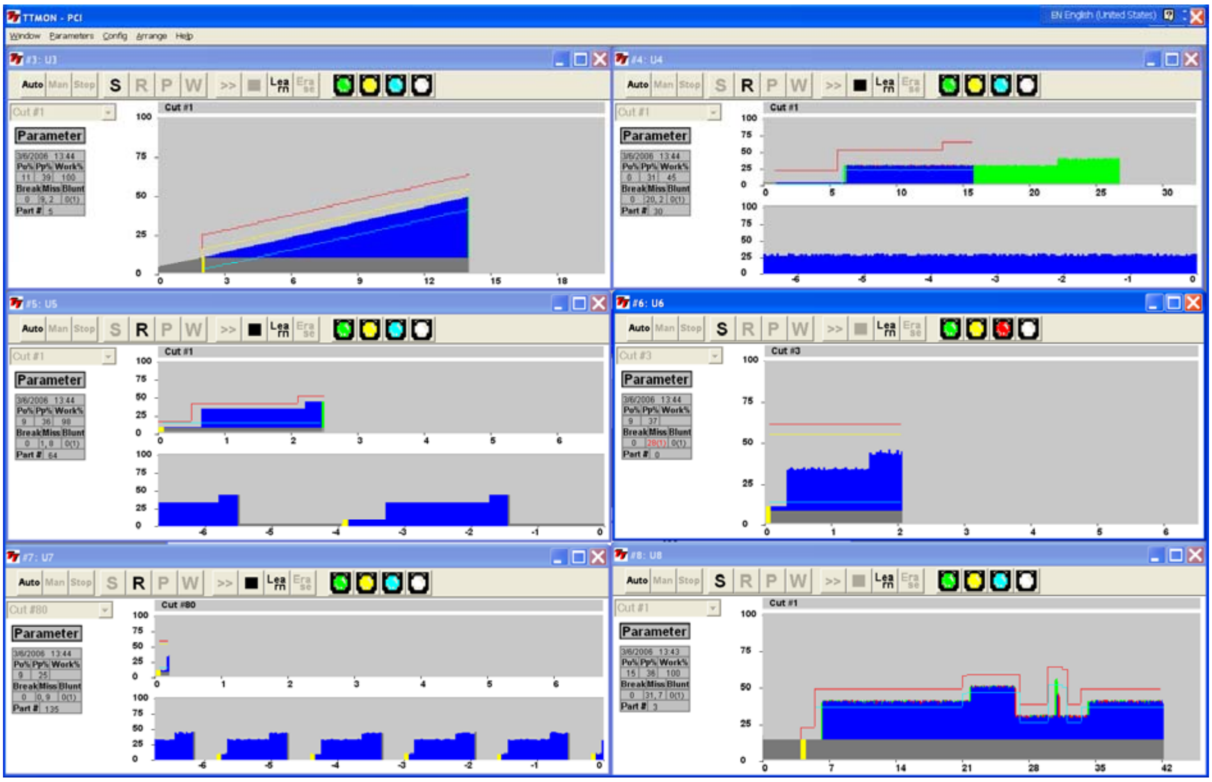
Techna-Tool Inc.
TECHNA-CHECK®



TTMON

User Manual

Released: May 2006

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1. The TTMON Concept

The ***TECHNA-CHECK®*** **TTMON** application is a Microsoft Windows application made for the single purpose of Machine Tool Monitoring.

TTMON implements a 1-20 channel Tool Monitoring System on a Windows XP/2000 based PC. **TTMON** works as a host application for a TPCI120 PCI-card. The PCI card interfaces the application to the real world of measurement transducers and digital I/O. Even a Profibus Communication Channel is available for the more complex machines.

Please consult the **TCPCI120 Hardware Manual** for information about the PCI board and Measurement Transducers.

The TTMON/PCI120 system has been exclusively developed for the **supervision of cutting tools on single spindle automatic machine tools. It is capable of detecting missing, blunt, and broken or damaged tooling.** TTMON measures, from external measurement transducer(s), either electrical power consumption or vibration of the spindle motor.

The Key Benefits of **TTMON** Tool Monitoring are:

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Improved part quality

The detection of missing or broken tools helps insure that the proper machining is being performed. Detection of tool wear and damage can help improve surface finish and tolerances.

Maximized tool life

By detecting for tool wear and damage, expensive tooling can be changed before the damage gets too severe. This detection also reduces dependence on hit or miss part counting schemes.

Protection of spindle and feed mechanism

By detecting catastrophic tool failures, the TECHNA-CHECK® **TTMON** can prevent serious damage to your head and feed mechanisms, not just at the station being monitored, but at downstream stations where "chain reaction" effects can occur.

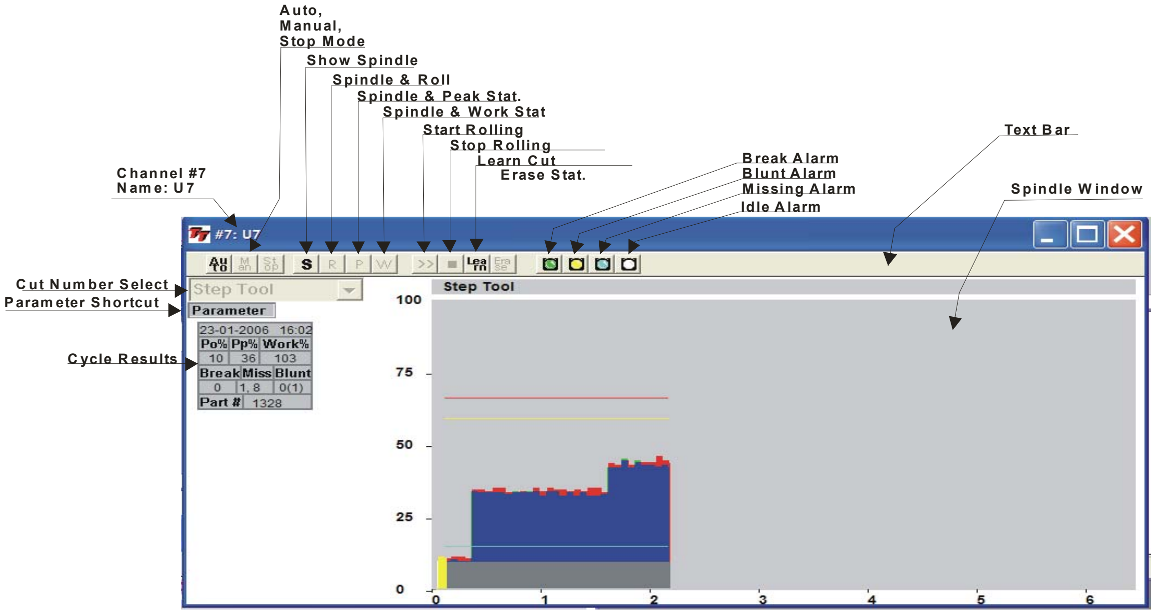
Improved up time

By creating the process improvements listed above, TECHNA-CHECK® **TTMON** keeps your machine running longer.

Easy installation

No mechanical modification of the machinery is necessary. The entire system mounts easily in your electrical cabinet.

1.1 TTMON Window Structure



TTMon opens a unique Window for each unit (spindle). The Window graphically shows the progress of the Machine Tool Monitoring and help to fine-tune the Monitoring Parameters.

1.1.1 Auto/Manual/Stop Mode

Auto/Manual.Stop Mode is selected from the buttons at the top of the screen.

In **Auto** Mode the windows tracks the work of the machine. When a Tool Shift occur the window shifts to show the new tool working.

In **Manual** Mode it is possible to display and select cuts not currently in progress.

Stop mode is a special mode implemented for easy (graphical) adjustment of limits.

1.1.2 Spindle, Roll and Statistic

Four buttons **S, R**, **P**, **W** are available for selecting various display modes.

The Spindle Mode (**S**) is used to show only active Measurement Cycles. It is only active when the start signal is applied.

In Roll Mode (**R**) the upper part of the screen shows the active cycle and the lower part of the screen show a 'Paper Roll Window' with all measurements including measurements done outside of the machining cycle.

In **P** mode the Spindle is shown in the upper window and the **Peak Statistic** is shown in the lower part of the screen.

In **W** mode the Spindle is shown in the upper window and the **Work Statistic** is shown in the lower part of the screen.

1.2 The Task Bar

The Task-Bar is an easy and convenient shortcut to the Spindle Windows. The Task-Bar may be placed at the Top, Bottom, Left or Right side of the screen. It may also be shut completely off. The Task bar includes a button for each unit (spindle).

When a button flashes red an alarm is present. When a button is activated the corresponding spindle window is opened or if already opened it is brought to the front of the screen.

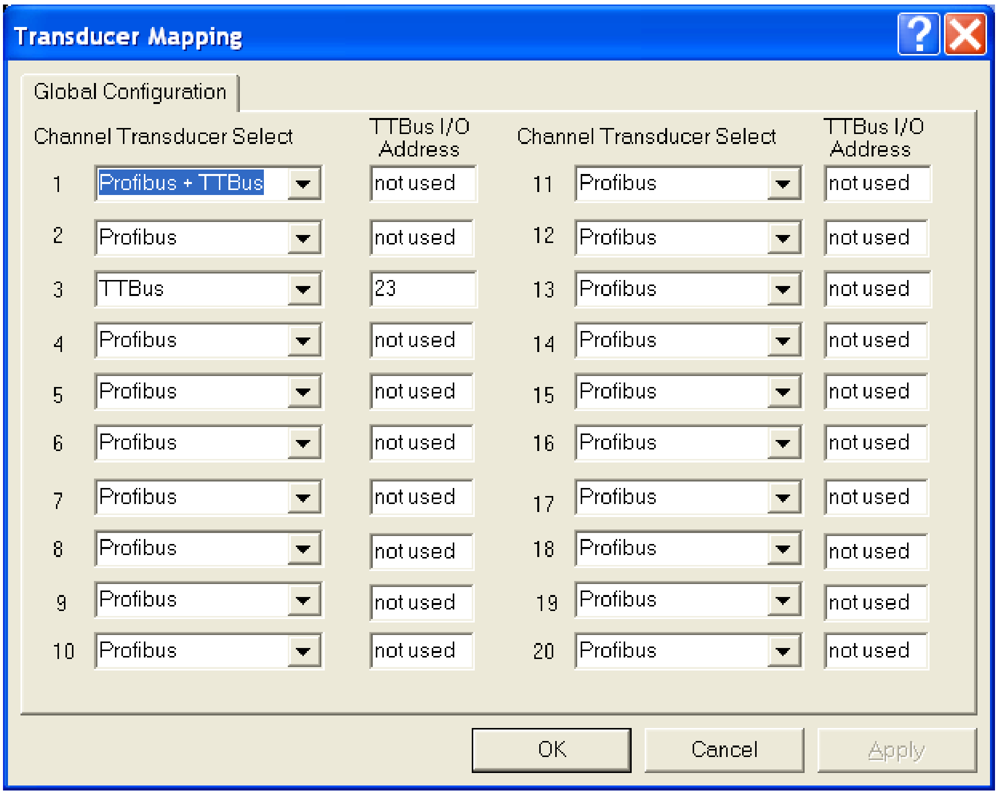
If the Task-Bar is not used the same functions are available from the Window Menu at the top.

1.3 The TTMON AboutBox

The AboutBox displays the current version of TTMON in this case 1.3.

1.4 The Transducer Mapping Dialog Box

The Transducer Mapping Dialog determines how measurement and Digital I/O is configured for each Channel (Spindle).



The **Channel Transducer Select** may be selected as **Profibus**, **Profibus + TTBus** or **TTBUS.**

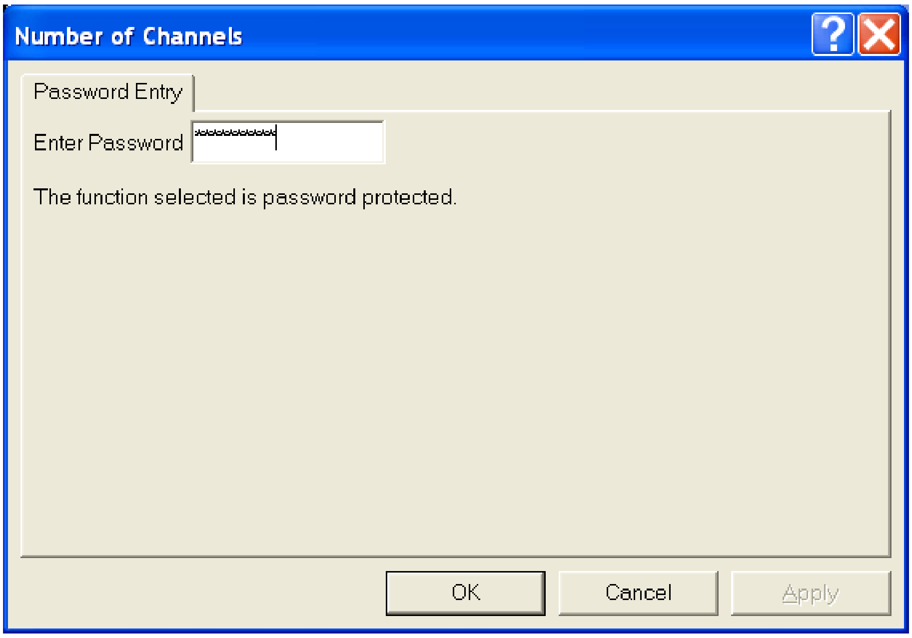
When **Profibus** is selected both Digital I/O and Measurement is supplied from the **Profibus** (Profibus is an Industrial Communication Bus Standard used by numerous machines).

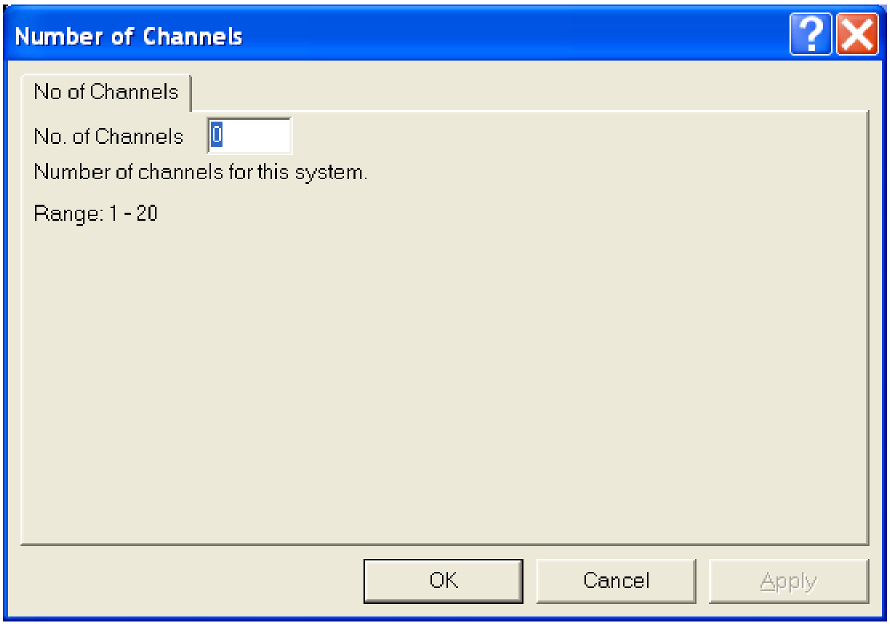
When **Profibus + TTBus** is selected Digital I/O is supplied from **Profibus** and Measurement is supplied from the proprietary **TTBus**. (TTbus is a Techna Check bus for interfacing transducers to the TPCI120 board). The **TTBus-address** of the measurement transducer is selected from the Parameters->Measurement menu.

When **TTBus** is selected both Measurement and Digital I/O must be supplied from **TTBus** transducers. The TTBus-address for the Digital I/O transducer must be entered in the I/O Address field. The **TTBus-address** of the measurement transducer is selected from the Parameters-> Measurement menu.

1.5 The Number-of-Channels Dialog Box

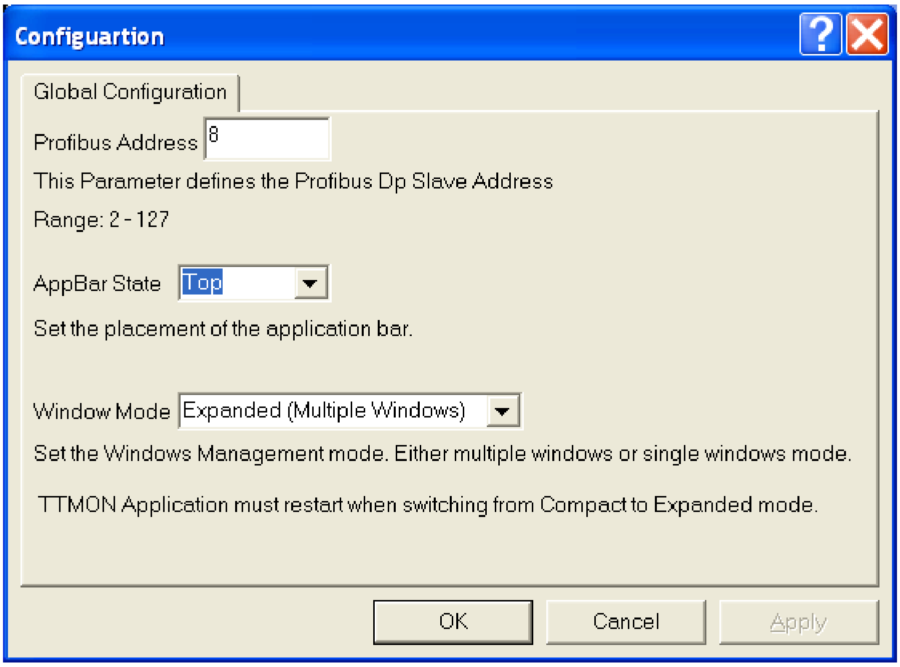
The number of channels is programmed from this dialog box. This function is available for Techna Tool Inc. only and is therefore Password Protected. The number of active channels is saved in Non-Volatile Storage on the TPCI-Board.





1.6 The Configuration Dialog Box

The Configuration dialog box set various parameters common to all channels (spindles).



Profibus Address

The Profibus slave address must be programmed here.

AppBar State

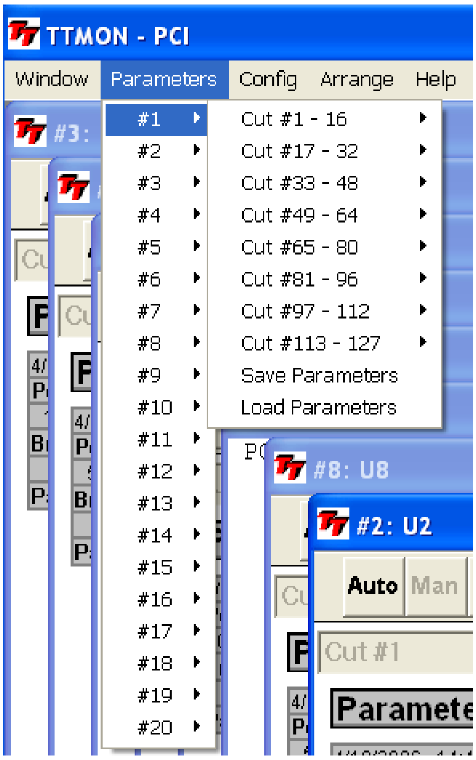
The placement of the Application Task-Bar must be programmed here.

Windows Mode

For small screen resolution systems it may be useful only to have one window open and maximized at a time. This function may be activated here.

1.7 Load/Save Parameters

It is possible to load/restore all parameters for a single channel to and from the hard disk.

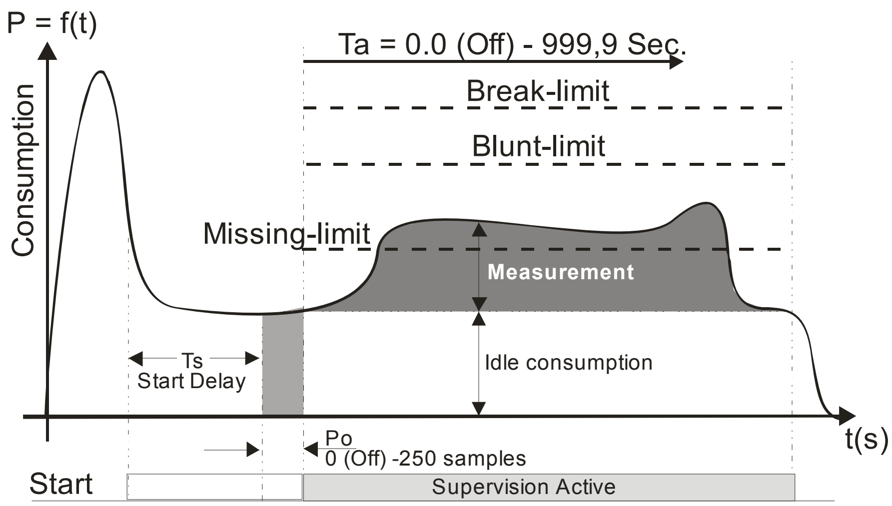


This function brings up a standard file dialog for naming and placement of the file.

2. Function

2.1 General

The figure below shows a typical measurement cycle on a machine spindle during a machining cycle. The first measurement peak, which is caused by a change in motor speed or a motor start, is not monitored at all. Only the portion of the cut where the spindle speed is constant and the tool is actually in cut is monitored by the unit. When the machine head begins to move towards the part, a **"Start" Signal** is generated by the machine which tells the TECHNA-CHECK® **TTMON** that a new cycle is beginning. When the unit receives the start signal, the user-defined **Start Delay, Ts**, is activated.



When the start delay ends, the unit initiates the idle measurement. It is very important to measure the idle **before** the tool begins cutting the part. The **idle measurement**, **Po**, is the portion of work done by the machine not going into the cut. Idle measurement will vary normally during the course of the day due to such factors as friction, temperature, oil and grease viscosity, etc. The idle measurement is calculated as an average of a certain programmable number (**Po Averaging)** of measurements.

After the idle measurement has completed, the tool monitoring becomes active. The duration of monitoring may be limited through the use of the monitoring timers, **Ta and Tw** , in order to avoid monitoring undesired events, such as motor speed changes. In many cases, these timers may be turned off, allowing monitoring for as long as the start signal is present. The TECHNA-CHECK® TTBus transducers includes a user programmable **Measurement Averaging** feature, which sets the number of individual measurements which are averaged into one calculated value (again, the number of measurements are related to the actual transducer type). This averaging can be used to "smooth" very noisy electrical signals, but it should be set as low as possible in order not to filter out very short duration measurement surges caused by tooling problems. The TECHNA-CHECK® TTMON includes a unique **Analog Zoom Function**, which greatly improves the monitoring of small tools. Refer to the section on "Analog Zoom Function" for details.

The TECHNA-CHECK **TTMON** is capable of monitoring 127 completely different cutting operations on each of the max. 20 channels available. This feature is useful when making multiple machining passes with the same machine head, or when making several different parts on the same machine. Prior to the Start Signal being received, the machine signals the cut# select, which cause the appropriate parameters to be used in monitoring the subsequent machine operation.

2.2 Learn Signal

For each type of monitoring (Missing, Break, and Blunt), there are one or more “Learn” modes available. The Learn modes allow the monitoring to take into account variations in tool grind from one tool to the next. In most applications, when using Learn modes, a Learn cycle should be initiated whenever the tool is changed. A Learn cycle may be initiated in three ways, as described below. It should be noted that during a Learn cycle, only Idle Power monitoring is taking place.

2.2.1 Learn Cycle Initiation -- Machine Controlled

A Learn cycle may be initiated by the machine controller. If the Start signal is made active while the Reset signal is being held active, the cycle will be a Learn cycle. If an Idle Power fault would occur during the Learn cycle, the reset signal must be taken low, then brought back high again to reset the fault. The Profibus interface also implements a function for initiating a Learn Cycle.

2.2.2 Learn Cycle Initiation -- TTMON

A Learn cycle may be initiated from the TTMON software package by pressing the appropriate function key (the Learn Button at the top of the Window)..

2.3 Fault Signals and Resetting of Faults

All faults generated by the TTMON are signaled to the machine controller by normally closed dry contact relays (refer to the section on "Electrical Connection") or via the Profibus interface. The Tool Break and Tool Missing faults share a common relay. It is typical that the machine will be programmed to stop its present cycle immediately and retract the machine head on detection of a Tool Missing or Tool Break condition. The Blunt Tool fault is signaled by a second relay. It is typical that the machine will be programmed to finish the current cycle before stopping the machine on a Blunt Tool fault.

All faults may be reset by using the RESET button located on the front panel of the unit, or through the use of the external Reset input (refer to the section on "Electrical Connection"). The fault relays will remain in their active (open) condition until a reset is received.

Profibus implements a separate bit for signaling the various types of alarms.

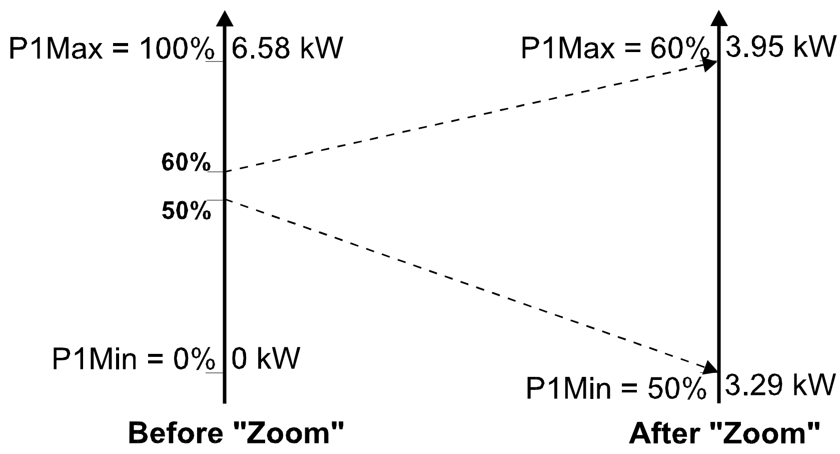
2.4 The Analog Zoom Function

Prior to setting the monitoring parameters, it is desirable to set up the **Analog Zoom Function** parameters. The Analog Zoom Function enables **TTMON** to monitor even very small tools by "focusing" the unit's full analog to digital conversion resolution into a narrow band of measurement. Note that the Analog Zoom Function should be set up prior to setting monitoring parameters, as the monitoring parameters will be "re-scaled" if changes are made to the Analog Zoom.

The transducer **measurement range** must first be set. Once the measurement range has been set, then any large idle powers may be subtracted from the display by adjusting P1Min so that the idle is only 5% to 10% of the full load. P1Max may then be adjusted so that the cutting torque is a rise of 10% to 20% above idle.

The figure below shows a hypothetical application to highlight the power of the Analog Zoom Function. In this application, a 380 VAC, three phase motor is being monitored. If the Current Range is set to 10 A, then 100% power is equivalent to 6.58 kW. If a small tool with a high spindle speed is being used, it is entirely possible that the idle power may be as high as 50% of the scale, while the cutting torque may only rise 2% or 3%. In order to maximize the ability to monitor this application, P1Min is "zoomed" to 50%, while P1Max is "zoomed" to 60%. The entire resolution of the unit is now concentrated in a 10% band. The unit is now only monitoring between 3.29 kW and 3.95 kW. The cutting torque will appear to be 10 times bigger.

Analog Zoom Function

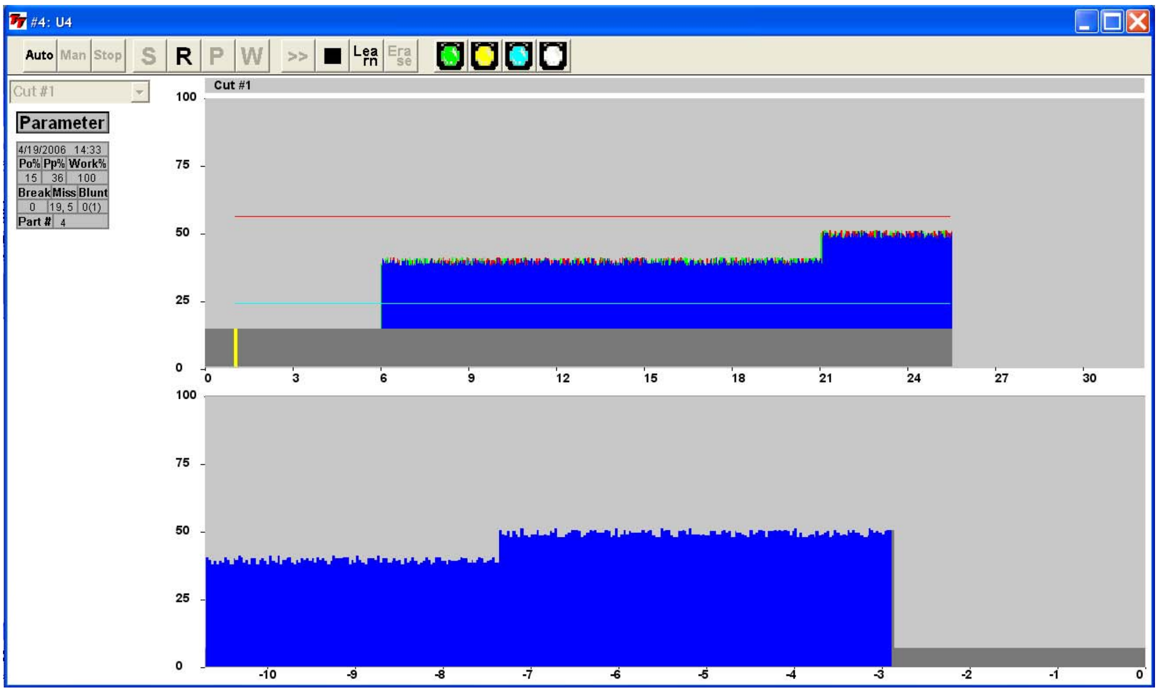


3. Missing Tool Supervision

3.1 Missing Tool -- Absolute Mode

The figure below shows how the missing tool detection, in Absolute Mode, is set up relative to a typical machining cycle. The **Missing Mode** parameter defines the type of **Missing Tool Limit** which will be set. In the **Absolute mode**, the Missing Tool Limit is a user-defined absolute measurement rise above idle. The measurement during the machining cycle must remain above the limit for a cumulative time longer than the **Missing Delay**, **Trm**. (Note that the cumulative nature of this measurement means that brief power dips below the Missing Limit will not cause a fault as long as the TOTAL amount of time spent above the Missing Limit is greater than the Missing Delay.) In the event of a missing tool fault, a red 1 will appear in the text-table window and the Missing LED Indicator will flash red. Missing Tool supervision remains active for the duration of **Tw**, if **Tw** is enabled. If **Tw** is turned off, Missing Tool supervision remains active the entire time the start signal is present, following the **Start Delay** and the idle power measurement.

Tool Missing Absolute Mode

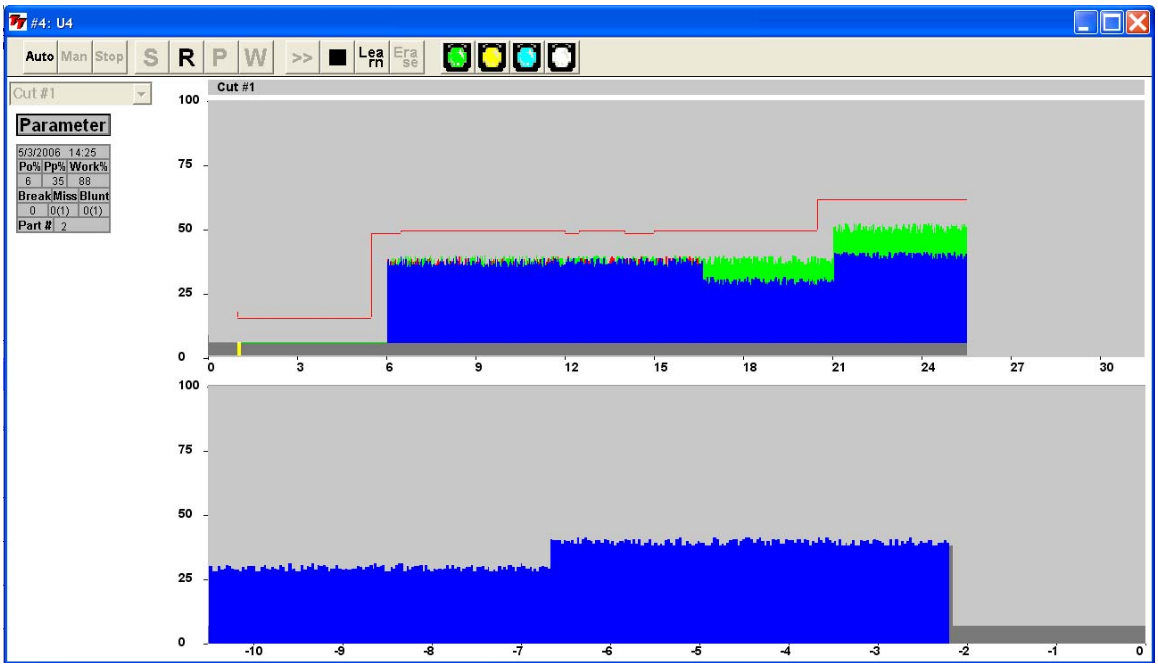


The Missing Limit is shown as the blue colored line in the graphics above. The Time-Over-Missing is calculated for each cycle and when no Missing Alarm is present it is displayed. The Time-Over-Missing is shown in the text-table instead of the alarm information. The Missing Delay may be set as close to the Time-Over-Missing value as possible without generating nuisance trips. If a Tool-Break is not detected for some reason it is important to catch a Tool-Missing in the same or at least the following cycle.

3.2 Missing Tool -- Learn Work Mode

The figure below shows how the missing tool detection, in Learn Work mode, is set up relative to a typical machining cycle. In the **Learn Work mode**, the Missing Tool Limit is a user-defined relative percentage of the work calculated during the Learn cycle. If the work calculated during a cycle does not exceed this percentage of the learned work, then a Missing alarm is generated. In the event of a missing tool fault, a red 1 will appear in the missing window and the particular station number will flash red. Missing Tool supervision remains active for the duration of **Tw**, if **Tw** is enabled. If **Tw** is turned off, Missing Tool supervision remains active the entire time the start signal is present, following the **Start Delay** and the idle power measurement.

Tool Missing Learn Work Mode



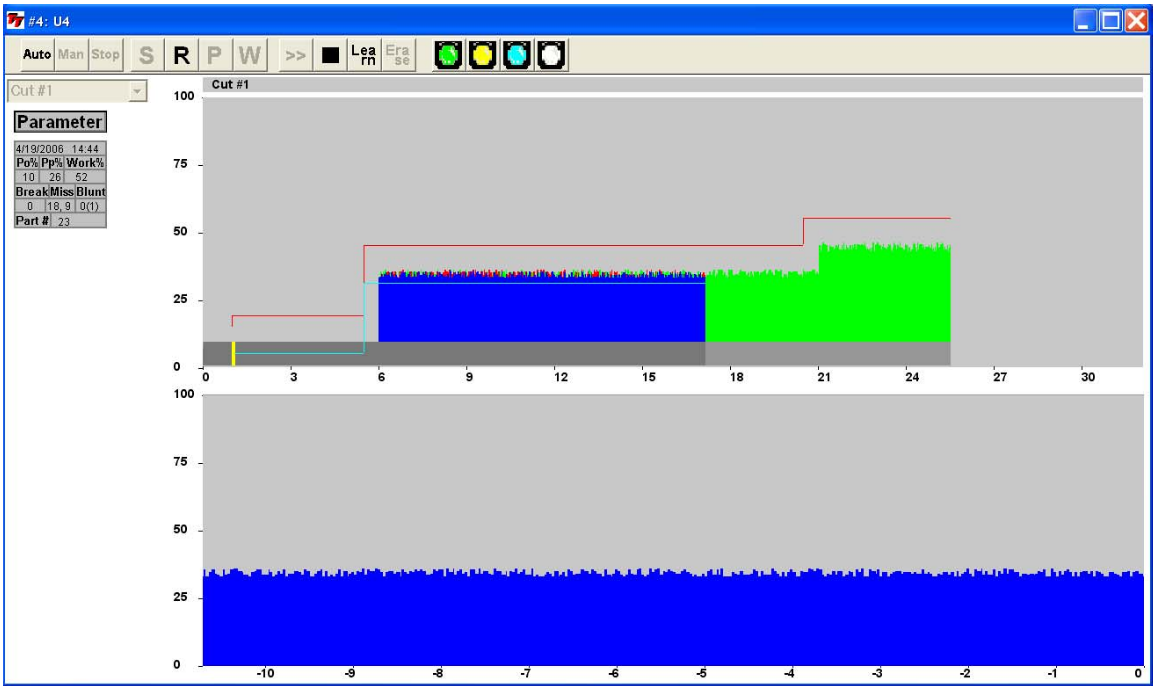
Setting these parameters too aggressively can result in more frequent nuisance trips. A good compromise and starting point for adjustment seems to be to set the Missing Limit fairly low, around 30 - 50 % (since if the tool is missing, there will be NO rise above idle).

In the figure above the green color represents the learned area and the blue represents the measurement in the current cycle. In the above example the blue area represents 88% of the learned (green) area. When the measurement is higher than the learned value it is shown as red. The more red the more blunt the tool should be.

3.3 Missing Tool -- Auto Learn Step Curve

The figure below shows the Auto Learn Step Curve missing mode, which is a new mode not available in previous ***TECHNA-CHECK***® versions. In this mode the Missing Limit is calculated as a step-curve from the original learned curve. The Missing Limit is a percentage decrease from this learned curve. This makes the missing limit follow the curve and may result in better monitoring for missing detection of step-tools. Even multiple spindle heads may be monitored successfully for single missing tools with this monitoring mode, especially if the Time-Over-Missing is placed as close to the normal value as possible. The Step-Width is programmable and a new learn cycle is not necessary when the Step-Width is modified. If synchronization problem exists between the learned and the monitor cycle the Step-Width should be increased in order to avoid false alarms.

Tool Missing Auto Learn Step Curve



The missing limit is drawn as the cycle proceeds and is shown in blue color.

4. *Tool Break Supervision*

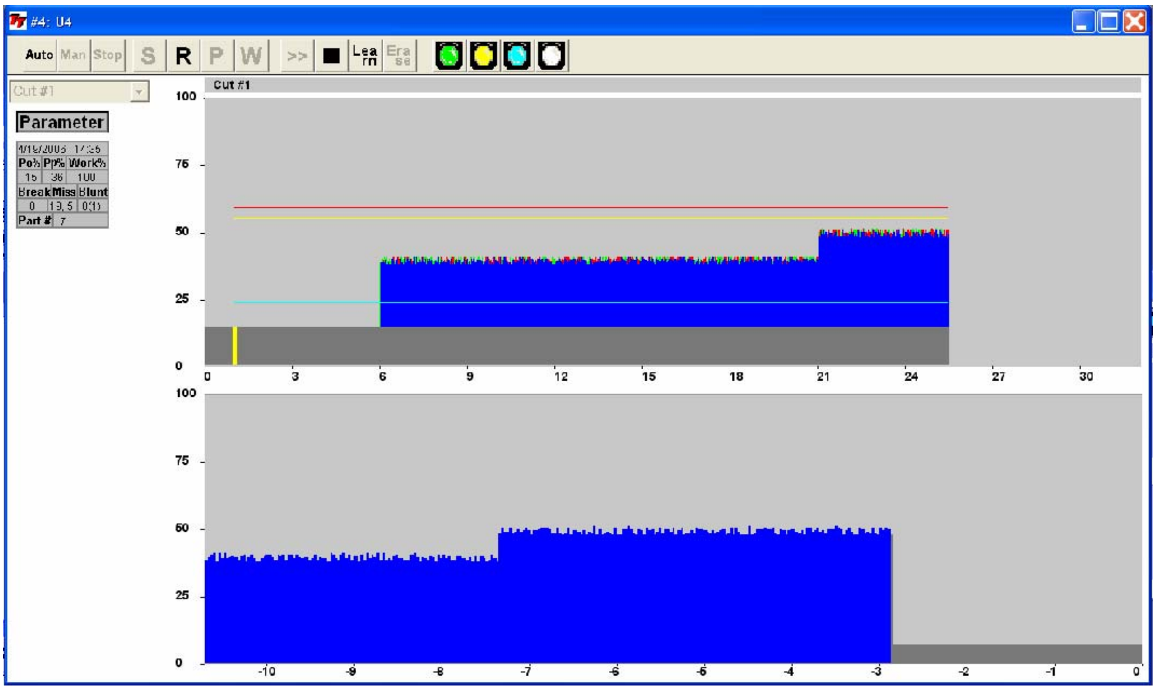
4.1 Break Mode Selection

When a tool breaks while it is machining a part, it is typical to notice a sharp, short duration "spike" of torque in the motor. This torque spike is the extra energy being used by the machine to actually break the tool. The TECHNA-CHECK® **TTMON** can detect this spike, and indicate a broken tool. (It should be noted that not all tools break the same way every time, and that a torque spike may not necessarily be generated in the process of breaking the tool. In this case, a missing tool condition should be noticed on the following cycle.)
There are four **Break Modes** available, which are described below.

4.2 Tool Break -- Absolute Peak Mode

The figure below shows a typical tool break situation, including the setting of the tool **Break Limit**. The Break Limit is a user-defined percentage increase above the Idle Power. If the Break Limit is exceeded for a cumulative time greater than the user-defined **Break Delay**, **Trb**, then a tool break fault will be generated. In the event of a broken tool fault, a red 1 will appear in the broken window and the particular station number will flash red. Tool Break supervision remains active for the duration of **Ta**, if **Ta** is enabled. If **Tw** is turned off, Tool Break supervision remains active the entire time the start signal is present, following the **Start Delay** and the idle power measurement.

Absolute Peak Break Mode

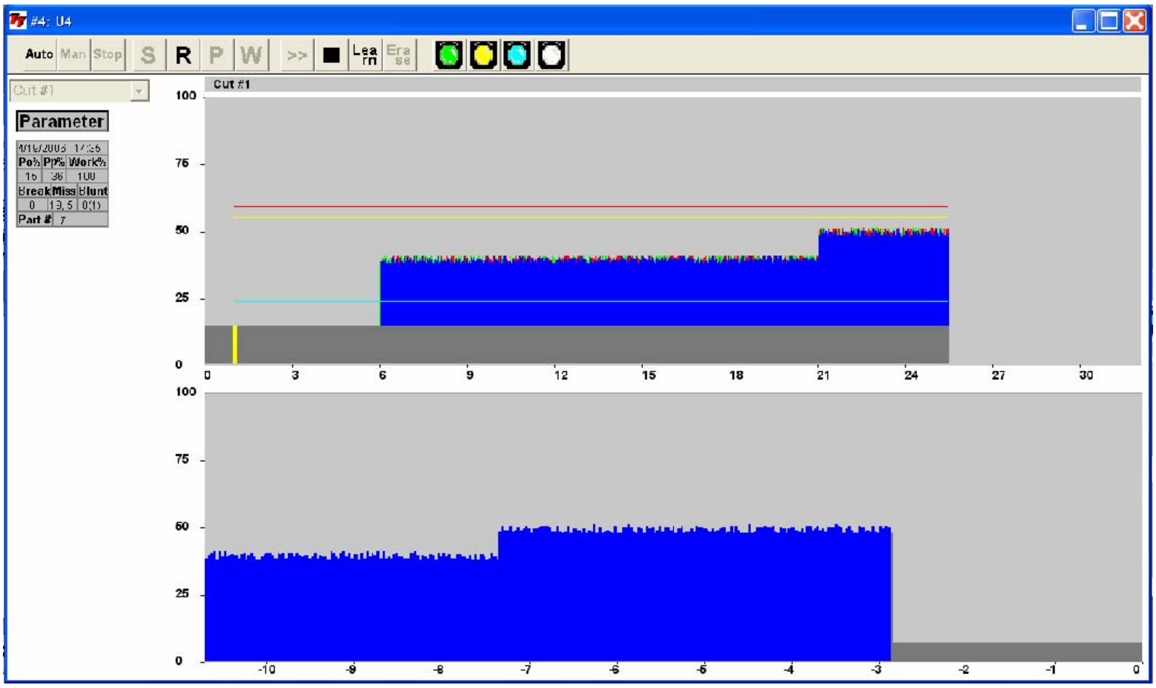


The Tool-Break Limit is shown in red color. No learn cycle is needed for this mode of Tool-Break monitoring.

4.3 Tool Break -- Learn Peak Mode

The figure below shows a typical tool break situation, including the setting of the tool **Break Limit** in Learn Mode. The Break Limit in Learn Mode is a user-defined percentile increase of the power consumption above the Idle Power PLUS the Learned peak power. If the Break Limit is exceeded for a cumulative time greater than the user-defined **Break Delay, Trb**, then a tool break fault will be generated. In the event of a missing tool fault, a red 1 will appear in the missing window and the particular station number will flash red. Tool Break supervision remains active for the duration of **Ta**, if **Ta** is enabled. If **Ta** is turned off, Tool Break supervision remains active the entire time the start signal is present, following the **Start Delay** and the idle power measurement.

Learn Peak Break Mode



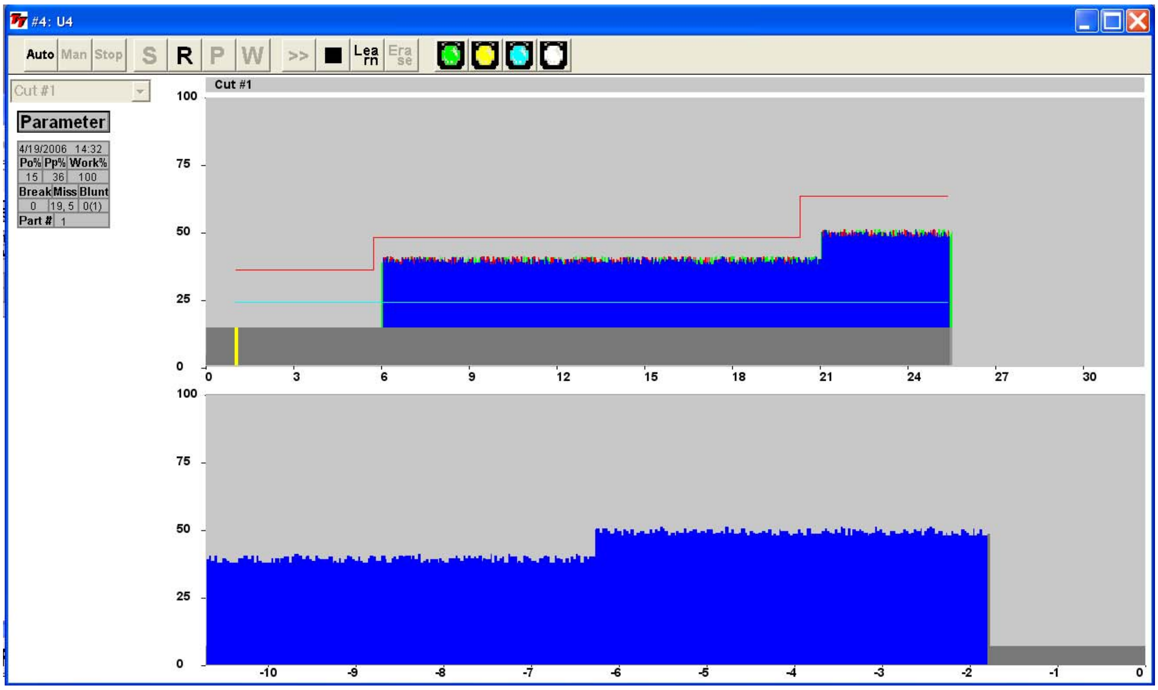
The Tool-Break Limit is shown in red color. A learn cycle is needed for this mode of Tool-Break monitoring.

Setting the Break Limit and Break Delay in Learn Mode is much the same as in the Absolute Peak Mode, except that the Break Limit in Learn Mode will “move” with respect to the learned cut. This adaptation allows the unit to adjust to changes in grind from one tool to the next, when the profile is re-learned.

4.4 Tool Break -- Absolute Peak Curve Mode

The Absolute Peak Curve mode works just like Absolute Peak Mode (sec. 3.6.2), but the limit changes in a **step** fashion as a function of time. This mode may well be used to supervise step tools. If the Break Limit is exceeded for a cumulative time greater than the user-defined **Break Delay, Trb**, then a tool break fault will be generated. Tool Break supervision remains active for the entire time, following the Start Delay and idle power measurement, that the Start Signal is present on the unit if monitoring timer Ta is turned off, or for the duration of Ta if it is enabled. Three steps are available and if a step limit is set to zero it is not monitored at all

Absolute Peak Curve Mode



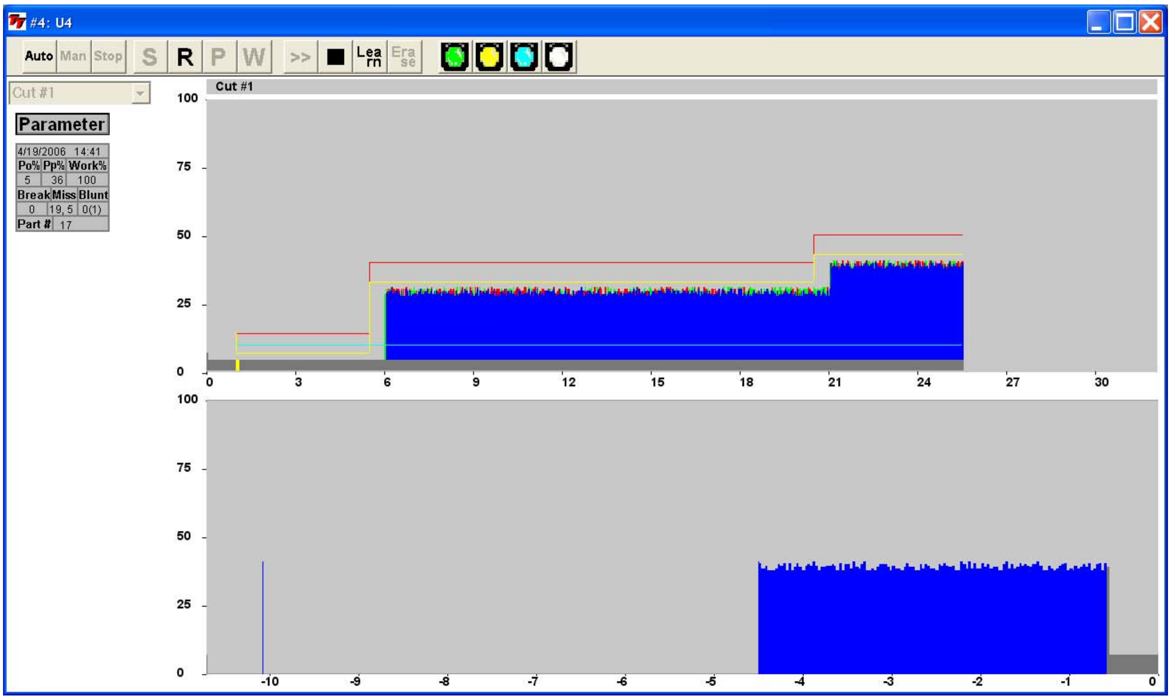
The Tool-Break Limit is shown in red color. No learn cycle is needed for this mode of Tool-Break monitoring.

If a step is set to zero it is not monitored at all. This feature may be used in monitoring tapping operations. The second step of the curve is the set to zero and used to switch-off the monitoring when the spindle changes direction. The first step is then used to monitor the forward (tapping) operation and step three is then used to monitor the reversal (tap getting out).

4.5 Tool Break -- Auto Learn Step Curve Mode

The figure below shows the Auto Learn Step Curve break mode, which is a new mode not available in previous ***TECHNA-CHECK***® versions. In this mode the Break Limit is calculated as a step-curve from the original learned curve. The Break Limit is a percentage increase from this learned curve. This makes the break limit follow the curve and may result in better monitoring for break detection of step-tools. Even multiple spindle heads may be monitored successfully for single breaking tools with this monitoring mode. The Step-Width is programmable and a new learn cycle is not necessary when the Step-Width is modified. If synchronization problem exists between the learned and the monitor cycle the Step-Width should be increased in order to avoid false alarms.

Absolute Peak Curve Mode



The Tool-Break Limit is shown in red color. A learn cycle is needed for this mode of Tool-Break monitoring.

5.0 Blunt Tool Supervision

5.1 Blunt Mode Selection

As a tool wears, it is normal for its cutting surfaces to become less efficient, and thus it requires more torque to cut the part. The TECHNA-CHECK® **TTMON** is designed to look for this rise in torque, and to stop the machine when a tool has reached a point where it would be desirable to change it.

There are four **Blunt Modes** available. If **Absolute Peak Mode** is selected, the detection of blunt tools is based on the value of the instantaneous torque measurement above idle. In **Work Mode**, the detection of blunt tools is based on the area under the torque curve for the duration of the cutting cycle, which is proportional to the work or energy used to cut the part. Peak Mode is recommended for most simple machining operations. Work Mode may be used when there are multiple or changing load levels observed during the cycle, such as when a step tool or complicated boring tool is used. Additionally, there are two Blunt Modes representing **Learn** versions of the two modes already described. They allow the system to automatically adjust to changes in grind from one tool to the next.

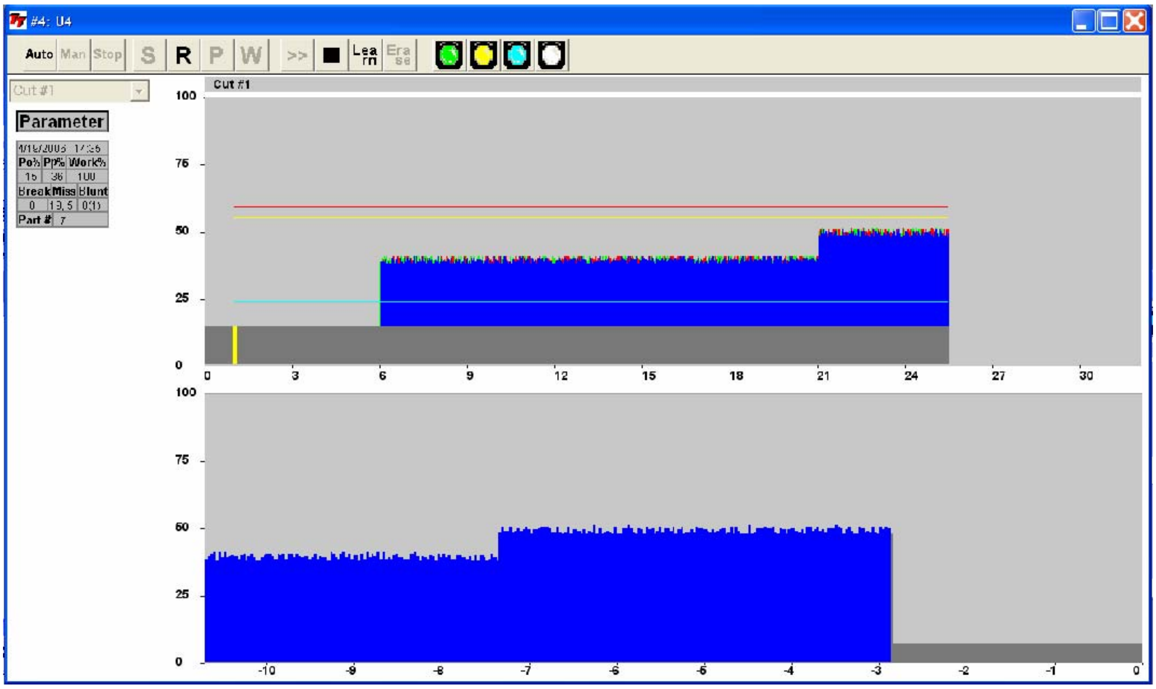
In any blunt mode, the use of the **Show Statistics** option from the **TTMON** application is helpful in setting appropriate values for the **Blunt Limit**. **TTMON** is continually keeping track of the peak torque or work used in each cycle. This data may be viewed in the Show Statistics display. This display will give you an idea, over time, of how the tool has worn, and where an appropriate Blunt Limit may be set.

Also in any blunt mode, the **Blunt Counter** feature is available. In order to reduce the number of undesired nuisance trips, the Blunt Counter may be set to require a number of consecutive blunt tool faults to be detected before the machine is signaled to stop. For example, a hard part or temporary chip build up may cause a blunt fault to occur in one cycle, but the condition may not be present again in the next cycle. In this case, a Blunt Counter setting of, for example, three would require this condition to occur three cycles in a row before a blunt trip stops the machine. In typical applications, a Blunt Counter setting from 2 to 5 is generally used, depending on material consistency and chip build-up, but higher settings may be used.

5.2 Blunt Tool – Absolute Peak Mode

The figure below shows a typical blunt tool situation using **Absolute Peak Mode** monitoring. In this mode the Blunt Limit represents a user-defined percentage increase above the Idle Power. If the Blunt Limit is exceeded for a cumulative time greater than the user-defined **Blunt Delay, Trs**, then a tool blunt fault will be generated. In the event of a blunt tool fault, a red number will appear in the blunt window and the particular station number will flash red. Blunt Tool supervision remains active for the duration of **Tba**, if **Tba** is enabled. If **Tba** is turned off, Blunt Tool supervision remains active the entire time the start signal is present, following the **Start Delay** and the idle power measurement.

Absolute Peak Blunt Mode

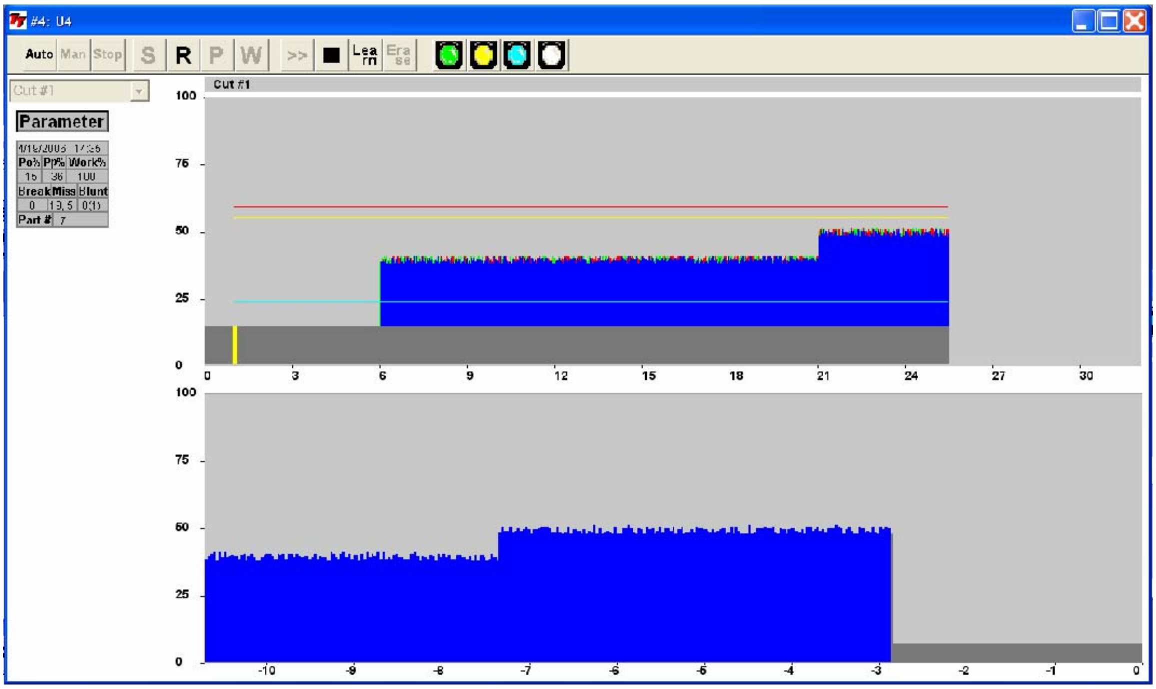


The Tool-Blunt Limit is shown in yellow color. No learn cycle is needed for this mode of Tool-Blunt monitoring.

5.3 Blunt Tool - Learn Peak Mode

The figure below shows a typical blunt tool situation using **Learn Peak Mode** monitoring, including the setting of the tool Blunt Limit. The Blunt Limit is a user defined percentile increase above the Idle Power PLUS the Learned Peak. If the Blunt Limit is exceeded for a cumulative time greater than the user-defined **Blunt Delay, Trs**, then a tool blunt fault will be generated. In the event of a blunt tool fault, a red number will appear in the blunt window and the particular station number will flash red. Blunt Tool supervision remains active for the duration of **Tba**, if **Tba** is enabled. If **Tba** is turned off, Blunt Tool supervision remains active the entire time the start signal is present, following the **Start Delay** and the idle power measurement.

Learn Peak Blunt Mode

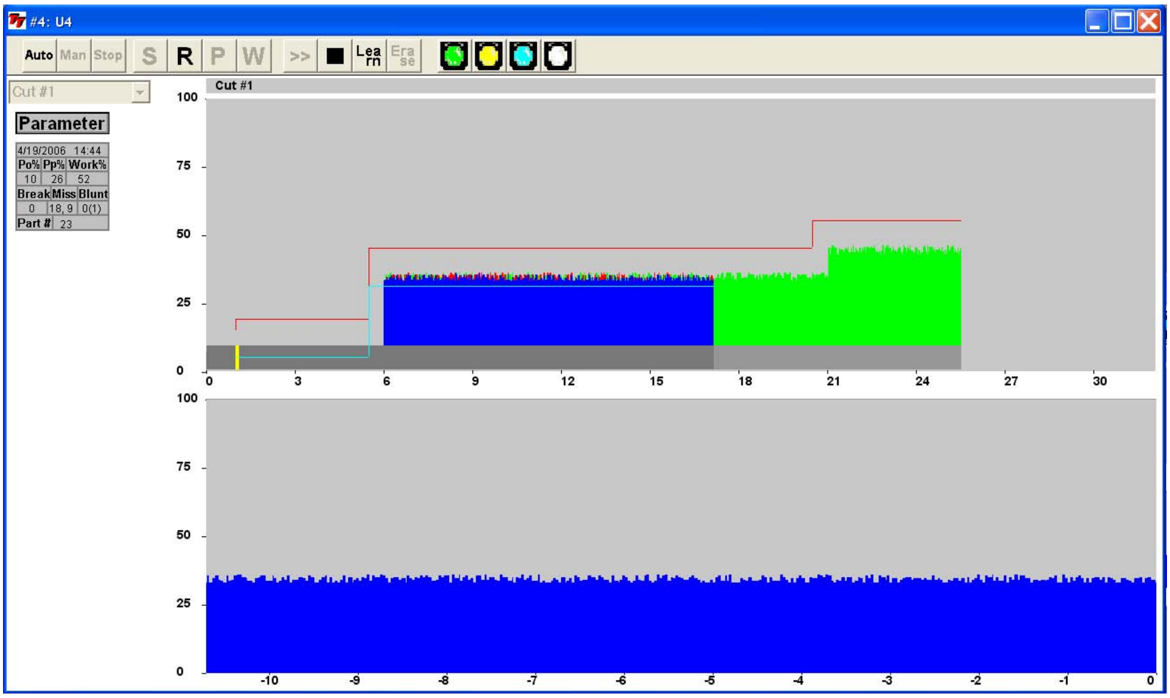


The Tool-Blunt Limit is shown in yellow color. A learn cycle is needed for this mode of Tool-Blunt monitoring.

5.4 Blunt Tool - Learn Work Mode

The figure below shows a typical blunt tool situation using **Learn Work Mode** monitoring, including the setting of the tool **Blunt Limit**. The work, or energy consumed, during the cutting cycle is proportional to the blue area in the figure. The Blunt Limit is a user-defined percentage increase above the Learned Work. A fault is generated if the measured work exceeds the percentage increase over the Learned Work (note that the Blunt Delay becomes inactive in Work Mode). In the event of a blunt tool fault, a red number will appear in the blunt window and the particular station number will flash red. Blunt Tool supervision remains active for the duration of **Tba**, if **Tba** is enabled. If **Tba** is turned off, Blunt Tool supervision remains active the entire time the start signal is present, following the **Start Delay** and the idle power measurement. Because Work Mode monitoring calculates total energy used in the entire cycle, any faults will always be signaled at the end of the cycle.

Learn Work Blunt Mode



The Tool-Blunt Limit is not actually shown but the green area in the above figure represents 100% in the Work calculation. A learn cycle is needed for this mode of Tool-Blunt monitoring.

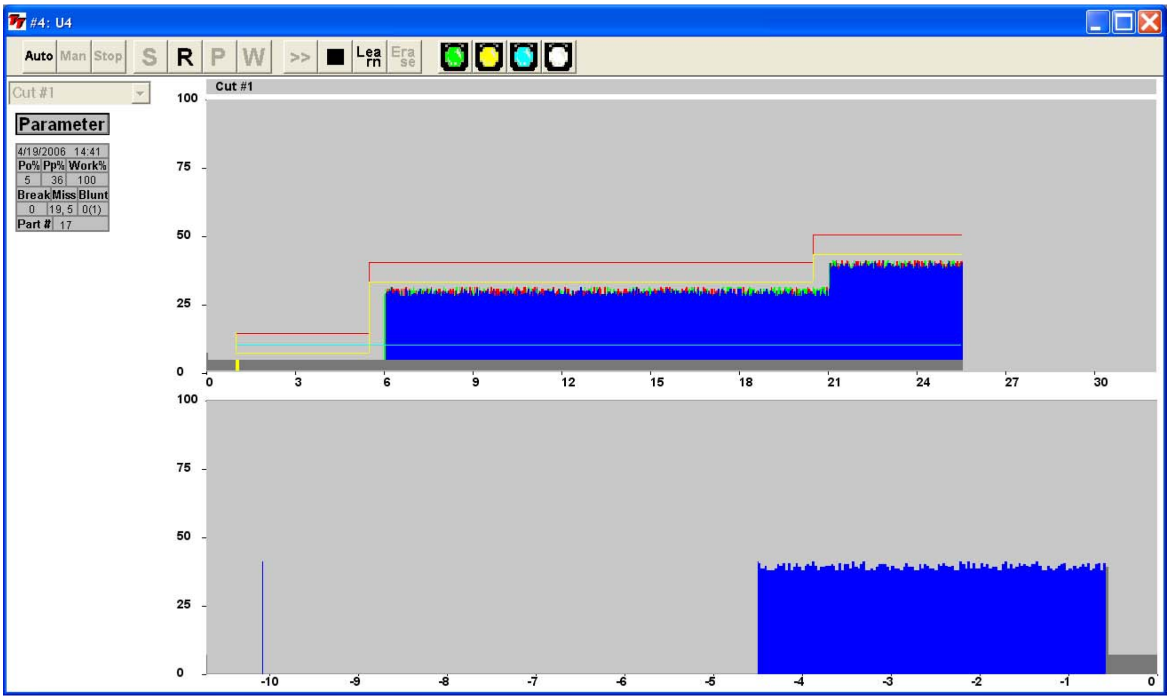
5.5 Blunt Tool - Blunt On Part Count

Each cut is counted by the **TTMON**. This part count may even be used to generate a Blunt Alarm. The number of parts to generate a Blunt Alarm is programmable form the **TTMON** application. The 'Blunt On Part#' function must be enabled as well.

5.6 Blunt Tool - Auto Learn Step Curve mode

The figure below shows the Auto Learn Step Curve blunt mode, which is a new mode not available in previous ***TECHNA-CHECK***® versions. In this mode the Blunt Limit is calculated as a step-curve from the previous learned curve. The Blunt Limit is a percentage increase from this learned curve. This makes the blunt limit follow the curve and may result in better monitoring for blunt detection of step-tools. Even multiple spindle heads may be monitored successfully for blunt tools with this monitoring mode. The Step-Width is programmable and a new learn cycle is not necessary when the Step-Width is modified. If synchronization problem exists between the learned and the monitor cycle the Step-Width should be increased in order to avoid false alarms.

Auto Learn Step Curve Mode



The Tool-Blunt Limit is shown in yellow color. A learn cycle is needed for this mode of Tool-Blunt monitoring.

5.7 Blunt Tool - Resetting the Part Counter

The part counter is reset to zero when a new learn is done.

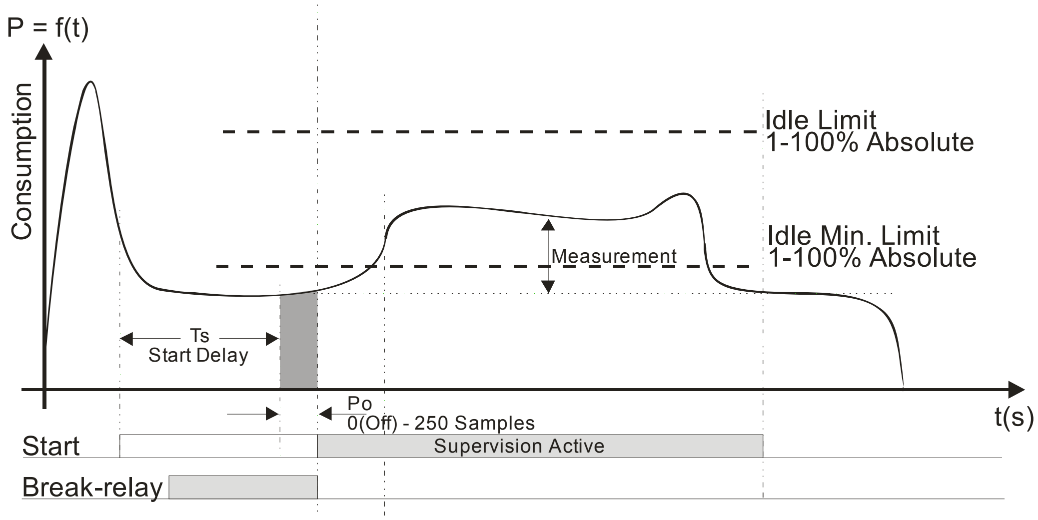
The part counter may also be manually reset to zero from **TTMON**. When no Alarm is present the Blunt Alarm Reset LED is used to reset the part counter.

6. Idle Limit Supervision

In some applications, it may be necessary to check that the machine idle power is within certain boundaries. For example, a very low idle power may indicate that a belt is broken or that there is no power to the motor. A very high idle power may also indicate belt problems, or problems with lubrication or bearings. In these cases, a high and low limit, IdleMax and IdleMin, for the idle power may be set. After the idle power is measured and Po is calculated, the value is compared with IdleMax and IdleMin. If it is not within the limits, then a Tool Break fault occurs immediately.

Each of the Idle Power Monitoring limits may be disabled by turning them all the way down to zero.

Idle Limits



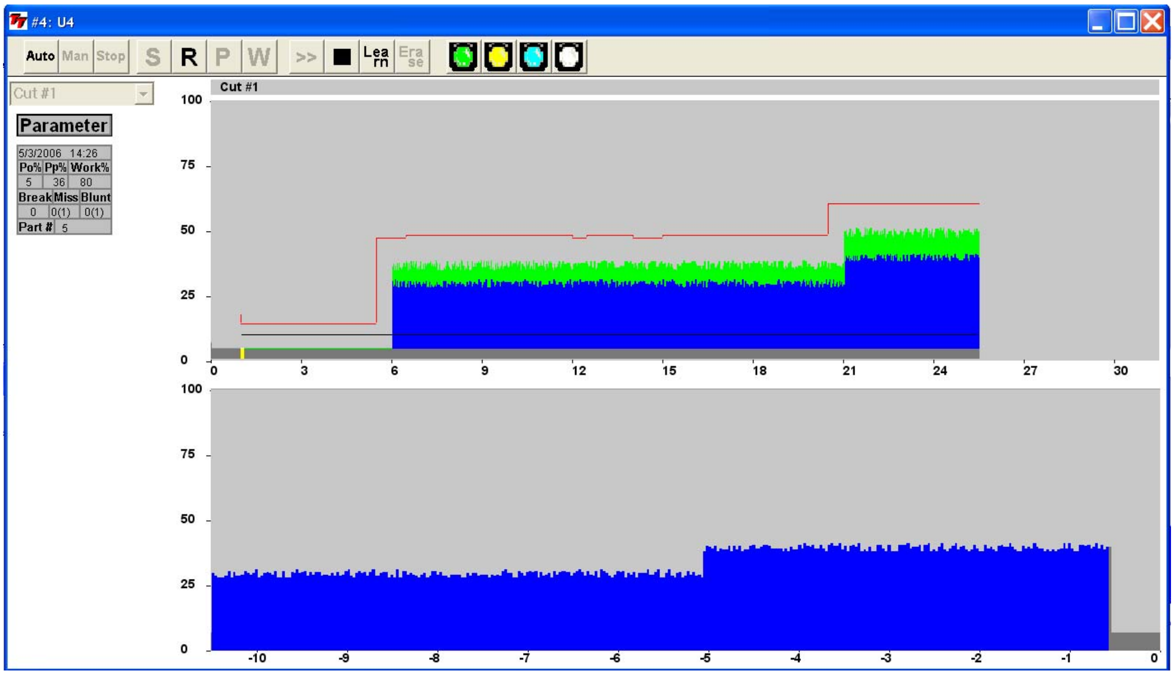
7.0 Touch Point Limit Function

Relay #3 output (of TTBUS IO100T) may be used as a touch point indication. If a Touch Point Limit greater than zero has been programmed the relay no. 3 contacts are closed when the power consumption reaches a threshold equal to Po + Touch Point Limit. The relay #3 contacts are released again when the start signal is removed.

This function may be used in some systems to tell the tool feed mechanism that a tooling operation has begun and the feed rate needs to be decreased. The tooling cycle may be shortened if a different, faster feed rate, can be used until the tool touches the target.

If the Profibus interface is used a separate bit signals the Touch Point Limit reached.

Touch Point Limit

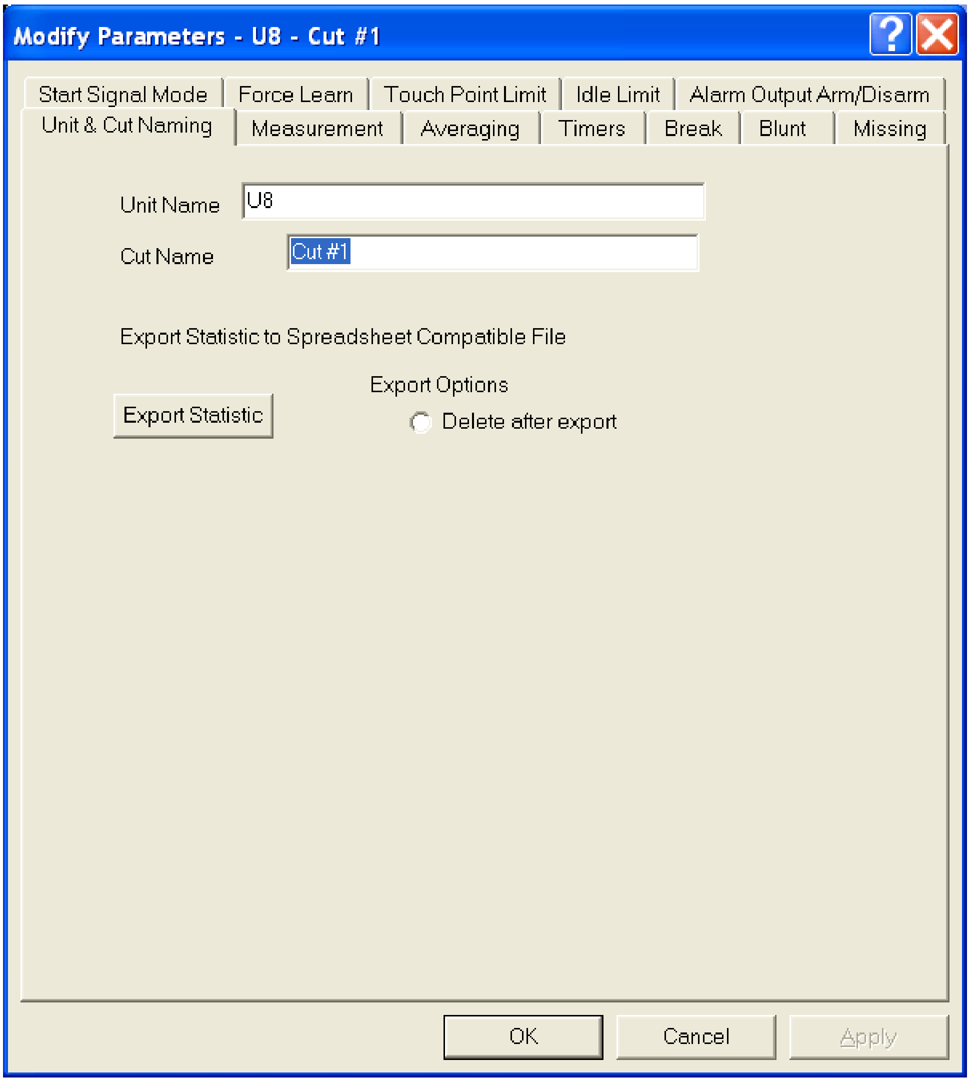


The Touch-Point Limit is shown in black color.

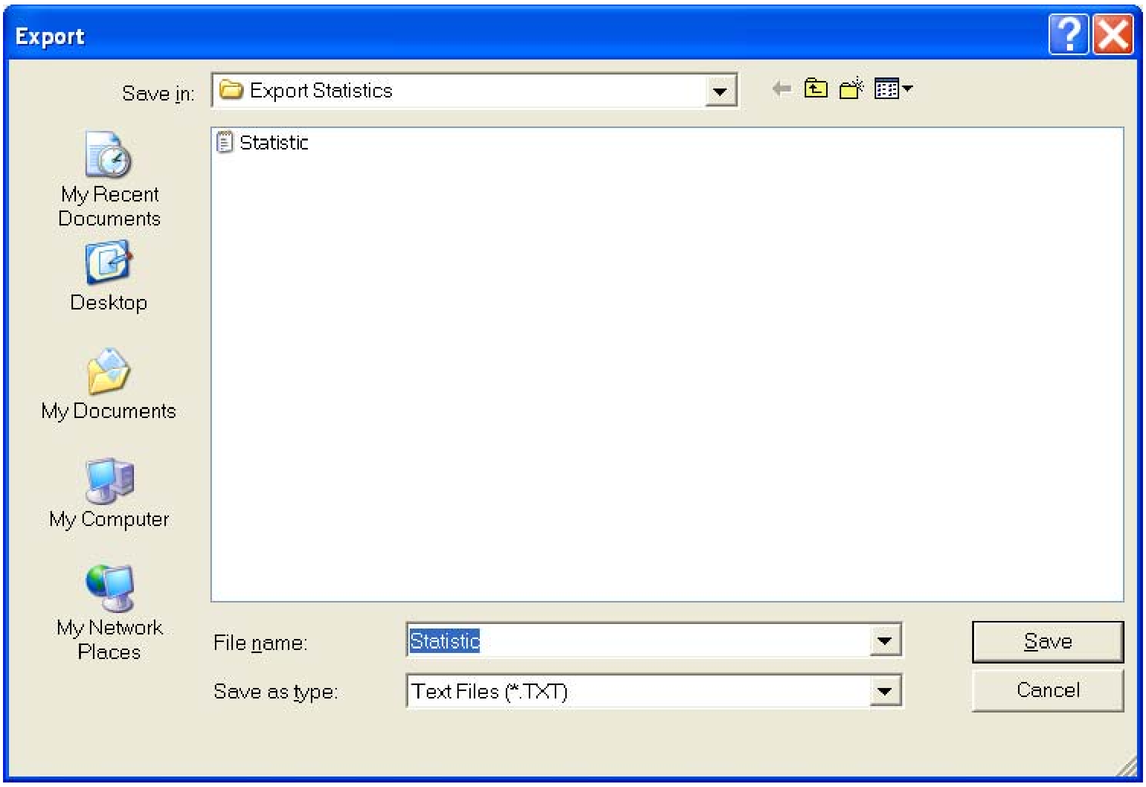
8.0 Parameters—Unit & Cut Naming

This menu makes it possible to modify the default **Unit** (Spindle) and **Cut** names.

A button for Export Statistic to a Spreadsheet File is also available. If the statistic must be erased after export a check box for this must be activated.

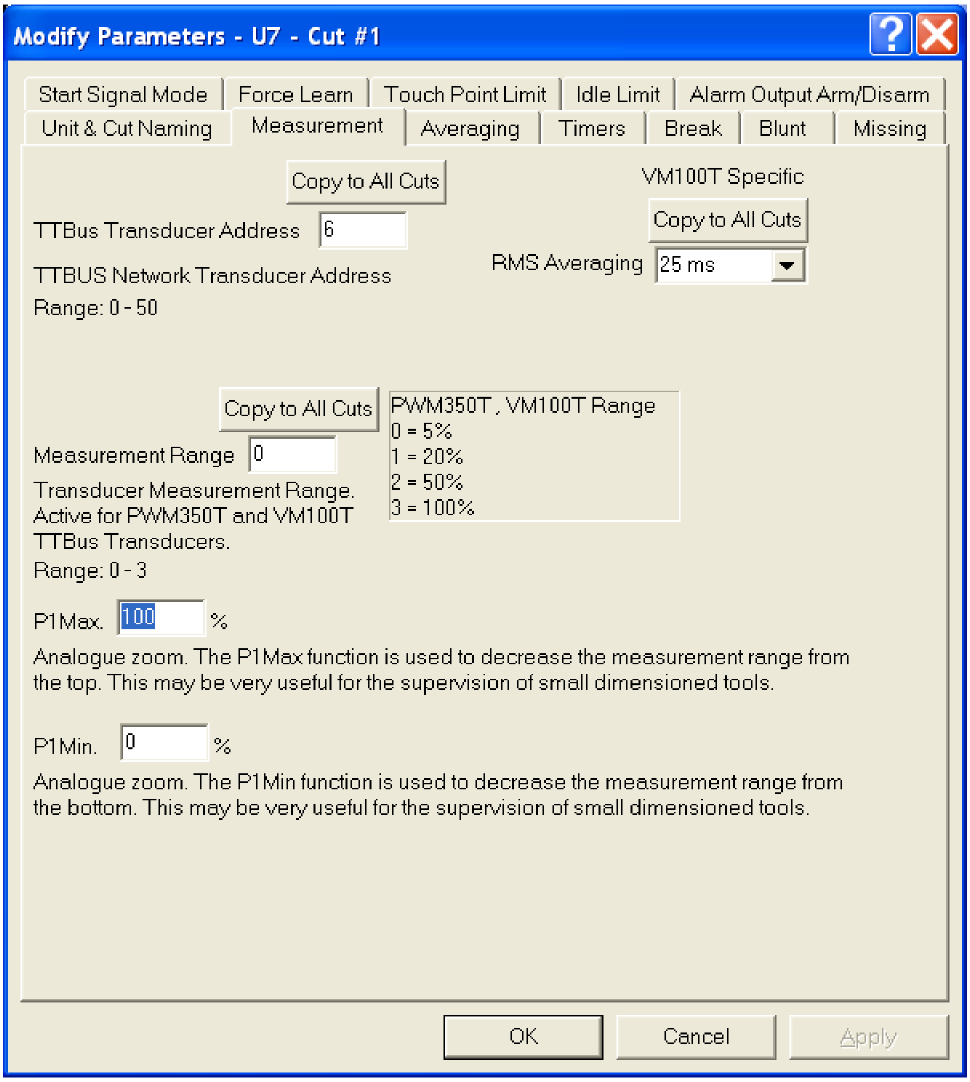


Export Statistic brings up a traditional file dialog box like shown below.



8.1 Parameters - Measurement

The parameter menu defines the parameters related to the measurement transducer.



TTBus Transducer Address

Measurement may be supplied either from **Profibus** or **TTBus**. If a **TTBus** transducer is used the **TTBus** transducer-address for the actual cut must be entered from the dialog above. It is possible to push a button which copies the Transducer Address to all other cuts of that unit (spindle). Often all cuts made with a specific spindle are using the same transducer but it is possible to monitor some cuts with **Power** while others are monitored for **Vibration**. In the future other sensor types may also be added.

RMS Averaging

If a VM100T transducer is used (a **TTBus** Vibration transducer) the transducer averaging period must be programmed from this dialog box.

Measurement Range

If a PWM350T or a VM100T **TTBus** transducer is used the measurement range must be programmed from the dialog box.

P1Max

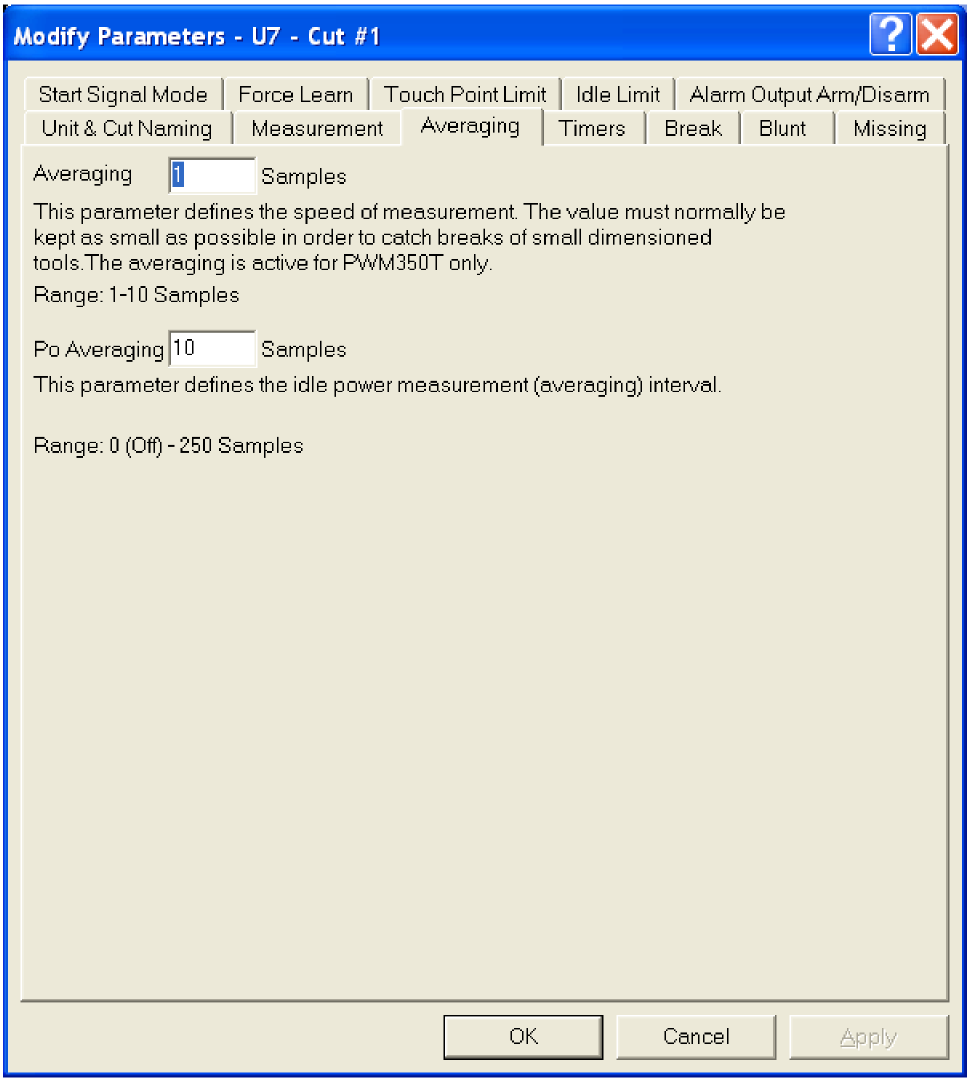
Analog zoom value. For small signals it is possible to increase the sensitivity by decreasing this value.

P1Min

Analog zoom value. The parameter may be useful for small signals and high idle measurements.

8.2 Parameters - Averaging

Dialog box for the setting of Measurement averaging and Idle Measurement averaging.



Averaging

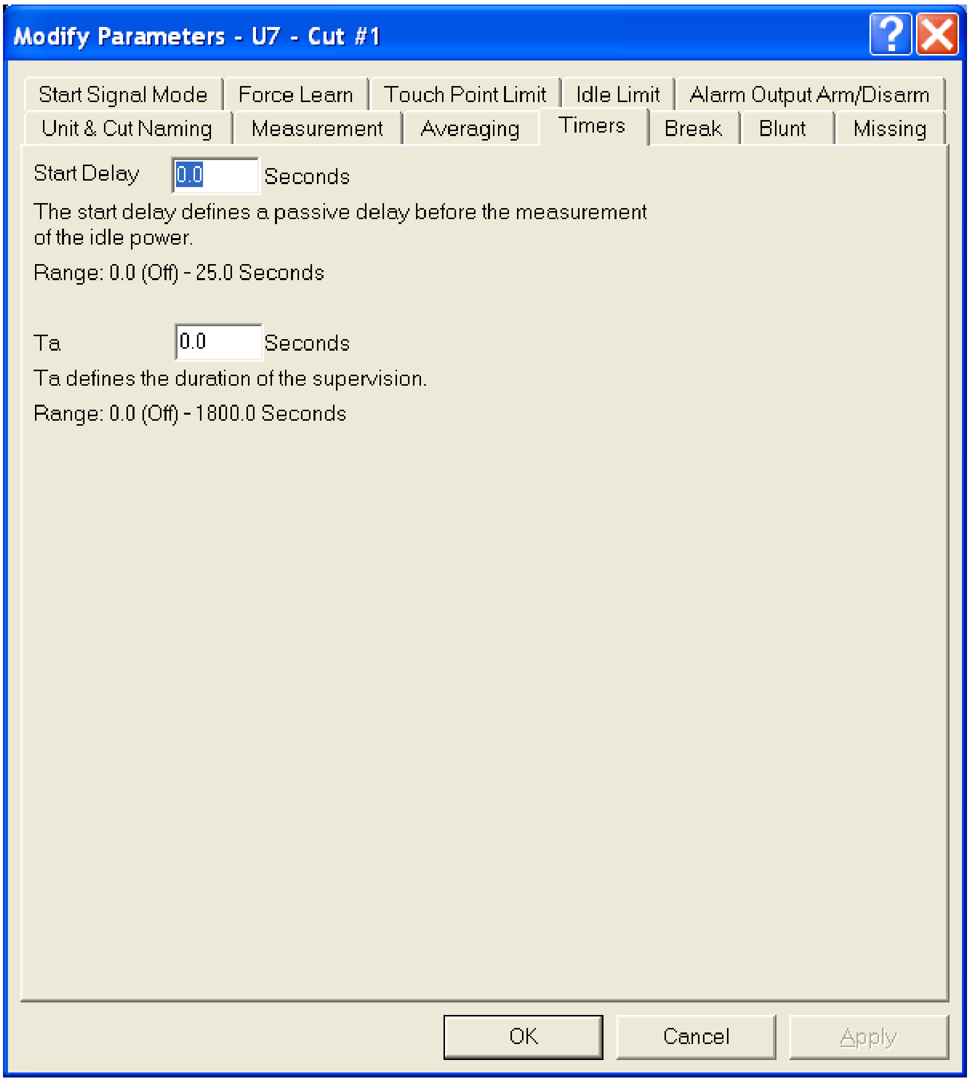
Averages the measurement from the Transducer, range 1 –10 measurements.

Po Averaging

Sets the number of measurements used to calculate the idle measurement value. A value of 0 (zero) effective switches the idle measurement off.

8.3 Parameters - Timers

A start-delay or a monitoring length may be programmed from this dialog box.



Start Delay

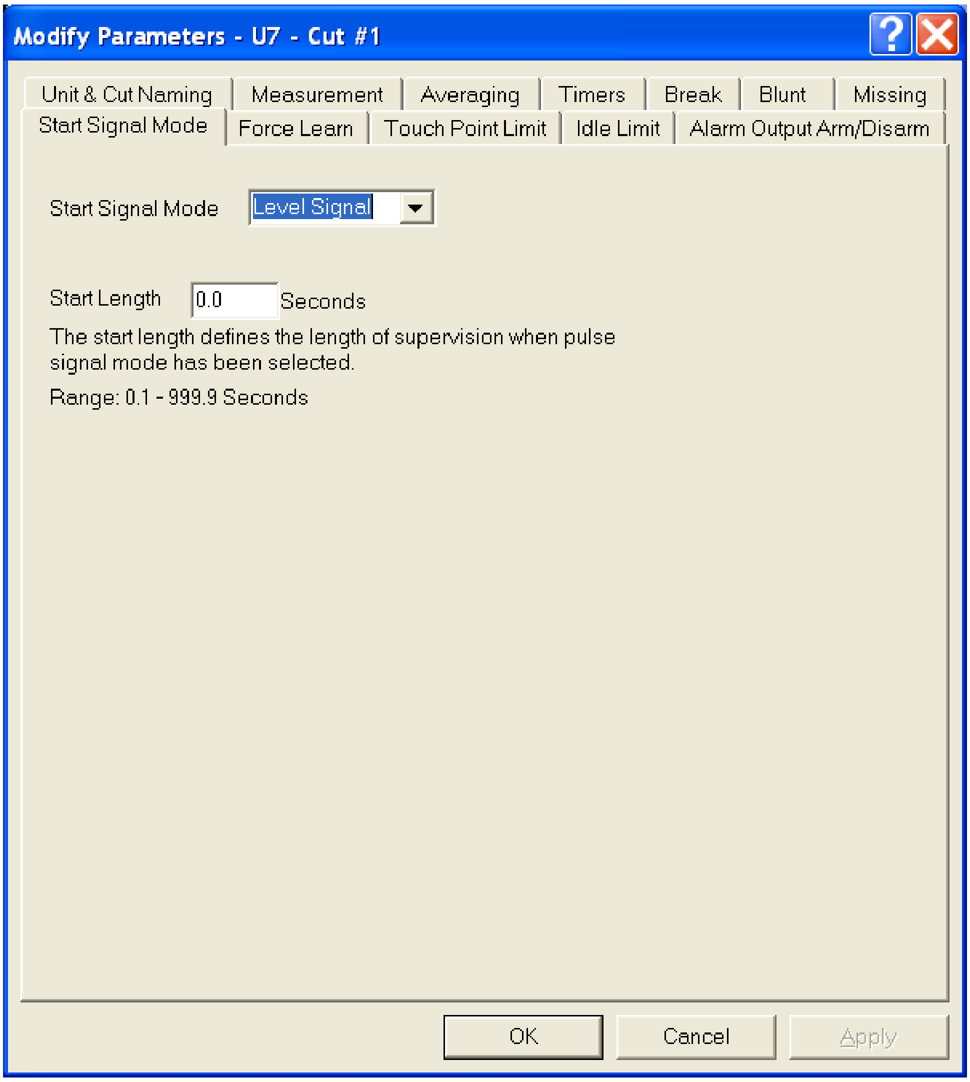
A delay which may be introduced after the Start-Signal is activated to delay the actual start of the Tool Monitoring.

Ta

Ta may be used to terminate the Tool Monitoring before the Start-Signal is removed. This is sometimes necessary when a tool breaks through a part. For example a drill that goes through cast iron may generate a spike, which varies a lot from cycle to cycle, and is difficult to supervise.

8.4 Parameters - Start Signal Mode

This dialog box defines values related to the Start-Signal.



Start-Signal Mode

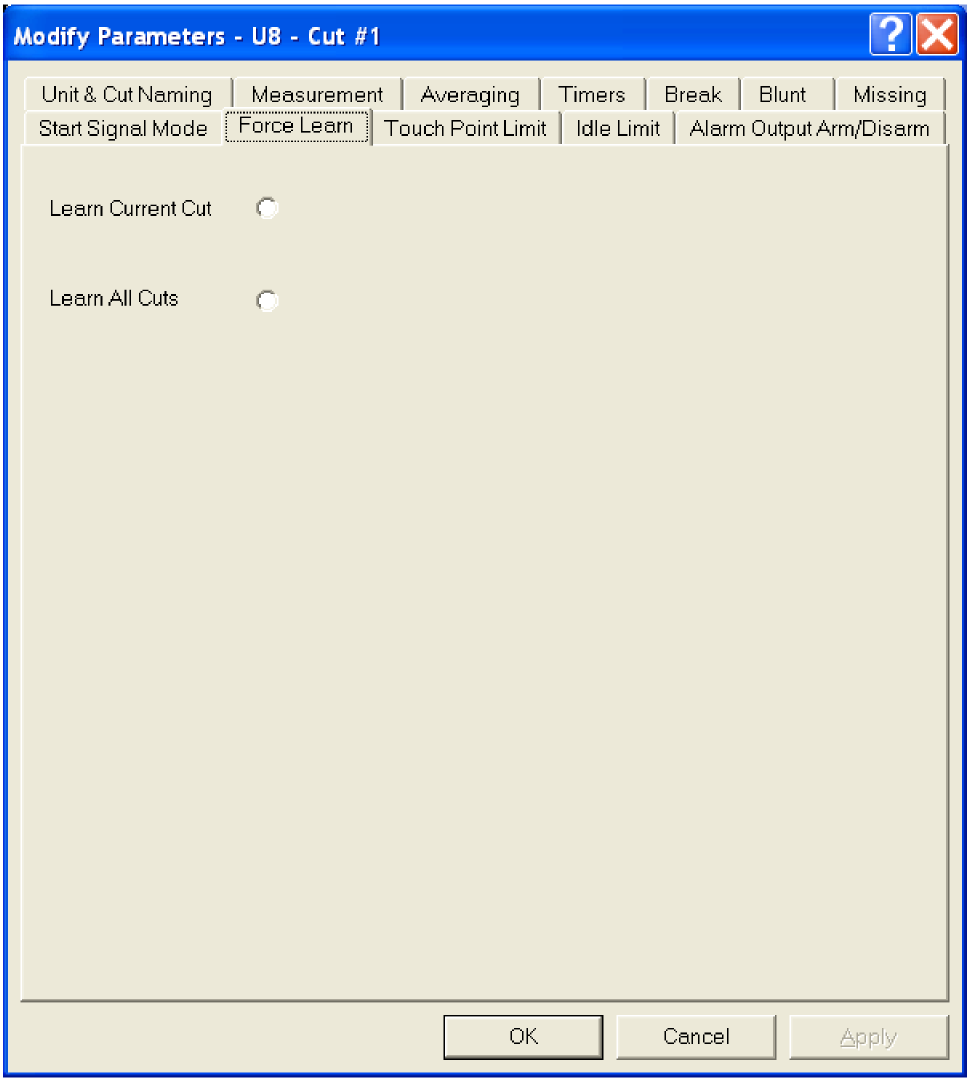
This parameter define whether the Start-Signal is a **Level** Signal or a **Pulse** Signal.

Start Length

If Start-Signal **Pulse** Mode is programmed the duration of the cut must be programmed here.

8.5 Parameters - Force Learn

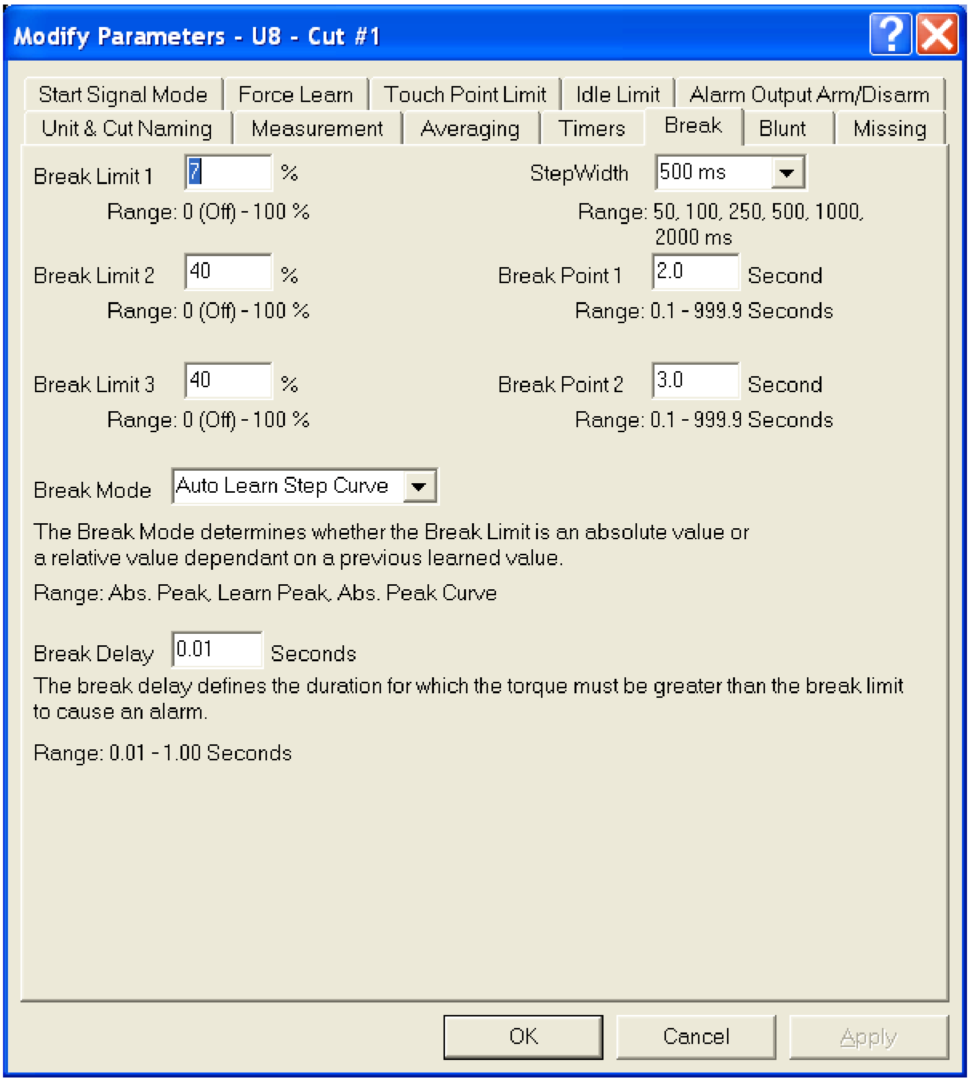
Dialog for activation of learn cut.



It is possible to learn a single cut or to force a learn of all cuts from this dialog box.

8.6 Parameters - Break

Dialog box for the setting of parameters related to Tool Break Monitoring.



Break Mode

Selects the Tool Break Monitoring operating mode.

Break Limit 1

The Break Limit 1 is used by all break monitoring modes. See the description of the individual Break Monitor modes in order to understand the precise function of this particular limit.

Break Limit 2

The Break Limit 2 is used to as the Tool Break Limit for the second step when Absolute Peak Curve Mode has been selected for the Tool Break Monitoring. If the limit is set to 0 (zero) this step is not monitored. This limit can be adjusted graphically when display Stop Mode has been selected.

Break Limit 3

The Break Limit 3 is used to as the Tool Break Limit for the third step when Absolute Peak Curve Mode has been selected for the Tool Break Monitoring. If the limit is set to 0 (zero) this step is not monitored. This limit can be adjusted graphically when display Stop Mode has been selected.

Break Point 1

This parameter sets the position where Break Limit 2 becomes active when Absolute Peak Curve Mode has been selected for the Tool Break Monitoring. This position can be adjusted graphically when display Stop Mode has been selected.

Break Point 2

This parameter sets the position where Break Limit 3 becomes active when Absolute Peak Curve Mode has been selected for the Tool Break Monitoring. This position can be adjusted graphically when display Stop Mode has been selected.

Step Width

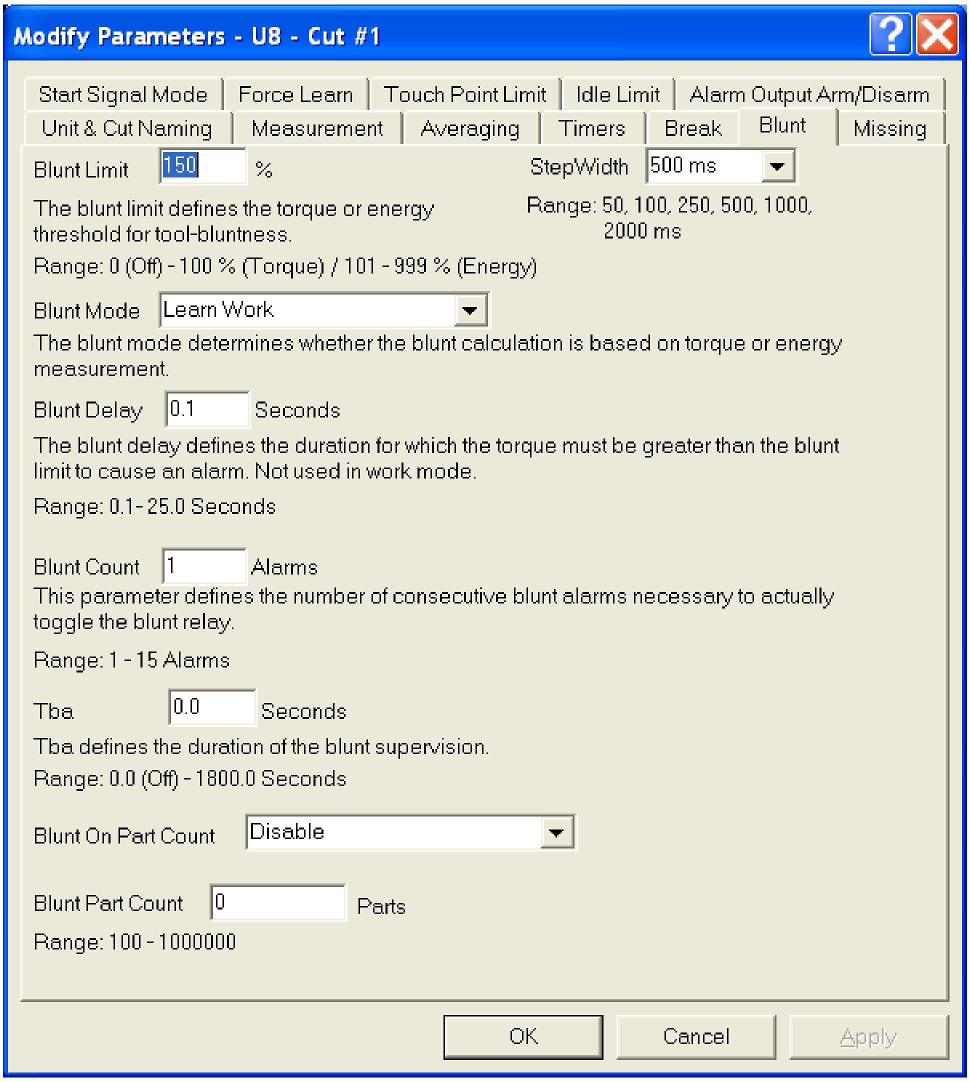
The Step Width parameter is used only when AutoLearnCurve Mode has been selected for the Tool Break Monitoring. The Step Width defines how close the Tool Break Limit Step-Curve is placed to the learned curve. The more the monitoring cycle shifts in time from the learn cycle to the monitoring cycle the higher value most be used. It is not necessary to perform a new learn when this value is changed. The AutoLearnCurve monitoring mode is also available for Blunt and Missing monitoring and the Step Width parameter is shared among the different types of monitoring

Break Delay

The Break-Delay defines the reaction time for the Tool Break Monitoring.

8.7 Parameters - Blunt

Dialog box for the setting of parameters related to Tool Blunt Monitoring.



Blunt Mode

Selects the Tool Blunt Monitoring operating mode.

Blunt Limit

The Blunt Limit is used by all blunt monitoring modes. See the description of the individual Blunt Monitor modes in order to understand the precise function of this particular limit.

Blunt Delay

The Blunt-Delay defines the reaction time for the Tool Blunt Monitoring. This parameter has no effect when Blunt Learn Work Mode has been selected.

Step Width

The Step Width parameter is used only when AutoLearnCurve Mode has been selected for the Tool Blunt Monitoring. The Step Width defines how close the Tool Blunt Limit Step-Curve is placed to the learned curve. The more the monitoring cycle shifts in time from the learn cycle to the monitoring cycle the higher value must be used. It is not necessary to perform a new learn when this value is changed. The AutoLearnCurve monitoring mode is also available for Break and Missing monitoring and the Step Width parameter is shared among the different types of monitoring

Blunt Count

This parameter defines how many consecutive times the blunt limit is exceeded before the unit actually generates the Blunt Alarm.

Tba

Tba may be used to terminate the Tool Blunt Monitoring before the Start-Signal is removed. This is sometimes necessary when a tool breaks through a part. For example a drill that goes through cast iron may generate a spike, which varies a lot from cycle to cycle, and is difficult to supervise.

Blunt On Part Count

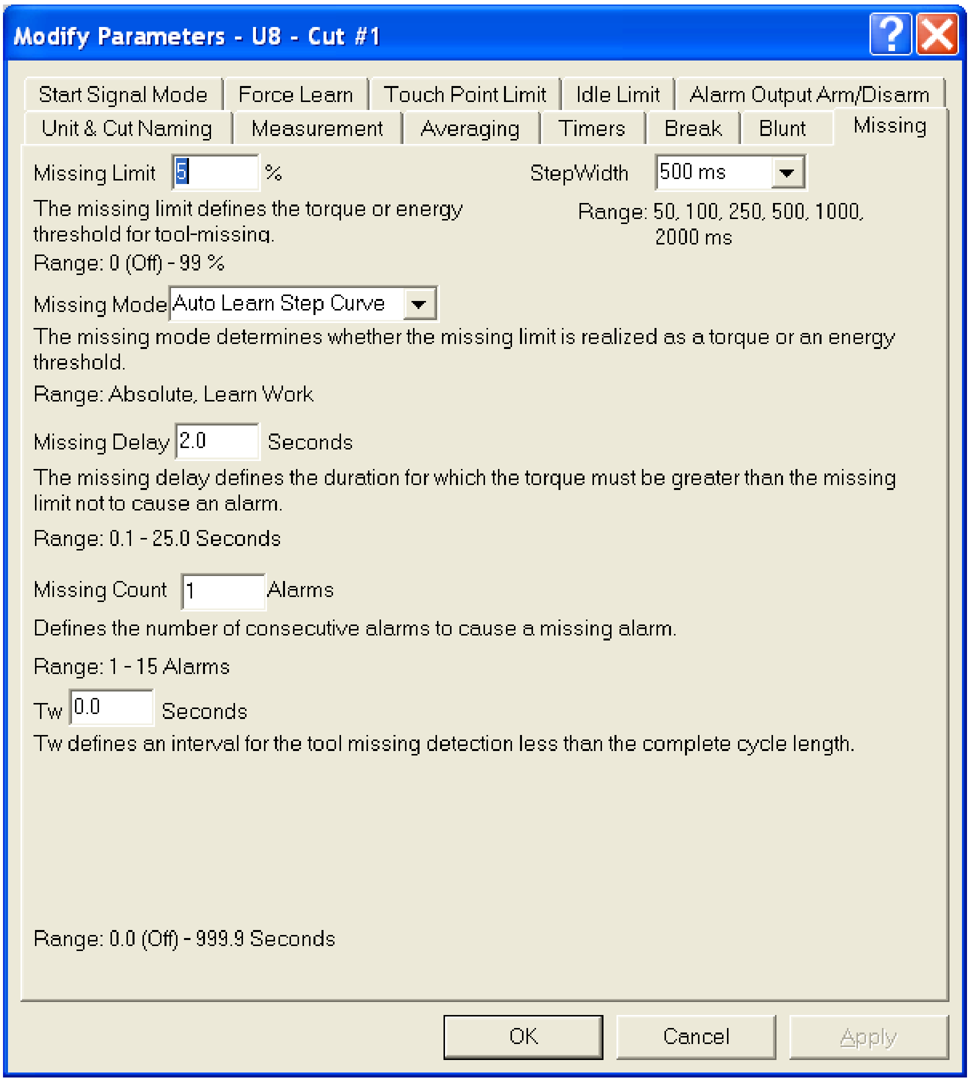
A part-counter is maintained for each cut. The part-counter counts the machining cycles which does not generate an alarm (good parts counting). This parameter defines whether the part-counter should be used to generate a Blunt Alarm or not. The part-counter is reset to zero when a learn-cycle is initiated. The part-counter may be reset manually by pressing the Blunt Alarm LED when no other type of Blunt Alarm is present.

Blunt Part Count

If Blunt-On-Part-Count has been enabled (see above) then Part Counter limit is programmed in this parameter.

8.8 Parameters - Missing

Dialog box for the setting of parameters related to Tool Missing Monitoring.



Missing Mode

Selects the Tool Missing Monitoring operating mode.

Missing Limit

The Missing Limit is used by all missing monitoring modes. See the description of the individual Missing Monitor modes in order to understand the precise function of this particular limit.

Step Width

The Step Width parameter is used only when AutoLearnCurve Mode has been selected for the Tool Missing Monitoring. The Step Width defines how close the Tool Missing Limit Step-Curve is placed to the learned curve. The more the monitoring cycle shifts in time from the learn cycle to the monitoring cycle the higher value must be used. It is not necessary to perform a new learn when this value is changed. The AutoLearnCurve monitoring mode is also available for Break and Blunt monitoring and the Step Width parameter is shared among the different types of monitoring

Missing Delay

The Missing Delay defines the time for which the measurement must exceed the Missing Limit in order not to signal a Tool Missing fault. When no Missing Alarm is present the Time-Over-Missing for the previous machining cycle is shown on the screen instead of the alarm indication. If for some reason a Tool Break is not detected it is important to detect a Tool Missing in the same cycle or at least the following cycle. When the Missing Delay is placed close to the Time-Over-Missing from the previous cycle there is a better chance for the missing fault to be generated in the same cycle if the Tool Break was not detected.

Missing Count

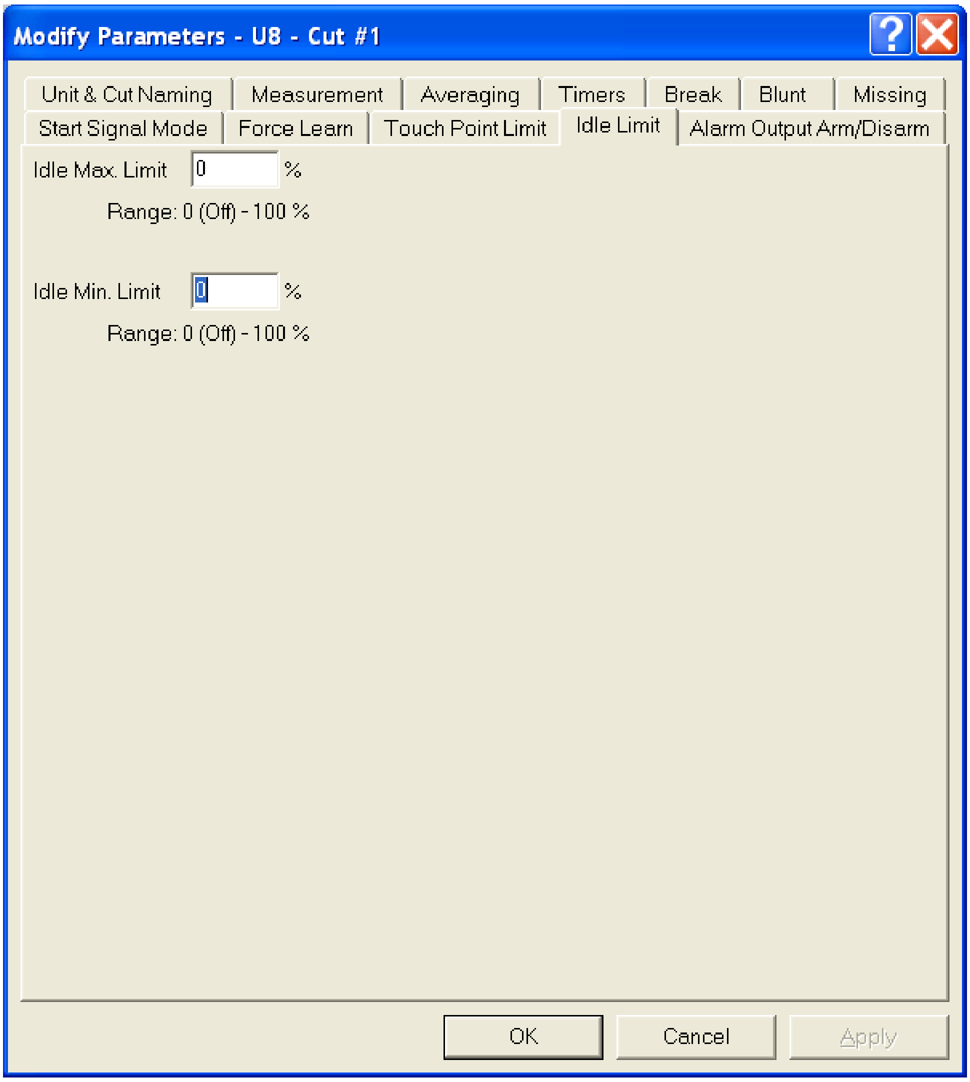
This parameter defines how many consecutive limit exceptions is needed in order to actually generate the Missing Alarm.

Tw

Normally the complete machining cycle length is used for the Missing Monitoring. If Tw is used (not zero) the the Missing Delay must be satisfied within the time Tw.

8.9 Parameters - Idle Limit

Dialog box for the setting of parameters related to Idle Monitoring.



Idle Max. Limit

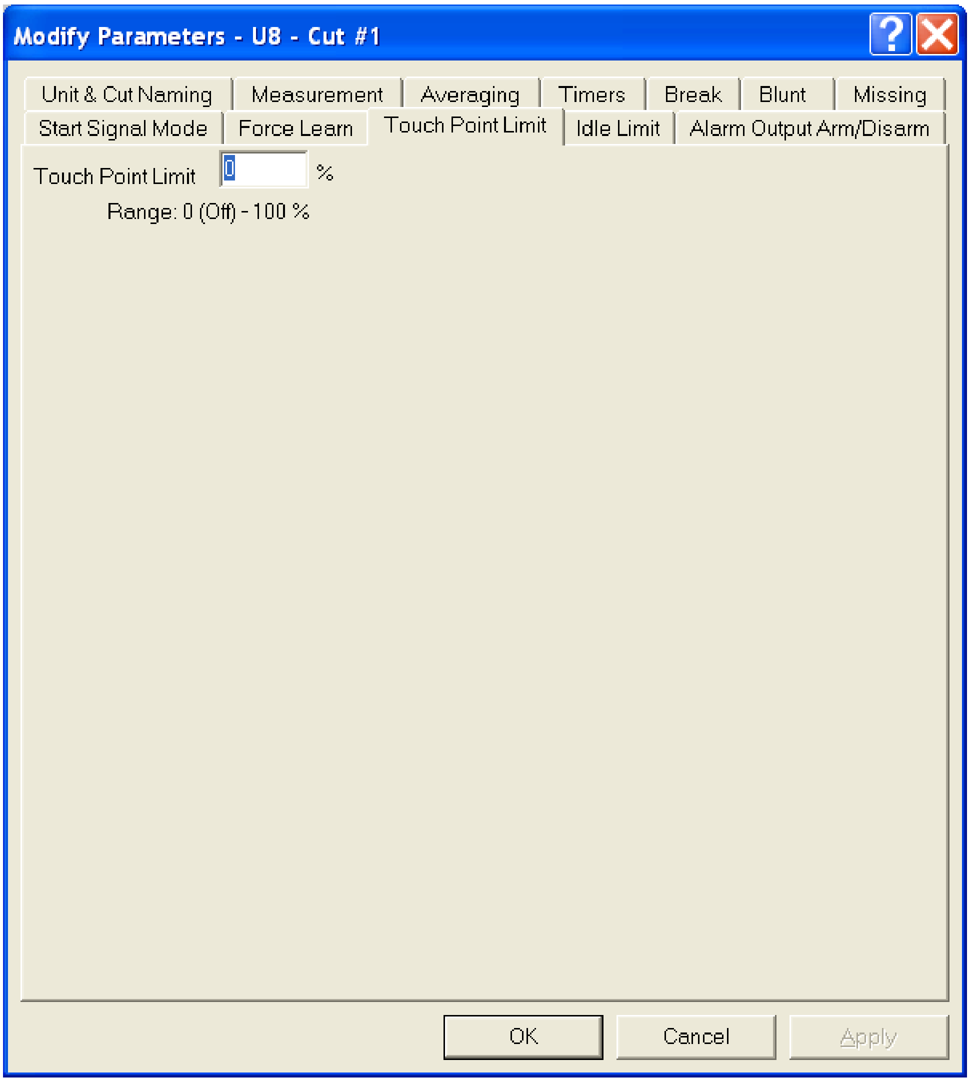
If the Idle Max. Limit is enabled (not zero) the idle measurement must be greater than the Max. limit in order to generate an Idle Alarm.

Idle Min. Limit.

If the Idle Min. Limit is enable (not zero) the idle power must be below the Min. limit in order to generate an Idle Alarm.

8.10 Parameters - Touch Point Limit

Dialog box for the setting of parameters related to the Touch Point feature.

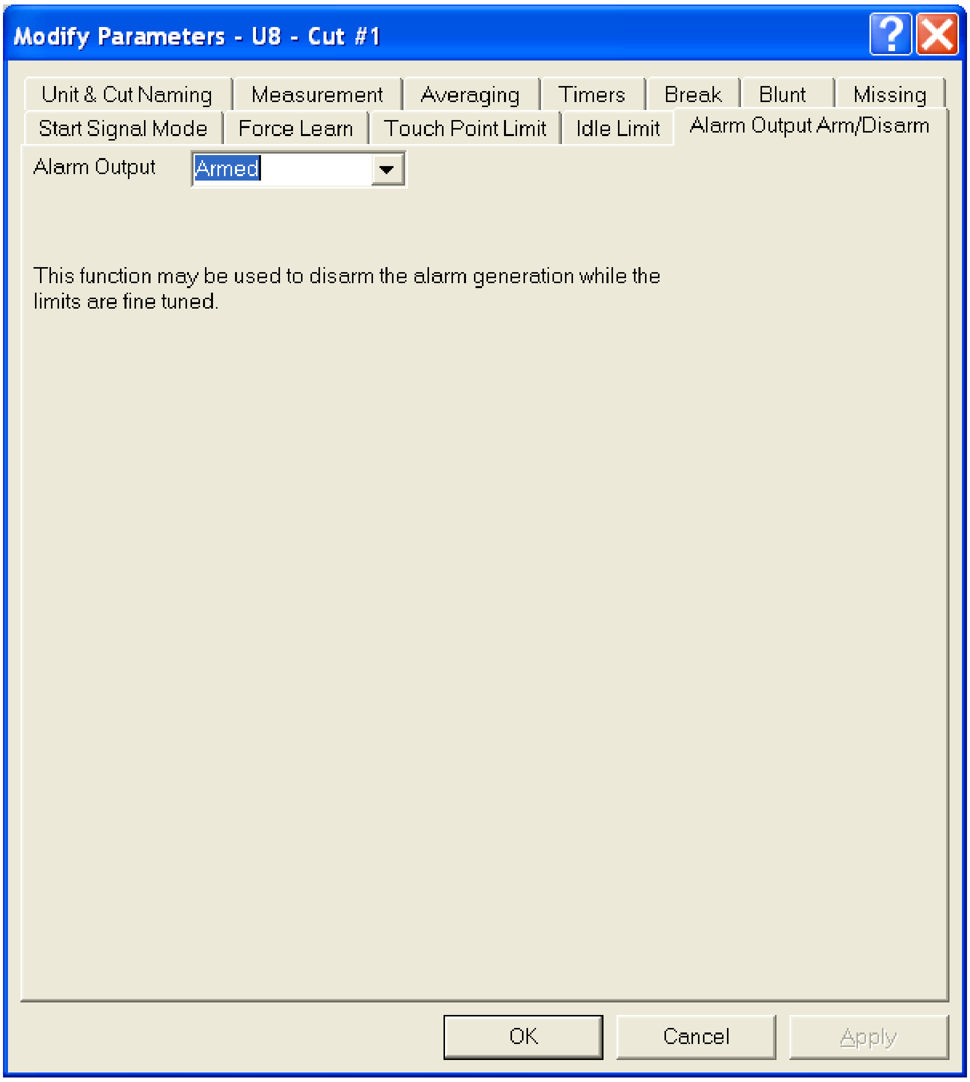


Touch Point Limit

A value different from zero enables the Touch Point function.

8.11 Parameters - Alarm Output

Dialog box for the setting of parameters related to Alarm Generation.

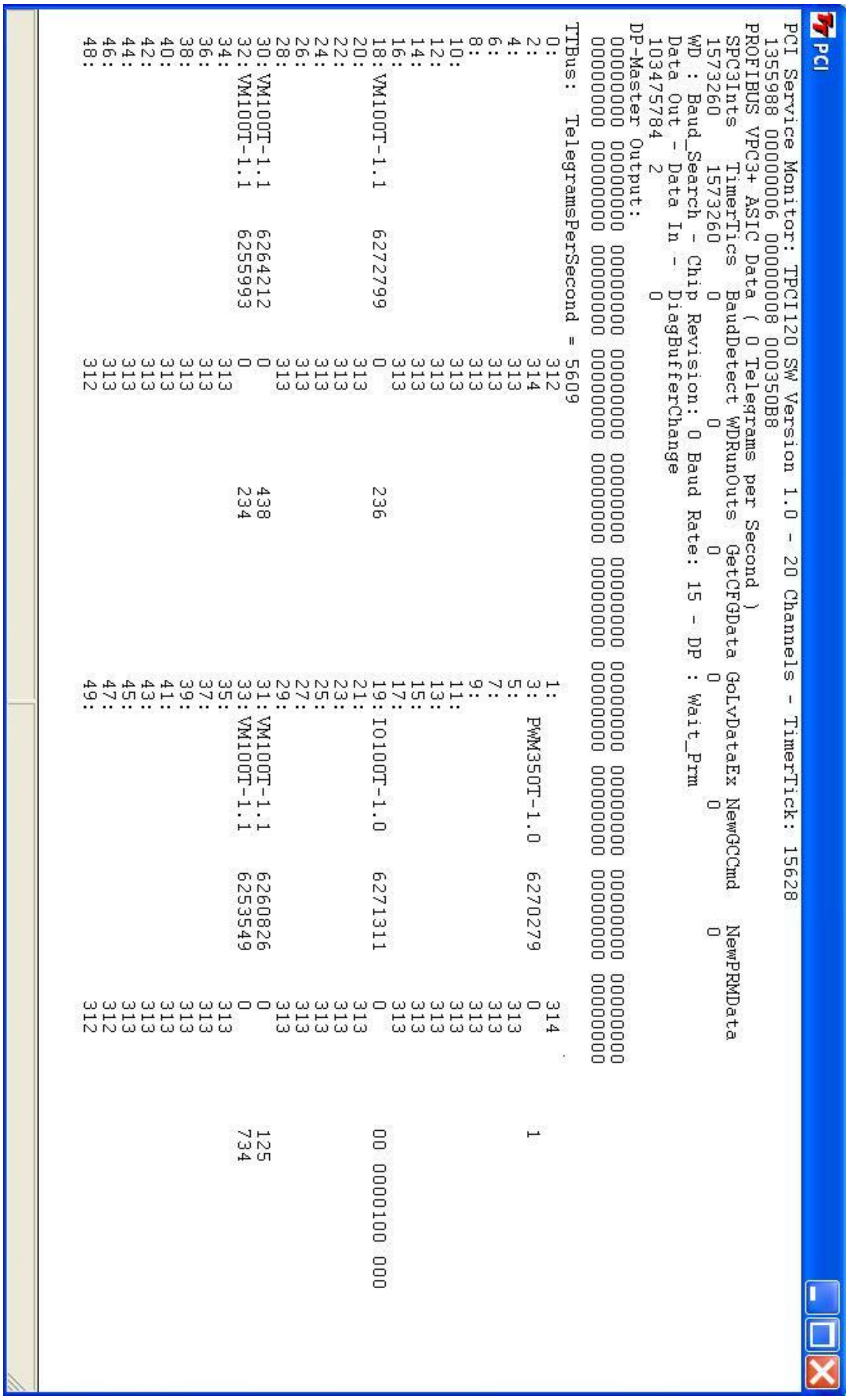


Alarm Output

Alarms may be Armed or Disarmed from this parameter. This parameter is common to all cuts for the unit (spindle) selected.

9.0 The Debug Window

The Debug Window helps to analyse communication issues.



9.1 PCI Communication Analysis

The Debug Window helps to debug communication issues.

```
PCI Service Monitor: TPCI120 SW Version 1.0 - 20 Channels - TimerTick: 15628
 1355988 00000006 00000008 000350B8
```

The first two lines display the type of card found (TPCI120) and the software version of the firmware running on the board (1.0). The number of channels (20 in this case) is shown. A TimerTick value is read from the board and displayed.

The second line includes information regarding PCI communication.

The first 3 hexadecimal numbers must be counting (changing) and the last number must be constant. The last number (000350B8 in this case) counts loss of telegrams in the communication between the PCI-board and the TTMON application. Under normal circumstances this will count only when TTMON is not started and stay constant when TTMON runs.

9.2 Profibus Communication Analysis

The Debug Window helps to analyse communication issues.

```
PROFIBUS VPC3+ ASIC Data ( 100 Telegrams per Second )
 SPC3Ints   TimerTics  BaudDetect WDRunOuts  GetCFGData GoLvDataEx NewGCCmd   NewPRMData
 43095      43060      1          0          1          1          31         1
 WD : Baud_Control - Chip Revision: 0 Baud Rate: 3 - DP : Data_Ex
 Data Out - Data In -  DiagBufferChange
 3831643    4674       0
DP-Master Output:
 90031F00 9002EC01 91018C01 91009601 90003201 91015C03 91015851 91016301 00000000 00000000
 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
```

The next section includes information about the Profibus Communication

The important information is to know the number of Telegrams transferred every second. In this case 100 telegrams is transferred every second. The number of telegrams per second should be higher than 50 otherwise excessive timing jitter from cycle to cycle is introduced.

The next few lines shows a lot of low-level communication information.

The DP-Master Output section displays the data received from the Profibus Master. One number is received for each channel. This number includes cut#, start signal, learn signal, reset signal and eventually a measurement value. In the above example only 8 channels are used and the remaining 12 channels are zeroed.

9.3 TTBus Communication Analysis

The Debug Window helps to analyse communication issues.

```
TTBus:  TelegramsPerSecond = 2804
 0:                         14                      1:                          16
 2:                         16                      3:  PWM350T-1.0   296002    0          1
 4:                         15                      5:                          15
 6:                         15                      7:                          15
 8:                         15                      9:                          15
 10:                        15                      11:                         15
 12:                        15                      13:                         15
 14:                        15                      15:                         15
 16:                        15                      17:                         15
 18:VM100T-1.1    296105    0          103          19:IO100T-1.0    294832    0          00 0000100 000
 20:                        15                      21:                         15
 22:                        15                      23:                         15
 24:                        15                      25:                         15
 26:                        15                      27:                         15
 28:                        15                      29:                         15
 30:VM100T-1.1    284976    0          62           31:VM100T-1.1    284144    0          439
 32:VM100T-1.1    283442    0          121          33:VM100T-1.1    282915    0          999
 34:                        15                      35:                         15
 36:                        15                      37:                         15
 38:                        15                      39:                         15
 40:                        14                      41:                         14
 42:                        14                      43:                         14
 44:                        14                      45:                         14
 46:                        14                      47:                         14
 48:                        14                      49:                         14
```

The remaining of the screen shows TTBus information.

Each TTBus transducer must be assigned a unique bus address in the range from 0 - 49. The address is programmed by two rotary BCD-switches located at the front of the transducer. When a TTBus transducer is attached it is automatically recognized and shown in the above list within 1 minute.

The text displayed with each address above shows the type of transducer and its software version. The text 'VM100T-1.1' is equal to a VM100T transducer running firmware version 1.1. The number following is the number of telegrams received from this transducer. The next number represents the number of communication timeouts. The timeout value for transducer is usually zero and the remaining timeouts will be slowly counting. Finally a measurement value or Digital I/O information (in case of IO100T transducer) is shown.

The TTBus transfers 2804 telegrams per second. In the example above 7 sensors are attached and each sensor will transfer 2804/7 telegrams per second.