

# ToolWear

Version 1.0.0

*monitoring tool wear*

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**Tecnologie e Prodotti per l'Automazione**

# Sommario

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# 1 Project purpose

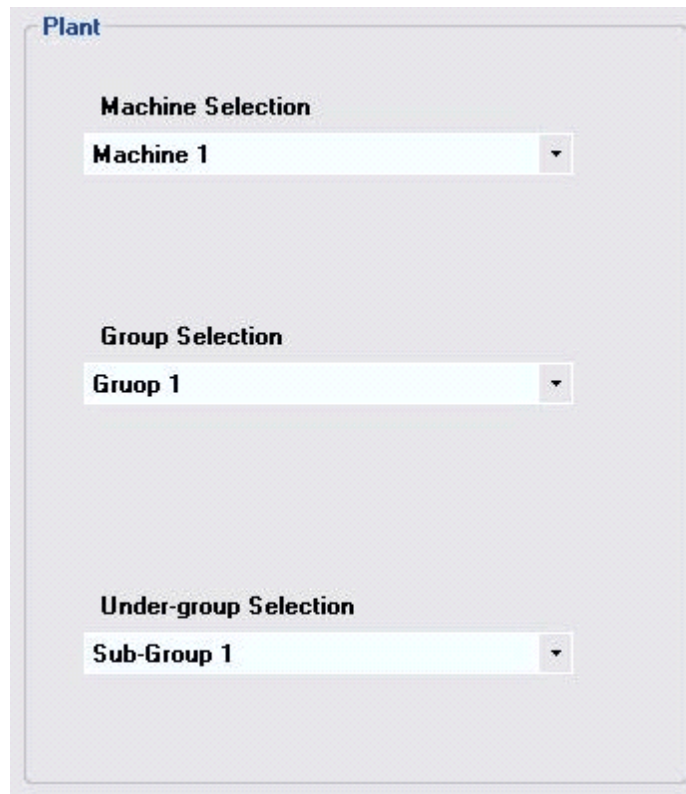
The project fulfills the need to constantly monitor the wear state of the tool drills, milling machines and blades mounted on a plant. Particularly, it allows to check the usage frequency of each tool, comparing it with a maximum associated value and notifying the state of progress of its wear.

## 2 Description of the Visualization Tool

The program is very versatile, it can be easily set through a simple XML file ("TpaWearCfg.xml") that macroscopically describes the technological structure of the plant.

Particularly, the configuration will describe each machine belonging to the plant and it will list all the groups and sub-groups that characterize it and, for each of them, the number of mounted tools and the index of the first tool.

In this way, Three combo box will be available on the Home Screen regarding the machine selection, the group selection and the sub-group selection.



When the sub-group of interest is established, alongside it will be shown a grid with so many rows as the mounted tools are and its columns will contain the information needed to locate the tool in the plant and its state of progress of wear:

## TOOLS TABLE

Machine 1

Gruop 1Sub-Group 1

Tool	Diameter	Type	Usage	Max Usage	% of Usage
11	5.5	3000	0	250	0
12	5	3000	0	500	0
13	8	3000	2900	3000	96
14	8	3000	0	100	0
15	11	3000	72	100	72
16	8	3000	0	100	0
17	8	3000	0	100	0
18	5	3000	71	100	71
19	8	3000	0	100	0
20	8	3000	0	1000	0

It will be possible to set (always in the "TpaWearCdg.xml" file) also the different warning levels of the state of wear; in this way each row will have a specific colour that identifies the belonging level, providing a visualization help that is surely more immediate.

Currently three warning levels are identified:

- 1) Green: if the usage percentage  $\leq 50\%$ ;
- 2) Yellow: if the usage percentage  $> 50\%$  and  $\leq 75\%$ ;
- 3) Red: if the usage percentage  $\geq 75\%$ ;

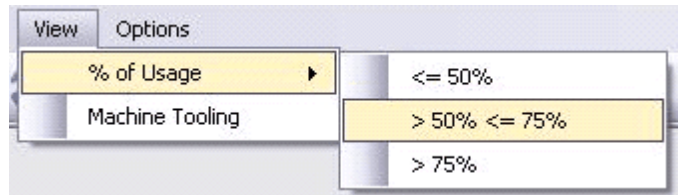
In the grid, the fields belonging to the columns "Usage" and "Max Usage" will be editable by the user through a password entry and when their editing will be finished, the usage percentage and the new belonging warning level will be redefined (row colouring). The password management will be described later.

The management levels is currently constrained to 3 (as it is described above), in the future it could be possible to foresee the management of a number of usage levels greater than 3, giving also the possibility to assign to each level the desired colour.

### 3 Menu Description

The application Menu is composed by three entries: "File", "View" and "Options".

View on:



Inside this sub-menu it's possible to choose one of the options: "Usage %" and "Machine Tooling".

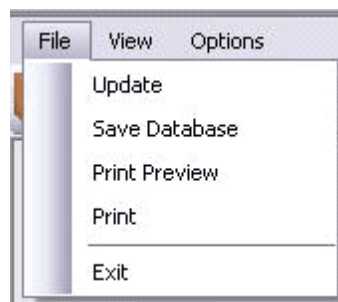
Selecting the first option, a list of all the bits that are within the usage percentage selected.

**USAGE TABLE**  
Using percentage between 51 e 75

Row	Machine	Group	Subgroup	Tool	Diameter	Type	Usage	Max Usage	% of Usage
1	1	1	1	15	11	3000	72	100	72
2	1	1	1	18	5	3000	71	100	71

Clicking on the second option the application features are reset as it is described at the point 2.

File:



This sub-menu shows three selectable entries "Update", "Save Database", "Print", "Exit".

The entry "Update" will load the file "WearTmpN.txt" to visualize the updated usage database of the tools.

As it has already been anticipated at the point 2, some data of the tool grid are editable by the user. The option "Save Database" allows to save the grid modifications in the tool database, namely in the "TpaWearDB.xml" file.

The entries "Print Preview" and "Print" allow to manage the printing of report that contains the data of the grid visualized during the command execution.

TOOLS TABLE			
Machine 1 - OVER_I 25.11-15			
Group 3 - Front Right Low			
Subgroup 2 - Linear Head			
Utensile	N° Utilizat	N° Max Utilizat	% DI Utilizzo
11	5	1000	0
12	5	1000	0
13	678	1000	67
14	5	1000	0
15	5	1000	0
16	0	1000	0
17	990	1000	99
18	05	1000	5
19	67	1000	6
20	06	1000	5
21	501	1000	50
22	500	678	73
23	345	1000	34
24	790	1000	79
25	10	1000	1

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The entry "Exit" closes the application

Options:

The entry Options is enabled only after the access, entering the password (see 6 paragraph).

## 4 Description process of data processing

To correctly locate and manage the appropriate usage frequency for each tool that takes part to the panel working, the optimizer will have the task to create an appropriate row inside the executive matrix. Particularly, the row will have the operative code "20" and it will contain the information regarding the tool that will be expressed in terms of machine number, group number, tool number and usage number (or path executed in the case of a milling cutter/blade) inside the program. Each row with this operative code can be added at the end of the executive matrix of the plant or at the end of the executive matrix of each machine. Otherwise, the writing of the row for the management of the tool wear will occur only if it's enabled the corresponding entry in the TPA:INI, so that the optimizer compatibility is maintained unchanged with previous GPL custom versions:

```
[OPTICUSTGEN]
AbVerUsura = 1      ;enabled
```

The GPL code will have the simple task to interpret the operative code "20" in the scanning routine of the executive matrix. Particularly, it will have to take the data contained in the row, formatting a string and adding it in an ASCII file ("WearTmpN.txt") that is contained in the directory specified in the entry "DirReport" of the TPA.INI, where *N* is the machine number.

The string will have to list the machine number, the group number, the sub-group number, the tool number and its usage number (or the executed path in the case of a cutter/blade) with ";" as separator element.

At this point, during its opening, the visualization program of the tool wear will update the data contained in each of its grid with the data written in the ASCII file from the GPL code, correctly saving them in the XML file ("TpaWearDB.xml").

In the case that one or more machines are executing workings on a piece, through the GPL cyclical the temporary files "StartN.txt", where *N* is the machine number (there is a file for each machine) will be written in the specified directory in the entry "DirReport" del TPA.INI.

The application will make the update of the data after that the lack of these files is checked, ensuring that the database modifications will be done only when all the machines are in Stop.



## 5 Files Configuration

As briefly explained in the preceding paragraphs, the right project functioning is related to the presence and to the structural correctness of the files; "TpaWearCfg.xml" and "TpaWearDB.xml".

Both files, that has to stay in the **Albatros/Bin** folder, can be written with the aid of a generic textual editor (like the Windows block notes, for example) and subsequently they can be saved changing the extension from "\*.txt" to "\*.xml".

"TpaWearCfg.xml"

The file will have to have a tree structure whose parent node will have to be named IMPIANTO. Within it there are the MACCHINA nodes, characterized by the "Des" attribute, to which is associated the machine description. Within the latter the GRUPPO nodes have to be created and also the related attributes "NumGru" and "Des" that will contain the data regarding the number and the description of the group in object. In them there will be the SOTTOGRUPPO nodes with the attributes "NumSottoGru", "Des", "NumTotUt" and "IdStart", that represent the number, the description, the quantity of equipped tools and the index of the first tool of the subgroup in object.

```
<IMPIANTO>
  <PARAMETRICA Read="1">
    <MAXUTGRUPPO>64</MAXUTGRUPPO>
    <COLGRUINDEXUT>14</COLGRUINDEXUT>
    <COLGRUDIAM>9</COLGRUDIAM>
    <COLUTDIAM>1</COLUTDIAM>
    <COLGRUTYPE>7</COLGRUTYPE>
    <COLUTTYPE>7</COLUTTYPE>
  </PARAMETRICA>

  <UTILIZZOTOOL>
    <MAXUTIL Def="100000"/>
    <LIVELLO livNum="1" limMin="0" limMax="50" Colore="Green"/>
    <LIVELLO livNum="2" limMin="51" limMax="75" Colore="Yellow"/>
    <LIVELLO livNum="3" limMin="76" limMax="100" Colore="Red"/>
  </UTILIZZOTOOL>

  <MACCHINA Des="MC MIRROR TETE">
    <GRUPPO NumGru="1" Des="010 - Gruppo Anteriore Sinistro Basso">
      <SOTTOGRUPPO NumSottoGru="2" Des="012 Teste Lineari" NumTotUt="16" IdStart="11"/>
    </GRUPPO>
  </MACCHINA>

  <MACCHINA Des="OVER_I">
    <GRUPPO NumGru="1" Des="010 - Gruppo Anteriore Sinistro Basso">
      <SOTTOGRUPPO NumSottoGru="1" Des="011 Groupe Pantographe" NumTotUt="1" IdStart="1"/>
      <SOTTOGRUPPO NumSottoGru="2" Des="012 Teste Lineari" NumTotUt="48" IdStart="11"/>
    </GRUPPO>
    <GRUPPO NumGru="2" Des="020 - Gruppo Anteriore Sinistro Alto">
      <SOTTOGRUPPO NumSottoGru="2" Des="022 Teste Lineari" NumTotUt="45" IdStart="11"/>
    </GRUPPO>
    <GRUPPO NumGru="5" Des="050 - Gruppo Posteriore Sinistro Basso">
      <SOTTOGRUPPO NumSottoGru="1" Des="051 Groupe Pantographe" NumTotUt="1" IdStart="1"/>
      <SOTTOGRUPPO NumSottoGru="2" Des="052 Teste Lineari" NumTotUt="48" IdStart="11"/>
    </GRUPPO>
    <GRUPPO NumGru="6" Des="060 - Gruppo Posteriore Sinistro Alto">
      <SOTTOGRUPPO NumSottoGru="2" Des="062 Teste Lineari" NumTotUt="45" IdStart="11"/>
    </GRUPPO>
  </MACCHINA>
</IMPIANTO>
```

In the IMPIANTO node it will be required to create the nodes PARAMETRICA and UTILIZZOTOOL.

The first will contain the sub-nodes MAXUTGRUPPO, COLGRUINDEXUT, COLGRUDIAM, COLUTDIAM, COLGRUTYPE and COLUTTYPE in order to configure the pointing indexes to the matrices that describe the parametric of the single machines. This will allow to the application program to show the diameter and the typology of the equipped tools. It is possible to exclude the reading of the parametric setting the attribute "Read" of the node PARAMETRICA to 0.

The node UTILIZZOTOOL will show within it different nodes LIVELLO with the relative attributes, in order to configure the usury level of the tools to take advantage of the function of colouring of the rows in the table (as explained in the section 2). The node DEFMAXUTIL defines the default value of the number of maximum usages of each tool.

"TpaWearDB.xml"

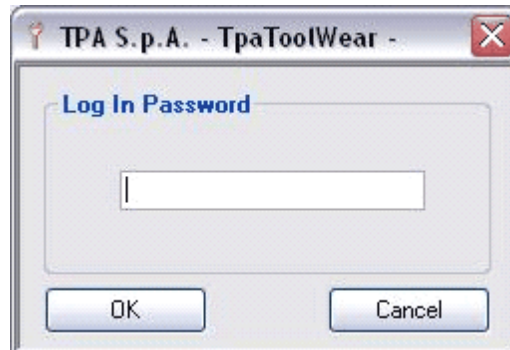
The structure of this file is similar to the structure of the previous file, the only one difference is that the node SOTTOGRUPPO contains some UTENSILE nodes of which represents an equipped tool in the machine. This file, if it doesn't exist, would be automatically generated at the first run of the application. The node UTENSILE is characterized by three attributes: "Id", "Util", "MaxUtil" that respectively represent the number of the tool, the number of usages and the maximum number of usages.

```
<SOTTOGRUPPO NumSottoGru="2" Des="Teste Lineari" NumTotUt="15" IdStart="11">
  <UTENSILE Id="11" Util="5" MaxUtil="1000" />
  <UTENSILE Id="12" Util="5" MaxUtil="1000" />
  <UTENSILE Id="13" Util="678" MaxUtil="1000" />
  <UTENSILE Id="14" Util="5" MaxUtil="1000" />
  <UTENSILE Id="15" Util="5" MaxUtil="1000" />
  <UTENSILE Id="16" Util="5" MaxUtil="1000" />
  <UTENSILE Id="17" Util="990" MaxUtil="1000" />
  <UTENSILE Id="18" Util="55" MaxUtil="1000" />
  <UTENSILE Id="19" Util="67" MaxUtil="1000" />
  <UTENSILE Id="20" Util="56" MaxUtil="1000" />
  <UTENSILE Id="21" Util="501" MaxUtil="1000" />
  <UTENSILE Id="22" Util="500" MaxUtil="678" />
  <UTENSILE Id="23" Util="345" MaxUtil="1000" />
  <UTENSILE Id="24" Util="790" MaxUtil="1000" />
  <UTENSILE Id="25" Util="10" MaxUtil="1000" />
</SOTTOGRUPPO>
```

## 6 Password Management

As anticipated in the previous pages, it has been added the management of an authentication through the insert of a password.

Through this window, it is possible to perform the access to the database editing.



The access through the password enables all the functions regarding the data modification of the tools; in particular, the Reset function of the database, the possibility to edit the value of the fields "Usage" and "Max Usage" in the tool table and the modification of the password in object are activated.

Selecting the rows in the tool table and, subsequently, clicking the Reset button, placed under the combo selection described in the section 2, this window will be shown.



In this window it can be chosen whether to reset the data of the tools belonging to the selected rows, to the View table or to all the plant; confirming the reset command, the values of the field "Usage" will be reset, while in the field "Max Usage" will be set the default value read in the configuration file.

If no-one row is selected, the above window will allow to choose only the second and the third option.

**Important: The default password is tpaspa.**

Using the entry of the menu Options --> Set Password there will be the access to this window, thanks to which it will be possible to change the access password.



It's required the insert the current password and the double insert of the new password that is decide to set.

The trap handler distinguishes the lowercase from the uppercase, it can be used both letters and numbers and the maximum password length is 10 characters.

## 7 License

The program is installed on a single PC plant supervisor and it's under license through the usage of a HW key.  
Specifically, the number of licenses is equal to the number of machines configured.



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