Dr. Zinngrebe GmbH

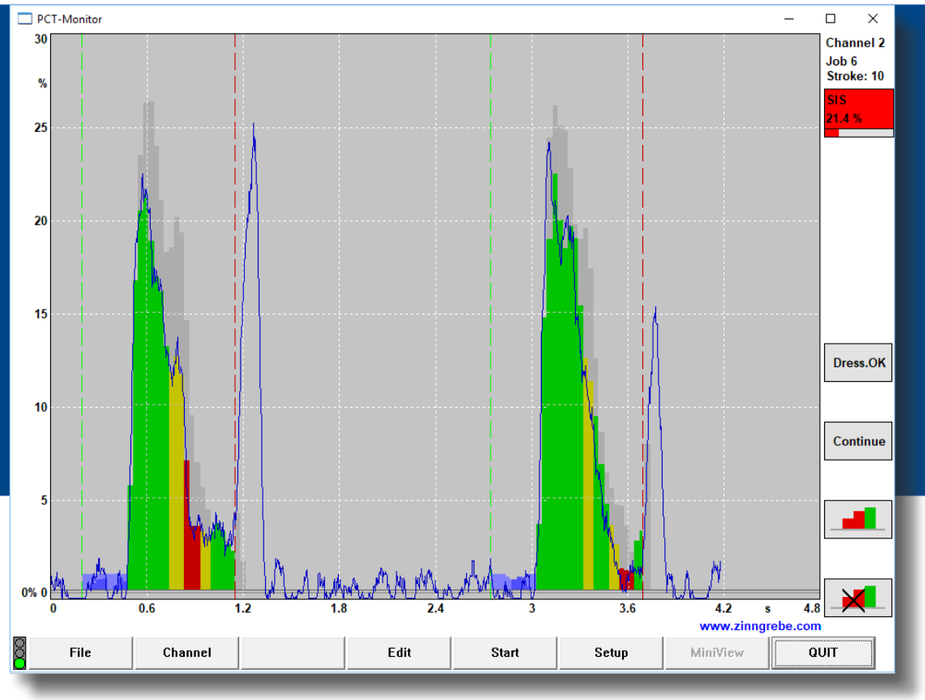
We would be glad to assist you in optimizing your machine tools. Of course, our services include detailed introductory instruction as well as on-site assistance at the first startup.

Process monitoring

Process display
Monitoring of manufacturing processes
Touch dressing

Dr. Zinngrebe GmbH
Schillerstr. 1/15, 89077 Ulm, Germany
T +49 731 2650 9701
office@zinngrebe.com www.zinngrebe.com

PCT 5.2 – ENG – 01/2024



The operating program
PCT Monitor

Process monitoring

Together with our customers we are optimizing process control for machine tools like grinding, turning, milling, drilling and honing machines.
You can trust our many years of experience in the field of process monitoring and our well-founded knowledge of machine building.

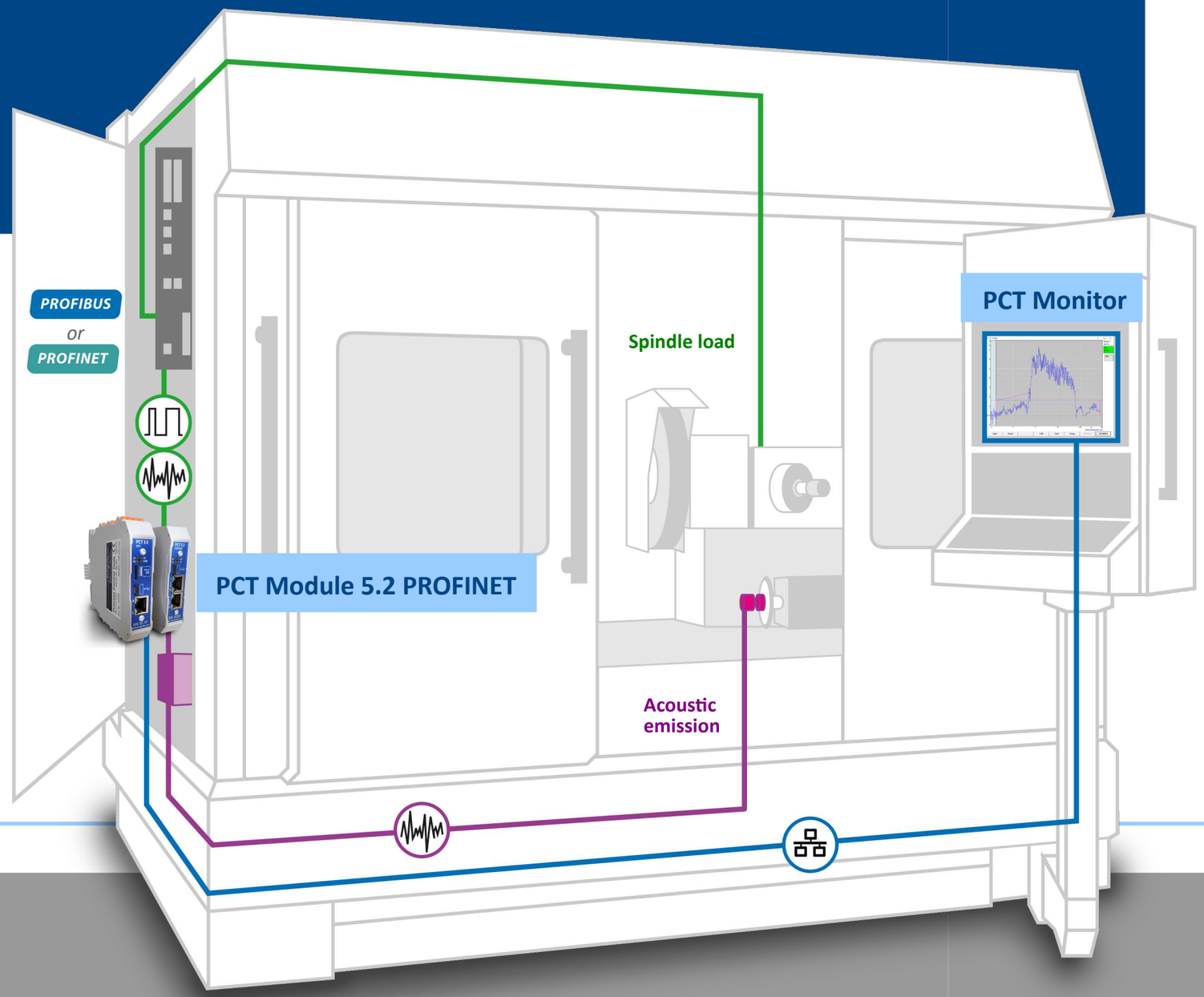
Our devices and monitoring strategies are in-house developments and fabricated in Germany. Here, we have made a conscious effort to simplify the interface to the machines and implement user-friendly operation.

A key component of every strategy is the learning function, which enables automatic monitoring adjustment. It is always possible to adapt the strategies to customer requirements.

PCT Module 5.1 PROFIBUS
consists of the PCB cards:
PCT 5.0 CPU and PCT 5.1 PROFIBUS

PCT-Modul 5.2 PROFINET
consists of the PCB cards:
PCT 5.0 CPU and PCT 5.2 PROFINET

Standard measurement instruments,
e. g. of a grinding machine:
- *Spindle load over Profibus (Siemens controller), and*
- *Acoustic emission via AE sensor*



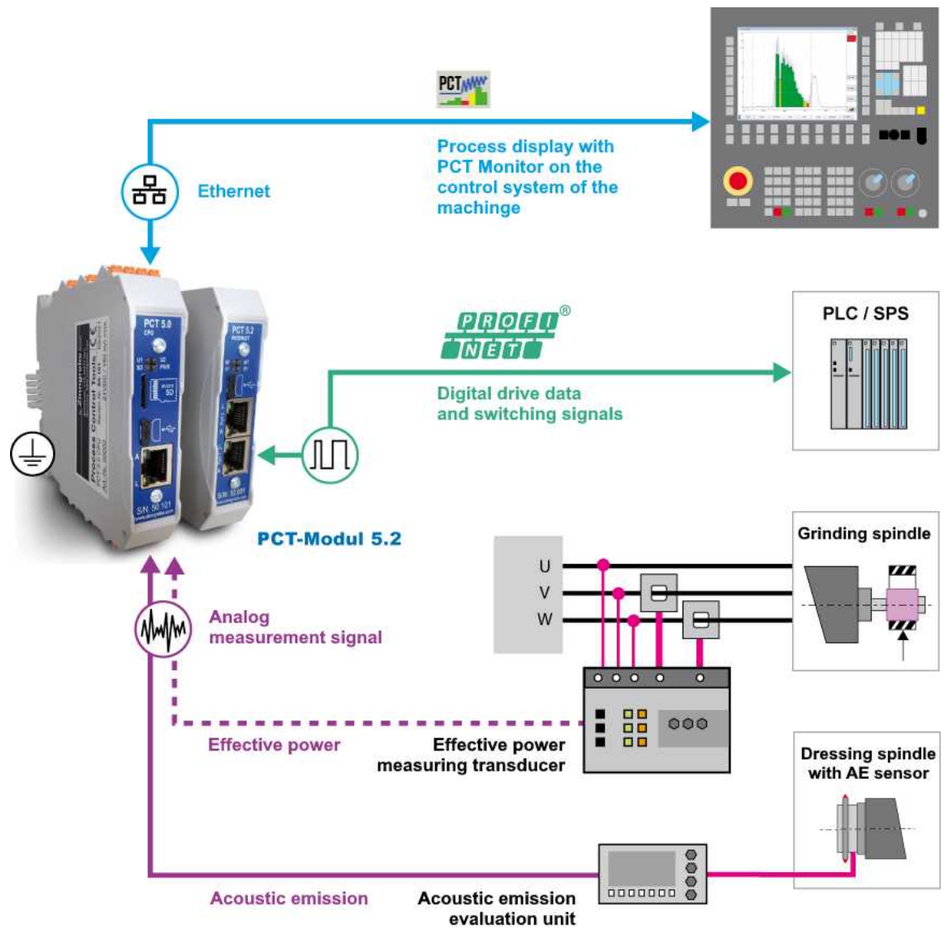
Measurement instruments

Effective process monitoring stands or falls with the quality of the measurement signals.

These are standard:
- **Torque, motor current and active power via Profinet or Profibus from Siemens controllers, up to eight drives in parallel**
- **Acoustic emission sensor**

Other sensors:
- **Spindle current from frequency converter**
- **Transducer for measuring power**
- **Displacement sensor**
- **RPM measurement via inductive proximity switch**

All analog measurement signals: +/- 10 Volt



Overview of possible connections for process monitoring.

Goals

Quality assurance:

- Process monitoring can assure form precision of the tool and constant quality of the processed workpieces.

Time savings:

- Unproductive segments of the process, e. g. air grinding, can be significantly reduced with the help of monitoring.

Reduced tool costs:

- The first dressing stroke with a too high dressing amount is avoided.
- Unnecessary dressing cycles are avoided by monitoring the dressing process.

Operational safety:

- Abnormal and out-of-round workpieces are detected early by process monitoring, so that no damage is caused to the tool or machine.
- This avoids production downtimes.

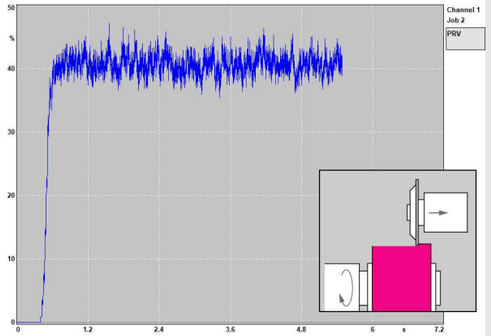
Monitoring strategies

Process monitoring is independently executed by the PCT Module. The following strategies are standard equipment on each device.

All strategies work with “self-learning”. Reference values are saved and parameters are automatically set in each learning cycle. This eliminates time-consuming settings by the machine operator. However, optimizations are always possible.

In the PCT Module, up to 250 jobs are available for individual monitoring configuration.
The logged measurement signals are displayed on the PCT Monitor.

PRV process display



Performance features

The measurement signal of machine processing is shown on the PCT Monitor and is saved in the PCT Module.

Generally monitoring is inactive. However an evaluation of the trigger level with pre-trigger time and stop lagtime is available.

Benefits / advantages

A machining sequence can be tracked and analyzed based on the measure-ment signal.

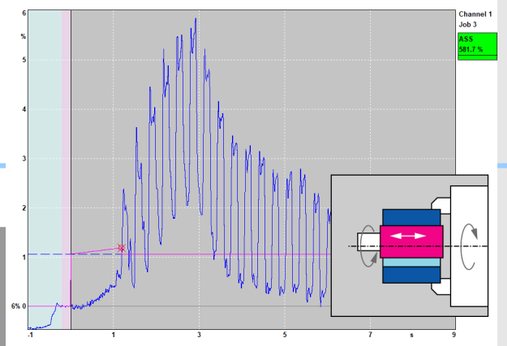
This enables much easier optimizations.

Special aspects

All processes started in the PCT Module are permanently saved to the microSD card. This data can be read back to the PCT Monitor at any time.

Storing of process data is performed for all strategies.

ASS first cut sensor



Performance features

The self-adjusting first cut sensor detects the first contact of the grinding wheel and the workpiece. This instant of time is called first cut.

ASS is used whenever grinding power is used as a measurement signal.

Benefits / advantages

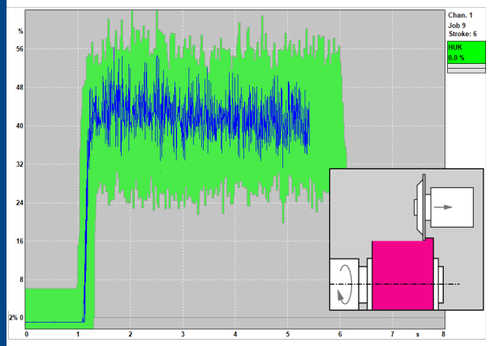
The cycle time is shortened when the nonproductive phase of air grinding is performed at a high infeed rate.

This requires reliable first cut detection, so that the workpiece and grinding wheel are not damaged with the first contact.

Special aspects

Reliable first cut detection, even when cooling lubricant is used. The levels of such disturbing influences of the measurement signal are acquired in the learning cycle, and so they do not lead to detection of the first cut.

HUK Envelope curve



Performance features

The range between the points of reversal of the four shifts represents the envelope curve: first shift up-wards using the upper threshold and downwards using the lower threshold and then shift to the left and to the right using for both the horizontal shifting.
The learned envelope is displayed with a green background.

Benefits / advantages

The envelope curve monitors signals, they always recur in a similar way regarding the time axis and the amplitudes.

An error is detected as soon as the measured values leave the range of the envelope for a time longer than the adjustable response time.

Special aspects

Exceeding above and below are reported separately.

The exceeding of the envelope is adjustable additionally with the error response time.

SWT threshold time

Performance features

A fixed threshold is adjusted. This strategy evaluates the number of all measurement values that lie above the threshold.

When this number is reached – equal to the response time – the monitoring reacts with OK. This point is marked by a red cross-hair.

Benefits / advantages

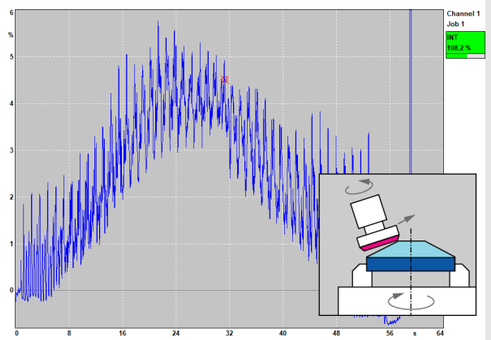
This can be used flexibly to monitor a minimum machining time which is specified by a parameter.

A learning cycle would automatically identify the response time parameter.

Special aspects

The strategy does not monitor whether the threshold is exceeded, rather it monitors whether the duration of threshold violations is exceeded.
When the value drops below the threshold the user can have the time measurement reset, in order to only monitor for a continuous and desired threshold violation.

INT integral sensor



Performance features

Computes the area under a curve. After the learning cycle, this area is set as 100 % (good part).

Monitoring now checks for two adjustable limits, e. g. 50 % (minimum stock removal for grinding OK) and e. g. 150 % (error: excessively high stock removal).

Benefits / advantages

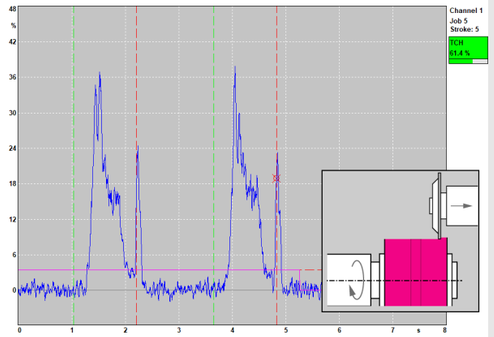
This functionality very precisely monitors the minimum and/or maximum stock removal during grinding.

Addition of all measurement values produces a very high filtering effect, so that signals disturbed by a high noise level are still monitored very reliably.

Special aspects

What is crucial in monitoring is not that the curves of a measurement signal are similar, rather it is important to attain a similar area under the curve compared to the good part.

TCH touch dressing



Performance features

Stroke-wise approaches and dressing until the contour of the grinding wheel is fully dressed for the first time.

Benefits / advantages

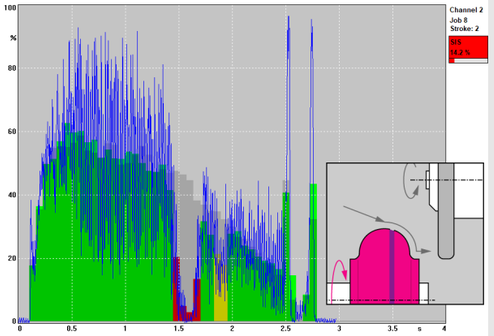
Timely completion of the dressing process, so that the grinding wheel is not worn unnecessary on expensive CBN and diamond grinding wheels.

Thermal deposits in the machine do not have any effect on the amount of dressed material.

Special aspects

Automatic detection of the dressing stroke, in which the dressing process can be completed.

SIS without segments



Performance features

The waveform of a good process is learned and the area under the signal is split and saved in vertical, gray bars (reference).

The monitoring now shows conformity and anomaly with the following colors:
- Red = error, signal too weak
- Yellow = Warning, still just OK
- Green = OK, sufficient signal

Benefits / advantages

The strategy does not require any settings be made by an operator, because learning a good process (reference) provides all of the information needed.

The color bar display is very user-friendly. A brief look is sufficient to read off the results of monitoring.

Special aspects

Disturbances in the signal are effectively filtered, because all measurement values of a bar are added. Consequently, the height of a bar just represents the area under the curve.

If there are red bars in unimportant segments, they can be deactivated with a button press.

The PCT Monitor is controlled by the eight soft keys or the touch screen on the machine's operator control panel.

PCT Monitor

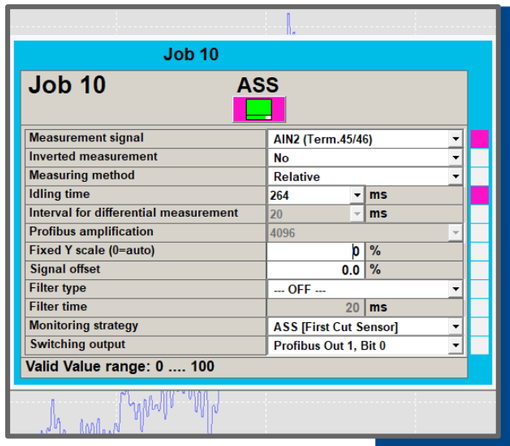
The PCT Monitor graphically shows all process data that is logged and monitored by the PCT Module. For the process monitoring itself, this operating program must not be opened, because all data can also retrieved and displayed from the PCT Module at a later time.

The PCT Monitor can be installed on any PC with a Windows operating system (WinXP or higher). It also runs on Siemens machine controllers, provided that the appropriate Windows program is installed on them. An Ethernet interface is needed for the communication with the PCT Module 5.2 PROFINET.

Editing of parameters

*Parameters for the monitoring strategy and measurement instruments are set via the Edit menu. A total of **250 jobs** are available for individual configuration.*

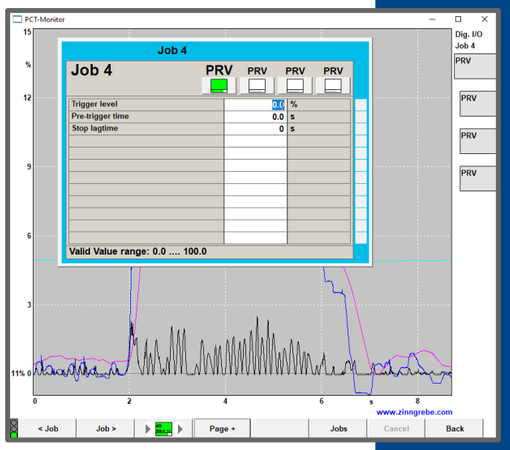
*A **backup copy** of all jobs can be made with the PCT Monitor.*



Parallel monitoring

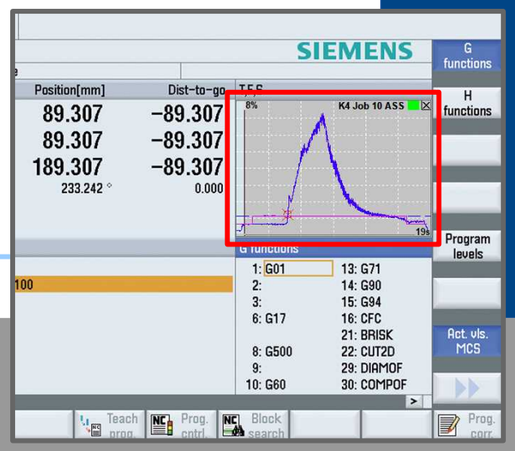
*The PCT Module can activate and monitor in parallel **up to four job instances**.*

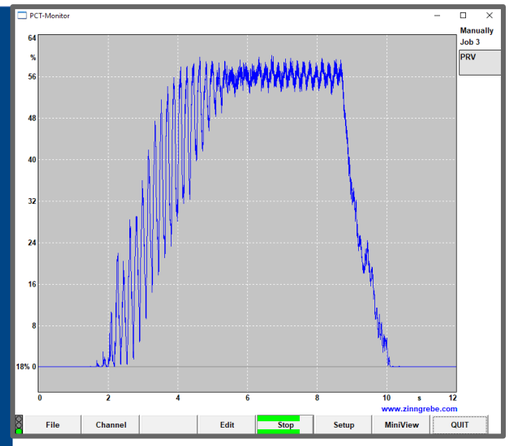
The job instances are separately adjustable in the PCT Monitor. All measurement signals can be displayed together to analyze them better (overlay).



MiniView

*The MiniView is a function which reduces the PCT Monitor to a small window, and **overlays it** on the machine operating program.*



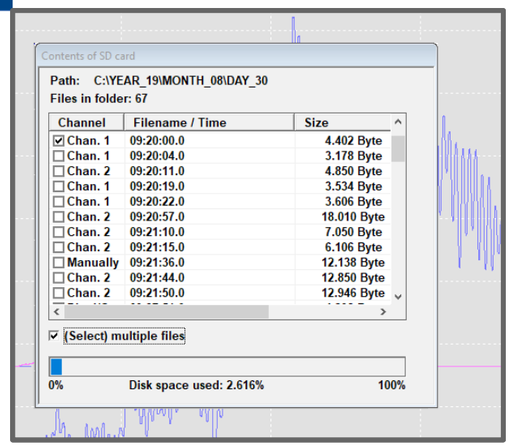


Manual channel

*Pressing the START button on the PCT Monitor activates the manual channel. This channel logs the process data of the last edited job in the **manual monitoring channel.***

17 program languages available:

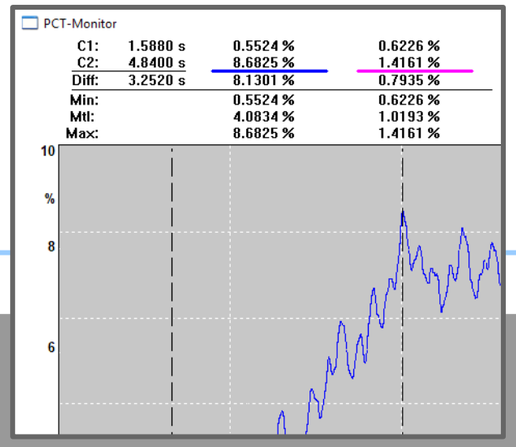
DEU, ENG, ITA, FRA, DAN, SWE, HUN, ZHO, SLK, POL, RUS, SPA, RON, POR, BUL, LAV and TUR.



Display of saved cycles

*Each started cycle is saved as a **PCT file** into the folder structure YEAR\MONTH\DAY on microSD card. This structure can be used for archival storage and supports data recovery.*

*These PCT files can be transferred to PC or USB memory stick and can be displayed on PCT Monitor also **offline**.*



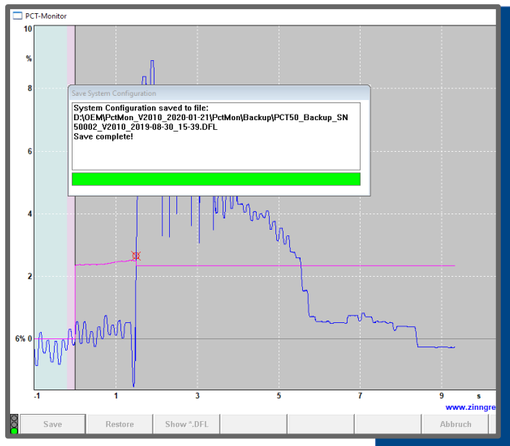
Cursor function

*Two cursor lines can be activated and be moved by the cursor keys. On the top of the process graphic appears the **data information of each single measured value (time and amplitude)** and of each single graph.*

Save and restore backup

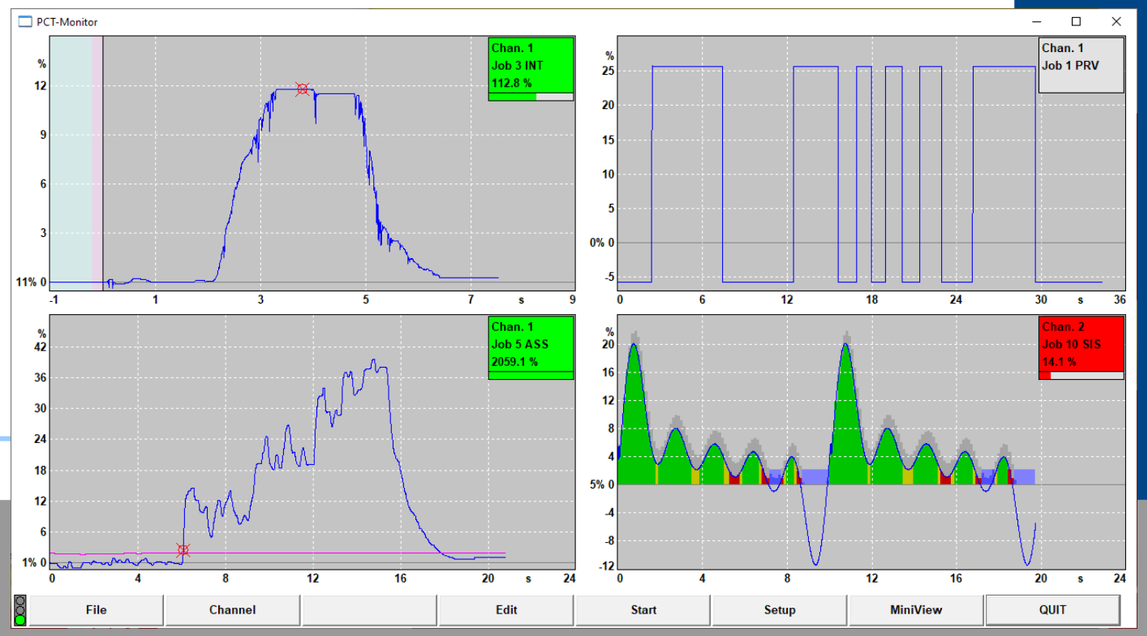
The configuration of the PCT Module is saved in a backup copy (.DFL). This process takes approximately 15 s.*

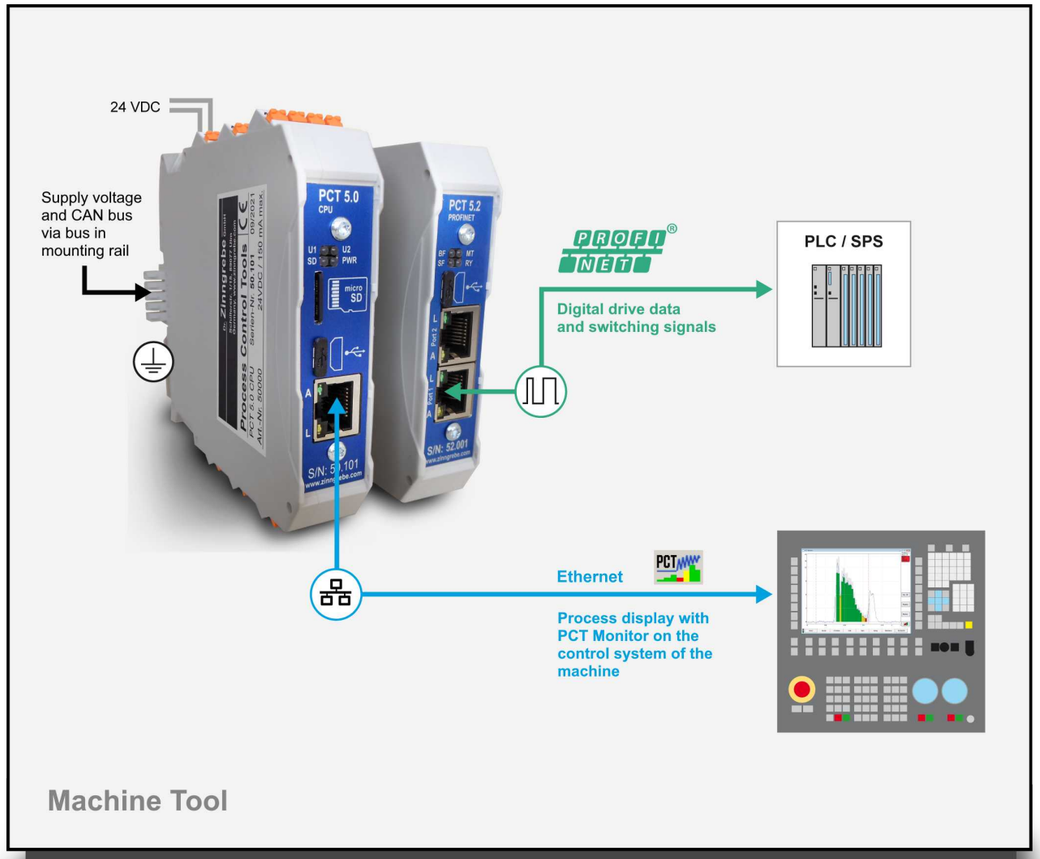
The backup file can be restored to any other PCT Module 5.2 PROFINET.



Window display setting

*In one PCT Monitor window can be **displayed together** up to 4 monitoring channels or up to 4 job instances.*





Example standard connection diagram
PCT Module 5.2 PROFINET.
The wiring effort is minimal.

PCT Modul

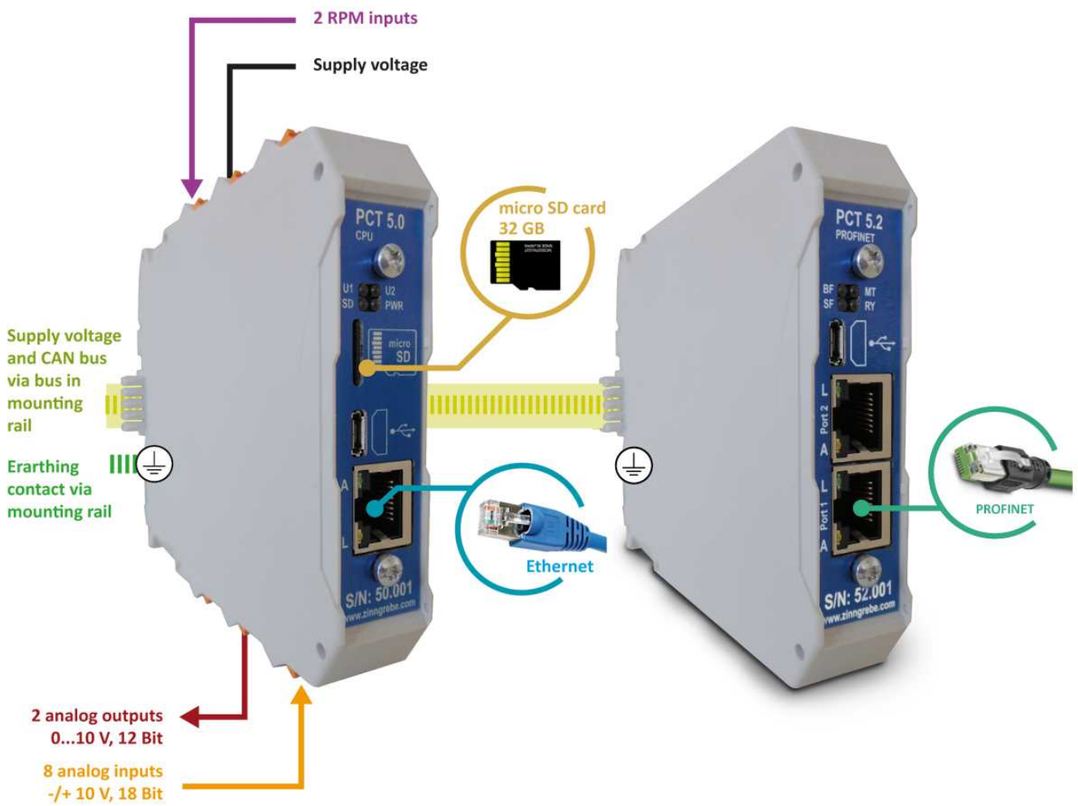
PCT Module impresses with its easy handling, many interfaces (available at no extra charge) and of course the intelligent monitoring strategies.

Process monitoring can immediately start:

- **24 VDC power supply**
- **Ethernet port to the PCT Monitor**
- **Profibus for starting monitoring and for reading the drive machine data from the Siemens controller**

The PCT Module 5.x is modular. For the monitoring of tool breakage we recommend the PCT Module 5.2 PROFINET.

PCT Module 5.1 PROFIBUS	**Art. no. 50100**	
Consisting of the PCB cards	PCT 5.0 CPU CPU card	PCT 5.1 PROFIBUS Profibus®- and digital I/O card
PCT Module 5.2 PROFINET	**Art. no. 50200**	
Consisting of the PCB cards	PCT 5.0 CPU CPU card	PCT 5.2 PROFINET Profinet® card
PCT Monitor	**Free of charge with every supplied PCT Module**	



PCT Module 5.2 PROFINET
Mounted on mounting rail DIN 35 mm
Dimensions: 100 x 62 x 115 mm

PCT Module 5.2 PROFINET

Five monitoring channels can be started independently of one another. So the PCT Module has the functional capability of 5 devices:

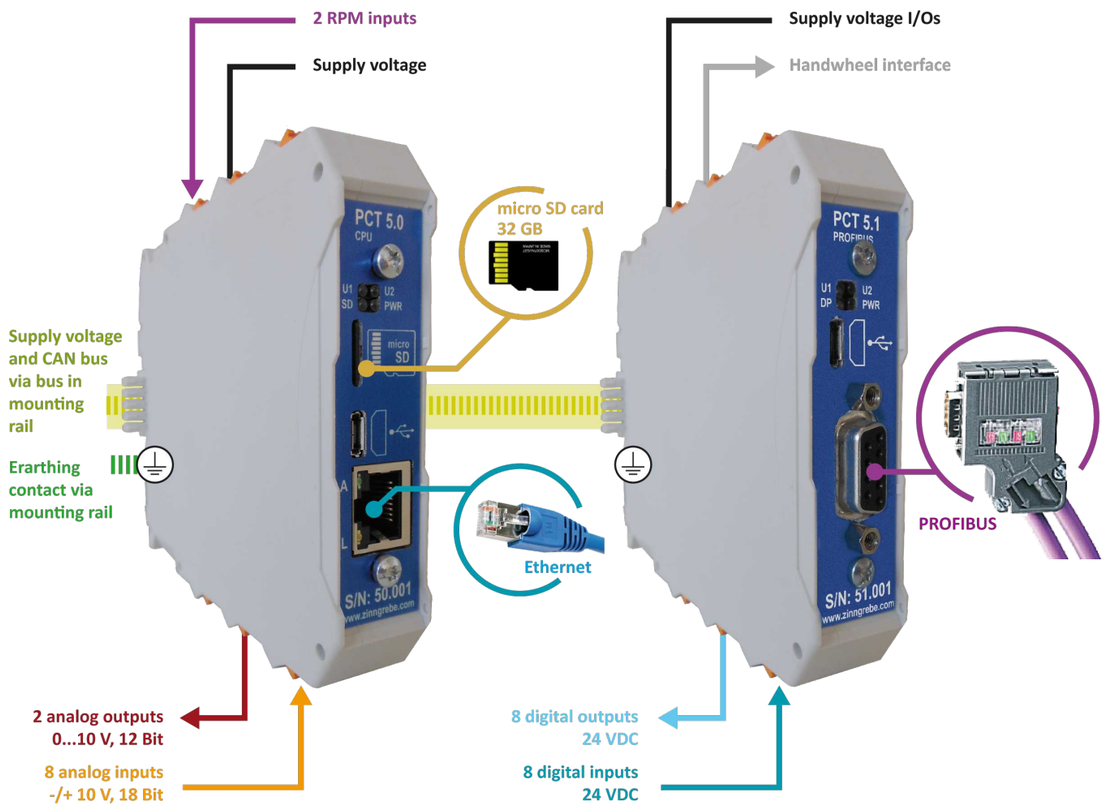
- **4 Profinet channels**
- **1 manual channel (from PCT Monitor)**

All cycles started on PCT Module are permanently saved to microSD card (32GB). Therefore recording can save data over several minutes, hours and also days. When the microSD card is full, the oldest data is automatically deleted.

The data, single PCT files or entire folders, can also be copied on USB stick, if one is inserted in the PC of the machine controller. This data can be displayed at any time with the PCT Monitor on PC.

PROFINET®

EMV ☑
RoHS ☑
CE



PCT-Modul 5.1 PROFIBUS

Digital switching signals, such as e. g. cycle start, learning or job selection, will be transmitted by Profinet or Profibus. If those interfaces are not available, it's possible to connect this NC/PLC signals (+24 VDC) also directly at the terminals.

Next to the 8 digital inputs and outputs the PROFIBUS-card has also a handwheel interface for adaptive grinding. We recommend to use a separate supply voltage +24 VDC, if using the digital I/O's.

The PCT Module 5.1 PROFIBUS is the direct replacement for the PCT Module 4.3. All connectors and terminal numbers and their functions are the same.

PCT Module 5.1 PROFIBUS
Mounted on mounting rail DIN 35 mm
Dimensions: 100 x 45 x 115 mm

EMV ☑
RoHS ☑