TOOLMON

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Application

Software Revision 1.0

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1. The TOOLMON Concept

The initial version of TOOLMON was designed to interface a number of independent Tool Monitor Modules to a single application using multiple windows. Each channel (unit) has a unique windows associated with it. A maximum of 24 TC6400's may be interfaced to a single version of TOOLMON. TOOLMON determines by itself how many modules are connected. Each TC6400 was designed to supervise a maximum of 64 cutting tools.

The TC6400 is a rack based system. The picture below shows a rack configured with 10 x TC6400 units running in a network.

This manual covers the function of the TOOLMON application. The TC6400 is a Tool Monitoring system based on Power Monitoring. In order to understand the function of the TC6400 and all it Tool Monitoring features, please consult the TC6400 hardware manual.

In the future the TOOLMON application is expected to interface to other hardware and eventually other type of sensors as well.

1.1 PC and OS (Operating System) requirements

PC Requirements for running 24 channels simultaneously:

CPU Speed:	Min. 700 MHz PIII type
RAM:	Min. 128MB
Hard Disk:	Min. 5 GB
Graphic Resolution:	Min. 800 x 600, preferable higher
Graphic Performance:	Reasonable fast graphics

For lesser number of channels a slower PC may be used.

OS Operating System Requirement:
    Windows XP/2000/NT or
    Windows Me/98/95

It is strongly recommended to use a Windows XP/2000/NT system while they were designed for smooth multitasking.

1.2 COM PORT Selection
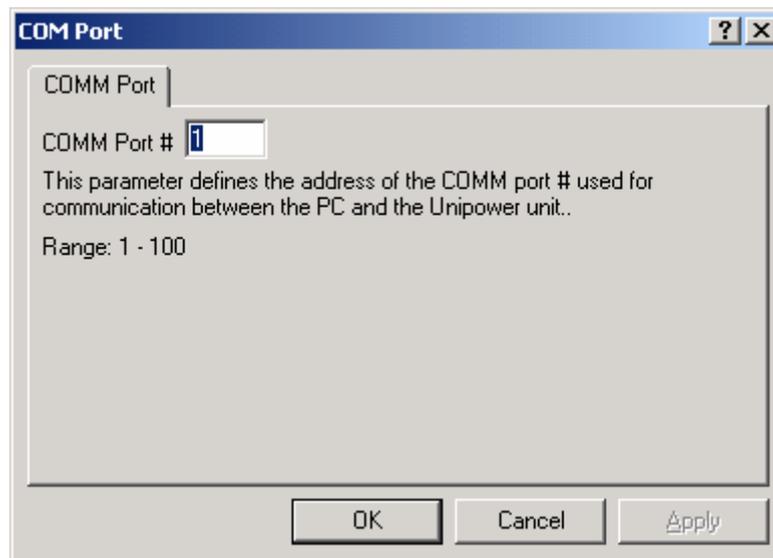
First step to run TOOLMON is to enter the COM port number used for communication with the network of Tool Monitors.

The COM port dialog box is activated form the menu Config->COMM Port.

1.3   Application Bar Management
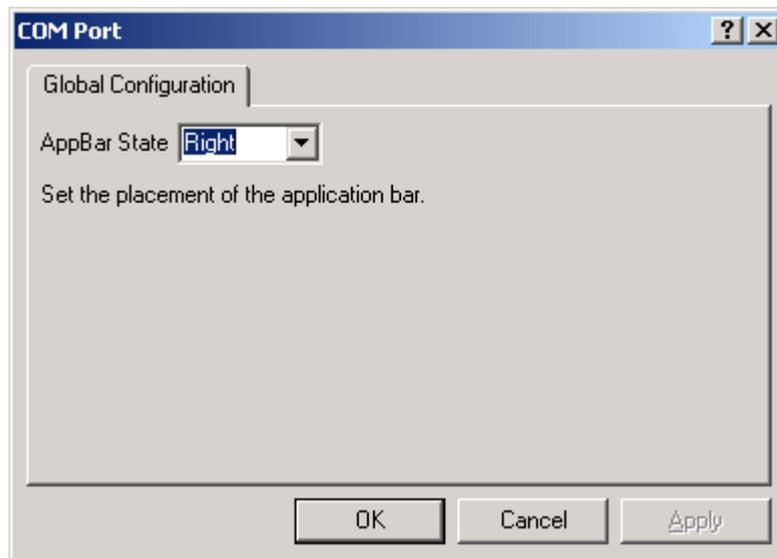
The application bar includes a button for each unit connected. The placement of the application bar is controlled from the menu Config->configuration. The options are Left, right, top, bottom or none.

2. Function

The TOOLMON application continuously monitors and receives measurement values from all the units connected in the network. All values are saved to memory (or disk) no matter if the corresponding unit windows is closed or open. Thus, if an alarm occur, it is always possible to open the windows in order to display the cycle and visualize what happened.

TOOLMON saves the latest monitoring cycles to disk and also saves a reference curve for each cut.

A Peak and Work statistic is saved to disk for each cut also,

2.1 File Generation and Disk Space Consumption

Curve Storage:
The maximum length of curve saved is 15 minutes. It will be possible to supervisor longer operations, but only 15 minutes will be displayed. When TOOLMON first starts a .MAP file for each possible unit is reserved in the current directory. Mapped files are a special file type allowing for random access rather than sequential access of its individual members.

Statistics:
The maximum number of values saved into the statistics are 60000 items. When TOOLMON first starts a .MAP file for each possible unit is reserved in the current directory.

File Overview:

|	
unit#1curve.map	; 9.504.000 bytes
unit#2curve.map	; 9.504.000 bytes
…..	
unit#24curve.map	; 9.504.000 bytes
unit#1stat.map	; 31.680.000 bytes
unit#2stat.map	; 31.680.000 bytes
…..	
unit#24stat.map	; 31.680.000 bytes
unit.bin	; 3.552.672 bytes
state.bin	; 1.244 bytes

The file state.bin records the current size of placement of the windows on the screen. If the file unit.bin is erased all .map files are initialized also when TOOLMON is started.

The disk space needed is thus very close to 1GB (GigaByte = 1000 MB).

File format may well change as new versions of TOOLMON is introduced.

3. Screen Organization

TOOLMON maintains a window for each possible unit interfaced to the application. Each windows includes various options for modifying the display.
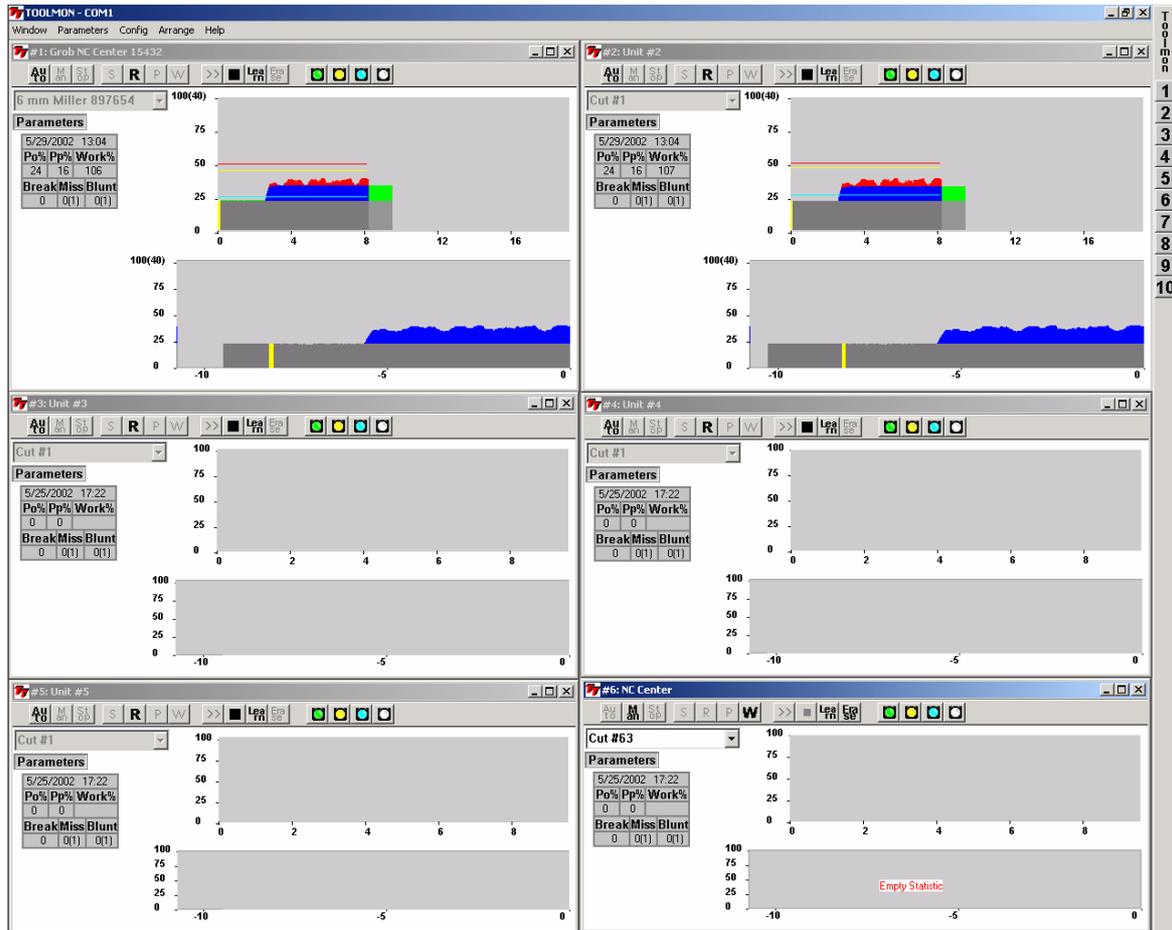
3.1 The Application Bar

The application bar, which is placed at the right side of the screen on the picture above, includes a button for each unit interfaced to TOOLMON. If a unit is removed from the network the button disappears and if a unit is added it reappears. If push of a button opens the corresponding window or brings it to the front if already opened. If an alarm is present the button will be flashing red.

3.2   Spindle and Roll Display
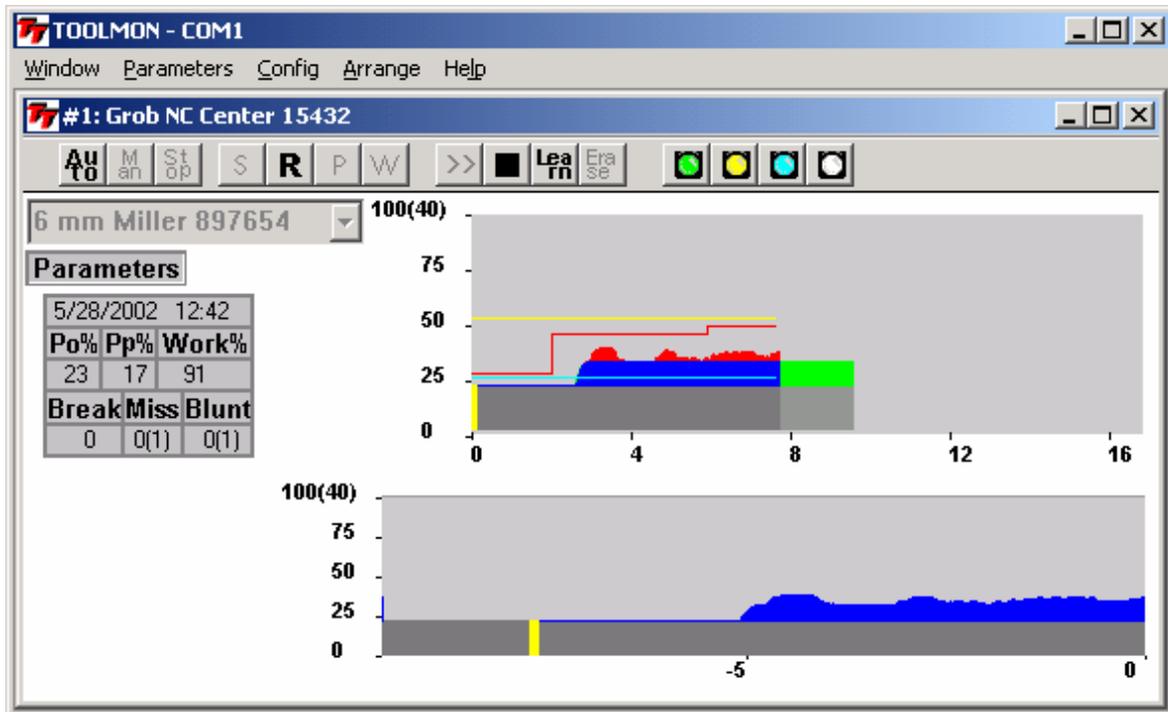
The Spindle and Roll mode display is selected by pushing the 'R' button on the unit menu bar. The display now shows the previous/current tooling cycle and a rolling display, which shows all measurements similar to an analogue recorder. The roll display is a useful tool to analyze for example if the Po averaging is done correctly.

The rolling may be stopped by pushing the stop button (black rectangle) on the menu bar and started again by pushing the >> button.

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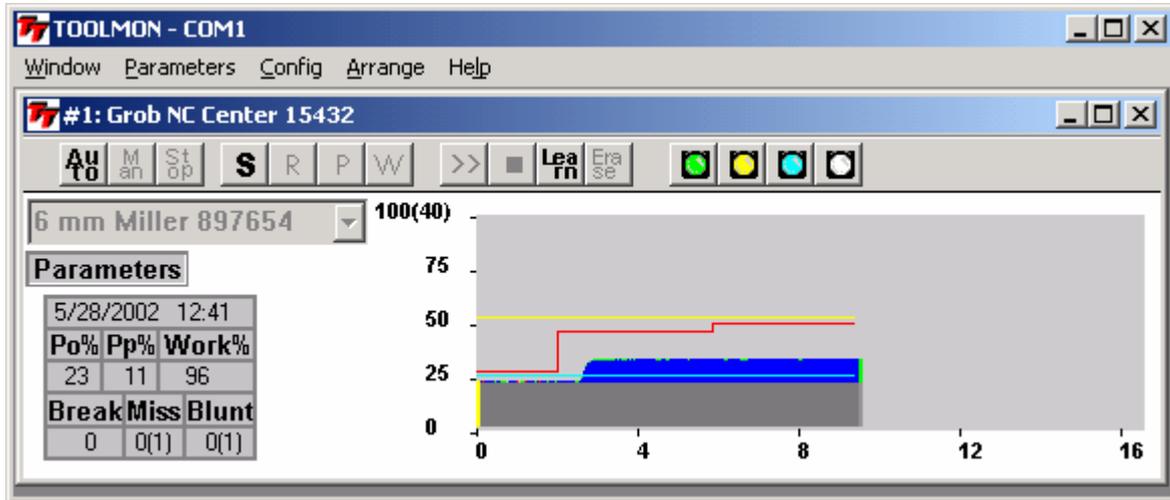
3.3 Spindle Only

The Spindle Only display is activated by pushing the 'S' key on the unit menu bar. In this case the display shows only the spindle. This display enables a large number of windows to be viewed simultaneously also depending on the resolution of the screen used.

## 3.4   Spindle and Peak Statistic
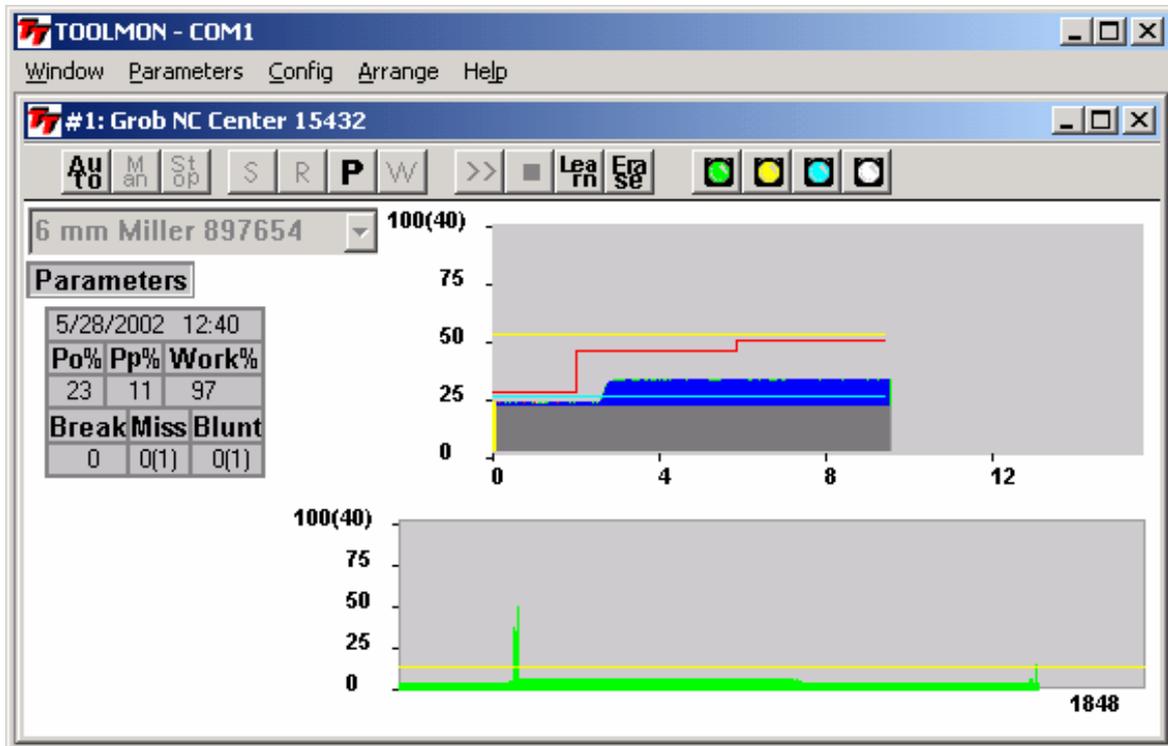
When the 'P' button on the unit menu bar is pushed the display shows the Spindle as well as the peak statistic. A button for erasing the statistic is enabled on the unit menu bar.

## 3.5   Spindle and Work Statistic
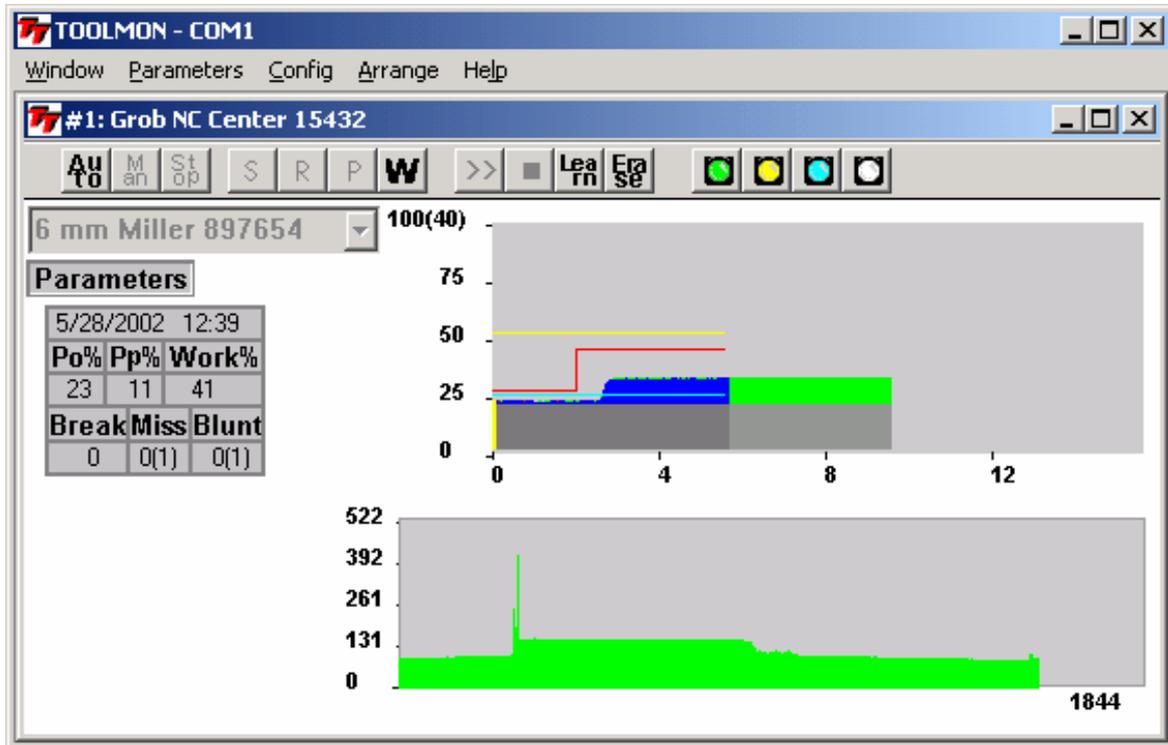
When the 'W' button on the unit menu bar is pushed the display shows the Spindle as well as the work statistic. A button for erasing the statistic is enabled on the unit menu bar.

3.6 Stop Mode
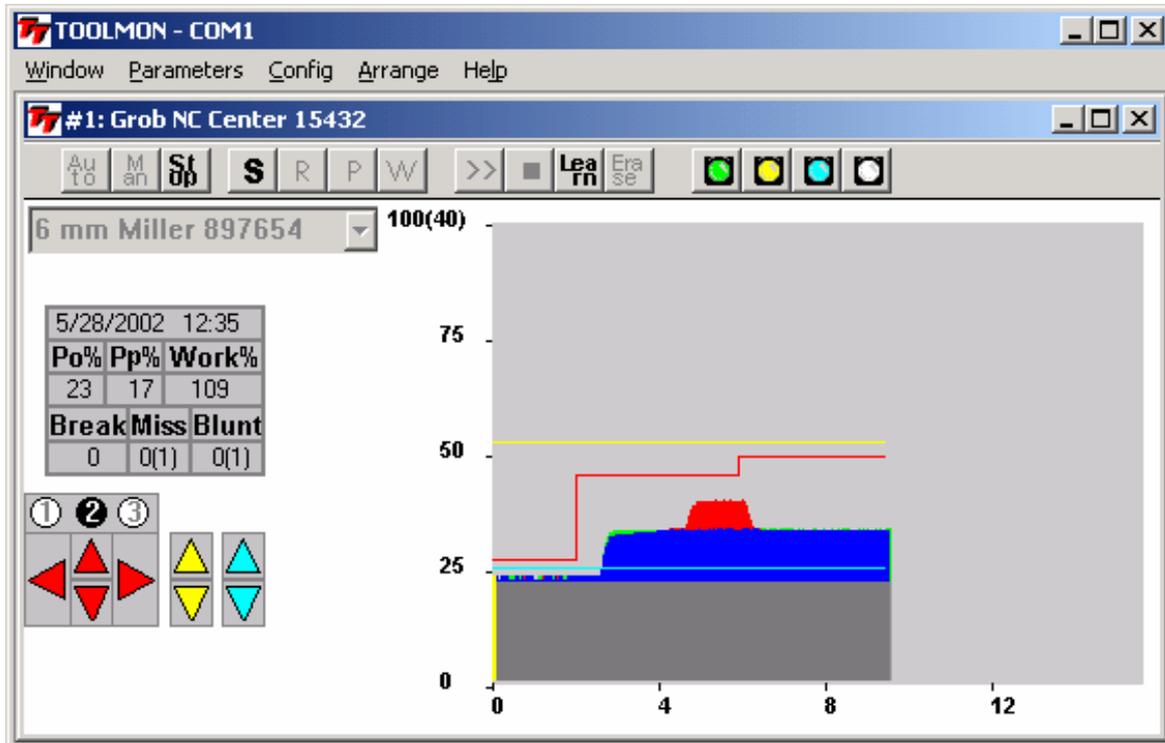
When the stop mode button is pushed the Spindle Window shows only the previous measurement cycle. When the cycle ends the display is updated. When this display is shown it is possible to modify limits by pushing the arrows displayed at the left side of the display.
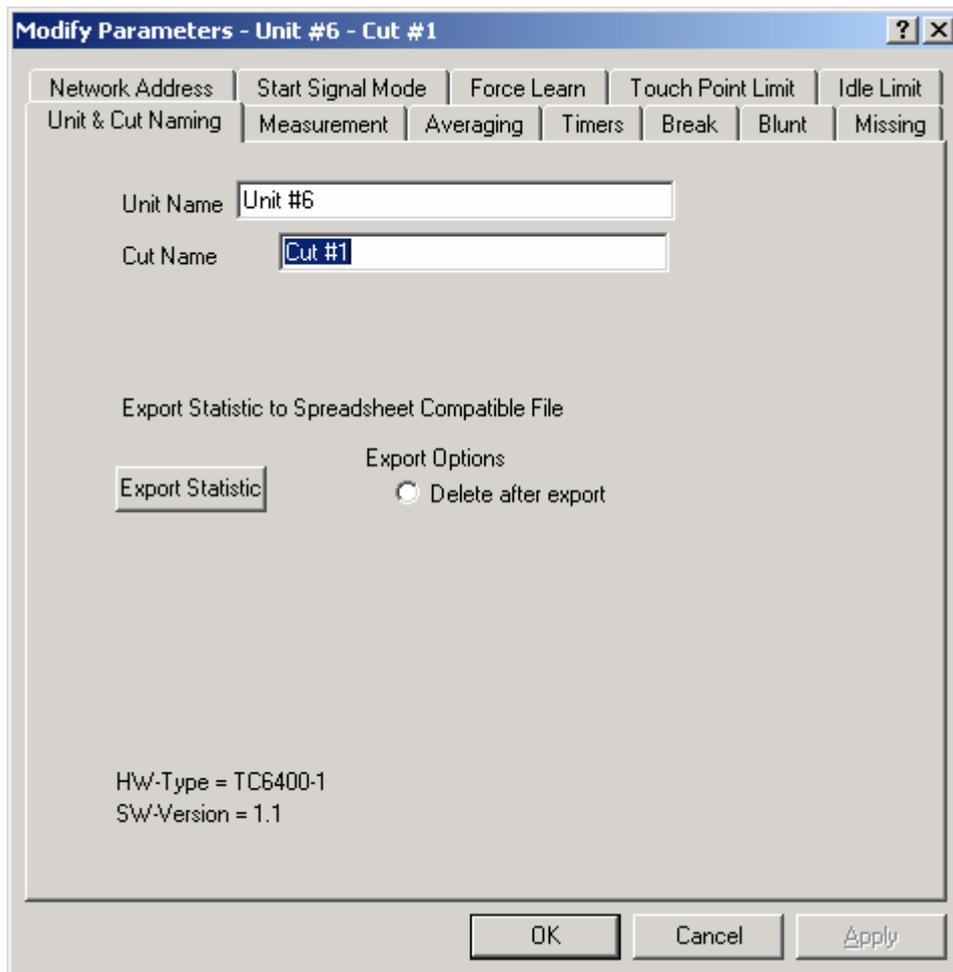
3.7 Manual Mode
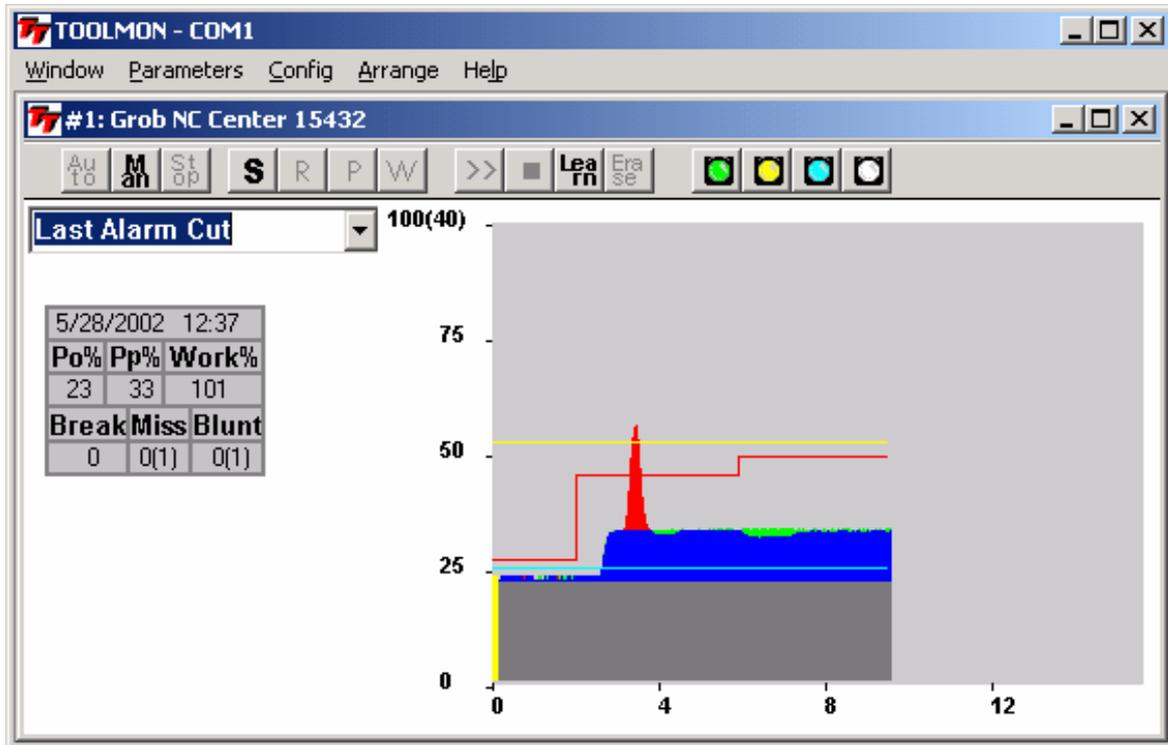
When manual mode is selected it is possible to view the curves for all 64 cuts as well as the last alarm cut.

4. Modify Parameters

4.1 Unit & Cut Naming

The Modify Parameter property sheet is displayed either from selecting the correct Unit (Machine Spindle) and Cut (Tool Type Identification) from the Parameter menu or from using the shortcut button displayed on each unit window.
The first page enables a Unit Name (Spindle Identification) and a Cut Name (Tool Type Identification) to be entered.
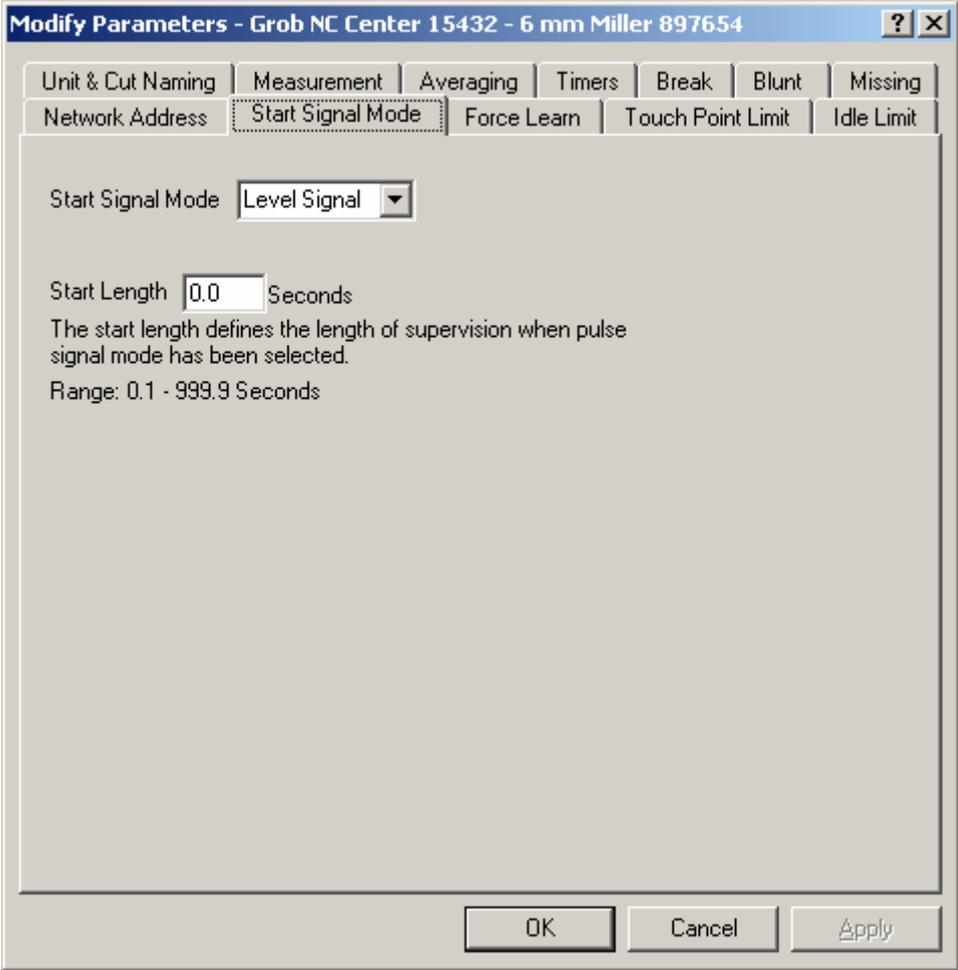A Button for export statistic is placed on this page also.
At the bottom of the dialog box hardware and software identification is placed.

4.2 Network Address
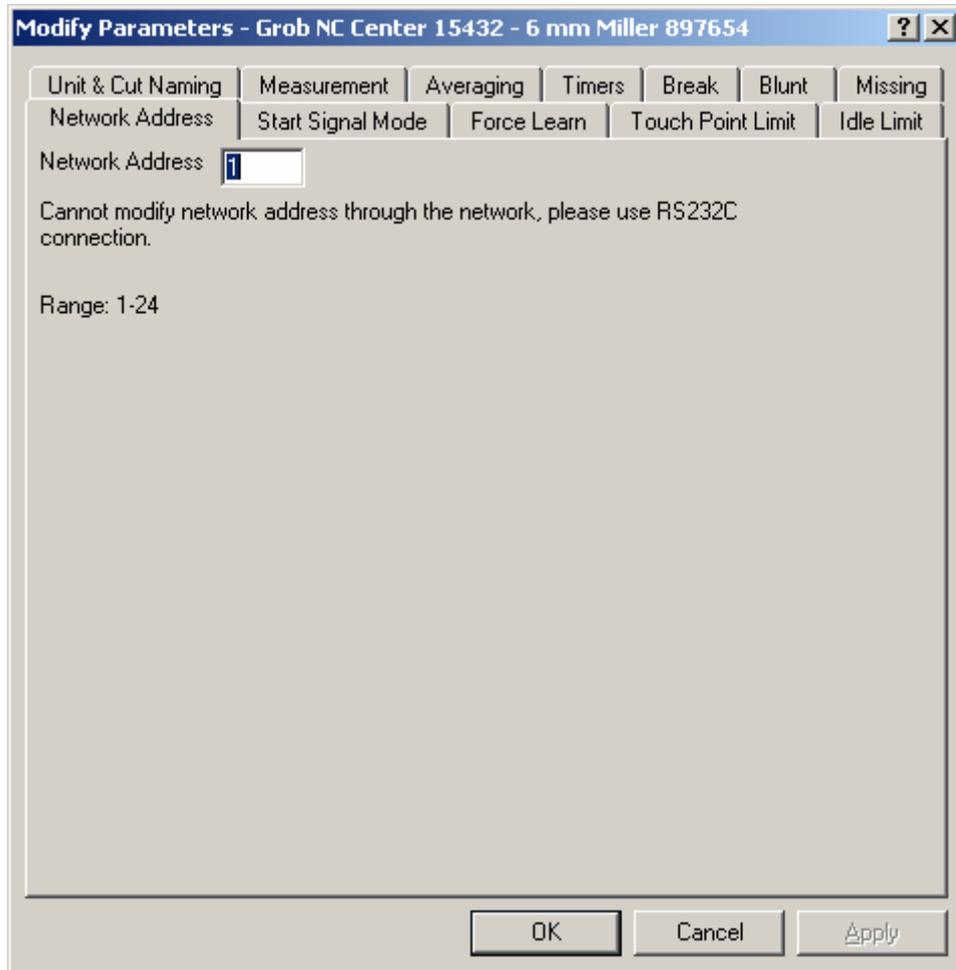
The network address is a number in the range 1 – 24. For security reasons the network address can only get changed from the RS232C port, not from the RS485 network.

4.3   Start Signal Mode

Start Signal Mode may be either Level Signal (normally used) or strobe. If strobe mode is selected the length of the Tooling Cycle must be programmed also.

4.4   Force Learn
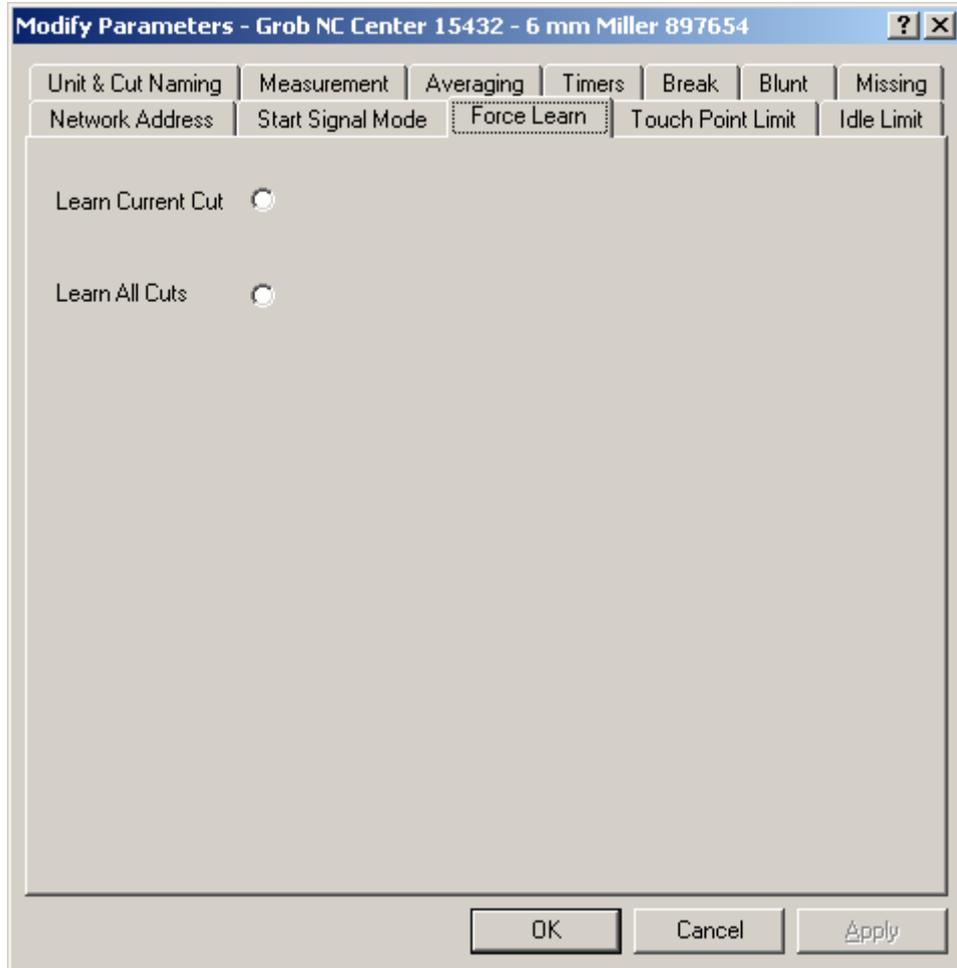
From this dialog box it is possible to force a learn of a single cut or to force a learn of all cuts belonging to the selected unit.

4.5   Touch Point Limit
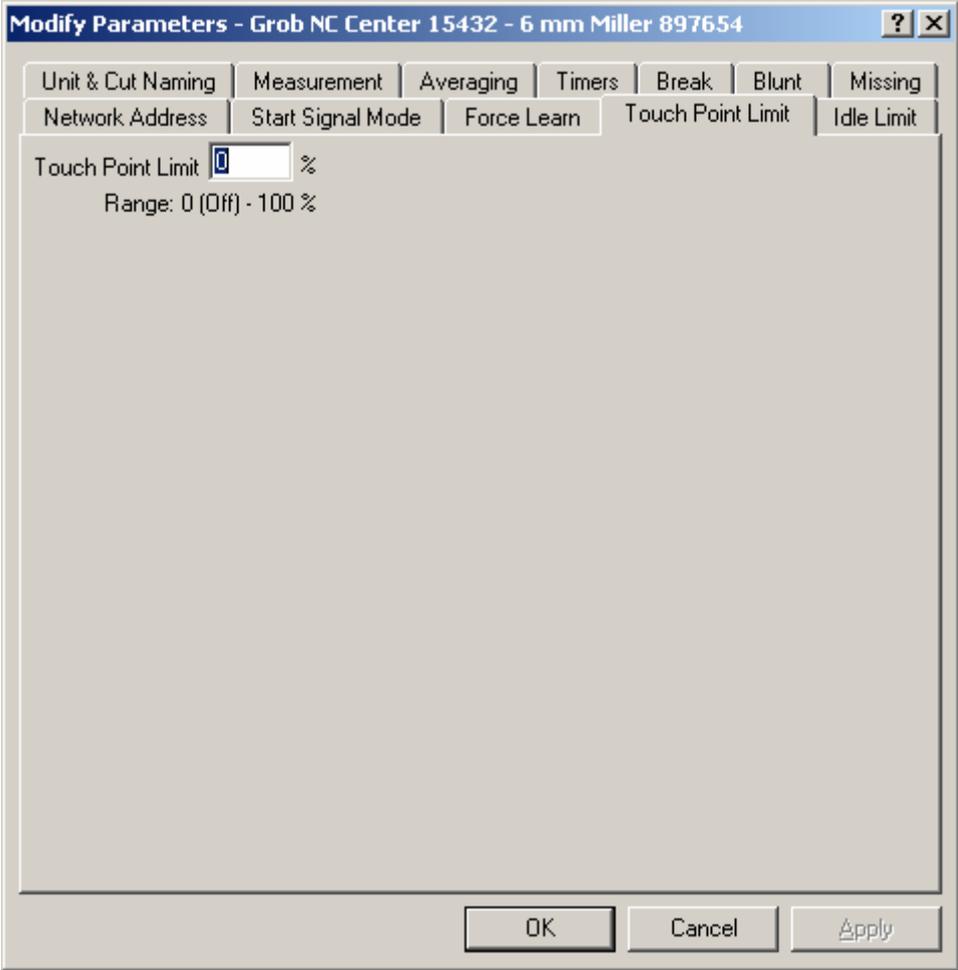
This dialog box define the Touch Point Limit (default = off).

4.6   *Idle Min. Limit*
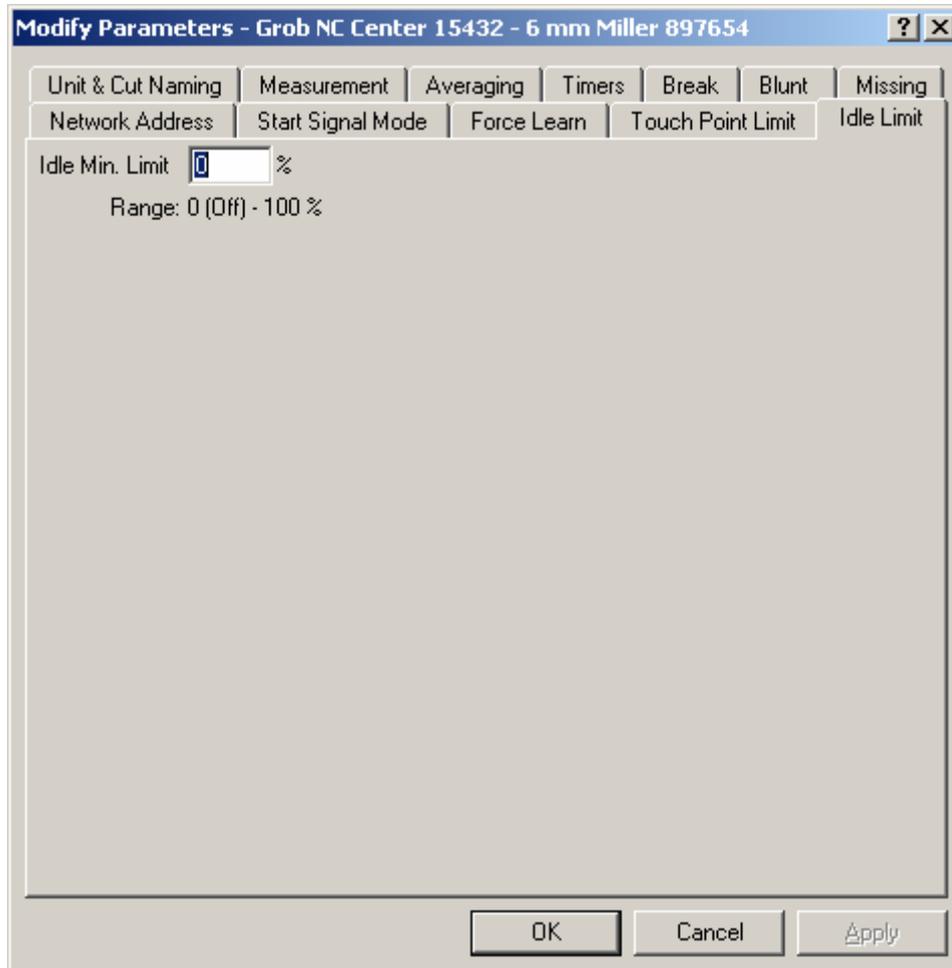
This dialog box define the idle min limit (default = off). This limit may be used to detect faults in the spindle transmission system, breaking of a belt etc.

4.7   Measurement

This dialog box makes it possible to select (zoom) a smaller measurement range within the total measurement range.

4.8   Averaging

Modify Parameters - Grob NC Center 15432 - 6 mm Miller 897654

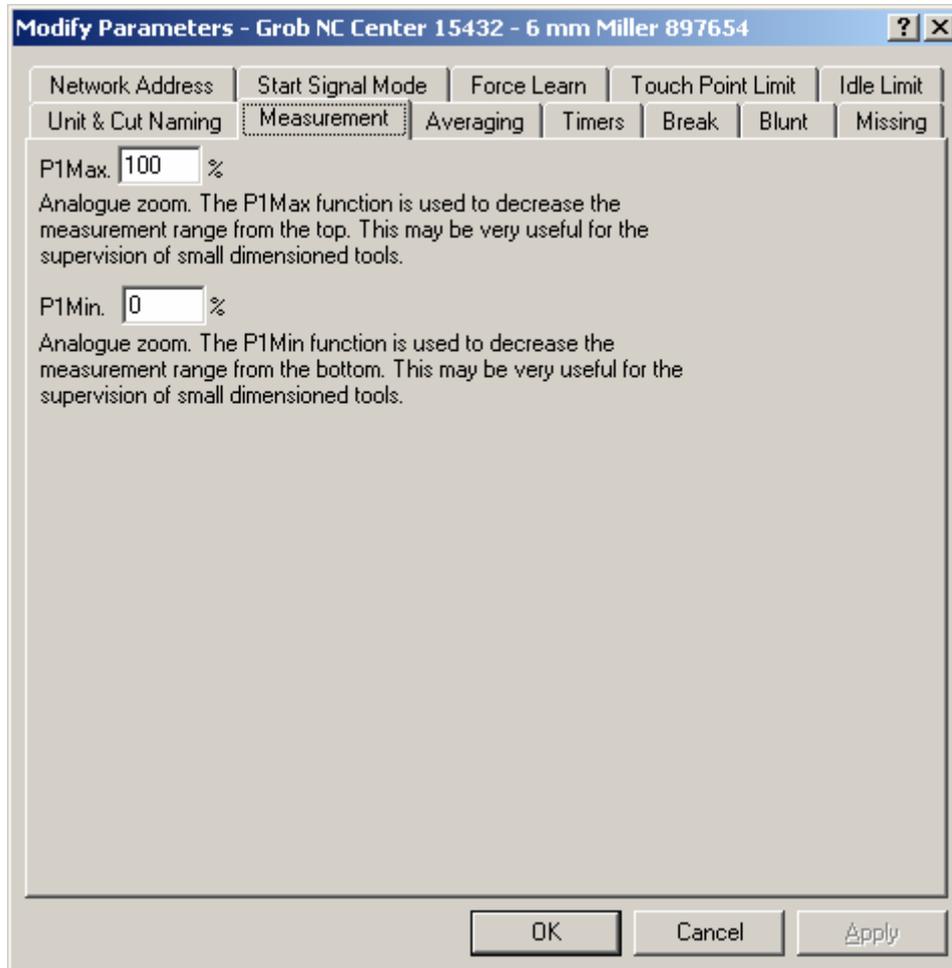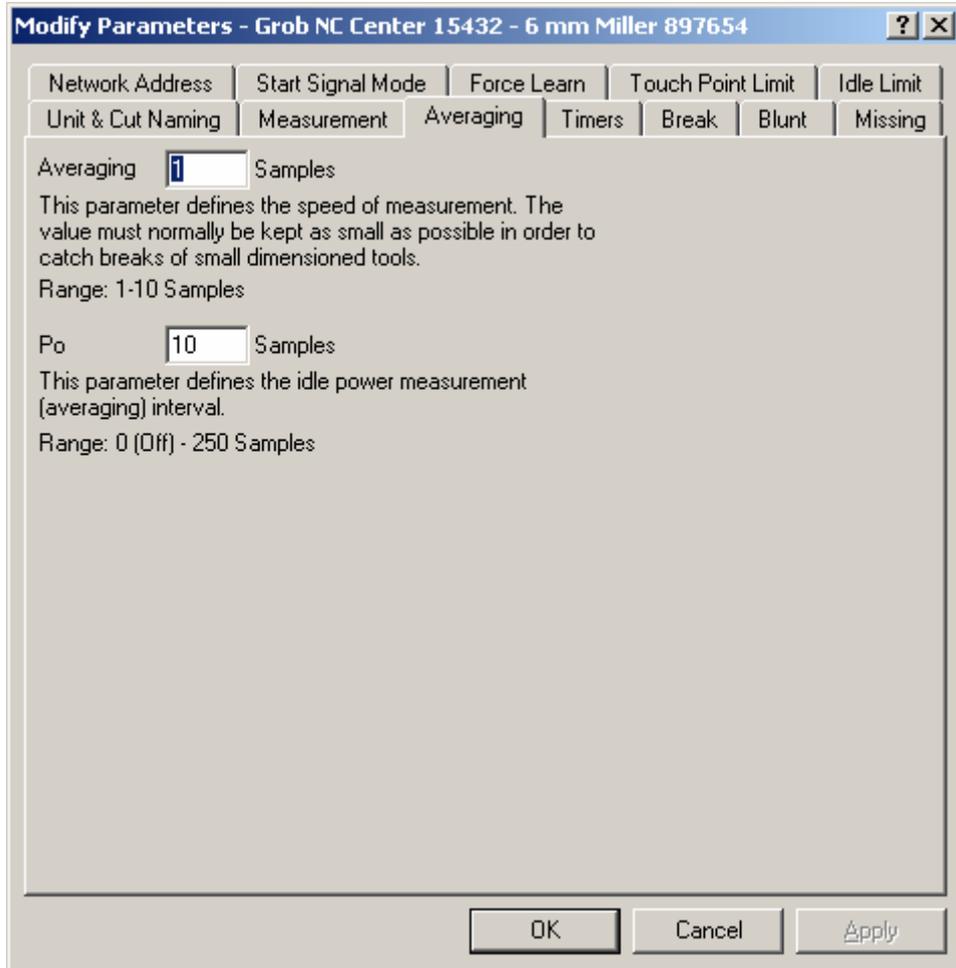| Network Address | Start Signal Mode | Force Learn | Touch Point Limit | Idle Limit |
| Unit & Cut Naming | Measurement | Averaging | Timers | Break | Blunt | Missing |

Averaging   [1]   Samples

This parameter defines the speed of measurement. The value must normally be kept as small as possible in order to catch breaks of small dimensioned tools.

Range: 1-10 Samples

Po   [10]   Samples

This parameter defines the idle power measurement (averaging) interval.

Range: 0 (Off) - 250 Samples

OK   Cancel   Apply

This menu defines the two averaging parameters.

The Averaging parameter is used on noisy spindles to obtain a more smooth measurement. This value must normally be as small as possible in order to be able to detect breaks of smaller tools.

The Po Averaging is used to decrease the possibility of having the Po measurement depend on a noise peak from the tooling spindle.

4.9   Timers
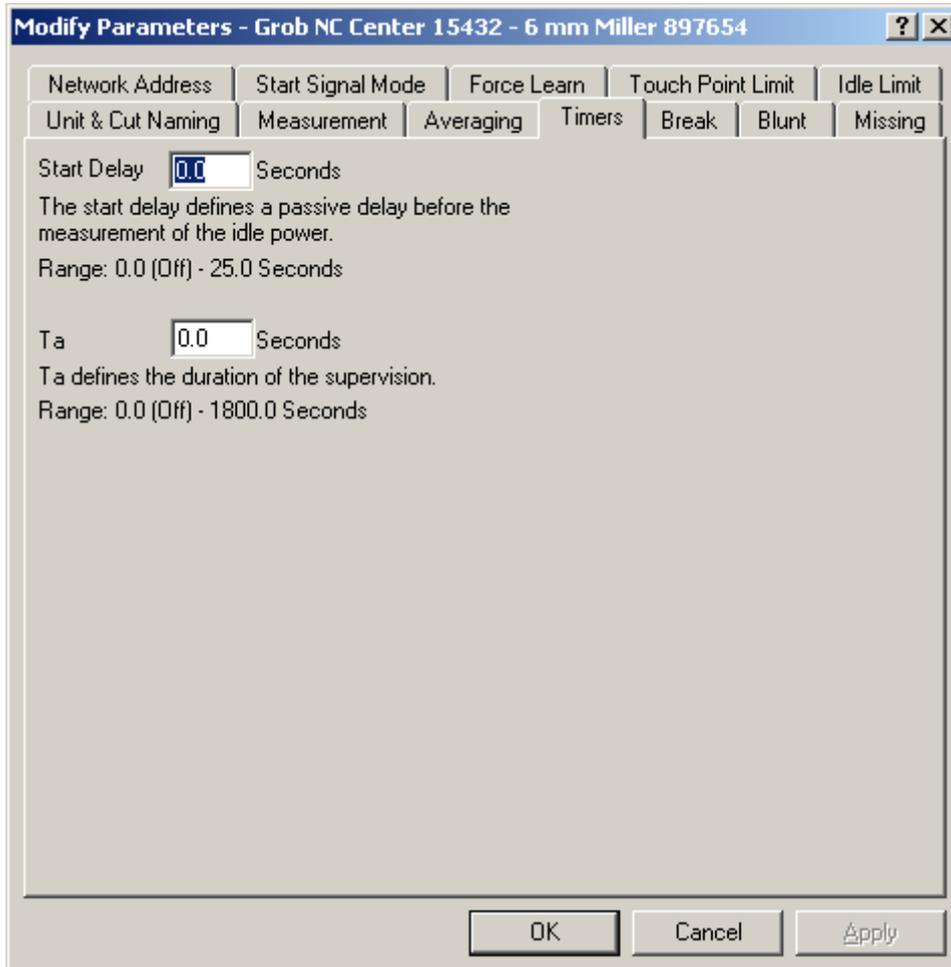
The start delay is used to delay the Po measurement in cases where the Spindle Motor is accelerating or decelerating. It is important to measure the idle power Po only when the speed of the tooling spindle has stabilized.

The time Ta is used to limit the length of the supervision. In some cases the supervision is switched of at the end of the supervision. An example may be a drill breaking through cast metal. This break through may well cause a huge spike in the measurement depending on the casting quality of the metal and the purity of the metal also.

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4.10   Break
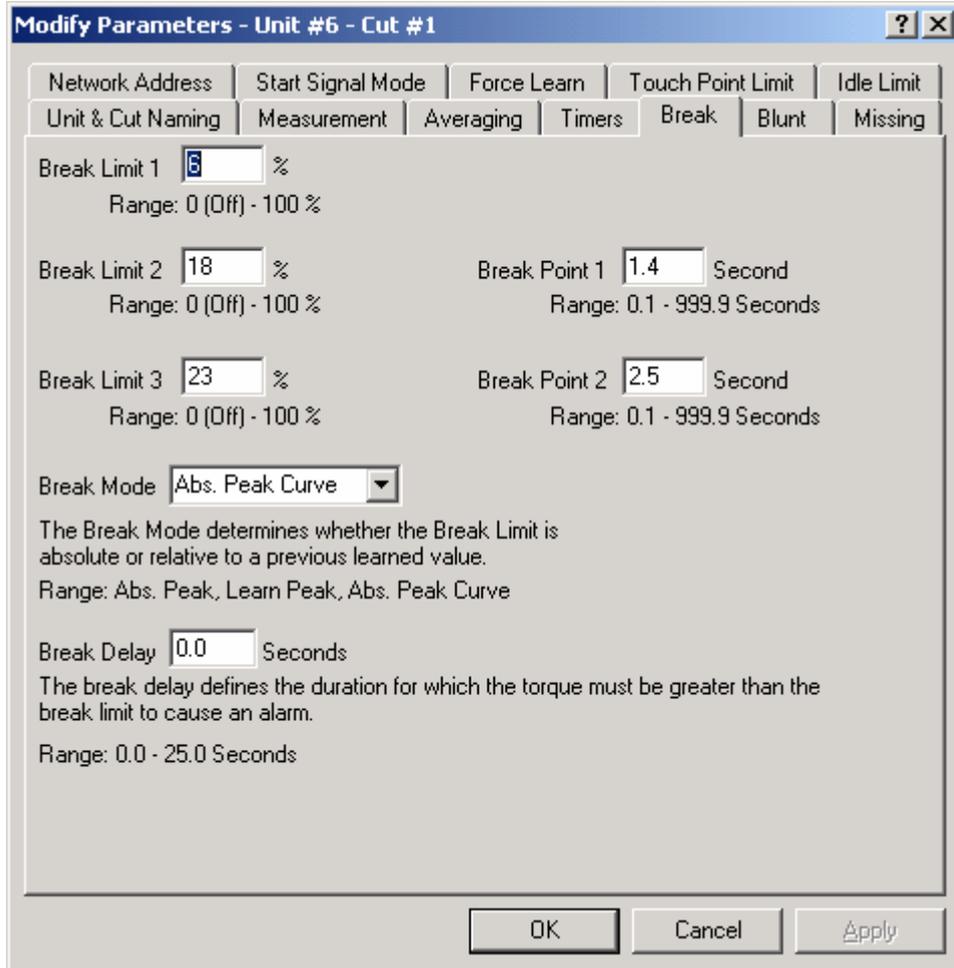
The break dialog is used to enter all parameters related to the tool break supervision. The Break Limit 2 and 3 as well as the two Break Points are only used when Abs. Peak Curve has been selected as preferred Break Mode. The Break Delay must normally be as fast as possible in order to catch break of small dimensioned tools.
The break limits and break points may also be changed from pushing arrows displayed on the unit window when Stop Mode has been activated.

4.11 Blunt

The blunt dialog box defines all the parameters related to the detection of tool bluntness.

4.12 Missing
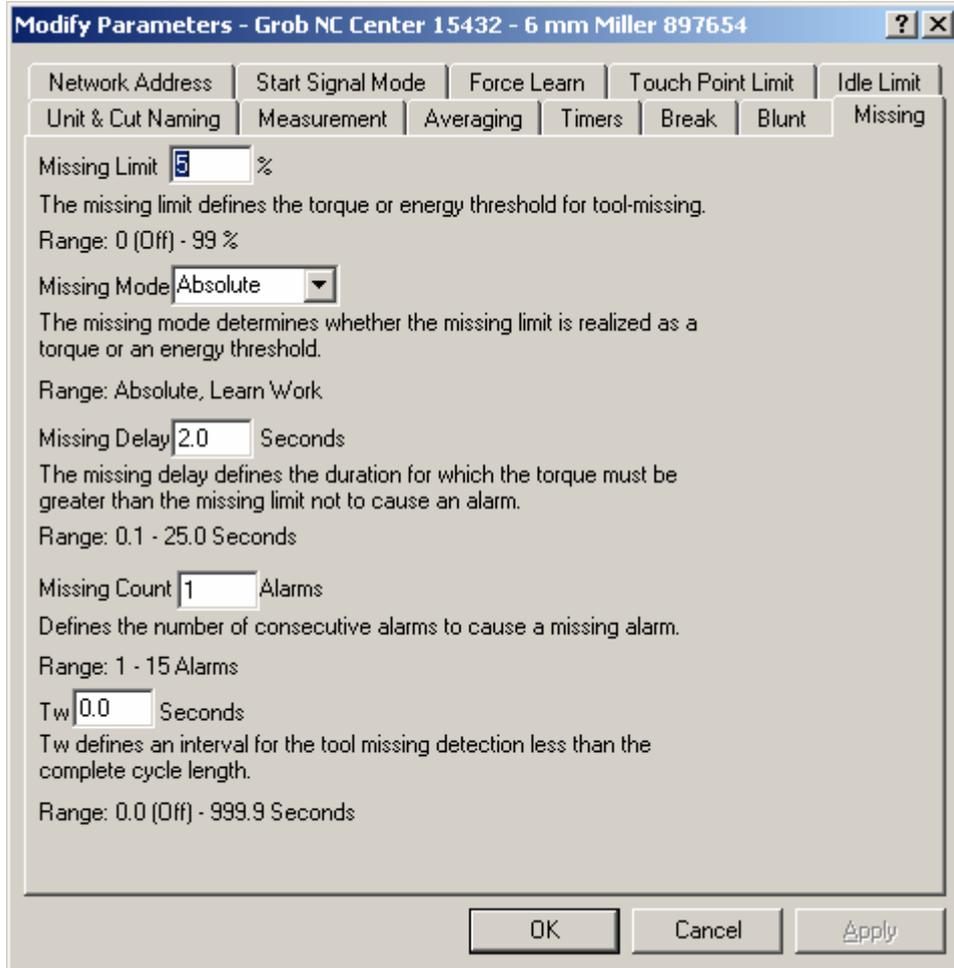
The missing dialog box defines all parameters related to the detection of a missing tool.

5.   Statistic Export to Spreadsheet Compatible File

When the Modify Parameters Unit & Cut Naming dialog box is display a button for exporting the statistic is shown also. Pushing this button displays a file dialog box, which makes it possible to change name and location of the file. The file type is .TXT. The file must be imported into a spreadsheet like Microsoft Excel© as a 'delimited text file'.
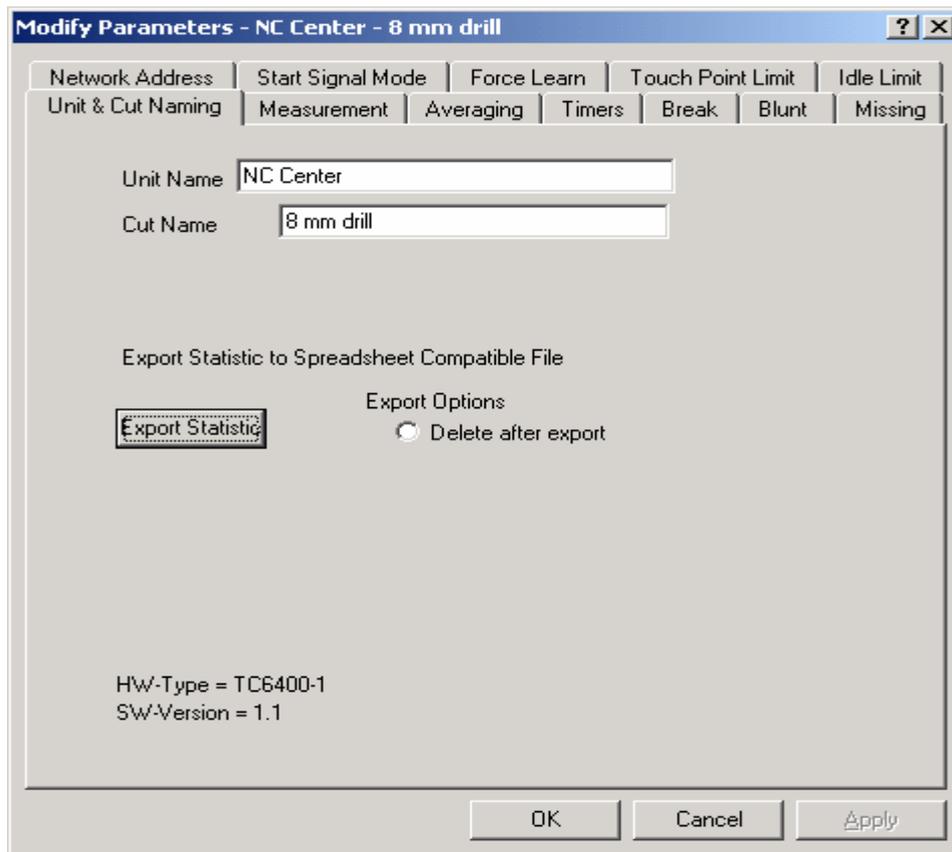
If deletion of the statistic after export is desired the 'Delete after export' option must be checked.

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5.1 Spreadsheed Export Format
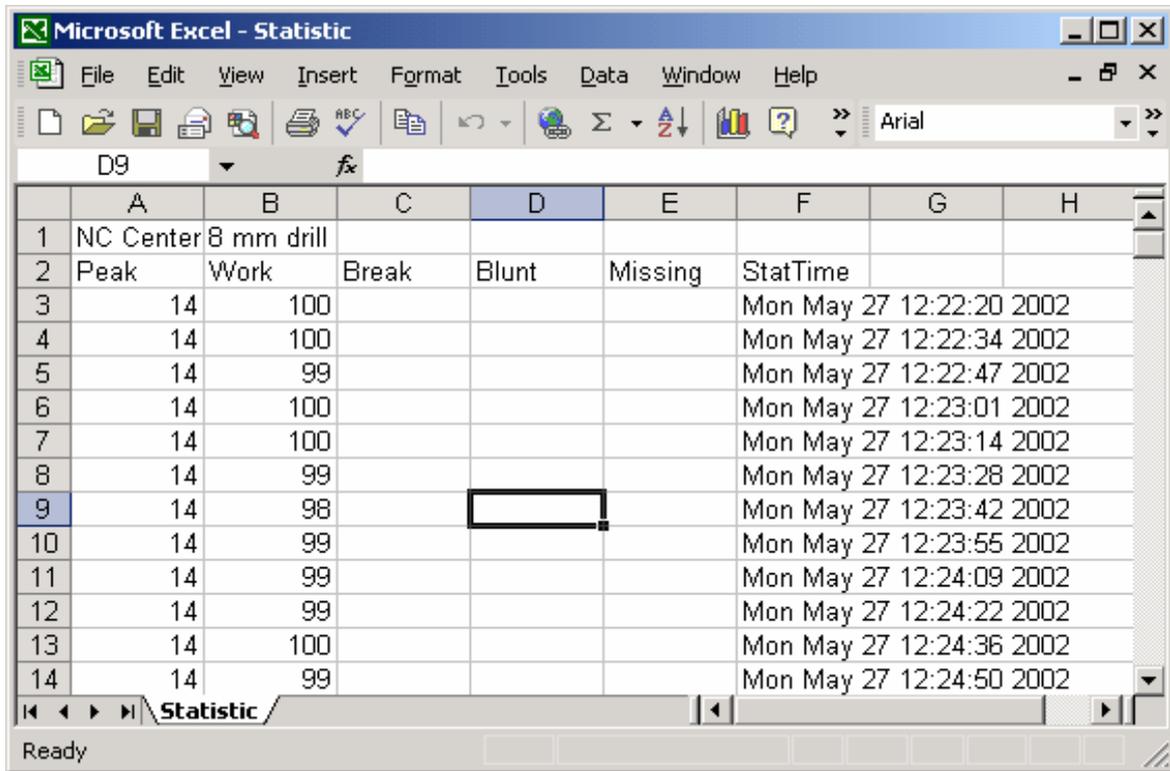
Cell ID

A1	Unit Name	
B1	Cut Name	
A2	Peak	; text Column identifier
B2	Work	; text Column identifier
C2	Break	; text Column identifier
D2	Blunt	; text Column identifier
E2	Missing	; text Column identifier
F2	StatTime	; text Column identifier

A3 - A60002	Peak Stat. Value	
B3 - B60002	Work Stat Value	
C3 - C60002	Break Alarm Info.	; a yes displayed indicate alarm present
C3 - D60002	Blunt Alarm Info.	; a yes displayed indicate alarm present
E3 - E60002	Missing Alarm Info.	; a yes displayed indicate alarm present
F3 - F60002	StatTime	; time recorded when item was added to the statistic.

The max. number of items recorded into the statistic 60000.

6. The Debug Window

The debug window is used by technicians to analyze the quality of the RS485 communication and to verify the function of the digital inputs.
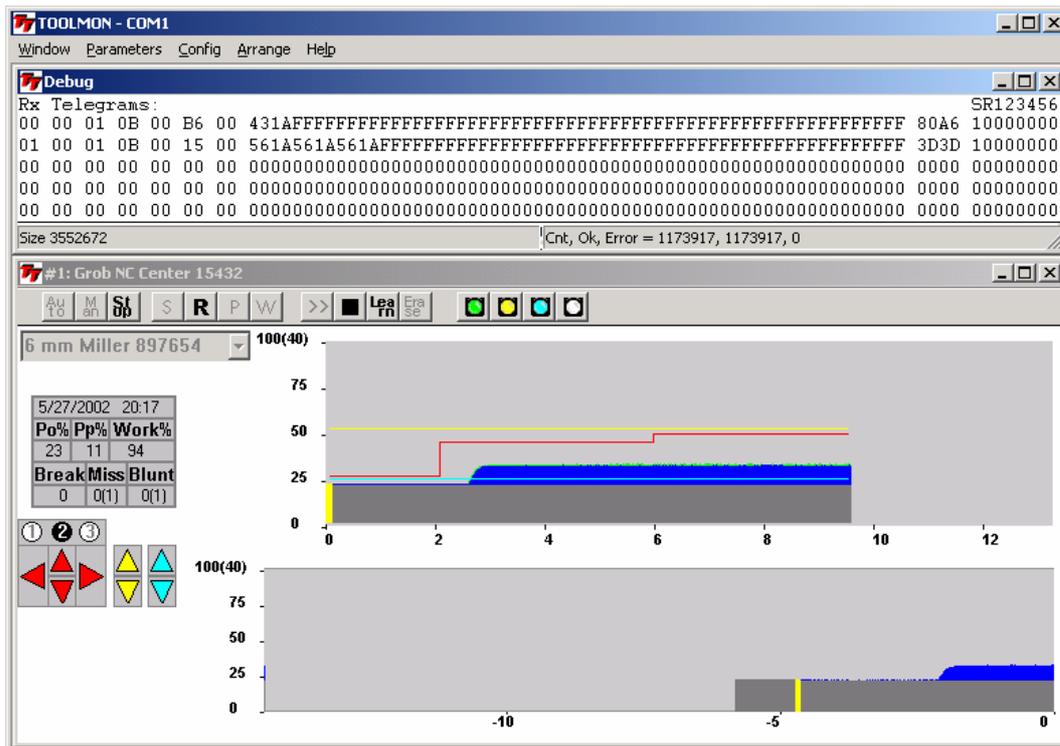
The debug window shows a line for each possible unit interfaced to TOOLMON. In the above example on two units (1 and 2) are connected the other lines are all zeroes. The information is displayed in ascii hexadecimal format. The first byte shows is the unit address (00 = unit #1).

6.1 Checking Wiring of Digital Inputs

The wiring of the digital inputs are displayed at the end of the line. Each input shows a '1' or a '0'. A '1' corresponds to +12—24 V connected and a '0' means 0V equal to input deactivated.

SR123456
S = Start Signal
R = Reset Signal (or External Learn)
1 = Cut Select 1 Signal
2 = Cut Select 2 Signal
3 = Cut Select 3 Signal
4 = Cut Select 4 Signal
5 = Cut Select 5 Signal
6 = Cut Select 6 Signal

6.1 Checking the Quality of the RS485 Communication Line

In order for TOOLMON to operate correctly a high quality RS485 communication line is required. A correctly wired and terminated RS485 communication line is normally quite immune to noise.

Analyzing communication quality from TC6400 to TOOLMON:
The number of telegram sent, telegrams received and the number of errors are displayed at the bottom of the debug window after the text 'cnt, ok, error'. The example on the previous page shows 1173917 telegrams sent and 1173917 telegrams received and zero telegram errors. Normally an error count of 0 - 100 telegrams out of 1000000 (1 million) is acceptable. Errors may also be caused by other applications running on the PC and thus using PC resources. The speed of the PC itself may also affect the error rate.

Analyzing communication quality from TOOLMON to TC6400:
A byte counter is shown in column #6 of the debug text. On the previous page Unit #1 displays hexadecimal value B6. If one more telegram is sent to the TC6400 this counter is increased by one. The byte counter in column #7 counts received telegrams with checksum error. The error count must be very low, hopefully zero. A classic example of an error source is the case were a port powered RS485—RS232C converter is used and a large number of TC6400's are connected. The port power is not enough to drive a large number of RS485 devices resulting in errors. When the converter is externally powered the problem is corrected. Both byte counters increments from FF to 00.