User friendliness during production ISO machines

Contents

1 General information

1.1 Document contents

This document is the second edition of the Tornos "Tips & Tricks".
In this document, we wish to illustrate the user friendliness offered by Tornos machines during production monitoring and during machining of the first part *(program fine-tuning)*.

2 Maximum user friendliness

To ensure maximum user friendliness, Tornos has focused on 3 aspects, namely:
- Ø   The NC interface *(T-MI)*
- Ø   The operator panel
- Ø   The model program

2.1 T-MI

The T-MI *(Tornos Machine Interface)* is designed to activate several operating modes.
It also provides information about the status of the machine and of the production under way.
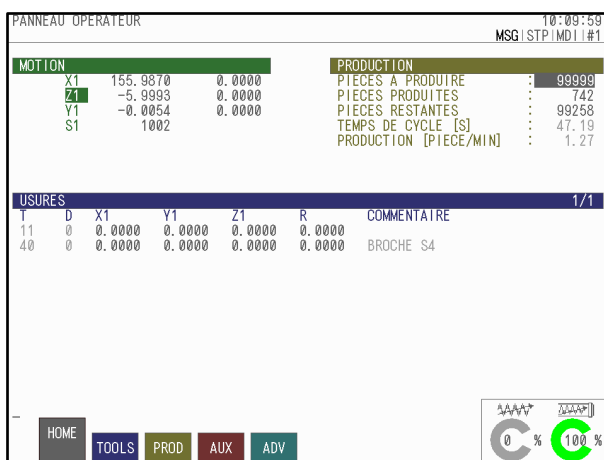
2.2 The operator panel

The operator panel is also designed to activate several operating modes using shortcuts.
The status of the indicator lights on the keys *(on/off)* provides an indication of the active modes.

2.3 The model program

Most of the flexibility of use of the machine depends directly on the part program.
The models delivered by Tornos are put together so as to allow multiple possibilities.
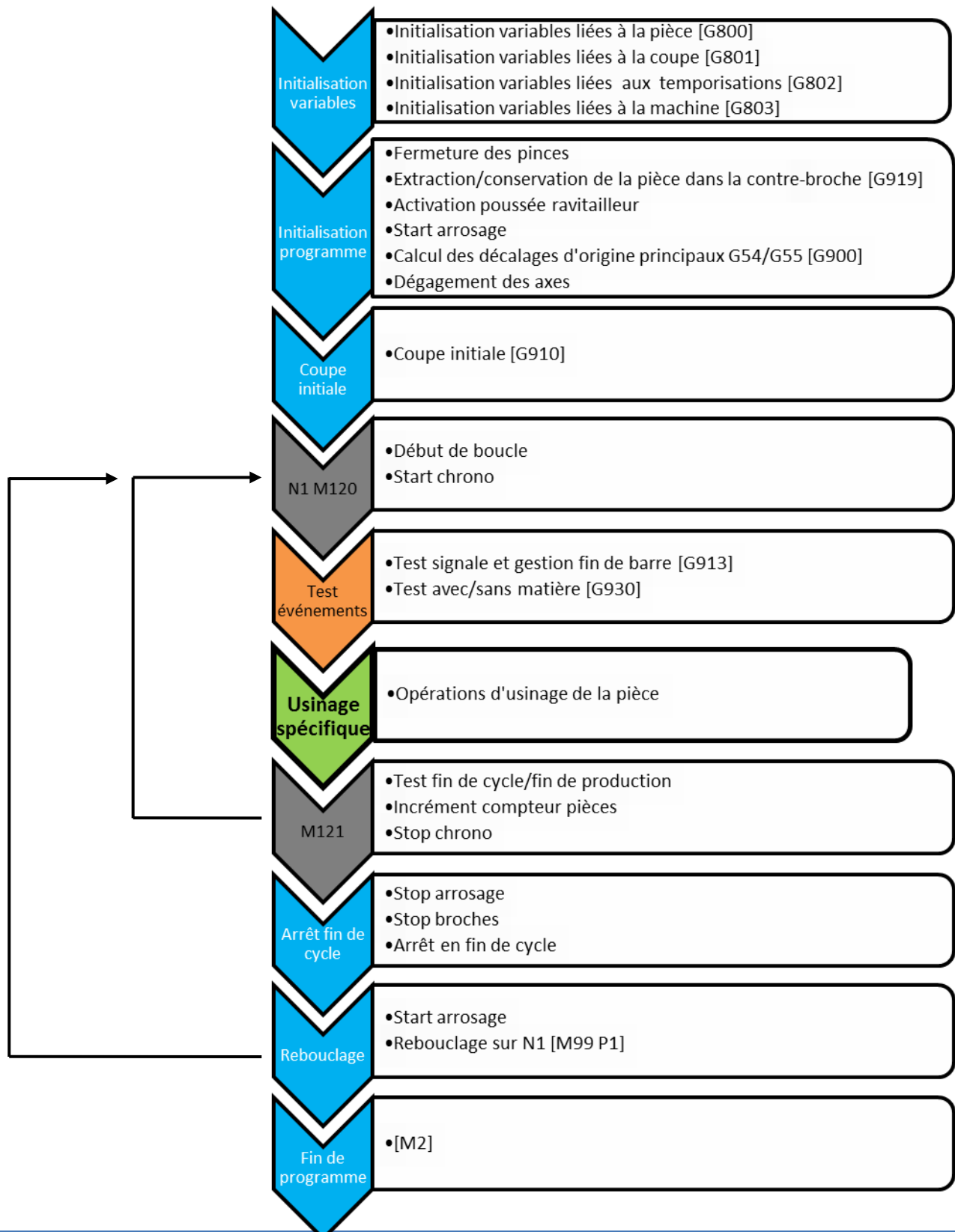Functions G910, G912, G913, G919, G930, M120, M121 play a vital role in this flexibility of use.

Initialisation variables
- Initialisation variables liées à la pièce [G800]
- Initialisation variables liées à la coupe [G801]
- Initialisation variables liées aux temporisations [G802]
- Initialisation variables liées à la machine [G803]

Initialisation programme
- Fermeture des pinces
- Extraction/conservation de la pièce dans la contre-broche [G919]
- Activation poussée ravitailleur
- Start arrosage
- Calcul des décalages d'origine principaux G54/G55 [G900]
- Dégagement des axes

Coupe initiale
- Coupe initiale [G910]

N1 M120
- Début de boucle
- Start chrono

Test événements
- Test signale et gestion fin de barre [G913]
- Test avec/sans matière [G930]

Usinage spécifique
- Opérations d'usinage de la pièce

M121
- Test fin de cycle/fin de production
- Incrément compteur pièces
- Stop chrono

Arrêt fin de cycle
- Stop arrosage
- Stop broches
- Arrêt en fin de cycle

Rebouclage
- Start arrosage
- Rebouclage sur N1 [M99 P1]

Fin de programme
- [M2]

3 Possibilities

3.1 Information about production

In order to simplify production monitoring, the "PROD" page of T-MI provides all the information about production on a single page, including for instance the cycle time, the part counter or the date and time at which the series of parts will be completed.

```
PRODUCTION OPERATEUR                                          10:03:29
                                                          | ***|MEM|#1
PRODUCTION                         INFORMATIONS MACHINE
PIECES A PRODUIRE       :    1000  NOM MACHINE     : EvoDECO10 V2
PIECES PRODUITES        :      12  NUMERO          : 2420011
PIECES RESTANTES        :     988  IDENTIFICATEUR  : 27631
TOTAL PIECES            :    2378  VERSION FANUC   : G431 74.0
TEMPS DE CYCLE [S]      :  215.62  VERSION LOGICIEL: 0609.ak
PRODUCTION [PIECE/MIN]  :    0.28  VERSION CONNECT.: 2.20
PRODUCTION [PIECE/HEURE]:      17  ADR. IP CONNECT.: 000.000.000.000
FIN DE PRODUCTION [DATE] :19.10.16
FIN DE PRODUCTION [HEURE]:   21:13

INFORMATIONS PIECE                 O1066  INFORMATIONS MEMOIRE PROGRAMME
NOM      : PIECE 6_6_R             PROGRAMMES SYSTEME       :    286
DATE     : 29.06.2016             PROGRAMMES UTILISATEUR    :     88
DIAMETRE : 10                     PROGRAMMES DISPONIBLES     :    637
MATIERE  : LAITON                                          36.99 %
CLIENT   : TORNOS                 MEMOIRE PROGRAMME SYSTEME :  246 KO
AUTEUR   : GBa                    MEMOIRE PROG. UTILISATEUR :  219 KO
DESSIN   : Chapitre 6_6           MEMOIRE PROG. DISPONIBLE  :  635 KO
AUTRE    : Axe C                                           42.27 %


    HOME  TOOLS  PROD  AUX  ADV
```

3.2 Stop at end of cycle

On Tornos machines, we can obviously cause a stop at end of cycle by pressing a key.
When the "STOP AT END OF CYCLE" key is lit, a stop will take place at the end of the cycle in progress.
Before the stop is indicated, the axes retract and the spindle coolant spraying stops.

To resume production, simply press the "START" key again.

Stop at end of initial cut
After a "RESET" or a machine shutdown, the program always performs initialisation. When the "STOP AT END OF CYCLE" key is active *(lit)* during this initialisation phase, the machine indicates a stop at the end of the initial cut [G910].
To continue the cycle, simply press the "START" key again.

Working in part-by-part mode
If you leave the "STOP AT END OF CYCLE" key on, this allows you to work in part-by-part mode *("START" at each cycle)*.

3.3 Stop during the cycle

On Tornos machines, the cycle can be stopped at any time using the "STOP CYCLE" key.
The "STOP CYCLE" key causes the program running to stop immediately.
Spindle rotation and coolant spraying do not stop. They can be stopped by pressing the "SPINDLE" and "COOLANT SPRAYING" keys.

The door can be opened *(provided the coolant spraying and spindles have stopped)*.
Subsequently, the program can resume by pressing the "START" key again *(provided the spindles have restarted)*.

N.B.: the cycle can even be stopped during threading. In this case, the tool will complete the stroke under way and stop as soon as the tool is out of the material.

3.4 Conditional stop [M1]

Conditional stops can obviously be used. To use them, simply set an [M1] in the program where you wish it to stop then go to the "AUX" page in T-MI and check the corresponding box.
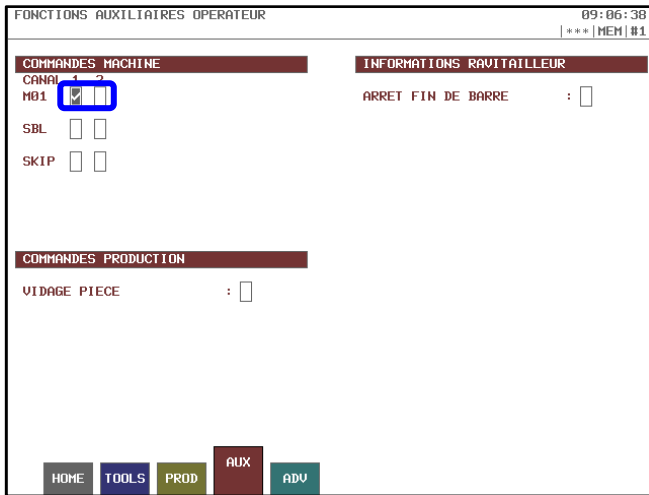

Use example:

For instance, it can be used to adjust a tool in Z.
Set an M1 in the program after the rapid tool approach, when the program stops you know the tool should be at a specific distance *(3 mm in the example)* from the face of the bar.

Then it couldn't be any simpler, simply take a leaf metal of the right thickness and place it against the face of the bar, then press the tool manually against the leaf metal and tighten the nut on the tool support.
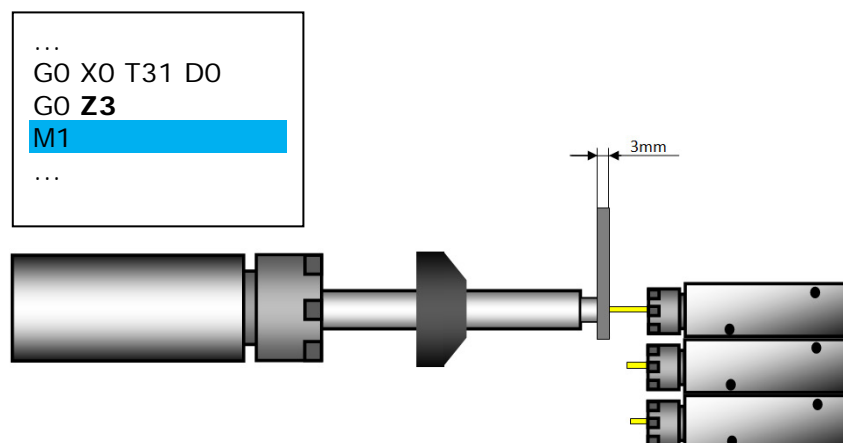
3.5 Cycle stops at regular intervals [G918]

It is sometimes useful to be able to stop cycles every so often, for instance when manual intervention by the operator is required to remove chips from inside the machine. To do this, insert a G918 A_ in the part program *(where you want it to stop)*.
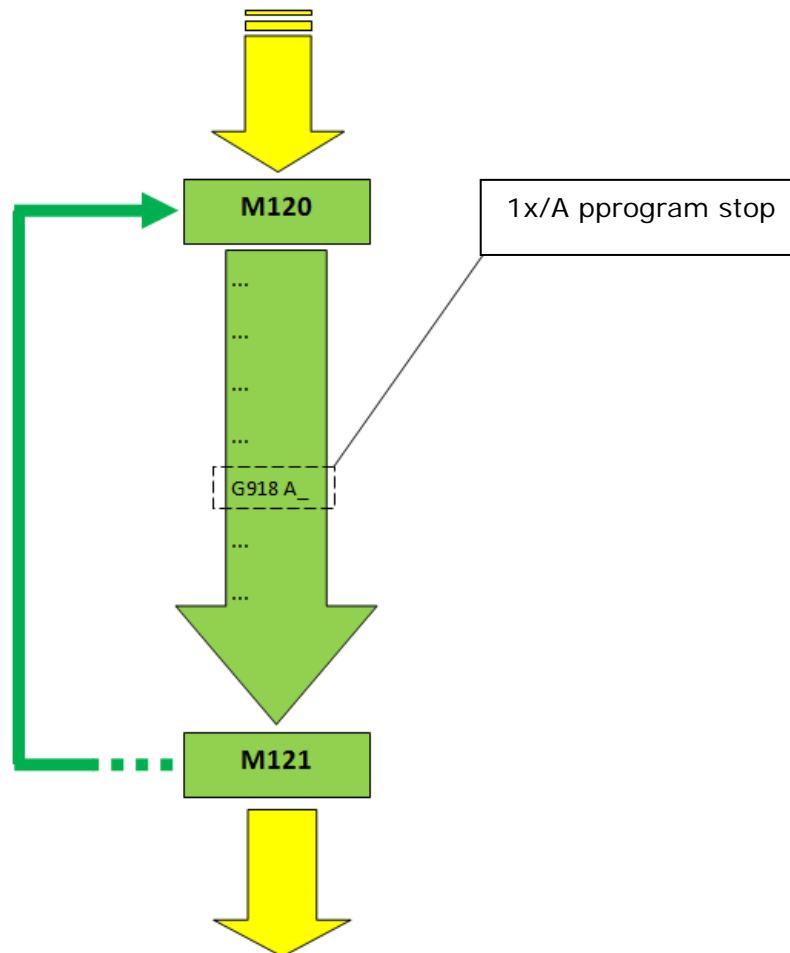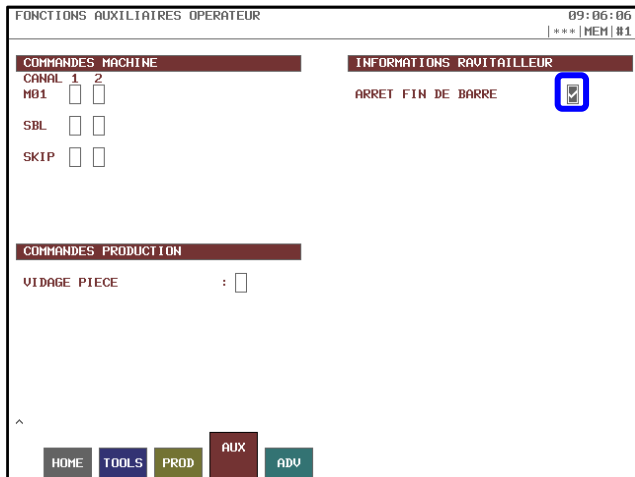

Example:
G918 A5 **à** This way, the machine will stop every 5 cycles.

N.B.: By default, the machine does not stop in no material mode.

3.6 Stop at end of bar

A stop at the end of the bar can be caused. To do this, simply check the "END OF BAR STOP" box on the "AUX" page of T-MI; this way, when the machine reaches the end of the bar, it will eject the remnant and then stop.

3.7 Displaying remaining parts before loading a new bar

If your machine is fitted with a built-in Tornos barfeeder, you can display the number of parts still to be machined before a new bar is loaded.
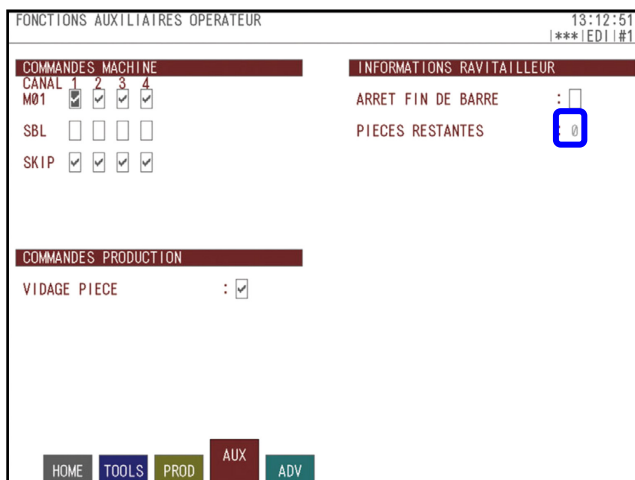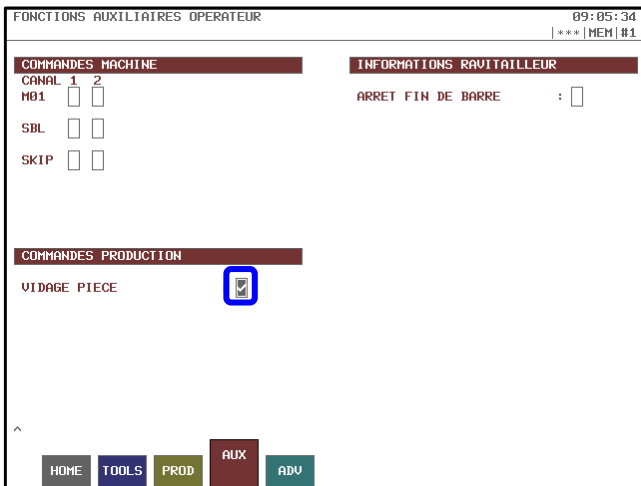
3.8 Emptying counter spindle at end of production

Checking the "PART EMPTYING" box on the "AUX" page of T-MI allows you to stop production without a semi-machined part in the counter spindle, so that the last part is not lost.
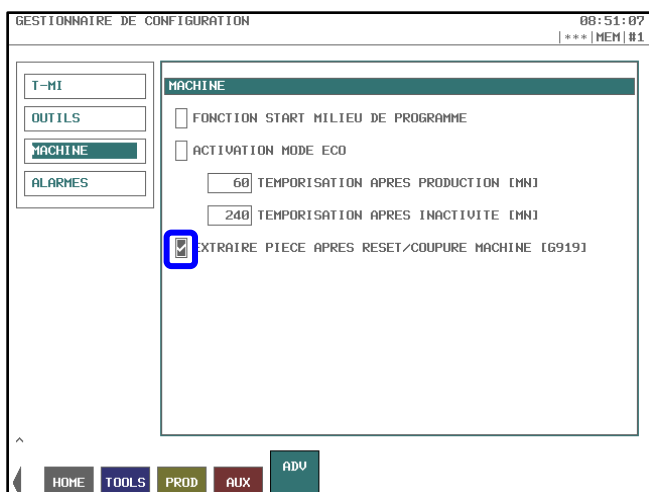This is extremely useful in the following cases:
- Ø machining precious metals
- Ø particularly long cycle times
- Ø long parts

```
FONCTIONS AUXILIAIRES OPERATEUR                    09:05:34
                                                |***|MEM|#1
COMMANDES MACHINE              INFORMATIONS RAVITAILLEUR
CANAL 1  2
M01  [ ][ ]                    ARRET FIN DE BARRE    : [ ]
SBL  [ ][ ]
SKIP [ ][ ]



COMMANDES PRODUCTION

VIDAGE PIECE              [✓]


^
      HOME  TOOLS  PROD  AUX  ADV
```

3.9 Part extraction/holding in counter spindle after "RESET"

Using the T-MI configuration page, you can adjust whether you want to hold the part in the counter spindle or not after a "RESET" when the machine resumes production.

```
GESTIONNAIRE DE CONFIGURATION                      08:51:07
                                                |***|MEM|#1
  T-MI          MACHINE
  OUTILS        [ ] FONCTION START MILIEU DE PROGRAMME
  MACHINE       [ ] ACTIVATION MODE ECO
  ALARMES          [ 60] TEMPORISATION APRES PRODUCTION [MN]
                   [240] TEMPORISATION APRES INACTIVITE [MN]
                [✓] EXTRAIRE PIECE APRES RESET/COUPURE MACHINE [G919]



^
      HOME  TOOLS  PROD  AUX  ADV
```

3.10 Working in with material/no material mode

The "Working in with material/no material mode" function is extremely useful.
This function allows you to work with or without material simply by pressing a key on the operator panel. No barfeeding handling is required.

Basic principle:
When the "work with material" mode is activated *(key lit)* the machine behaves normally and machines parts.
When the "work with no material" mode is activated *(key off)* the Z axis of the material spindle is locked, the part counter does not increment and the spindle and counter spindle collet controls are inhibited *(which avoids premature wearing of the collets)*.

To switch from one mode to the other, simply press the "working in with material/no material mode" key.
The mode can be changed at any time *(before or during production)*.
The status of the key is always only taken into consideration when a new cycle is about to start *(straight after the part has been cut or straight after the initial cutting)*.

Sequence when switching to no material mode:
1. Cutting
2. Bar retraction
3. Z axis locked
4. Inhibition of part counter
5. Inhibition of spindle collet controls *(spindle collet always remains closed)*
6. Inhibition of counter spindle collet controls after part extraction *(counter spindle collet always remains open)*

Sequence when switching to with material mode:
1. Cutting
2. Z axis unlocked
3. Material repositioned against the cutter
4. Reactivation of the part counter as soon as the next cycle
5. Reactivation of spindle collet controls
6. Reactivation of counter spindle collet controls as soon as the next cycle

N.B.: the bar retraction distance when switching to no material mode is calculated automatically according to the Z geometry of the cutting tool to ensure the bar is inside the guidebush. Nevertheless, the parameters of this retraction can be set personally using argument "A" of G930.

N.B.: after a "RESET" or a "machine outage" the bar needs to be repositioned correctly if it is in the retracted position.

N.B.: by default, the work with no material mode is not authorised if the program contains a superimpose function.
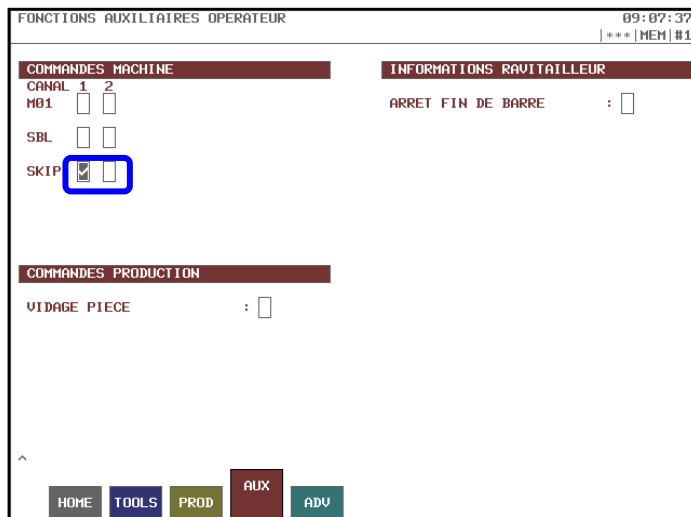
3.11 "SBL" mode

The SBL *(Single Block)* mode is extremely useful when fine-tuning the program *(premier cycle)*. It allows you to run the program line by line. The "START" key thus needs to be pressed after each line is run.
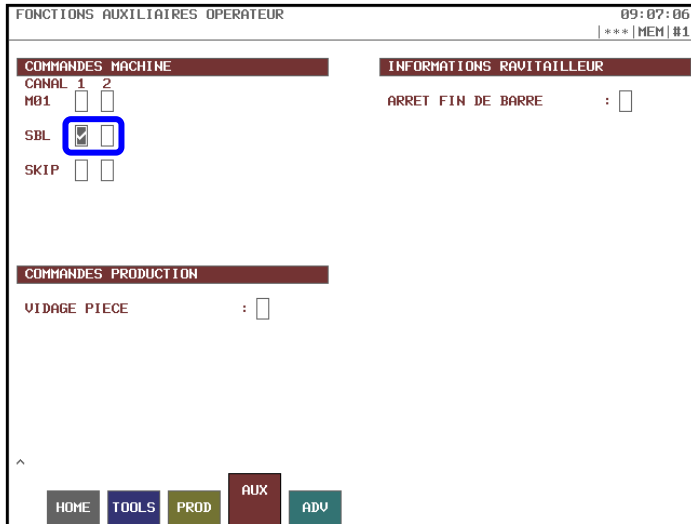
3.12 "SKIP" mode

The SKIP mode allows you to skip the running of a line of code that starts with the character "/".

## 3.13 Running the program run with the handle

The program can be run using the machine handle, which is convenient when fine-tuning the program *(first cycle)*. To do this, simply set the feed potentiometer to 0% and to make the handle turn in the + direction.

3.14 Locking an axis

The axis locking function allows you to lock one or more axes. This is useful when fine-tuning the program *(first cycle).* It allows you to test the program by machine zone and thus reduce the risk of possible collisions.
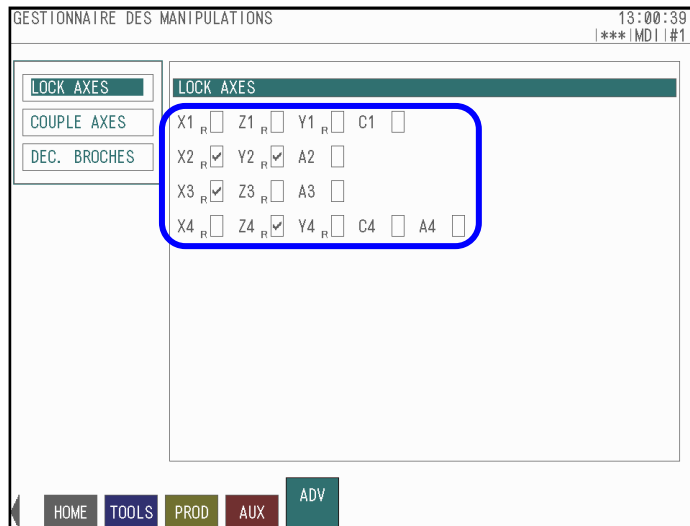

3.15 "ECO" mode

Tornos machines have an ECO mode that allows you to reduce their energy consumption. After a specific amount of time *(settable parameters)* of machine inactivity as well as at the end of production, the power to the amplifiers is cut off and the NC screen goes on stand-by.
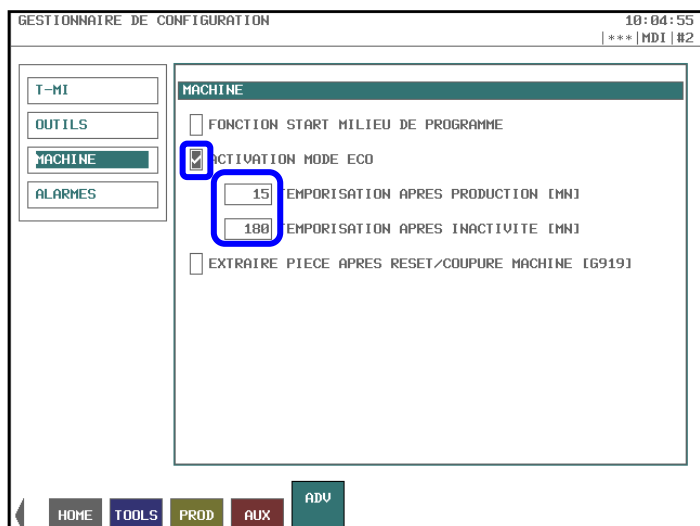
3.16 Linear correction of tool wear

The linear correction of tool wear is interesting for users who are familiar with the series of parts to be machined. It makes it possible to automate the correction of tool wear according to default ramps.
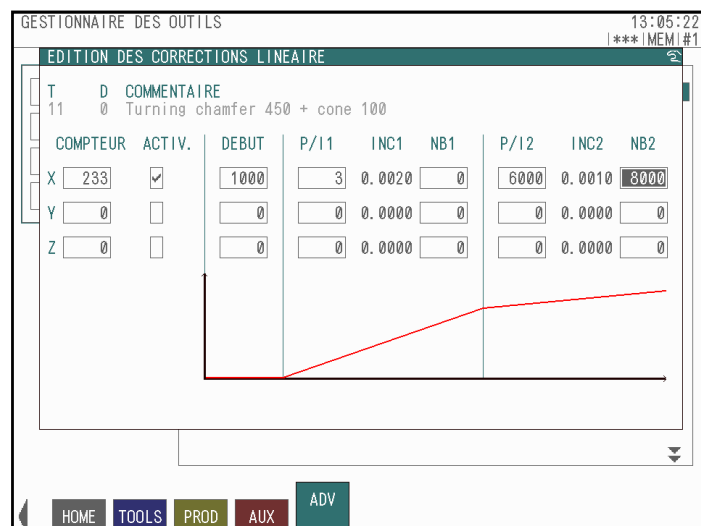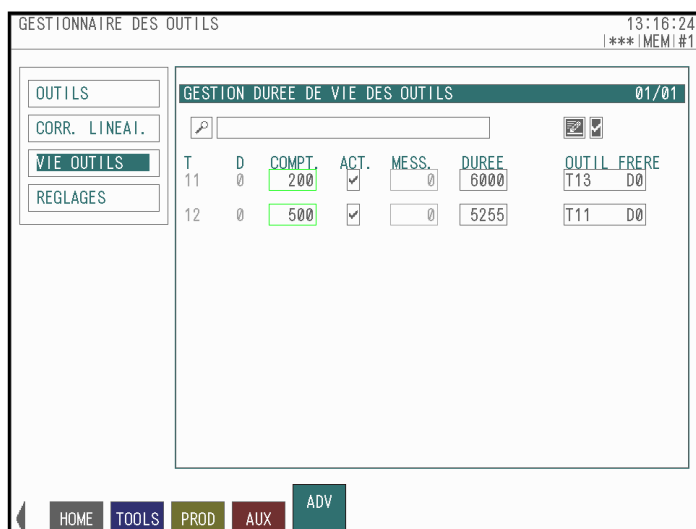
3.17 Tool life management

Tool life management is particularly interesting when the operator is unable to remain in front of his machine permanently.

This function makes it possible to:

1) Display a warning message when a given tool reaches a default number of cycles *(the machine continues production despite the message)*
2) Display an alarm and stop the machine when a given tool reaches a default number of cycles
3) Continue production with a twin tool *(same geometries)* to the one which has reached this default number of cycles.

```
GESTIONNAIRE DES OUTILS                        13:16:24
                                               |***|MEM|#1

  OUTILS         GESTION DUREE DE VIE DES OUTILS        01/01

  CORR. LINEAI.   🔍 [              ]            🖷 ✓

  VIE OUTILS      T   D   COMPT.  ACT.  MESS.   DUREE   OUTIL FRERE
                  11  0    200    ✓       0     6000    T13    D0
  REGLAGES
                  12  0    500    ✓       0     5255    T11    D0




                          ADV
  ◀ HOME  TOOLS  PROD  AUX
```
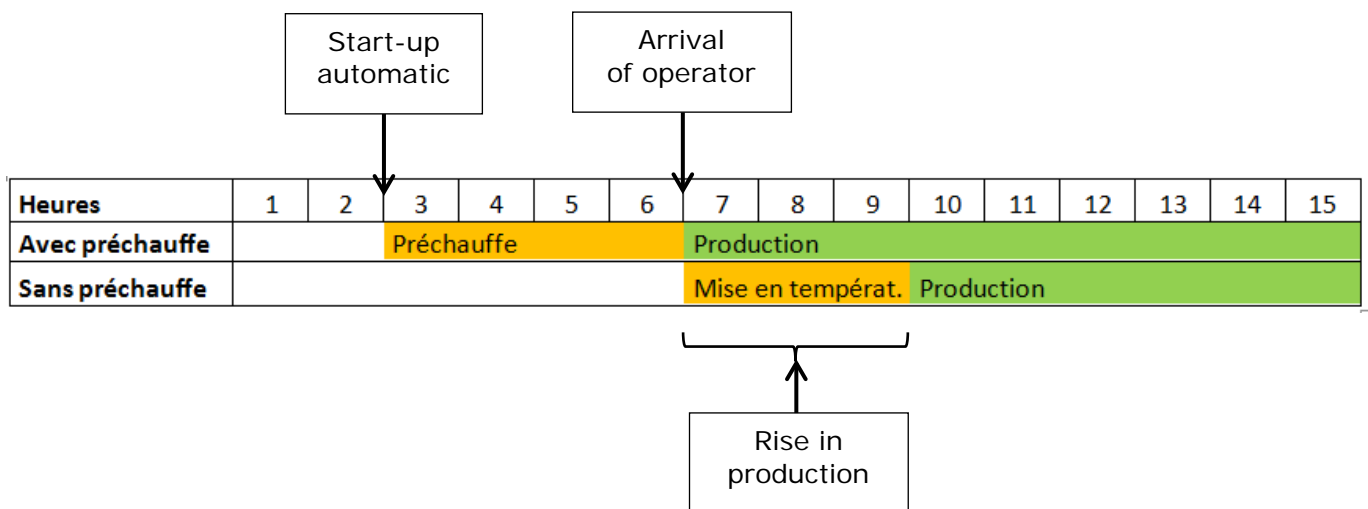
TORNOS

3.18Preheat

Tornos offers an optional machine preheating function for very accurate parts. The machine may therefore start automatically, in no material mode, at a default time and date. The advantage of this function is that you save time waiting for the machine to reach its temperature.
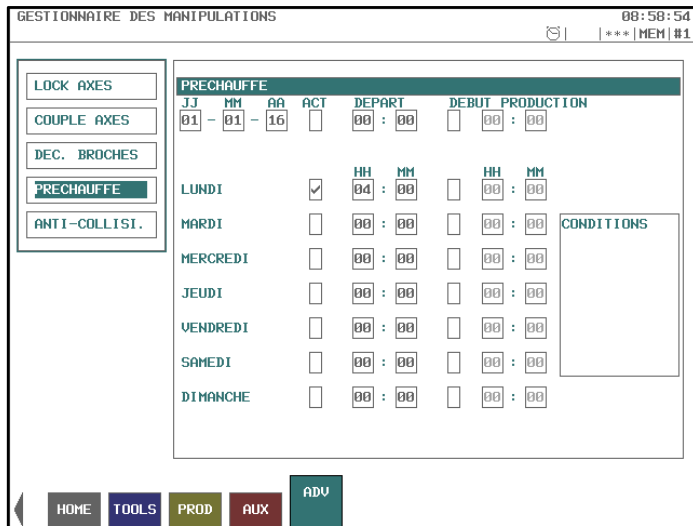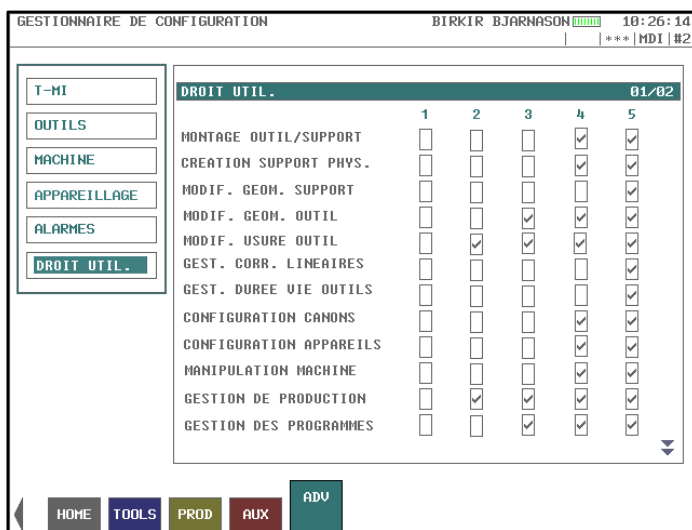

Example:

3.19 User rights

On Tornos machines, access to certain machine functions can be granted or denied depending on default operator levels.

In fact, Tornos machines are capable of recognising 5 groups of users.
To identify themselves on the machine, operators simply need to insert their personal USB flash drive into the NC.
Thus, depending on the user authorisation clearance, certain machine functions are activated or locked.

This is particularly interesting for companies who employ workers with very different skill sets.
Among other things, this avoids poor handling by a person with insufficient training.


Example:
If your team is working at night, limit solely to the functions intended to monitor production such as access to the tool wear correction.

N.B.: it is very simple to generate USB flash drives with the desired clearance level directly from the machine.

3.20 Highlighting

Tornos has worked on highlighting visual elements that will allow the operator to react quickly when faced with certain situations. Here are a few examples:

The user can view the status of potentiometers from afar *(axes feeds + spindle rotations)* via two small graphics on the "HOME" page. When the potentiometer in question is at 100% it appears in green, and it goes orange as soon as this is no longer the case, allowing the user quickly to see whether a potentiometer has accidentally decreased.
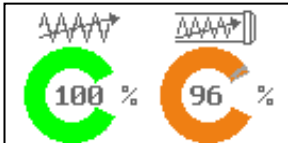
The tool *(wear)* correctors which are not at 0 are displayed in bold, which allows the user quickly to find the tool wear which most often needs intervention.

Tips & Tricks

On the "HOME" page, the user quickly sees the status of the various axes and spindles thanks to small illustrative letters.

Examples: L= Lock *(the axis is locked)*
              R= Reference *(in reference position)*
              T= Torque *(the axis is in torque limitation)*
              …

A banner that can be found on all the pages of T-MI provides immediate information as to the status of the machine.

Examples: Active mode, active channel, alarm in progress, preheating programmed, …

Operator panel:
On the operator panel, the keys flash to indicate that the action can be carried out and they flash quickly when the action must be carried out. This allows the operator to learn his/her way around quickly.
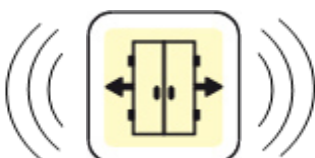
3.21 Peripheral device management

The machine peripheral devices can be configured very simply direction from the T-MI pages. This will allow you to obtain operation during production that perfectly meets your needs.
Here are a few examples:

Indicator light:
The indicator light allows you to see the status of the machine from a distance in the workshop. T-MI allows you to configure the behaviour of your indicator light.

Examples: - Have the indicator light flash orange when the series of parts is complete
             - Have the indicator light light up green when the machine is in production mode
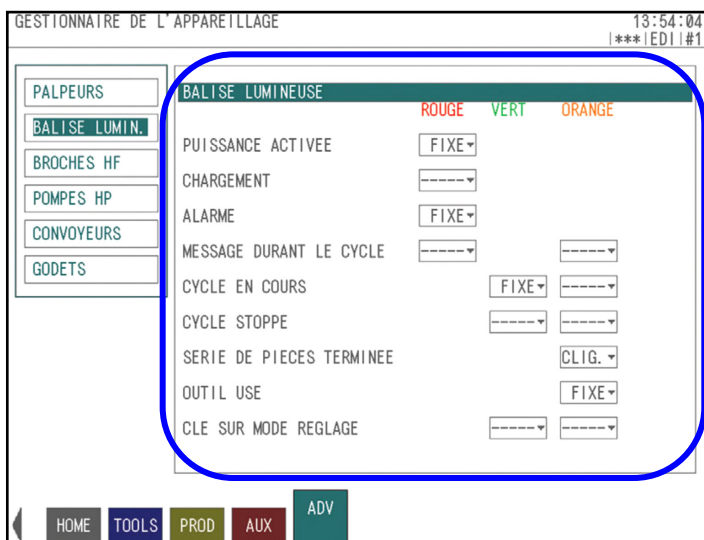
Part and chip conveyor:
The parameters of the conveyors on and off times can be set. This will ensure you have a flow of parts and chips that perfectly meets your needs.

Tips & Tricks
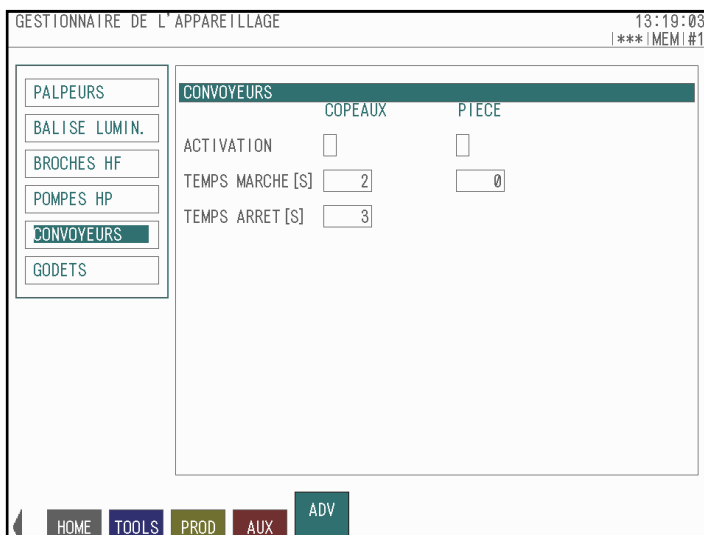
TORNOS

Multi-cup:
Tornos offers several types of cup part catchers on its machines. For this type of peripheral device too, you can benefit from maximum configuration flexibility, for instance:
- Ø Number of cups used
- Ø Number of parts desired per cup

```
GESTIONNAIRE DE L'APPAREILLAGE                    13:19:43
                                                |***|MEM|#1

 ┌─────────────┐   ┌─────────────────────────────────────┐
 │  PALPEURS   │   │ RECUPERATEUR A GODET                 │
 └─────────────┘   │ GODET    COMPTEUR  PRESET            │
 ┌─────────────┐   │ > 1 <        0        0              │
 │ BALISE LUMIN.│  │   2                   0              │
 └─────────────┘   │   3                   0              │
 ┌─────────────┐   │   4                   0              │
 │  BROCHES HF │   │   5                   0              │
 └─────────────┘   │   6                   0              │
 ┌─────────────┐   │   7                   0              │
 │  POMPES HP  │   │   8                   0              │
 └─────────────┘   │   9                   0              │
 ┌─────────────┐   │  10                   0              │
 │  CONVOYEURS │   │                                      │
 └─────────────┘   │ [Ω] CHANGEMENT GODET  [ ] ARRET EN FIN DE PRODUCTION │
 ┌─────────────┐   │ [ ] ACTIVATION        [ ] ROTATION APRES CHAQUE PIECE│
 │   GODETS    │   │ [10] NOMBRE DE GODETS  [0] ATTENTE AVANT ROTATION [S]│
 └─────────────┘   │                                      │
                   └─────────────────────────────────────┘
                      ┌─────┐
                      │ ADV │
  ◄ │ HOME │ TOOLS │ PROD │ AUX │
```