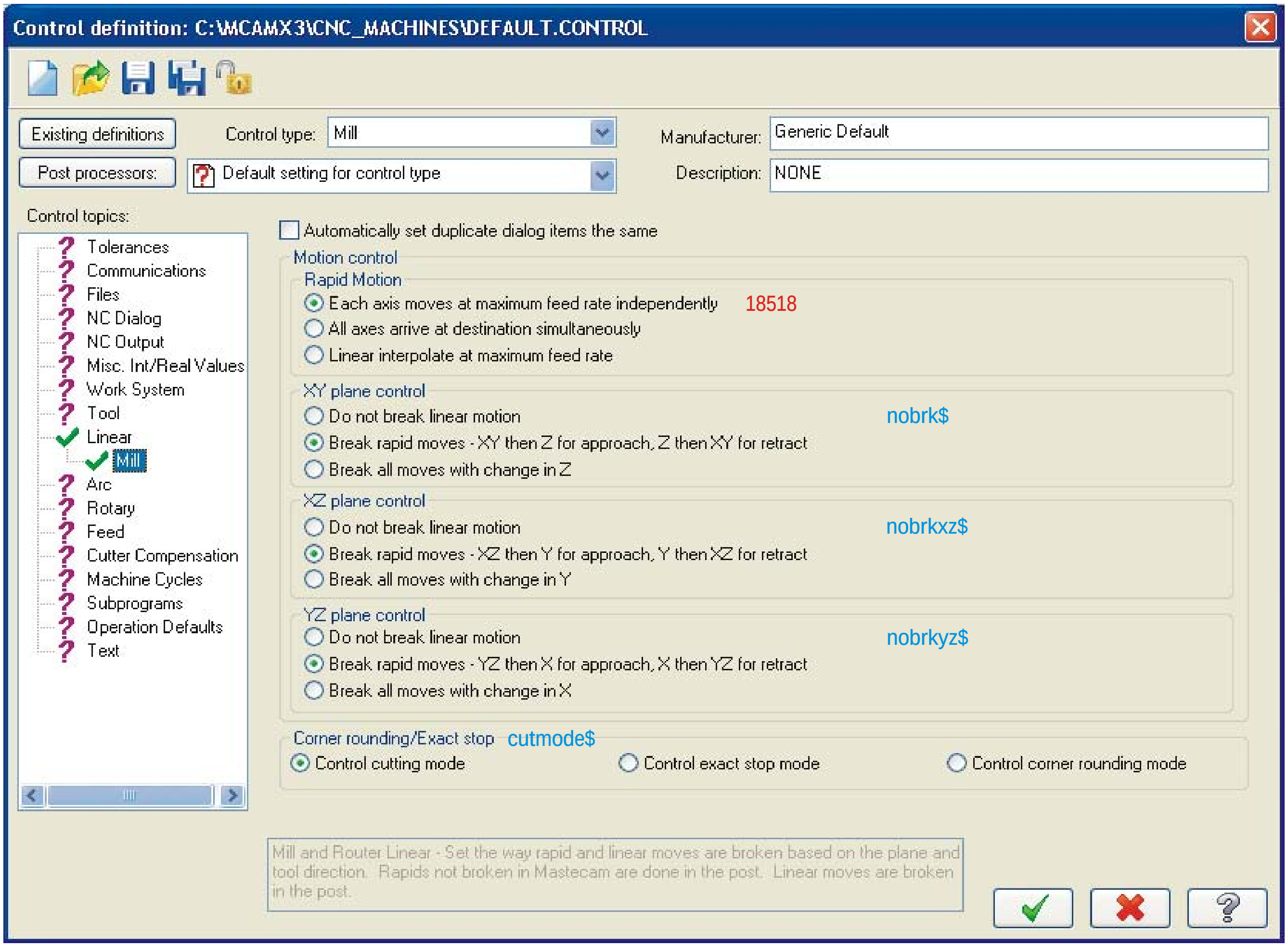
Tool page (Mill–Router)



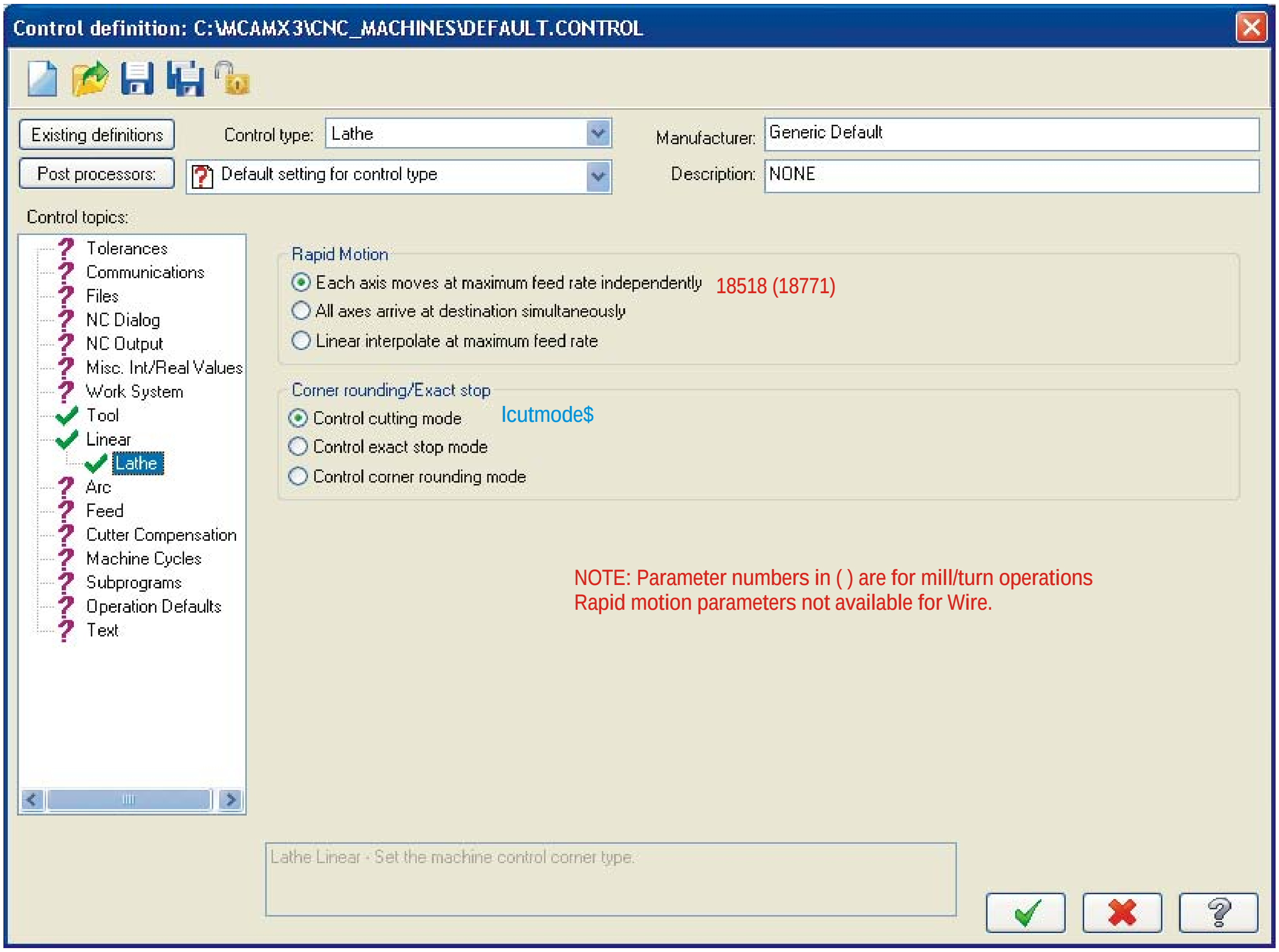
Tool page (Lathe)



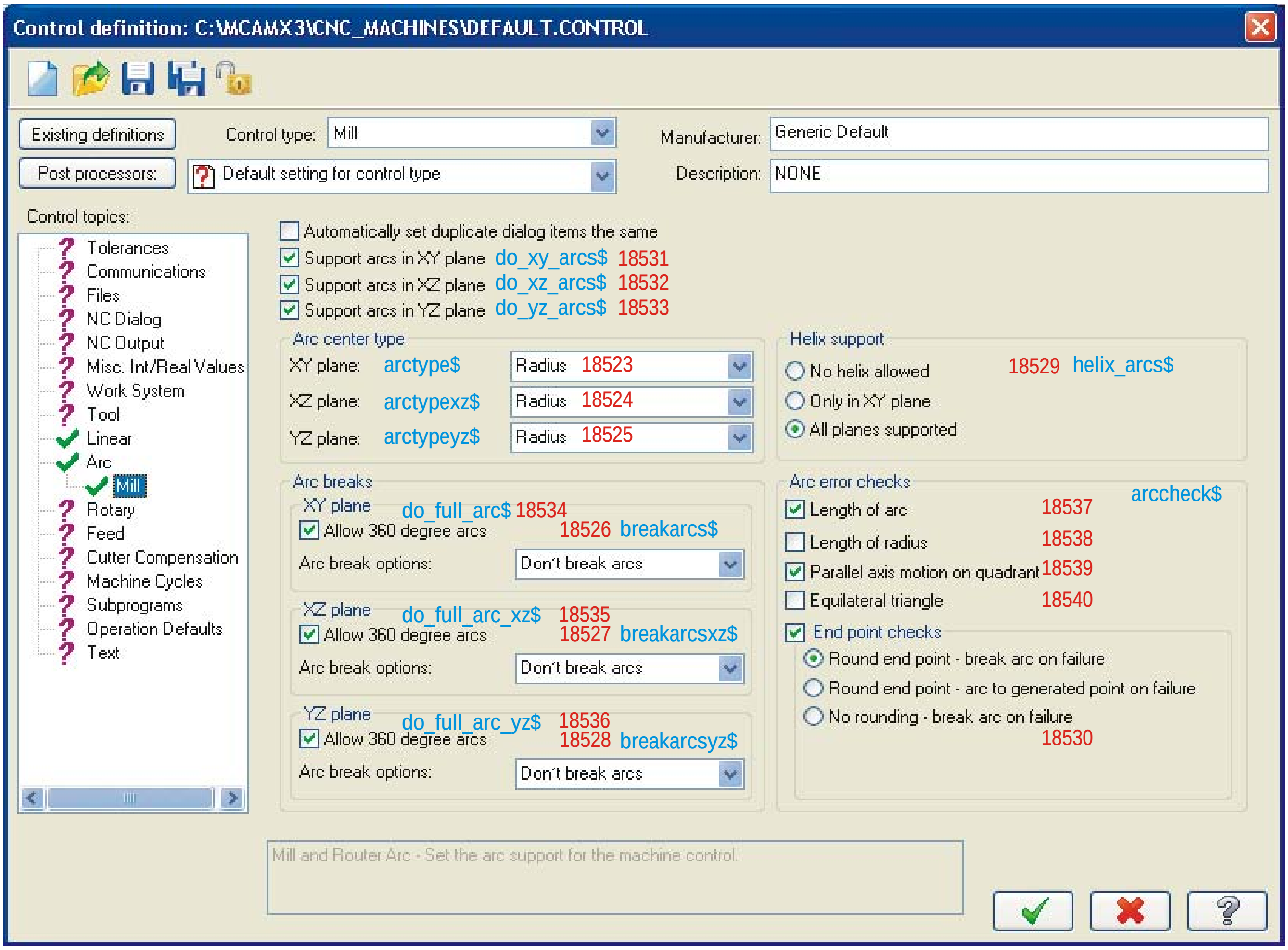
Linear page (Mill–Router)



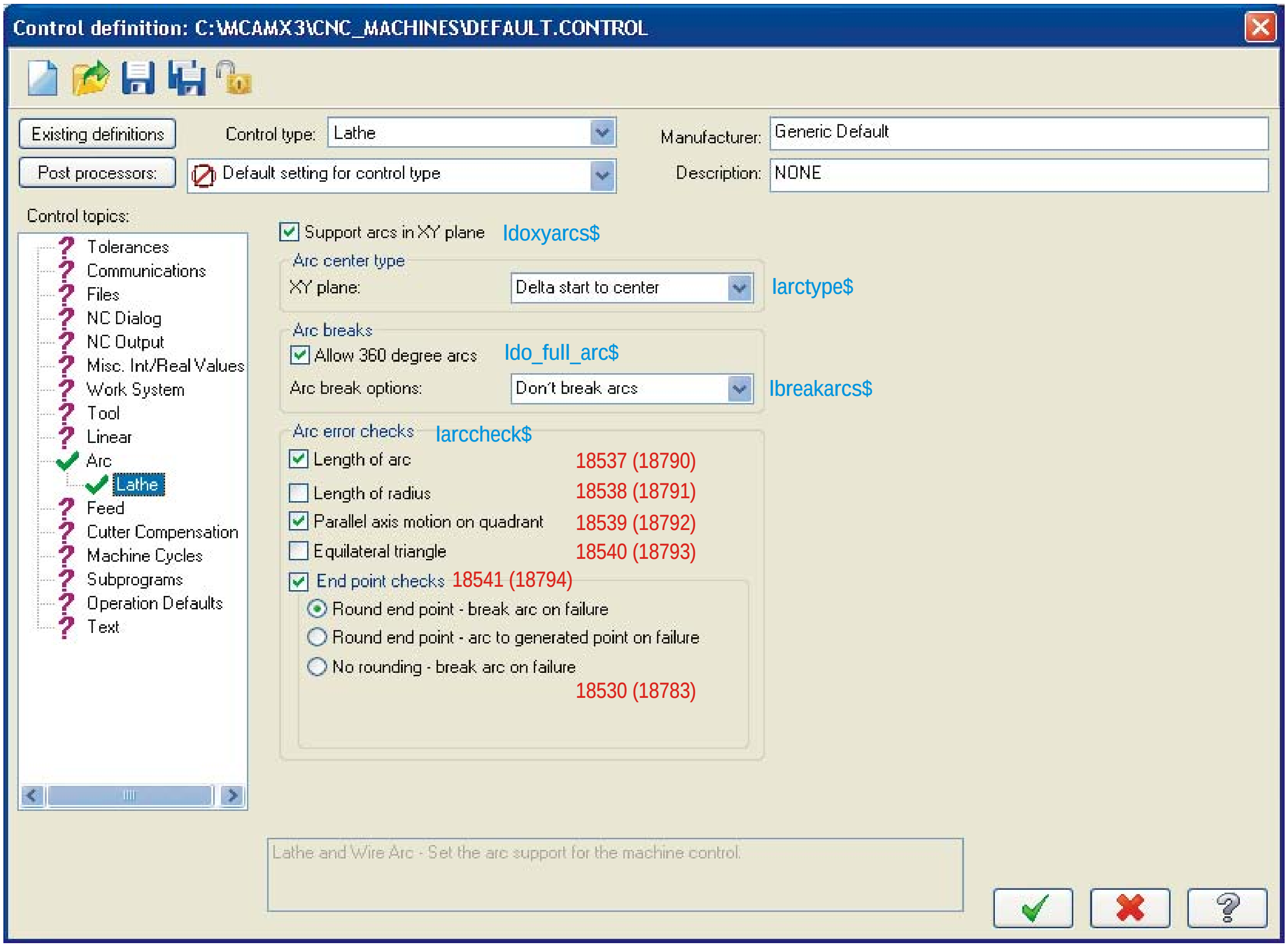
Linear page (Lathe–Mill/Turn–Wire)



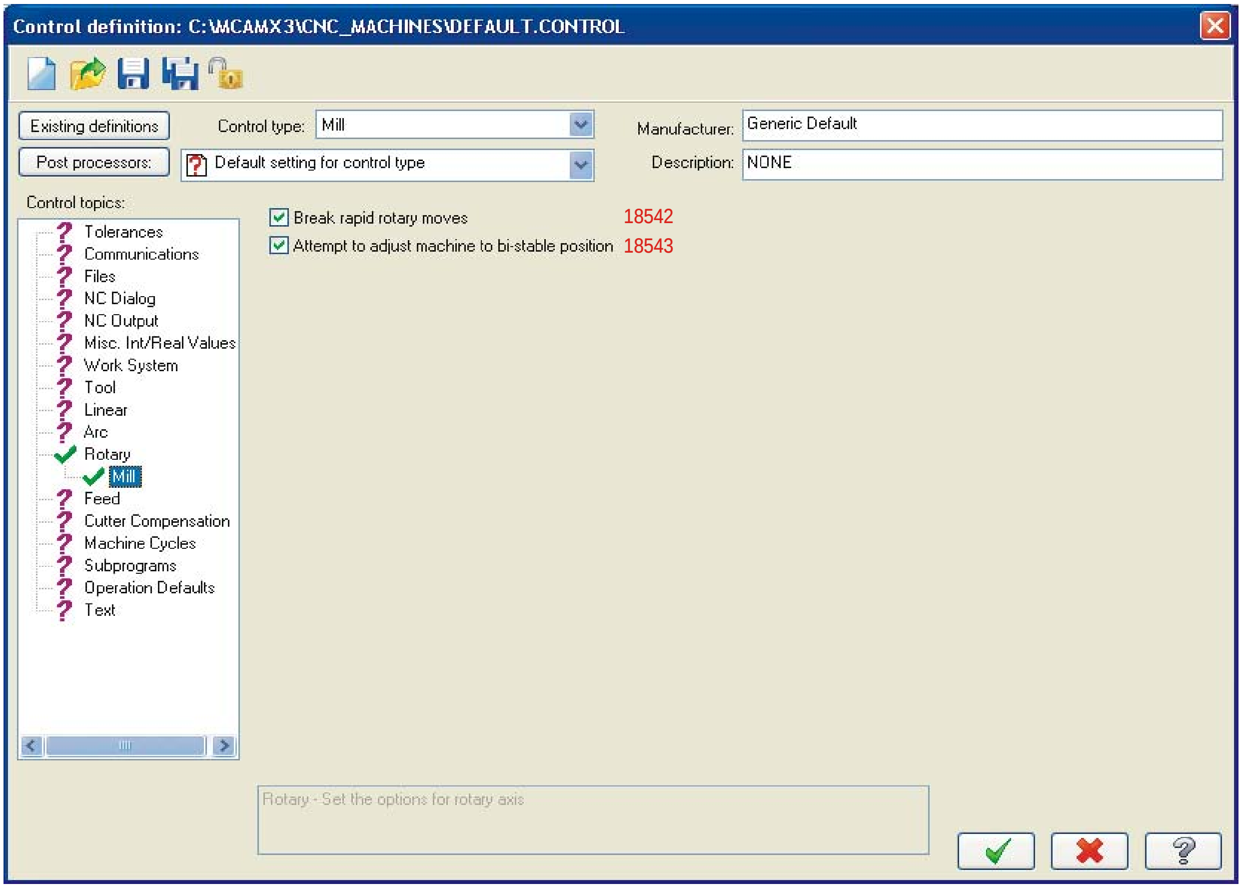
Arc page (Mill–Router–Wire)



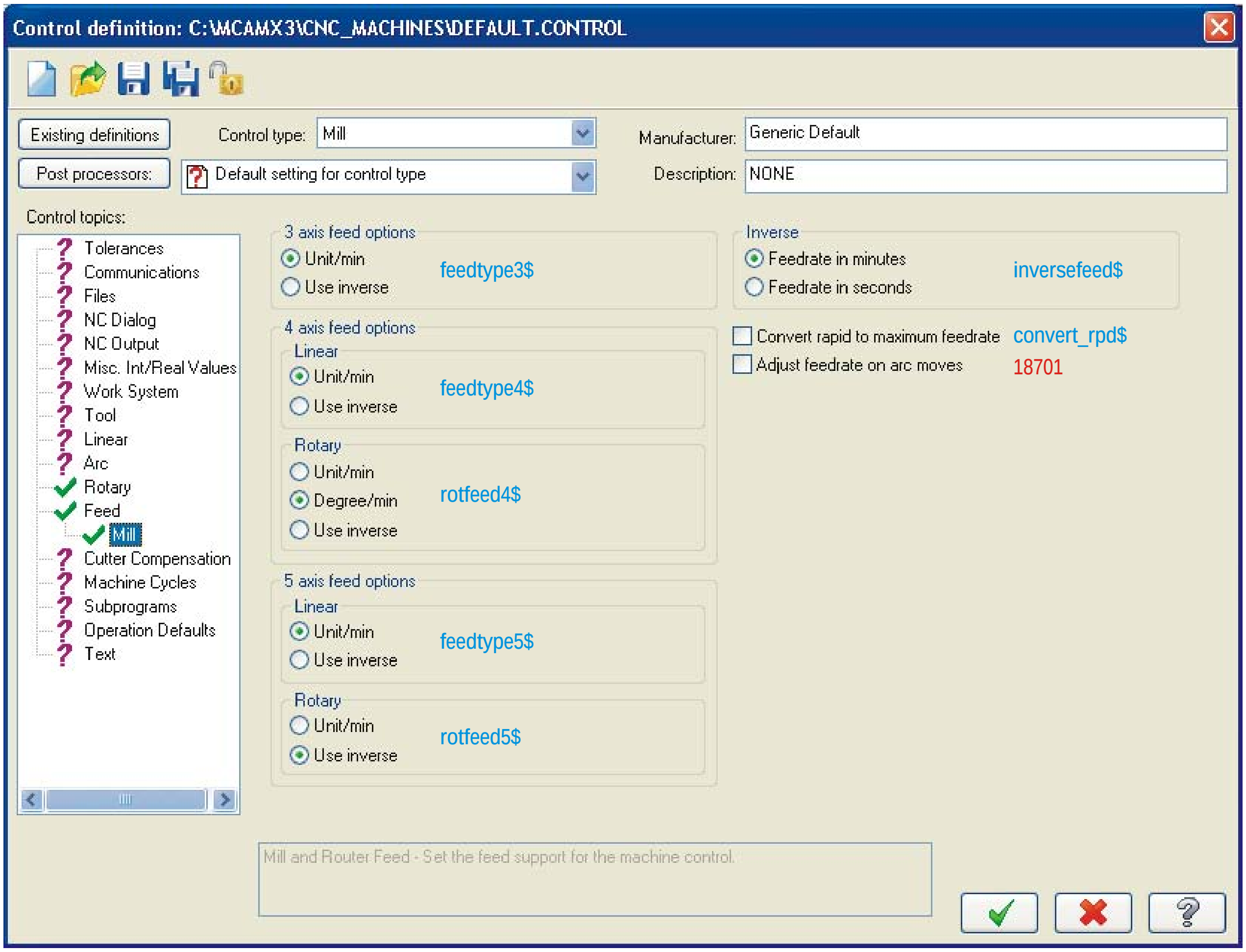
Arc page (Lathe)



Rotary page (Mill–Router–Lathe)

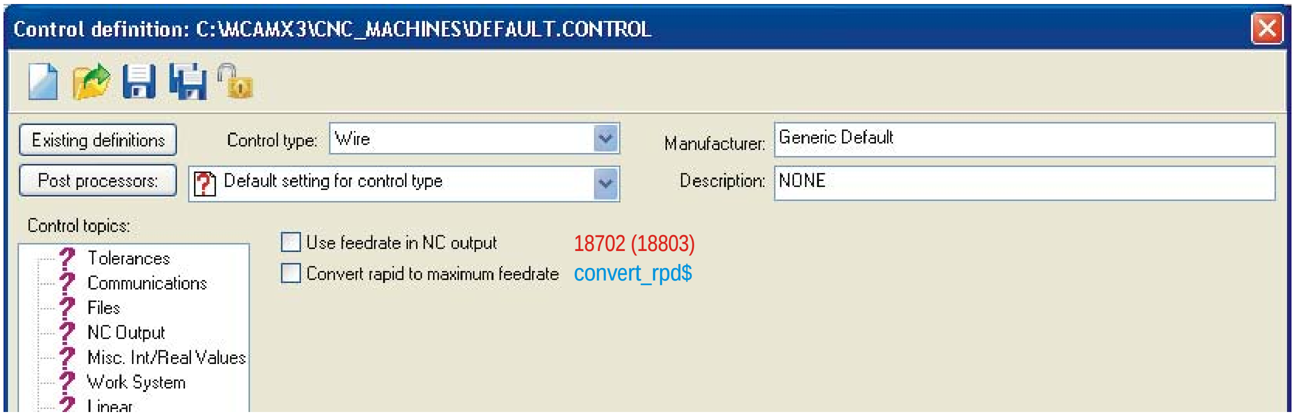


Feed page (Mill–Router)

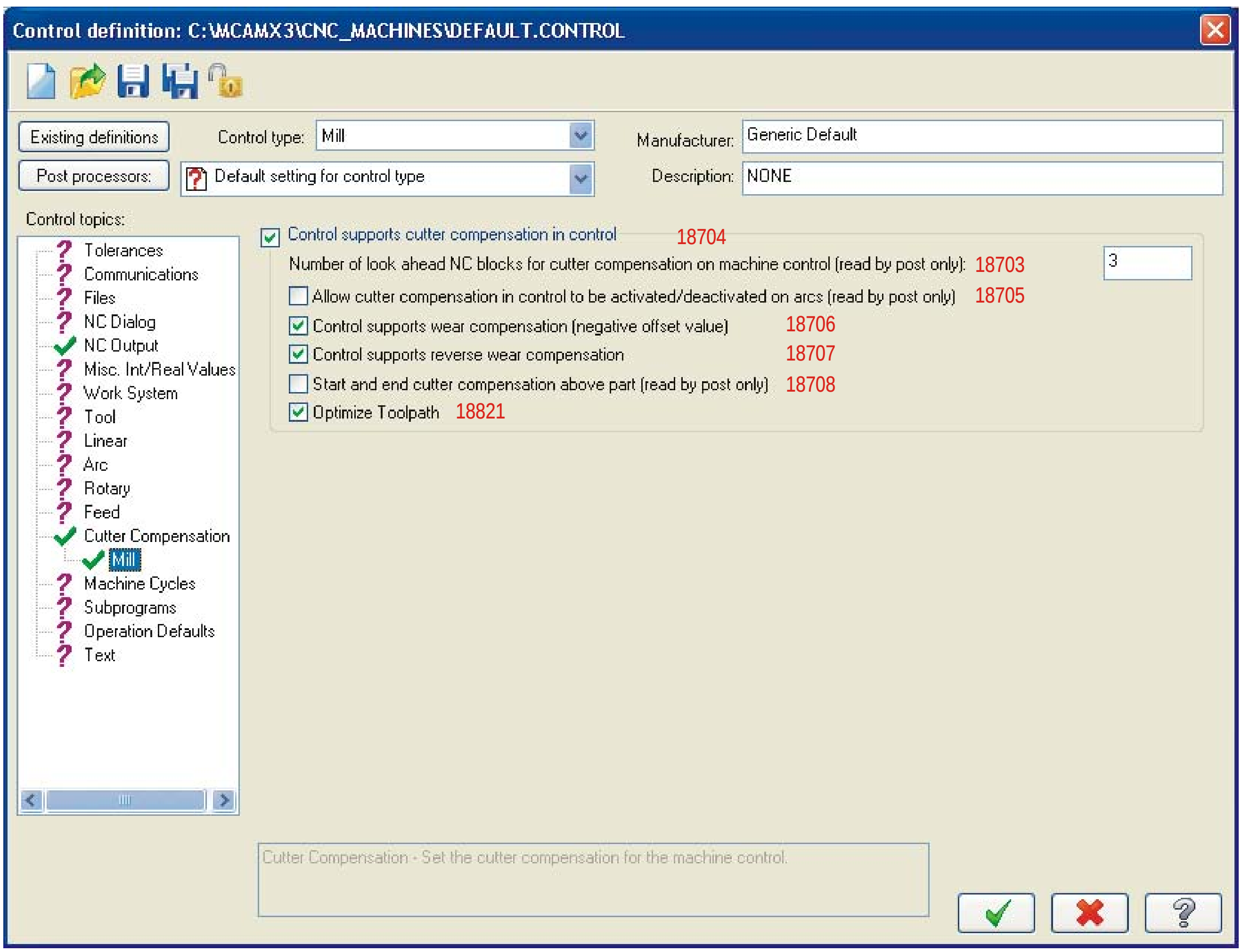


Feed page (Lathe)

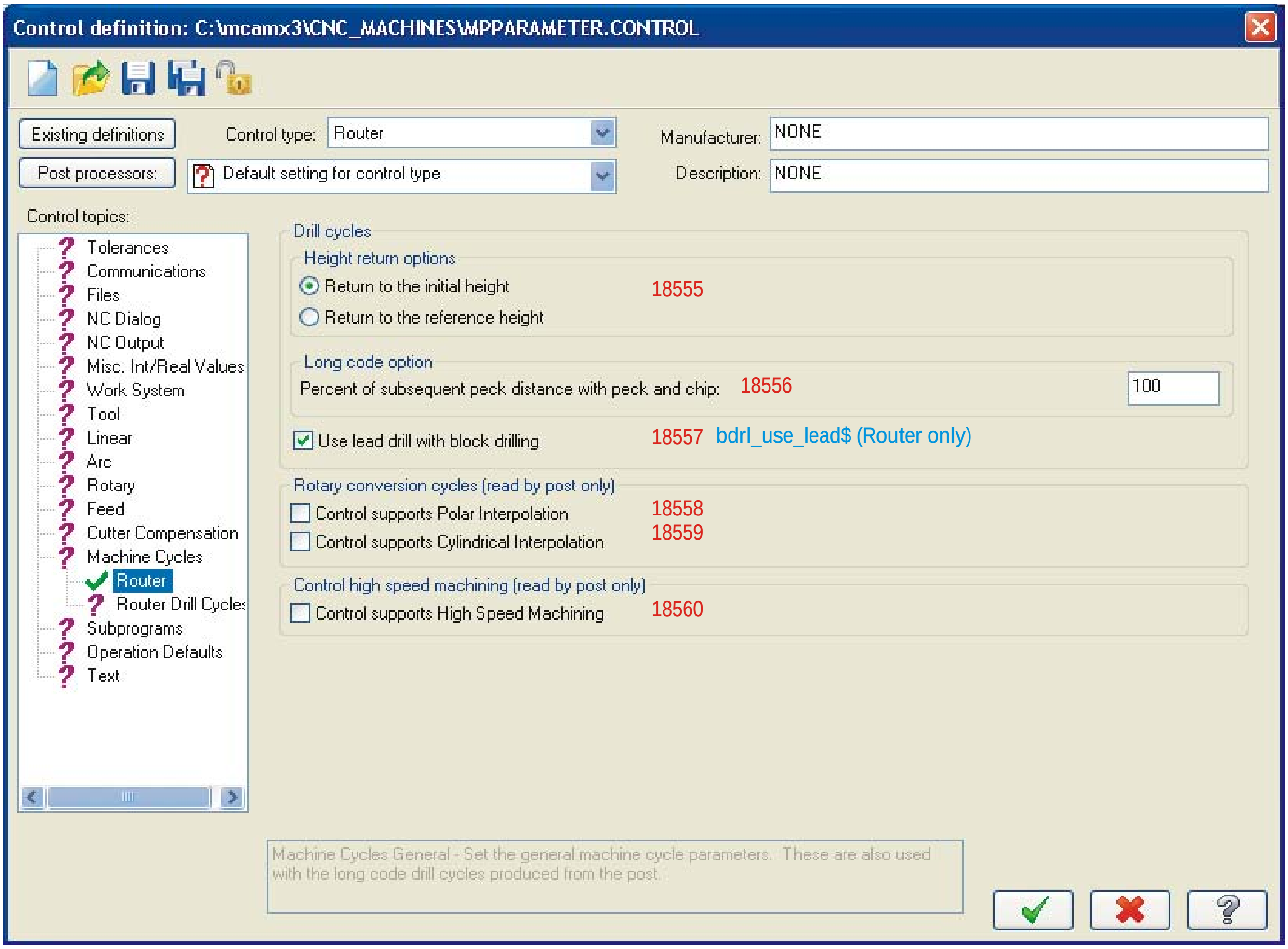
Feed page (Wire)



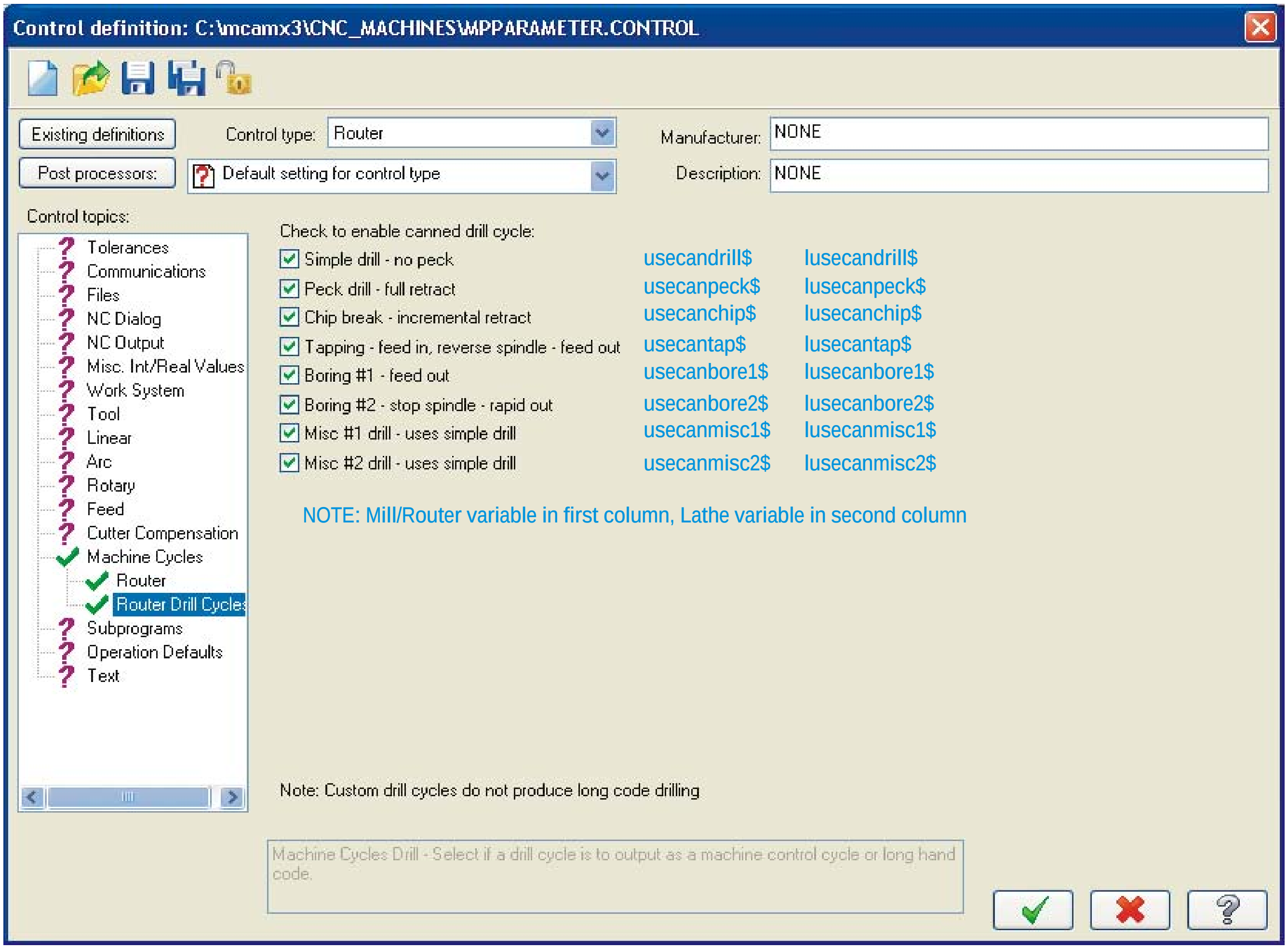
Cutter Compensation page



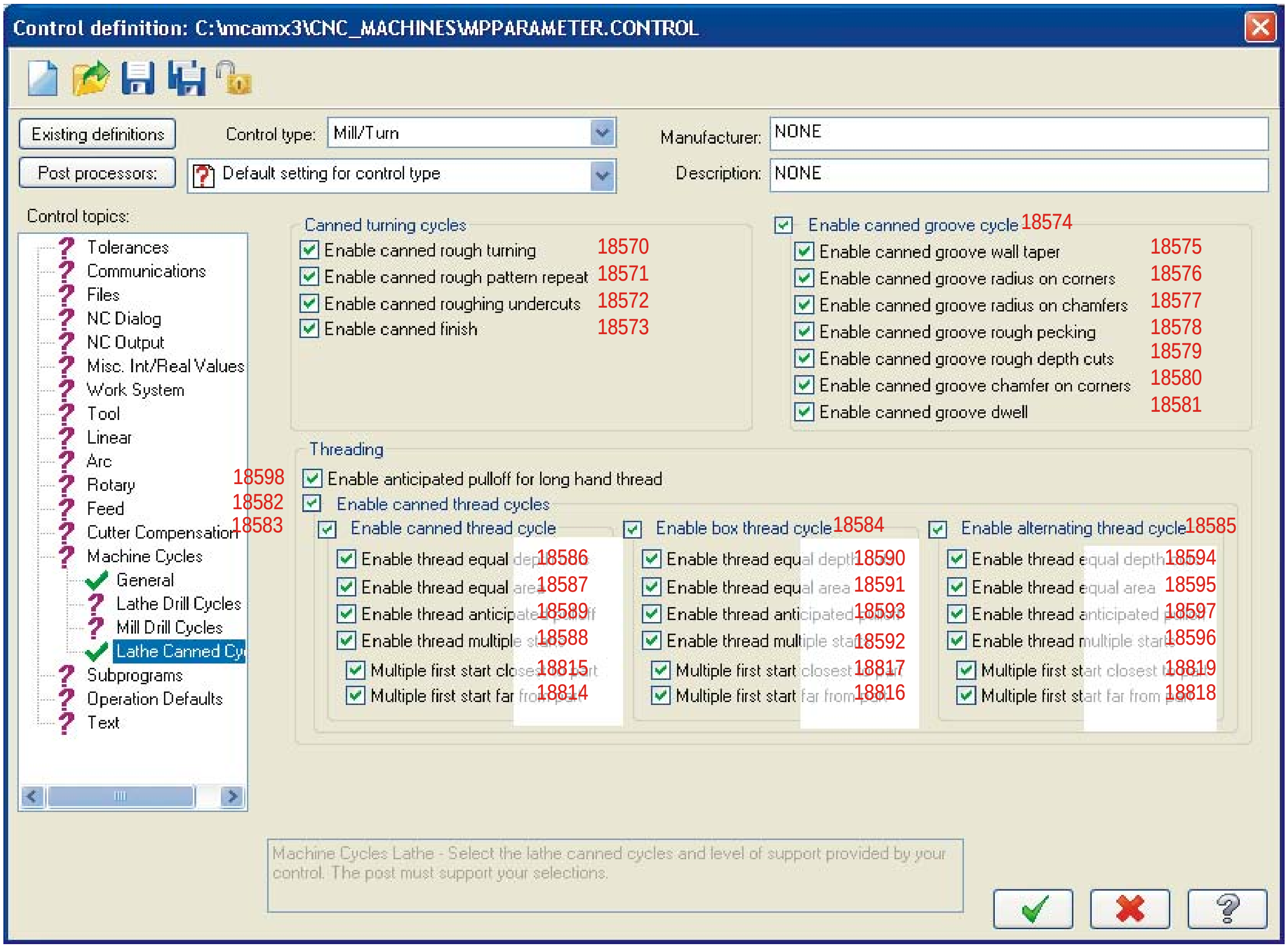
Machine Cycles page (Mill–Router–Lathe)



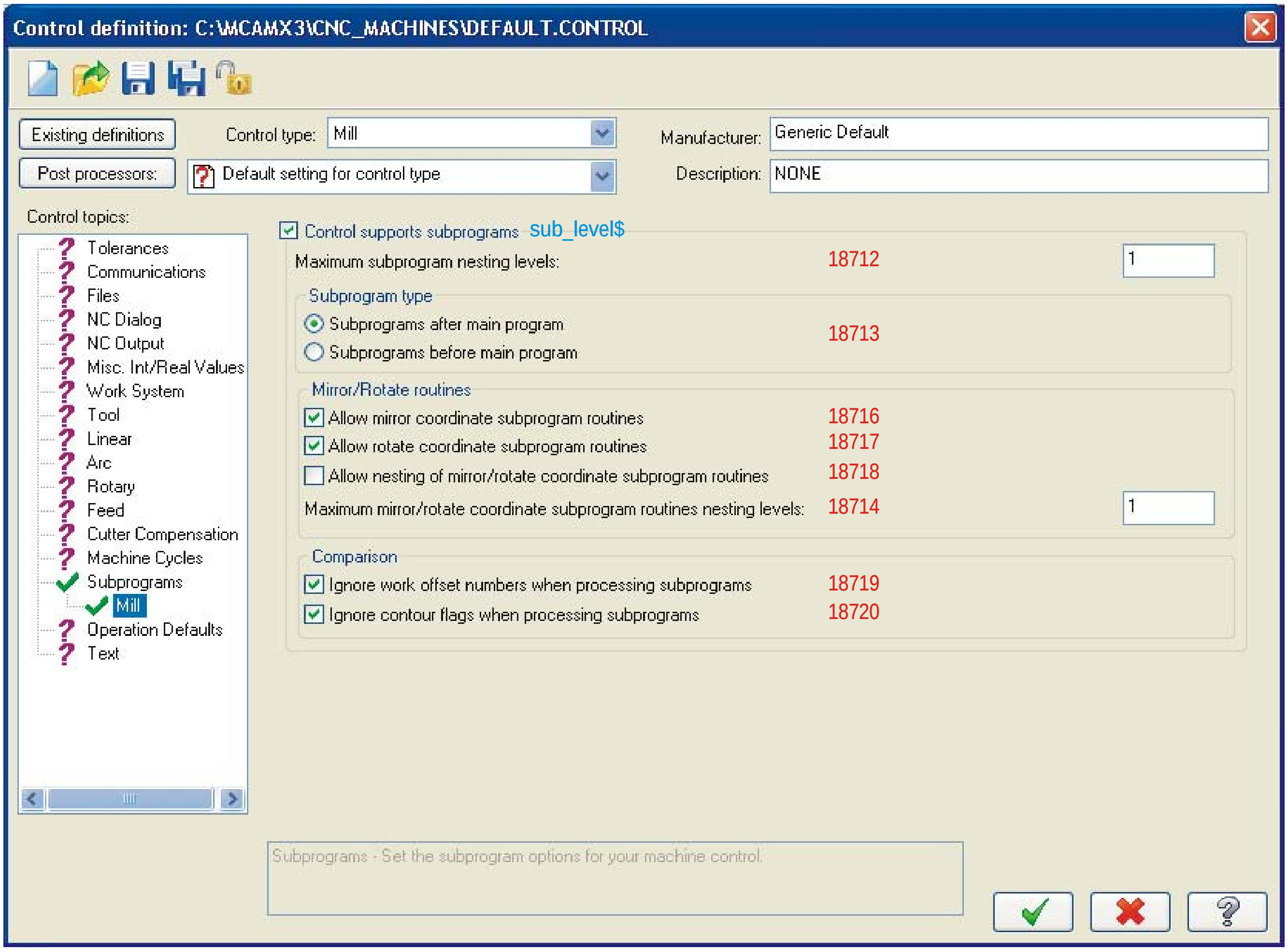
Drill Cycles page (Mill–Router–Lathe)



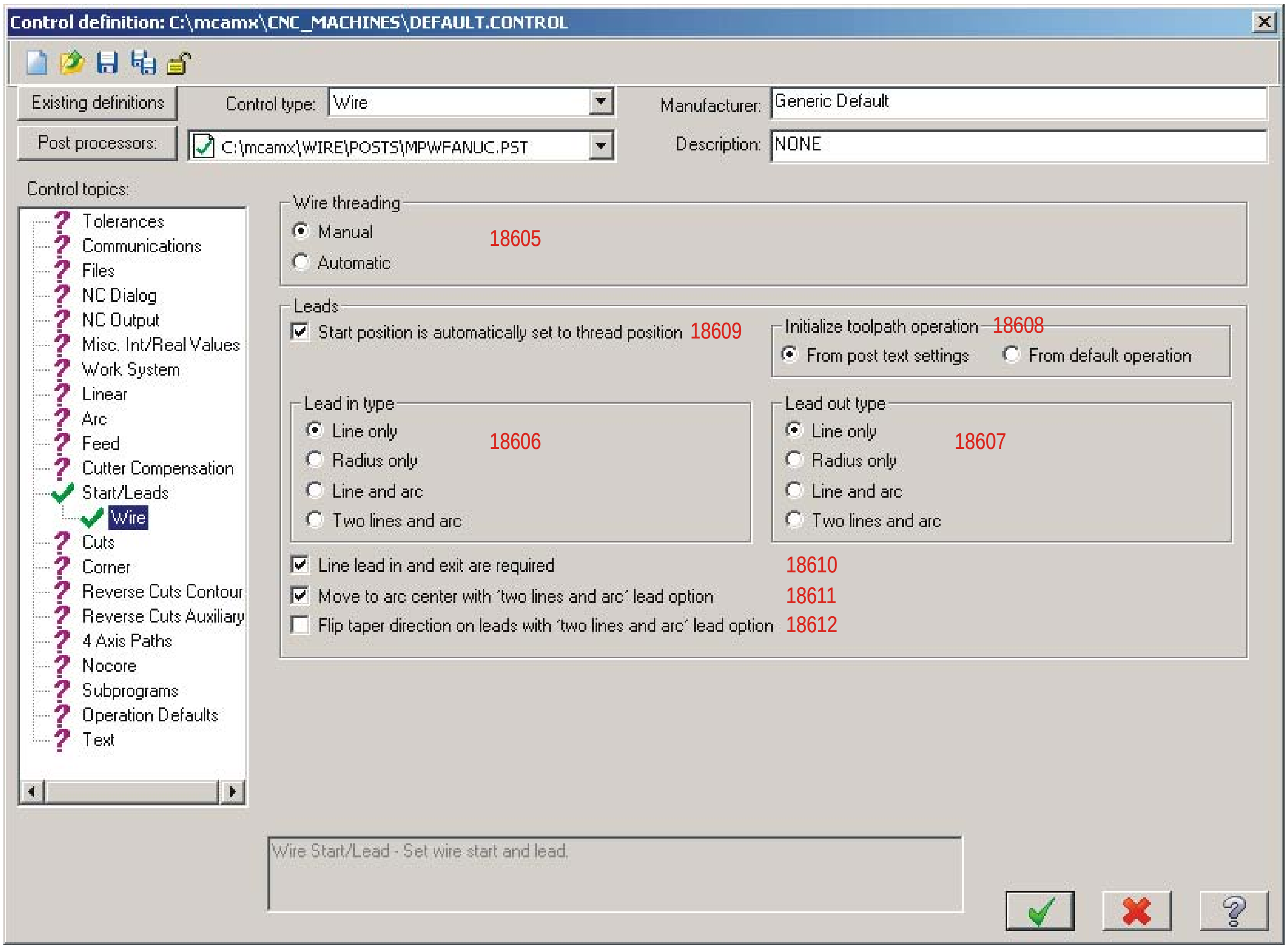
Lathe Canned Cycles page (Lathe)



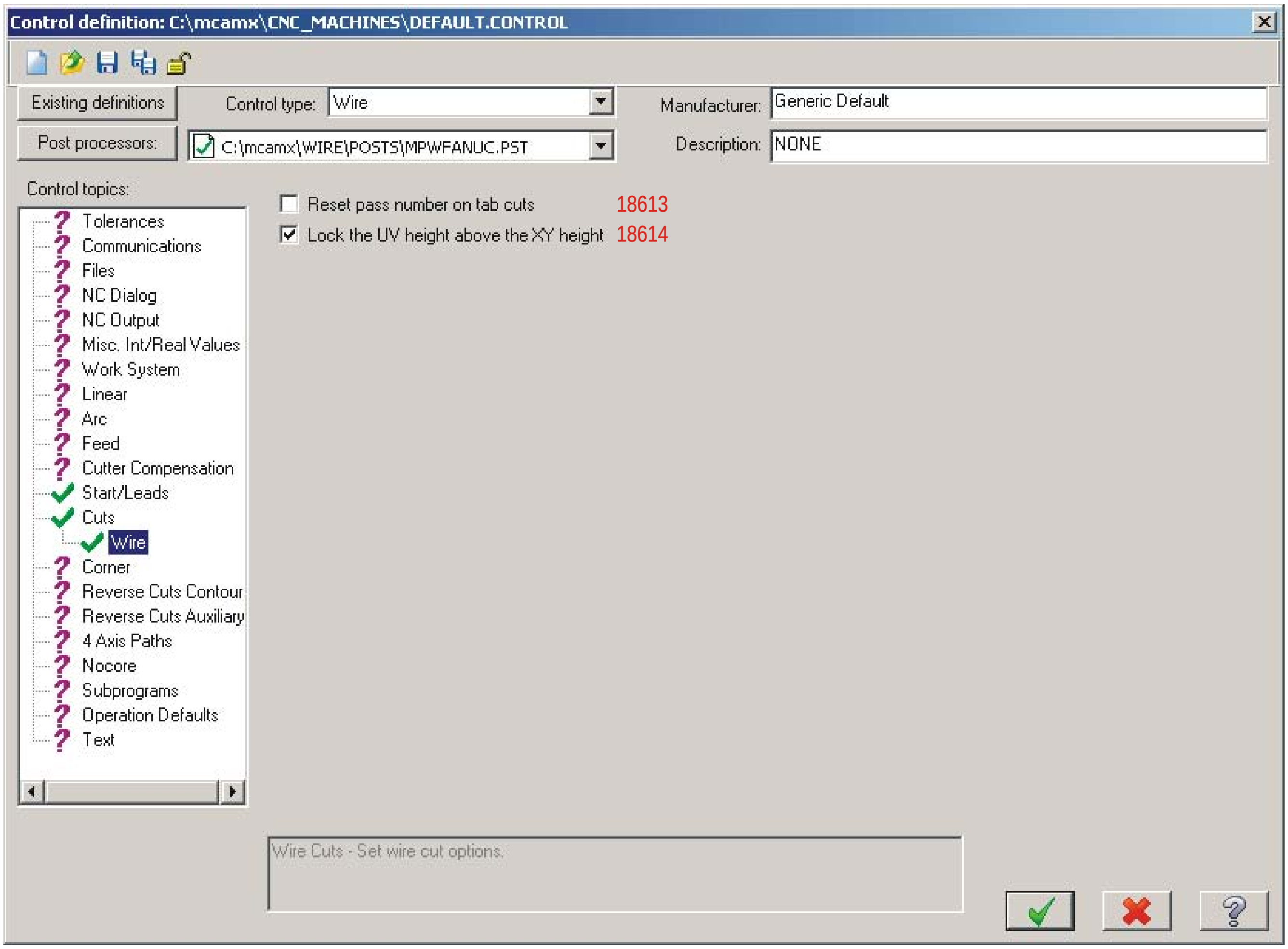
Subprograms page



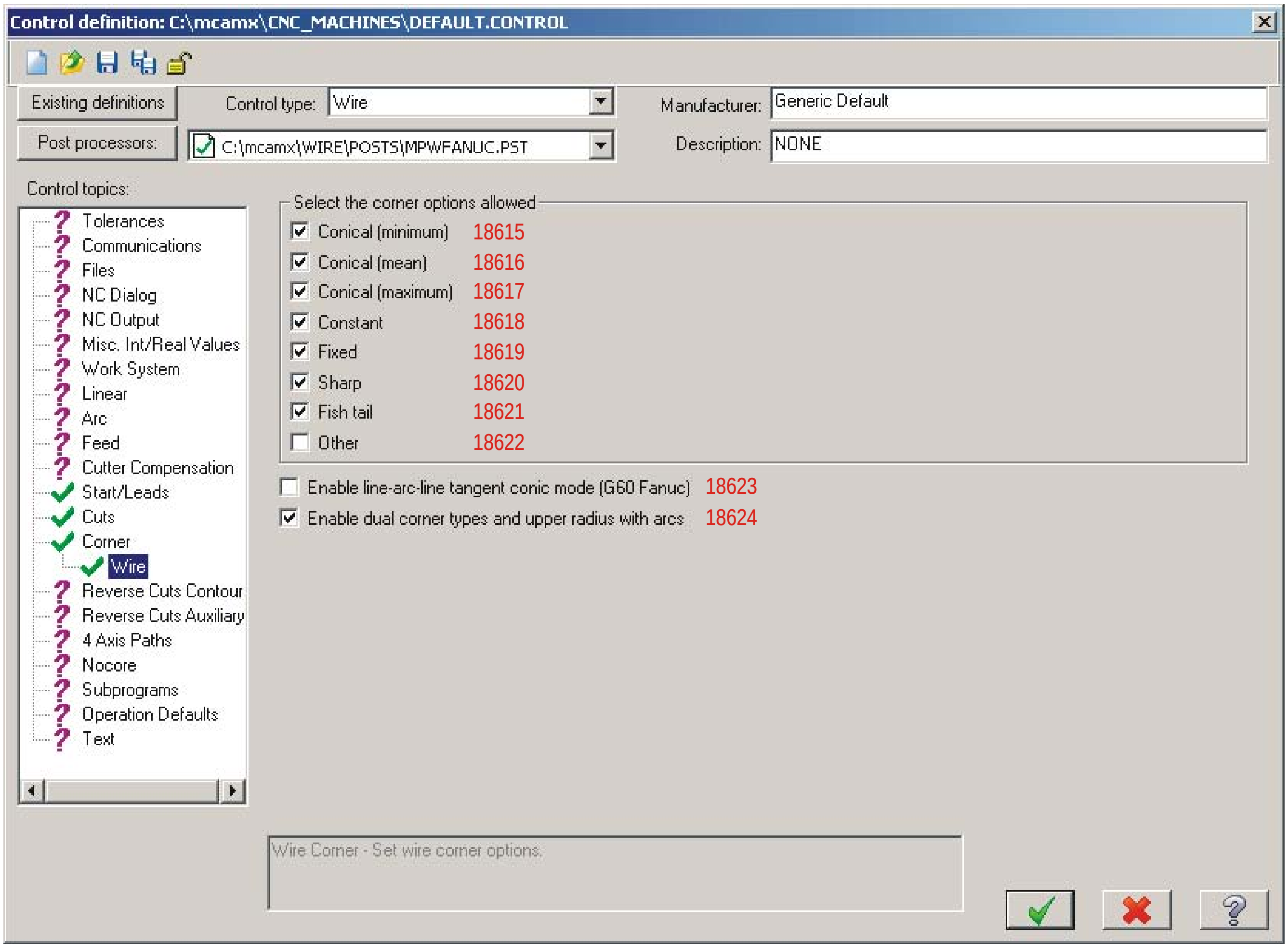
Start/Leads page (Wire)



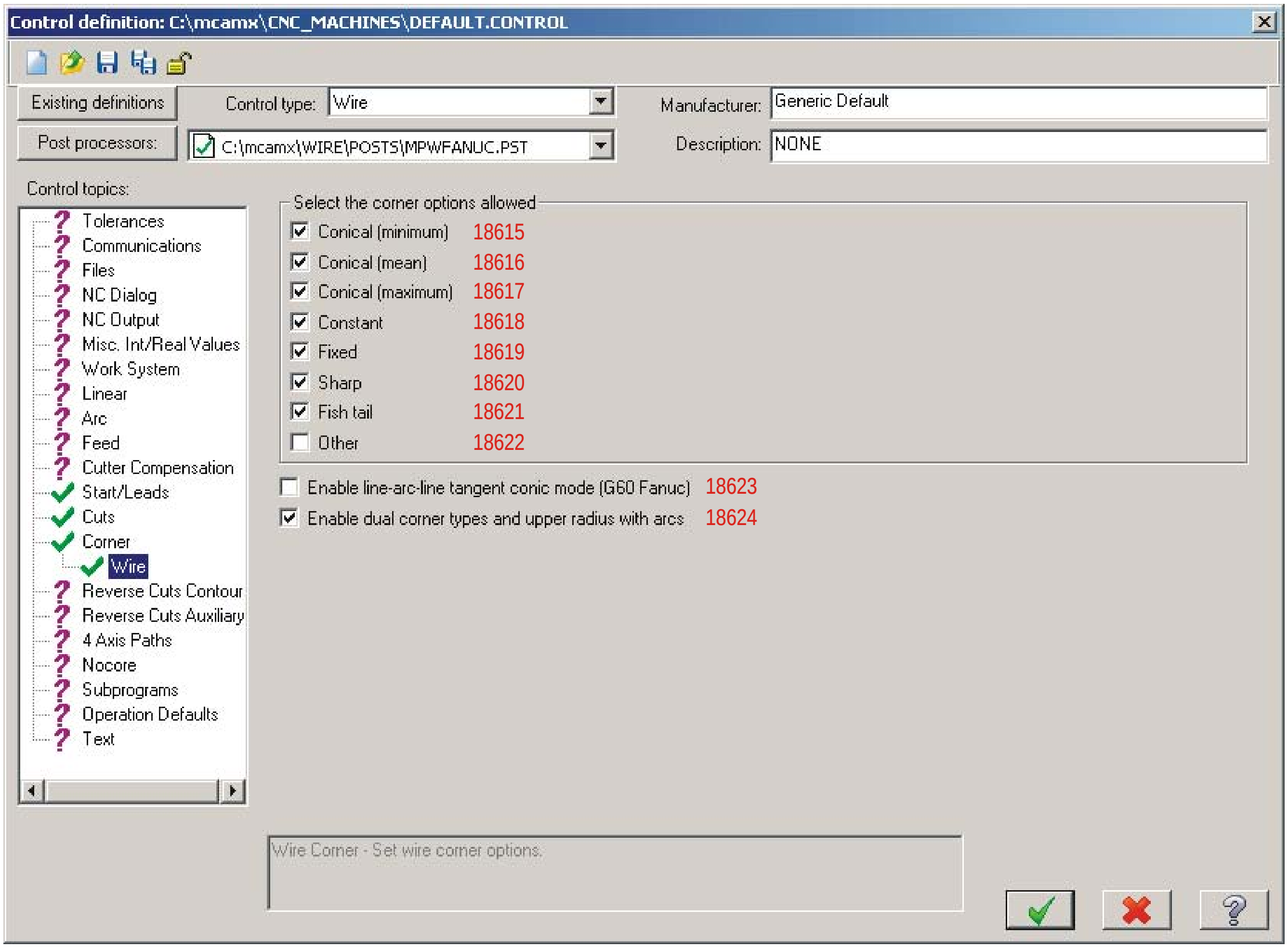
Cuts page (Wire)



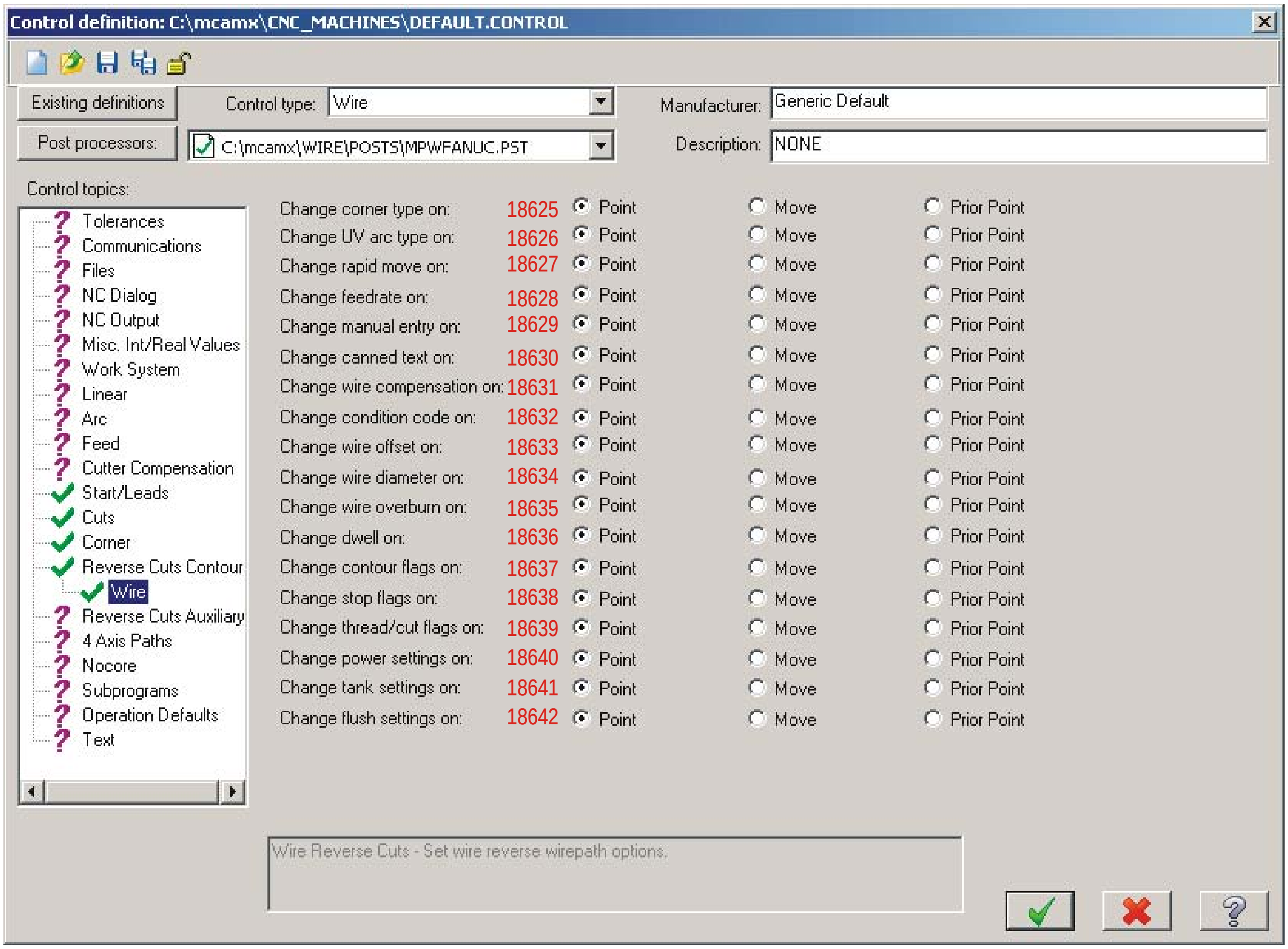
Corner page (Wire)



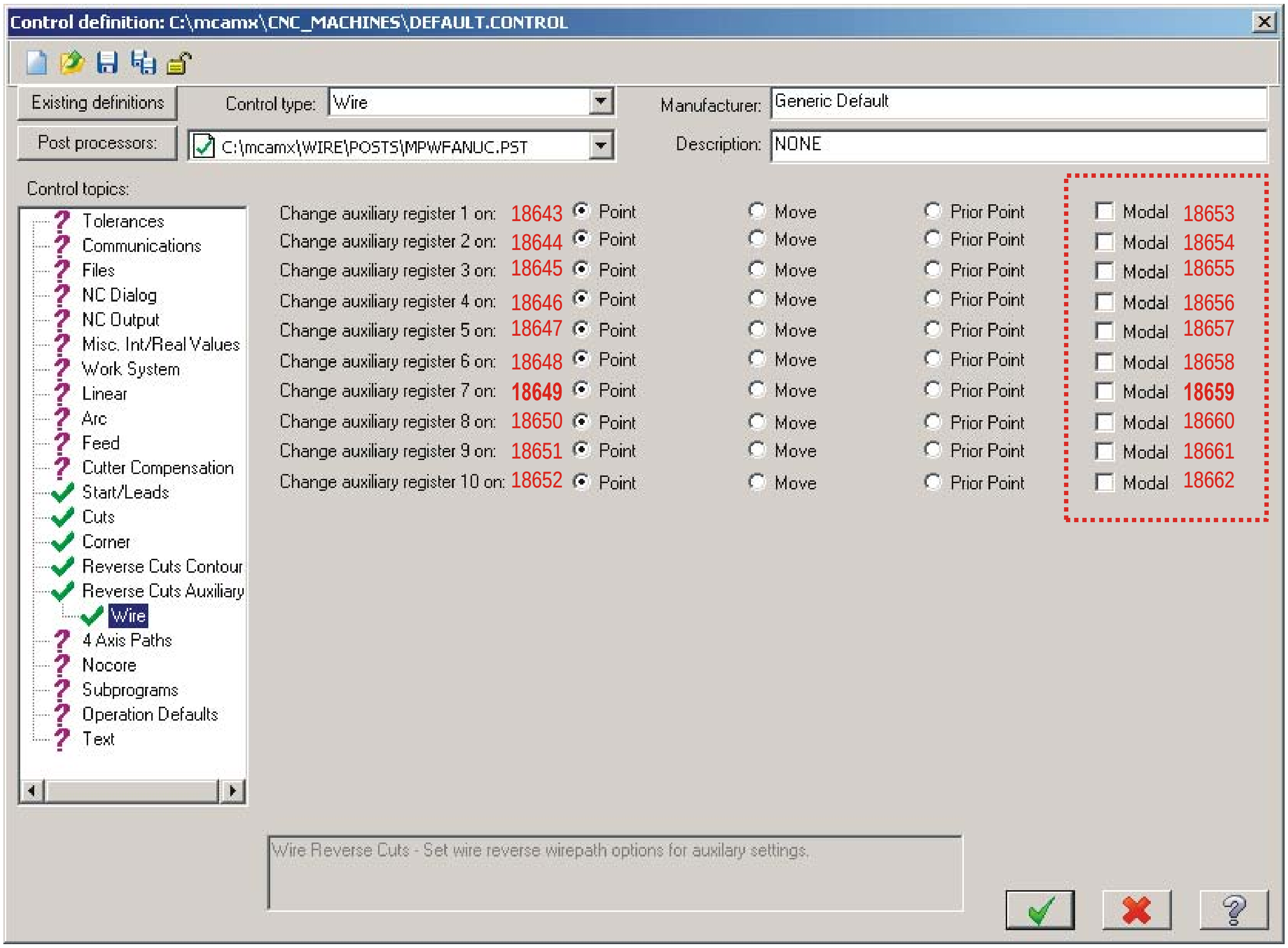
Corner page (Wire)



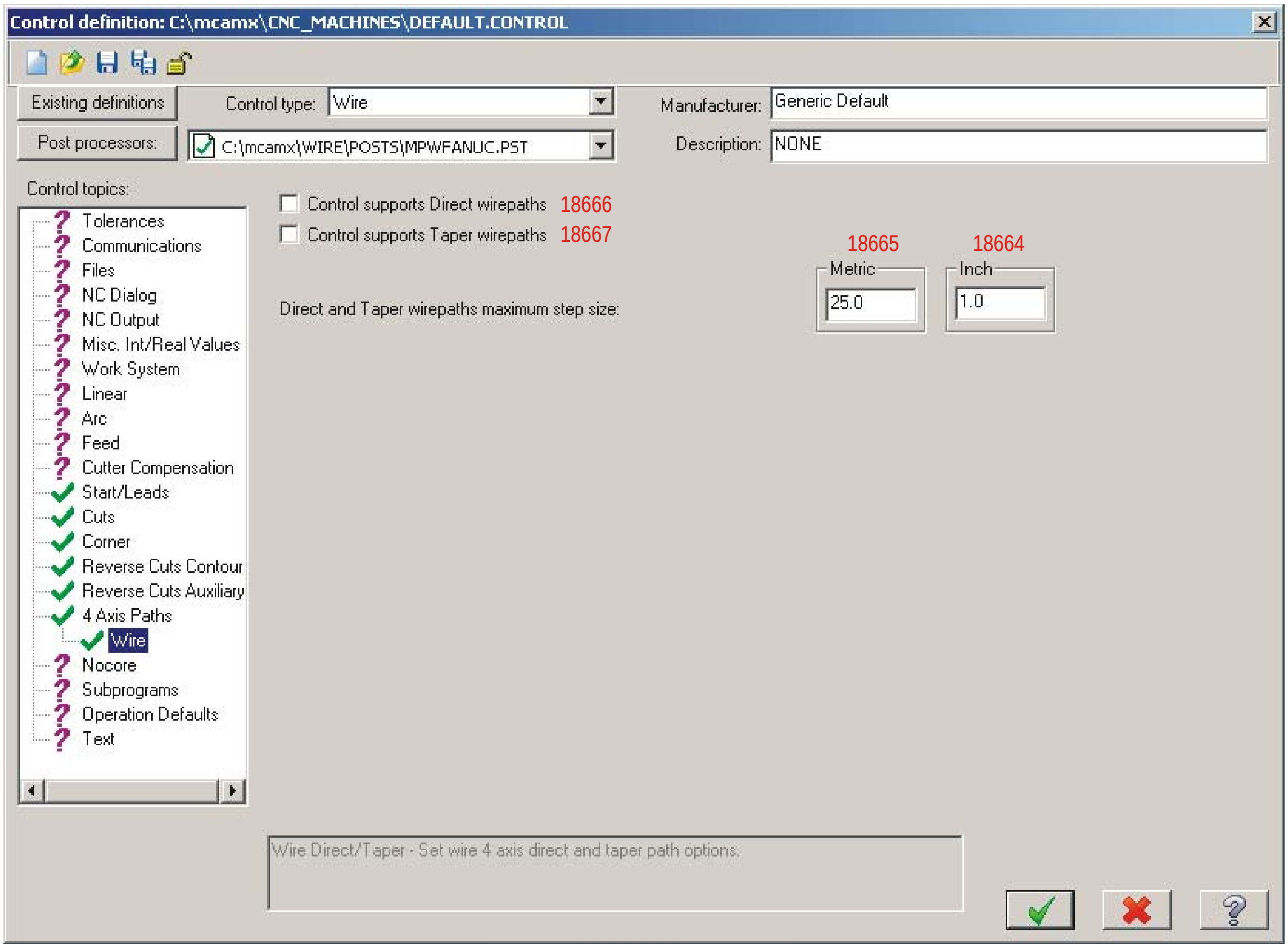
Reverse Cuts Contour page (Wire)



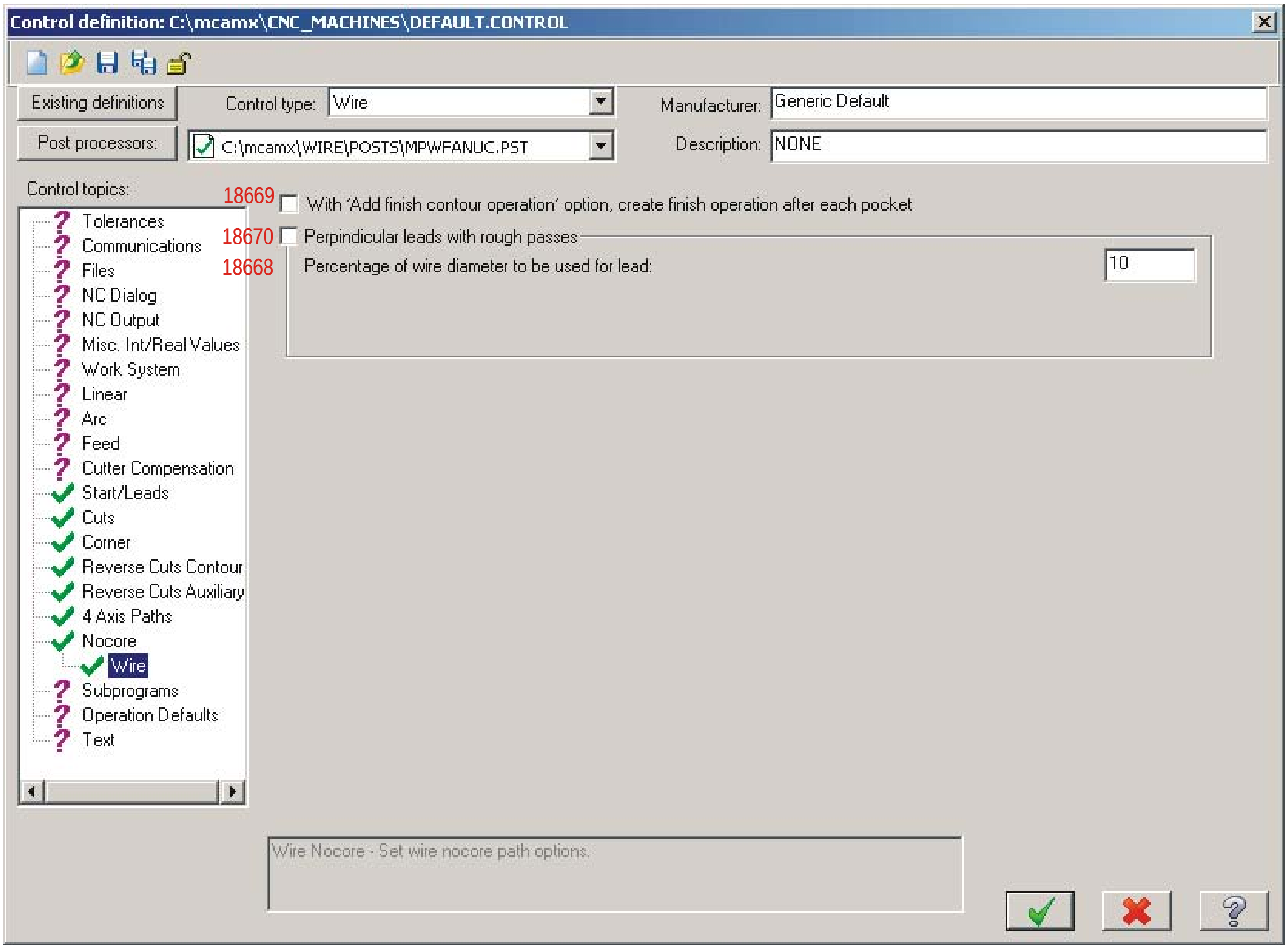
Reverse Cuts Auxiliary page (Wire)



4-Axis Paths page (Wire)



Nocore page (Wire)



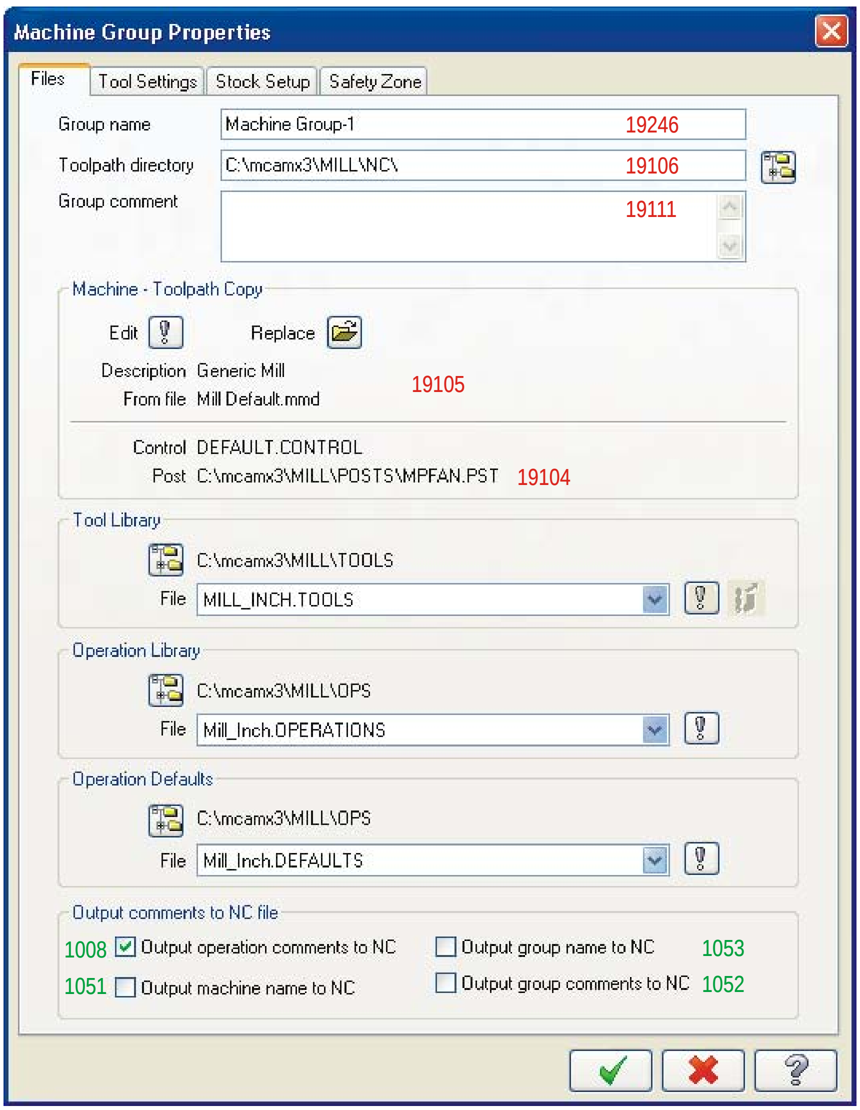
Machine group property pages

Most of the fields shown in the following pages use parameters to store their values, but the values for some fields are available as pre-defined variables, or even directly in the NCI G-code. Use the following color key to determine the type of value:

- Red labels indicate parameter numbers
- Blue labels indicate pre-defined variable names
- Green labels indicate NCI G-codes

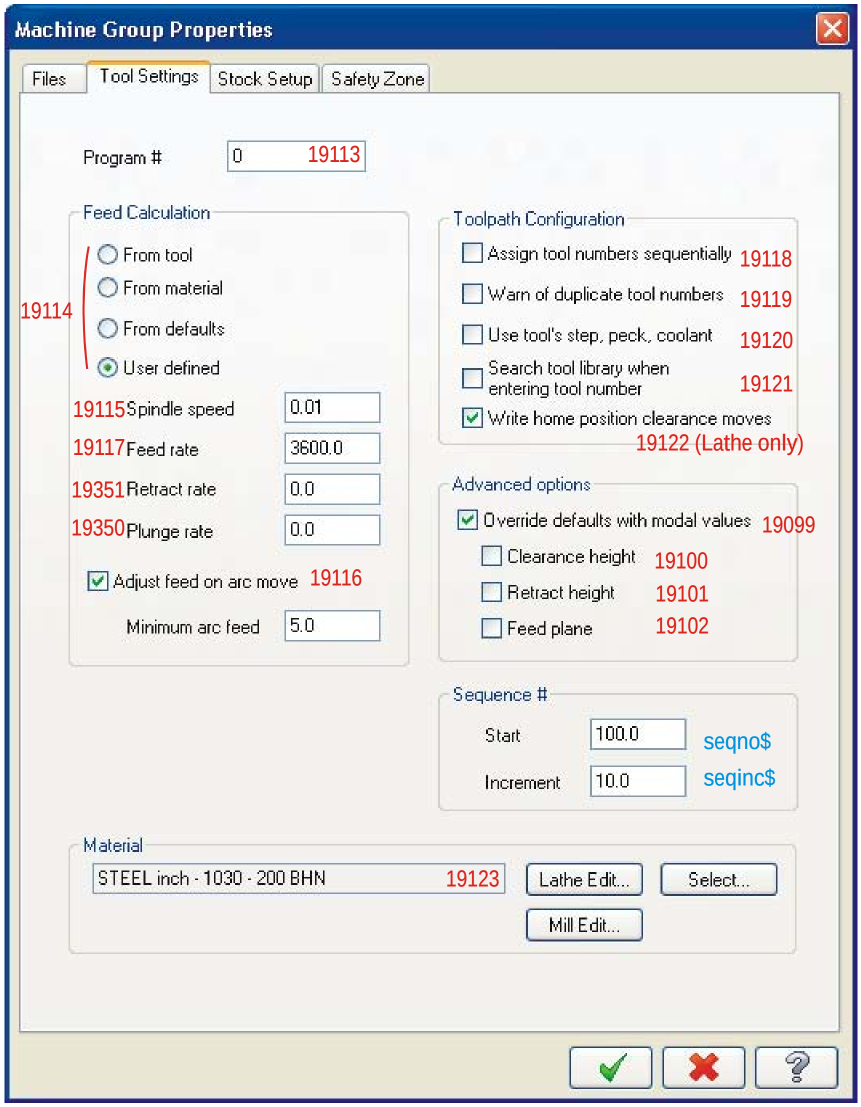
Some fields are available as both parameters and pre-defined variables. In these cases, you can use whichever method is most convenient. Typically, this will be the pre-defined variable.

Files tab (Machine Group Properties)

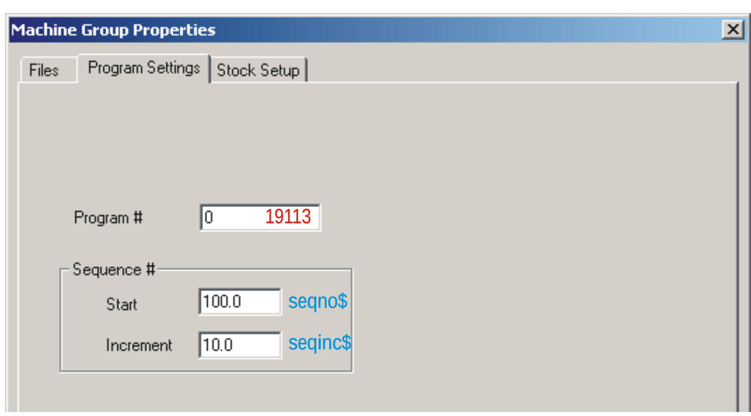


The comments at the bottom of the tab are available directly from the NCI file, rather than parameters. The number in green lists the NCI Gcode where the comment will be output.

Tool Settings tab (Machine Group Properties)

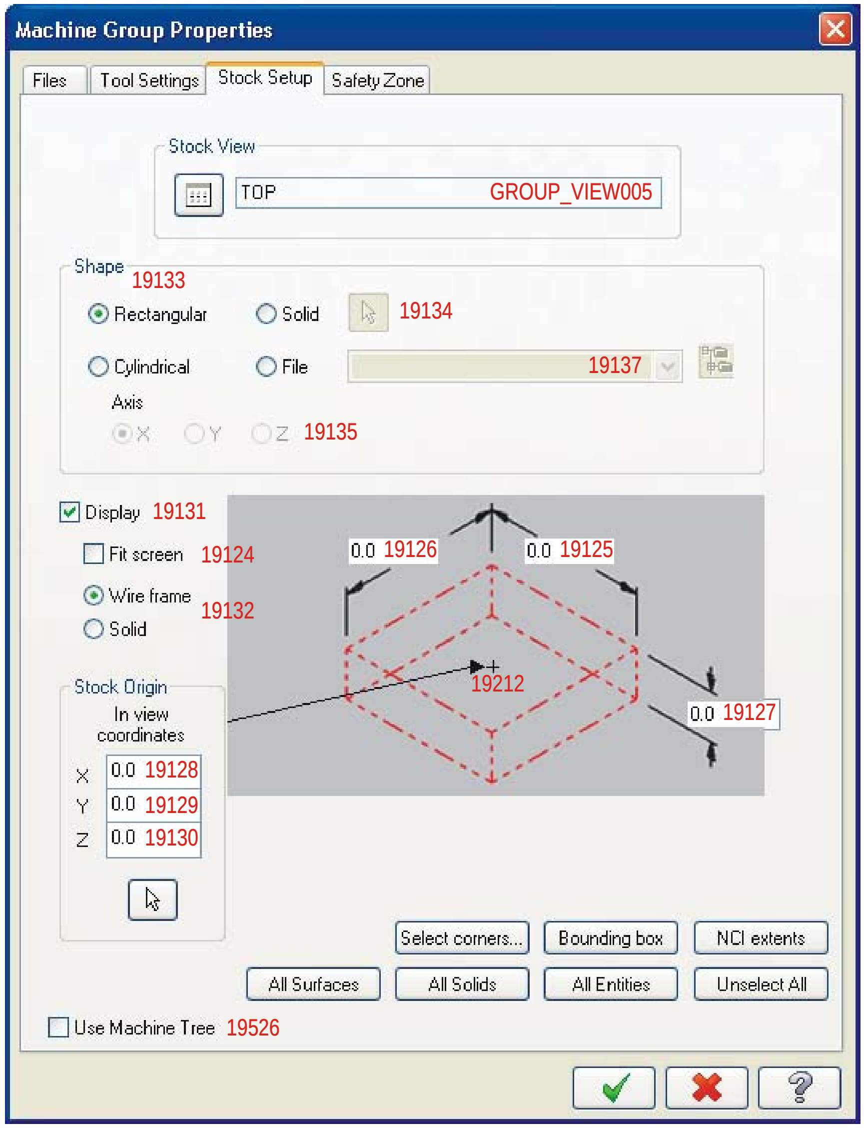


Mastercam Wire uses an abbreviated version of this tab—**Program Settings**—as shown below.



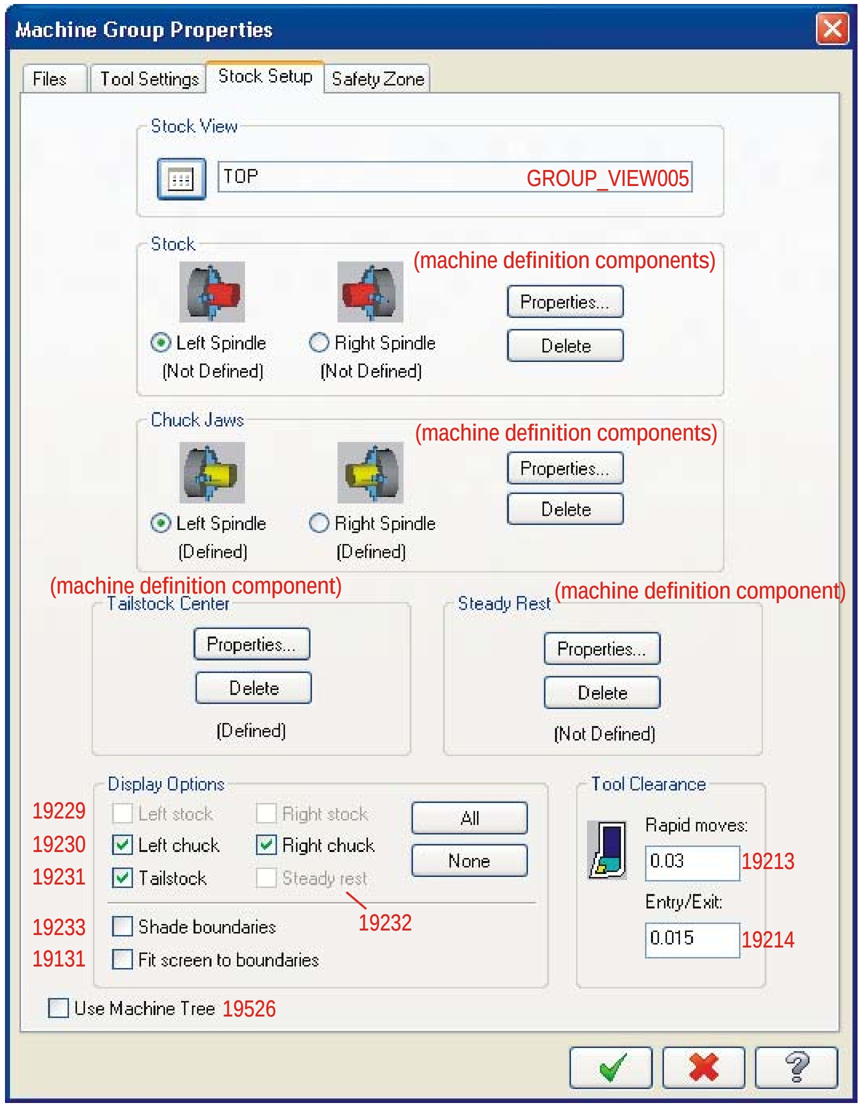
Stock Setup tab—Mill/Router (Machine Group Properties)

Stock models are now stored in the machine definition as machine definition components. This means that in addition to the machine group parameters noted here, you can also access the machine definition component parameters. These will generally prove to be more robust and flexible. As a best practice, you should use the machine definition parameters instead of the legacy machine group parameters.

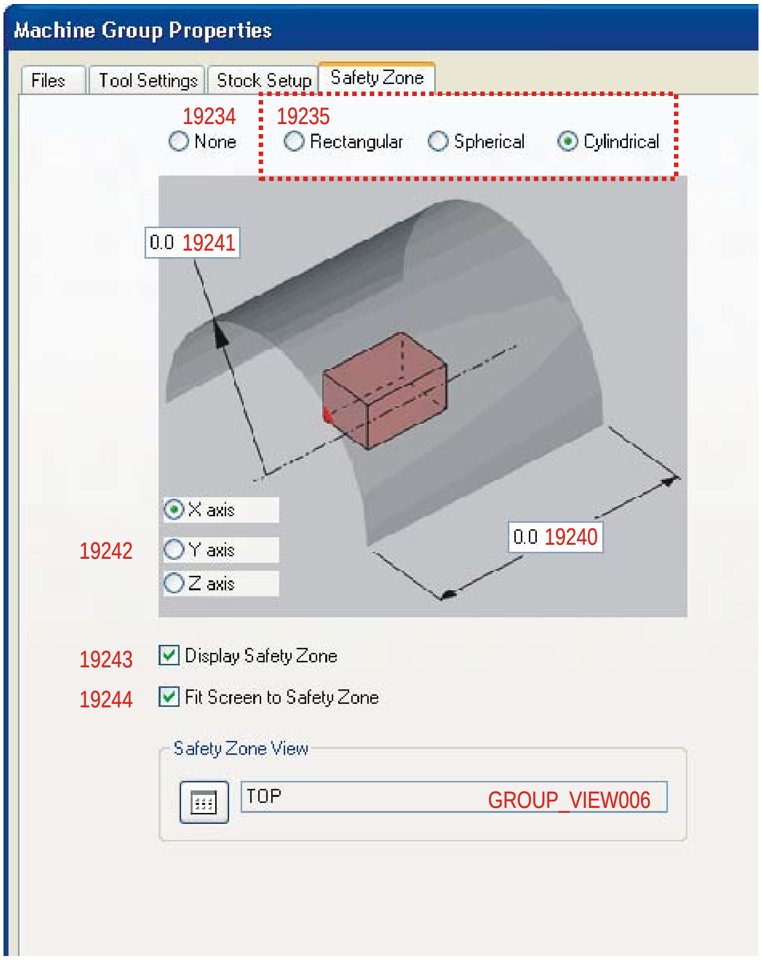


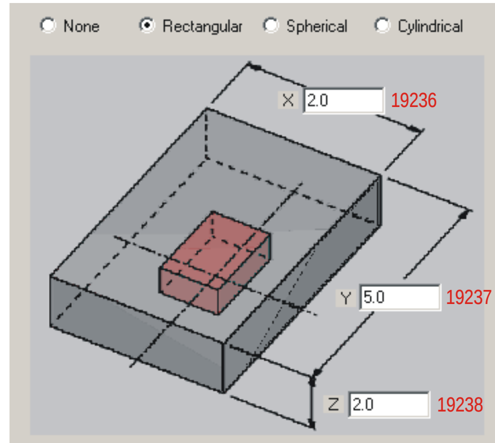
Stock Setup tab—Lathe (Machine Group Properties)

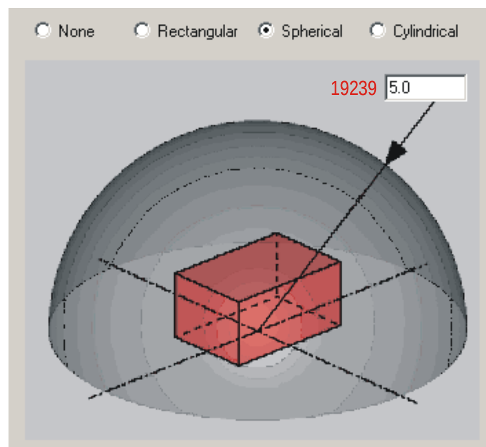
Stock models—as well as chuck jaws, tailstock centers, and steady rests—are now stored in the machine definition as machine definition components. This means that in addition to the machine group parameters noted here, you can also access the machine definition component parameters. These will generally prove to be more robust and flexible. As a best practice, you should use the machine definition parameters instead of the legacy machine group parameters.


Machine Group Properties
Files
Tool Settings
Stock Setup
Safety Zone
Stock View
TOP
GROUP_VIEW005
Stock
(machine definition components)
Left Spindle
(Not Defined)
Right Spindle
(Not Defined)
Properties...
Delete
Chuck Jaws
(machine definition components)
Left Spindle
(Defined)
Right Spindle
(Defined)
Properties...
Delete
(machine definition component)
Tailstock Center
Properties...
Delete
(Defined)
Steady Rest
(machine definition component)
Properties...
Delete
(Not Defined)
Display Options
19229
Left stock
Right stock
All
19230
Left chuck
Right chuck
None
19231
Tailstock
Steady rest
19232
19233
Shade boundaries
19131
Fit screen to boundaries
Tool Clearance
Rapid moves:
0.03
19213
Entry/Exit:
0.015
19214
Use Machine Tree 19526

Safety Zone tab (Machine Group Properties)







chapter 3

Parameter Reference

This chapter lists every parameter used in Mastercam X3. It is divided into two main sections:

This section includes parameters numbered 10000–19999. It also includes 30000s parameters, which are reserved for use by C-hooks; see page 162.

Throughout these sections, notes and annotations indicate parameters that are only used in previous versions of Mastercam or that are longer used, and where appropriate, their replacements in Mastercam X3 or later.

The most recent additions are indicated by **(New for X3)**, while deletions are noted by *(Removed for X3)*.

Often the parameter tables reference the names of other related parameter groups; for your convenience, in the electronic (PDF) version of this document, these are typically live hyperlinks.

Operation & toolpath parameters

General operation parameters

Information used to write the file (header)

19998	*Size of the header (removed for X3)*
19997	*Size of the operation structure (removed for X3)*
19996	*Major version number (removed for X3)*
19995	*Minor version number (removed for X3)*
19994	*Toolpath Group name for these operations (removed for X3)*

OPERATION

15237	Operation ID (op_id$)
15238	Toolpath operation code (tool_op$)
15239	Toolpath comment
15240	Slot
OP_DB	
OP_COMMON	
OP_FILTER	
OP_TOOL_INFO	
OP_CC	
OP_CC	
OP_VIEW (Tplane)	
OP_VIEW002 (Cplane)	
OP_VIEW003 (WCS view data)	
OP_MISC	
OP_TOOL_DISPLAY	
OP_AUX_FILE	
OP_CANNED_TEXT	
OP_V8	
OP_DEPTH_CUTS	
OP_MULTI_CUTS	
OP_LEAD_IO	
OP_HOME_POS	
OP_ROTARY	
OP_COMMON_LATHE	
OP_HOME_POS	
15329	Version

15544	Data stream ID
15545	Axis combination ID
	Mill Toolpaths
PRM_DRILL	
PRM_CONTOUR	
PRM_POCKET	
PRM_XFORM	
PRM_SRF_RGH_PARALLEL	
PRM_SRF_RGH_RADIAL	
PRM_SRF_RGH_PROJECT	
PRM_SRF_RGH_FLOWLINE	
PRM_SRF_RGH_CONTOUR	
PRM_SRF_RGH_POCKET	
PRM_SRF_FIN_PARALLEL	
PRM_SRF_FIN_RADIAL	
PRM_SRF_FIN_PROJECT	
PRM_SRF_FIN_FLOWLINE	
PRM_SRF_FIN_CONTOUR	
PRM_C-HOOK	
PRM_CIRCMILL	
PRM_RULED	
PRM_REVOLVED	
PRM_LOFTED	
PRM_SWEPT2D	
PRM_SWEPT3D	
PRM_COONS	
PRM_CURVE_5AX	
PRM_SRF_FIN_PENCIL	
PRM_SRF_FIN_LEFTOVER	
PRM_SRF_FIN_STEEP	
PRM_SRF_FIN_SHALLOW	
PRM_SRF_FIN_CONSCALOP	
PRM_SRF_RGH_PLUNGE	
PRM_SRF_FLOW5AX	
PRM_SRF_4AX	
PRM_SWARF_5AX	
PRM_LFINISH	
PRM_LROUGH	

PRM_LGROOVE	
PRM_LTHREAD	
PRM_LDRILL	
PRM_LATHE_FACE	
PRM_LCUTOFF	
PRM_WIRE_CONTOUR	
PRM_WCAN_CYCLE	
PRM_WIRE_NOCORE	
PRM_WIRE_POINT	
PRM_WIRE_4AXIS	
PRM_THDMILL	
PRM_TRIMMED	
PRM_SOLID_DRILL	
PRM_SLOTMILL	
PRM_HELIX_BORE	
PRM_SRF_RGH_RESTMILL	
PRM_NESTING	
PRM_SRF_FIN_BLEND (X)	
PRM_MSURF_5AX	(X)
PRM_SLICE_5AX (X)	(X)
PRM_PORT_5AX (X)	(X)
PRM_TAB_CUTOFF	**Deleted in X2**
PRM_SRF_HMM (X)	
PRM_2D_HMM	**(new for X3)**
FBM_DRILLPARAMETERS	**(new for X3)**
PRM_FBM_POCKET	**(new for X3)**
PRM_LCAN_FINISH	
PRM_LCAN_ROUGH	
PRM_LCAN_PATTERN	
PRM_LGROOVE	
PRM_LROUGH	
PRM_LFINISH	
PRM_LSTOCK_XFER	
PRM_LSTOCK_FLIP	
PRM_LBARFEED	
PRM_LCHUCK_CLAMP	
PRM_LTAILSTOCK	
PRM_LSTEADYREST	

PRM_PINCH_TURN	**(new for X3)**
PRM_CUSTOM_OP	
PRM_ADV_5AX	**(X2)**

OP_DB

15254	*Start of section `fpos` in binary file, -1 if not yet generated (removed in X3)*
15255	*End of section `fpos` in binary file, -1 if not yet generated (removed in X3)*
15083	Number of entities in this operation (for alloc)
15084	Number of boundaries in this operation (contour, pocket)
15085	High entity ID # (used to number boundaries)
15086	NCI marked for regeneration (dirty) (True/False)
15087	Selected for editing, deleting and reordering (True/False)
15088	Selection expanded in treeview (True/False)
15089	ASCII NCI has been generated and/or posted (True/False)
15090	Operation imported from library (True/False)
15330	Transform operation ID # that spawned this operation
15497	Aggregate head ID number assigned to this operation
15498	Tool position ID number assigned to this operation
15508	Which app last accessed this operation?: 0=none (the Mastercam .exe) 1=toolpath/contour 2=toolpath/pocket 3=toolpath/face 4=helix bore 5=slotmill 6=circle mill 10=surface machining appmch 20=mulitaxis curve5ax 21=multiaxis swarf5ax 22=multiaxis msurf5ax 23=multiaxis flow5ax 24=multiaxis rotary4ax 25=multiaxis drill5ax
15509	Which version of the app
15511	Block id# assigned to this operation
15504	Operation id# that spawned this one
15092	Number of entities to display in Operation Manager
15093	Display toolpath (True/False)
15094	ID # of operation this operation replaced
15095	Binary NCI of operation has been edited (True/False)
15096	System level
15256	*Don't ever post this operation (removed for X3)*

15097	Operation contains solids toolpath entities (True/False)
15325	Op ID # of trimming operation, **`null_id`** for not trimmed
15326	Number of times the operation has been edited
15571	NCI read: true = NCI section has been read in, false = go get it when needed (X) (Used to be 15340 prior to Mastercam X.)
15499	Geometry sub-tree expanded (True/False)
15500	Last tab page in toolpath parameters page (zero-based)
15580	*pointer to head of backplot (removed in X3)*
15581	*pointer to tail of backplot (removed in X3)*
15582	source of group's feed rate
15577	Draw regen? **(new for X3)**
15608	Operation is synched? **(new for X3)**

OP_COMMON

10042	Program number
10040	Starting sequence number
10041	Sequence number increment
10020	Clearance plane
10021	Clearance: true = incremental, false = absolute
15100	Clearance plane on (True/False)
15374	Retract plane
10023	Retract: true = incremental, false = absolute
15101	Retract plane on (True/False)
10024	Feed plane
10025	Feed plane: true = incremental, false = absolute
10029	Toolpath depth
15103	Depth: true = incremental, false = absolute
10026	Rapid up from bottom depth (True/False)
15105	Calculated cycle time for NCI section
15106	Use reference point(s) (True/False)
10080	Toolpath reference (retraction) point – X
10081	Toolpath reference (retraction) point – Y
10082	Toolpath reference (retraction) point – Z
15107	NCI output destination file name
10010	Amount of stock to leave
10027	Top of stock
10028	Top of stock: true = incremental, false = absolute
15108	Force a tool change in nci (True/False)
15109	Use only entities contained in tp_group group id #'s (True/False)
15110	Use tp_ents from other operations (True/False)
15111	Operation group ID #

10007	For common parameter dialog **`cmp_to_tip`** (True/False)
15112	To batch (op's NCI not immediately generated) (True/False)
12258	Use reference point(s) (True/False)
12259	Second reference point – X
12260	Second reference point – Y
12261	Second reference point – Z
15327	Abs/inc, XYZ enabled
15339	Use clearance plane at start/end (True/False)
15601	Use rotation tool center point **(X2)**

OP_COMMON001

10701	*Clearance plane (removed for X3)*
10702	*Clearance: true = incremental, false = absolute (removed for X3)*
10700	*Clearance plane on (True/False) (removed for X3)*
10704	*Retract plane (removed for X3)*
10705	*Retract: true = incremental, false = absolute (removed for X3)*
10703	*Retract plane on (True/False) (removed for X3)*
10706	*Feed plane (removed for X3)*
10707	*Feed plane: true = incremental, false = absolute (removed for X3)*
15102	*Depth in Z of toolpath (removed for X3)*
10708	*Rapid up from bottom depth (True/False) (removed for X3)*

OP_COMMON002

10105	*Feed plane (removed for X3)*
10104	*Feed plane: true = incremental, false = absolute (removed for X3)*
10107	*Depth in Z of toolpath (removed for X3)*
10106	*Depth: true = incremental, false = absolute (removed for X3)*

OP_COMMON003

15098	*Clearance plane (removed for X3)*
15099	*Clearance: true = incremental, false = absolute (removed for X3)*
10505	*Retract plane (removed for X3)*
10516	*Retract: true = incremental, false = absolute (removed for X3)*
10504	*Feed plane (removed for X3)*

10514	*Feed plane: true = incremental, false = absolute (removed for X3)*
10506	*Depth in Z of toolpath (removed for X3)*
10518	*Depth: true = incremental, false = absolute (removed for X3)*
15104	*Rapid up from bottom depth (True/False) (removed for X3)*
15257	*For common parameter dialog (removed for X3)*

OP_FILTER

15134	Arc filter on (True/False)
15135	*Create arcs: true = use arcs, false = lines (removed in X3)*
15136	Maximum tolerance error
15137	Minimum arc radius
15138	Maximum arc radius
15082	Amount of look ahead
15340	Create arcs in XY plane (True/False)
15341	Create arcs in XZ plane (True/False)
15342	Create arcs in YZ plane (True/False)
15343	One way (True/False)

OP_MISC

15182	True = on
15190	Misc ints 1-10
15191	Misc ints 1-10
15192	Misc ints 1-10
15193	Misc ints 1-10
15194	Misc ints 1-10
15195	Misc ints 1-10
15196	Misc ints 1-10
15197	Misc ints 1-10
15198	Misc ints 1-10
15199	Misc ints 1-10
15200	Misc reals 1-10
15201	Misc reals 1-10
15202	Misc reals 1-10
15203	Misc reals 1-10
15204	Misc reals 1-10
15205	Misc reals 1-10
15206	Misc reals 1-10

15207	Misc reals 1-10
15208	Misc reals 1-10
15209	Misc reals 1-10

OP_TOOL_DISPLAY

15235	Use tool display (True/False)
10085	Mode: true = step, false = run
10086	Delay in seconds
10087	Step mode: true = step, false = endpoints
10088	Amount of step increment
10089	Tool motion:True = animate, false = static

OP_ROTARY

15236	Rotary axis: true = on
15351	Rotation type: 1 = axis substitution, 2 = rotary axis positioning, 3 = 3-axis
15352	Rotary axis to rotate about: 1 = about X, 2= about Y, 3 = about Z
15258	Axis of rotation line (endpoint)
15259	Axis of rotation line (endpoint)
15260	Axis of rotation line (endpoint)
15261	Axis of rotation line (endpoint)
15262	Axis of rotation line (endpoint)
15263	Axis of rotation line (endpoint)
15558	Rotary diameter (was 10072) (X)
15371	Direction: CW or CCW
15372	Axis to substitute, relative to view: 1 = X, 2 = Y
15373	Angle point 0,0 rolls to
10073	Unroll enabled (True/False)
10074	Unroll tolerance

OP_COMMON_LATHE

13150	Use toolpath entry point (True/False)
13151	Toolpath start point
13152	Toolpath start point
13153	Toolpath start point
13154	Use toolpath retraction point (True/False)
13155	Update boundaries for current operation (True/False)
13156	Update boundaries for subsequent operations (True/False)
13157	Stock boundaries are valid for operation (True/False)
13158	Regenerate toolpath for tool collision (True/False)

13159	Entity ID for left stock boundary
13160	Entity ID for right stock boundary
13161	Entity ID for left chuck boundary
13162	Entity ID for right chuck boundary
13163	Entity ID for tailstock boundary
13173	Entry angle for remaining stock (in radians)
13174	Exit angle for remaining stock (in radians)
13175	Do remaining stock analysis for operation (True/False)
13196	Tool clearance: true = use clearance from operation, false = from job setup
13197	Boundary avoidance clearance for lathe tools
13198	Entry/exit vector clearance
13199	Keep uncut stock (True/False)
13204	Entity ID for steadyrest boundary

OP_AUX_FILE

15113	On (True/False)
15114	File name
15115	File date
15253	Aux file marked for regeneration (dirty) (True/False)

OP_CANNED_TEXT

15120	On (True/False)
15121	Canned text 0-99, 1000-1099, 2000-2099
15122	Canned text 0-99, 1000-1099, 2000-2099
15123	Canned text 0-99, 1000-1099, 2000-2099
15124	Canned text 0-99, 1000-1099, 2000-2099
15125	Canned text 0-99, 1000-1099, 2000-2099
15126	Canned text 0-99, 1000-1099, 2000-2099
15127	Canned text 0-99, 1000-1099, 2000-2099
15128	Canned text 0-99, 1000-1099, 2000-2099
15129	Canned text 0-99, 1000-1099, 2000-2099
15130	Canned text 0-99, 1000-1099, 2000-2099
15531	Additional canned text/events (X)
15532	Additional canned text/events (X)
15533	Additional canned text/events (X)
15534	Additional canned text/events (X)
15535	Additional canned text/events (X)
15536	Additional canned text/events (X)
15537	Additional canned text/events (X)
15538	Additional canned text/events (X)
15539	Additional canned text/events (X)
15540	Additional canned text/events (X)

OP_V8

15131	The 'from pt' used when translating – X
15132	The 'from pt' used when translating – Y
15133	The 'from pt' used when translating – Z
15602	*Tool change type (removed for X3)*
15603	Tool change approach event list **(X2)**
15604	Tool change approach event list **(X2)**
15609	Tool change state **(new for X3)**
15610	UID for tool change event list, approach **(new for X3)**
15634	UID for tool change event list, retract **(new for X3)**
15658	UID for tool change event list, null tool change **(new for X3)**
15682	Tool change event list, null tool change **(new for X3)**

OP_DEPTH_CUTS

15211	Depth cuts: true = on
10065	Max rough step size
10066	Number of finish cuts
10067	Z depth of finish cuts
10068	Stock to leave
15378	Output subprogram labels (True/False)
10069	Keep tool down (True/False)
10064	Use island depths (True/False)
15379	Depth cut order: true = by depth, false = by contour
15452	Subprogram output mode: true = incremental, false = absolute

OP_MULTI_CUTS

15214	Multi passes: true = on
15560	Number of roughing cuts (was 10106) (X)
15561	Depth of roughing cuts (was 10107) (X)
15380	Number of finish cuts
15381	Depth of finish cuts
15385	Keep tool down (True/False)

Tool settings

OP_TOOL_INFO

10002	Tool number
10090	Tool type ID number
10091	Radius type: None, corner or full
10005	Tool diameter
10006	Tool corner radius
15139	Threads per inch or thread pitch (mm)
10092	Tool tip angle
10003	Diameter offset number
10004	Length offset number
10030	Feed rate
10031	Plunge rate
15140	Retract rate
10034	Spindle speed
15141	Merged from ASCII NCI file (True/False)
10035	Spindle speed is CSS (True/False)
15345	Feed rate is actually a surface finish (True/False)
15375	Plunge feed rate is actually a surface finish (True/False)
10022	Coolant: 0 = off, 1 = flood, 2 = mist, 3 = tool (spindle)
15143	Number of flutes
10093	Tool material: HSS, CAR, etc.
10094	Tool description
15144	Mastercam tool reference geometry filename
LTOOL_REC	
15145	Values in metric (True/False)
15146	Station number for mill-turn
15147	Active turret (for mill-turn)
15148	Active spindle (for mill-turn)
15149	Internal tool ID #
10036	Maximum spindle speed (lathe)
15376	Custom tool display comes from: auto(0), file (1) or level (2)
15377	Tool reference level
15541	Which machine group it belongs to (X)
15542	0 = not a virtual turret, 1+ = virtual turret number, use with MATTS (X) **Deleted in (X2)**
15543	Component group to which tool belongs (X)

OP_TOOL_INFO002

13165	*Tool diameter (removed for X3)*
13166	*Tool corner radius (removed for X3)*
15139	*Threads per inch or thread pitch (mm) (removed for X3)*

10512	*Tool tip angle (removed for X3)*
13167	*Diameter offset number (removed for X3)*
15377	*Tool reference level (removed for X3)*

OP_TOOL_INFO003

14050	*Tool corner radius (removed for X3)*
14051	*Threads per inch or thread pitch (mm) (removed for X3)*
14052	*Tool tip angle (removed for X3)*
14053	*Plunge rate (removed for X3)*
14054	*Retract rate (removed for X3)*
14055	*Spindle speed (removed for X3)*
14056	*Spindle speed is CSS (True/False) (removed for X3)*
14124	*Feed rate is actually a surface finish (True/False) (removed for X3)*
14125	*Plunge rate is actually a surface finish (True/False) (removed for X3)*
14058	*Coolant: 0 = off, 1 = flood, 2 = mist, 3 = tool (spindle) (removed for X3)*
14059	*Number of flutes (removed for X3)*
14060	*Station number (for mill-turn) (removed for X3)*
14061	*Active turret (for mill-turn) (removed for X3)*
14062	*Active spindle (for mill-turn) (removed for X3)*
14063	*Internal tool ID # (removed for X3)*
14064	*Maximum spindle speed (lathe) (removed for X3)*

OP_CC

15346	Compensation type: 0 = computer 1 = control 2 = wear 3 = reverse wear 4 = off
15347	Compensation direction: 0 = left, 1 = right
10070	Roll around sharp corners
15563	Optimize: (applicable only when type = COMP_CONTROL) (True/False) (X) (was 10124 before X)

OP_CC001 (for Pocket paths)

10426	*Optimize: (applicable only when type = COMP_CONTROL) (True/False) (removed for X3)*

OP_CC002 (for Lathe and Wire operations)

15151	*Optimize: (applicable only when type = COMP_CONTROL) (True/False) (removed for X3)*

LTOOL_REC

13200	Tool orientation number
13201	Corner radius
13202	Width (tool clearance data)
15241	Height (tool clearance data)
15242	Angle (in radians)
15243	Rake angle (in radians)
15244	Tool center position
15245	Tool center position
15246	**`back_v`**
15247	**`back_v`**
15248	**`front_v`**
15249	**`front_v`**
15250	Back used (True/False)
15251	Front used (True/False
15552	Tool Angle
15553	Spindle orient angle

View information

OP_VIEW (Tplane)

15152	Tool plane is on
15153	Tool plane view number at time of creation
15154	Tool plane view matrix
15155	Tool plane view matrix
15156	Tool plane view matrix
15157	Tool plane view matrix
15158	Tool plane view matrix
15159	Tool plane view matrix
15160	Tool plane view matrix
15161	Tool plane view matrix
15162	Tool plane view matrix
15163	Tool plane origin (world coordinates)
15164	Tool plane origin (world coordinates)
15165	Tool plane origin (world coordinates)
15348	Named view ID #
15166	User defined work offset number

OP_VIEW002 (Cplane)

15167	Construction plane is on
15168	Construction plane view number at time of creation
15169	Construction plane view matrix
15170	Construction plane view matrix
15171	Construction plane view matrix
15172	Construction plane view matrix
15173	Construction plane view matrix
15174	Construction plane view matrix
15175	Construction plane view matrix
15176	Construction plane view matrix
15177	Construction plane view matrix
15178	Construction plane origin (world coordinates)
15179	Construction plane origin (world coordinates)
15180	Construction plane origin (world coordinates)
15349	Named view ID #
15181	User-defined work offset number

OP_VIEW003 (WCS view data)

15355	WCS is on
15356	WCS plane view number at time of creation
15357	WCS plane view matrix
15358	WCS plane view matrix

15359	WCS plane view matrix
15360	WCS plane view matrix
15361	WCS plane view matrix
15362	WCS plane view matrix
15363	WCS plane view matrix
15364	WCS plane view matrix
15365	WCS plane view matrix
15366	WCS plane origin (world coordinates)
15367	WCS plane origin (world coordinates)
15368	WCS plane origin (world coordinates)
15369	Named view ID #
15370	User-defined work offset number

Lead in/out, entry/exit

OP_LEAD_IO

15233	Lead in/out: true = on
OP_ENTRY_EXIT	
OP_ENTRY_EXIT001	
15562	Overlap amount (was 10117) (X)
15234	Enter at midpoint of first entity for closed contours (True/False)
15328	Check entry/exit motion for gouges (True/False)
15449	Output first move before plunge (True/False)
15450	Output last move after plunge (True/False)

OP_LEAD_IO001

10420	*Overlap amount (removed for X3)*

OP_ENTRY_EXIT

15219	Use entry / exit entities (True/False)
15386	Line: true = perpendicular, false = tangent (was 10102) (X)
15387	Length of entry/exit line (was 10103) (X)
15220	Line ramp height
15388	Radius of entry/exit arc (was 10104) (X)
15559	Sweep angle of entry arc (in radians) (was 10105) (X)
15221	Arc helix height
15382	Output entry/exit on only first/last depth cut (True/False)
15222	Use entry/exit point (True/False)
15223	Use entry/exit point depth (True/False)
15224	Length of entry/exit line as % of tool diameter
15225	Radius of entry/exit arc as % of tool diameter

OP_ENTRY_EXIT001

15565	*Line: true = perpendicular, false = tangent (was 10307) (X) (removed for X3)*
15566	*Length of entry/exit line (was 10310) (X) (removed for X3)*
15567	*Radius of entry/exit arc (was 10311) (X) (removed for X3)*
15568	*Sweep angle of entry arc (in radians) (was 10312) (X) (removed for X3)*
10419	*Output entry/exit on only first/last depth cut (True/False) (removed for X3)*
15226	Use entry exit entities (True/False)
15383	Line: true = perpendicular, false = tangent (was 10118) (X)
10119	Length of entry/exit line
15227	Line ramp height

10120	Radius of entry/exit arc
10121	Sweep angle of entry arc (in radians)
15228	Arc helix height
15389	Output entry/exit on only first/last depth cut (True/False)
15229	Use entry/exit point (True/False)
15230	Use entry/exit point depth (True/False)
15231	Length of entry/exit line as % of tool diameter
15232	Radius of entry/exit arc as % of tool diameter

OP_ENTRY_EXIT_PK001

10421	*Line: true = perpendicular, false = tangent (removed for X3)*
10422	*Length of entry/exit line (removed for X3)*
10423	*Radius of entry/exit arc (removed for X3)*
10424	*Sweep angle of entry arc (in radians) (removed for X3)*
10425	*Output entry/exit on only first/last depth cut (True/False) (removed for X3)*

OP_HOME_POS

15215	Home pos: true = on
15216	Tool home position X
15217	Tool home position Y
15218	Tool home position Z

OP_HOME_POS001

10008	*Tool home position X (was 10007) (X) (removed for X3)*
10009	*Tool home position Y (was 10008) (X) (removed for X3)*
13168	*Tool home position Z (removed for X3)*

Contour toolpaths

PRM_CONTOUR

PRM_CTOURPOCK	
10101	Infinite look-ahead is enabled (True/False) **(Pre-X)**
10071	Infinite look-ahead is enabled (True/False) (X)
10113	Maximum depth variance
PRM_REMACH_CTOUR	
PRM_CHAMFER_CTOUR	
12014	Contour type: 0 = 2D Contour 1 = 3D Contour 2 = 2D Chamfer 3 = 3D Chamfer 4 = Ramp 5 = Remaching
12015	Tapered wall contour enabled (True/False)
12016	Taper angle (in radians)
12017	Depth cut order: true = by depth, false = by contour
PRM_EXT_SHORT	Start extend/shorten
PRM_EXT_SHORT002	End extend/shorten
15485	Entry feed rate override
15486	Entry feed rate override is enabled (True/False)
15487	Exit feed rate override
15488	Exit feed rate override is enabled (True/False)
PRM_TP_COMMON	(X)
PRM_TAB	(X)
PRM_CHAIN_SORT	(X)
PRM_OSCILLATE_CTOUR	**(new for X3)**
12709	Position tabs automatically, based on distance between tabs **(new for X3)**
12710	Max distance between tabs (used in conjunction with 12709) **(new for X3)**
PRM_ROUT_COMMON	*(Pre-X)*
PRM_ROUT_TAB	*(Pre-X)*

PRM_REMACH_CTOUR

10431	Remaining stock mode: 0 = all previous operations, 1 = the previous operation, 2 = rough tool diameter
10432	Roughing tool diameter
12000	Clearance as a percentage of the tool diameter
10433	Clearance to unmachined stock

10434	Machine complete finish passes (True/False)
10410	Remachining tolerance percentage
10411	Remachining tolerance
12002	Display stock for remachining (True/False)

PRM_CTOURPOCK

12253	Linearization tolerance (used to be 10110) (X)
10314	Finish all (True/False) (used to be 10114) (X)
12004	Tip comp: true = tool tip, false = tool center

PRM_CTOURPOCK001
(this entire group removed for X3)

PRM_CHAMFER_CTOUR

12005	Chamfer width
12006	Chamfer tip offset
12007	Chamfer depth

PRM_RAMP_CTOUR

12008	Ramp contour option: 0 = angle, 1 = depth, 2 = plunge
12009	Ramp angle
12010	Ramp/plunge depth
12011	Ramp one way on open contours (True/False)
12012	Linearize ramp contour helixes (True/False)
12013	Ramp contour helix linearization tolerance
15507	True = output pass at final depth

PRM_EXT_SHORT

15489	Extend/shorten is enabled (True/False)
15490	Extend / shorten: true = extend, false = shorten
15491	Distance to extend / shorten
15492	Percentage of tool diameter

PRM_EXT_SHORT002

15493	Extend / shorten is enabled (True/False)
15494	Extend / shorten: true = extend, false = shorten
15495	Distance to extend / shorten
15496	Percentage of tool diameter

PRM_ROUT_COMMON
(This group was replaced by PRM_TP_COMMON for Mastercam X.)

PRM_TP_COMMON

16000	Breakthrough enabled (True/False)
16001	Breakthrough amount

PRM_ROUT_TAB

(This group was replaced by PRM_TAB for Mastercam X.)

PRM_TAB

16002	Tabs enabled (True/False)
16003	Automatically calculate tab positions (True/False)
16004	Number of tabs (for auto tab)
16005	Tab width
16006	Tab thickness
16007	Full thickness tab (True/False)
16008	Tab point: (0 = start, 1 = midpoint, 2 = end) of tab
16009	Tab entry/exit (0 = vertical, 1 = arc, 2 = ramp)
16010	Arc radius
16011	Percentage of tab thickness (arc radius)
16012	Ramp angle
16013	Use advanced auto tab positioning (True/False)
16014	Use feed plane for full height tabs (True/False)
16015	Use points on chain for start & tab positions (True/False)
16016	Minimum distance from endpoint
16017	Minimum distance between tabs
16018	Minimum distance from sharp corner
16019	Sharp corner angle
16020	X dimension of maximum size shape to tab
16021	Y dimension of maximum size shape to tab
16022	Tab all shapes
16053	Overwrite tab edit (True/False)
16054	Cutoff type (0 = none, 1 = after)
16055	Do tab cutoff pass on finish (True/False)

PRM_WIRE_WSORT

(This group was replaced by PRM_CHAIN_SORT for Mastercam X.)

PRM_CHAIN_SORT

14072	Sort method
14073	Sort start angle for rotary sort

PRM_OSCILLATE_CTOUR

12706	Oscillation strategy (linear or highspeed) **(new for X3)**
12707	Distance along contour **(new for X3)**
12708	Maximum depth **(new for X3)**

Drill toolpaths

PRM_DRILL

10100	Drill cycle
10108	First peck increment
10109	Subsequent peck increment
10110	Peck clearance
10111	Retraction distance for chip break
10112	Dwell
10118	Pre-defined bore shift
10117	Add this amount to total depth
10115	Adjust depth per drill tip (True/False)
12018	Drill point sorting method used
15071	Custom drill cycle parameters
15072	Custom drill cycle parameters
15073	Custom drill cycle parameters
15074	Custom drill cycle parameters
15075	Custom drill cycle parameters
15076	Custom drill cycle parameters
15077	Custom drill cycle parameters
15078	Custom drill cycle parameters
15079	Custom drill cycle parameters
15080	Custom drill cycle parameters
15081	Use custom parameters is checked (True/False)
12019	Drill5ax output format axis type selected: 0=3 axis, 1=4 axis, 2=5 axis
12020	Use points and lines or points
12021	Tool axis option
12022	Tip position control
12023	Project type (to plane or surface)
12024	5-axis tool display length
12025	Drill5ax output format 4-axis type axis selected (0 = X, 1 = Y, 2 = Z)
12254	Plane vector for drill5ax plane option
12255	Plane vector for drill5ax plane option
12256	Plane vector for drill5ax plane option
15212	Output 1018 NCI (sub program) line in drill cycle (True/False)
15213	Subprogram output mode: true = incremental, false = absolute
15277	Operation was created as a automatic start hole operation (True/False)
PRM_5AX_LIMIT	**(new for X3)**

Pocket toolpaths

PRM_POCKET

PRM_CTOURPOCK	**(new for X3)**
12045	Roughing enabled (True/False)
12046	Finishing enabled (True/False)
15564	Machining direction: true = climb mill, false = conventional (was 10401) (X)
10315	Create additional finish operation (True/False)
10208	Cutting method: 0 = zigzag, 1 = spiral inside out, 2 = spiral outside in (was 10300) (X)
10302	Roughing step size
10414	Roughing step size (percentage)
10301	Roughing angle
10416	Spiral inside to outside (True/False)
10427	Minimize tool burial (True/False) (was 10415) (X)
10304	Number of finish passes
10305	Finish pass step size
10417	Finish outer boundary (True/False)
15569	Optimize finish passes (True/False) (was 10321) (X)
10418	Keep tool down (True/False)
10313	Output finish passes with rough pass (True/False)
10410	Remachining tolerance (percentage)
10411	Remachining tolerance
10412	Display stock for remachining (True/False)
10413	Display stock for constant overlap spiral (True/False)
PRM_TAPER	
PRM_RGH_ENTRY	
PRM_POCK_FACING	
15570	Compensation for finish passes (was 10350) (X)
15524	True = display stepover (X)
PRM_REMACH_POCK	
PRM_OPEN_POCK	
12017	Depth cut order: true = by depth, false = by pocket
10450	Pocket type: 0 = standard, 1 = facing, 2 = island facing, 3 = remachining, 4 = open
PRM_PKT_HSOPTS	
15474	Number of finish spring cuts
15475	Feed rate override
15476	Spindle speed override

15477	Feed rate override enabled (True/False)
15478	Spindle speed override enabled (True/False)
PRM_THINWALL	
15479	Entry feed rate override
15480	Entry feed rate override enabled (True/False)
15481	Exit feed rate override
15482	Exit feed rate override enabled (True/False)
PRM_CHAIN_SORT	
PRM_TP_COMMON	

PRM_ROUT_POCK

	This parameter group replaced by PRM_POCKET.
16030	*Roughing enabled (True/False) (removed for X3)*
16031	*Finishing enabled (True/False) (removed for X3)*
16032	*Machining direction: true = climb mill, false = conventional (removed for X3)*
16033	*Create additional finish operation (True/False) (removed for X3)*
16034	*Cutting method: 0 = zigzag, 1 = spiral inside out, 2 = spiral outside in (removed for X3)*
16035	*Roughing step size (removed for X3)*
16036	*Roughing step size (percentage) (removed for X3)*
16037	*Roughing angle (removed for X3)*
16038	*Spiral inside to outside (True/False) (removed for X3)*
16039	*Minimize tool burial (True/False) (removed for X3)*
16040	*Number of finish passes (removed for X3)*
16041	*Finish pass step size (removed for X3)*
16042	*Finish outer boundary (True/False) (removed for X3)*
16043	*Optimize finish passes (True/False) (removed for X3)*
16044	*Keep tool down (True/False) (removed for X3)*
16045	*Output finish passes with rough pass (True/False) (removed for X3)*
16046	*Remachining tolerance percentage (removed for X3)*
16047	*Remachining tolerance (removed for X3)*
16048	*Display stock for remachining (True/False) (removed for X3) (removed for X3)*
16049	*Display stock for constant overlap spiral (True/False) (removed for X3)*
16050	*Compensation for finish passes (removed for X3)*
16028	*Depth cut order: true = by depth, false = by pocket (removed for X3)*
16051	*Pocket type: 0 = standard, 1 = facing, 2 = island facing, 3 = remachining, 4 = open (removed for X3)*

PRM_TAPER

12026	Tapered wall pocketing enabled (True/False)
12567	Tapered wall pocketing: Base taper angle (in radians) (was 10331) (X)
12568	Tapered wall pocketing: Island taper angle (in radians) (was 10332) (X)

PRM_RGH_ENTRY

12042	Rough entry on (True/False)
12569	Entry type: 0 = helix, 1 = ramp, 2 = entry point (was 10380) (X)
PRM_HELIX	
PRM_RAMP	

PRM_RAMP

12030	Minimum length
12031	Maximum length
12032	Z clearance (relative to top of stock / previous depth)
12033	Zig plunge angle
10390	Zag plunge angle
12034	XY clearance
10388	Ramp direction
10391	Calculate ramp direction automatically (True/False)
12035	Direction: true = CCW, false = CW
12036	Entry attemps fail: true = skip, false = plunge
12037	Save boundary (True/False)
10392	Additional slot width
12038	Use entry point (True/False)
12555	Use entry point depth (True/False) (was 10400) (X)
12039	Minimum length % (of tool dia.)
12040	Maximum length % (of tool dia.)
12041	Entry feed rate: true = feed rate, false = plunge rate

PRM_POCK_FACING

12560	Overlap percentage (was 10406) (X)
10407	Overlap amount
12562	Approach distance (was 10408) (X)
12563	Stock above islands (was 10409) (X)
12043	Exit distance

PRM_REMACH_POCK

10431	Mode: 0 = all previous operations, 1 = previous operation, 2 = rough tool diameter
10432	Roughing tool diameter
12000	Clearance as a percentage of the tool diameter
10433	Clearance to unmachined stock
12001	Apply entry/exit curves to the rough pass (True/False)
10434	Machine complete finish passes (True/False)

PRM_OPEN_POCK

10441	Overlap as a percentage of tool diameter
12413	Overlap distance on the open side
12044	Use a specialized open cutting method (True/False)

PRM_PKT_HSOPTS

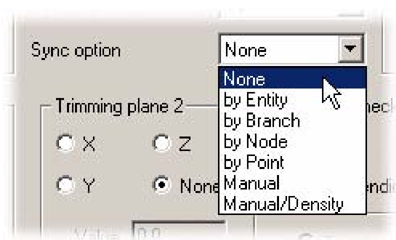
12419	Sharp corner smoothing length
12420	Channel mode: 0 = off, 1 = full material, 2 = everywhere (for deep Z cuts)
12309	Distance between channel loops (high speed)
12305	Channel radius (for high speed pocket)

PRM_THINWALL

15483	Thinwall on (True/False)
15484	Number of thinwall cuts
15503	Finish direction: true = climb cut, false = conventional cutting

Wireframe toolpaths

PRM_RULED

10208	Cutting method: 0 = zigzag, 1 = one way, 2 = circular, 3 = 5ax swarf
12212	5-axis swarf angle
12213	Constant Z cutting enabled (True/False)
12214	Constant Z cutting - initial
12215	Constant Z cutting - final
12216	Constant Z cutting - step
12217	Stepover amount (across cut distance)
12218	Trimming plane 1: 0 = X, 1 = Y, 2 = Z, 3 = none
12219	Trimming plane 1 coordinate
12220	Trimming plane 2 : 0 = X, 1 = Y, 2 = Z, 3 = none
12221	Trimming plane 2 coordinate
12222	Trimming plane control: true = trim the toolpath, false = trim the tool
12223	Gouge check: true = perp to machining angle, false = off
12004	Tip comp: true = tool tip, false = tool center
12224	Sync option setting: 0 = **None**, 1 = **by Entity**, … 6 = **Manual/Density** 
PRM_CHAIN_SORT	(X)

PRM_REVOLVED

12225	Axis: X, Y or L: L = toolpath point entity points to the axis
12226	Trim: N = nothing, H = height, W = width
12227	Shape: True = concave, false = convex
12228	Retract to reference plane (True/False)
12229	Retract amount (absolute)
12054	Stepover amount
12230	Center
12231	Axis Depth (abs)
12232	Height (under 'Trim toolpath to')
12233	Width – From (under 'Trim toolpath to')
12234	Width – To (under 'Trim toolpath to')

12235	Trim sign
12236	Trim sign
12004	True = comp to tool tip, false = tool center
12237	True = rapid between passes, false = feed (X)
PRM_CHAIN_SORT	

PRM_SWEPT2D

12239	Across cut distance
12241	Across: roll cutter around corners (0 = none, 1 = sharp, 2 = all)
12242	Across: cutter comp in computer (0 = right, 1 = left)
12243	Along: roll cutter around corners (0 = none, 1 = sharp, 2 = all)
12244	Along: cutter comp in computer (0 = right, 1 = left)
12004	Tip comp: true = tool tip, false = tool center
12224	Sync option setting: 0 = none, 1 = by entity, ... 6 = manual/density
12409	Infinite look ahead enabled (True/False)
PRM_CHAIN_SORT	

PRM_SWEPT3D

10208	Cut direction: 0 = zigzag, 1 = one way, 2 = circular, 3 = 5ax swarf
12238	Along cut distance
12239	Across cut distance
12004	Tip comp: true = tool tip, false = tool center
12224	Sync option setting: 0 = none, 1 = by entity, ... 6 = manual/density
12240	Direction: 0 = along, 1 = across
12245	Rotate/translate: 0 = rotate the across contour, 1 = translate
12246	Number of across contours: 1 or 2
PRM_CHAIN_SORT	

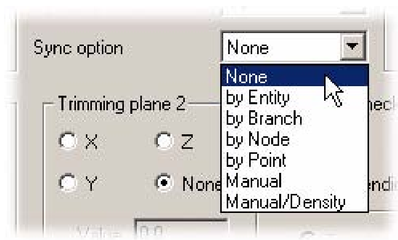
PRM_COONS

10208	Cut method: 0 = zigzag, 1 = one way, 2 = circular, 3 = 5ax swarf
12247	Blending: 0 = linear, 1 = parabolic, 2 = cubic, 3 = cubic with slope matching
12238	Along cut distance
12239	Across cut distance
12004	Tip comp: true = tool tip, false = tool center
12224	Sync option setting: 0 = none, 1 = by entity, ... 6 = manual/density

12240	Direction: 0 = along, 1 = across
12248	Number of patches in across direction
12249	Number of patches in along direction
PRM_CHAIN_SORT	(X)

PRM_LOFTED

10208	Cut method: 0 = zigzag, 1 = one way, 2 = circular, 3 = 5ax swarf
12238	Cutting direction: Along (True/False)
12239	Cutting direction: Across (True/False)
12004	Tip comp: true = tool tip, false = tool center
12224	Sync option setting: 0 = **None**, 1 = **by Entity**, … 6 = **Manual/Density**



12240	Direction: 0 = along, 1 = across (X)
PRM_CHAIN_SORT	

Circle toolpaths

PRM_CIRCMILL

PRM_TP_COMMON	(X)
12004	Comp to tip (True/False)
12107	Thread start angle
12206	Entry/exit arc sweep
10407	Overlap between entry and exit arcs
12207	Circle diameter (used when circles are defined by points)
12208	Start at center of circle (True/False)
12209	Enter along a line that is perpendicular to the entry arc (True/False)
12210	Enable roughing (True/False)
12055	Stepover as a percentage of the tool diameter
12054	Stepover
12211	Enable helical entry (True/False)
PRM_HELIX	
12265	Machine finish passes at: true = all depths, false = final depth

PRM_ROUT_CIRC
(This group deleted, replaced by PRM_CIRCMILL.)

PRM_HELIX

10389	Minimum radius
10381	Maximum radius
10386	Z clearance (relative to top of stock / previous depth)
10382	Plunge angle (in radians)
10385	XY clearance
10384	Direction: true = CCW, false = CW
10397	Entry attemps fail: true = skip, false = plunge
10394	Follow boundary (True/False)
10395	Follow boundary on failure only (True/False)
10396	Minimum boundary length (for follow boundary)
10398	Save boundary (True/False)
10393	Output arc move(s) (True/False)
10383	Maximum error tolerance
10399	Use entry point (True/False)
12027	Minimum radius %
12028	Maximum radius %
12029	Entry feed rate: true = feed rate, false = plunge rate

PRM_THDMILL

12188	Number of active teeth
12189	Clearance plane depth
12190	Feed plane
12191	Top of thread
12192	Thread depth
12193	Values: 0 = absolute, 1 = incremental
12194	Thread pitch
12107	Thread start angle
12195	Overcut
12196	Entry/exit arc clearance
12197	Entry/exit line length
12198	Helical entry/exit at top of thread (True/False)
12199	Helical entry/exit at bottom of thread (True/False)
12200	Linearize helixes (True/False)
12201	Helix linearization tolerance
12202	Thread type: 0 = ID, 1 = OD
12203	Thread diameter
12204	Thread type: 0 = right hand, 1 = left hand
12571	Start at center (True/False) (was 12290) (X)
12205	Machining direction: 0 = top to bottom, 1 = bottom to top
12572	Perpendicular entry (True/False) (was 12291) (X)
12385	Taper angle (to centerline)
12657	Number of spring passes **(new for X3)**
12658	Feed rate to use when overriding programmed feed rate **(new for X3)**
12659	Spindle speed to use when overriding programmed spindle speed **(new for X3)**
12660	Override programmed feed rate? (Yes/No) **(new for X3)**
12661	Override programmed spindle speed? (Yes/No) **(new for X3)**

PRM_SLOTMILL

PRM_CTOURPOCK	
12004	Comp to tip (True/False)
12107	Start angle
12206	Entry/exit sweep
10407	Overlap between entry and exit arcs
12207	Circle diameter (used when circles are defined by points)
12208	Start at center of circle (True/False)
12209	Enter along a line that is perpendicular to the entry arc

12386	Enable ramp entry (True/False)
12387	Ramp stepover as a percentage of the tool diameter
12388	Ramp stepover
12389	Ramp plunge angle
12390	Output helixes as arcs (True/False)
12391	Helix linearization tolerance
12392	Number of finish passes
12393	Finish pass stepover
12394	Number of rough passes
12395	Rough pass stepover
12396	Machine finish passes at: true = all depths, false = final depth
12397	Keep tool down (True/False)
PRM_CHAIN_SORT	(X)
PRM_TP_COMMON	**(new for X3)**

PRM_HELIX_BORE

12107	Start angle
12206	Entry/exit sweep
10407	Overlap
12207	Circle diameter
12208	Start at center of circle (True/False)
12209	Enter along a line
13298	Z step per revolution for roughing
12399	Number of roughing passes
12400	Roughing stepover
12401	Feed rate at final depth as a percentage
12402	Feed rate at final depth
12403	Output a finish pass (True/False)
12404	Z step per revolution for finishing
12393	Finish stepover
12405	Finish pass spindle speed as a percentage
12406	Finish pass spindle speed
12407	Finish pass feed rate as a percentage
12408	Finish pass feed rate
10393	Output arc move(s) (True/False)
12391	Helix linearization tolerance

Solid drill / autodrill toolpaths

PRM_SOLID_DRILL

AUTODRILLPRM	
SDETECT_DRILL_PARAMS	
15319	Delete dependants
15320	Basic
15321	Solid operation ID
15322	*Solid pointer (removed for X3)*
15323	Redetect on regen (True/False)
15324	Stock clearance
15502	Create points (True/False)
15513	Use custom drill parameters (True/False)
15514	Custom drill cycle
15515	Custom drill cycle
15516	Custom drill cycle
15517	Custom drill cycle
15518	Custom drill cycle
15519	Custom drill cycle
15520	Custom drill cycle
15521	Custom drill cycle
15522	Custom drill cycle
15223	Custom drill cycle

AUTODRILLPRM

	Note: These parameters do NOT get to the Post, since AutoDrill generates individual drilling toolpath operations.
15278	Tool type: 0=Drill, 1=Tap RH Coarse, 2=Tap RH Fine, 3=Tap LH Coarse, 4=Tap LH Fine, 5=Reamer, 6=Boring Bar, 7=Endmill
15279	Use filter arc (True/False)
15280	No warnings (True/False)
15281	Spot drill (True/False)
15282	Spot maximum depth
15283	Spot diameter
15284	Chamfer type: 0 = none, 1 = add depth to spot cycle, 2 = make new op
15285	Chamfer size
15286	Destination operation group id #
15287	Depth from top of arc (True/False)
15288	Tool library name
15289	Pre drill (True/False)
15290	Minimum pre-drill diameter
15291	Pre-drill diameter increment
15292	Pre drill stock

15293	Pre drill tip comp (True/False)
15294	Pre drill break thru
15295	Pre drill stock flag (True/False)
15296	PRM filename
15297	Tool match tolerance
15298	Tip comp (True/False)
15299	Break thru
15300	5-axis (True/False)
15301	View RB
15302	Group added (True/False)
15303	Use arc views (True/False)
15304	Use default diameter (True/False)
15305	Default diameter
15306	Sel

SDETECT_DRILL_PARAMS

15307	Minimum hole radius
15308	Maximum hole radius
15309	Include blind holes (True/False)
15310	Create arcs using this offset
15311	New geometry color
15312	Limit search to given plane (True/False)
15313	Plane to limit search to if limit by plane = True
15314	Include split cylinders (True/False)
15315	Limit by sweep code
15316	Limit sweep angle 0.0 - 360.0 degrees
15317	Limit sweep step size - controls # of sections tested along

Facing toolpaths

PRM_FACING

12051	Cutting method: 0 = zigzag, 1 = one way (climb), 2 = one way (conventional), 3 = one pass
12052	Move between cuts: 0 = high speed loops, 1 = linear, 2 = rapid
12053	Linearization tolerance
12054	Stepover distance
12055	Stepover distance as % of tool diameter
12056	Along overlap distance
12057	Along overlap as % of tool diameter
12058	Across overlap distance
12059	Across overlap as % of tool diameter
12060	Approach distance
12061	Approach distance as % of tool diameter
12062	Exit distance
12063	Exit distance as % of tool diameter
12064	Determine roughing angle automatically (True/False)
12065	Roughing angle
12066	Change feed rate between cuts (True/False)
12067	Feed rate between cuts
12068	Amount of stock to leave in Z
PRM_CHAIN_SORT	
12711	Select cutting method **(new for X3)**
12712	Turn on last pass option: **Reverse direction of last pass** / **Even number of passes** **(new for X3)**

Transform operations

PRM_XFORM

15557	Xform type: 8 = mirror, 13 = rotate, 16 = translate (was 10050) (X)
15069	Start of operation range to transform
15070	End of operation range to transform
15331	Don’t delete transform source operation if **make_ops** = True (True/False)
15332	Work offset numbering: 0 = auto increment, 1 = maintain source operations, 2 = assign
15333	Start number work offsets with this number
15334	Increment work offsets by this number
15335	First match work offset in named views and ops (True/False)
15275	Force unique subprogram number for ‘clump’ option (True/False)
15276	Don’t post the source operations (True/False)
15264	Don't skip original instance (True/False)
15000	NCI Grouping: true = group ops, false = seperate ops
15001	Subprogram output mode: true = incremental, false = absolute
15002	Look for pre-defined work offset #’s when xforming the Tplane (True/False)
15003	Transform options: true = transform geometry and make new ops false = transform toolpath only
15004	Translate NCI coordinates - leave tool plane intact (True/False)
15005	Output subprogram labels (True/False)
15006	Shift tool origin in NCI 1013 data (True/False)
PRM_XFORM_MIRROR	
PRM_XFORM_ROTATE	
PRM_XFORM_TRANSLATE	

PRM_XFORM_MIRROR

15020	Relative to operation. Cplane - **tp_mirror_x**, **tp_mirror_l**
15021	Coordinates translated to vw2 (True/False)
15051	Mirror axis — endpoint 1, in world coordinates
15052	Mirror axis endpoint— endpoint 1, in world coordinates
15053	Mirror axis endpoint— endpoint 1, in world coordinates
15054	Mirror axis endpoint— endpoint 2, in world coordinates

15055	Mirror axis endpoint— endpoint 2, in world coordinates
15056	Mirror axis endpoint— endpoint 2, in world coordinates
PRM_XFORM_VIEW	
15057	Reverse cutter compensation (True/False)
15058	Reverse toolpath (True/False)
15059	Method generated (endpoint, midpoint, etc.)
15060	Method generated (endpoint, midpoint, etc.)
15061	T values
15062	T values
15063	T values
15064	T values
15065	Selected entities ID numbers
15066	Selected entities ID numbers
15067	*Selected entities database pointers (removed for X3)*
15068	*Selected entities database pointers (removed for X3)*

PRM_XFORM_ROTATE

15020	Rotation point: 1 = C view origin, 2 = point
15021	Coordinates translated to view 2 (True/False)
15042	Number of steps
15043	Rotation point in world coordinates (X)
15044	Rotation point in world coordinates (Y)
15045	Rotation point in world coordinates (Z)
15046	Rotation angle (in degrees)
PRM_XFORM_VIEW	
15047	Method generated: endpoint, midpoint, etc.
15048	T values
15049	T values
15050	Selected entities ID number
15067	*Selected entities database pointers (removed for X3)*
15273	Start angle (in degrees)

PRM_XFORM_TRANSLATE

15020	Translation direction: 17 = rect, 18 = polar, 19 = between pts, 20 = between views
15021	Coordinates translated to view 2 (True/False)
15022	Number of steps in X
15023	Number of steps in Y
15024	Translate distance in X
15025	Translate distance in Y
15026	Point type: 1 = vector, 3 = from pt, 4 = to pt
15027	Point type: 1 = vector, 3 = from pt, 4 = to pt
15028	Point type: 1 = vector, 3 = from pt, 4 = to pt
15029	Point type: 1 = vector, 3 = from pt, 4 = to pt

15030	Point type: 1 = vector, 3 = from pt, 4 = to pt
15031	Translate direction: 1 = vector, 3 = from pt, 4 = to pt
15032	Polar distance (if polar method used)
15033	Polar angle in degrees (if polar method used)
15274	Zigzag toolpath array (True/False)
15390	Use source view (True/False)
PRM_XFORM_VIEW	Source view data
PRM_XFORM_VIEW002	Destination view data
15034	Method generated: endpoint, midpoint, etc.
15035	Method generated: endpoint, midpoint, etc.
15036	T values
15037	T values
15038	T values
15039	T values
15040	Selected entities ID number
15041	Selected entities ID number
15067	*Selected entities database pointers (removed for X3)*
15068	*Selected entities database pointers (removed for X3)*

PRM_XFORM_VIEW

15007	View matrix
15008	View matrix
15009	View matrix
15010	View matrix
15011	View matrix
15012	View matrix
15013	View matrix
15014	View matrix
15015	View matrix
15016	View origin
15017	View origin
15018	View origin
15019	View number at time of creation

PRM_XFORM_VIEW002

15391	View matrix
15392	View matrix
15393	View matrix
15394	View matrix
15395	View matrix
15396	View matrix
15397	View matrix
15398	View matrix
15399	View matrix

15400	View origin
15401	View origin
15402	View origin
15403	View number at time of creation

Trimmed toolpaths

PRM_TRIMMED

12288	X - which side to keep
12289	Y - which side to keep
12290	Z - which side to keep
12291	Tool up/down: 0 = keep tool up, 1 = keep tool down
PRM_CHAIN_SORT	(X)

Nesting

PRM_NESTING

15404	Version
15405	Resolution
15406	ResCBox
15407	ResUser
15408	SheetToSheetDist
15409	SheetToPartDist
15410	PartToPartDist
15411	IfFitPartInPart
15412	*IfFillAllSheets (removed for X3)*
15413	*IfAutoPairs (removed for X3)*
15414	IfNestFillersToNestHeight
15415	IfPreferHoleFilling
15416	IfDeleteChains
15417	IfCreateGroups
15418	IfUseMainColor
15419	IfUseMainLevel
15420	IfCycleColors
15421	IfCycleLevels
15422	ResultColor
15423	ResultLevel
15424	IfRestoreLast
15425	IfSaveScrap
15426	IfAddPartsAsGroup
15427	IfIgnoreHoles
15428	IfInnerHoles
15429	StartingCorner
15430	IfAddLabels
15431	ScanForNotes
15432	DrawUsingColors
15433	LabelHeight
15434	IfAutoOrigins
15435	ScrapName
15436	xfmMethod: 0 = Toolplane, 1 = Coordinate
15437	xfmGroupOutputBy: 0 = operation order, 1 = operation type
15438	xfmWoff: 0 = off, 1 = maintain source operation's #'s, 2 = assign new
15439	XfmWoffStart
15440	XfmWoffInc
15441	xfmWoffMatchExisting (True/False)
15442	xfmWoffCreateNewOps (True/False)

15443	xfmWoffKeepExistingOp (True/False)
15444	xfmCopySourceOps (True/False)
15445	xfmDisablePosting (True/False)
15446	xfmSubPgmOn (True/False)
15447	xfmSubPgmAbs (True/False)
15448	xfmSubPgmUnique (True/False)
15453	ParentOpId
15454	SeparateOpPerSheet (True/False)
15455	WorkOffsetPerSheet (True/False)
15456	WoffStart
15457	WoffInc
15458	sortMode: 0=none, 1=next closest, 2=max vacuum, 3=manual
15459	sortGroupByTool (True/False)
15460	sortGroupByRegion (True/False)
15461	SortRegionOrder
15462	SortRegionX
15463	SortRegionY
15464	SortRegionOverlap
15465	sortStartPt – X
15466	sortStartPt – Y
15467	sortStartPt – X
15468	sortZigZag (True/False)
15469	sortMinToolChg (True/False)
15470	sortGroupBySheet (True/False)
15501	force_re-nest (True/False)
15512	Stop between sheets: 0=no, 1=stop (M00), 2=optional stop (M01)
15547	Sheet fill direction
15548	Attach auto chains
15549	Display group page
15550	Load default sheet
15551	Guillotine cut
15572	Exact nesting mode (0,1,2) **(new for X3)**
15573	*(Reserved for future use)* **(new for X3)**
15574	Each part stored on a different "unused" level **(new for X3)**
15575	Sort order of chains in source operations for max vac within clusters **(new for X3)**
15576	Sort order of source operations for max vac within clusters **(new for X3)**
15578	True if **Automatically attach geometry** option is selected.
15579	Skip Results dialog after nesting complete.
15592	Onion skin active (y/n) **(new for X3)**

15593	For **Skin all parts less than...** option, dimension 1 **(new for X3)**
15594	For **Skin all parts less than...** option, dimension 2 **(new for X3)**
15595	Ignore tabbed parts? (y/n) **(new for X3)**
15596	Onion skin method: 0=All parts, 1=minimum size **(new for X3)**
15597	Sort chains—cut smallest parts first **(new for X3)**
15598	Amount of stock to leave on Z axis **(new for X3)**
15599	Tool diameter used during skinning **(new for X3)**
15600	Determine minimum part size by this width along X or Y axis **(new for X3)**
15605	Corner of sheet to use as the tool origin **(new for X3)**
15606	Common edge **(new for X3)**
15607	Create separate block drill operations **(new for X3)**

Surface rough toolpaths

PRM_SRF_RGH_PARALLEL

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_DIRECTION	
PRM_SRF_DEPTHS	
PRM_SRF_ROUGH_SETTINGS	
10205	Maximum stepover
10200	Machining angle
10208	Cut method: 0 = zigzag, 1 = one way
10223	Prompt for relative start point (True/False)
12104	Plunge distance
12105	Retract distance
12428	Tangent line length (gap setting)

PRM_SRF_RGH_RADIAL

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_DIRECTION	
PRM_SRF_DEPTHS	
PRM_SRF_ROUGH_SETTINGS	
12103	Maximum angle increment
10208	Cutting method: 0 = zigzag, 1 = one way
12106	Start inside (True/False)
12107	Start angle
12108	Sweep angle
12109	Offset distance
12104	Plunge distance
12105	Retract distance
12428	Tangent line length (gap setting)

PRM_SRF_RGH_PROJECT

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_DIRECTION	
PRM_SRF_DEPTHS	
PRM_SRF_ROUGH_SETTINGS	
12110	Projection type: 0 = NCI, 1 = curves, 2 = points, 3 = blend
12111	NCI filename
12112	Add depths (True/False)

12104	Plunge distance
12105	Retract distance
12113	Oper ID # of NCI to project
12302	Blend stepover
10208	Cutting method: 0 = zigzag, 1 = one way
12573	Cutting method: 0 = across, 1 = along (was 12310) (X)
12428	Tangent line length (gap setting)
15510	Force a retract move between cuts **(new for X3)**

PRM_SRF_RGH_FLOWLINE

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_DIRECTION	
PRM_SRF_DEPTHS	
PRM_SRF_ROUGH_SETTINGS	
10208	Cut method: 0 = zigzag, 1 = one-way, 2 = spiral
12115	Use along distance (True/False)
12116	Along cut: distance
12117	Use across distance (True/False)
12118	Across cut: distance
12119	Across cut: scallop height
12120	Check flowline motion for gouge (True/False)
12104	Plunge distance
12105	Retract distance
12121	Start point (which corner)
12122	Cut direction (U or V)
12264	Shared edge tolerance: 0.0 = off
12421	True = row only (v8 code), false = grid (v9)
12428	Tangent line length (gap setting)
12682	Number of flow blend passes **(X2)**
12683	Flow blend enabled (True/False) **(X2)**
12684	Percent of tool diameter for rib resolution **(X2)**

PRM_SRF_RGH_CONTOUR

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_DIRECTION	
PRM_SRF_DEPTHS	
10223	Prompt for relative start point (True/False)
10208	Direction of open boundaries: 0 = zigzag, 1 = one way
10415	Direction of closed boundaries: True = climb
12554	Use rest mill (True/False) (was 10123) (X)
12124	Rest stepover

12125	Rest overlap
12126	Order cuts bottom to top (True/False)
12104	Plunge distance
12105	Retract distance
12127	Sharp corner smoothing length
12128	How shallow is to be used in contour: 0 = shallow is off, remove cuts, allow partial 1 = shallow is off, remove cuts, disallow partial 2 = shallow is off, add cuts, allow partial 3 = shallow is off, add cuts, disallow partial 10 = shallow is on, remove cuts, allow partial 11 = shallow is on, remove cuts, disallow partial 12 = shallow is on, add cuts, allow partial 13 = shallow is on, add cuts, disallow partial
12129	Minimum stepdown to add cuts to shallow area
12130	Angle to determine shallow area
12131	Smooth stepover length
12132	Rampdown length
12133	Use tangent z arc (True/False)
12134	Restmill cut Z extension length
12135	Offset consecutive closed contours by this
12114	Previous operation ID
12283	Bit 0: 0 = use prev op's recut file, 1 = use prev op’s NCI file
12300	Adjust absolute cut depths for drive stock
12301	Allow tangent entry/exit arc outside tool center boundary
12310	Helix: true = use helix, false = straight
12311	Helix radius
12312	Helix Z clearance
12313	Helix Z angle
12314	Output arc moves: true = output arcs, false = lines
12315	Helix tolerance
12316	Helix direction: true = CCW, false = CW
12317	Helix feed: true = feed rate, false = plunge rate
12318	Top of stock is on (True/False)
12428	Tangent line length (gap setting)
15471	Allow burial: true = allow in cut order, false = minimize it
15505	Flat use: 0-flat_use is off (2d), 1-flat_use is off (3d), 2-flat_use is on (2d), 3-flat_use is on (3d)
15506	Stepover for flat step
12431	True=use tool percentage
12432	Percentage of tool used in stepover
12433	True=automatically detect flats
12434	Do spiral
12435	Max XY deviation

PRM_SRF_RGH_POCKET

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_DIRECTION	
PRM_SRF_DEPTHS	
PRM_SRF_HSOPTS	
10223	Prompt for relative start point (True/False)
10442	Plunge tool outside tool center boundary (True/False)
12126	Order cuts bottom to top (True/False)
12104	Plunge distance
12105	Retract distance
12136	use quick zigzag (in place of toolpath/zigzag) (True/False)
12131	Smooth stepover length
12133	Use tangent Z arc (True/False)
12257	Top of stock is on (True/False)
12300	Adjust absolute cut depths for drive stock (True/False)
12308	Channel everywhere (for deep Z cuts) (True/False)
12418	Pre-drill and enter at deepest point(s) (True/False)
12428	Tangent line length (gap setting)
12436	Keep full increment
12433	Automatically detect flats (True/False)
PRM_POCKET	**(new for X3)**

PRM_SRF_RGH_PLUNGE

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_DEPTHS	
10205	Maximum stepover
12104	Plunge distance
12105	Retract distance
12113	Operation ID # of NCI to project
12310	Helix: true = use helix, 1 = straight
12311	Helix radius
12312	Helix Z clearance
12313	Helix Z angle
12314	Output arc moves: true = output arcs, false = lines
12315	Helix tolerance
12316	Helix direction: true = CCW, false = CW
12317	Helix feed: true = feed rate, false = plunge rate

12319	Path type: 0 = 2 point grid, 1 = NCI
12318	Top of stock is on (True/False)
12428	Tangent line length (gap seting)
12685	True = use V8–style stepping; False = use V9 and later style **(X2)**

PRM_SRF_RGH_RESTMILL

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_DEPTHS	
10223	Prompt for operation's start point (True/False)
10208	Direction of open boundaries (0 = zigzag, 1 = one-way)
10415	Direction of closed boudaries (True = climb)
12123	Use rest mill (True/False)
12124	Stepover
12125	Overlap
12126	Order cuts bottom to top: true = bottom to top, false = top to bottom
12104	Plunge distance
12105	Retract distance
12127	Sharp corner smoothing length
12128	How shallow is to be used: 0 = shallow is off, remove cuts, allow partial 1 = shallow is off, remove cuts, disallow partial 2 = shallow is off, add cuts, allow partial 3 = shallow is off, add cuts, disallow partial 10 = shallow is on, remove cuts, allow partial 11 = shallow is on, remove cuts, disallow partial 12 = shallow is on, add cuts, allow partial 13 = shallow is on, add cuts, disallow partial
12129	Minimum stepdown to add cuts to shallow area
12130	Angle to determine shallow
12131	Smooth stepover length
12132	Rampdown length
12133	Use tangent z arc (True/False)
12134	Restmill cut extension length
12135	Offset consecutive closed contours by this
12114	Previous operation ID #
12283	Rest code: bit 0: 0 = use previous operation's recut file, 1 = use previous operation's NCI file bit 1: 0 = use ONE prev operation, 1 = use ALL prev operations bit 2: 0 = use previous operation, 1 = use rough tool
12300	Adjust absolute cut depths for drive stock (True/False)

12301	Allow tangent entry/exit arc outside the tool containment boudary (True/False)
12415	*Rough diameter (removed for X3)*
12565	*Rough corner radius (was 10302) (X) (removed for X3)*
12310	Helix: true = helix, false = straight
12311	Helix radius
12312	Helix Z clearance
12313	Helix Z angle
12314	Output arc moves: true = output arc, false = lines
12315	Helix tolerance
12316	Direction: true = CCW, false = CW
12317	Entry feed rate: true = feed rate, false = Plunge rate
12318	Top of stock is on (True/False)
12425	Use rest overlap, (True/False)
12426	Remaining stock resolution
12428	Tangent line length (gap setting)
15471	Gouge check: true = allow burial in curt order, false = minimize it
12431	Use tool percentage (True/False)
12432	Percentage of tool diameter for stepover
12433	Automatically detect flat (True/False)

Surface finish toolpaths

PRM_SRF_FIN_PARALLEL

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_LIMITS	
10205	Maximum stepover
10200	Machining angle
10208	Cut method: 0 = zigzag, 1 = one way
10223	Prompt for relative start point (True/False)
12104	Plunge distance
12105	Retract distance
12428	Tangent line length (gap setting)

PRM_SRF_FIN_RADIAL

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_LIMITS	
12103	Maximum angle increment
10208	Cut method: 0 = zigzag, 1 = one way
12106	Start inside (True/False)
12107	Start angle
12108	Sweep angle
12109	Offset distance
12104	Plunge distance
12105	Retract distance
12428	Tangent line length (gap setting)

PRM_SRF_FIN_PROJECT

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_LIMITS	
12110	Projection type: 0 = NCI, 1 = curves, 2 = points, 3 = two curve blend
12111	NCI filename
12112	Add depths (True/False)
12104	Plunge distance
12105	Retract distance

12113	NCI to project
12428	Tangent line length (gap setting)
15510	Force retract (True/False) (X)

PRM_SRF_FIN_FLOWLINE

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_LIMITS	
10208	Cut_method: 0 = zigzag, 1 = one way, 2 = spiral
12115	Use along distance (True/False)
12116	Along cut: distance
12117	Use across distance (True/False)
12118	Across cut: distance
12119	Across cut: scallop height
12120	Check flowline motion for gouge (True/False)
12104	Plunge distance
12105	Retract distance
12121	Start point (which corner)
12122	Cut direction (U or V)
12264	Shared edge tolerance: 0.0 = off
12421	True = row only (v8 code), false = grid (v9)
12428	Tangent line length (gap setting)
12686	Number of flow blend passes **(X2)**
12687	Flow blend enabled (True/False) **(X2)**
12688	Percent of tool diameter for rib resolution **(X2)**

PRM_SRF_FIN_CONTOUR

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_DEPTHS	
10223	Prompt for relative start point (True/False)
10208	Direction of open boundaries: 0 = zigzag, 1 = one way
10415	Direction of closed boundaries: True = climb
12123	Use rest mill (True/False)
12124	Rest stepover
12125	Rest overlap
12126	Order cuts bottom to top (True/False)
12104	Plunge distance
12105	Retract distance
12127	Sharp corner smoothing length

12128	How shallow is to be used in contour: 0 = shallow is off, remove cuts, allow partial 1 = shallow is off, remove cuts, disallow partial 2 = shallow is off, add cuts, allow partial 3 = shallow is off, add cuts, disallow partial 10 = shallow is on, remove cuts, allow partial 11 = shallow is on, remove cuts, disallow partial 12 = shallow is on, add cuts, allow partial 13 = shallow is on, add cuts, disallow partial
12129	Minimum stepdown to add cuts to shallow area:
12130	Angle to determine shallow area
12131	Smooth stepover length
12132	Rampdown length
12133	Use tangent Z arc (True/False)
12134	Restmill cut extension length
12135	Offset consecutive closed contours by this value
12114	Previous operation ID #
12283	Bit 0: 0 = use prev op's recut file, 1 = use prev opís NCI file
12300	Adjust absolute cut depths for drive stock (True/False)
12301	Allow tangent entry/exit arc outside tool containment boundary (True/False)
12310	Helix: true = use helix, false = straight
12311	Helix radius
12312	Helix Z clearance
12313	Helix Z angle
12314	Output arc moves: true = output arcs, false = lines
12315	Helix tolerance
12316	Helix direction: true = CCW, false = CW
12317	Helix feed: true = feed rate, false = plunge rate
12318	Top of stock is on (True/False)
12428	Tangent line length (gap setting)
15471	Allow burial: true = allow burial in opt cut order, false = minimize it
15505	Flat use: 0-flat_use is off (2d), 1-flat_use is off (3d), 2-flat_use is on (2d), 3-flat_use is on (3d)
15506	Stepover for flat step
12431	True=use tool percentage
12432	Percentage of tool used in stepover
12433	True=automatically detect flats
12434	Do spiral
12435	Max XY deviation

PRM_SRF_FIN_PENCIL

PRM_SRF_COMMON
PRM_SRF_DIRECTION

PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_LIMITS	
10415	Machining direction: true = climb, false = conventional cut
10223	Prompt for relative start point (True/False)
12104	Plunge distance
12105	Retract distance
10200	Machining angle (bias angle)
12263	Ignore climb(/conventional) flag (True/False)
12424	Number of total passes
12449	Multipass (True/False)
10208	Cutting method: 0=zigzag, 1=oneway
12054	Stepover for offset passes
12428	Tangent line length (gap setting)
12438	Pencil angle
12574	Overthickness **(new for X3)**

PRM_SRF_FIN_LEFTOVER

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_LIMITS	
10205	Maximum stepover
10200	Machining angle
10208	Cut method: 0 = zigzag, 1 = one way, 2 = 3D collapse
10223	Prompt for relative start point (True/False)
12564	Roughing tool diameter (was 10301) (X)
12565	Roughing tool corner radius (was 10302) (X)
12566	Cut extension (was 10303) (X)
10415	Machining direction: true = climb, false = conventional cut
10325	Expand cuts from the inside to the outside (True/False)
10324	Create outermost 3D collapse pass (True/False)
10326	Resolution: percentage of stepover
12104	Plunge distance
12105	Retract distance
12292	Hybrid: true = perpendicular to pencil, false = at machining angle
12298	From slope angle
12299	To slope angle
12303	Collapse resolution: true = automatically calculate resolution percentage, false = use resolution percentage

12304	Skip smoothing of outer boundary (True/False)
12320	Blend Cuts: true = blend Z cuts with XY, false = XY only
12321	Blend extension
12322	Blend angle
12323	Rough tool cut tolerance
12422	Tolerance: true = use rough tolerance, false = set rough tolerance equal to cut tolerance
12423	Rough pencil map: true = skip, false = use it
12428	Tangent line length (gap setting)
12430	Skip internal lines in 3D collapse: (True/False)

PRM_SRF_FIN_STEEP

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_LIMITS	
10205	Maximum stepover
10200	Machining angle
10208	Cut method: 0 = zigzag, 1 = one way
10223	Prompt for relative start point (True/False)
10310	Angle of surface normal (start of range)
10311	Angle of surface normal (end of range)
10312	Cut extension
12104	Plunge distance
12105	Retract distance
12307	Include cuts outside from/to range (True/False)
12428	Tangent line length (gap setting)

PRM_SRF_FIN_SHALLOW

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_LIMITS	
10205	Maximum stepover
10200	Machining angle
10208	Cut method: 0 = zigzag, 1 = one way, 2 = 3D collapse
10223	Prompt for relative start point (True/False)
10320	Angle of surface normal (start of range)
10321	Angle of surface normal (end of range)
10322	Cut extension
10415	Machining direction: true = climb, false = conventional cut
10325	Expand cuts from the inside to the outside (True/False)

10324	Create outermost 3D collapse pass (True/False)
10326	Resolution: percentage of stepover
12104	Plunge distance
12105	Retract distance
12923	Output: true = 5-axis, false = 3-axis
12924	5-axis output: lead/lag angle
12925	5-axis output: lead/lag angle limit
12926	5-axis output: side angle
12927	5-axis output: side angle limit
12303	Collapse resolution: true = automatically calculate resolution percentage, false = use resolution percentage
12428	Tangent line length (gap setting)
12430	Skip internal lines in 3D collapse (True/False)
12137	Optimization type: 0 = extrema, 1 = closest

PRM_SRF_FIN_CONSCALOP

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_LIMITS	
10205	Maximum stepover
10223	Prompt for relative start point (True/False)
10415	Machining direction: true = climb, false = conventional cut
10325	Expand cuts from the inside to the outside (True/False)
10324	Create outermost 3D collapse pass (True/False)
10326	Resolution: percentage of stepover
12104	Plunge distance
12105	Retract distance
12137	Optimization type: 0 = extrema, 1 = closest
10200	Machining angle
12303	Collapse resolution: true = automatically calculate resolution percentage, false = use resolution percentage
12306	Collapse settings: true = hold outermost zone static, false = collapse it
12428	Tangent line length (gap setting)
12430	Skip internal lines in 3D collapse (True/False)
12575	Enable sharp-corner smoothing? (Y/N) **(new for X3)**
12576	Angle tolerance to define which corners are considered sharp. **(new for X3)**
12577	Maximum rounding distance. **(new for X3)**

PRM_SRF_FIN_BLEND (X)

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_LIMITS	
12110	Projection type: set to 3 (two curve blend)
12104	Plunge distance
12105	Retract distance
12302	Blend stepover
10208	Cutting method: 0 = zigzag, 1 = one way, 2 = spiral
12238	Cutting Method: true = along, false = across
12417	If along, true = do 2D projection, false = do 3D
12428	Tangent line length (gap setting)
15472	Percentage of stepover to use for temporary ‘across’ cut used to build final along 3D cut
15473	Skip vertical walls (True/False)

Surface common settings

PRM_SRF_COMMON

10226	Respond to check bit on surfaces (True/False)
10227	Stock to leave on check surfaces
10228	Prompt for tool center boundary (True/False)
12410	Comp to tip (True/False)
10204	Cut tolerance
12411	Maximum stepdown

PRM_SRF_DIRECTION

10915	Direction vectors are to be used (True/False) (was 10715) (X)
10909	Plunge angle in XY (was 10709) (X)
10910	Plunge angle in Z (was 10710) (X)
10911	Plunge relative: 0 = to Cplane X-axis, 1 = to cut (was 10711) (X)
10912	Retract angle in XY)was 10712) (X)
10913	Retract angle in Z (was 10713) (X)
10914	Retract relative: 0 = to Cplane X-axis, 1 = to cut (was 10714) (X)

PRM_SRF_GAP_SETTINGS

10255	Retract: true = use gap percentage, false = use gap distance
10259	Maximum short gap (as a distance)
10258	Maximum short gap (as percentage of stepover (or tool diameter))
10260	Gap motion: 0 = direct, 1 = broken, 2 = smooth, 3 = follow surface fixed feed rate, 10 = direct, 11 = broken, 12 = smooth, 13 = follow surface (was 10221) (X)
10256	Check short gap motion for gouge (True/False)
10257	Check long gap motion for gouge (True/False)
10246	Optimize cut order (True/False)
10247	Plunge into previously cut area (True/False)
10248	Follow tool center boundary in gap (True/False)
12414	Tangential arc radius
12556	Tangential arc sweep angle (was 10402) (X)

PRM_SRF_EDGE_SETTINGS

10252	Search for shared edges (obsolete - defaults to False)
10251	Use “solid hidden face” (True/False)
10249	Containment boundary offset distance (set to 0 in v8 operations)
10250	Containment boundary offset option 0 = offset inside 1 = no offset (center) (this is default) 2 = offset outside

10242	Roll tool at edges: 1 = only between surfaces, 2 = over all surfaces, 3 = auto
10254	Sharp corner tolerance: true = use corner percentage, false = use corner distance
10253	Sharp corner tolerance (as distance)
10240	Sharp corner tolerance (as percentage of cut tolerance)

PRM_SRF_DEPTHS

12557	Cut depths: true = incremental, false = absolute (was 10403) (X)
12070	Tip comp: true = tip depths, false = center depths
12444	Maximum storage currently allocated for critical depths (X)
12445	Current count of number of critical depths (X)
12446	Counter to indicate that variable critical depths were changed (dirty flag) (X)
12447	*Database list entity pointer (X) (removed in X3)*
12448	*Pointer to critical depths (X) (removed in X3)*
12558	Incremental: adjustment to top cut (was 10404) (X)
12559	Incremental: adjustment to bottom and other cuts (was 10405) (X)
12412	## Absolute: highest cut
14071	Absolute: lowest cut
12072–12101	Critical depths selected by user **(Pre-X)**

PRM_SRF_ROUGH_SETTINGS

10233	Allow motion in -Z along surface (True/False)
10224	Allow motion in +Z along surface (True/False)
10235	Plunge control: 1 = cut from one side, 2 = cut from both, 0 = allow multiple plunges

PRM_SRF_HSOPTS

12439	Use variable step: True=variable, False=Fixed distance between offest passes
12440	Use tangent ramp: True=tangent ramp, False=loop transition between offset passes
12441	Use tangent ramp angle: True=angle, False=length specification of tangent ramp
12442	Tangent ramp length
12443	Tangent ramp angle

PRM_SRF_LIMITS

10243	Use cut depth limits (True/False)
12102	Tip comp: true = tip depths, false = center depths
10244	Depth limit 1

10245 | Depth limit 2

High-speed 2D toolpaths

PRM_2D_HMM

12713	2D toolpath style: core mill, peel mill, bland mill, area mill, rest mill **(new for X3)**
12714	Rounding radius **(new for X3)**
12715	Rough offset **(new for X3)**
12716	Extend entry? **(new for X3)**
12717	Create finish pass **(new for X3)**
12718	Back feedrate **(new for X3)**
12719	Stepover **(new for X3)**
12720	Width of slot **(new for X3)**
PRM_CONTOUR	

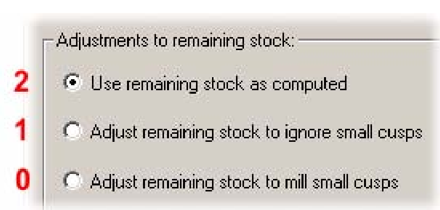
High-speed surface toolpaths

PRM_SRF_HMM (X)

12578	Z step size (maximum)
12579	XY or XYZ step size (maximum)
12580	Z depth limit 1
12581	Z depth limit 2
12582	Angle limit 1
12583	Angle limit 2
12584	Minimum stepdown (for adaptive or other non constant z step)
12585	Stepdown precision
12586	Minimum difference between Z steps (for adaptive or contour flats type processing)
12587	Tolerance for smoothing operation
12588	Maximum radius in smoothing operation
12589	Curl over radius...for shortest retract route
12590	Curl down radius...for shortest retract route
12591	Reference cutter diameter
12592	Reference cutter corner radius
12593	Cut tolerance (add filter tolerance to get total tolerance)
12594	Stock remaining on check geometry
12595	Tool containment boundary offset amount (for offset inside or outside [not for center])
12596	Minimum stepover
12597	Maximum stepover
12598	Offset tolerance (for smoothing)
12599	Overthickness - increase reference tool by this amount (pencil, usually)
12600	Bitangency angle - definition of a crease
12601	Vertical stepover distance
12602	Horizontal stepover distance
12603	Machining cut angle
12604	Pass extension - extend cut by this amount
12605	Limit raster stepover by this amount (see raster limit style)
12606	Gap size - keep tool down within this gap size (actual distance)
12607	Gap size - keep tool down within this gap size (percentage of tool diameter)
12608	Maximum cutting distance (retract and load a same shape tool)
12609	Maximum cutting time (retract and load a same shape tool)
12610	Helix radius
12611	Helix additional z clearance
12612	Helix max angle
12613	Minimum profile ramp diameter
12614	Entry radius in (vertical)
12615	Entry radius out (vertical)
12616	Transition ramp angle

12617	Stepover expressed as a percentage of tool diameter
12618	Entry radius in (horizontal)
12619	Entry radius out (horizontal)
12620	Maximum entry ramp angle (horizontal)
12621	Link extension (start)
12622	Link shallow angle
12623	Prefillet corner radius
12624	Second tool containment boundary offset amount
12625	Maximum trimming distance
12626	Limiting number of offsets (scallop)
12627	Limiting number of offset (pencil)
12628	Style: 0-Core roughing (pocket, out to in) 1-Area clearance (pocket, in to out) 2-Waterline (Z contour) 3-Constant stepover (scallop) 4-Horizontal (facing) 5-Raster (parallel) 6-Pencil (single and multipass) 7-Flowline 8-Blend 9-Spiral 10-Project 11-Rough rest passes
12629	Zigzag (True/False)
12630	Climb (True/False)
12631	Use approximate start point (True/False)
12632	Optimize cut order (True/False)
12633	Reverse order (bottom up for example) (True/False)
12634	Adaptive stepdown (True/False)
12635	Profile (constant z) smoothing (True/False)
12636	Retract style - 0=Shortest, 1=minimal, 2=full retract
12637	Rest area calculation (True/False)
12638	Top of stock is to be used (True/False)
12639	Tool containment boundary offset direction - 0=inside, 1=center (no offset), 2=outside
12640	Add offset distance to tool radius (True/False)
12641	Use depths (True/False) - True = use z depth limit 1 and 2
12642	Stepover style - 0=3d, 1=2d, (2=future)
12643	Offset limit style - 0-no offsets, 1-limited offsets, 2-unlimited offsets
12644	Raster limit style - 0-disabled, 1-limited, 2-fill in stepover
12645	Gap size type - 0=gap size dist, 1=gap size pct of tool diameter, (2=future)
12646	Sister tool type - 0=none, 1=distance, 2=time
12647	Contact area only (True/False) - False=contact and outermost, True=contact area only
12648	Helix entry style - 0=profile ramp, 1=helix, 2=future
12649	Link trimming style - 0=none,1=minimal, 2=fully, 3=future

12650	Gap style - 0=tangential ramp, 1=ramp, 2=direct
12651	Pencil offset limit style - 0=no offsets, 1=limited offsets, 2=unlimited offsets
12652	Down up style: 0=any direction, 1=down mill only, 2=up mill only, 3=neither up nor down, 4=future
12653	Prefer reverse (True/False)
12654	Prefillet on (True/False)
12655	Gouge check holder (True/False)
12656	Raster gap style -0=smooth, 1=straight, 2=future
12662	The feedrate to be used when approach/retract moves on the **Linking parameters** page are output as feedrate moves instead of rapid moves (see parameter 12676).
12663	Clearance distance used for gouge checking the tool holder.
12664	Axial offset distance
12665	The stock to leave amount for wall surfaces.
12666	The stock to leave amount for floor surfaces.
12667	The rest roughing stock resolution.
12668	The amount of **Stock adjustment** to be applied to the stock model.
12669	*Pointer to holder (removed for X3)*
12670	*Pointer to holder entity (removed for X3)*
12671	Number of axial offsets
12672	The ID number of the previous operation used for rest roughing.
12673	Total size of the holder
12674	Number of segments in the tool holder definition
12675	Counter to indicate changes in holder
12676	When True, outputs feed rate moves instead of rapids for approach/retract moves on the **Linking parameters** page (parameter 12662 stores the feedrate).
12677	When True, outputs arc moves for entry helixes.
12678	When True, use the **Expand inside to out** cutting method option.
12679	Sets the stock computation method for rest roughing toolpaths: 0=**All previous operations**, 1=**One previous operation**, 2=**Roughing tool**, 3=**CAD file**.
12680	Sets the stock adjustment method:



12689	Minimum stepover, expressed as a percentage of tool diameter **(X2)**
12690	Minimum "span" or extent required of a pocket for it to be machined (pockets smaller than this amount are not machined) **(X2)**
12691	X coordinate for the center point for radial/spiral toolpaths **(X2)**
12692	Y coordinate for the center point for radial/spiral toolpaths **(X2)**
12693	Inner radius for radial/spiral toolpaths **(X2)**
12694	Outer radius for radial/spiral toolpaths **(X2)**

12695	Starting angle for a radial toolpath **(X2)**
12696	Ending angle for a radial toolpath **(X2)**
12697	Z-ramp distance for a horizontal entry arc **(X2)**
12698	True = use feed rate for helix; False = use plunge rate **(X2)**
12699	True = spiral clockwise; False = spiral counterclockwise **(X2)**
12700	True = use trochoidal loops to minimize tool burial; False = do not use trochoidal loops **(X2)**
12732	Scallop toolpaths “Steep/Shallow” option: Use boundaries as drive curves, then collapse (Y/N) **(new for X3)**
12733	Keep trochoidal loops inside machining region (Y/N) **(new for X3)**
12734	Ignore outer radius when calculating spiral/radial toolpaths (Y/N) **(new for X3)**

Advanced multiaxis toolpaths

PRM_ADV_5AX

15583	Text to display in TP Mgr **(new for X3)**
15584	Name of adv multiaxis chook **(new for X3)**
15585	Name of parameter function **(new for X3)**
15586	Name of tool function **(new for X3)**
15587	Name of geometry function **(new for X3)**
15588	(not used) **(new for X3)**
15589	Name of regen function **(new for X3)**
15590	(not used) **(new for X3)**
15591	(not used) **(new for X3)**
15592	(not used) **(new for X3)**

Feature-based machining: drill toolpaths

FBM_DRILLPARAMETERS

12737	Solid operation ID **(new for X3)**
FBM_DRILLPARAMETERS_SETUP	**(new for X3)**
FBM_DRILLPARAMETERS_HOLEDETECTION	**(new for X3)**
FBM_DRILLPARAMETERS_DEEPHOLE	**(new for X3)**
FBM_DRILLPARAMETERS_SPOTDRILLING	**(new for X3)**
FBM_DRILLPARAMETERS_PREDRILLING	**(new for X3)**
FBM_PARAMETERS_TOOLS	**(new for X3)**
FBM_DRILLPARAMETERS_DEPTHS	**(new for X3)**

FBM_DRILLPARAMETERS_SETUP

12856	**Automatic initial hole detection** turned on (y/n) **(new for X3)**
12857	Enable Tool page? **(new for X3)**
12858	Enable Depths page? **(new for X3)**
12859	Method for grouping operations—None, Plane, or Tool. **(new for X3)**
12860	Method for sorting points **(new for X3)**
12861	Use subprograms? (y/n) **(new for X3)**
12862	Incremental or absolute subprograms **(new for X3)**

FBM_DRILLPARAMETERS_HOLEDETECTION

12863	Read hole data from solids created with the SolidWorks® Hole Wizard® **(new for X3)**
12864	Path to use with Hole Wizard **(new for X3)**
12865	Co-axial hole criteria. Determines whether Mastercam treats multiple holes that share a common axis as a single hole, or as multiple holes from different planes. **(new for X3)**
SDETECT_DRILL_PARAMS	**(new for X3)**

SDETECT_DRILL_PARAMS

15307	Minimum radius of holes to detect (note: users enter this number as a diameter value) **(new for X3)**
15308	Maximum radius of holes to detect (note: users enter this number as a diameter value) **(new for X3)**
15309	Include blind holes (y/n) **(new for X3)**
15310	Arc offset **(new for X3)**
15311	Color **(new for X3)**
15312	Limit search for holes to a specific plane **(new for X3)**
15313	Plane to limit search to **(new for X3)**

15314	Include split holes **(new for X3)**
15315	Detect holes by minimum or maximum sweep angle **(new for X3)**
15316	Sweep angle threshold **(new for X3)**
15317	Sampling increment (step) along length of hole to determine sweep angle. **(new for X3)**

FBM_DRILLPARAMETERS_DEEPHOLE

12866	**Deep drilling** option turned on (y/n) **(new for X3)**
12867	Deep drilling strategy: • Split holes between faces • Drill to maximum and finish with a long tool • Drill to maximum and warn user • Cut entire hole with a long drill. **(new for X3)**
12868	The maximum hole depth :: diameter ratio for normal drilling. Mastercam applies deep drilling parameters only to holes that exceed this ratio. **(new for X3)**
12869	Primary face depth percentage **(new for X3)**
12870	Canned cycle to use for deep drilling **(new for X3)**

FBM_DRILLPARAMETERS_SPOTDRILLING

12871	**Spot drilling** option turned on (y/n) **(new for X3)**
12872	Max percentage of finished hole **(new for X3)**
12873	Max depth **(new for X3)**
12874	Allow center drill **(new for X3)**
12875	Combine spot drill operations that meet or exceed maximum depth **(new for X3)**
12876	Use selected tool for all spot drill operations **(new for X3)**

FBM_DRILLPARAMETERS_PREDRILLING

12877	**Pre-drilling** option turned on (y/n) **(new for X3)**
12878	Minimum drill diameter **(new for X3)**
12879	Increment between drill sizes for each set of pre-drill operations **(new for X3)**
12880	Use **Stock to leave** option (y/n) **(new for X3)**
12881	Amount of stock to leave **(new for X3)**
12882	Use **Tip compensation** option (y/n) **(new for X3)**
12883	Use **Additional break through** option (y/n) **(new for X3)**
12884	Break through method: **Distance**, or **% of tool diameter** **(new for X3)**
12885	Break through amount **(new for X3)**

FBM_PARAMETERS_TOOLS

12886	Tool library path **(new for X3)**
12887	Diameter matching tolerance for selecting drills **(new for X3)**
12888	Use tools in .MCX file (y/n) **(new for X3)**
12889	Use tools from tool library (y/n) **(new for X3)**
12890	Create tools as needed (y/n) **(new for X3)**
12891	Create only standard sizes (y/n) **(new for X3)**
12892	Consider flute length when creating new tools (y/n) **(new for X3)**
12893	Action to take if hole exceeds flute length **(new for X3)**
12894	Increment to use when creating new tools of different lengths **(new for X3)**
12895	Tip geometry / hole bottom geometry **(new for X3)**
12896	Tool tip match tolerance **(new for X3)**
12897	Allow flat endmills? (y/n) **(new for X3)**

FBM_DRILLPARAMETERS_DEPTHS

12898	Method for determining clearance **(new for X3)**
12899	Clearance value **(new for X3)**
12900	Absolute or incremental clearance **(new for X3)**
12901	Use clearance only at the start and end of an operation **(new for X3)**
12902	Retract distance **(new for X3)**
12903	Apply tip compensation? (y/n) **(new for X3)**
12904	Apply additional break through amount? (y/n) **(new for X3)**
12905	Method for computing break through **(new for X3)**
12906	Amount of break through **(new for X3)**
12907	Tap/ream depth adjustment method **(new for X3)**
12908	Amount of tap/ream depth adjustment **(new for X3)**

Feature-based machining: pocket toolpaths

PRM_FBM_POCKET

12737	Solid operation ID **(new for X3)**
FBM_POCKETPARAMETERS_SETUP	**(new for X3)**
FBM_POCKETPARAMETERS_POCKETDETECTION	**(new for X3)**
FBM_POCKETPARAMETERS_FACETL	**(new for X3)**
FBM_POCKETPARAMETERS_ROUGHTL	**(new for X3)**
FBM_POCKETPARAMETERS_ROUGHTL	**(new for X3)**
FBM_POCKETPARAMETERS_FINISHTL	**(new for X3)**
FBM_POCKETPARAMETERS_FACE	**(new for X3)**
FBM_POCKETPARAMETERS_ROUGH	**(new for X3)**
FBM_POCKETPARAMETERS_REST	**(new for X3)**
FBM_POCKETPARAMETERS_FINISH	**(new for X3)**
FBM_POCKETPARAMETERS_DEPTHS	**(new for X3)**

FBM_POCKETPARAMETERS_SETUP

12738	**Automatic initial feature detection** turned on (y/n) **(new for X3)**
12744	Method for grouping operations—1=Op type, 2=Tool, 3=Plane, or 4=Hole. **(new for X3)**
12746	Comment **(new for X3)**

FBM_POCKETPARAMETERS_POCKETDETECTION

12747	Allow through pockets (y/n) **(new for X3)**
12748	Method for cutting through pockets: 0=leave stock at bottom, 1=break through **(new for X3)**
12749	Amount of stock to leave at bottom. **(new for X3)**
12750	Break through distance **(new for X3)**
12751	Method for selecting level for edge curves **(new for X3)**
12752	Level on which to place edge curves **(new for X3)**
12753	Minimum number of unused level on which **(new for X3)** to place edge curves
12754	Recognize holes greater than this diameter as features **(new for X3)**

FBM_POCKETPARAMETERS_FACE

FBM_POCKETPARAMETERS_DCUTS	**(new for X3)**
12823	Enable facing operations (y/n) **(new for X3)**
12824	Select climb or conventional **(new for X3)**
12825	Cutting method: Zigzag, One way, Controlled engagement **(new for X3)**

12826	Stock to leave in Z **(new for X3)**
12827	Max stepover **(new for X3)**
12828	Across overlap distance **(new for X3)**
12829	Along overlap distance **(new for X3)**
12830	Approach distance **(new for X3)**
12831	Exit distance **(new for X3)**

FBM_POCKETPARAMETERS_ROUGH

FBM_POCKETPARAMETERS_DCUTS001	**(new for X3)**
12832	Select climb or conventional **(new for X3)**
12833	Cut method **(new for X3)**
12834	Stock to leave on floors **(new for X3)**
12835	Stock to leave on walls **(new for X3)**
12836	Stepover **(new for X3)**
12837	Entry method: profile ramp or helix **(new for X3)**
12838	Profile boundary for ramp **(new for X3)**
12839	Face approach distance **(new for X3)**
12840	Face overlap distance **(new for X3)**
12841	Face exit diatance **(new for X3)**
12842	Use long tool values when length::diameter ratio is greater than this value **(new for X3)**
12843	Outside **(new for X3)**

FBM_POCKETPARAMETERS_REST

FBM_POCKETPARAMETERS_DCUTS002	**(new for X3)**
12844	Select climb or conventional **(new for X3)**
12845	Stock to leave on floors **(new for X3)**
12846	Stock to leave on walls **(new for X3)**
12847	Stepover **(new for X3)**
12848	Use long tool values when length::diameter ratio is greater than this value **(new for X3)**

FBM_POCKETPARAMETERS_DCUTS

12812	Depth cuts mode for facing operations **(new for X3)**

FBM_POCKETPARAMETERS_DCUTS001

12813	Depth cuts mode for roughing operations **(new for X3)**

FBM_POCKETPARAMETERS_DCUTS002

12814	Depth cuts mode for restmill operations **(new for X3)**

FBM_POCKETPARAMETERS_FINISH

FBM_POCKETPARAMETERS_LEADIO001	**(new for X3)**
12850	Select climb or conventional **(new for X3)**
12851	Stock to leave on floors **(new for X3)**
12852	Stock to leave on walls **(new for X3)**
12853	Stepover **(new for X3)**
12854	Use long tool values when length::diameter ratio is greater than this value **(new for X3)**
12855	Cutter comp **(new for X3)**
12910	Outside **(new for X3)**

FBM_POCKETPARAMETERS_LEADIO

12815	Entry/exit mode: perpendicular or tangent **(new for X3)**
12816	Line length **(new for X3)**
12817	Arc radius **(new for X3)**
12818	Sweep angle **(new for X3)**

FBM_POCKETPARAMETERS_LEADIO001

12819	Entry/exit mode: perpendicular or tangent **(new for X3)**
12820	Line length **(new for X3)**
12821	Arc radius **(new for X3)**
12822	Sweep angle **(new for X3)**

FBM_POCKETPARAMETERS_DEPTHS

12807	Linking parameters: clearance **(new for X3)**
12808	Retract **(new for X3)**
12809	Feed plane **(new for X3)**
12810	Incremental or absolute clearance **(new for X3)**

Feature-based machining: tool parameters

FBM_POCKETPARAMETERS_FACETL

FBM_POCKETPARAMETERS_TL	**(new for X3)**
12800	Allowed end mill types: flat endmills, bull nose, face mills **(new for X3)**

FBM_POCKETPARAMETERS_ROUGHTL

FBM_POCKETPARAMETERS_TL001	**(new for X3)**

FBM_POCKETPARAMETERS_FINISHTL

FBM_POCKETPARAMETERS_TL002	**(new for X3)**
12805	Method for selecting or creating tools to machine internal fillet arcs in the XY axes: **Match tool with arc**, or **Use next smaller tool** **(new for X3)**
12806	Desired tool radius as % of arc size **(new for X3)**

FBM_POCKETPARAMETERS_TL

	(This set of parameters used for face tools)
12755	Tool #1 from preferred tool list **(new for X3)**
12756	Tool #2 from preferred tool list **(new for X3)**
12757	Tool #3 from preferred tool list **(new for X3)**
12758	Tool #4 from preferred tool list **(new for X3)**
12759	Tool # from preferred tool list5 **(new for X3)**
12760	Tool #6 from preferred tool list **(new for X3)**
12761	Tool #7 from preferred tool list **(new for X3)**
12762	Tool #8 from preferred tool list **(new for X3)**
12763	Tool #9 from preferred tool list **(new for X3)**
12764	Tool #10 from preferred tool list **(new for X3)**
12765	Number of tools **(new for X3)**
12766	Minimum diameter for automatic tool selection **(new for X3)**
12767	Minimum diameter for automatic tool selection **(new for X3)**
12768	Tool size increment for automatic tool selection (diameter) **(new for X3)**
12769	Tool size increment for automatic tool selection (% of max diameter) **(new for X3)**

FBM_POCKETPARAMETERS_TL001

	(This set of parameters used for rough/restmill tools)
12770	Tool #1 from preferred tool list **(new for X3)**
12771	Tool #2 from preferred tool list **(new for X3)**

12772	Tool #3 from preferred tool list **(new for X3)**
12773	Tool #4 from preferred tool list **(new for X3)**
12774	Tool #5 from preferred tool list **(new for X3)**
12775	Tool #6 from preferred tool list **(new for X3)**
12776	Tool #7 from preferred tool list **(new for X3)**
12777	Tool #8 from preferred tool list **(new for X3)**
12778	Tool #9 from preferred tool list **(new for X3)**
12779	Tool #10 from preferred tool list **(new for X3)**
12780	Number of tools **(new for X3)**
12781	Minimum diameter for automatic tool selection **(new for X3)**
12782	Minimum diameter for automatic tool selection **(new for X3)**
12783	Tool size increment for automatic tool selection (diameter) **(new for X3)**
12784	Tool size increment for automatic tool selection (% of max diameter) **(new for X3)**

FBM_POCKETPARAMETERS_TL002

	(This set of parameters used for finish tools)
12785	Tool #1 from preferred tool list **(new for X3)**
12786	Tool #2 from preferred tool list **(new for X3)**
12787	Tool #3 from preferred tool list **(new for X3)**
12788	Tool #4 from preferred tool list **(new for X3)**
12789	Tool #5 from preferred tool list **(new for X3)**
12790	Tool #6 from preferred tool list **(new for X3)**
12791	Tool #7 from preferred tool list **(new for X3)**
12792	Tool #8 from preferred tool list **(new for X3)**
12793	Tool #9 from preferred tool list **(new for X3)**
12794	Tool #10 from preferred tool list **(new for X3)**
12795	Number of tools **(new for X3)**
12796	Minimum diameter for automatic tool selection **(new for X3)**
12797	Minimum diameter for automatic tool selection **(new for X3)**
12798	Tool size increment for automatic tool selection (diameter) **(new for X3)**
12799	Tool size increment for automatic tool selection (% of max diameter) **(new for X3)**

Chooks

PRM_C-HOOK

15266	Operation description to display in the Operation Manager
15267	Source C-Hook name (no prefix path). If "" (null string), call as .dll.
15268	C-Hook's function or dll to call when operation's parameters are selected in the Operation Manager
15269	C-Hook's function or dll to call when operation's tool is selected in the Operation Manager
15270	C-Hook's function or dll to call when operation's geometry is selected in the Operation Manager
15271	C-Hook's function or dll to call when operation's NCI is selected in the Operation Manager with the left mouse button
15272	*C-Hook's function or dll to call to regenerate operation's NCI section (removed for X3)*
15336	C-Hook's function or dll to call when operation's NCI is selected in the Operation Manager with the right mouse button
15337	Filter operation (True/False)
15338	Toolpath edited (True/False)
30000–31999	Range of parameter numbers reserved for use by C-Hook developers. **(new for X3)**

Multiaxis toolpaths

PRM_CURVE_5AX

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
MULTAX_ENTRY_EXIT	
12019	OutputFormat (CM5dlg parameters)
12141	CurveType (CM5dlg parameters)
12142	ToolAxis (CM5dlg parameters)
12023	ProjectType (CM5dlg parameters)
12022	TipControl (CM5dlg parameters)
12143	EdgeType (CM5dlg parameters)
12144	Curve following method: true = step increment, false = chordal deviation
12145	Step increment distance
12146	Maximum step distance for chordal deviation
12147	Chordal deviation
12148	Maximum projection distance
12149	Radial offset
12150	Offset sign
12139	Side angle: positive is to the right, negative is to the left
12151	Lead angle
12152	Normal depth
12153	Toolplane axis: true = 5- axis, false = 3-axis
12154	Ma **`View number`**
12155	Do all edges (True/False)
12156	Display clipped corners on the screen (True/False)
12157	Minimize corners (True/False)
12158	Gouge check: 0 = infinite, 1 = user defined look ahead distance, 2 = none
12159	User defined look ahead distance
12160	Tip compensation: 0 = tip on curve, 1 = compensate to surface
12024	Tool display and NCI vector length
12025	Fourth axis: 0 = X, 1 = Y
12250	Bit 0 means lines are relative to toolpath direction Bit 1 was used for relative to surface Bit 2 is used for finish all depths Bit 3 is or chain tool axis control
12251	Plane vector for tool axis control
12252	Plane vector for tool axis control
12253	Plane vector for tool axis control
PRM_5AX_LIMIT	

PT_GENERATOR	

PRM_SRF_FLOW5AX

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_LIMITS	
10208	Cut method
12115	Use along distance (True/False)
12116	Along cut: distance
12117	Use across distance (True/False)
12118	Across cut: distance
12119	Across cut: scallop height
12120	Check flowline motion for gouge (True/False)
12138	Positive: top of tool is forward (tip back)
12104	Plunge distance
12105	Retract distance
12139	Side angle: positive is to the right, negative is to the left
12121	Start point (which corner)
12122	Cut direction (U or V)
12264	Shared edge tolerance: 0.0 = off
12421	True = row only (v8 code), false = grid (v9)
12427	Tool display and NCI output length
MULTAX_ENTRY_EXIT	
PRM_5AX_LIMIT	
12019	OutputFormat (CM5dlg parameters)
12373	PatternType (CM5dlg parameters)
12142	ToolAxis (CM5dlg parameters)
12374	Cut type
12025	4th axis: 0 = X, 1 = Y, 2 = Z
12250	specflags : so far only used for chain tool axis control usage (bits 0 & 1)
12251	Plane vector for tool axis control
12252	Plane vector for tool axis control
12253	Plane vector for tool axis control
PT_GENERATOR	
12437	Stock on drive surface
12701	Number of flow blend passes **(X2)**
12702	True = enable flow blend passes; False = disable flow blend passes **(X2)**
12703	Rib resolution as percent of tool diameter **(X2)**

PRM_SRF_4AX

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_DEPTHS	
10223	Use center point (True/False)
10208	Direction of open boundaries:(0 = zigzag, 1 = one way)
10415	Direction of closed boundaries (True = climb)
12138	Positive = top of tool is forward (tip back)
12140	Axis damp length
12104	Plunge distance
12105	Retract distance
12139	Side angle: positive is to the right, negative is to the left
12025	4th axis: 0 = X, 1 = Y, 2 = Z
12284	Cut type: true = axial cut, false = rotary cut
12285	Axial cut angular step (max) (radius)
12286	Axial cut angular start (radius)
12287	Axial cut angular sweep (radius)
12427	Tool display and NCI length
MULTAX_ENTRY_EXIT	
PRM_5AX_LIMIT	
12019	OutputFormat (CM5dlg parameters)
12373	PatternType (CM5dlg parameters)
12142	ToolAxis (CM5dlg parameters)
12374	Cut type
12250	specflags : so far only used for chain tool axis control usage (bits 0 and 1)
12251	Plane vector for tool axis control
12252	Plane vector for tool axis control
12253	Plane vector for tool axis control
PT_GENERATOR	

PRM_SWARF_5AX

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
MULTAX_ENTRY_EXIT	
12144	Curve following method: true = step increment, false = chordal deviation
12145	Step increment distance
12146	Maximum step distance for chordal deviation

12147	Chordal deviation
12153	Toolplane axis: true = 5-axis, false = 4-axis
12161	Floor type
12162	Wall type
12163	Distance above low point
12164	(not used)
12165	Use floor (True/False)
12166	No floor (True/False)
12167	Use fans cuts (True/False)
12168	Use swarf fans cuts (True/False)
12169	Stock on walls
12170	Additional clearance on floor
12171	Maximum step along cut
12172	Number of wall passes
12173	Distance off wall per pass
12174	Number of floorpasses
12175	Distance off floor per pass
12176	Use floor for normal (True/False)
12177	Floor normal X vector
12178	Floor normal Y vector
12179	Floor normal Z vector
12180	Floor X point
12181	Floor Y point
12182	Floor Z point
12183	Fan feedrate
12184	Use floor gouge protect: true = detect, false = protect
12185	Show toolpath before gouge check (True/False)
12158	Gouge check: 0 = infinite, 1 = user-defined look ahead distance, 2 = none
12159	User defined look ahead distance
12024	Tool display and NCI vector length
12265	Do finish passes at all depths (True/False)
12187	Minimize corners (True/False)
12025	Fourth axis: 0 = X, 1 = Y
12262	Sync option setting: 0 = none, 1 = by Entity, ... 6 = Manual/Density
PRM_5AX_LIMIT	
PT_GENERATOR	
12429	Use zigzag multiple passes (True/False)
15546	Closed Walls : True = enter at start of first wall, False = Enter at middle of first wall
12704	Max angle deviation from 5-axis vector for 4-axis output **(X2)**
12705	Max angle difference between vectors for 4-axis output **(X2)**

PRM_MSURF_5AX

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
MULTAX_ENTRY_EXIT	
12019	OutputFormat (CM5dlg parameters)
12373	PatternType (CM5dlg parameters)
12142	ToolAxis (CM5dlg parameters)
12374	Cut type
12022	Tip control
12143	Edge type
PRM_M5_CYL	
PRM_M5_SPH	
PRM_M5_BOX	
12375	Operation type: finish = 0, rough = 1
10208	Cut method: zigzag, one way, spiral
12376	Surface tolerance
12416	Step between passes
12116	Maximum step distance
12377	Iteration count
12378	Depth cut distance
10128	*Point generators (removed for X3)*
PT_GENERATOR	
12150	Offset sign
12153	True = 5 axis, False = 3 axis
12154	View number
12158	Gouge check: 0=infinite, 1=user defined look ahead distance, 2=none
12159	User defined look ahead distance
12160	Tip compensation, 0=tip on curve, 1=Comp to surface
12024	Tool display and NCI vector length
12025	4^{th} axis: 0 = X, 1 = Y
12250	bit 0 means lines are relative to toolpath dir bit 1 was used for relative to surf norm (no longer) bit 2 is used for finish all depths (C5_FIN_ALL_BIT) bit 3 is for chain tool axis control usage
12251	Plane vector for tool axis control
12252	Plane vector for tool axis control
12253	Plane vector for tool axis control
12115	Use along distance (True/False)
12117	Use across distance (True/False)
12119	Across cut: scallop height

12120	Check cuts (True/False)
12138	Lead/lag: + top of tool is forward (tip back)
12104	Plunge distance
12105	Retract distance
12139	Side angle: positive is to the right, negative is to the left
12121	Start point (which corner)
12122	Cut direction (U or V)
12264	Shared edge tolerance
PRM_5AX_LIMIT_	
12437	Stock on drive surface
12736	Allow undercuts? **(new for X3)**

PRM_SLICE_5AX (X)

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
MULTAX_ENTRY_EXIT	
12019	OutputFormat (CM5dlg parameters)
12450	Slice type
12142	ToolAxis (CM5dlg parameters)
12023	Project type
12022	Tip control
12143	Edge type
12144	True = step incr, False = chord dev
12145	Step increment distance
12146	Maximum step distance for chordal dev
12147	Chordal deviation
12148	Maximum projection distance
12149	Offset radius
12150	Offset sign
12139	Side angle positive is to the right, negative is to the left
12151	Lead angle
12152	Norm depth
12153	True - five axis, False - three axis
12154	View_number
12155	Do all edges (True/False)
12156	Display clipped corners on the screen (True/False)
12157	Minimize corners
12158	Gouge check: 0=infinite, 1=user defined look ahead distance, 2=none
12159	User defined look ahead distance
12160	Tip compensation, 0=tip on curve, 1=Comp to surface

12570	Tool display and NCI vector length
12025	4^{th} Axis: 0 = X, 1 = Y
12250	bit 0 means lines are relative to toolpath dir bit 1 was used for relative to surf norm (no longer) bit 2 is used for finish all depths (C5_FIN_ALL_BIT) bit 3 is for chain tool axis control usage
12251	Plane vector for tool axis control
12252	Plane vector for tool axis control
12253	Plane vector for tool axis control
PRM_5AX_LIMIT	
PT_GENERATOR	

PRM_PORT_5AX (X)

PRM_SRF_COMMON	
PRM_SRF_DIRECTION	
PRM_SRF_GAP_SETTINGS	
PRM_SRF_EDGE_SETTINGS	
PRM_SRF_LIMITS	
12250	Cut method
12115	Use along distance (True/False)
12116	Along cut: distance
12117	Use across distance (True/False)
12118	Across cut: distance
12119	Across cut: scallop height
12120	Check cuts (True/False)
12138	Lead/lag: + top of tool is forward (tip back)
12104	Plunge distance
12105	Retract distance
12139	Side angle: + is to the right, - is to the left
12121	Start point (which corner)
12122	Cut direction (U or V)
12264	Shared edge tol (0.0=off)
12421	T-row only (v8 code), F-grid (v9)
12427	Tool display and NCI output length
10127	*Entry/exit settings (removed for X3)*
MULTAX_ENTRY_EXIT	
PRM_5AX_LIMIT	
12019	Output format
12373	Pattern type
12142	Tool axis
12374	Cut type
12025	4^{th} axis: 0 = X, 1 = Y, 2 = Z
12250	So far only used for chain tool axis control usage (bits 0 & 1)
12251	Plane vector for tool axis control

12252	Plane vector for tool axis control
12253	Plane vector for tool axis control
PT_GENERATOR	
12437	Stock on drive surface
12551	Port compensation method
12552	Search range for port compensation

Multiaxis toolpaths: common settings

MULTAX_ENTRY_EXIT

ENT_EXIT	
ENT_EXIT002	
12266	Curve Tolerance

ENT_EXIT

12267	Approach/retract (True/False)
12268	Approach/retract height
12269	Entry/exit (True/False)
12270	Direction: true = right, false = left
12271	Length
12272	Height
12273	Thickness
12274	Pivot Angle

ENT_EXIT002

12275	Approach/retract (True/False)
12276	Approach/retract height
12277	Entry/exit (True/False)
12278	Direction: true = right, false = left
12279	Length
12280	Height
12281	Thickness
12282	Pivot Angle

PT_GENERATOR

12379	Angle point generator : True=on
12380	Distance point generator : True=on
12381	Chord point generator: True=on
12382	Maximum chordal deviation
12383	Maximum projection distance
12384	Maximum tool axis angle

PRM_M5_CYL

12334	Cylinder axis point 1
12335	Cylinder axis point 1
12336	Cylinder axis point 1
12337	Cylinder axis point 2
12338	Cylinder axis point 2
12339	Cylinder axis point 2
12340	Cylinder minimum radius
12341	Cylinder maximum radius

12342	Cylinder start angle
12343	Cylinder sweep angle
12344	Cylinder equator start angle
12345	Side of surface

PRM_M5_SPH

12346	Sphere center point
12347	Sphere center point
12348	Sphere center point
12349	Sphere axis vector
12350	Sphere axis vector
12351	Sphere axis vector
12352	Sphere minimum radius
12353	Sphere maximum radius
12354	Sphere pole start angle
12355	Sphere pole sweep angle
12356	Sphere equator start angle
12357	Sphere equator sweep angle
12358	Side of surface

PRM_M5_BOX

12359	Box axis point 1
12360	Box axis point 1
12361	Box axis point 1
12362	Box axis point 2
12363	Box axis point 2
12364	Box axis point 2
12365	Box length along axis (X)
12366	Box minimum width (Y)
12367	Box minimum height (Z)
12368	Box start angle
12369	Box sweep angle
12370	Box corner radius on min box
12371	Box Z plane rotation angle
12372	Side of surface

PRM_5AX_LIMIT

MULTAX_LIMIT	X
MULTAX_LIMIT002	Y
MULTAX_LIMIT003	Z
12333	Option

MULTAX_LIMIT

12324	X-axis limit active (True/False)

12325	X-axis minimum angle (as cosine)
12326	X-axis maximum limit (as cosine)

MULTAX_LIMIT002

12327	Y-axis limit active (True/False)
12328	Y-axis minimum angle (as cosine)
12329	Y-axis maximum limit (as cosine)

MULTAX_LIMIT003

12330	Z-axis limit active (True/False)
12331	Z-axis minimum angle (as cosine)
12332	Z-axis maximum limit (as cosine)

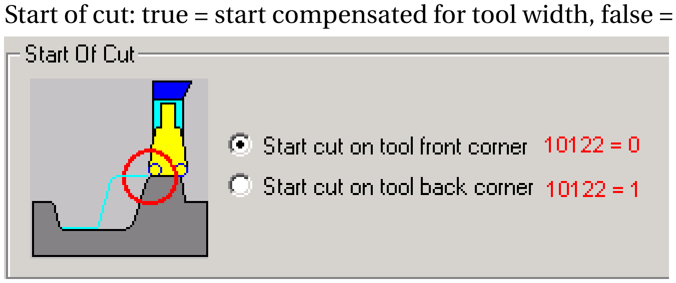
Lathe roughing toolpaths

PRM_LROUGH

10214	Direction: 0 = ID, 1 = OD, 2 = face, 3 = back
13343	Step amount (was 10200) (X)
10215	Use equal steps (True/False)
10407	Overlap amount (was 10201) (X)
10216	Use overlap (True/False)
10220	Use advanced parameters (True/False)
13344	Cut angle relative to cut direction (was 10204) (X)
10213	True = zigzag, false = one way
10202	Stock to leave in X
10203	Stock to leave in Z
13345	Stepover amount (was 10205) (X)
10221	Plunge move feed rate
PRM_LATHE_EE	
PRM_LATHE_PLUNGE001	
13164	Entry amount
13171	Feed rate for plunge: true = use regular feed rate , false = use plunge feed rate
13188	Use minimum angle (True/False)
13189	Minimum overlap angle
13190	Minimum overlap angle absolute (True/False)
13191	Minimum step amount
13192	Do semi-finish pass (True/False)
13193	Number of cuts
13194	Step amount
13143	Stock to leave in X
13144	Stock to leave in Z
PRM_PINCH_PARAMS	**(new for X3)**

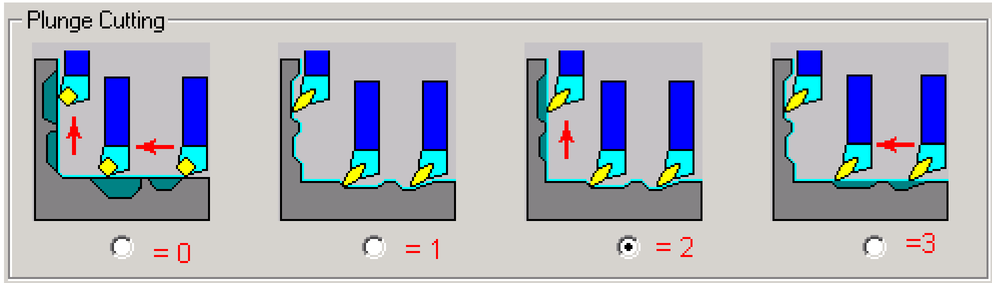
PRM_LATHE_PLUNGE

10122 Start of cut: true = start compensated for tool width, false = start on corner

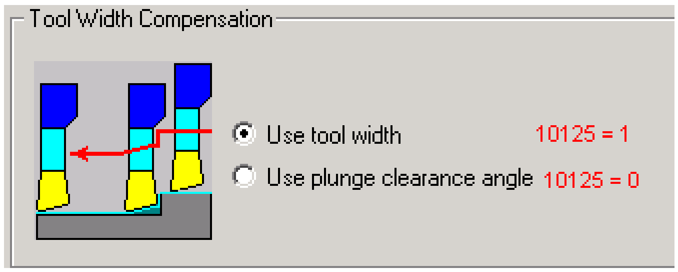


10123 Maximum incremental plunge angle (in radians)

10124 Plunge cutting selection setting: 0, 1, 2, or 3



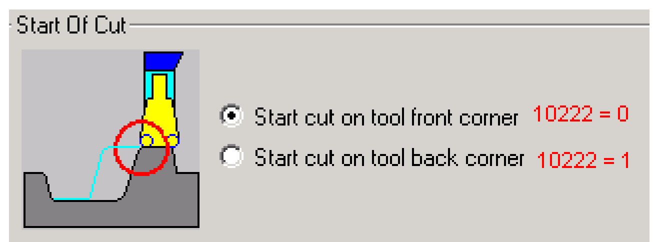
10125 Tool width compensation: true = use tool width in compensation calculation



PRM_LATHE_PLUNGE001

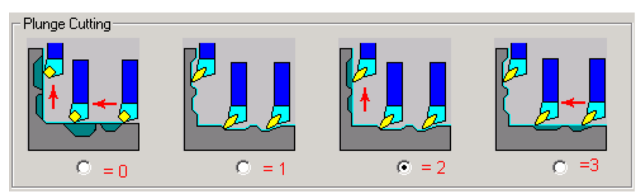
(This group of parameters used for lathe rough operations)

10522 Start of cut: true = start compensated for tool width, false = start on corner (was 10222) (X)

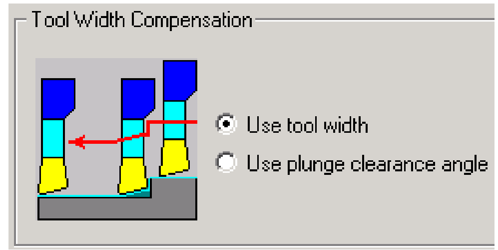


10523 Maximum incremental plunge angle (in radians) (was10223) (X)

10524 Plunge cutting selection setting: 0, 1, 2, or 3 (was 10224) (X)



10525	Tool width compensation: 1 = use tool width in compensation calculation, 0 = Use plunge clearance angle (was 10225) (X)



PRM_PINCH_PARAMS

13242	True = pinching, False = not pinching **(new for X3)**
13243	Operation to pinch **(new for X3)**
13244	(not used) **(new for X3)**
13245	(not used) **(new for X3)**

Lathe finish toolpaths

PRM_LFINISH

13341	Number of finish cuts (was 10100) (X)
10101	Step amount
10102	Stock to leave in X
10103	Stock to leave in Z
13342	Linearization tolerance (was 10104) (X)
PRM_LATHE_EE	
13020	Contour to finish: true = use chain, false = use associated operation's chain
13021	Operation that contains profile
13022	Direction: 0 = ID, 1 = OD, 2 = face, 3 = back
PRM_LATHE_CORNER_BREAK	

PRM_LATHE_CORNER_BREAK

13176	Break the corners (True/False)
13177	Break type: true = Radius corners, false =Chamfer corners
13178	Size of radius
13179	Maximum angle to put radius on
13180	Minimum angle to put radius on
13181	Chamfer height
13182	Radius on chamfer
13183	Chamfer angle tolerance
13184	Feed rate mode: 0 = same as toolpath, 1 = Feed rate, 2 = minimum number of revolutions
13185	Feed rate
13186	Feed rate type: R = feed/revolution, M = feed/min., S = surface finish
13187	Minimum number of revolutions

Lathe entry/exit

PRM_LATHE_EE

PRM_LATHE_EE_VEC	Entry vector
PRM_LATHE_EE_VEC002	Exit vector

PRM_LATHE_EE_VEC

11001	Lead-in vector angle (cosine)
11002	Lead-in vector angle (sine)
13000	Arc
13001	Arc
11007	Lead-in arc radius
13002	Arc
11008	Lead-in arc sweep (radians)
13003	Use entry/exit vector (True/False)
11006	Use entry/exit arc (True/False)
11021	Amount to extend/shorten the first/last move in toolpath
11022	Extend/shorten first/last move in toolpath enabled (True/False)
11003	Entry vector: 1 = rapid, 0 = feed
11023	Entry vector direction mode: 0 = user, 1 = tangent, 2 = perpendicular
11004	Entry vector: feed rate
11005	Entry vector feed rate type: ‘R’ = feed/rev, ‘M’ = feed/minute, ‘S’ = same as toolpath
11025	Entry/exit: 0 = auto, 1 = user defined
11024	Minimum auto entry length
13004	Adjust contour first/last entities (True/False)
13005	Amount to lengthen/shorten contour first/last entity
13006	Use amount to lengthen/shorten contour first/last entity (True/False)
13007	Length of line added to contour first/last entity
13008	Angle of line added to contour first/last entity
13009	Add a line perpendicular to contour first/last entity (True/False)

PRM_LATHE_EE_VEC002

11011	Lead-out vector angle (cosine)
11012	Lead-out vector angle (sine)
13010	Arc
13011	Arc
11017	Lead-out arc radius
13012	Arc
11018	Lead-out arc sweep (radians)
13013	Use entry/exit vector (True/False)
11016	Use entry/exit arc (True/False)

11026	Amount to extend/shorten the first/last move in toolpath
11027	Extend/shorten first/last move in toolpath enabled (True/False)
11013	Retraction vector: 1 = rapid, 0 = feed
11028	Exit vector direction mode: 0 = user, 1 = tangent, 2 = perpendicular
11014	Retraction vector: feed rate
11015	Retraction vector feed rate type: 'R' = feed/rev, 'M' = feed/minute, 'S' = same as toolpath
11030	Use auto entry/exit (True/False)
11029	Minimum auto entry length
13014	Adjust contour first/last entities (True/False)
13015	Amount to lengthen/shorten contour first/last entity
13016	Use amount to lengthen/shorten contour first/last entity (True/False)
13017	Length of line added to contour first/last entity
13018	Angle of line added to contour first/last entity
13019	Add a line perpendicular to contour first/last entity (True/False)

Lathe groove toolpaths

PRM_LGROOVE

13137	Groove defintion type: 0 = 1 point, 1 = 2 point, 2 = 3 line, 3 = 2 boundary method (chain)
13363	Spline linearization tolerance (was 10305) (X)
13138	Groove cut direction: 0 = ID, 1 = OD, 2 = face, 3 = back, 4 = angle
10307	Groove angle
13370	Retract moves rate: True = rapid, false = feed (was 10326) (X)
10327	Retract feed rate
10328	Retract feed rate type: R = per rev, M = per minute
13240	Finish backoff
13241	Backoff type: 0 = invalid (pre v9.1), 1 = percent of tool width, 2 = distance
PRM_GROOVE_SHAPE	
PRM_GROOVE_ROUGH	
PRM_GROOVE_FINISH	

PRM_GROOVE_SHAPE

10331	Groove width
10332	Groove height
10333	Taper on wall 1
10334	Taper on wall 2
PRM_LATHE_CORNER	
PRM_LATHE_CORNER002	
PRM_LATHE_CORNER003	
PRM_LATHE_CORNER004	
13172	Make groove same width as tool (True/False)

PRM_LATHE_CORNER

10713	Corner definition: true = corner defined, false = none (square)
10335	Type: 0 = square, 1 = radius, 2 = chamfer, 3 = chamfer with radius
10336	Corner radius or top radius on chamfer
10762	Bottom radius on chamfer
10337	Chamfer angle
10339	Corner chamfer: 0 = width, 1 = height
10338	Chamfer width or height

PRM_LATHE_CORNER001

10713	Corner definition: true = corner defined, false = none (square)
10760	Type: 0 = square, 1 = radius, 2 = chamfer, 3 = chamfer with radius
10761	Corner radius or top radius on chamfer
10762	Bottom radius on chamfer
10714	Chamfer angle
10715	Corner chamfer: 0 = width, 1 = height
10716	Chamfer width or height

PRM_LATHE_CORNER002

13026	Corner definition: true = corner defined, false = none (square)
10340	Type: 0 = square, 1 = radius, 2 = chamfer, 3 = chamfer with radius
10341	Corner radius or top radius on chamfer
13027	Bottom radius on chamfer
10342	Chamfer angle
10344	Corner chamfer: 0 = width, 1 = height
10343	Chamfer width or height

PRM_LATHE_CORNER003

13028	Corner definition: true = corner defined, false = none (square)
10345	Type: 0 = square, 1 = radius, 2 = chamfer, 3 = chamfer with radius
10346	Corner radius or top radius on chamfer
13029	Bottom radius on chamfer
10347	Chamfer angle
10349	Corner chamfer: 0 = width, 1 = height
10348	Chamfer width or height

PRM_LATHE_CORNER004

13030	Corner definition: true = corner defined, false = none (square)
10350	Type: 0 = square, 1 = radius, 2 = chamfer, 3 = chamfer with radius
10351	Corner radius or top radius on chamfer
13371	Bottom radius on chamfer (was 13031) (X)
10352	Chamfer angle
10354	Corner chamfer: 0 = width, 1 = height
10353	Chamfer width or height

PRM_GROOVE_ROUGH

13356	Do groove rough (True/False) (was 10308) (X)

13127	Finish current groove before roughing next one (True/ False)
13357	Cut direction:(X) 0 = positive 1 = negative 2 = bi-directional (center start) 3 = chain direction (was 10309)
13358	Step amount (was 10301) (X)
13128	Number of steps across groove
13129	Rough step: 0 = use number of steps 1 = use step 2 = use percent of tool width
13359	Stock to leave in X (was 10302) (X)
13360	Stock to leave in Z (was 10303) (X)
13361	Stock clearance between cuts (was 10310) (X)
10329	Amount of stock on top of groove
13362	Backoff percent of step (was 10311) (X)
13130	Finish each groove after roughing it (True/False)
PRM_LATHE_PECK001	
PRM_GROOVE_DEPTH	
PRM_GROOVE_STEP	
13131	Step percent of tool width

PRM_LATHE_PECK

13347	Use peck parameters (True/False) (was 10702) (X)
10744	Peck type: 0= none, 1 = number, 2 = incremental, 3 = decreasing increment
13355	Peck on first plunge only (True/False) (was 10313) (X)
10316	Depth **(Pre-X)**
10318	Last increment **(Pre-X)**
13348	Peck amount: 'number of pecks' (was 10315) (X)
13349	Peck increment (was 10704) (X)
13350	Final peck increment (was 10706) (X)
10740	Retract type: 0= none, 1 = absolute, 2 = incremental (was 10319)
10742	Retract amount (absolute)
10741	Retract amount (incremental) (was 10320) (X)
10743	Dwell type: 0= none, 1 = all pecks, 2 = last peck
13351	Dwell value (was 10321) (X)
13023	Dwell units: 0 = seconds, 1 = revolutions

PRM_LATHE_PECK001

13352	Use peck parameters (True/False) (was 10312) (X)
10744	Peck type: 0 = none, 1 = number, 2 = incremental, 3 = decreasing increment
13353	Peck on first plunge only (True/False) (was 10313) (X)

13354	Peck amount: ‘number of pecks’ (was 10315) (X)
10316	Peck increment
10318	Last peck increment
10319	Retract type: 0 = none, 1 = absolute, 2 = incremental
10742	Peck incremental amount
13364	Peck retract increment (was 10320) (X)
10743	Dwell type: 0 = none, 1 = all pecks, 2 = last peck
13365	Dwell (was 10321)(X)
13023	Dwell units: 0 = seconds, 1 = revolutions

PRM_LATHE_PECK002

10722	Use peck parameters (True/False)
10723	Peck type: 0= none, 1 = number, 2 = incremental, 3 = decreasing increment
13024	Peck on first plunge only (True/False)
10724	Peck number
10725	Peck increment
10726	Peck last increment
10727	Peck retract type : 0= none, 1 = absolute, 2 = incremental
10728	Peck absolute amount
10729	Peck incremental amount
10731	Peck dwell type: 0 = none, 1 = all pecks, 2 = last peck
10732	Peck dwell
13025	Dwell units: 0 = seconds, 1 = revolutions

PRM_GROOVE_DEPTH

13366	Do groove depth cuts (True/False) (was 10322) (X)
13367	Use depth number/increment: 0 = number, 1 = increment (was 10323) (X)
13368	Depth cut increment (was 10325) (X)
13120	Retract to Stock Clearance: true = incremental, false = absolute
13369	Depth cut number (was 10324) (X)
13372	Zigzag between depth cuts (True/False) (was 13121) (X)

PRM_GROOVE_STEP

13122	Clean up ‘stair steps’ between depths (True/False)
13123	Minimum step size to clean up
13124	Radius to arc on with for step removal cut
13125	Sweep angle to arc on with for step removal cut
13126	Arc onto step cleanup pass (True/False)

PRM_GROOVE_FINISH

10360	Do groove finish (True/False)
10361	Start on positive side (True/False)
10364	Number of finish passes

10365	Finish stepover amount
10366	Stock to leave in X
10367	Stock to leave in Z
13132	Tool back offset number
13133	Use back offset number (True/False)
10370	Multiple passes: true = finish each groove completely, false = finish grooves together
10380	Amount to lengthen 1st cut
13134	Amount of overlap between 1st and 2nd cuts
PRM_LATHE_EE	
13136	Wall backoff: true = overlap is percent of tool width, false = overlap is length

Lathe thread toolpaths

PRM_LTHREAD

10822	Thread name (was 10422) (X)
10823	Allowance name (was 10423) (X)
PRM_THREAD_SHAPE	
PRM_THREAD_CUT	

PRM_THREAD_SHAPE

10819	Thread cut type: 0 = ID, 1 = OD, 2 = face/back (was 10419) (X)
10800	Thread lead: thread/inch (mm) setting returns a negative value, inches (mm)/thread setting returns a positive value (was 10400) (X)
10811	Major diameter (was 10411) (X)
10812	Minor diameter (was 10412) (X)
10813	Start position (was 10413) (X)
10814	End position (was 10414) (X)
10815	Taper angle (was 10415) (X)
10816	Cut side of axis: 0 = positive side, 1 = negative side (Negative X is checked) (was 10816) (X)
10830	Use allowance (True/False) (was 10430) (X)
10817	Major allowance (was 10417) (X)
10818	Minor allowance (was 10418) (X)
10824	Allowance tolerance (was 10424) (X)
10805	Lead angle (was 10405) (X)
10840	Included angle (was 10440) (X)
13195	Diameter at small end (True/False)
13380	Allowance is disabled (True/False) **(new for X3)**

PRM_THREAD_CUT

10809	NC output type: 0 = long hand (G32), 1 = canned (G76), 2 = box (G92) (was 10409) (X)
10801	First cut depth (was 10801) (X)
10802	Last cut depth (was 10402) (X)
10820	Number of starts (was 10420) (X)
10821	Auto compute acceleration clearance (True/False) (was 10421) (X)
10803	Acceleration clearance amount (was 10403) (X)
10831	Units: true = revolutions, false = inches (was 10431) (X)
10832	Clearance above threads between passes (was 10432) (X)
10833	Clearance at to add at end of thread pass (was 10433) (X)
10834	Units: true = revolutions, false = inches (was 10434) (X)
10804	Anticipated pulloff distance (was 10404) (X)

10835	Units: true = revolutions, false = inches (was 10435) (X)
10808	Amount of stock to leave for spring cuts (was 10408) (X)
10807	Number of spring cuts (was 10407) (X)
10810	Feed rate (was 10410) (X)
10837	Number of cuts (was 10437) (X)
10838	Determine cut depths: true = equal depth, false = equal area (was 10438) (X)
10836	Determine cut number: true = number of cuts, false = first cut depth (was 10436) (X)
10839	Tool lead-in angle at start of thread (was 10439) (X)
15554	Multi-start (True/False)
15555	Start closest (True/False)
15556	Start clear last (True/False)

Lathe drill toolpaths

PRM_LDRILL

10500	Drill cycle
10507	First peck increment
10508	Subsequent peck increment
10509	Peck clearance
10510	Retraction distance for chip break
10503	Dwell
10520	Shift value
10117	Drill tip compensation breakthrough amount
10511	Adjust depth per drill tip (True/False)
10519	Drill point in Z
10502	Drill X position
10514	Feed plane (retract value) incremental mode is checked (True/False) **(Pre-X)**
15071	Custom drill cycle parameters
15072	Custom drill cycle parameters
15073	Custom drill cycle parameters
15074	Custom drill cycle parameters
15075	Custom drill cycle parameters
15076	Custom drill cycle parameters
15077	Custom drill cycle parameters
15078	Custom drill cycle parameters
15079	Custom drill cycle parameters
15080	Custom drill cycle parameters
15081	Use custom parameters is checked (True/False)
13169	Clearance height is incremental from stock (True/False)
13170	Retraction height is incremental from stock (True/False)

Lathe face toolpaths

PRM_LATHE_FACE

10603	Do groove roughing (True/False)
10604	Maximum stepover
10606	Do groove finishing (True/False)
10608	Amount of each cut
10607	Number of finish passes
10609	Stock to leave after rough and finish
10614	Lead-in amount
10612	Retract amount
10613	Retract speed: 0 = linear, 1 = rapid
10601	Overcut_amount
10615	Cut from Z axis : true = cut away from center line, false = cut toward center line
PRM_LATHE_EE	

Lathe cutoff toolpaths

PRM_LCUTOFF

13346	'X' tangent point (was 10701) (X)
10711	Cut tool to: 0 = front radius, 1 = back radius
10712	Lead in amount
10750	Retract Radius: 0 = none, 1 = absolute, 2 = incremental
10752	Retract amount, absolute
10751	Retract amount, incremental
PRM_LATHE_PECK	
PRM_LATHE_CORNER001	
PRM_LATHE_EE	
10718	Do clearance cut (True/False)
10719	Clearance amount X
10720	Clearance amount Z
10721	Clearance cut lead in amount
PRM_LATHE_PECK001	
13039	Do canned text (True/False)
PRM_LCUTOFF_CANTXT	
PRM_LCUTOFF_CANTXT002	
PRM_LCUTOFF_CANTXT003	
PRM_LCUTOFF_CANTXT004	
PRM_LCUTOFF_CANTXT005	
PRM_LCUTOFF_CANTXT006	
PRM_LCUTOFF_CANTXT007	
PRM_LCUTOFF_CANTXT008	

PRM_LCUTOFF_CANTXT

13031	Radius to output canned text
13040	Canned text values
13041	Canned text values
13042	Canned text values
13043	Canned text values
13044	Canned text values
13045	Canned text values
13046	Canned text values
13047	Canned text values
13048	Canned text values
13049	Canned text values
13261	Additional canned text values (X)
13262	Additional canned text values (X)
13263	Additional canned text values (X)
13264	Additional canned text values (X)
13265	Additional canned text values (X)
13266	Additional canned text values (X)

13267	Additional canned text values (X)
13268	Additional canned text values (X)
13269	Additional canned text values (X)
13270	Additional canned text values (X)

PRM_LCUTOFF_CANTXT002

13032	Radius to output canned text
13050	Canned text values
13051	Canned text values
13052	Canned text values
13053	Canned text values
13054	Canned text values
13055	Canned text values
13056	Canned text values
13057	Canned text values
13058	Canned text values
13059	Canned text values
13271	Additional canned text values (X)
13272	Additional canned text values (X)
13273	Additional canned text values (X)
13274	Additional canned text values (X)
13275	Additional canned text values (X)
13276	Additional canned text values (X)
13277	Additional canned text values (X)
13278	Additional canned text values (X)
13279	Additional canned text values (X)
13280	Additional canned text values (X)

PRM_LCUTOFF_CANTXT003

13033	Radius to output canned text
13060	Canned text values
13061	Canned text values
13062	Canned text values
13063	Canned text values
13064	Canned text values
13065	Canned text values
13066	Canned text values
13067	Canned text values
13068	Canned text values
13069	Canned text values
13281	Additional canned text values (X)
13282	Additional canned text values (X)
13283	Additional canned text values (X)
13284	Additional canned text values (X)
13285	Additional canned text values (X)

13286	Additional canned text values (X)
13287	Additional canned text values (X)
13288	Additional canned text values (X)
13289	Additional canned text values (X)
13290	Additional canned text values (X)

PRM_LCUTOFF_CANTXT004

13034	Radius to output canned text
13070	Canned text values
13071	Canned text values
13072	Canned text values
13073	Canned text values
13074	Canned text values
13075	Canned text values
13076	Canned text values
13077	Canned text values
13078	Canned text values
13079	Canned text values
13291	Additional canned text values (X)
13292	Additional canned text values (X)
13293	Additional canned text values (X)
13294	Additional canned text values (X)
13295	Additional canned text values (X)
13296	Additional canned text values (X)
13297	Additional canned text values (X)
13298	Additional canned text values (X)
13299	Additional canned text values (X)
13300	Additional canned text values (X)

PRM_LCUTOFF_CANTXT005

13035	Radius to output canned text
13080	Canned text values
13081	Canned text values
13082	Canned text values
13083	Canned text values
13084	Canned text values
13085	Canned text values
13086	Canned text values
13087	Canned text values
13088	Canned text values
13089	Canned text values
13301	Additional canned text values (X)
13302	Additional canned text values (X)
13303	Additional canned text values (X)
13304	Additional canned text values (X)

13305	Additional canned text values (X)
13306	Additional canned text values (X)
13307	Additional canned text values (X)
13308	Additional canned text values (X)
13309	Additional canned text values (X)
13310	Additional canned text values (X)

PRM_LCUTOFF_CANTXT006

13036	Radius to output canned text
13090	Canned text values
13091	Canned text values
13092	Canned text values
13093	Canned text values
13094	Canned text values
13095	Canned text values
13096	Canned text values
13097	Canned text values
13098	Canned text values
13099	Canned text values
13311	Additional canned text values (X)
13312	Additional canned text values (X)
13313	Additional canned text values (X)
13314	Additional canned text values (X)
13315	Additional canned text values (X)
13316	Additional canned text values (X)
13317	Additional canned text values (X)
13318	Additional canned text values (X)
13319	Additional canned text values (X)
13320	Additional canned text values (X)

PRM_LCUTOFF_CANTXT007

13037	Radius to output canned text
13100	Canned text values
13101	Canned text values
13102	Canned text values
13103	Canned text values
13104	Canned text values
13105	Canned text values
13106	Canned text values
13107	Canned text values
13108	Canned text values
13109	Canned text values
13321	Additional canned text values (X)
13322	Additional canned text values (X)
13323	Additional canned text values (X)

13324	Additional canned text values (X)
13325	Additional canned text values (X)
13326	Additional canned text values (X)
13327	Additional canned text values (X)
13328	Additional canned text values (X)
13329	Additional canned text values (X)
13330	Additional canned text values (X)

PRM_LCUTOFF_CANTXT008

13038	Radius to output canned text
13110	Canned text values
13111	Canned text values
13112	Canned text values
13113	Canned text values
13114	Canned text values
13115	Canned text values
13116	Canned text values
13117	Canned text values
13118	Canned text values
13119	Canned text values
13331	Additional canned text values (X)
13332	Additional canned text values (X)
13333	Additional canned text values (X)
13334	Additional canned text values (X)
13335	Additional canned text values (X)
13336	Additional canned text values (X)
13337	Additional canned text values (X)
13338	Additional canned text values (X)
13339	Additional canned text values (X)
13340	Additional canned text values (X)

Lathe canned toolpaths

PRM_LCAN_ROUGH

13139	Change to longhand (True/False)
10214	Direction: 0 = OD, 1= ID, 2 = face, 3 = back
13343	Step amount (was 10200) (X)
10202	Stock to leave in X
10203	Stock to leave in Z
13345	Stepover amount (was 10205) (X)
PRM_LATHE_EE	
10201	Overlap
13164	Entry Amount
PRM_LATHE_PLUNGE	
13239	Plunge cutting: true = profile has an undercut (relief) condition, false = ignore undercut areas

PRM_LCAN_FINISH

13121	Operation that contains profile
13141	Not used
13142	Change to longhand (True/False)
13143	Not used
13144	Not used
13145	Linearization tolerance
PRM_LATHE_EE	
13203	Unique subprogram number (was 13165) (X)
13239	Plunge cutting: true = profile has an undercut (relief) condition, false = ignore undercut areas

PRM_LCAN_PATTERN

13147	Output longhand (True/False) (Not used)
13148	Change to longhand (True/False)
13341	Number of passes (was 10100) (X)
10101	Stepover
10102	Stock to leave in X
10103	Stock to leave in Z
13149	Pattern offset angle (in radians)
13342	Linearization tolerance (was 10104) (X)
PRM_LATHE_EE	

Lathe misc ops

PRM_LSTOCK_XFER

13205	Active spindle for stock transfer
13206	Z coordinate on stock to be transferred
13207	Previous Z coordinate on stock to be transferred
13208	Use stock BACK face as init Z position (True/False)
13209	Z coordinate on transferred stock
13210	Source chuck reference position before transfer
13211	Source chuck reference position before transfer
13212	Source chuck reference position after transfer
13213	Source chuck reference position after transfer
13214	Destination chuck reference position before transfer
13215	Destination chuck reference position before transfer
13216	Destination chuck pickoff position
13217	Destination chuck pickoff position
13218	Get final (Lathe) X coordinate from stock (True/False)
13219	Move Cplane origin to new stock position (True/False)
13220	Move Tplane origin to new stock position (True/False)
13221	Transfer geometry also (True/False)
13222	Level to store transferred geometry on
13223	Offset from source geometry level for transferred geometry
13224	Use geolevel (as opposed entity level) (True/False)
13225	Blank original geometry (True/False)
13226	Entity with list of transferred entity IDs
13227	Entity with list of original entity IDs
OP_MISC	Custom real / integer parameters

PRM_LSTOCK_FLIP

13205	Active spindle for stock to flip
13206	Z coordinate on stock before flip
13207	Previous Z coordinate on stock
13209	Z coordinate on stock after flip
13210	Chuck reference position before flip
13211	Chuck reference position before flip
13212	Chuck reference position after flip
13213	Chuck reference position after flip
13219	Move Cplane origin to new stock position (True/False)
13220	Move Tplane origin to new stock position (True/False)
13221	Transfer geometry also during flip (True/False)
13222	Level to store transferred geometry on
13223	Offset from source geometry level for transferred geometry
13224	Use geolevel [param: 13222] (as opposed entity level)

13225	Blank original geometry (True/False)
13226	Entity with list of transferred geometry entity IDs
13227	Entity with list of original geometry entity IDs
OP_MISC	Custom real / integer parameters

PRM_LBARFEED

13205	Active spindle for stock to barfeed
13206	Z coordinate on stock before barfeed
13207	Previous Z coordinate on stock
13208	Get initial Z position from stock face (True/False)
13209	Z coordinate on stock after barfeed
13210	Chuck reference position before barfeed
13211	Chuck reference position before barfeed
13212	Chuck reference position after barfeed
13213	Chuck reference position after barfeed
13228	Use chuck positions (True/False)
13219	Move Cplane origin to new stock position (True/False)
13220	Move Tplane origin to new stock position (True/False)
13221	Transfer geometry also during barfeed (True/False)
13222	Level to store transferred geometry on
13223	Offset from source geometry level for xfer'd geometry
13224	Use geolevel [param: 13222](as opposed entity level)
13225	Blank original geometry (True/False)
13226	Entity with list of transferred entity id's
13227	Entity with list of original entity id's
13229	Operation type: 0= bar feed, 1 = bar feed with tool as stop, 2 = bar pull
13230	Stock clearance for bar pull
13231	Grip length for bar pull
13232	Use plunge feed rate for approaching stock (True/False)
OP_MISC	Custom real / integer parameters
13233	Tool X position for stop, bar puller

PRM_LCHUCK_CLAMP

13205	Active spindle for chuck
13229	Operation type: 0 = clamp, 1 = un-clamp, 2 = reposition
13210	Initial chuck reference position
13211	Initial chuck reference position
13212	Final chuck reference position
13213	Final chuck reference position
OP_MISC	Custom real / integer parameters

PRM_LTAILSTOCK

13234	Operation: true = engage, false = retract
13235	Initial tailstock reference position

13236	Final tailstock reference position
13237	Is initial / final position based on stock position (True/False)
13238	Is initial position based on tailstock minimum point (True/False)
OP_MISC	Custom real / integer parameters

PRM_LSTEADYREST

13235	Initial steadyrest reference position (Z)
13236	Initial steadyrest reference position (Z)
OP_MISC	Custom real / integer parameters

Lathe multi-tasking

PRM_PINCH_TURN

13246	ID of source roughing op **(new for X3)**
13247	Dwell (seconds) at start of second cut **(new for X3)**
13248	Turret which takes first cut: 0=upper or 1=lower **(new for X3)**
13249	Type of dwell at start of second cut: time (see 13247), number of revolutions (see 13278), or distance (see 13279) **(new for X3)**
13376	0=Pinch turn or 1=Balance turn? **(new for X3)**
13377	Sync first pass only, or every pass **(new for X3)**
13378	Number of revolutions for dwell **(new for X3)**
13379	Distance amount for dwell **(new for X3)**
13381	Double feed rate? (y/n) **(new for X3)**

PRM_CUSTOM_OP

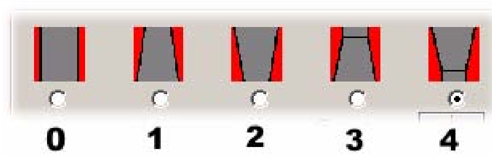
13250	0=custom, 1+ = defined by the post
13251	True = reference misc op, False = primary misc op
13252	*(Removed in X3)*
13253	*(Removed in X3)*
13254	*(Removed in X3)*
13255	*(Removed in X3)*
13256	*(Removed in X3)*
13257	*(Removed in X3)*
13258	*(Removed in X3)*
13259	*(Removed in X3)*
13260	Entity idn of start of event list
13373	Custom op icon name **(X2)**
13374	True = custom op events cannot be added **(X2)**

Introduced in X as PRM_MISC_OP; renamed to PRM_CUSTOM_OP for X2

Wire contour

PRM_WIRE_CONTOUR

PRM_WIRE_COMMON	
10071	Infinite look-ahead is enabled (True/False)
14074	Taper active (True/False)
10055	Initial taper angle. Note: Positive or 0
14030	Taper direction: 0 = left, 1 = right
14031	Taper: 0=no cancel, 1=cancel after, 2=apply after
14032	Pass number to apply/cancel taper on
14033	CW corner type : 0 = Conical 1 = Sharp 2 = Constant 3 = Other 4 = Fixed 5 = FishTail
14034	CW corner radius - if corner type fixed
14035	CCW corner type: 0 = Conical 1 = Sharp 2 = Constant 3 = Other 4 = Fixed 5 = FishTail
14036	CCW corner radius - if corner type = fixed
14037	CW UV arc type
14038	CW UV arc radius - if uv arc type = fixed
14039	CCW UV arc type
14040	CCW UV arc radius - if uv arc type = fixed
PRM_WIRE_EE	
PRM_WIRE_EE002	
14154	Apply max lead length to final skim pass (True/False) (was 10714) (X)
14153	Allow program to change cut position with tabs (True/False) (was 10713) (X)
14137	Lead in comes from inside closed coutour (True/False) (was 10115) (X)
10300	Skim cut method: 0 = one-way, 1 = reverse (was 10100) (X)
14041	Lead in comes from left of open coutour (True/False)
14132	Tab width (was 10108) (X)
14078	Distance from start of chain to thread
14130	Number of rough skim cuts (was 10104) (X)

14133	Number of tab cuts (was 10110) (X)
14134	Number of finish cuts - together (was 10111) (X)
14135	Number of finish cuts - separate (was 10112) (X)
14042	Cut order: 0 = all cuts together, 1 = tabs and finish together 2 = rough, tab and finish separtely
14043	Use special entry/exit to prevent part drop out (True/False)
10072	Reset starting power setting number for tab cut (True/False)
14136	Output tab with last rough cut (True/False) (was 10113) (X)
10114	Output tab as: true = glue stop, false = stop point
14044	Output subprogram labels (True/False)
14045	Subprogram output mode: true = incremental, false = absolute
14138	Multiple contours use same subprogram (True/False) (was 10116) (X)
PRM_CHAIN_SORT	(X)
14075	Contour was created as a NoCore finish contour (True/False)
14076	Expand this operation (True/False)
14077	This operation was created by expanding (True/False)
14079	Apply thread distance (old **`tab_height`**) (True/False)
14105	Contour type:  0 = No taper 1 = Taper IN 2 = Taper OUT 3 = Land UP 4 = Land DOWN
14106	Chain Height position: 0 = XY height 1 = Land height 2 = UV height
14107	Land height (XY extension)
14108	Land height: true = incremental, false = absolute
14109	Generate stop: 0 = always, 1 = first only, 2 = never
14110	Use sub offset (True/False)
14111	Sub offset
PRM_WIRE_TAB	
PRM_WIRE_EE003	finish passes entry/exit info
14112	‘Perform rough cut’ option is checked (True/False)
14113	‘Tab’ cut option is checked (True/False)
14114	‘Skim cuts after tab’ option is checked (True/False)

PRM_WIRE_TAB

14092	Automatically calculate tab positions (True/False)
14093	Number of tabs (for auto tab)
14094	Tab point: (0 = start, 1 = midpoint, 2 = end) of tab
14095	Use advanced auto tab positioning (True/False)
14096	Use points on chain for start and tab positions (True/False)
14097	Minimum distance from endpoint
14098	Minimum distance between tabs
14099	Minimum distance from sharp corner
14100	Sharp corner angle
14101	X dimension of maximum size shape to tab
14102	Y dimension of maximum size shape to tab
14103	Tab all shapes (True/False)
14104	Overwrite tab edit (True/False)

Wire canned cycles

PRM_WCAN_CYCLE

PRM_WIRE_COMMON	
10400	Drill cycle
10401	Initial height
10402	Reference height
10403	Absolute height
10404	First peck increment
10405	Other peck increment
10406	Peck clearance
10409	Retract distance (was 10407) (X)
10408	Dwell
15071	Custom drill cycle parameters
15072	Custom drill cycle parameters
15073	Custom drill cycle parameters
15074	Custom drill cycle parameters
15075	Custom drill cycle parameters
15076	Custom drill cycle parameters
15077	Custom drill cycle parameters
15078	Custom drill cycle parameters
15079	Custom drill cycle parameters
15080	Custom drill cycle parameters
15081	Use custom parameters is checked (True/False)

Nocore wirepaths

PRM_WIRE_NOCORE

PRM_WIRE_COMMON	**(new for X3)**
10053	Auto entry - go from start to thread to pocket start (True/False)
10054	Auto exit - go to cut position afterward (True/False)
PRM_WIRE_EE	
14154	Apply max lead length to final skimpass (True/False) (was 10714) (X)
14153	Allow progr10713am to change cut position with tabs (True/False) (was) (X)
10208	Cutting method: 0 = zigzag, 1 = one way, etc. (was 10200) (X)
10217	Stepover percentage
14046	Roughing step size
14139	Roughing angle (was 10203) (X)
14140	Roughing direction : 0 = CW, 1 = CCW (was 10216) (X)
14047	Finishing enabled (True/False)
10206	Number of finish passes
10207	Finish pass step size
10212	Move to closest boundary point for finish (True/False)
14159	Output finish passes with rough pass (True/False) (was 14078) (X)
10211	Compensation for finish passes
14044	Output subprogram labels (True/False)
14045	Subprogram output mode: true = incremental, false = absolute
14138	Multiple contours use same subprogram (True/False) (was 10116) (X)
PRM_CHAIN_SORT	(X)
14160	Minimize tool burial (True/False) (was 14079) (X)
14161	Create additional finish contour operation (True/False) (was 14080) (X)
14110	Use sub offset (True/False)
14111	Sub offset

Point wirepaths

PRM_WIRE_POINT

PRM_WIRE_COMMON | **(new for X3)**

4axis wirepaths

PRM_WIRE_4AXIS

PRM_WIRE_COMMON	**(new for X3)**
10071	Infinite look-ahead is enabled (True/False)
14127	4axis step size (if sync = NONE) (was 10023) (X)
10303	Old common trim_plane1
10309	4axis cutting method: 0 = taper, 1 = direct
PRM_WIRE_EE	
PRM_WIRE_EE002	
14154	Apply max lead length to final skim pass (True/False) (was 10714) (X)
14153	Allow program to change cut position with tabs (True/False) (was 10713) (X)
14137	Lead in comes from inside closed contour (True/False) (was 10115) (X)
10300	Skim cut method: 0 = one-way, 1 = reverse
14041	Lead in comes from left of open contour (True/False)
14157	Tab width (was 10313) (X)
14078	Distance from start of chain to thread
10308	Number of rough skim cuts
14133	Number of tab cuts (was 10314) (X)
14134	Number of finish cuts - together (was 10315) (X)
14135	Number of finish cuts - separate (Unused) (was 10112) (X)
14042	Unused for now in 4-axis
14043	Use special entry/exit to prevent part dropout (True/False)
10072	Reset starting power setting number for tab cut (True/False)
14136	Output tab with last rough cut (True/False) (was 10316) (X)
10317	Output tab as: true = glue stop, false = stop point
14048	Sync option setting: 0 = None 1 = By entity 2 = By Branch 3 = By node 4 = By point 5 = Manual 6 = Manual/density
14044	Output subprogram labels (True/False)
14045	Subprogram output mode: true = incremental, false = absolute
14138	Multiple contours use same subprogram (True/False) (was 10116) (X)
14079	Apply thread distance (old `tab_height`) (True/False)
14109	Generate stop: 0 = always, 1 = first only, 2 = never

14110	Use sub offset (True/False)
14111	Sub offset
PRM_WIRE_TAB	
PRM_WIRE_EE003	
14112	Rough on (True/False)
14113	Tab on (True/False)
14114	Finish on (True/False)

Wire toolpaths, common settings

PRM_WIRE_COMMON

14000	Starting pass number
14001	Power setting library entitiy ID #
14065	Power setting library entitiy ID #
14049	*Pointer to power setting library entity (removed for X3)*
14066	*Pointer to power setting library entity (removed for X3)*
14067	Use miscellaneous integers/reals (True/False)
14068	Multipass miscellaneous integers and reals entitiy ID #
14069	*Pointer to multipass miscellaneous integers/reals entity (removed for X3)*
14155	UV extension (was 10311) (X)
14002	UV extension: true = incremental, false = absolute
14131	UV trim plane (was 10106) (X)
14003	UV trim plane: true = incremental, false = absolute
10201	UV height (was 10101) (X)
14004	True = UV height incremental, false = absolute
14129	XY height (was 10102) (X)
14005	XY height: true = incremental, false = absolute
10306	XY trim plane (was 10107) (X)
14006	XY trim plane: true = incremental, false = absolute
14156	XY extension (was 10312) (X)
14007	XY extension: true = incremental, false = absolute
10050	Wire on (True/False)
10051	Power on (True/False)
14126	Flush: 0 = off, 1 = on, 2 = other (was 10022) (X)
14070	Tank: 0 = empty, 1 = fill
11052	Start wirepath at thread position (True = 'Auto start position' is ON)
14128	Linearization tolerance (was 10024) (X)
14008	Thread position (X coordinate)
14009	Thread position (Y coordinate)
14010	Thread position (Z coordinate)
14011	Cut position (X coordinate)
14012	Cut position (Y coordinate)
14013	Cut position (Z coordinate)
14014	Second (UV) thread position (X coordinate) - future
14015	Second (UV) thread position (Y coordinate)- future
14016	Second (UV) thread position (Z coordinate)- future
14017	Second cut position (X coordinate) - future
14018	Second cut position (Y coordinate) - future
14029	Second cut position (Z coordinate) - future
14020	Start position (X coordinate)

14021	Start position (Y coordinate)
14022	Start position (Z coordinate)
14023	Work origin (X coordinate)
14024	Work origin (Y coordinate)
14025	Work origin (Z coordinate)
14080	Use UV thread position (True/False)
14081	UV thread cut flag: 0 = not used, 1 = thread, 2 = cut, 3 = both
14082	Rapid height
14083	Rapid height: true = incremental, false = absolute
14084	Use rapid height (True/False)
14085	Use UV extension (True/False)
10486	Use UV trim plane(True/False)
14087	Use XY trim plane (True/False)
14088	Use XY extension (True/False)
14089	Suppress thread (True/False)
14090	Suppress cut (True/False)
14177	Newly created? **(new for X3)**
14178	Machine offset **(new for X3)**

PRM_WIRE_COMMON001
(*this entire group removed for X3)*

PRM_WIRE_COMMON002
(*this entire group removed for X3)*

PRM_WIRE_EE

14141	Lead in: N = none, A = arc, L = line (was 10700) (X)
14142	Lead out: N = none, A = arc, L = line (was 10701) (X)
14143	Radius of entry / exit arc (was 10702) (X)
14144	Sweep angle of entry / exit arc (in radians) (was 10703) (X)
14026	Apply the value in max lead out length (even if zero) (True/False)
14145	Maximum lead out length (was 10704) (X)
14146	Overlap amount (can be negative for tabs) (was 10705) (X)
14027	Cut wire before leaving contour (True/False)
14162	Rapid from thread point
14163	Rapid to cut point
14164	Output stop code before tab
14165	Output stop code after tab
14166	Rapid to start position at end of program

PRM_WIRE_EE002

14147	Lead in: N = none, A = arc, L = line (was 10707) (X)
14148	Lead out: N = none, A = arc, L = line (was 10708) (X)
14149	Radius of entry arc (was 10709) (X)
14150	Sweep angle of entry arc (in radians) (was 10710) (X)
14028	Apply the value in max lead out length (even if 0) (True/False)
14151	Maximum lead out length (was 10711) (X)
14152	Overlap amount (can be negative for tabs) (was 10712) (X)
14158	Cut wire before leaving contour (True/False) (was 14029) (X)
14167	Rapid from thread point
14168	Rapid to cut point
14169	Output stop code before tab
14170	Output stop code after tab
14171	Rapid to start position at end of program

PRM_WIRE_EE003

14116	Lead in: N = none, A = arc, L = line
14117	Lead out: N = none, A = arc, L = line
14118	Radius of exit arc
14119	Sweep angle of exit arc (in radians)
14120	Apply the value in max lead out length (even if 0) (True/False)
14121	Maximum lead out length
14122	Overlap amount (can be negative for tabs)
14123	Cut wire before leaving contour (True/False)
14172	Rapid from thread point
14173	Rapid to cut point
14174	Output stop code before tab
14175	Output stop code after tab
14176	Rapid to start position at end of program

Machine definition parameters

The parameters in this section generally correspond to the annotated screen captures in **Machine definition pages** starting on page 19.

General machine information

CNC_MACHINE_TYPE

17001	Machine type (mill / lathe)
17002	Is this a VTL? (lathe only)
17003	Default lathe WCS (None/Top/LatheZ=WorldZ)
MULTIAX_MOTION_TYPE	Multi-axis motion control
MACHINE_DYNAMICS_TYPE	Machine dynamics information for high-feed machining and operation timing calculations
AXIS_FEEDRATE_TYPE004	Global machine axis feedrates
AXIS_FEEDRATE_TYPE005	Global machine axis feedrates
17920	Maximum linear feedrate (inch) **(New for X3)**
17921	Maximum linear feedrate (mm) **(New for X3)**
17922	Maximum rotary feedrate **(New for X3)**
17004	Use machine feed/min, feed/rev
17005	Use machine deg/min
17006	*Use machine inverse time values (removed for X3)*
AXIS_FEEDRATE_TYPE006	Toolpath operation feedrate limits - inch, mm deg/min & inverse time are not used...
AXIS_FEEDRATE_TYPE007	Toolpath operation feedrate limits - inch, mm deg/min & inverse time are not used...
COOLANT_TYPE	Coolant
17007	Control definition file
17008	Post-processor file
17009	Tool library files (inch), doctored
17010	Tool library files (mm), doctored
17011	Material library file (inch, -9999, mm)
17012	Comment to describe the machine
17013	Name of tool bar state to load with machine
17014	Use the toolbar state (True/False)
17015	Entity ID number for the cnc machine entity (this one!)
17016	Entity ID number of related control definition
17017	*Entity ID number of machine base component entity (removed for X3)*
17018	Entity ID number of 1st component group entity
17019	Entity ID number of 1st machine reference position
17020	Entity ID number of list of axis combination entities
17021	Entity ID number of list of machining modes

17675	Insert catalog file
17676	Insert catalog file
17677	Holder catalog file
17678	Holder catalog file
17703	Maximum wire taper angle (degrees)
General component information	Default construction plane
17814	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces. Each one has its own parameter ID.
17815	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17816	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17817	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17818	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17819	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17820	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17821	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17822	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17823	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17824	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17825	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17826	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17827	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17828	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.

17829	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17830	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17831	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17832	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17833	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17834	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17835	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17836	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17837	A segment of the unique identifier for this machine. This is a 192-bit number broken up into 24 pieces, 17814–17837.
17839	True = machine supports RTCP (rotation tool center point) programming
17913	Switch to automatically load tools **(new for X3)**
17914	Machine version **(new for X3)**

MACHINE_POSITION

17599	Name: used to identify tool changer and machine reference positions
17600	Data source: USER_DEFINED, etc. vs. MACHINE_REF_POS
17601	Control definition reference return code (G28, etc.) index
AXIS_POSITIONS	User positions for each of the axes
17602	Machine reference position list index
ENT_IDN_TYPE	ent_idns of this and related entities in database

MULTIAX_MOTION_TYPE

17022	Break combined rotary axis motion (True/False)
17023	Maximum combined angle before break is required

AXIS_POSITIONS

AXIS_COORD	X axis motion
AXIS_COORD001	Y axis motion
AXIS_COORD002	Z axis motion

AXIS_COORD003	A axis motion
AXIS_COORD004	B axis motion
AXIS_COORD005	C axis motion

ENT_IDN_TYPE

17253	This entity
17254	Next sibling entity
17255	Previous sibling entity
17256	1st child entity

ENT_IDN_TYPE001

17257	This entity
17258	Next sibling entity
17259	Previous sibling entity
17260	1st child entity

ENT_IDN_TYPE002

17261	This entity
17262	Next sibling entity
17263	Previous sibling entity
17264	1st child entity

ENT_IDN_TYPE003

17265	This entity
17266	Next sibling entity
17267	Previous sibling entity
17268	1st child entity

AXIS_COORD

17603	X coordinate value
17604	Type: ABS_TOOL_COORD, INC_TOOL_COORD, etc.

AXIS_COORD001

17936	Y coordinate value
17937	Type: ABS_TOOL_COORD, INC_TOOL_COORD, etc.

AXIS_COORD002

17938	Z coordinate value
17939	Type: ABS_TOOL_COORD, INC_TOOL_COORD, etc.

AXIS_COORD003

17940	A coordinate value
17941	Type: ABS_TOOL_COORD, INC_TOOL_COORD, etc.

AXIS_COORD004

17942	B coordinate value
17943	Type: ABS_TOOL_COORD, INC_TOOL_COORD, etc.

AXIS_COORD005

17944	C coordinate value
17945	Type: ABS_TOOL_COORD, INC_TOOL_COORD, etc.

GROUP_VIEW

17704	View ID number **(X2)**
17705	View number **(X2)**
17706	Lathe Cplane coordinate **(X2)**
17707	Toolplane view matrix **(X2)**
17708	Toolplane view matrix **(X2)**
17709	Toolplane view matrix **(X2)**
17710	Toolplane view matrix **(X2)**
17711	Toolplane view matrix **(X2)**
17712	Toolplane view matrix **(X2)**
17713	Toolplane view matrix **(X2)**
17714	Toolplane view matrix **(X2)**
17715	Toolplane view matrix **(X2)**
17716	View origin in world **(X2)**
17717	View origin in world **(X2)**
17718	View origin in world **(X2)**

Machine dynamics

MACHINE_DYNAMICS_TYPE
Parameters taken from HighFeed:

17024	Maximum change in feedrate to recombine segments (%)
17025	Look-ahead as a percentage of tool diameter
17026	Maximum feedrate change per block (inch/min)
17027	Maximum feedrate change per block (mm/min)
17029	Segment length as % of tool diameter
17030	Minimum change in direction to slow down to min_corner_fr
17031	Feedrate to slow down to at sharp corners (inch/min)
17032	Feedrate to slow down to at sharp corners (mm/min)
17033	Test diameter
17034	Cornering acceleration

Group dynamic information, NOT from HighFeed

17035	Timing increment for MT sync-list (Future Use)
17036	Machine motion acceleration value (in/min^2)
17037	Machine motion acceleration value (mm/min^2)

Axis feedrate limits

There are 8 groups of parameters. Each group has the same parameters, but each group is applied to a different area. Most of these groups have been removed from Mastercam X3. These are included only for reference for your older posts. Only the last two are still used

Table 1: Parameter groups for axis feedrate limits

Where used	Parameter group name
Linear axis properties (inch)	*AXIS_FEEDRATE_TYPE (removed for X3)*
Linear axis properties (mm)	*AXIS_FEEDRATE_TYPE001 (removed for X3)*
Rotary axis properties (inch)	*AXIS_FEEDRATE_TYPE002 (removed for X3)*
Rotary axis properties (mm)	*AXIS_FEEDRATE_TYPE003 (removed for X3)*
Machine axis feedrate limits (inch)	*AXIS_FEEDRATE_TYPE004 (removed for X3)*
Machine axis feedrate limits (mm)	*AXIS_FEEDRATE_TYPE005 (removed for X3)*
Operation feedrate limits (inch)	**AXIS_FEEDRATE_TYPE006**
Operation feedrate limits (mm)	**AXIS_FEEDRATE_TYPE007**

AXIS_FEEDRATE_TYPE

17642	*Minimum feed per minute (entire group removed for X3)*
17643	*Maximium feed per minute*
17644	*Minimum feed per revolution*
17645	*Maximium feed per revolution*
17646	*Minimum inverse feed rate*
17647	*Maximum inverse feed rate*
17648	*Minimum degrees per minute*
17649	*Maximum degrees per minute*

AXIS_FEEDRATE_TYPE001

17650	*Minimum feed per minute (entire group removed for X3)*
17651	*Maximium feed per minute*
17652	*Minimum feed per revolution*
17653	*Maximium feed per revolution*
17654	*Minimum inverse feed rate*
17655	*Maximum inverse feed rate*
17656	*Minimum degrees per minute*
17657	*Maximum degrees per minute*

AXIS_FEEDRATE_TYPE002

17658	*Minimum feed per minute (entire group removed for X3)*
17659	*Maximium feed per minute*
17660	*Minimum feed per revolution*
17661	*Maximium feed per revolution*

17662	*Minimum inverse feed rate*
17663	*Maximum inverse feed rate*
17664	*Minimum degrees per minute*
17665	*Maximum degrees per minute*

AXIS_FEEDRATE_TYPE003

17666	*Minimum feed per minute* *(entire group removed for X3)*
17667	*Maximium feed per minute*
17668	*Minimum feed per revolution*
17669	*Maximium feed per revolution*
17670	*Minimum inverse feed rate*
17671	*Maximum inverse feed rate*
17672	*Minimum degrees per minute*
17673	*Maximum degrees per minute*

AXIS_FEEDRATE_TYPE004

17038	*Minimum feed per minute* *(entire group removed for X3)*
17039	*Maximium feed per minute*
17040	*Minimum feed per revolution*
17041	*Maximium feed per revolution*
17042	*Minimum inverse feed rate*
17043	*Maximum inverse feed rate*
17044	*Minimum degrees per minute*
17045	*Maximum degrees per minute*

AXIS_FEEDRATE_TYPE005

17046	*Minimum feed per minute* *(entire group removed for X3)*
17047	*Maximium feed per minute*
17048	*Minimum feed per revolution*
17049	*Maximium feed per revolution*
17050	*Minimum inverse feed rate*
17051	*Maximum inverse feed rate*
17052	*Minimum degrees per minute*
17053	*Maximum degrees per minute*

AXIS_FEEDRATE_TYPE006

17054	Minimum feed per minute
17055	Maximium feed per minute
17056	Minimum feed per revolution
17057	Maximium feed per revolution
17058	Minimum inverse feed rate
17059	Maximum inverse feed rate
17060	Minimum degrees per minute
17061	Maximum degrees per minute

AXIS_FEEDRATE_TYPE007

17062	Minimum feed per minute
17063	Maximium feed per minute
17064	Minimum feed per revolution
17065	Maximium feed per revolution
17066	Minimum inverse feed rate
17067	Maximum inverse feed rate
17068	Minimum degrees per minute
17069	Maximum degrees per minute

Axis combination info

AXIS_COMBO

17683	Entity ID of axis combination **(New for X3)**
17684	ID of first component in axis combo (closest to base) **(New for X3)**
17685	ID of next component in axis combo. **(New for X3)**
17686	ID of next component in axis combo. **(New for X3)**
17687	ID of next component in axis combo. **(New for X3)**
17688	ID of next component in axis combo. **(New for X3)**
17689	ID of next component in axis combo. **(New for X3)**
17690	ID of next component in axis combo. **(New for X3)**
17691	ID of next component in axis combo. **(New for X3)**
17692	ID of next component in axis combo. **(New for X3)**
17693	ID of next component in axis combo. **(New for X3)**
17694	ID of next component in axis combo. **(New for X3)**
17695	ID of next component in axis combo. **(New for X3)**
17696	Axis combination user description **(New for X3)**

General component information

Component header

19958	Component type (numeric) **(New for X3)**
19959	Component ID (numeric) **(New for X3)**
19960	Component type (string) **(New for X3)**

MACHINE_COMPONENT_TYPE

17201	Component name
17202	Component group id
17203	Type of component (machine base, chuck, turret, etc)
17204	Color to draw component
17205	Minimum linear/rotational travel limits (in(mm)/rad) **Deleted in X2**
17206	Maximum linear/rotational travel limits (in(mm)/rad) **Deleted in X2**
17207	Reference point on component in world coordinates
17208	Reference point on component in world coordinates
17209	Reference point on component in world coordinates
17210	Point on component which is actually positioned in the NC program (world coordinates)
17211	Point on component which is actually positioned in the NC program (world coordinates)
17212	Point on component which is actually positioned in the NC program (world coordinates)
17213	Position of reference point with component on machine at initial position in world coordinates
17214	Position of reference point with component on machine at initial position in world coordinates
17215	Position of reference point with component on machine at initial position in world coordinates
17216	Transformation matrix to put component on machine at initial position
17217	Transformation matrix to put component on machine at initial position
17218	Transformation matrix to put component on machine at initial position
17219	Transformation matrix to put component on machine at initial position
17220	Transformation matrix to put component on machine at initial position
17221	Transformation matrix to put component on machine at initial position
17222	Transformation matrix to put component on machine at initial position
17223	Transformation matrix to put component on machine at initial position
17224	Transformation matrix to put component on machine at initial position

17225	Transformation matrix to put component at current NC position = initXform initially
17226	Transformation matrix to put component at current NC position = initXform initially
17227	Transformation matrix to put component at current NC position = initXform initially
17228	Transformation matrix to put component at current NC position = initXform initially
17229	Transformation matrix to put component at current NC position = initXform initially
17230	Transformation matrix to put component at current NC position = initXform initially
17231	Transformation matrix to put component at current NC position = initXform initially
17232	Transformation matrix to put component at current NC position = initXform initially
17233	Transformation matrix to put component at current NC position = initXform initially
17234	Current position of anchorPt (world coordinates) = anchorPt at start of program most of the time...
17235	Current position of anchorPt (world coordinates) = anchorPt at start of program most of the time...
17236	Current position of anchorPt (world coordinates) = anchorPt at start of program most of the time...
17764	Chord tolerance for MachineWorks polygons. **(X2)**
17765	Transparency setting. **(X2)**
17766	String ID for the component. This is unique for each component. Example: **`69D20EEB-02E7-11DC-B46A-444553544200`** **(new for X3)**
17767–17788	*A segment of the unique component group identifier. This is a 192-bit number broken up into 24 pieces. (removed for X3)*
ENT_IDN_TYPE001	
17237	Entity id number of owner machine
17451	Don't show this component in simulation (True/False)
17238	Component is expanded state in dialogs: bit 0 - MDM dialog bit 1 - axis combination dialog remaining bits -> future expansion (Turret Mgr, etc)
17239	Type of geometry used to define the component
SOLID_COMPONENT	**(X3)**
BLOCK_COMPONENT	**(X3)**
CYLINDER_COMPONENT	**(X3)**
EXTRUDED_COMPONENT	**(X3)**
REVOLVED_COMPONENT	**(X3)**
STOCK_COMPONENT_TYPE	**(X3)**
MISC_COMPONENT_TYPE	(for future use)
MACHINE_BASE_COMPONENT_TYPE	(for future use)

LINEAR_AXIS_COMPONENT_TYPE	**(X3)**
ROTARY_AXIS_COMPONENT_TYPE	**(X3)**
RECT_TABLE_COMPONENT_TYPE	(for future use)
ROUND_TABLE_COMPONENT_TYPE	(for future use)
WIRE_TABLE_COMPONENT_TYPE	(for future use)
VISE_JAW_COMPONENT_TYPE	(for future use)
VISE_COMPONENT_TYPE	(for future use)
CHUCKJAWS_COMPONENT_TYPE	**(X3)** Renamed from CHUCK_JAW_COMPONENT_TYPE **(X2)**
CHUCK_COMPONENT_TYPE	**(X3)**
COLLET_COMPONENT_TYPE	**(X3)**
GUIDE_BUSHING_COMPONENT_TYPE	(for future use)
LATHE_CENTER_COMPONENT_TYPE	**(X3)** Renamed from TAILSTOCK_CENTER_COMPONENT_TYPE **(X2)**
TAILSTOCK_COMPONENT_TYPE	**(X3)**
STEADYREST_COMPONENT_TYPE	**(X3)**
TOOL_COMPONENT_TYPE	**(X3)**
WIRE_UPPER_GUIDE_COMPONENT_TYPE	**(X3)**
WIRE_LOWER_GUIDE_COMPONENT_TYPE	**(X3)**
DRILL_BLOCK_STATION_COMPONENT_TYPE	**(X3) [Review]**
MULTI_HEAD_COMPONENT_TYPE	
MH_PIGGYBACK_COMPONENT_TYPE	
ATC_COMPONENT_TYPE	
TOOL_SPINDLE_COMPONENT_TYPE	
TURRET_COMPONENT_TYPE	
MULTI_TOOL_COMPONENT_TYPE	(Future Use)

COMPONENT_GROUP_TYPE

17789–17812	*A segment of the unique component group identifier. This is a 192-bit number broken up into 24 pieces. (no longer used)*

Solid geometry properties

SOLID_COMPONENT

17268	Entity ID of solid **(new for X3)**
17269	Solid geometry file **(new for X3)**
17270	STL file for solid **(new for X3)**

SOLID_COMPONENT_01

17271	Entity ID of solid **(new for X3)**
17272	Solid geometry file **(new for X3)**
17273	STL file for solid **(new for X3)**

SOLID_COMPONENT_02

17274	Entity ID of solid **(new for X3)**
17275	Solid geometry file **(new for X3)**
17276	STL file for solid **(new for X3)**

Block geometry properties

BLOCK_COMPONENT

17277	Length of block **(new for X3)**
17278	Width of block **(new for X3)**
17279	Height of block **(new for X3)**
17280	Base point (X) **(new for X3)**
17281	Base point (Y) **(new for X3)**
17282	Base point (Z) **(new for X3)**

BLOCK_COMPONENT_01

17283	Length **(new for X3)**
17284	Width **(new for X3)**
17285	Height **(new for X3)**
17286	Base point (X) **(new for X3)**
17287	Base point (Y) **(new for X3)**)
17288	Base point (Z) **(new for X3)**)

BLOCK_COMPONENT_02

17289	Length **(new for X3)**
17290	Width **(new for X3)**
17291	Height **(new for X3)**
17292	Base point (X) **(new for X3)**
17293	Base point (Y) **(new for X3)**
17294	Base point (Z) **(new for X3)**

Cylinder geometry properties

CYLINDER_COMPONENT

17295	Outer radius of cylinder (Note: This is a radius value, but the entry field on the dialog box is a diameter value.) **(new for X3)**
17296	Length of cylinder **(new for X3)**
17297	Axis orientation vector (X) **(new for X3)**
17298	Axis orientation vector (Y) **(new for X3)**
17299	Axis orientation vector (Z) **(new for X3)**
17300	Base point (X) **(new for X3)**
17301	Base point (Y) **(new for X3)**
17302	Base point (Z) **(new for X3)**
17841	Inner radius of cylinder (Note: This is a radius value, but the entry field on the dialog box is a diameter value.) **(new for X3)**

CYLINDER_COMPONENT_01

17303	Outer radius of cylinder (Note: This is a radius value, but the entry field on the dialog box is a diameter value.) **(new for X3)**
17304	Length of cylinder **(new for X3)**
17305	Axis orientation vector (X) **(new for X3)**
17306	Axis orientation vector (Y) **(new for X3)**
17307	Axis orientation vector (Z) **(new for X3)**
17308	Base point (X) **(new for X3)**
17309	Base point (Y) **(new for X3)**
17310	Base point (Z) **(new for X3)**
17842	Inner radius of cylinder (Note: This is a radius value, but the entry field on the dialog box is a diameter value.) **(new for X3)**

CYLINDER_COMPONENT_02

17311	Outer radius of cylinder (Note: This is a radius value, but the entry field on the dialog box is a diameter value.) **(new for X3)**
17312	Length of cylinder **(new for X3)**
17313	Axis orientation vector (X) **(new for X3)**
17314	Axis orientation vector (Y) **(new for X3)**
17315	Axis orientation vector (Z) **(new for X3)**
17316	Base point (X) **(new for X3)**
17317	Base point (Y) **(new for X3)**
17318	Base point (Z) **(new for X3)**
17843	Inner radius of cylinder (Note: This is a radius value, but the entry field on the dialog box is a diameter value.) **(new for X3)**

CYLINDER_COMPONENT_03

17319	Outer radius of cylinder (Note: This is a radius value, but the entry field on the dialog box is a diameter value.) **(new for X3)**
17320	Length of cylinder **(new for X3)**
17321	Axis orientation vector (X) **(new for X3)**
17322	Axis orientation vector (Y) **(new for X3)**
17323	Axis orientation vector (Z) **(new for X3)**
17324	Base point (X) **(new for X3)**
17325	Base point (Y) **(new for X3)**
17326	Base point (Z) **(new for X3)**
17844	Inner radius of cylinder (Note: This is a radius value, but the entry field on the dialog box is a diameter value.) **(new for X3)**

CYLINDER_COMPONENT_04

17327	Outer radius of cylinder (Note: This is a radius value, but the entry field on the dialog box is a diameter value.) **(new for X3)**
17328	Length of cylinder **(new for X3)**
17329	Axis orientation vector (X) **(new for X3)**
17330	Axis orientation vector (Y) **(new for X3)**
17331	Axis orientation vector (Z) **(new for X3)**
17332	Base point (X) **(new for X3)**
17333	Base point (Y) **(new for X3)**
17334	Base point (Z) **(new for X3)**
17845	Inner radius of cylinder (Note: This is a radius value, but the entry field on the dialog box is a diameter value.) **(new for X3)**

CYLINDER_COMPONENT_05

17335	Outer radius of cylinder (Note: This is a radius value, but the entry field on the dialog box is a diameter value.) **(new for X3)**
17336	Length of cylinder **(new for X3)**
17337	Axis orientation vector (X) **(new for X3)**
17338	Axis orientation vector (Y) **(new for X3)**
17339	Axis orientation vector (Z) **(new for X3)**
17340	Base point (X) **(new for X3)**
17341	Base point (Y) **(new for X3)**
17342	Base point (Z) **(new for X3)**
17846	Inner radius of cylinder (Note: This is a radius value, but the entry field on the dialog box is a diameter value.) **(new for X3)**

Extruded profile geometry properties

EXTRUDED_COMPONENT

17343	Extrude profile entity ID **(new for X3)**
17344	Extrude direction vector (X) **(new for X3)**
17345	Extrude direction vector (Y) **(new for X3)**
17346	Extrude direction vector (Z) **(new for X3)**
17347	Extrude distance **(new for X3)**

EXTRUDED_COMPONENT_01

17349	Extrude profile entity ID **(new for X3)**
17350	Extrude direction vector (X) **(new for X3)**
17351	Extrude direction vector (Y) **(new for X3)**
17352	Extrude direction vector (Z) **(new for X3)**
17353	Extrude distance **(new for X3)**

EXTRUDED_COMPONENT_02

17354	Extrude profile entity ID **(new for X3)**
17355	Extrude direction vector (X) **(new for X3)**
17356	Extrude direction vector (Y) **(new for X3)**
17357	Extrude direction vector (Z) **(new for X3)**
17358	Extrude distance **(new for X3)**

Revolved profile geometry properties

REVOLVED_COMPONENT

17359	Revolve profile entity ID **(new for X3)**
17360	Line of revolution, endpoint 1 (X) **(new for X3)**
17361	Line of revolution, endpoint 1 (Y) **(new for X3)**
17362	Line of revolution, endpoint 1 (Z) **(new for X3)**
17363	Line of revolution, endpoint 2 (X) **(new for X3)**
17364	Line of revolution, endpoint 2 (Y) **(new for X3)**
17365	Line of revolution, endpoint 2 (Z) **(new for X3)**

REVOLVED_COMPONENT_01

17366	Revolve profile entity ID **(new for X3)**
17367	Line of revolution, endpoint 1 (X) **(new for X3)**
17368	Line of revolution, endpoint 1 (Y) **(new for X3)**
17369	Line of revolution, endpoint 1 (Z) **(new for X3)**
17370	Line of revolution, endpoint 2 (X) **(new for X3)**
17371	Line of revolution, endpoint 2 (Y) **(new for X3)**
17372	Line of revolution, endpoint 2 (Z) **(new for X3)**

REVOLVED_COMPONENT_02

17373	Revolve profile entity ID **(new for X3)**
17374	Line of revolution, endpoint 1 (X) **(new for X3)**
17375	Line of revolution, endpoint 1 (Y) **(new for X3)**
17376	Line of revolution, endpoint 1 (Z) **(new for X3)**
17377	Line of revolution, endpoint 2 (X) **(new for X3)**
17378	Line of revolution, endpoint 2 (Y) **(new for X3)**
17379	Line of revolution, endpoint 2 (Z) **(new for X3)**

Stock component

This section describes parameters for cylindrical bar stock.

- Stock margin parameters are output with the machine group parameters, BARSTOCK_TYPE.
- Stock geometry parameters for other stock models is output using the standard component geometry parameters: for example, REVOLVED_COMPONENT.

STOCK_COMPONENT_TYPE

BARSTOCK_GEO_TYPE	

BARSTOCK_GEO_TYPE

TUBE_GEO_TYPE	
17380	Ref position at max Z **(new for X3)**
17381	Use margins?**(new for X3)**
17382	Hole in stock? **(new for X3)**
17383	OD margin **(new for X3)**
17384	ID margin **(new for X3)**
17385	Left margin **(new for X3)**)
17386	Right margin **(new for X3)**

TUBE_GEO_TYPE

CYLINDER_COMPONENT	
17387	Inner radius **(new for X3)**

TUBE_GEO_TYPE_01

CYLINDER_COMPONENT	
17388	Inner radius **(new for X3)**

TUBE_GEO_TYPE_02

CYLINDER_COMPONENT	
17389	Inner radius **(new for X3)**

Linear axis component

LINEAR_AXIS_COMPONENT_TYPE

AXIS_PARAMS_TYPE	Parameters for direction of physical axis
AXIS_PARAMS_TYPE001	Parameters for direction of programmed axis (when different from physical axis direction).
17390	Axis label to be output in the NC program for absolute axis motion.
17391	Axis to drive on the machine. 1, 2, 3, or -1, corresponding to X_AXIS, Y_AXIS, Z_AXIS, MACRO_AXIS.
17923	Axis label to be output in the NC program for incremental axis motion. **(New for X3)**
17924	Rapid traverse rate limit (inch) **(New for X3)**
17925	Rapid traverse rate limit (mm) **(New for X3)**
17396	Axis is output as diameter (X & Y only) (True/False)

AXIS_PARAMS_TYPE

	[these parameters are used to describe physical axis motion]
17392	Base axis direction with relation to the WCS: X_AXIS, Y_AXIS, Z_AXIS, NEG_X_AXIS, NEG_Y_AXIS, NEG_Z_AXIS **(new for X3)**
17393	Tilt the machine axis (True/False)
17394	Tilt axis: Axis of rotation for axis out of plane (WCS axis!); X_AXIS,-9999, Y_AXIS, Z_AXIS, NEG_X_AXIS,-9999, NEG_Y_AXIS, NEG_Z_AXIS
17395	Tilt angle: Angle of rotation for tilt,-9999, right hand rule (degrees)
TRAVEL_LIMITS_TYPE	inch travel limits
TRAVEL_LIMITS_TYPE001	mm travel limits
17729	Initial defined axis position (measured along the axis) (inch)
17730	Initial defined axis position (measured along the axis) (mm)
17731	Start-up axis position for simulation

AXIS_PARAMS_TYPE001

	[these parameters are used to describe programmed axis motion, where different from physical]
17950	Base axis direction with relation to the WCS: X_AXIS, Y_AXIS, Z_AXIS, NEG_X_AXIS, NEG_Y_AXIS, NEG_Z_AXIS **(new for X3)**
17926	Tilt the machine axis (True/False) **(new for X3)**
17927	Tilt axis: Axis of rotation for axis out of plane (WCS axis!); X_AXIS,-9999, Y_AXIS, Z_AXIS, NEG_X_AXIS,-9999, NEG_Y_AXIS, NEG_Z_AXIS **(new for X3)**
17928	Tilt angle: Angle of rotation for tilt,-9999, right hand rule (degrees) **(new for X3)**
TRAVEL_LIMITS_TYPE002	inch travel limits **(new for X3)**

TRAVEL_LIMITS_TYPE003	mm travel limits **(new for X3)**
17929	Initial defined axis position (measured along the axis) (inch) **(new for X3)**
17930	Initial defined axis position (measured along the axis) (mm) **(new for X3)**
17931	Initial position for simulation (G28) **(new for X3)**

TRAVEL_LIMITS_TYPE

17719	Minimum travel limit (physical motion) (inch) **(New for X3)**
17720	Maximum travel limit (physical motion) (inch) **(New for X3)**

TRAVEL_LIMITS_TYPE001

17721	Minimum travel limit (physical motion) (mm) **(New for X3)**
17722	Maximum travel limit (physical motion) (mm) **(New for X3)**

TRAVEL_LIMITS_TYPE002

17723	Minimum travel limit (programmed motion) (inch). Also, rotary axis minimum travel limit. **(New for X3)**
17724	Maximum travel limit (programmed motion) (inch). Also, rotary axis maximum travel limit. **(New for X3)**

TRAVEL_LIMITS_TYPE003

17725	Minimum travel limit (programmed motion) (mm) **(New for X3)**
17726	Maximum travel limit (programmed motion) (mm) **(New for X3)**

TRAVEL_LIMITS_TYPE004

17727	Tailstock retracted position **(New for X3)**
17728	Maximum advanced position of tailstock **(New for X3)**

Rotary axis component

ROTARY_AXIS_COMPONENT_TYPE

17397	Axis label to be output in the NC program for absolute axis motion.
17398	Axis to drive on the machine. 1, 2, 3, or -1, corresponding to A_AXIS, B_AXIS, C_AXIS, MACRO_AXIS.
17932	Axis label to be output in the NC program for incremental axis motion. **(New for X3)**
17933	Maximum feed rate (degrees/minute) **(New for X3)**
17399	Axis of rotation with respect to machine linear axes
17401	Axis '0 deg' vector with relation to machine axes. Lies in plane perpendicular to axis of rotation
17402	TRUE = CW is positive direction for this axis
17403	Tilted (nutated) machine axis (True/False)
17404	Tilt axis: Axis of rotation for axis out of plane (WCS axis!). X_AXIS,-9999, Y_AXIS, Z_AXIS, NEG_X_AXIS,-9999, NEG_Y_AXIS, NEG_Z_AXIS
17405	Angle of rotation for tilted axis,-9999, right hand rule (degrees)
17406	Minimum reposition angle (degrees)
17407	Maximum reposition angle (degrees)
17408	This an indexing axis (True/False)
17409	Index angle (must divide evenly into 360)
17410	Output type: Signed continuous,-9999, signed direction (0-360 deg), shortest direction (0 - 360 deg)
17411	Break rotary moves (True/False)
17412	Use chordal deviation to determine when to break (True/False)
17413	Maximum angular move before breaking
TRAVEL_LIMITS_TYPE002	Min/max linear travel limits measured along axis direction **(X2)**
17847	Defined angle position (initial angle position) **(New for X3)**
17848	Initial angle position for simulation (G28) **(New for X3)**

Machine table

(These parameters for future use.)

RECT_TABLE_COMPONENT_TYPE

TSLOT_GEO_TYPE	
17414	Slot spacing (future use) **(New for X3)**
17415	Axis direction (future use) **(New for X3)**
17416	Length (future use) **(New for X3)**
17417	Width (future use) **(New for X3)**
17418	Height (future use) **(New for X3)**
17419	Pocket width (future use) **(New for X3)**
17420	Pocket height (future use) **(New for X3)**

TSLOT_GEO_TYPE

17421	Key width (future use) **(New for X3)**
17422	Key height (future use) **(New for X3)**
17423	Slot width (future use) **(New for X3)**
17424	Depth (future use) **(New for X3)**
17425	Length (future use) **(New for X3)**

Chuck

CHUCK_COMPONENT_TYPE

17446	Minimum useable spindle RPM
17447	Maximum programmable spindle RPM
17674	*Jaw position in X (longitudinal) (removed in X3)*
17734	Number of jaws **(new for X3)**
17934	Jaw position, longitudinal (world X axis) **(new for X3)**
CHUCK_GEO_TYPE	
17849	Automatically set jaw position from channel depth (True/False) **(new for X3)**

CHUCK_GEO_TYPE

17441	OD of chuck **(new for X3)**
17442	ID of chuck **(new for X3)**
17443	Thickness of chuck **(new for X3)**
17444	Channel width **(new for X3)**
17445	Channel depth **(new for X3)**

Chuck jaws

CHUCKJAWS_COMPONENT_TYPE

17430	[not used] **(new for X3)**
17840	Grip length **(new for X3)**
17435	Grip reference point (Z) **(new for X3)**
17436	Grip reference point (radius) **(new for X3)**
17437	Clamping method **(new for X3)**
17438	Active spindle **(new for X3)**
17439	Get clamp position from stock? **(new for X3)**
17440	Grip on maximum diameter? **(new for X3)**
CHUCKJAW_GEO_TYPE	

CHUCKJAW_GEO_TYPE

17426	Jaw width **(new for X3)**
17427	Width of step **(new for X3)**
17428	Thickness of chuck jaw **(new for X3)**
17732	Parametric profile or chained profile? **(new for X3)**
17733	Entity ID of chain used for profile **(new for X3)**
17681	Jaw height **(new for X3)**
17682	Height of jaw step **(new for X3)**

Collet

COLLET_COMPONENT_TYPE

TUBE_GEO_TYPE | **(new for X3)**

Tailstock

TAILSTOCK_COMPONENT_TYPE

TRAVEL_LIMITS_TYPE004	**(new for X3)**
17737	Tailstock advance/retract feed rate (inch) **(new for X3)**
17738	Tailstock advance/retract feed rate (mm) **(new for X3)**
17739	Is quill programmable? **(new for X3)**
TAILSTOCK_GEO_TYPE	

TAILSTOCK_GEO_TYPE

17551	Quill diameter **(new for X3)**
17736	Quill length
17552	Amount of quill extension **(new for X3)**
17553	Length of tailstock block **(new for X3)**
17554	Width of tailstock block **(new for X3)**
17555	Height of tailstock block **(new for X3)**
17556	Height at which quill is mounted on block **(new for X3)**

Lathe center

LATHE_CENTER_COMPONENT_TYPE

LATHE_CENTER_GEO_TYPE	

LATHE_CENTER_GEO_TYPE

17735	Position along axis of tailstock center **(new for X3)**
17448	Diameter
17449	Point angle **(new for X3)**
17450	Length of center **(new for X3)**

Steady rest

STEADYREST_COMPONENT_TYPE

17850	Entity ID of chain used for collision avoidance boundary **(new for X3)**
STEADYREST_GEO_TYPE	

STEADYREST_GEO_TYPE

17559	(future use) **(new for X3)**
17560	(future use) **(new for X3)**
17561	(future use) **(new for X3)**
17562	(future use) **(new for X3)**
17740	(future use) **(new for X3)**
17741	(future use) **(new for X3)**
17742	(future use) **(new for X3)**

Tool components

TOOL_COMPONENT_TYPE

TOOL_LOCATION_TYPE	
17918	Entity ID of tool geometry **(new for X3)**
17919	Color of tool holder geometry **(new for X3)**

TOOL_LOCATION_TYPE

17240	(not currently used)
17241	(not currently used)
17242	(not currently used)
17243	(not currently used)
17851	Number of ATC pocket **(new for X3)**
17852	Number of turret face/index position **(new for X3)**
17853	Number of gang tool position **(new for X3)**
17854	(not currently used)
17855	(not currently used)
17252	(not currently used)
17856	(not currently used)
17857	(not currently used)
17858	(not currently used)
17859	(not currently used)
17860	(not currently used)
17861	(not currently used)
17862	(not currently used)
17863	(not currently used)
17864	(not currently used)
17865	(not currently used)
17935	(not currently used)

Wire upper guide

WIRE_UPPER_GUIDE_COMPONENT_TYPE

17568	Thread time **(new for X3)**
17570	Align with lower guide? (Y/N) **(new for X3)**
WIRE_GUIDE_GEO_TYPE	

WIRE_GUIDE_GEO_TYPE

17564	Major radius **(new for X3)**
17565	Minor radius **(new for X3)**
17566	Included angle **(new for X3)**
17567	Cylinder height **(new for X3)**

Wire lower guide

WIRE_LOWER_GUIDE_COMPONENT_TYPE

WIRE_LOWER_GUIDE_GEO_TYPE	

WIRE_LOWER_GUIDE_GEO_TYPE

17697	Major radius **(new for X3)**
17698	Minor radius **(new for X3)**
17699	Included angle **(new for X3)**
17700	Cylinder height **(new for X3)**

Router spindles (main & piggyback)

MULTI_HEAD_COMPONENT_TYPE

17605	Minimum useable spindle RPM
17606	Maximum programmable spindle RPM
17586	Anchor point/position on machine—X offset
17587	Anchor point/position on machine—Y offset
17588	Anchor point/position on machine—Z offset
17592	Bitwise number containing the heads that are used
17593	Work offset number
17594	Entity ID number of first head
17701	View number **(new for X3)**

MH_PIGGYBACK_COMPONENT_TYPE

17605	Minimum useable spindle RPM
17606	Maximum programmable spindle RPM
17586	Anchor point/position on machine—X offset
17587	Anchor point/position on machine—Y offset
17588	Anchor point/position on machine—Z offset
17593	Work offset number
17702	View number **(new for X3)**

Automatic toolchanger

ATC_COMPONENT_TYPE

17596	Index method
17597	Tool change time
17598	Max. number of tools in carousel
17866	Time to index between pockets **(new for X3)**
MACHINE_POSITION	

Mill/live tool spindles

TOOL_SPINDLE_COMPONENT_TYPE

17605	Minimum useable spindle RPM
17606	Maximum programmable spindle RPM
17607	*Component id number for associated ATC (removed for X3)*
17868	User ID string for associated turret or ATC component **(new for X3)**
17892	Face or index position of associated turret **(new for X3)**
17893	Tool transform status **(new for X3)**

Turret

TURRET_COMPONENT_TYPE

17608	Axis of turret rotation - defines CW/CCW direction for auto-station numbering
17609	Defines direction of tools in indexed position - must be perpendicular to rotaryAxis
17610	Time to index between adjacent stations (sec.)
17611	Number of tool stations defined
17612	Index type: CW, CCW, MINIMIZE
POLYGON_GEO_TYPE	Turret parametric geometry definition **(new for X3)**
17613	Minimum spindle speed (RPM) for live tools
17614	Maximum spindle speed (RPM) for live tools
17902	Position indexed at start of program **(new for X3)**
17903	Slant-bed angle **(new for X3)**
17904	Gauge length in X (cross tools) **(new for X3)**
17905	Gauge length in Z (face tools) **(new for X3)**
17906	Use gauge length in X? **(new for X3)**
17907	Use gauge length in Z? **(new for X3)**
17908	Tool location radius—default location for mounting tools. **(new for X3)**

POLYGON_GEO_TYPE

17630	Width (diameter) of turret across flats **(New for X3)**
17631	Thickness **(New for X3)**
17632	Number of faces or index positions **(New for X3)**
17633	Fillet radius **(New for X3)**

POLYGON_GEO_TYPE001

17634	Width (diameter) of turret across flats **(New for X3)**
17635	Thickness **(New for X3)**
17636	Number of faces or index positions **(New for X3)**
17637	Fillet radius **(New for X3)**

Gang tool block (lathe)

GANG_TOOL_COMPONENT_TYPE

17946	Minimum spindle speed (RPM) for live tools **(new for X3)**
17947	Maximum spindle speed (RPM) for live tools **(new for X3)**
17948	Slant-bed angle **(new for X3)**
17949	Turret index position **(new for X3)**

Coolant type

COOLANT_TYPE

17070	Text description for coolant/flushing option 1
17071	Text description for coolant/flushing option 2
17072	Text description for coolant/flushing option 3
17073	Text description for coolant/flushing option 4
17074	Text description for coolant/flushing option 5
17075	Text description for coolant/flushing option 6
17076	Text description for coolant/flushing option 7
17077	Text description for coolant/flushing option 8
17078	Text description for coolant/flushing option 9
17079	Text description for coolant/flushing option 1
17080	Text description for "coolant enabled" state for coolant option 1
17081	Text description for "coolant enabled" state for coolant option 2
17082	Text description for "coolant enabled" state for coolant option 3
17083	Text description for "coolant enabled" state for coolant option 4
17084	Text description for "coolant enabled" state for coolant option 5
17085	Text description for "coolant enabled" state for coolant option 6
17086	Text description for "coolant enabled" state for coolant option 7
17087	Text description for "coolant enabled" state for coolant option 8
17088	Text description for "coolant enabled" state for coolant option 9
17089	Text description for "coolant enabled" state for coolant option 10
17090	Text description for "coolant disabled" state for coolant option 1
17091	Text description for "coolant disabled" state for coolant option 2
17092	Text description for "coolant disabled" state for coolant option 3
17093	Text description for "coolant disabled" state for coolant option 4
17094	Text description for "coolant disabled" state for coolant option 5
17095	Text description for "coolant disabled" state for coolant option 6
17096	Text description for "coolant disabled" state for coolant option 7
17097	Text description for "coolant disabled" state for coolant option 8

17098	Text description for “coolant disabled” state for coolant option 9
17099	Text description for “coolant disabled” state for coolant option 10
17100	Text to be used for Coolant button label on Toolpath parameters page.
17101	1st 'coolant off' command shuts off ALL coolant commands on the machine (True/False)
17102	Use coolant commands in post-processor (provided for backward compatibility) (True/False)
17103	Use event list to activate coolant
17104	*(not used in X3)*

Control definition parameters

The parameters in this section generally correspond to the annotated screen captures in **Control definition pages** starting on page 53.

General control definition parameters

Control definition header

19990	Machine group name **(New for X3)**

ENT_IDN_CTRL

18001	Post ID
18002	(not used)
18003	(not used)
18004	(not used)

CONTROL_TYPE

ENT_IDN_CTRL	
18010	Manufacturer
18011	Parent group ID
18012	Start unique post ID
18013	Tolerance entity ID
18014	Communication entity ID
18015	File entity ID
18016	Posts entity ID
18017	NC mill entity ID
18018	NC router entity ID
18019	NC lathe entity ID
18020	NC wire entity ID
18021	NC output entity ID
18022	NC path entity ID
18023	NC cycles entity ID
18024	NC wire path entity ID

FILE_POSTLIST_CTRL

18205	Post ID
18206	Valid Status
18207	Start ascii entity id
18208	Start binary entity id
18209	Start text entity id
18210	Post data path and file name

Tolerances page

TOLERANCE_CTRL

18055	NC Precision – Inch (minimum step value - **mtol$**)
18056	NC Precision - Metric (minimum step value - **met_mtol$**)
18057	Chordal Deviation – Inch (**chord_tol$**)
18058	Chordal Deviation – Metric (**met_chord_tol$**)
18059	Deviation of vector endpoints - Inch (**vert_tol$**)
18060	Deviation of vector endpoints – Metric (**met_vert_tol$**)
18061	General math function tolerance – Inch (**xtol$**)
18062	General math function tolerance – Metric (**met_xtol$**)
18063	Minimum distance between arc end points – Inch (**ltol$**)
18064	Minimum distance between arc end points – Metric (**met_ltol$**)
18065	Minimum arc length – Inch (**minarc$)**
18066	Minimum arc length – Metric (**met_minarc$**)
18067	Minimum arc radius – Inch (**minrad$**)
18068	Minimum arc radius – Metric (**met_minrad$**)
18069	Maximum arc radius – Inch (**maxrad$**)
18070	Maximum arc radius – Metric (**met_maxrad$**)
18071	Minimum change in plane for helix – Inch (**helix_tol$**)
18072	Minimum change in plane for helix – Metric (**met_helix_tol$**)
18073	Maximum deviation in calculated arc end points from machine grid – Inch (**arc_tol$**)
18074	Maximum deviation in calculated arc end points from machine grid – Metric (**met_arc_tol$**)
18075	Minimum angle tolerance (**atol$**)
18076	Maximum angle tolerance (**max_atol$**)
18077	Truncate NC Precision: 0 = no, 1 = yes

Communications page

COMMUNICATION_CTRL

18105	End of line delay
18106	Baud rate (Actual value selected, i.e. – 9600)
18107	Port number (1, 2, 3 or 4)
18108	Number of data bits (6, 7 or 8)
18109	Number of stop bits (1 or 2)
18110	Handshaking (0 = None, 1 = Software, 2 = Hardware)
18111	Communications product (0 = Mastercam, 1 = Other, 2=Cimco)
18112	Parity (O = Odd, E = Even, N = None)
18113	Format (A = Ascii, E = EIA, B = BIN)
18114	Strip carriage return (True/False)
18115	Strip line feed (True/False)
18116	Echo terminal emulation (True/False)
18117	Display to screen (True/False)
18118	DOS communications mode (True/False)
18820	External communications **(new for X3)**

Files page

FILE_CTRL

POST_DLG_SETTINGS	
18155	Error message options (0 = All error messages to file, 1 = All error messages to screen, 2 = Only first error message to screen)
18156	Keep error file (0 = On fatal errors, 1 = On fatal and non-fatal errors, 2 = On post errors and messages, 3 = On errors, messages, and prompts, 4 = Always keep log file)
18157	Transform operation options (0 = Transform op parameters only, 1 = Source ops parameters only, 2 = Transform and source parameters) **(obsolete for X3)**
15158	NC data path
18159	NCI data path
18160	Setup sheet template data path and file name
18161	Post executable data path and file name
18162	Operations library (Inch) data path and file name
18163	Operations library (Metric) data path and file name
18164	Default operations library (Inch) data path and file name
18165	Default operations library (Metric) data path and file name
18166	Chook from Misc. values button data path and file name
18167	Chook from Aux. register button data path and file name (Wire)
18168	Power setting library (Inch) data path and file name (Wire)
18169	Power setting library (Metric) data path and file name (Wire)
18170	NC File extension (**`sextnc$`**)
18171	Write NC operation information (True/False) **(obsolete for X3)**

Post dialog box defaults

These settings are the default **Post** dialog box settings as saved with the control definition. They are not the settings selected at the time of posting.

POST_DLG_SETTINGS

18750	Create NCI file (True/False)
18751	Overwrite NCI file (0 = ask, 1 = overwrite)
18752	Create NC file (True/False)
18753	Overwrite NC file (0 = ask, 1 = overwrite)
18754	Send to machine (True/False)
18755	Edit NCI file (True/False)
18756	Edit NC file (True/False)
18757	Export oplist **(obsolete for X3)**
18758	Export prm **(obsolete for X3)**
18759	Status of the **Output Tplanes relative to WCS** option. This affects how the NCI 1014 line is written.
18760	Output MCX file descriptor (True/False)

NC Dialog page

NC_DIALOG_MILL_CTRL

18255	Not Used
18256	Set check box for Reference Point button (0 = No, 1 = Yes)
18257	Not Used
18258	Not Used
18259	Not Used
18260	Set check box for Tool Display button (0 = No, 1 = Yes)

NC_DIALOG_ROUTER_CTRL

18305	Not Used
18306	Set check box for Reference Point button (0 = No, 1 = Yes)
18307	Not Used
18308	Not Used
18309	Not Used
18310	Set check box for Tool Display button (0 = No, 1 = Yes)

NC_DIALOG_LATHE_CTRL

18355	Not Used
18356	Not Used
18357	Set check box for Reference Point button (0 = No, 1 = Yes)
18358	Not Used
18359	Not Used
18360	Set check box for Tool Display button (0 = No, 1 = Yes)

NC_DIALOG_WIRE_CTRL

18405	*Not Used (removed for X3)*
18406	Not Used
18407	Not Used
18408	Not Used
18409	Not Used
18410	Not Used
18411	Not Used

NC Output page

NC_OUTPUT_CTRL

18455	Start sequence number
18456	Increment sequence number
18457	Maximum sequence number
18458	Maximum characters in NC comment
18459	Number of places to the left of decimal
18460	Number of places to the right of decimal
18461	Spaces between NC addresses
18462	First alternate EOB character (ascii value equivalent)
18463	Second alternate EOB character (ascii value equivalent)
18464	Text from **Description** field in Control Def Mgr.
18465	Main program default absolute/incremental (0 = absolute, 1 = incremental)
18466	Output operation comments to NC (0 = no, 1 = yes)
18467	Output group comments to NC (0 = no, 1 = yes)
18468	Output group name to NC (0 = no, 1 = yes)
18469	Output machine name to NC (0 = no, 1 = yes)
18470	Output sequence numbers (True/False)
18471	Reset sequence numbers in subprograms (True/False)
18472	Use decimal sequence numbers (True/False)
18473	Delete Cr/Lf at end of NC block (True/False)
18474	Use optional EOB characters (True/False)
18475	Ouput debug info (True/False) **(Obsolete for X3; always output as 0.)**

Work System page

NC_PATH_WORKSYS_CTRL

18505	Work coordinate selection (0 = home position, 1 = local work offset, 2 = other, 3 = work offsets)
18506	Tplane during automatic work offset number creation (0 = all T planes, 1 = only transform T planes)
18507	Translate NCI coordinates to machine view with aggregate (Mill/Router)

Tool page

NC_PATH_TOOL_CTRL

18508	Tool offset registers (0 = add to tool, 1 = from tool)
18509	Add tool amount
18510	Add length amount
18511	Add diameter amount
18512	Add back offset amount
18513	Get Home Position option (0 = from default setting, 1 = from tool setting, 2 = from machine definition)
18514	Use head number to replace tool number (True/False)
18515	Add head number to offset register (True/False)
18516	Enable staged tool routines (True/False)
18517	Write length register to NCI with lathe toolpaths

NC_PATH_TOOL_CTRL002

18761	Tool offset registers (0 = add to tool, 1 = from tool)
18762	Add tool amount
18763	Add length amount
18764	Add diameter amount
18765	Add back offset amount
18766	Get Home Position option (0 = from default setting, 1 = from tool setting, 2 = from machine definition)
18767	Use head number to replace tool number (True/False)
18768	Add head number to offset register (True/False)
18769	Enable staged tool routines (True/False)
18770	Write length register to NCI with lathe toolpaths

Linear page

NC_PATH_LINEAR_CTRL

18518	Rapid motion (0 = each axis moves at max. feed rate independently, 1 = all axes arrive at destination simultaneously, 2 = linear interpolation at maximum feed rate)
18519	XY plane control (0 = do not break linear motion, 1 = break rapid moves – XY then Z for approach, Z then XY for retract, 2 = break all moves with change in Z)
18520	XZ plane control (0 = do not break linear motion, 1 = break rapid moves – XZ then Y for approach, Y then XZ for retract, 2 = break all moves with change in Y)
18521	YZ plane control (0 = do not break linear motion, 1 = break rapid moves – YZ then X for approach, X then YZ for retract, 2 = break all moves with change in X)
18522	Corner rounding/exact stop (0 = control cutting mode, 1 = control exact stop mode, 2 = control corner rounding mode)

NC_PATH_LINEAR_CTRL002

18771	Rapid motion (0 = each axis moves at max. feed rate independently, 1 = all axes arrive at destination simultaneously, 2 = linear interpolation at maximum feed rate)
18772	XY plane control (0 = do not break linear motion, 1 = break rapid moves – XY then Z for approach, Z then XY for retract, 2 = break all moves with change in Z)
18773	XZ plane control (0 = do not break linear motion, 1 = break rapid moves – XZ then Y for approach, Y then XZ for retract, 2 = break all moves with change in Y)
18774	YZ plane control (0 = do not break linear motion, 1 = break rapid moves – YZ then X for approach, X then YZ for retract, 2 = break all moves with change in X)
18775	Corner rounding/exact stop (0 = control cutting mode, 1 = control exact stop mode, 2 = control corner rounding mode)

Arc page

NC_PATH_ARC_CTRL

18523	XY plane arc center type (0 = absolute, 1 = delta start to center, 2 = delta center to start, 3 = unsigned incremental, 4 = radius, 5 = signed radius)
18524	XZ plane arc center type (0 = absolute, 1 = delta start to center, 2 = delta center to start, 3 = unsigned incremental, 4 = radius, 5 = signed radius)
18525	YZ plane arc center type (0 = absolute, 1 = delta start to center, 2 = delta center to start, 3 = unsigned incremental, 4 = radius, 5 = signed radius)
18526	XY plane arc break options (0 = don't break, 1 = break at quadrants, 2 = break at 180 degrees)
18527	XZ plane arc break options (0 = don't break, 1 = break at quadrants, 2 = break at 180 degrees)
18528	YZ plane arc break options (0 = don't break, 1 = break at quadrants, 2 = break at 180 degrees)
18529	Helix support (0 = no helix allowed, 1 = only in XY plane, 2 = all planes supported)
18530	Arc end point checks (0= round end point – break arc on failure, 1 = round end point – arc to generated point on failure, 2 = no rounding – break arc on failure)
18531	Support arcs on XY plane (True/False)
18532	Support arcs on XZ plane (True/False)
18533	Support arcs on YZ plane (True/False)
18534	Allow 360 degree arcs on XY plane (True/False)
18535	Allow 360 degree arcs on XZ plane (True/False)
18536	Allow 360 degree arcs on YZ plane (True/False)
18537	Arc error checks – length of arc (True/False)
18538	Arc error checks – length of radius (True/False)
18539	Arc error checks – parallel axis motion on quadrant (True/False)
18540	Arc error checks – equilateral triangle (True/False)
18541	Arc error checks – end point checks (True/False)

NC_PATH_ARC_CTRL002

18776	XY plane arc center type (0 = absolute, 1 = delta start to center, 2 = delta center to start, 3 = unsigned incremental, 4 = radius, 5 = signed radius)
18777	XZ plane arc center type (0 = absolute, 1 = delta start to center, 2 = delta center to start, 3 = unsigned incremental, 4 = radius, 5 = signed radius)
18778	YZ plane arc center type (0 = absolute, 1 = delta start to center, 2 = delta center to start, 3 = unsigned incremental, 4 = radius, 5 = signed radius)
18779	XY plane arc break options (0 = don't break, 1 = break at quadrants, 2 = break at 180 degrees)

18780	XZ plane arc break options (0 = don't break, 1 = break at quadrants, 2 = break at 180 degrees)
18781	YZ plane arc break options (0 = don't break, 1 = break at quadrants, 2 = break at 180 degrees)
18782	Helix support (0 = no helix allowed, 1 = only in XY plane, 2 = all planes supported)
18783	Arc end point checks (0= round end point – break arc on failure, 1 = round end point – arc to generated point on failure, 2 = no rounding – break arc on failure)
18784	Support arcs on XY plane (True/False)
18785	Support arcs on XZ plane (True/False)
18786	Support arcs on YZ plane (True/False)
18787	Allow 360 degree arcs on XY plane (True/False)
18788	Allow 360 degree arcs on XZ plane (True/False)
18789	Allow 360 degree arcs on YZ plane (True/False)
18790	Arc error checks – length of arc (True/False)
18791	Arc error checks – length of radius (True/False)
18792	Arc error checks – parallel axis motion on quadrant (True/False)
18793	Arc error checks – equilateral triangle (True/False)
18794	Arc error checks – end point checks (True/False)

Rotary page

NC_PATH_ROTARY_CTRL

18542	Break rapid rotary moves (True/False)
18543	Attempt to adjust machine to bi-stable position

Feed page

NC_PATH_FEED_CTRL

18544	Three axis feed options (0 = unit/min., 1 = use inverse)
18545	Four axis linear feed options (0 = unit/min., 1 = use inverse)
18546	Four axis rotary feed options (0 = unit/min., 1 = degree/min., 2 = use inverse)
18547	Five axis linear feed options (0 = unit/min., 1 = use inverse)
18548	Five axis rotary feed options (0 = unit/min., 1 = use inverse)
18549	Inverse feed (0 = feed rate in minutes, 1 = feed rate in seconds)
18700	Convert rapid to maximum feed rate (True/False)
18701	Adjust feed rate on arc moves (True/False)
18702	Use feed rate in NC output (True/False) (Wire Only)

NC_PATH_FEED_CTRL002

18795	Three axis feed options (0 = unit/min., 1 = use inverse)
18796	Four axis linear feed options (0 = unit/min., 1 = use inverse)
18797	Four axis rotary feed options (0 = unit/min., 1 = degree/min., 2 = use inverse)
18798	Five axis linear feed options (0 = unit/min., 1 = use inverse)
18799	Five axis rotary feed options (0 = unit/min., 1 = use inverse)
18800	Inverse feed (0 = feed rate in minutes, 1 = feed rate in seconds)
18801	Convert rapid to maximum feed rate (True/False)
18802	Adjust feed rate on arc moves (True/False)
18803	Use feed rate in NC output (True/False) (Wire Only)

Cutter Compensation page

NC_PATH_COMP_CTRL

18703	Number of look ahead blocks for control comp
18704	Control supports cutter compensation in control
18705	Allow cutter comp in control to be activated/ deactivated on arcs (True/False)
18706	Control supports wear compensation (True/False)
18707	Control supports reverse wear compensation (True/ False)
18708	Start and end cutter compensation above part
18709	*Compensate the first and last point in cutter comp. in control simulation (True/False) (removed for X3)*
18710	*Display the first and last entities in cutter comp. in control simulation (True/False) (removed for X3)*
18711	*Display a warning when cutter compensation in control simulation finds an error (True/False) (removed for X3)*
18821	Optimze toolpaths (true/false) **(New for X3)**

Subprograms page

NC_PATH_SUBS_CTRL

18712	Maximum subprogram nesting levels
18713	Subprogram location (0 = after main program, 1 = before main program)
18714	Maximum mirror/rotate coordinate subprogram routines nesting levels
18715	Control supports subprograms (True/False)
18716	Allow mirror coordinate subprogram routines (True/False)
18717	Allow rotate coordinate subprogram routines (True/False)
18718	Allow nesting of mirror/rotate coordinate subprogram routines (True/False)
18719	Ignore work offset numbers when processing subprograms
18720	Ignore contour flags when processing subprograms

Misc. Int/Real Values page

NC_PATH_CTRL

NC_PATH_WORKSYS_CTRL	
NC_PATH_TOOL_CTRL	
NC_PATH_TOOL_CTRL002	
NC_PATH_LINEAR_CTRL	
NC_PATH_LINEAR_CTRL002	
NC_PATH_ARC_CTRL	
NC_PATH_ARC_CTRL002	
NC_PATH_ROTARY_CTRL	
NC_PATH_FEED_CTRL	
NC_PATH_FEED_CTRL002	
NC_PATH_COMP_CTRL	
NC_PATH_SUBS_CTRL	
18721	Initialize tool path operation (0 = from these settings, 1 = from default operation)
18722	Set miscellaneous values on first operation of each type only
18723	Use separate mill and lathe text and values (Mill/Turn control)

Machine Cycles page

CYCLES_2CTRL

NC_GEN_CYCLES_CTRL	
NC_DRILL_CYCLES_CTRL	
NC_DRILL_CYCLES_CTRL002	
NC_LATHE_CYCLES_CTRL	

NC_GEN_CYCLES_CTRL

18555	Height return options (0 = return to initial height, 1 = return to reference height)
18556	Percent drill depth decline with peck and chip
18557	Use lead drill with block drilling (True/False) (Router)
18558	Control supports polar interpolation (True/False)
18559	Control supports cylindrical interpolation (True/False)
18560	Control supports high speed machining (True/False)
18561	Use separate mill and lathe text and values (Mill/Turn)

Drill cycles page

NC_DRILL_CYCLES_CTRL

18562	Simple drill – no peck (True/False)
18563	Peck drill – full retract (True/False)
18564	Chip break – incremental retract (True/False)
18565	Tapping – feed in, reverse spindle – feed out (True/False)
18566	Boring #1 – feed out (True/False)
18567	Boring #2 – stop spindle – rapid out (True/False)
18568	Misc. #1 drill – uses simple drill (True/False)
18569	Misc. #2 drill – uses simple drill (True/False)

NC_DRILL_CYCLES_CTRL002

18804	Simple drill – no peck (True/False)
18805	Peck drill – full retract (True/False)
18806	Chip break – incremental retract (True/False)
18807	Tapping – feed in, reverse spindle – feed out (True/False)
18808	Boring #1 – feed out (True/False)
18809	Boring #2 – stop spindle – rapid out (True/False)
18810	Misc. #1 drill – uses simple drill (True/False)
18811	Misc. #2 drill – uses simple drill (True/False)

Lathe Canned Cycles page

NC_LATHE_CYCLES_CTRL

18570	Enable canned rough turning (True/False)
18571	Enable canned rough pattern repeat (True/False)
18572	Enable canned roughing undercuts (True/False)
18573	Enable canned finish (True/False)
18574	Enable canned groove cycle (True/False)
18575	Enable canned groove wall taper (True/False)
18576	Enable canned groove radius on corners (True/False)
18577	Enable canned groove radius on chamfers (True/False)
18578	Enable canned groove rough pecking (True/False)
18579	Enable canned groove rough depth cuts (True/False)
18580	Enable canned groove chamfer on corners (True/False)
18581	Enable canned groove dwell (True/False)
18582	Enable canned thread cycles (True/False)
18583	Enable canned thread cycle (True/False)
18584	Enable box thread cycle (True/False)
18585	Enable alternating thread cycle (True/False)
18586	Enable thread equal depth cuts (True/False)
18587	Enable thread equal area (True/False)
18588	Enable thread multiple starts (True/False)
18589	Enable thread anticipated pull off (True/False)
18590	Enable thread equal depth cuts - Box (True/False)
18591	Enable thread equal area - Box (True/False)
18592	Enable thread multiple starts - Box (True/False)
18593	Enable thread anticipated pull off - Box (True/False)
18594	Enable thread equal depth cuts - Alternating (True/False)
18595	Enable thread equal area - Alternating (True/False)
18596	Enable thread multiple starts - Alternating (True/False)
18597	Enable thread anticipated pull off - Alternating (True/False)
18598	Enable anticipated pull off for long hand thread (True/False)
18812	NOT USED - First start far from part with multiple threading
18813	NOT USED First start closest to part with multiple threading
18814	Enable first start far from part with multiple threading
18815	Enable first start closest to part with multiple threading
18816	Enable first start far from part with multiple threading
18817	Enable first start closest to part with multiple threading
18818	Enable first start far from part with multiple threading
18819	Enable first start closest to part with multiple threading

Start/Leads page (Wire)

WIRE_NC_PATH_CTRL

NC_WIRE_LEADS_CTRL
NC_WIRE_CUTS_CTRL
NC_WIRE_CORNER_CTRL
NC_WIRE_REVERSE_CTRL
NC_WIRE_AUX_REV_CTRL
NC_WIRE_TAPER_CTRL
NC_WIRE_NOCORE_CTRL

NC_WIRE_LEADS_CTRL

18605	Wire threading (0 = manual, 1 = automatic)
18606	Lead in type (0 = line only, 1 = radius only, 2 = line and arc, 3 = two lines and arc)
18607	Lead out type (0 = line only, 1 = radius only, 2 = line and arc, 3 = two lines and arc)
18608	Initialize toolpath operation (0 = from these settings, 1 = from default operation)
18609	Start position is automatically set to thread position (True/False)
18610	Line lead in and exit are required (True/False)
18611	Move to arc center with ‘two lines and arc’ lead option (True/False)
18612	Flip taper direction on leads with ‘two lines and arc’ lead option (True/False)

Cuts page (Wire)

NC_WIRE_CUTS_CTRL

18613	Reset pass number on tab cuts (True/False)
18614	Lock the UV height above the XY height (True/False)

Corner page (Wire)

NC_WIRE_CORNER_CTRL

18615	Conical – minimum (True/False)
18616	Conical –mean (True/False)
18617	Conical – maximum (True/False)
18618	Constant (True/False)
18619	Fixed (True/False)
18620	Sharp (True/False)
18621	Fish Tail (True/False)
18622	Other (True/False)
18623	Enable line-arc-line tangent conic mode (True/False)
18624	Enable dual corner types and upper radius with arcs (True/False)

Reverse Cuts Contour page (Wire)

NC_WIRE_REVERSE_CTRL

18625	Change corner type on (0 = point, 1 = move, 2 = prior point)
18626	Change UV arc type on (0 = point, 1 = move, 2 = prior point)
18627	Change rapid move on (0 = point, 1 = move, 2 = prior point)
18628	Change feed rate on (0 = point, 1 = move, 2 = prior point)
18629	Change manual entry on (0 = point, 1 = move, 2 = prior point)
18630	Change canned text on (0 = point, 1 = move, 2 = prior point)
18631	Change wire compensation on (0 = point, 1 = move, 2 = prior point)
18632	Change condition code on (0 = point, 1 = move, 2 = prior point)
18633	Change wire offset on (0 = point, 1 = move, 2 = prior point)
18634	Change wire diameter on (0 = point, 1 = move, 2 = prior point)
18635	Change wire over burn on (0 = point, 1 = move, 2 = prior point)
18636	Change dwell on (0 = point, 1 = move, 2 = prior point)
18637	Change contour flags on (0 = point, 1 = move, 2 = prior point)
18638	Change stop flags on (0 = point, 1 = move, 2 = prior point)
18639	Change thread/cut flags on (0 = point, 1 = move, 2 = prior point)
18640	Change power settings on (0 = point, 1 = move, 2 = prior point)
18641	Change tank settings on (0 = point, 1 = move, 2 = prior point)
18642	Change flush settings on (0 = point, 1 = move, 2 = prior point)

Reverse Cuts Auxiliary page (Wire)

NC_WIRE_AUX_REV_CTRL

18643	Change auxiliary register 1 on (0 = point, 1 = move, 2 = prior point)
18644	Change auxiliary register 2 on (0 = point, 1 = move, 2 = prior point)
18645	Change auxiliary register 3 on (0 = point, 1 = move, 2 = prior point)
18646	Change auxiliary register 4 on (0 = point, 1 = move, 2 = prior point)
18647	Change auxiliary register 5 on (0 = point, 1 = move, 2 = prior point)
18648	Change auxiliary register 6 on (0 = point, 1 = move, 2 = prior point)
18649	Change auxiliary register 7 on (0 = point, 1 = move, 2 = prior point)
18650	Change auxiliary register 8 on (0 = point, 1 = move, 2 = prior point)
18651	Change auxiliary register 9 on (0 = point, 1 = move, 2 = prior point)
18652	Change auxiliary register 10 on (0 = point, 1 = move, 2 = prior point)
18653	Change auxiliary register 1 on - modal (True/False)
18654	Change auxiliary register 2 on - modal (True/False)
18655	Change auxiliary register 3 on - modal (True/False)
18656	Change auxiliary register 4 on - modal (True/False)
18657	Change auxiliary register 5 on - modal (True/False)
18658	Change auxiliary register 6 on - modal (True/False)
18659	Change auxiliary register 7 on - modal (True/False)
18660	Change auxiliary register 8 on - modal (True/False)
18661	Change auxiliary register 9 on - modal (True/False)
18662	Change auxiliary register 10 on - modal (True/False)

4-axis Paths page (Wire)

NC_WIRE_TAPER_CTRL

18663	Direct and Taper wire paths maximum angle
18664	Direct and Taper wire paths maximum step size - inch
18665	Direct and Taper wire paths maximum step size – metric
18666	Control supports Direct wire paths (True/False)
18667	Control supports Taper wire paths (True/False)

Nocore page (Wire)

NC_WIRE_NOCORE_CTRL

18668	Percentage of wire diameter to be used for lead
18669	With 'Add finish contour operation' option, create finish operation after each pocket (True/False)
18670	Perpendicular leads with rough passes (True/False)

Machine group parameters

The parameters in this section generally correspond to the annotated screen captures in **Machine group property pages** starting on page 81.

General machine group parameters

Machine group header

19970	Machine group name **(New for X3)**

OP_GROUP_INFO

19246	Name and path of defaults file
GROUP_PG1	Files tab
GROUP_PG2	Tool settings tab
GROUP_PG3	Stock setup tab
GROUP_PG4	Safety zone tab

GROUP_LIST

19247	Group number, 0 = deleted, > 0 = alive
19248	Machine group name
19249	Parent group number
19250	Number of grp_ent's pointed to by *e
19251	*(Removed in X3)*
ATTRIBUTES	
19252	Group attributes (not yet used)
19253	True = don't display in groups dialog
19254	Temp marker used in sorting in merging
19255	OpMgr expanded flag
19256	Type of group
19257	Group's color
19258	Group's level
19259	True - use entitys' color & level
19260	File position of group
OP_GROUP_INFO	
19261	PRODUCT_MILL, PRODUCT_LATHE, PRODUCT_ROUTER or PRODUCT_WIRE
19262	*(Removed in X3)*
19263	*(Removed in X3)*
19264	*(Removed in X3)*

ATTRIBUTES

19026	Width (not currently used)
19027	Style (not currently used)
19028	Pen (not currently used)
19029	PSTYLE (not currently used)

Files page

GROUP_PG1

19104	*(removed for X3)*
19105	Name and path of machine definition
19106	Path of NCI file
19107	Not used
19108	Project Manager folder flag0
19352–19514	Project Manager folder flags
19109	*(removed for X3)*
19110	*(removed for X3)*
GROUP_VIEW	Cplane view and origin info **(new for X3)**
GROUP_VIEW002	Tplane view and origin info **(new for X3)**
GROUP_VIEW003	Gview view and origin info **(new for X3)**
GROUP_VIEW004	WCS view and origin info **(new for X3)**
GROUP_VIEW005	This group's stock view and origin information
GROUP_VIEW006	This group's safety zone view and origin information
19111	General group comments
19112	This group's machine entity ID number
19352–19514	Project Manager folder flags
19515	If >0, the Toolpath Manager insert arrow is positioned after this operation; if <0, it is positioned after this group. **(X2)**
GROUP_PG1_ADVANCED_DEFAULTS	
19112	This group's machine entity ID number

GROUP_VIEW

19294	View ID# **(new for X3)**
19295	View number **(new for X3)**
19516	Coordinate display **(new for X3)**
19296	Toolplane view matrix **(new for X3)**
19297	Toolplane view matrix **(new for X3)**
19298	Toolplane view matrix **(new for X3)**
19299	Toolplane view matrix **(new for X3)**
19300	Toolplane view matrix **(new for X3)**
19301	Toolplane view matrix **(new for X3)**
19302	Toolplane view matrix **(new for X3)**
19303	Toolplane view matrix **(new for X3)**
19304	Toolplane view matrix **(new for X3)**
19305	View origin in world **(new for X3)**
19306	View origin in world **(new for X3)**
19307	View origin in world **(new for X3)**

GROUP_VIEW002

19294	View ID# **(new for X3)**
19295	View number **(new for X3)**
19516	Coordinate display **(new for X3)**
19296	Toolplane view matrix **(new for X3)**
19297	Toolplane view matrix **(new for X3)**
19298	Toolplane view matrix **(new for X3)**
19299	Toolplane view matrix **(new for X3)**
19300	Toolplane view matrix **(new for X3)**
19301	Toolplane view matrix **(new for X3)**
19302	Toolplane view matrix **(new for X3)**
19303	Toolplane view matrix **(new for X3)**
19304	Toolplane view matrix **(new for X3)**
19305	View origin in world **(new for X3)**
19306	View origin in world **(new for X3)**
19307	View origin in world **(new for X3)**

GROUP_VIEW003

19294	View ID# **(new for X3)**
19295	View number **(new for X3)**
19516	Coordinate display **(new for X3)**
19296	Toolplane view matrix **(new for X3)**
19297	Toolplane view matrix **(new for X3)**
19298	Toolplane view matrix **(new for X3)**
19299	Toolplane view matrix **(new for X3)**
19300	Toolplane view matrix **(new for X3)**
19301	Toolplane view matrix **(new for X3)**
19302	Toolplane view matrix **(new for X3)**
19303	Toolplane view matrix **(new for X3)**
19304	Toolplane view matrix **(new for X3)**
19305	View origin in world **(new for X3)**
19306	View origin in world **(new for X3)**
19307	View origin in world **(new for X3)**

GROUP_VIEW004

19294	View ID# **(new for X3)**
19295	View number **(new for X3)**
19516	Coordinate display **(new for X3)**
19296	Toolplane view matrix **(new for X3)**
19297	Toolplane view matrix **(new for X3)**
19298	Toolplane view matrix **(new for X3)**

19299	Toolplane view matrix **(new for X3)**
19300	Toolplane view matrix **(new for X3)**
19301	Toolplane view matrix **(new for X3)**
19302	Toolplane view matrix **(new for X3)**
19303	Toolplane view matrix **(new for X3)**
19304	Toolplane view matrix **(new for X3)**
19305	View origin in world **(new for X3)**
19306	View origin in world **(new for X3)**
19307	View origin in world **(new for X3)**

GROUP_VIEW005

19266	View ID#
19267	View number
19520	Coordinate display **(new for X3)**
19268	Toolplane view matrix
19269	Toolplane view matrix
19270	Toolplane view matrix
19271	Toolplane view matrix
19272	Toolplane view matrix
19273	Toolplane view matrix
19274	Toolplane view matrix
19275	Toolplane view matrix
19276	Toolplane view matrix
19277	View origin in world
19278	View origin in world
19279	View origin in world

GROUP_VIEW006

19280	View ID#
19281	View number
19521	Coordinate display **(new for X3)**
19282	Toolplane view matrix
19283	Toolplane view matrix
19284	Toolplane view matrix
19285	Toolplane view matrix
19286	Toolplane view matrix
19287	Toolplane view matrix
19288	Toolplane view matrix
19289	Toolplane view matrix
19290	Toolplane view matrix
19291	View origin in world
19292	View origin in world

19293 | View origin in world

Tool settings page

GROUP_PG2

19113	Program number
19114	Where this group's ops get their feeds and speeds from (0 = from tool, 1 = from material, 2 = from defaults, 3=user-defined)
19115	User-defined default feed rate
19116	True if this machine is to have its speed adjusted on an arc move; False if not
19117	User-defined default spindle speed.
19118	True if the tools created in this group are to be given sequential tool numbers; False if not
19119	True if the user is to be warned whenever they could be creating duplicate tool numbers; False if not
19120	True if operations are to get step, peck, and coolant values from tools; False if not
19121	True if the user wants the tool library searched when they enter a tool number; False if not
19122	Send tool to clear position to go home (lathe only)
19123	This group's material filename and path
19350	User-defined default plunge rate
19351	User-defined default retract rate

GROUP_PG1_ADVANCED_DEFAULTS

19099	Enable options to override defaults with modal values
19100	Override default clearance height with modal value
19101	Override default retract height with modal value
19102	Override default feed plane with modal value
19103	Override defaults with named views

Stock setup tab

Stock models—as well as chuck jaws, tailstock centers, and steady rests—are now stored in the machine definition as machine definition components. This means that in addition to the machine group parameters noted here, you can also access the machine definition component parameters. These will generally prove to be more robust and flexible. As a best practice, you should use the machine definition parameters instead of the legacy machine group parameters.

GROUP_PG3

19124	Fit stock in screen (Y/N)
19125	Stock size. X dimension if block, diameter if cylinder.
19126	Stock size. Y dimension if block, length if cylinder.
19127	Stock size. Z dimension if block, not used if cylinder.
19128	Stock origin (X). See parameter 19212 to identify which corner of stock model this is.
19129	Stock origin (Y). See parameter 19212 to identify which corner of stock model this is.
19130	Stock origin (Z). See parameter 19212 to identify which corner of stock model this is.
19131	Show stock: True=always show stock in gview
19132	Draw stock as a translucent solid instead of wireframe (True/False)
19133	Stock shape: 0=rect, 1=cyl, 2=solid, 3=stl file
19134	Solid enity id number
19135	Stock cylinder axis: 0=X, 1=Y, 2=Z
19136	Center stock on axis (True/False)
19137	STL filename
19138	Line style to display stock with
19139	Color of stock when displayed
19140	3D lines for stock definition: line 1, endpoint 1, X
19141	3D lines for stock definition: line 1, endpoint 1, Y
19142	3D lines for stock definition: line 1, endpoint 1, Z
19143	3D lines for stock definition: line 1, endpoint 2, X
19144	3D lines for stock definition: line 1, endpoint 2, Y
19145	3D lines for stock definition: line 1, endpoint 2, Z
19146	3D lines for stock definition: line 2, endpoint 1, X
19147	3D lines for stock definition: line 2, endpoint 1, Y
19148	3D lines for stock definition: line 2, endpoint 1, Z
19149	3D lines for stock definition: line 2, endpoint 2, X
19150	3D lines for stock definition: line 2, endpoint 2, Y
19151	3D lines for stock definition: line 2, endpoint 2, Z
19152	3D lines for stock definition: line 3, endpoint 1, X
19153	3D lines for stock definition: line 3, endpoint 1, Y
19154	3D lines for stock definition: line 3, endpoint 1, Z
19155	3D lines for stock definition: line 3, endpoint 2, X
19156	3D lines for stock definition: line 3, endpoint 2, Y

19157	3D lines for stock definition: line 3, endpoint 2, Z
19158	3D lines for stock definition: line 4, endpoint 1, X
19159	3D lines for stock definition: line 4, endpoint 1, Y
19160	3D lines for stock definition: line 4, endpoint 1, Z
19161	3D lines for stock definition: line 4, endpoint 2, X
19162	3D lines for stock definition: line 4, endpoint 2, Y
19163	3D lines for stock definition: line 4, endpoint 2, Z
19164	3D lines for stock definition: line 5, endpoint 1, X
19165	3D lines for stock definition: line 5, endpoint 1, Y
19166	3D lines for stock definition: line 5, endpoint 1, Z
19167	3D lines for stock definition: line 5, endpoint 2, X
19168	3D lines for stock definition: line 5, endpoint 2, Y
19169	3D lines for stock definition: line 5, endpoint 2, Z
19170	3D lines for stock definition: line 6, endpoint 1, X
19171	3D lines for stock definition: line 6, endpoint 1, Y
19172	3D lines for stock definition: line 6, endpoint 1, Z
19173	3D lines for stock definition: line 6, endpoint 2, X
19174	3D lines for stock definition: line 6, endpoint 2, Y
19175	3D lines for stock definition: line 6, endpoint 2, Z
19176	3D lines for stock definition: line 7, endpoint 1, X
19177	3D lines for stock definition: line 7, endpoint 1, Y
19178	3D lines for stock definition: line 7, endpoint 1, Z
19179	3D lines for stock definition: line 7, endpoint 2, X
19180	3D lines for stock definition: line 7, endpoint 2, Y
19181	3D lines for stock definition: line 7, endpoint 2, Z
19182	3D lines for stock definition: line 8, endpoint 1, X
19183	3D lines for stock definition: line 8, endpoint 1, Y
19184	3D lines for stock definition: line 8, endpoint 1, Z
19185	3D lines for stock definition: line 8, endpoint 2, X
19186	3D lines for stock definition: line 8, endpoint 2, Y
19187	3D lines for stock definition: line 8, endpoint 2, Z
19188	3D lines for stock definition: line 9, endpoint 1, X
19189	3D lines for stock definition: line 9, endpoint 1, Y
19190	3D lines for stock definition: line 9, endpoint 1, Z
19191	3D lines for stock definition: line 9, endpoint 2, X
19192	3D lines for stock definition: line 9, endpoint 2, Y
19193	3D lines for stock definition: line 9, endpoint 2, Z
19194	3D lines for stock definition: line 10, endpoint 1, X
19195	3D lines for stock definition: line 10, endpoint 1, Y
19196	3D lines for stock definition: line 10, endpoint 1, Z
19197	3D lines for stock definition: line 10, endpoint 2, X
19198	3D lines for stock definition: line 10, endpoint 2, Y
19199	3D lines for stock definition: line 10, endpoint 2, Z
19200	3D lines for stock definition: line 11, endpoint 1, X

19201	3D lines for stock definition: line 11, endpoint 1, Y
19202	3D lines for stock definition: line 11, endpoint 1, Z
19203	3D lines for stock definition: line 11, endpoint 2, X
19204	3D lines for stock definition: line 11, endpoint 2, Y
19205	3D lines for stock definition: line 11, endpoint 2, Z
19206	3D lines for stock definition: line 12, endpoint 1, X
19207	3D lines for stock definition: line 12, endpoint 1, Y
19208	3D lines for stock definition: line 12, endpoint 1, Z
19209	3D lines for stock definition: line 12, endpoint 2, X
19210	3D lines for stock definition: line 12, endpoint 2, Y
19211	3D lines for stock definition: line 12, endpoint 2, Z
A_3D	3D arc #1 for stock definition
A_3D002	3D arc #2 for stock definition
19212	Origin corner: 0=center, 1-8 = one of the stock corners
19213	Boundary avoidance clearance for lathe tools
19214	Entry/exit vector clearance for lathe tools
19526	Use machine tree option **(New for X3)**
19215	*Default active spindle (left/right) (removed for X3)*
19216	*Default turret to load tools into (top/bottom) (removed for X3)*
19217	Entity ID's for left stock boundaries
19218	Entity ID's for left stock boundaries
19219	Entity ID's for right stock boundaries
19220	Entity ID's for right stock boundaries
19221	Entity ID's for left chuck boundaries
19222	Entity ID's for left chuck boundaries
19223	Entity ID's for right chuck boundaries
19224	Entity ID's for right chuck boundaries
19225	Entity ID's for tailstock boundaries
19226	Entity ID's for tailstock boundaries
19227	Entity ID's for steadyrest boundaries
19228	Entity ID's for steadyrest boundaries
19229	Show stock boundaries (True/False)
19230	Show chuck boundaries (True/False)
19231	Show tailstock boundaries (True/False)
19232	Show steadyrest boundaries (True/False)
19233	Fill lathe stock/chuck/tailstock boundaries with color (True/False)
BARSTOCK_TYPE	Stock definition parameters
BARSTOCK_TYPE002	Stock definition parameters
CHUCK_TYPE	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*

CHUCK_TYPE002	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
TAILSTOCK_TYPE	*(Obsolete for X3—use machine definition component parameters. See TAILSTOCK_COMPONENT_TYPE and LATHE_CENTER_COMPONENT_TYPE, in addition to general component parameter groups).*
STEADYREST_TYPE	*(Obsolete for X3—use machine definition component parameters. See STEADYREST_COMPONENT_TYPE, in addition to general component parameter groups).*

A_3D

19000	X position of end point 1
19001	Y position of end point 1
19002	Z position of end point 1
19003	X position of end point 2
19004	Y position of end point 2
19005	Z position of end point 2
19006	X position of center point
19007	Y position of center point
19008	Z position of center point
19009	Radius
19010	Start angle
19011	Sweep angle
19012	View

A_3D002

19013	X position of end point 1
19014	Y position of end point 1
19015	Z position of end point 1
19016	X position of end point 2
19017	Y position of end point 2
19018	Z position of end point 2
19019	X position of center point
19020	Y position of center point
19021	Z position of center point
19022	Radius
19023	Start angle
19024	Sweep angle
19025	View

Lathe peripheral boundaries

BARSTOCK_TYPE

19030	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19031	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19032	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19033	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19034	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19035	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19036	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19037	Margins on OD, ID min & max Z
19038	Margins on OD, ID min & max Z
19039	Margins on OD, ID min & max Z
19040	Margins on OD, ID min & max Z

BARSTOCK_TYPE002

19041	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19042	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19043	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19044	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19045	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19046	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19047	*(Obsolete for X3—use CYLINDER_COMPONENT parameters for bar stock)*
19048	Margins on OD, ID min & max Z
19049	Margins on OD, ID min & max Z
19050	Margins on OD, ID min & max Z
19051	Margins on OD, ID min & max Z

CHUCK_TYPE

19052	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*

19053	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19054	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19055	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19056	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19057	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19058	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19059	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19060	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19061	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19522	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19523	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*

CHUCK_TYPE002

19062	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*

19063	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19064	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19065	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19066	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19077	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19078	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19079	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19080	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19081	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19524	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*
19525	*(Obsolete for X3—use machine definition component parameters. See CHUCK_COMPONENT_TYPE and CHUCKJAWS_COMPONENT_TYPE, in addition to general component parameter groups).*

TAILSTOCK_TYPE

19082	*(Obsolete for X3—use machine definition component parameters. See TAILSTOCK_COMPONENT_TYPE and LATHE_CENTER_COMPONENT_TYPE, in addition to general component parameter groups).*

19083 *(Obsolete for X3—use machine definition component parameters. See TAILSTOCK_COMPONENT_TYPE and LATHE_CENTER_COMPONENT_TYPE, in addition to general component parameter groups).*

19084 *(Obsolete for X3—use machine definition component parameters. See TAILSTOCK_COMPONENT_TYPE and LATHE_CENTER_COMPONENT_TYPE, in addition to general component parameter groups).*

19085 *(Obsolete for X3—use machine definition component parameters. See TAILSTOCK_COMPONENT_TYPE and LATHE_CENTER_COMPONENT_TYPE, in addition to general component parameter groups).*

19086 *(Obsolete for X3—use machine definition component parameters. See TAILSTOCK_COMPONENT_TYPE and LATHE_CENTER_COMPONENT_TYPE, in addition to general component parameter groups).*

19087 *(Obsolete for X3—use machine definition component parameters. See TAILSTOCK_COMPONENT_TYPE and LATHE_CENTER_COMPONENT_TYPE, in addition to general component parameter groups).*

19088 *(Obsolete for X3—use machine definition component parameters. See TAILSTOCK_COMPONENT_TYPE and LATHE_CENTER_COMPONENT_TYPE, in addition to general component parameter groups).*

19089 *(Obsolete for X3—use machine definition component parameters. See TAILSTOCK_COMPONENT_TYPE and LATHE_CENTER_COMPONENT_TYPE, in addition to general component parameter groups).*

19090 *(Obsolete for X3—use machine definition component parameters. See TAILSTOCK_COMPONENT_TYPE and LATHE_CENTER_COMPONENT_TYPE, in addition to general component parameter groups).*

19091 *(Obsolete for X3—use machine definition component parameters. See TAILSTOCK_COMPONENT_TYPE and LATHE_CENTER_COMPONENT_TYPE, in addition to general component parameter groups).*

STEADYREST_TYPE

19092 *(Obsolete for X3—use machine definition component parameters. See STEADYREST_COMPONENT_TYPE, in addition to general component parameter groups).*

19093 *(Obsolete for X3—use machine definition component parameters. See STEADYREST_COMPONENT_TYPE, in addition to general component parameter groups).*

19094 *(Obsolete for X3—use machine definition component parameters. See STEADYREST_COMPONENT_TYPE, in addition to general component parameter groups).*

19095 *(Obsolete for X3—use machine definition component parameters. See STEADYREST_COMPONENT_TYPE, in addition to general component parameter groups).*

19096 *(Obsolete for X3—use machine definition component parameters. See STEADYREST_COMPONENT_TYPE, in addition to general component parameter groups).*

19097 *(Obsolete for X3—use machine definition component parameters. See STEADYREST_COMPONENT_TYPE, in addition to general component parameter groups).*

19098 *(Obsolete for X3—use machine definition component parameters. See STEADYREST_COMPONENT_TYPE, in addition to general component parameter groups).*

Safety zone tab

GROUP_PG4

19234	Safezone on (True/False)
19235	Type: SAFEZONE_RECT, SAFEZONE_SPH, SAFEZONE_CYL
19236	X, Y and Z dimensions of rectangle
19237	X, Y and Z dimensions of rectangle
19238	X, Y and Z dimensions of rectangle
19239	Spherical radius
19240	Cylindrical X axis length
19241	Cylindrical radius
19242	Cylinder axis: X, Y or Z
19243	Display
19244	Fit screen
19245	Extend Z

chapter 4

NCI Reference

This chapter lists all of the Gcodes that are output in the NCI file. It is divided into two main sections:

Each parameter that is output on line 2 is also documented. Typically, these correspond to pre-defined variables.

NCI Gcodes

This section lists all of the NCI Gcodes in Mastercam X3. However, it does not include any of the Gcodes that are used specifically for event-based programming for Mastercam MT.

- Each entry is preceded by a lettered code indicating which product(s) the entry applies to.
- The table following each entry lists the predefined post variables used to store each parameter.

Control Flags Parameters are detailed in a separate section on page 387.

M R 0 : Linear Move at rapid rate

Prototype:

```
0
1 2 3 4 5 6
```

1	Cutter compensation	**cc$, ccomp$**	0	Cutter compensation modal (no change)
			40	Cancel cutter compensation in the control
			41	Cutter compensation in the control = left
			42	Cutter compensation in the control = right
			140	Cancel cutter compensation last move in the contour
2	X position	**xnci$, x$**		
3	Y position	**ynci$, y$**		
4	Z position	**znci$, z$**		
5	Feed rate	**fr$**	Positive	Feed rate in units per minute
			-1	Unchanged
			-2	Rapid
6	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.

L 0 : Linear Move at rapid rate

Prototype: `0`
`1 2 3 4 5 6`

1	Cutter compensation	**cc$, ccomp$**	0	Cutter compensation modal (no change)
			40	Cancel cutter compensation in the control
			41	Cutter compensation in the control = left
			42	Cutter compensation in the control = right
			140	Cancel cutter compensation last move in the contour
2	X position	**xnci$, x$**		
3	Y position	**ynci$, y$**		
4	Z position	**znci$, z$**		
5	Feed rate	**fr$**	Positive	Feed rate in units per minute
			Negative	Feed rate in units per revolution
6	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.

W 0 : Linear move at rapid rate

Prototype: **0**
1 2 3 4 5 6 7 8 9

1	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
2	X position	**xnci$, x$**		
3	Y position	**ynci$, y$**		
4	Z position	**znci$, z$**		
5	Feed rate	**fr$**	Positive	Feed rate in units per minute
			-1	Unchanged
6	Wire taper	**wt$**		
7	Corner type	**wc$**	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fishtail
8	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
9	Corner type radius	**wc_rad$**		

M R 1 : Linear Move at feed rate

Prototype: **1**
1 2 3 4 5 6

1	Cutter compensation	**cc$, ccomp$**	0	Cutter compensation modal (no change)
			40	Cancel cutter compensation in the control
			41	Cutter compensation in the control = left
			42	Cutter compensation in the control = right
			140	Cancel cutter compensation last move in the contour
2	X position	**xnci$, x$**		
3	Y position	**ynci$, y$**		
4	Z position	**znci$, z$**		
5	Feed rate	**fr$**	Positive	Feed rate in units per minute
			-1	Unchanged
			-2	Rapid
6	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.

L 1 : Linear Move at feed rate

Prototype:
```
1
1 2 3 4 5 6
```

1	Cutter compensation	**cc$, ccomp$**	0	Cutter compensation modal (no change)
			40	Cancel cutter compensation in the control
			41	Cutter compensation in the control = left
			42	Cutter compensation in the control = right
			140	Cancel cutter compensation last move in the contour
2	X position	**xnci$, x$**		
3	Y position	**ynci$, y$**		
4	Z position	**znci$, z$**		
5	Feed rate	**fr$**	Positive	Feed rate in units per minute
			Negative	Feed rate in units per revolution
6	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.

W 1 : Linear move at feed rate

Prototype: 1
1 2 3 4 5 6 7 8 9

1	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
2	X position	**xnci$, x$**		
3	Y position	**ynci$, y$**		
4	Z position	**znci$, z$**		
5	Feed rate	**fr$**	Positive	Feed rate in units per minute
			-1	Unchanged
6	Wire taper	**wt$**		
7	Corner type	**wc$**	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fishtail
8	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
9	Corner type radius	**wc_rad$**		

M R 2 : Arc Move CW

Prototype: **2**
1 2 3 4 5 6 7 8 9 10

1	Plane position	**plane$**	0	XY plane
			1	YZ plane
			2	XZ plane
2	Cutter compensation	**cc$, ccomp$**	0	Cutter compensation modal (no change)
			40	Cancel cutter compensation in the control
			41	Cutter compensation in the control = left
			42	Cutter compensation in the control = right
			140	Cancel cutter compensation last move in the contour
3	X position	**xnci$, x$**		
4	Y position	**ynci$, y$**		
5	Absolute X axis arc center	**xc$**		(relative to plane)
6	Absolute Y axis arc center	**yc$**		(relative to plane)
7	Z position	**znci$, z$**		
8	Feed rate	**fr$**	Positive	Feed rate per minute
			Negative	Feed rate per revolution
			-1	Unchanged
			-2	Rapid
9	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
10	Full arc flag	**full_arc_flg$**	0	NOT a full arc move
			1	Full arc move (360-degree sweep)

L 2 : Arc Move CW

Prototype: **2**
1 2 3 4 5 6 7 8 9 10

1	Plane position	**plane$**		(Not used)
2	Cutter compensation	**cc$, ccomp$**	0	Cutter compensation modal
			40	Cancel cutter compensation in the control
			41	Cutter compensation in the control = left
			42	Cutter compensation in the control = right
			140	Cancel cutter compensation last move in the contour
3	X position	**xnci$, x$**		
4	Y position	**ynci$, y$**		
5	Absolute X axis arc center	**xc$**		(relative to plane)
6	Absolute Y axis arc center	**yc$**		(relative to plane)
7	Z position	**znci$, z$**		
8	Feed rate	**fr$**	Positive	Feed rate in units per minute
			Negative	Feed rate in units per revolution
9	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
10	Full arc flag	**full_arc_flg$**	0	NOT a full arc move
			1	Full arc move (360-degree sweep)

W 2 : Arc move clockwise

Prototype: **2**
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1	(Not used)			
2	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
3	X position	**xnci$, x$**		
4	Y position	**ynci$, y$**		
5	Absolute X-axis arc center	**xc$**		(relative to plane)
6	Absolute Y-axis arc center	**yc$**		(relative to plane)
7	Z position	**znci$, z$**		
8	Feed rate	**fr$**	Positive	Feed rate per minute
			-1	Unchanged
9	Wire taper	**wt$**		
10	Corner type	**wc$**	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fishtail
11	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
12	Corner type radius	**wc_rad$**		
13	Arc type	**warc_ctyp$**	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fish Tail
14	Arc type radius	**wcor_rad$**		
15	Full arc flag	**full_arc_flg$**	0	NOT a full arc move
			1	Full arc move (360-degree sweep)

M R 3 : Arc Move CCW

Prototype: **3**
1 2 3 4 5 6 7 8 9 10

1	Plane position	**plane$**	0	XY plane
			1	YZ plane
			2	XZ plane
2	Cutter compensation	**cc$, ccomp$**	0	Cutter compensation modal (no change)
			40	Cancel cutter compensation in the control
			41	Cutter compensation in the control = left
			42	Cutter compensation in the control = right
			140	Cancel cutter compensation last move in the contour
3	X position	**xnci$, x$**		
4	Y position	**ynci$, y$**		
5	Absolute X axis arc center	**xc$**		(relative to plane)
6	Absolute Y axis arc center	**yc$**		(relative to plane)
7	Z position	**znci$, z$**		
8	Feed rate	**fr$**	Positive	Feed rate per minute
			Negative	Feed rate per revolution
			-1	Unchanged
			-2	Rapid
9	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
10	Full arc flag	**full_arc_flg$**	0	NOT a full arc move
			1	Full arc move (360-degree sweep)

L 3 : Arc Move CCW

Prototype: **3**
1 2 3 4 5 6 7 8 9 10

1	Plane position	**plane$**		(Not used)
2	Cutter compensation	**cc$, ccomp$**	0	Cutter compensation modal
			40	Cancel cutter compensation in the control
			41	Cutter compensation in the control = left
			42	Cutter compensation in the control = right
			140	Cancel cutter compensation last move in the contour
3	X position	**xnci$, x$**		
4	Y position	**ynci$, y$**		
5	Absolute X axis arc center	**xc$**		
6	Absolute Y axis arc center	**yc$**		
7	Z position	**znci$, z$**		
8	Feed rate	**fr$**	Positive	Feed rate in units per minute
			Negative	Feed rate in units per revolution
9	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
10	Full arc flag	**full_arc_flg$**	0	NOT a full arc move
			1	Full arc move (360-degree sweep)

W 3 : Arc move counterclockwise

Prototype: **3**
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1	(Not used)			
2	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
3	X position	**xnci$, x$**		
4	Y position	**ynci$, y$**		
5	Absolute X-axis arc center	**xc$**		(relative to plane)
6	Absolute Y-axis arc center	**yc$**		(relative to plane)
7	Z position	**znci$, z$**		
8	Feed rate	**fr$**	Positive	Feed rate per minute
			-1	Unchanged
9	Wire taper	**wt$**		
10	Corner type	**wc$**	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fishtail
11	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
12	Corner type radius	**wc_rad$**		
13	Arc type	**warc_ctyp$**	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fish Tail
14	Arc type radius	**wcor_rad$**		
15	Full arc flag	**full_arc_flg$**	0	NOT a full arc move
			1	Full arc move (360-degree sweep)

L 4 : Dwell and Spindle Change

Prototype:

```
4
1 2 3
```

1	Dwell	**dwell$**		Dwell time
2	Spindle speed	**ss$**	Positive	Spindle speed in RPM
			0	Spindle stop
			Negative	Spindle speed in surface units per minute
3	(Not used)			

M R 4 : Dwell and Spindle Change

Prototype: **4**
1 2 3

1	Dwell	**dwell$**		Dwell time
2	Spindle speed	**ss$**	Positive	Spindle forward
			0	Spindle stop
			Negative	Spindle reverse
3	Spindle direction	**spdir$**		

W 4 : Dwell

Prototype:

```
4
1 2 3
```

1	Dwell	**dwell$**	Dwell time
2	(Not used)		
3	(Not used)		

M R 11 : 5-Axis Move

Prototype: `11`
`1 2 3 4 5 6 7 8 9 10 11 12`

1	X position	**xnci$, x$**		
2	Y position	**ynci$, y$**		
3	Z position	**znci$, z$**		
4	U position	**u$**		
5	V position	**v$**		
6	W position	**w$**		
7	Feed rate	**fr$**	Positive	Feed rate
			-1	Unchanged
			-2	Rapid
8	*Tool parameters = rev5+cutpos+cuttyp		‘nnn’	
		rev5$	000	Zero angle
			100	5-axis flip (not vertical), same angle as previous
			200	Same angle as next
			300	180-degree angle
			400	Same angle as previous + 180 degrees
			500	Same angle as next + 180 degrees
		cutpos$	10	Start
			20	Middle
			30	End
			40	Entry to cut
			50	Exit from cut
		cuttyp$	1	Zigzag
			2	One way
			3	Circular
			4	Swarf
9	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
10	Surface normal vector	**p_svec$**		
11	Surface normal vector	**q_svec$**		
12	Surface normal vector	**r_svec$**		

* These are maintained for compatability only. Use the Control Flags Parameter instead!

W 11 : 4-Axis Taper Move

Prototype: `11`
`1 2 3 4 5 6 7 8 9`

1	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
2	X position	**xnci$, x$**		lower point
3	Y position	**ynci$,y$**		lower point
4	Z position	**znci$,z$**		lower point
5	U position	**u$**		upper point
6	V position	**v$**		upper point
7	W position	**w$**		upper point
8	Feed rate	**fr$**		Feed rate
9	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.

W 20 : Direct 4-axis lower guide – linear move at rapid

Prototype:

```
20
1 2 3 4 5 6 7 8 9
```

1	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
2	X position	**xnci$, x$**		
3	Y position	**ynci$, y$**		
4	Z position	**znci$, z$**		
5	Feed rate	**fr$**	Positive	Feed rate in units per minute
			-1	Unchanged
6	Wire taper	**wt$**		
7	Corner type	**wc$**	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fishtail
8	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
9	Corner type radius	**wc_rad$**		

W 21 : Direct 4-axis lower guide – linear move at feed rate

Prototype: `21`
`1 2 3 4 5 6 7 8 9`

1	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
2	X position	**xnci$, x$**		
3	Y position	**ynci$, y$**		
4	Z position	**znci$, z$**		
5	Feed rate	**fr$**	Positive	Feed rate in units per minute
			-1	Unchanged
6	Wire taper	**wt$**		
7	Corner type	**wc$**	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fishtail
8	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
9	Corner type radius	**wc_rad$**		

W 22 : Direct 4-axis lower guide – arc move clockwise

Prototype: `22`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15`

1	(Not used)			
2	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
3	X position	**xnci$, x$**		
4	Y position	**ynci$, y$**		
5	Absolute X-axis arc center	**xc$**		(relative to plane)
6	Absolute Y-axis arc center	**yc$**		(relative to plane)
7	Z position	**znci$, z$**		
8	Feed rate	**fr$**	Positive	Feed rate per minute
			-1	Unchanged
9	Wire taper	**wt$**		
10	Corner type	wc$	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fishtail
11	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
12	Corner type radius	**wc_rad$**		
13	Arc type	**warc_ctyp$**	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fish Tail
14	Arc type radius	**wcor_rad$**		
15	Full arc flag	**full_arc_flg$**	0	NOT a full arc move
			1	Full arc move (360-degree sweep)

W 23 : Direct 4-axis lower guide – arc move counterclockwise

Prototype: `23`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15`

1	(Not used)			
2	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
3	X position	**xnci$, x$**		
4	Y position	**ynci$, y$**		
5	Absolute X-axis arc center	**xc$**		(relative to plane)
6	Absolute Y-axis arc center	**yc$**		(relative to plane)
7	Z position	**znci$, z$**		
8	Feed rate	**fr$**	Positive	Feed rate per minute
			-1	Unchanged
9	Wire taper	**wt$**		
10	Corner type	wc$	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fishtail
11	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
12	Corner type radius	**wc_rad$**		
13	Arc type	**warc_ctyp$**	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fish Tail
14	Arc type radius	**wcor_rad $**		
15	Full arc flag	**full_arc_flg$**	0	NOT a full arc move
			1	Full arc move (360-degree sweep)

W 30 : Direct 4-axis upper guide – linear move at rapid

Prototype:
```
30
1 2 3 4 5 6 7 8 9
```

1	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
2	X position	**wx$**		
3	Y position	**wy$**		
4	Z position	**wz$**		
5	Feed rate	**wfr$**	Positive	Feed rate in units per minute
			-1	Unchanged
6	Wire taper	wtpr$		
7	Corner type	wcor$	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fishtail
8	Control flags	cur_cfl g$		See “Control Flags Parameters” on page 387.
9	Corner type radius	wcor_rad $		

W 31 : Direct 4-axis upper guide – linear move at feed rate

Prototype: `31`
`1 2 3 4 5 6 7 8 9`

1	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
2	X position	**wx$**		
3	Y position	**wy$**		
4	Z position	**wz$**		
5	Feed rate	**wfr$**	Positive	Feed rate in units per minute
			-1	Unchanged
6	Wire taper	wtpr$		
7	Corner type	wcor$	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fishtail
8	Control flags	cur_cflg$		See “Control Flags Parameters” on page 387.
9	Corner type radius	wcor_rad$		

W 32 : Direct 4-axis upper guide – arc move clockwise

Prototype: **32**
1 2 3 4 5 6 7 8 9 10 11 12 13 14

1	(Not used)			
2	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
3	X position	**wx$**		
4	Y position	**wy$**		
5	Absolute X-axis arc center	**wxc$**		(relative to plane)
6	Absolute Y-axis arc center	**wyc$**		(relative to plane)
7	Z position	**wz$**		
8	Feed rate	**wfr$**	Positive	Feed rate per minute
			-1	Unchanged
9	Wire taper	**wtpr$**		
10	Corner type	wcor$	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fishtail
11	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
12	Corner type radius	**wcor_rad$**		
13	Arc type	**warc_cortyp$**	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fish tail
14	Arc type radius	**wcor_radius$**		

W 33 : Direct 4-axis upper guide – arc move counterclockwise

Prototype: **33**
1 2 3 4 5 6 7 8 9 10 11 12 13 14

1	(Not used)			
2	Wire compensation	**cc$, ccomp$**	0	Wire compensation modal (no change)
			40	Cancel wire compensation in the control
			41	Wire compensation in the control = left
			42	Wire compensation in the control = right
			140	Cancel wire compensation last move in the contour
3	X position	**wx$**		
4	Y position	**wy$**		
5	Absolute X-axis arc center	**wxc$**		(relative to plane)
6	Absolute Y-axis arc center	**wyc$**		(relative to plane)
7	Z position	**wz$**		
8	Feed rate	**wfr$**	Positive	Feed rate per minute
			-1	Unchanged
9	Wire taper	**wtpr$**		
10	Corner type	wcor$	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fishtail
11	Control flags	**cur_cflg$**		See “Control Flags Parameters” on page 387.
12	Corner type radius	**wcor_rad$**		
13	Arc type	**warc_cortyp$**	0	Conical
			1	Sharp
			2	Constant
			3	Other
			4	Fixed
			5	Fish tail
14	Arc type radius	**wcor_radius$**		

L M R W 80 : Cancel Drill / Canned Cycle

Prototype:

```
80
[blank line]
```

Note: Even though Gcode 80 has no parameters, a blank line must be output for the second line.

L 81 : Start Canned Cycle

Prototype: `81`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19`

1	Drill cycle type	**drillcyc$**	0	Simple
			1	Peck
			2	Chip break
			3	Tap
			4	Bore #1
			5	Bore #2
			6	Misc #1
			7	Misc #2
			8-19	Custom cycles
2	X position	***drl_depth_x$, x$**		XYZ is a 3D point that represents the drill point at the bottom of the hole.
3	Y position	***drl_depth_y$, y$**		XYZ is a 3D point that represents the drill point at the bottom of the hole.
4	Z position	***drl_depth_z$, z$, depth$**		XYZ is a 3D point that represents the drill point at the bottom of the hole.
5	Dwell time	**dwell$**		
6	Feed rate	**frplunge$**		
7	First peck amount	**peck1$**		
8	Subsequent peck amount	**peck2$**		
9	Peck clearance	**peckclr$**		
10	Chip break retract	**retr$**		
11	Drill cycle initial height	**initht$**		
12	Drill cycle reference height	**refht$**		
13	Drill depth	**zdrl$**		
14	Boring bar clearance shift amount	**shftdrl$**		
15	W position**	**w$**		UW is a 2D point that represents the initial height point.
16	U position**	**u$**		UW is a 2D point that represents the initial height point.
17	(Not used)			
18	Control flags	cur_cflg$		See “Control Flags Parameters” on page 387.
19	Drill depth	**rev_drl5$**	1	Indicates reversal of the drill direction from UVW to XYZ.

If vers_no is 8 or greater, the following data is calculated and overwrites the parameters passed in the NCI:

- depth from z
- zdrl (calculated) from w – initht
- refht from zdrl (calculated) + refht
- tosz (top of stock) from zdrl (calculated) + zdrl (original)
- initht from w
- xdrl from x

M R 81 : Start Drill Cycle

Prototype: `81`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19`

1	Drill cycle type	***drl_cycle$, drillcyc$**	0	Simple
			1	Peck
			2	Chip break
			3	Tap
			4	Bore #1
			5	Bore #2
			6	Misc #1
			7	Misc #2
			8-19	Custom cycles
2	X position	***drl_depth_x$, x$**		XYZ is a 3D point that represents the drill point at the bottom of the hole.
3	Y position	***drl_depth_y$, y$**		XYZ is a 3D point that represents the drill point at the bottom of the hole.
4	Z position	***drl_depth_z$, z$, depth$**		XYZ is a 3D point that represents the drill point at the bottom of the hole.
5	Dwell time	***dwell$**		
6	Feed rate	***frplunge$**		
7	First peck amount	***peck1$**		
8	Subsequent peck amount	***peck2$**		
9	Peck clearance	***peckclr$**		
10	Chip break retract	***retr$**		
11	Drill cycle initial height	***drl_sel_ini$, initht$**		The distance from the selected drill position (zdrl) to the *initial* height, sign is positive for above selected drill position.
12	Drill cycle reference height	***drl_sel_ref$, refht$**		The distance from the selected drill position (zdrl) to the *reference* height, sign is positive for above selected drill position.
13	Drill depth	***drl_sel_tos zdrl$**		The distance from the selected drill position (zdrl) to the *top of stock*, sign is positive for above selected drill position.
14	Boring bar clearance shift amount	***shftdrl$**		
15	U position	***drl_init_x $, u$**		UVW is a 3D point that represents the initial height point.

16	V position	***drl_init_y $, v$**		UVW is a 3D point that represents the initial height point.
17	W position	***drl_init_z $, w$**		UVW is a 3D point that represents the initial height point.
18	Control flags	cur_cflg$		See “Control Flags Parameters” on page 387.
19	Drill depth	***rev_drl5$**	1	When 1, indicates reversal of the drill direction from UVW to XYZ.

The * prefacing the variable names above indicates that these are the values read from the NCI file data. The other variables are calculated by MP.

Note: If vers_no is 8 or greater, the following data is calculated and overwrites the parameter passed in the NCI:

- depth from z
- zdrl (calculated) from w – initht
- refht from zdrl (calculated) + refht
- tosz (top of stock) from zdrl (calculated) + zdrl (original)
- initht from w

W 81 : Start Canned Cycle

Prototype: `81`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19`

1	Drill cycle type	**cancyc$**	0-19	Custom cycles
2	X position*	**xnci$, x$**		XYZ is a 3D point that represents the drill point at the bottom of the hole.
3	Y position*	**ynci$, y$**		XYZ is a 3D point that represents the drill point at the bottom of the hole.
4	Z position*	**znci$, z$**		XYZ is a 3D point that represents the drill point at the bottom of the hole.
5	Entered value	**canned1$**		
6	(Not used)	**$**		
7	Entered value	**canned4$**		
8	Entered value	**canned5$**		
9	Entered value	**canned6$**		
10	Entered value	**canned7$**		
11	Entered value	**canned2$**		
12	Entered value	**canned3$**		
13	(Not used)			
14	(Not used)			
15	(Not used)			
16	(Not used)			
17	(Not used)			
18	Control flags	cur_cflg$		See “Control Flags Parameters” on page 387.
19	(Not used)			

L M R W 82 : Additional Drill / Canned Cycle Parameters

Prototype: `82`
`1 2 3 4 5 6 7 8 9 10`

1	Drill parameter 1	**drl_prm1$**	
2	Drill parameter 2	**drl_prm2$**	
3	Drill parameter 3	**drl_prm3$**	
4	Drill parameter 4	**drl_prm4$**	
5	Drill parameter 5	**drl_prm5$**	
6	Drill parameter 6	**drl_prm6$**	
7	Drill parameter 7	**drl_prm7$**	
8	Drill parameter 8	**drl_prm8$**	
9	Drill parameter 9	**drl_prm9$**	
10	Drill parameter 10	**drl_prm10$**	

Note: The drl_prm *variables do not have a specific meaning; they are values that the post customization file can use for whatever purpose needed for that cycle.*

R 83 : Block Drill / Canned Cycle Parameters

Prototype: **83**
1 2 3 4 5 6 7 8 9 10 11 12

1	Drill point (X) position at depth.	**bdrl_x$**	Position of the *lead* tool
2	Drill point (Y) position at depth.	**bdrl_y$**	Position of the *lead* tool
3	Drill point (Z) position at depth.	**bdrl_z$**	Position of the *lead* tool
4	Offset to lead tool in X	**bdrl_ofs_x$**	Distance of drill hole to the lead drill position.
5	Offset to lead tool in Y	**bdrl_ofs_y$**	Distance of drill hole to the lead drill position.
6	Offset to lead tool. In Z	**bdrl_ofs_z$**	Distance of drill hole to the lead drill position.
7	Tool group number	**bdrl_tool_grp$**	
8	Work offset number	**bdrl_wrk_ofs$**	
9	Position of lead drill at initial height.	**bdrl_u$**	Clearance point position in X
10	Position of lead drill at initial height.	**bdrl_v$**	Clearance point position in Y
11	Position of lead drill at initial height.	**bdrl_w$**	Clearance point position in Z
12	Bitwise tool number	**bdrl_tool_no $**	In this parameter, the data is stored in “bitwise” format.

Note: MP also reads the following variables when block drilling is active: bdrl_x2, bdrl_y2, and bdrl_z2. These three values are actually read from NCI **M R 81 : Start Drill Cycle** and **M R 100 : Canned Cycle Repeat Position** data records. They are the actual drilled location (which may not be the lead tool position) at depth.

.

M R 100 : Canned Cycle Repeat Position

Prototype:
```
100
1 2 3 4 5 6 7 8 9 10 11 12 1314 15 16 17 18 19 20 21 22 23
```

1	(Not used)		
2	X position	***drill_depth_x$, x$**	XYZ is a 3D point that represents the drill point at the bottom of the hole.
3	Y position	***drill_depth_y$, y$**	XYZ is a 3D point that represents the drill point at the bottom of the hole.
4	Z position	***drill_depth_z z$**	XYZ is a 3D point that represents the drill point at the bottom of the hole.
5	Drill cycle reference height	***drl_sel_ref$, refht$**	The distance from the selected drill position (zdrl) to the *initial* height, sign is positive for above selected drill position.
6	Drill depth	***drl_sel_ref$, zdrl$**	The distance from the selected drill position (zdrl) to the *reference* height, sign positive for above selected drill position.
7	Dwell time	***dwell$**	
8	Feed rate	***frplunge$**	
9	U position	***drl_init_x$, u$**	UVW is a 3D point that represents the initial height point.
10	V position	***drl_init_y$, v$**	UVW is a 3D point that represents the initial height point.
11	W position	***drl_init_z$, w$**	UVW is a 3D point that represents the initial height point.
12	Control flags	cur_cflg$	See “Control Flags Parameters” on page 387.
13	Drill depth	***rev_drl5$**	When 1, indicates reversal of the drill direction from UVW to XYZ.
14	Top of stock	***drl_sel_tos$**	the distance from the selected drill position (zdrl) to the *top of stock*, sign positive for above zdrl
15	X vector X	***drl_m1$**	Drilling matrix XX (see **note below)
16	X vector Y	***drl_m2$**	Drilling matrix XY
17	X vector Z	***drl_m3$**	Drilling matrix XZ
18	Y vector X	***drl_m4$**	Drilling matrix YX
19	Y vector Y	***drl_m5$**	Drilling matrix YY
20	Y vector Z	***drl_m6$**	Drilling matrix YZ
21	Z vector X	***drl_m7$**	Drilling matrix ZX
22	Z vector Y	***drl_m8$**	Drilling matrix ZY
23	Z vector Z	***drl_m9$**	Drilling matrix ZZ

The * prefacing the variable names above indicates these are the values read from the NCI file data. The other variables are calculated by MP.

**The matrix (m1-m9) from the NCI 1014 tool plane data is copied to this matrix at the Gcode 81.

This matrix (drl_m1-drl_m9) data is copied to the tool plane matrix (m1-m9) at the Gcode 100.

Note: The read parameters changed for Mastercam X. (Also see the ***M R 81 : Start Drill Cycle*** *on page 326.)*

W 100 : Canned Cycle Repeat Position

Prototype:

```
100
1 2 3 4 5
```

1	(Not used)		
2	X position	**xnci$, x$**	
3	Y position	**ynci$, y$**	
4	Z position	**znci$, z$**	
5	(Not used)		

L 200 : Threading Parameters One

Prototype:

```
200
1 2 3 4 5 6 7 8
```

1	Number of spring cuts	**nspring$**		
2	Finish allowance	**thdfinish$**		
3	Anticipated thread pull-off	**thdpulloff$**		
4	Number of starts	**nstarts$**		
5	Clearance perpendicular to cuts	**thdxclr$**		
6	Thread infeed angle	**thdangle$**		Value in radians
7	Equal depth thread cuts	**thdequcut$**	0	Determine depth cuts from: Equal area method.
			1	Determine depth cuts from: Number of cuts.
8	Number of cuts	**thdncuts$**	>0	Determine number of cuts from: Number of cuts.

Always appears together with the **L 201 : Threading Parameters Two**.

L 201 : Threading Parameters Two

Prototype: `201`
`1 2 3 4 5 6 7 8 9 10 11 12`

1	X position 1	**thdx1$**		Thread major
2	X position 2	**thdx2$**		Thread minor
3	Z position 1	**thdz1$**		Starting Z position of thread
4	Z position 2	**thdz2$**		Ending Z position of thread
5	Lead settings	**thdlead$**	Positive	Lead in units per thread
			Negative	Lead in threads per inch*
6	Amount of first cut	**thdfirst$**		Calculated based on thdequcut$thdequcut
7	Amount of last cut	**thdlast$**		
8	Stock clearance in Z	**thdzclr$**		Acceleration clearance
9	Thread angle	**thda1$**		Value in radians
10	Thread included angle	**thda2$**		Value in radians
11	Thread type settings	**thdtype$**	0	Long cycle (pg32)
			1	Canned (pg76)
			2	Long cycle (pg92)
12	X position 3	**thdx3$**		Ending X position of thread

Always appears together with the **L 200 : Threading Parameters One**.

- thdlead$ is always converted to a (positive) units-per-thread value.
- Calculate thread taper by (thdx2 – thdx3).

L 900 : Stock Transfer – Misc Ops function

Prototype: **900**
1 2 3 4 5 6 7 8 9 10 11

1	Active spindle for stock to transfer	**stck_spindle$**	0 1	Main spindle Sub spindle
2		**stck_init_z$**		Z coordinate on stock to be transferred
3		**stck_final_z$**		Z coordinate on transferred stock
4		**stck_chuk_st_z$**		Source chuck Z axis reference position *before* transfer
5		**stck_chuk_st_x$**		Source chuck X axis reference position *before* transfer
6		**stck_chuk_end_z$**		Source chuck Z axis reference position *after* transfer
7		**stck_chuk_end_x$**		Source chuck X axis reference position *after* transfer
8		**stck_chuk_st_dz$**		Destination chuck Z axis reference position *before* transfer
9		**stck_chuk_st_dx$**		Destination chuck X axis reference position *before* transfer
10		**stck_chuk_end_dz$**		Destination chuck Z axis reference position *after* transfer
11		**stck_chuk_end_dx$**		Destination chuck X axis reference position *after* transfer

Processed by postblock pstck_trans$.

L 901 : Stock Flip – Misc Ops function

Prototype:
```
901
1 2 3 4 5 6 7
```

1	Active spindle for stock to transfer	**stck_spindle$**	0	Main spindle
			1	Sub spindle
2		**stck_init_z$**		Z coordinate on stock *before* flip
3		**stck_final_z$**		Z coordinate on stock *after* flip
4		**stck_chuk_st_z$**		Chuck Z axis position *before* flip
5		**stck_chuk_st_x$**		Chuck X axis position *before* flip
6		**stck_chuk_end_z$**		Chuck Z axis position *after* flip
7		**stck_chuk_end_x$**		Chuck X axis position *after* flip

Processed by postblock pstck_flip$.

L 902 : Stock Advance – Misc Ops function

Prototype: `902`
`1 2 3 4 5 6 7 8 9 10 11 12`

1	Active spindle for stock to transfer	**stck_spindle$**	0	Main spindle
			1	Sub spindle
2		**stck_op$**	0	Push stock
			1	Push stock with Use Tool Stop option
			2	Pull stock
3		**stck_clear$**		Stock clearance (pull stock method)
4		**stck_grip$**		Grip length (pull stock method)
5		**stck_init_z$**		Z coordinate of stock *before* advance
6		**stck_final_z$**		Z coordinate of stock *after* advance
7		**stck_appr_fr$**		Feed rate that the bar puller uses while moving into position
8		**stck_adv_fr$**		Feed rate that the stock advances at
9		**stck_chuk_st_z$**		Chuck Z axis position *before* advance
10		**stck_chuk_st_x$**		Chuck X axis position *before* advance
11		**stck_chuk_end_z$**		Chuck Z axis position *after* advance
12		**stck_chuk_end_x$**		Chuck X axis position *after* advance

Processed by postblock pstck_bar_fd$.

L 903 : Chuck – Misc Ops function

Prototype:
```
903
1 2 3 4 5 6
```

1	Active spindle for clamp/unclamp	**clmp_spindle$**	0	main spindle
			1	Sub spindle
2	Operation	**clmp_op$**	0	Clamp
			1	Un-clamp
			2	Re-position
3		**stck_chuk_st_z$**		Original Z axis Chuck Position
4		**stck_chuk_st_x$**		Original X axis Chuck Position
5		**stck_chuk_end_z$**		Final Z axis Chuck Position
6		**stck_chuk_end_x$**		Final X axis Chuck Position

L 904 : TailStock – Misc Ops function

Prototype:

```
904
1 2 3
```

1	Operation	**tlstck_on$**	0	Retract tailstock
			1	Engage tailstock
2		**stck_init_z$**		Initial Z position of tailstock
3		**stck_final_x$**		Final Z position of tailstock

L 905 : SteadyRest – Misc Ops function

Prototype:
```
905
1 2
```

1	**stck_init_z$**	Initial steady rest position
2	**stck_final_z$**	Final steady rest position

Processed by postblock psteadyrest$.

L 911 : Define Misc Ops custom parameters — reals

Prototype: `911`
`1 2 3 4 5 6 7 8 9 10`

1	Miscellaneous real 1	**miscops_mr1$**	
2	Miscellaneous real 2	**miscops_mr2$**	
3	Miscellaneous real 3	**miscops_mr3$**	
4	Miscellaneous real 4	**miscops_mr4$**	
5	Miscellaneous real 5	**miscops_mr5$**	
6	Miscellaneous real 6	**miscops_mr6$**	
7	Miscellaneous real 7	**miscops_mr7$**	
8	Miscellaneous real 8	**miscops_mr8$**	
9	Miscellaneous real 9	**miscops_mr9$**	
10	Miscellaneous real 10	**miscops_mr10$**	

L 912 : Define Misc Ops custom parameters — integers

Prototype:

```
912
1 2 3 4 5 6 7 8 9 10
```

1	Miscellaneous integer 1	**miscops_mi1$**
2	Miscellaneous integer 2	**miscops_mi2$**
3	Miscellaneous integer 3	**miscops_mi3$**
4	Miscellaneous integer 4	**miscops_mi4$**
5	Miscellaneous integer 5	**miscops_mi5$**
6	Miscellaneous integer 6	**miscops_mi6$**
7	Miscellaneous integer 7	**miscops_mi7$**
8	Miscellaneous integer 8	**miscops_mi8$**
9	Miscellaneous integer 9	**miscops_mi9$**
10	Miscellaneous integer 10	**miscops_mi10$**

M R L 950 : Axis combination

Prototype: **950**
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

4	**syncaxis$**	Component ID of axis combination
[all other parameters]	(Not used)	

M R L W 999 : Start of operation

Prototype: `999`
`1 2 3`

This NCI Gcode is currently only useful for Mastercam MultiTasking.

1	Code for specific operation type	**tool_op$**	See the following sections for lists of operation codes: “M R 1016 : Additional Miscellaneous Parameters” on page 368 “L 1016 : Additional Miscellaneous Parameters” on page 371 “W 1016 : Additional Miscellaneous Parameters” on page 373
2	data stream	**synchstream$**	
3	Operation ID numbers	**op_id$**	

M R 1000 : Null tool change

Prototype:

```
1000
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
```

1	Program number	**progno$**		
2	Starting sequence number	**seqno$**		
3	Sequence number increment	**seqinc$**		
4	Tool number	**t$**		
5	Tool diameter offset number	**tloffno$**		
6	Tool length offset number	**tlngno$**		
7	Plane position	**plane$**	0	XY plane
			1	YZ plane
			2	XZ plane
8	Spindle speed in RPM	**ss$**	Positive	Spindle forward
			0	Spindle stop
			Negative	Spindle reverse
9	Feed rate	**fr$**		
10	Coolant use	**coolant$**	0	Off
			1	Flood
			2	Mist
			3	Tool
11	X rapid position	**xr$**		
12	Y rapid position	**yr$**		
13	Z rapid position	**zr$**		
14	X home position	**xh$**		
15	Y home position	**yh$**		
16	Z home position	**zh$**		
17	Axis substitution	**rotaxis$**	-2	Axis substitution, substitute Y, CCW
			-1	Axis substitution, substitute X, CCW
			0	None
			1	Axis substitution, substitute X, CW
			2	Axis substitution, substitute Y, CW
			11	Polar conversion, rotate about X
			12	Polar conversion, rotate about Y
			13	Polar conversion, rotate about Z
			21	4-axis, rotate about X
			22	4-axis, rotate about Y
			23	4-axis, rotate about Z

18	Diameter for axis substitution	**rotdia$**	

L 1000 : Null tool change

Prototype: `1000`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18`

1	Program number	**progno$**		
2	Starting sequence number	**seqno$**		
3	Sequence number increment	**seqinc$**		
4	Tool number	**t$**		
5	Tool diameter offset number	**tloffno$**		
6	Maximum spindle speed	**maxss$**		
7	Tool orientation	**orient$**		
8	Spindle speed	**ss$**	Positive	Spindle speed in RPM
			0	Spindle stop
			Negative	Spindle speed in surface units per minute
9	Feed rate	**fr$**	Positive	Feed rate in units per minute
			Negative	Feed rate in units per revolution
10	Coolant use	**coolant$**	0	Off
			1	Flood
			2	Mist
			3	Tool
11	X rapid position	**xr$**		
12	Y rapid position	**yr$**		
13	Z rapid position	**zr$**		
14	X home position	**xh$**		
15	Y home position	**yh$**		
16	Z home position	**zh$**		
17	Spindle direction	**spdir$**	1	Spindle forward
			0	Spindle stop
			-1	Spindle reverse
18	(Not used)			

W 1000 : Null tool change

Prototype: `1000`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22`

1	Program number	**progno$**		
2	Starting sequence number	**seqno$**		
3	Sequence number increment	**seqinc$**		
4	Cut pass	**pass$**		
5	Condition code	**ccode$**		
6	Offset number	**offset$**		
7	(Not used)			
8	Initial wire taper	**inittaper$**	Positive	Taper, right
			0	No taper
			Negative	Taper, left
9	Feed rate	**fr$**		
10	Flushing	**water$**	0	Off
			1	Flood
			2	Other
11	X thread position	**threadx$**		
12	Y thread position	**thready$**		
13	Z thread position	**threadx$**		
14	X start position	**startx$**		
15	Y start position	**starty$**		
16	Z start position	**startz$**		
17	Height of XY plane	**xyheight$**		
18	Height of UV plane	**uvheight$**		
19	X skewed wire thread	**up_st_vecx$**		
20	Y skewed wire thread	**up_st_vecy$**		
21	Z skewed wire thread	**up_st_vecz$**		
22	Skewed wire thread	**up_st_mode$**	0	Off
			1	Apply to thread
			2	Apply to cut
			3	Apply to both thread/cut

M R 1001 : Start-of-file tool change

Prototype: `1001`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18`

1	Program number	**progno$**		
2	Starting sequence number	**seqno$**		
3	Sequence number increment	**seqinc$**		
4	Tool number	**t$**		
5	Tool diameter offset number	**tloffno$**		
6	Tool length offset number	**tlngno$**		
7	Plane position	**plane$**	0	XY plane
			1	YZ plane
			2	XZ plane
8	Spindle speed in RPM	**ss$**	Positive	Spindle forward
			0	Spindle stop
			Negative	Spindle reverse
9	Feed rate	**fr$**		
10	Coolant use	**coolant$**	0	Off
			1	Flood
			2	Mist
			3	Tool
11	X rapid position	**xr$**		
12	Y rapid position	**yr$**		
13	Z rapid position	**zr$**		
14	X home position	**xh$**		
15	Y home position	**yh$**		
16	Z home position	**zh$**		
17	Axis substitution	**rotaxis$**	-2	Axis substitution, substitute Y, CCW
			-1	Axis substitution, substitute X, CCW
			0	None
			1	Axis substitution, substitute X, CW
			2	Axis substitution, substitute Y, CW
			11	Polar conversion, rotate about X
			12	Polar conversion, rotate about Y
			13	Polar conversion, rotate about Z
			21	4-axis, rotate about X
			22	4-axis, rotate about Y
			23	4-axis, rotate about Z

18	Diameter for axis substitution	**rotdia$**	

L 1001 : Start-of-file tool change

Prototype: `1001`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18`

1	Program number	**progno$**		
2	Starting sequence number	**seqno$**		
3	Sequence number increment	**seqinc$**		
4	Tool number	**t$**		
5	Tool diameter offset number	**tloffno$**		
6	Maximum spindle speed	**maxss$**		
7	Tool orientation	**orient$**		
8	Spindle speed	**ss$**	Positive	Spindle speed in RPM
			0	Spindle stop
			Negative	Spindle speed in surface units per minute
9	Feed rate	**fr$**	Positive	Feed rate in units per minute
			Negative	Feed rate in units per revolution
10	Coolant use	**coolant$**	0	Off
			1	Flood
			2	Mist
			3	Tool
11	X rapid position	**xr$**		
12	Y rapid position	**yr$**		
13	Z rapid position	**zr$**		
14	X home position	**xh$**		
15	Y home position	**yh$**		
16	Z home position	**zh$**		
17	Spindle direction	**spdir$**	1	Spindle forward
			0	Spindle stop
			-1	Spindle reverse
18	(Not used)			

W 1001 : Start-of-file tool change

Prototype: `1001`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22`

1	Program number	**progno$**		
2	Starting sequence number	**seqno$**		
3	Sequence number increment	**seqinc$**		
4	Cut pass	**pass$**		
5	Condition code	**ccode$**		
6	Offset number	**offset$**		
7	(Not used)			
8	Initial wire taper	**inittaper$**	Positive	Taper, right
			0	No taper
			Negative	Taper, left
9	Feed rate	**fr$**		
10	Flushing	**water$**	0	Off
			1	Flood
			2	Other
11	X thread position	**threadx$**		
12	Y thread position	**thready$**		
13	Z thread position	**threadx$**		
14	X start position	**startx$**		
15	Y start position	**starty$**		
16	Z start position	**startz$**		
17	Height of XY plane	**xyheight$**		
18	Height of UV plane	**uvheight$**		
19	X skewed wire thread	**up_st_vecx$**		
20	Y skewed wire thread	**up_st_vecy$**		
21	Z skewed wire thread	**up_st_vecz$**		
22	Skewed wire thread	**up_st_mode$**	0	Off
			1	Apply to thread
			2	Apply to cut
			3	Apply to both thread/cut

M R 1002 : Tool Change

Prototype: `1002`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18`

1	Program number	**progno$**		
2	Starting sequence number	**seqno$**		
3	Sequence number increment	**seqinc$**		
4	Tool number	**t$**		
5	Tool diameter offset number	**tloffno$**		
6	Tool length offset number	**tlngno$**		
7	Plane position	**plane$**	0	XY plane
			1	YZ plane
			2	XZ plane
8	Spindle speed in RPM	**ss$**	Positive	Spindle forward
			0	Spindle stop
			Negative	Spindle reverse
9	Feed rate	**fr$**		
10	Coolant use	**coolant$**	0	Off
			1	Flood
			2	Mist
			3	Tool
11	X rapid position	**xr$**		
12	Y rapid position	**yr$**		
13	Z rapid position	**zr$**		
14	X home position	**xh$**		
15	Y home position	**yh$**		
16	Z home position	**zh$**		
17	Axis substitution	**rotaxis$**	-2	Axis substitution, substitute Y, CCW
			-1	Axis substitution, substitute X, CCW
			0	None
			1	Axis substitution, substitute X, CW
			2	Axis substitution, substitute Y, CW
			11	Polar conversion, rotate about X
			12	Polar conversion, rotate about Y
			13	Polar conversion, rotate about Z
			21	4-axis, rotate about X
			22	4-axis, rotate about Y
			23	4-axis, rotate about Z

18	Diameter for axis substitution	**rotdia$**	

L 1002 : Tool Change

Prototype:

```
1002
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
```

1	Program number	**progno$**		
2	Starting sequence number	**seqno$**		
3	Sequence number increment	**seqinc$**		
4	Tool number	**t$**		
5	Tool diameter offset number	**tloffno$**		
6	Maximum spindle speed	**maxss$**		
7	Tool orientation	**orient$**		
8	Spindle speed	**ss$**	Positive	Spindle speed in RPM
			0	Spindle stop
			Negative	Spindle speed in surface units per minute
9	Feed rate	**fr$**	Positive	Feed rate in units per minute
			Negative	Feed rate in units per revolution
10	Coolant use	**coolant$**	0	Off
			1	Flood
			2	Mist
			3	Tool
11	X rapid position	**xr$**		
12	Y rapid position	**yr$**		
13	Z rapid position	**zr$**		
14	X home position	**xh$**		
15	Y home position	**yh$**		
16	Z home position	**zh$**		
17	Spindle direction	**spdir$**	1	Spindle forward
			0	Spindle stop
			-1	Spindle reverse
18	(Not used)			

W 1002 : Tool Change

Prototype:

```
1002
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
```

1	Program number	**progno$**		
2	Starting sequence number	**seqno$**		
3	Sequence number increment	**seqinc$**		
4	Cut pass	**pass$**		
5	Condition code	**ccode$**		
6	Offset number	**offset$**		
7	(Not used)			
8	Initial wire taper	**inittaper$**	Positive	Taper, right
			0	No taper
			Negative	Taper, left
9	Feed rate	**fr$**		
10	Flushing	**water$**	0	Off
			1	Flood
			2	Other
11	X thread position	**threadx$**		
12	Y thread position	**thready$**		
13	Z thread position	**threadx$**		
14	X start position	**startx$**		
15	Y start position	**starty$**		
16	Z start position	**startz$**		
17	Height of XY plane	**xyheight$**		
18	Height of UV plane	**uvheight$**		
19	X skewed wire thread	**up_st_vecx$**		
20	Y skewed wire thread	**up_st_vecy$**		
21	Z skewed wire thread	**up_st_vecz$**		
22	Skewed wire thread	**up_st_mode$**	0	Off
			1	Apply to thread
			2	Apply to cut
			3	Apply to both thread/cut

M R 1003 : End of File

Prototype:
```
1003
1 2 3
```

1	X home position	**xh$**	
2	Y home position	**yh$**	
3	Z home position	**zh$**	

L 1003 : End of File

Prototype:
```
1003
1 2 3
```

1	X home position	**xh$**	
2	(Not used)		
3	Z home position	**zh$**	

W 1003 : End of File

Prototype:
```
1003
1 2 3
```

1	X thread position	**threadx$**	
2	Y thread position	**thready$**	
3	Z thread position	**threadz$**	

L M R W 1004 : Cancel Cutter Compensation

Prototype:
```
1004
[blank line]
```

Note: Even though Gcode 1004 has no parameters, a blank line must be output for the second line.

L M R W 1005 : Manual Entry / Comment before

Prototype: **1005**
comment

Text to be inserted into the NC program	

L M R W 1006 : Manual Entry / Comment after

Prototype: **1006**
comment

Text to be inserted into the NC program	

L M R W 1007 : Manual Entry / Comment with

Prototype: **1007**
comment

Text to be inserted into the NC program	

L M R W 1008 : Manual Entry / Tool operation comment

Prototype: **1008**
comment

Text to be inserted into the NC program	

W 1009 : Wire Cut Length (obsolete)

Prototype: `1009`
`1 2 3`

1	Wirepath cut length	**cutlength$**
2	(Not used)	
3	(Not used)	

Note: This NCI Gcode is no longer output.

W 1010 : Wire Condition Change

Prototype: `1010`
`1 2 3 4 5 6 7 8 9 1011 12 13 14`

1	Wire compensation	**cc$**	0	Cutter compensation modal (no change)
			40	Cancel cutter compensation in the control
			41	Cutter compensation in the control = left
			42	Cutter compensation in the control = right
			140	Cancel cutter compensation last move in the contour
2	Condition code	**ccode$**		
3	Wire offset	**offset$**		
4	Wire diameter	**tldia$**		
5	Register value 1	**reg1$**		
6	Register value 2	**reg2$**		
7	Register value 3	**reg3$**		
8	Register value 4	**reg4$**		
9	Register value 5	**reg5$**		
10	Register value 6	**reg6$**		
11	Register value 7	**reg7$**		
12	Register value 8	**reg8$**		
13	Register value 9	**reg9$**		
14	Register value 10	**reg10$**		

L M R W 1011 : Define Miscellaneous Reals

Prototype:
```
1011
1 2 3 4 5 6 7 8 9 10
```

1	Miscellaneous real 1	**mr1$**
2	Miscellaneous real 2	**mr2$**
3	Miscellaneous real 3	**mr3$**
4	Miscellaneous real 4	**mr4$**
5	Miscellaneous real 5	**mr5$**
6	Miscellaneous real 6	**mr6$**
7	Miscellaneous real 7	**mr7$**
8	Miscellaneous real 8	**mr8$**
9	Miscellaneous real 9	**mr9$**
10	Miscellaneous real 10	**mr10$**

L M R W 1012 : Define Miscellaneous Integers

Prototype:
```
1012
1 2 3 4 5 6 7 8 9 10
```

1	Miscellaneous integer 1	**mi1$**
2	Miscellaneous integer 2	**mi2$**
3	Miscellaneous integer 3	**mi3$**
4	Miscellaneous integer 4	**mi4$**
5	Miscellaneous integer 5	**mi5$**
6	Miscellaneous integer 6	**mi6$**
7	Miscellaneous integer 7	**mi7$**
8	Miscellaneous integer 8	**mi8$**
9	Miscellaneous integer 9	**mi9$**
10	Miscellaneous integer 10	**mi10$**

M R 1013 : Define Miscellaneous Parameters

Prototype:

```
1013
1 2 3 4 5 6 7 8 9 10
```

1	Cutter compensation use	**cc$**	0	Cutter compensation modal
			40	Cancel cutter compensation in the control
			41	Cutter compensation in the control = left
			42	Cutter compensation in the control = right
			140	Cancel cutter compensation last move in the contour
2	Tool diameter	**tldia$**		
3	Tool corner radius	**tcr$**		
4	Depth values to center or tip setting	**cctotip$**	0	Center
			1	Tip
5	View number	**tplnno$**	0	No matrix
			1	Top
			2	Front
			3	Back
			4	Bottom
			5	Right side
			6	Left side
			7	Isometric
			8	Axonometric
6	X coordinate of tool plane origin	**tox$**		(relative to view)
7	Y coordinate of tool plane origin	**toy$**		(relative to view)
8	Z coordinate of tool plane origin	**toz$**		(relative to view)
9	Operation code	**opcode$**	1	2D contour
			2	3D contour
			3	Drill
			4	Pocket
			5	Ruled
			6	2D swept
			7	3D swept
			8	Revolution
			9	Loft
			10	Coons
			11	Fillet

		12	Flowline
		13	Multisurface finish
		14	Multisurface rough
		15	Point
		16	Drill 5-axis
		17	Swarf 5-axis
		18	Curve 5-axis
		19	Facing
10	Tool reference path and name*	**strtool$, strtoolpath$**	

L 1013 : Define Miscellaneous Parameters

Prototype: `1013`
`1 2 3 4 5 6 7 8 9 10`

1	Cutter compensation	**cc$**	0	Cutter compensation modal
			40	Cancel cutter compensation in the control
			41	Cutter compensation in the control = left
			42	Cutter compensation in the control = right
			140	Cancel cutter compensation last move in the contour
2	Tool corner raidus	**tcr$**		Tool nose radius or tool radius of drill type tool
3	Tool diameter	**tldia$**		Always 0
4	(Not used)			
5	(Not used)			
6	X coordinate of tool plane origin	**tox$**		(relative to view)
7	Y coordinate of tool plane origin	**toy$**		(relative to view)
8	X coordinate of tool plane origin	**toz$**		(relative to view)
9	Operation code	**opcode$**	101	Rough
			102	Finish
			103	Groove
			104	Thread
			105	Drill
			106	Point
10	Tool library path and name*	**strtool$, strtoolpath$**		

W 1013 : Define Miscellaneous Parameters

Prototype: `1013`
`1 2 3 4 5 6 7 8 9 10`

1	Cutter compensation use	**cc$**	0	Cutter compensation modal
			40	Cancel cutter compensation in the control
			41	Cutter compensation in the control = left
			42	Cutter compensation in the control = right
			140	Cancel cutter compensation last move in the contour
2	Tool (wire) diameter	**tldia$**		
3	Tool (wire) radius	**tlrad$**		
4	Overburn amount	**overburn$**		
5	Wire status	**wire$**	0	Off
			1	On
6	Power status	**power$**	0	Off
			1	On
7	Work origin X	**wox$**		
8	Work origin y	**woy$**		
9	Operation code	**opcode$**	201	Contour
			202	Contour
			203	Canned (Drill)
			204	No Core
			205	4-axis taper, no skim
			206	2D reverse skimcut
			207	(Not used)
			208	4-axis direct, reverse skimcuts
			209	4-axis direct, no skimcuts
			210	4-axis taper, reverse skimcuts
			211	4-axis taper, one-way skimcuts
			212	4-axis direct, one-way skimcuts
			213	2D one-way skimcuts
			214	Rapid point
10	Power library path and name	**strtool$, strtoolpath$**		Full 'path and name' of the power library used for the operation

L M R W 1014 : Tool Plane View Matrix

Prototype:
```
1014
1 2 3 4 5 6 7 8 9
```

1	**m1$**	
2	**m2$**	
3	**m3$**	
4	**m4$**	
5	**m5$**	
6	**m6$**	
7	**m7$**	
8	**m8$**	
9	**m9$**	

View	xx	xy	xz	yx	yy	yz	zx	zy	zz
Top (1)	1	0	0	0	1	0	0	0	1
Front (2)	1	0	0	0	0	1	0	-1	0
Back (3)	-1	0	0	0	0	1	0	1	0
Bottom (4)	-1	0	0	0	1	0	0	0	-1
Right Side (5)	0	1	0	0	0	1	1	0	0
Left Side (6)	0	-1	0	0	0	1	-1	0	0
Isometric (7)	0.7071	0.7071	0	-0.4082	0.4082	0.8165	0.5774	-0.5774	0.5773
Axonometric (8)	0.5	-0.8536	0.1464	0.5	0.1464	0.8536	0.7071	0.5	0.5
Variable Name	m1	m2	m3	m4	m5	m6	m7	m8	m9

W 1015 : Subroutine Parameters

Prototype: `1015`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20`

1	Subroutine type settings	**subtyp$**	0	Not a subroutine
			1	Write subroutine
			2	Call subroutine only
2	Subroutine number	**subno$**		
3	Thread/cut flag	**td_ct_flg$**	0	No thread or cut
			1	Allow thread the wire
			2	Allow cut the wire
4	Tab cut	**tabcut$**	0	No tab cut
			1	Tab cut
			2	Contour with tab cut
5	Wire trim (wtrim)		0	Trim in control
			1	Trim in computer
			2	3D tracking
6	Skimcut options	**skimpass$**	0	No skimcut
			+1	First skim cut pass on a contour
			-1	Subsequent skim cut pass on a contour
			-2	Last skim cut pass on a contour
7	Wire cut position X	**cutx$**		
8	Wire cut position Y	**cuty$**		
9	XY trimming plane	**trimplane1$**		
10	UV trimming plane	**trimplane2$**		
11	Register value 1	**reg1$**		
12	Register value 2	**reg2$**		
13	Register value 3	**reg3$**		
14	Register value 4	**reg4$**		
15	Register value 5	**reg5$**		
16	Register value 6	**reg6$**		
17	Register value 7	**reg7$**		
18	Register value 8	**reg8$**		
19	Register value 9	**reg9$**		
20	Register value 10	**reg10$**		

MR 1016 : Additional Miscellaneous Parameters

Prototype:

```
1016
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
```

1	Operation id	**op_id$**		
2	Tool type	**tool_typ$**		
3	Internal toolpath opcode	**tool_op$**	1	Contour
			2	Drill
			3	Pocket
			4	Transform operation. Version 7: linear array Version 8+: mirror, rotate, translate
			5	Multisurface rough parallel
			6	Multisurface rough radial
			7	Multisurface rough project
			8	Multisurface rough flowline
			9	Multisurface rough contour
			10	Multisurface rough pocket
			11	Multisurface finish parallel
			12	Multisurface finish radial
			13	Multisurface finish project
			14	Multisurface finish flowline
			15	Multisurface finish contour
			16	For C-Hook- created operations
			17	Manual entry
			18	Version 8
			19	Point
			20	Trimmed
			21	Ruled
			22	Revolved
			23	Letters
			24	Swept 2D
			25	Swept 3D
			26	Coons
			27	Lofted
			28	5-axis drilling
			29	5-axis curve
			30	Project toolpath onto a plane
			31	Project toolpath onto a cylinder
			32	Project toolpath onto a sphere
			33	Project toolpath onto a cone
			34	Project toolpath onto a cross section

35	Project toolpath onto a surface
36	Non-associative contour
37	Non-associative drilling
38	Non-associative pocketing
39	Multisurface finish pencil trace
40	Multisurface finish leftover stock
41	Multisurface finish steep
42	Multisurface finish shallow
43	Multisurface finish constant scallop
44	Multisurface rough plunge
45	Multisurface finish 5-axis flowline
46	Multisurface finish 4-axis
47	Merged in ASCII NCI
48	5-axis swarf
49	5-axis roll die
51	Face contouring
52	Cross contouring
53	C-axis contouring
54	Non-associative drilling (*not used)*
55	Face drilling
56	Cross drilling
57	C-axis drilling
100	Thread mill
101	Edit common operation parameters
102	Facing
103	Associative trimmed
104	Solid drill control operation
105	Slot mill
106	Helix bore
107	Multi-surface rough restmill
108	Associative nesting container operation
109	Multi-surface finish blend
110	Multi-surface 5axis, rough
111	Slice 5axis
112	Port 5axis
115	Advanced multiaxis
130	Tab cutoff
131	Multi-surface rough pocket, light
132	High-speed surface toolpaths
133	Nesting onionskin operation
134	2d hardmill machining/peel mill
135	Saw
136	FBM drill control operation

			137	FBM pocket control operation
			138	FBM contour control operation *(future use)*
			301	Router contour
			302	Router pocket
			303	Router circmill
			304	Router cutoff (not used after V8)
			305	Router surface rough pocket
			306	Router multi-drill
			416	Engraving
			439	Art
			440	Advanced multiaxis (Moduleworks)
4	Construction view number	**cplnno$**		
5	X coordinate of construction plane origin	**corgx$**		(relative to view)
6	Y coordinate of construction plane origin	**corgy$**		(relative to view)
7	X coordinate of construction plane origin	**corgz$**		(relative to view)
8	Cutter compensation in computer	**cc_computer$**	0	Off
			41	Left
			42	Right
9	Work offset number	**workofs$**		
10	Metric is used	**met_tool$**		
11	Number of flutes on cutter	**n_flutes$**		
12	Active spindle for lathe	**spindle_no$**		
13	Number of threads on tap	**n_tap_thds$**		
14	Station number	**lstation$**		(Head number)
15	Upper turret is used	**lturret$**		
16	Unique tool ID	**ltool_id$**		
17	Operation ID	**xform_op_id$**		If the operation is a transform operation, this is the operation ID of the transformed operation.

L 1016 : Additional Miscellaneous Parameters

Prototype: `1016`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17`

1	**op_id$**		
2	**tool_typ$**		
3	**tool_op$**	51	face contouring (C axis)
		52	cross contouring (C axis)
		53	C axis contouring
		55	face drilling (C axis)
		56	cross drilling (C axis)
		57	C axis drilling
		60	Rough
		61	Finish
		62	Grooving
		63	Threading
		64	Drill
		65	Point
		66	Facing
		67	Cutoff
		68	Plunge rough
		69	Manual entry
		70	Merged ASCII
		201	Canned finish
		202	Canned rough
		203	Canned rough and finish
		204	Canned rough face
		205	Canned rough and finish face
		206	Canned pattern repeat rough
		207	Canned pattern repeat rough and finish
		208	Canned groove rough
		209	Canned groove finish
		210	Quick rough
		211	Quick finish
		212	Quick groove
		213	C-hook generated
		214	Stock transfer
		215	Stock flip
		216	Bar feed
		217	Chuck clamp/unclamp
		218	Tailstock operation
		219	Steadyrest operation

		220	Pinch-turn (MultiTasking)
		221	Custom operation with tool (MultiTasking/event-driven post)
		222	Custom operation without tool (MultiTasking/event-driven post)
		223	Reference custom operation (MultiTasking/event-driven post)
4	**cplnno$**		
5	**corgx$**		(relative to view)
6	**corgy$**		(relative to view)
7	**corgz$**		(relative to view)
8	**cc_computer$**	0	Off
		41	Left
		42	Right
9	**workofs$**		
10	**met_tool$**		
11	**n_flutes$**		
12	**spindle_no$**	0	Main spindle
		1	Sub spindle
13	**n_tap_thds$**		
14	**lstation$**		(Not used)
15	**lturret$**	0	No
		1	Yes
16	**ltool_id$**		
17	**xform_op_id$**		If the operation is a transform operation, this is the operation ID of the transformed operation.

W 1016 : Additional Miscellaneous Parameters

Prototype: `1016`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17`

1	Operation id	**op_id$**		
2	Finish spawned from Nocore	**nocore_fin$**		
3	Internal toolpath opcode	**tool_op$**	74	Contour
			75	Canned
			76	No Core
			77	Manual entry
			78	Point
			79	4-axis
			80	Transform
			81	Associative trimmed
			82	Merged in ASCII NCI
4	Construction view number	**cplnno$**		
5	X coordinate of construction plane origin	**corgx$**		(relative to view)
6	Y coordinate of construction plane origin	**corgy$**		(relative to view)
7	X coordinate of construction plane origin	**corgz$**		(relative to view)
8	Cutter compensation in computer	**cc_computer$**	0	Off
			41	Left
			42	Right
9	Work offset number	**workofs$**		
10	Metric is used	**met_tool$**		
11	Punch, die, open flag	**pdo_type$**	0	Punch
			1	Die
			2	Open
12		**spindle_no$**		
13		**rpd_hght$**		
14		**landheight$**		
15	Contour type button selected	**contour_typ$**		0, 1, 2, 3, 4 (left to right)
16	Chain height button selected	**contour_pos$**	0	XY height

		1	Land height
		2	UV height
17	(*Not used*)		

L M R 1017 : Construction Plane View Matrix

Prototype: `1017`
`1 2 3 4 5 6 7 8 9`

1	X vector X in WCS	**cm1$**	
2	X vector Y in WCS	**cm2$**	
3	X vector Z in WCS	**cm3$**	
4	Y vector X in WCS	**cm4$**	
5	Y vector Y in WCS	**cm5$**	
6	Y vector Z in WCS	**cm6$**	
7	Z vector X in WCS	**cm7$**	
8	Z vector Y in WCS	**cm8$**	
9	Z vector Z in WCS	**cm9$**	

L M R 1018 : Subprogram Start Definition

Prototype: **1018**
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

1	Subprogram number	**sub_op_id$**		
2	Actual operation id	**sub_grp_id$**		
3	Transform / non-tansform indicator	**sub_ref_id$**	0	Non-transform
			>0	Transform
4	Iteration counter	**sub_sec_no$**		Transform operations: <0 = Off 0 = Original >0 = Copy Non-transform operations: <1 = Copy in transform 1 = Original >1 = Copy
5	Total number of instances (1-based)	**sub_totl_no$**		
6	(Not used)	**sub_chn no$**		
7	Absolute or incremental	**sub_inc$**	0	Absolute
			1	Incremental
8	Transform type	**sub_trnstyp$**	0	Mirror
			1	Rotate
			2	Scale (not used)
			3	Translate
9		**sub_trnmthd$**	0	Translate method = Tool plane
			1	Translate method = Tool plane with “Tool plane origin ONLY” checked
			2	Translate method = Coordinate
10	Transform matrix	**sub_m1$**		
11	Transform matrix	**sub_m2$**		
12	Transform matrix	**sub_m3$**		
13	Transform matrix	**sub_m4$**		
14	Transform matrix	**sub_m5$**		
15	Transform matrix	**sub_m6$**		
16	Transform matrix	**sub_m7$**		
17	Transform matrix	**sub_m8$**		
18	Transform matrix	**sub_m9$**		

19	Transform X data	**sub_trnsx$**		Mirrored data: X-axis mirror. Set X-axis intersection. Rotated data: XYZ = center of rotation relative to current view. Translated data: XYZ = translation distance relative to original operation.
20	Transform Y data	**sub_trnsy$**		Mirrored data: Y-axis mirror. Set Y-axis intersection. Rotated data: XYZ = center of rotation relative to current view Translated data: XYZ = translation distance relative to original operation.
21	Transform Z data	**sub_trnsz$**		Rotated data: XYZ = center of rotation relative to current view Translated data: XYZ = translation distance relative to original operation
22	First tool in the transform group	**sub_nxt_t$**		
23	First head number in the transform group	**sub_nxt_h$**		
24	(Not used)	**sub_nxt_tid$**		
25	More than one tool in transform	**sub_mny_t$**	0	Only one tool used in the transform
			1	Multiple tools used in the transform
26	(Internal Use)		1	Source
			2	Source path
			10	One level call
			100	Separate subs
			100 0	All Incremenal
27	(Internal Use)			Flags if it is OK to write the 1018 line

L M R 1019 : Subprogram End Definition

Prototype:

```
1019
1 2 3 4 5 6
```

1	Subprogram number	**esub_op_id$**		
2	Actual operation id	**esub_grp_id$**		
3	Transform / non-transform flag	**esub_ref_id$**	0	Non-transform
			>0	Transform
4	Iteration counter	**esub_sec_no$**		Transform operations: <0 = Off 0 = Original >0 = Copy Non-transform operations: <1 = Copy in transform 1 = Original >1 = Copy
5	Total number of instances	**esub_totl_no$**		
6	(Not used)	**esub_chn_no$**		

M R 1020 : Stock Parameters

Prototype: `1020`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14`

1	X component, width	**stck_ht$**		
2	Y component, height	**stck_wdth$**		
3	Z component, thickness	**stck_thck$**		
4	X origin of block	**stck_x$**		
5	Y origin of block	**stck_y$**		
6	Z origin of block	**stck_z$**		
7	Origin corner	**stck_crnr$**	0	Origin corner: top - center
			1	Origin corner: top – upper left
			2	Origin corner: top – upper right
			3	Origin corner: top – lower right
			4	Origin corner: top – lower left
			5	Origin corner: bottom – upper left
			6	Origin corner: bottom – upper right
			7	Origin corner: bottom – lower right
			8	Origin corner: bottom – lower left
8	Rotary axis in terms of Tplane	**rotary_vecx$**		
9	Rotary axis in terms of Tplane	**rotary_vecy$**		
10	Rotary axis in terms of Tplane	**rotary_vecz$**		
11	(Not used)			
12	Parameter file read flag (read internally)			
13	Maximum spindle speed	**maxss$**		
14	String with the stock material name	**stck_matl$**		

L 1020 : Stock Parameters

Prototype: `1020`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14`

1	Length of stock along Z axis	**stck_ht$**	
2	Maximum diameter of stock	**stck_wdth$**	
3	Same as 2	**stck_thck$**	
4	Center of stock along Z axis	**stck_x$**	
5	Center of stock	**stck_y$**	
6	Center of stock	**stck_z$**	Always 0
7	Origin corner	**stck_crnr$**	Always 0
8	Rotary axis in terms of Tplane	**rotary_vecx$**	Always 0
9	Rotary axis in terms of Tplane	**rotary_vecy$**	Always 0
10	Rotary axis in terms of Tplane	**rotary_vecz$**	Always 0
11	(Not used)		
12	Parameter file read flag (read internally)		
13	Maximum spindle speed	**maxss$**	
14	Stock material name	**stck_matl$**	

W 1020 : Stock Parameters

Prototype: `1020`
`1 2 3 4 5 6 7 8 9 10 11 12 13 14`

1	X component, width	**stck_ht$**		
2	Y component, height	**stck_wdth$**		
3	Z component, thickness	**stck_thck$**		
4	X origin of block	**stck_x$**		
5	Y origin of block	**stck_y$**		
6	Z origin of block	**stck_z$**		
7	Origin corner	**stck_crnr$**	0	Origin corner: top - center
			1	Origin corner: top – upper left
			2	Origin corner: top – upper right
			3	Origin corner: top – lower right
			4	Origin corner: top – lower left
			5	Origin corner: bottom – upper left
			6	Origin corner: bottom – upper right
			7	Origin corner: bottom – lower right
			8	Origin corner: bottom – lower left
8	(Not used)			
9	(Not used)			
10	(Not used)			
11	Tank fill / empty flag	**tank$**		
12	Parameter file read flag (read internally)			
13	(Not used)			
14	String with the stock material name	**stck_matl$**		

L M R W 1025 : Canned Text

Prototype:

```
1025
1 2 3 4 5 6 7 8 9 10
```

1	Cantext parameter	**cant_pos1$, cant_val1$**		cant_pos1 through cant_pos10 are represented by the 1000s digit, where:
2		**cant_pos2$, cant_val2$**	0nnn	Canned text before
3		**cant_pos3$, cant_val3$**	1nnn	Canned text with
4		**cant_pos4$, cant_val4$**	2nnn	Canned text after
5		**cant_pos5$, cant_val5$**		cant_val1 through cant_val10 is a value (1-99) extracted from the lower three nnn digits.
6		**cant_pos6$, cant_val6$**		
7		**cant_pos7$, cant_val7$**		
8		**cant_pos8$, cant_val8$**		
9		**cant_pos9$, cant_val9$**		
10		**cant_pos10$, cant_val10$**		

L M R 1027 : Working Coordinate System

Prototype: `1027`
`1 2 3 4 5 6 7 8 9 10 11 12`

1	**t_wcs_m1$**	
2	**t_wcs_m2$**	
3	**t_wcs_m3$**	
4	**t_wcs_m4$**	
5	**t_wcs_m5$**	
6	**t_wcs_m6$**	
7	**t_wcs_m7$**	
8	**t_wcs_m8$**	
9	**t_wcs_m9$**	
10	**t_orgin_x$**	
11	**t_orgin_y$**	
12	**t_orgin_z$**	

M R 1028 : Head definition data

Prototype: `1028`
`1 2 3 4 5 6 7 8 9 10 11 12`

1	**ra_type$**	0	No special head (std)
		1	Right-angle
		2	Compound
		3	Block drill
		4	UST
2	**ra_offset$**		
3	**ra_vecx$**		
4	**ra_vecy$**		
5	**ra_vecz$**		
6	**ra_svecx$**		
7	**ra_svecy$**		
8	**ra_svecz$**		
9	**ra_block$**		
10	**ra_station$**		
11	**ra_head_grp$**		
12	**ra_tc_type$**	0	Auto T.C. (default)
		1	Fixed unit
		2	Manual T.C.

M R 1029 : Head shift parameters

Prototype: `1029`
`1 2 3 4 5 6 7 8 9 10 11`

1	**ra_hvecx$**	
2	**ra_hvecy$**	
3	**ra_hvecz$**	
4	**ra_bvecx$**	
5	**ra_bvecy$**	
6	**ra_bvecz$**	
7	**ra_tvecx$**	
8	**ra_tvecy$**	
9	**ra_tvecz$**	
10	**ra_translated$**	
11	**ra_rot_head$**	

L M R W 1050 (Define NCI Version Header)

Prototype: `1050`
`1 2 3 4 5 6 7 8 9`

1	Mastercam major version number	**vers_no$**		
2	Mastercam minor version number	**m_vers_no$**		
3	MCX file - day stamp	**mc_day$**		
4	MCX file - month stamp	**mc_mon$**		
5	MCX file - year stamp	**mc_year$**		
6	MCX file - hour stamp	**mc_hour$**		
7	MCX file - minute stamp	**mc_minute$**		
8	MCX file - second stamp	**mc_sec$**		
9	MCX file name	**smcname$**		

L M R W 1051 : Machine name

Prototype: `1051`
`string`

Text to be inserted into the NC program.	Name of machine definition.

L M R W 1052 : Machine group comment

Prototype: `1052`
`string`

Text to be inserted into the NC program.	Comment recorded in machine group properties.

L M R W 1053 : Machine group name

Prototype: `1053`
`string`

Text to be inserted into the NC program.	Name of machine group.

Control Flags Parameters

The control flags (also called "contour flags") parameter is a single parameter passed from the NCI that carries several pieces of information in a single numeric value. The control flags parameter appears in every motion NCI Gcode (Gcodes 0, 1, 2, 11, 81) to control such values as contour start, stop, and end, coolant, and 5-axis angles (for Mill) or rapid behavior (for Lathe).

Each decimal position in the control flags parameter value represents an individual flag. For example, 1 (first decimal place) is the contour stop flag, 10 (second decimal place) is the contour optional stop flag, 100 (third decimal place) is the contour end flag, and so forth. When added together, the result is a single number that represents multiple flags. Zero is implied when the place fields are empty, but only leading zeros may be omitted.

For example (in Mill), if:

```
cur_cflg = 3201001
```

The control flags (reading left to right) set the following:

- 5-axis: 180-degree angle
- Coolant flood
- Contour start on
- Contour optional stop off
- Contour stop on

The flag as read from the NCI is available as the predefined variable cur_cflg$. You should rarely need to use the cur_cflg$ variable directly because the post executable sets separate variables for each flag.

The following tables describe the control flag settings for each product.

M R Mill / Router Control Flags Parameters

Control flags = cstop$ + cgstop$ + cend$ + cstart$ +rpd_typ$ + coolant$ + rev5$	**cur_cflg$**		
	cstop$	0	Contour stop off
		1	Contour stop on
	cgstop$	00	Contour optional stop off
		10	Contour optional stop on
	cend$	000	Contour end off
		100	Contour end on
		200	Compensation OFF position
		300	Both contour and compensation off See notes below
	cstart$	0000	Contour start off
		1000	Contour start on
		2000	Compensation ON position
		3000	Both contour & compensation start See notes below
	rpd_typ$	70000	Pause for tool inspection (high speed surface toolpaths)
	coolant$	100000	Coolant off
		200000	Coolant flood
		300000	Coolant mist
		400000	Coolant tool
	rev5$	1000000	Five axis, non-vertical tool: flipped Vertical tool: same as previous angle
		2000000	Five axis: same as next angle
		3000000	Five axis: 180 degree angle
		4000000	Five axis: previous + 180 degrees
		5000000	Five axis: next + 180 degrees

The Compensation ON/OFF position flag values are added to cend$ and cstart$ flag, if they exist at the same location in the NCI file. Example: Contour END (100) and compensation OFF (200) can occur at the same location, so the flag values are added and you will see a value of 300.

The compensation flags (2000 and 200) are independent of the compensation actually being programmed in the toolpath program! They mark where compensation would normally be activated and canceled in the toolpath by Mastercam.

The raw values shown in this chart are not the values set in the individual variables. Example: if **`cur_cflg$ = 1000`** (contour start), the variable cstart$ is set to 1.

L Lathe Control Flags Parameters

Control flags = cstop$ + cgstop$ + cend$ + cstart$ + rpd_typ$ + coolant$	**cur_cflg$**		
	cstop$	0	Contour stop off
		1	Contour stop on
	cgstop$	00	Contour optional stop off
		10	Contour optional stop on
	cend$	000	Contour end off
		100	Contour end on
		200	Compensation OFF position
		300	Both contour and compensation off See notes below
	cstart$	0000	Contour start off
		1000	Contour start on
		2000	Compensation ON position
		3000	Both contour & compensation start See notes below
	rpd_typ$	10000	Clear to home
		20000	Rapid to start
		30000	Rapid around obstruction
		40000	Rapid between points
		50000	Entry / Exit
		60000	Start / End rough turning cycles
	coolant$	100000	Coolant off
		200000	Coolant flood
		300000	Coolant mist
		400000	Coolant tool

The Compensation ON/OFF position flag values are added to cend$ and cstart$ flag, if they exist at the same location in the NCI file. Example: Contour END (100) and compensation OFF (200) can occur at the same location, so the flag values are added and you will see a value of 300.

The compensation flags (2000 and 200) are independent of the compensation actually being programmed in the toolpath program! They mark where compensation would normally be activated and canceled in the toolpath by Mastercam.

The raw values shown in this chart are not the values set in the individual variables. Example: if **`cur_cflg$ = 1000`** (contour start), the variable cstart$ is set to 1.

W Wire Control Flags Parameters

Control flags = cstop$ + cgstop$ + cend$ + cstart$ + thrd_cut$ + water$ + power$ + tank$	**cur_cflg$**		
	cstop$	0 1	Contour stop off Contour stop on
	cgstop$	00 10	Contour optional stop off Contour optional stop on
	cend$	000 100 200 300	Contour end off Contour end on Compensation OFF position Both contour and compensation off See notes below
	cstart$	0000 1000 2000 3000	Contour start off Contour start on Compensation ON position Both contour & compensation start See notes below
	thrd_cut$	10000 20000	Thread the wire Cut the wire
	water$	100000 200000 300000	Water off Water on Water option 1
	power$	1000000 2000000	Power off Power on
	tank$	10000000 20000000	Tank empty Tank fill

The Compensation ON/OFF position flag values are added to cend$ and cstart$ flag, if they exist at the same location in the NCI file. Example: Contour END (100) and compensation OFF (200) can occur at the same location, so the flag values are added and you will see a value of 300.

The compensation flags (2000 and 200) are independent of the compensation actually being programmed in the wirepath! They mark where compensation would normally be activated and canceled in the wirepath by Mastercam.

The raw values shown in this chart are not the values set in the individual variables. Example: if `cur_cflg$ = 1000` (contour start), the variable cstart$ is set to 1.

Tool Information (20000s Parameters)

Tool information lines are added in the 20000s lines in the NCI file. The data is presented in a two-line format:

- The first line contains the parameter number.
- The second line contains the value or values.

The second line can be interpreted as either a single string or as a series of numeric values separated by spaces. In the reference sections that follow, for each parameter there is a prototype that describes the data structure of the parameter value, followed a description of the actual values. These are not assigned variable names but can be scanned for the desired values with the function **`rpar`**. (See “Extracting numeric values from 20000s parameters” on page 9 to learn more about how to extract numeric values from the parameter string.)

```
g
string
```

The codes are divided into three sections:

- The first section contains codes numbered below 20100 and above 20500. They are either Mill/Router-specific, or are used across multiple products.
- The second section contains Lathe-specific codes, numbered from 20100–20199.
- The third section contains Wire-specific codes. Most of these are numbered above 20200.

Note that some codes might be output for a certain product, but with a blank value if the value isn’t used in that product.

See **NCI Gcodes** for information about NCI Gcodes numbered below 10000.

Mill/Router/Generic

20001 : Tool name

Used in: **Mill Lathe Router**

Prototype:
```
20001
string (tool name)
```

20002 : Tool definition: manufacturer's tool code

Used in: **Mill Lathe Router**

Prototype:
```
20002
string (manufacturer's tool code)
```

20003 : Chuck name

Used in: **Mill Router**

Prototype:
```
20003
string (chuck name)
```

20004 : Tool definition: tool parameters

Used in: **Mill Router**

Prototype:
```
20004
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
```

1	tool number
2	tool type:
	1=center drill
	2=spot drill
	3=drill
	4=right hand tap
	5=left hand tap
	6=reamer
	7=boring bar
	8=counter bore
	9=counter sink
	10=end mill - flat
	11=end mill - spherical
	12=chamfer mill
	13=face mill
	14=slot mill
	15=radius mill
	16=dovetail mill
	17=tapered mill
	18=lollipop mill

	19=end mill – bullnose
3	tool material:
	1=high speed steel
	2=carbide
	3=coated carbide
	4=ceramic
	5=borzon
	6=unknown
4	corner radius type:
	0= flat mill
	1= bullnose mill
	2= spherical mill
5	tool diameter
6	corner radius
7	number of threads/inch or pitch (mm)
8	tool tip included angle
9	diameter offset register #
10	length offset register #
11	linear feed rate
12	plunge feed rate
13	retract feed rate
14	spindle speed
15	coolant type:
	0=coolant off
	1=flood
	2=mist
	3=tool (spindle)
16	number of flutes

20005 : Tool definition: tool parameters for drills

Used in: **Mill Router**

Prototype:

```
20005
1 2 3 4 5 6 7 8 9
```

1	drill canned cycle type
2	1st peck increment (% of tool dia.)
3	2nd peck increment (% of tool dia.)
4	peck clearance (% of tool dia.)
5	chip break (% of tool dia.)
6	amount of dwell in seconds
7	shoulder angle
8	tap drill diameter
9	amount to shift off wall for fine boring

20006 : Tool definition: tool parameters

Used in: **Mill Router**

Prototype:
```
20006
1 2 3 4 5 6 7 8
```

1	cutter ability: 0=capable of roughing and finishing 1=capable of roughing only 2=capable of finishing only
2	% of tool dia. for rough XY stepover
3	% of tool dia. for rough Z step
4	% of tool dia. for finish XY stepover
5	% of tool dia. for finish Z step
6	tool tip diameter
7	tool minor diameter
8	thread mill angle

20007 : Tool definition: holder parameters

Used in: **Mill Router**

Prototype:
```
20007
1 2 3 4 5 6 7 8 9 10 11
```

1	minimum diameter required for tool to plunge
2	flute length
3	overall length
4	shoulder length
5	arbor diameter
6	holder diameter
7	holder length
8	0 = cw, 1 = ccw
9	% of surface ft/mm to be applied against workpiece matl sfm
10	% of feed/tooth to be applied against workpiece matl fpt
11	0 = values in inches, 1 = metric

20008 : Tool definition: aggregate head parameters

Used in: **Mill Router**

Prototype:
```
20008
1 2 3 4 5 6 7 8 9
```

1	head axis in X
2	head axis in Y

3	head axis in Z
4	head body type: (0 = cylinder, 1 = square)
5	head body diameter
6	head body length
7	station body type (0 = cylinder, 1 = square)
8	station body diameter
9	station body length

20010 : Construction plane name

Used in: **Mill Lathe Router Wire**

```
g
string
g = 20010
string (construction plane name)
```

20011 : Construction plane commment

Used in: **Mill Lathe Router Wire**

Prototype:
```
20011
string (construction plane commment)
```

This line has no value in Wire. It will be output, but will always be blank.

20012 : Tool plane name

Used in: **Mill Lathe Router Wire**

Prototype:
```
20012
string (tool plane name)
```

20013 : Tool plane comment

Used in: **Mill Lathe Router Wire**

Prototype:
```
20013
string (tool insert name)
```

This line has no value in Wire. It will be output, but will always be blank.

20014 : WCS plane name

Used in: **Mill Lathe Router Wire**

Prototype:
```
20014
string (WCS plane name)
```

20015 : WCS plane comment

Used in: **Mill Lathe Router Wire**

Prototype:
```
20015
string (WCS plane comment)
```

This line has no value in Wire. It will be output, but will always be blank.

20016 : Material name

Used in: **Mill Lathe Router**

Prototype:
```
20016
string (material name)
```

This line has no value in Wire. It will be output, but will always be blank.

20017 : Material comment

Used in: **Mill Lathe Router**

Prototype:
```
20017
string (material comment)
```

This line has no value in Wire. It will be output, but will always be blank.

20018 : Machine group name

Used in: **Mill Lathe Router Wire**

Prototype:
```
20018
string (machine group name)
```

20501 : Nested sheet: material name

Used in: **Mill Router**

Prototype:
```
20501
string (material name)
```

Sheet information is output for each sheet change notification in the NCI.

20502 : Nested sheet: parameters

Used in: **Mill Router**

Prototype:
```
20502
1 2 3 4 5 6 7 8 9 10 11 12
```

Sheet information is output for each sheet change notification in the NCI.

1	sheet length (X dimension)
2	sheet width (Y dimension)
3	Sheet thickness (temporary placeholder)
4	sheet corner (1 = lower left, 2 = lower right, 3 = upper right, 4 = upper left)
5	sheet number
6	sheet instance
7	integer pad
8	integer pad
9	integer pad
10	real pad
11	real pad
12	real pad

20600 : Axis combination components

Used in: **Mill Router Lathe Wire**

Prototype:
```
20600
1 2 3 4 5
```

A 20600 line is output for each component in the axis combination.

1	Entity ID for component
2	String ID for component
3	Axis label (absolute)
4	Axis label (incremental)
5	Component name

20601 : Axis combination info

Used in: **Mill Router Lathe Wire**

Prototype:
```
20601
1 2 3 4
```

A 20601 line is output for the axis combination itself.

1	Entity ID
2	String ID
3	1=Mapped axis combination, otherwise 0
4	Axis combination name

20700 : Tool change info per data stream

Used in: **Mill Router Lathe Wire**

Prototype:
```
20700
0 1 2 3 4 5 6 7
```

Code 20700 summarizes tool usage for each data stream, 0-7. Each parameter value corresponds to one of the data streams.

0–7	For each data stream, the parameter indicates the following: • 0=No tool change in data stream • 1=One tool change in data stream • 2=More than one tool change in data stream

Lathe

20100 : Lathe tool definition : programming parameters

Used in: **Lathe**

Prototype:
```
20100
1 2 3 4 5 6 7 8 9
```

1	tool slot number

2	tool type: 0=General Turning Tools 1=Threading Tools 2=Grooving/Parting Tools 3=Boring Bars 4=Drills, Taps, Reamers 5=Custom Geometry Tools
3	use in top turret
4	active spindle
5	tool angle in turret (in degrees)
6	top turret
7	tool number
8	tool offsets for right edge
9	tool offsets for left edge

20101 : Lathe tool definition: general cutting parameters

Used in: **Lathe**

Prototype:
```
20101
1 2 3 4 5 6 7 8 9 10
```

1	fast feed rate
2	feed rate type
3	slow feed rate
4	spindle speed
5	spindle speed in css
6	percent of material css to use
7	percent of material feed/rev to use
8	spindle direction
9	coolant status for tool
10	cutting parameters in metric

20102 : Lathe tool definition: geometric parameters

Used in: **Lathe**

Prototype:
```
20102
1 2 3 4 5 6 7 8
```

1	tool orientation
2	tool clearance angle for programming
3	tool rake angle for programming
4	tool width for programming
5	tool height for programming

6	tool center for programming
7	tool center for programming
8	comp to center of insert nose radius

20103 : Lathe tool definition: insert name

Used in: **Lathe**

Prototype:
```
20103
string (tool insert name)
```

20104 : Lathe tool definition: insert general parameters

Used in: **Lathe**

Prototype:
```
20104
1 2 3 4 5 6 7 8
```

1	ASCII code for insert shape
2	IC diameter
3	length
4	corner radius
5	thickness
6	insert material for feed speed calculations
7	insert type (-1 = not used)
8	is insert defined in mm or inches?

20105 : Lathe tool definition: general turning/boring insert parameters

Used in: **Lathe**

Prototype:
```
20105
1 2 3 4 5 6 7
```

1	cross section index ASCII code
2	end relief angle
3	roughing depth of cut
4	finish depth of cut
5	roughing overlap amount
6	facing retraction amount
7	facing x overcut amount

20106 : Lathe tool definition: threading insert parameters

Used in: **Lathe**

Prototype:
```
20106
1 2 3 4 5 6 7 8 9 10 11 12
```

1	insert style:

	1='TOP NOTCH' Thread Insert
	2 ='LAYDOWN' Thread Insert
2	unified, ACME, buttress, etc.
3	insert for external thread?
4	design thread pitch
5	top notch dist. to insert point from side of insert
6	laydown height of insert (~= thread depth)
7	width of flat for ACME, buttress
8	depth of 1st cut
9	depth of last cut
10	finish pass allowance
11	anticipated pull-off
12	number of spring cuts

20107 : Lathe tool definition: grooving/parting insert parameters

Used in: **Lathe**

Prototype:

```
20107
1 2 3 4 5 6 7 8 9 10
```

1	cutting length of insert
2	shank width
3	end length for top notch type P
4	distance to insert point for top notch type V
5	end angle for Sandvik type 5R
6	roughing depth of cut
7	finish depth of cut
8	stock clearance
9	backoff percent
10	roughing overlap amount

20108 : Lathe tool definition: drilling tool parameters (geometry)

Used in: **Lathe**

Prototype:

```
20108
1 2 3 4 5 6 7 8 9 10 11 12 13 14
```

1	drill, tap, reamer, etc:
	1=Drill
	2=Center Drill
	3=Countersink
	4=Counterbore
	5=End Mill
	6=Reamer
	7=Right Hand Tap

	8=Left Hand Tap
2	tool diameter
3	shank diameter
4	tip included angle
5	flute length
6	length at cutting diameter
7	flute helix angle
8	number of flutes
9	chamfer height for reamers, taps
10	tip diameter for center drills
11	tip length for center drills
12	shoulder angle for center drills
13	thread pitch for taps
14	tap type: 1=Tapered Tap 2=Plug Tap 3=Bottoming Tap

20109 : Lathe tool definition: drilling tool parameters

Used in: **Lathe**

Prototype:

```
20109
1 2 3 4 5 6
```

1	preferred drilling cycle
2	1st peck increment
3	subsequent peck increment
4	peck clearance
5	retraction amount
6	dwell time

20110 : Lathe tool definition: holder name

Used in: **Lathe**

Prototype:

```
20110
string (tool holder name)
```

20111 : Lathe tool definition: holder parameters

Used in: **Lathe**

Prototype:

```
20111
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
```

1	shape index ascii code
2	qualified length

3	maximum width
4	shank width
5	shank height
6	'head' length
7	'head' width
8	corner chamfer width
9	corner chamfer height
10	end cutting edge angle
11	side cutting edge angle
12	True = round shank
13	left hand tool?
14	vertically mounted tool?
15	is holder defined in mm or inches?

20112 : Lathe tool definition: custom tool geometry file name

Used in: **Lathe**

Prototype:

```
20112
string (custom tool geometry file name)
```

Wire

20019 : Pass comment from power library

Used in: **Wire**

Prototype:

```
20019
string (power library pass comment)
```

This line has a value in Wire only. It is output for Mill and Router toolpaths, but will be blank.

20200 : Wirepath stock to leave

Used in: **Wire**

Prototype:

```
20200
1 2 3
```

1	Stock to leave
2	Total offset
3	Apply additional offset to: (0 = program coordinates, 1 = machine offset registers)

cnc software, inc.
671 Old Post Road
Tolland, CT 06084 USA
www.mastercam.com

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