

Application report with adaptive Control

SW BA W06-22



of the monitoring system

Toolinspect

Data transmission: Digital
CNC-control: Siemens 840D
Removed material: Alu

**MCU GmbH & Co. KG
Headquarter**

Am Gehrenbach 8
88167 Maierhöfen
Tel. +49(0)8383 92219-76
Fax +49(0)8383 92219-77
info@mcu-gmbh.de
www.mcu-gmbh.de

**MCU GmbH & Co. KG
Global Sales Office**

Max-Eyth-Straße 51
71364 Winnenden
Tel. +49(0)7195 1375-38
Fax +49(0)7195 1375-39
sales@mcu-gmbh.de
www.mcu-gmbh.de

www.toolinspect.de

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Advantages in connection with the tool- and process monitoring system **Toolinspect[®], in series production.**

- at the development the **simple operation and minimal imbeddings** were in the centre in the NC programme.
- **a small instruction** of the using staff is sufficient for Toolinspect
- Simple **operation via 3 – functionkeys.**
- Choose between **19 languages.**
- the system becomes (shift, milling, drill, graters, threads etc., at different CNC engines with different process.)
- Toolinspect can be operated with the common CNC controls. (**Siemens 840D/840Dsl/828Dsl, Bosch Rexroth, Fanuc, Indramat, Bosch, Heidenhain**)
- process fluctuations are recognized automatically and the supervision limits adapt to the changes **without intervention of the operator.**
- **automatic system and data saving on an external CF card.**
- **external module with mobile -- of one's own processor.**
- Optional extension „**adaptive control**“ of rough machining to reduce the processing time.
- **automatic reconnaissance of tool change over tool magazine** and therefore no operation necessary.
- **torque and way information is selected from the CNC control.** Higher processing speed can hereby be driven.
- a more exact supervision is guaranteed selection of processings in three single Sekmente by here:
 - material touch (fluctuations)
 - middle process (constant processing)
 - finishing process (possible fluctuations)

Further information: www.mcu-gmbh.de

- **Monitoring** straight **after tool change.**
- **Process analysis** with data interpretation for technologists and export function of the actual values and machine data to **Excel.**
- **Robust flash memory**
- Optional extension: storage of up to **250 different alarm messages** for 96 hours.

Monitoring system:

The **Toolinspect**® device is used to monitor tools on metal-cutting machines. The data, necessary for this task are normally transmitted to the device by a CNC control via a Profibus-DP interface. The monitoring strategy is automatically selected by the integrated software, according to the tool or machining process. The necessary parameters are determined and entered individually for one machine type by the machine tool manufacturer. No changes or adjustments are then necessary in the NC program or via the visualization interface.

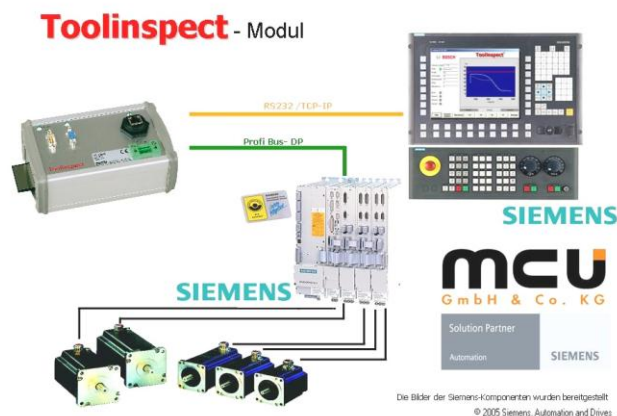
Pic. GE Fanuc Series 320i

GE Fanuc Series 160i bis 300i – Toolinspect Ti/DP1



Pic. Siemens 840D

Siemens 840D mit Toolinspect Ti/DP1



The visualization on external Windows Computers (from Win98) gets connected via a TCP/IP or RS232 interface with the Toolinspect hardware. Alternatively the visualization can be displayed on an extra operating panel.

The SW Technology People:

The Schwäbische Werkzeugmaschinen GmbH – SW – evolved in the mid 1990 from Heckler & Koch Maschinen u. Anlagen GmbH.

Since 2004 SW is part of the EMAG-Group in Salach (near Stuttgart) and since 2008, with the entry of the SDB, a German financial investment company SW is now even stronger with SW shares in the Süddeutsche EMAG Beteiligung GmbH (Stuttgart).

320 committed employees reached a turn-over of more than 110 million Euros. The industrial, commercial and technical apprenticeship for young professionals was strengthened in the past years. Trainee programs will enable and promote creative talents for specialized functions and management capabilities.

A well balanced age structure ensures know-how transfer from experts to beginners. Provident, detailed planning in all technical and commercial areas safeguard the all current demands and consistent new or updated developments aligned with current market demands. We invest several millions of Euros each year into new machines, the improvement of existing SW machines and people, as well as for better external and internal services.

If you want to learn more about our programs and plans, please contact us or our colleagues in your branch offices. You can reach us at www.sw-machines.de or at +49 7402-74-0.

SW. The Technology People.

Test result:

After the installation, the machine processed flange- workpieces out of aluminium. Over the Toolinspect system, milling, drilling from 3.0 mm and threading from M6 could safely be monitored.

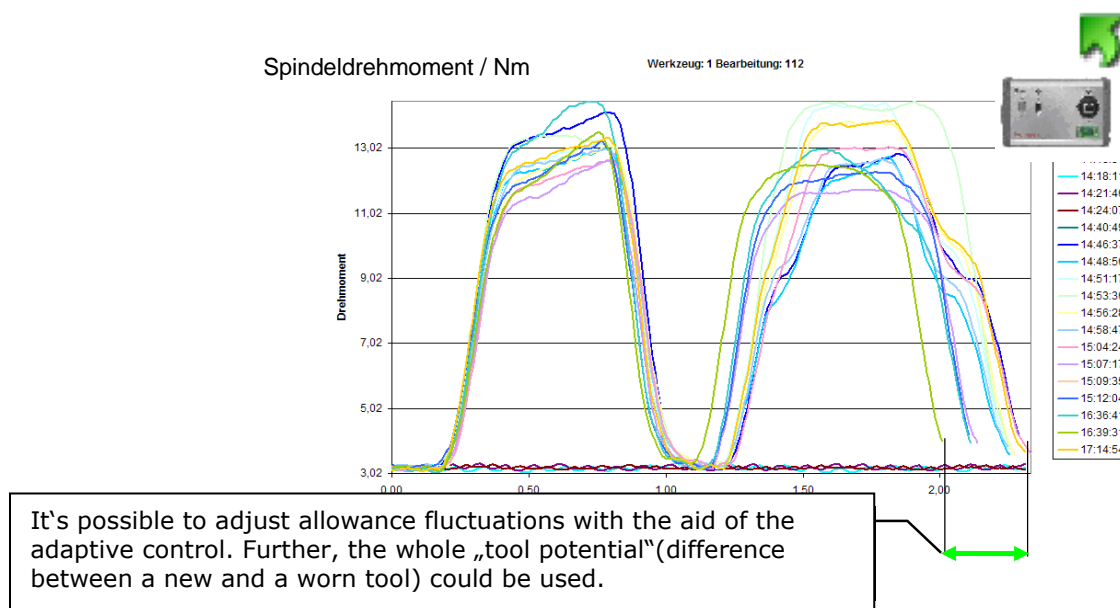
The operator does not need a visualization to set parameters or limits, this part is done automatically from the Toolinspect module.

All information is shown at a text display. The machine operator only requires 3 function keys (at the Siemens 840D control) to run Toolinspect.

(depending on the current feed control spindle torque) The use of the adaptive system can compensate for fluctuations in mass to the tool and potential (the difference between new and worn tool) is utilized.

The adaptive control of machining processes of milling and drilling operations will enable processing of an M-specific function in the NC program.

With the AC-controlled tools, a cycle time reduction was higher than 3%.

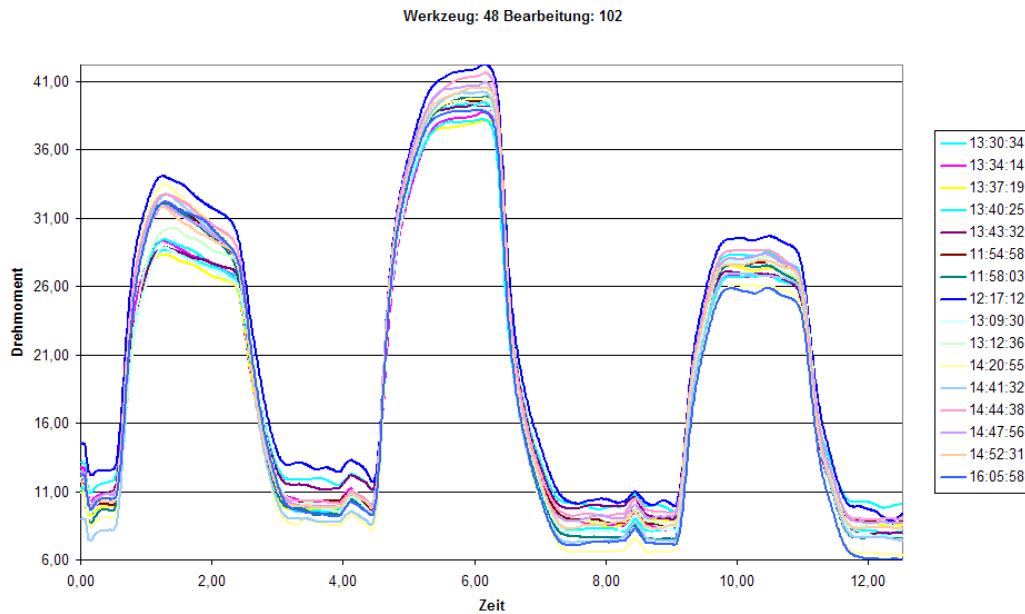


Basic conditions:

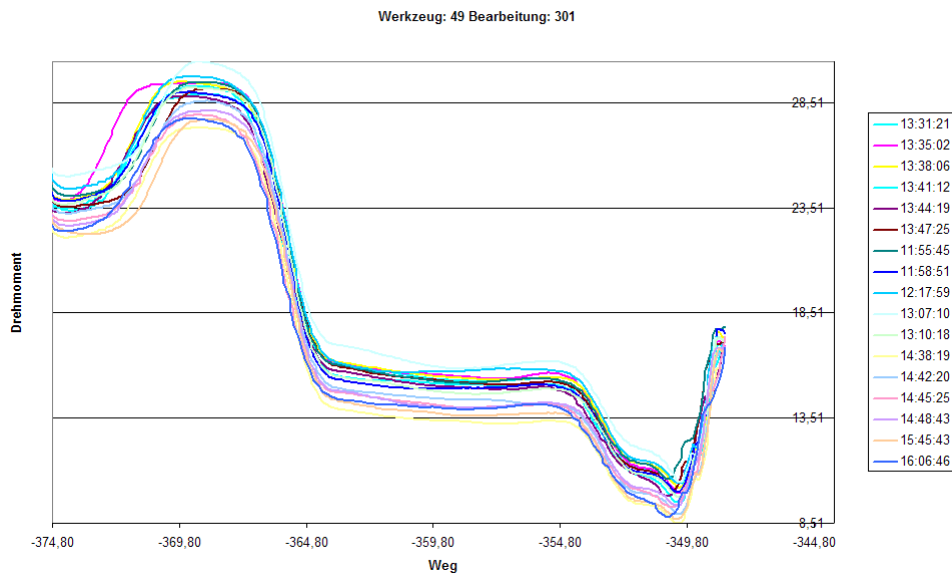
In general, there is diversity in all machining processes, concerning torque values and other process specific data.

In Image 1, the edits (with cutter tool 48) are shown with different cutting forces. Here are variations on mass of steel casting noted.

Image.1

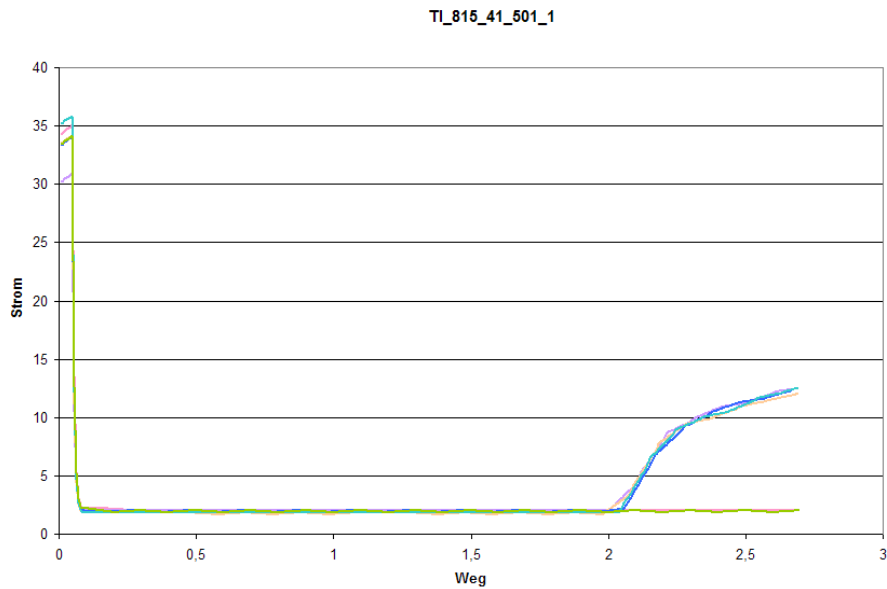


In Image 2, the editing (with a special tool T49) are shown with different cutting forces. Here are the tailor fluctuations observed.



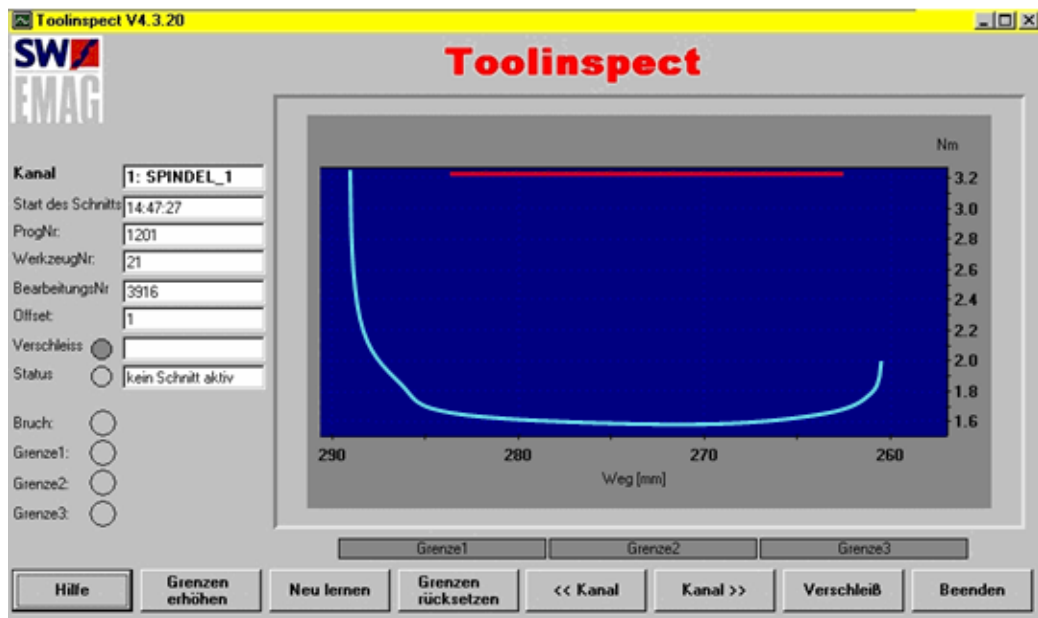
In Image 3, the editing (with tool 41) are shown with very reproducible data. Here are just a little to determine mass variations.
Here, between the processing and double handling a signal difference more easily.

Image.3

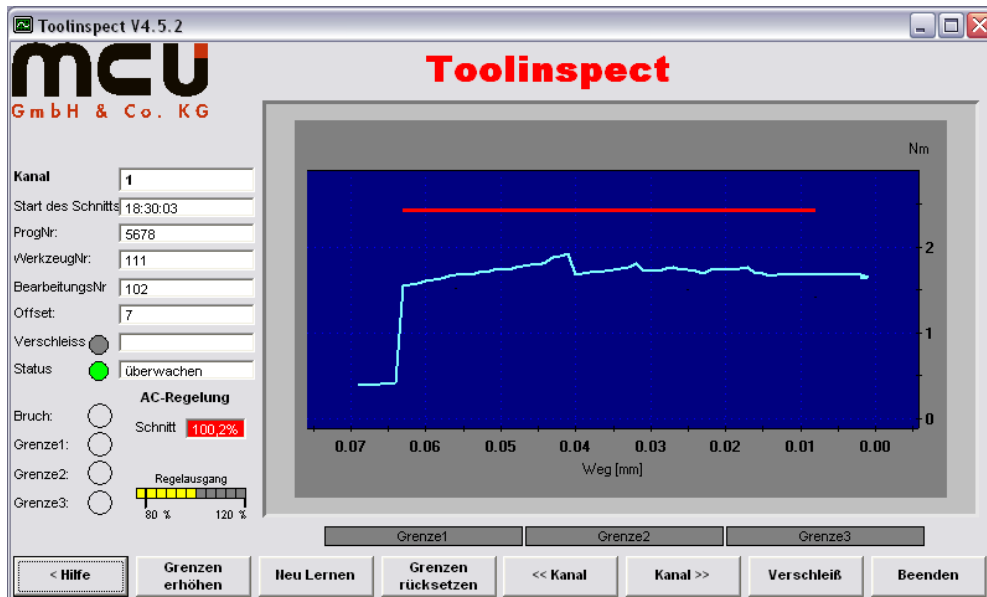


In Image 3 the user interface is shown. Here, the cutting forces of all machining cuts are visualized.

Image.3



Operation and visualisation : 1



“Reset limits” button

This button resets the system for the active program (the program which is displayed in the interface under Prog. no. :) to the original values and relearn is carried out.

“Relearn” button

This button is used to carry out relearn. The program-specific data (increased limits) are not reset. The limits readjust to the actual values in the following machine cycles.

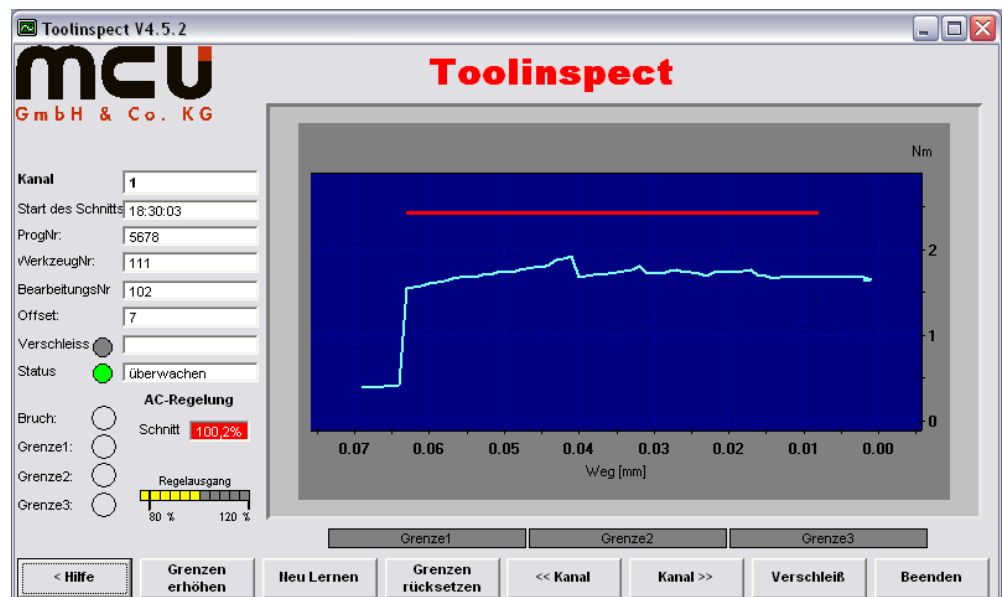
“Increase limits” button

If an incorrect message is generated by Toolinspect, the limit of the relevant fault message (switching threshold which generates a fault message) can be increased by pressing the F2 button. If this cut is reactivated in the next machine cycle, the increase of the limit is marked in yellow.

“Help” button

This button is used to call the Help function. Monitoring remains active. All histories of alarms are displayed as a sub-item “ALARMS”.

Operation and visualisation : 2



“<< Channel” button

This button is used to switch over (decrement) the active channel, e.g. from channel 2 to channel 1.

“Channel >>” button

This button is used to switch over (increment) the active channel, e.g. from channel 1 to channel 2.

“Wear” button

This button is used to visualise wear monitoring. This is an option. If the option is not activated, a demo screen appears here.

“End” button

This button ends the visualisation. Monitoring remains active.

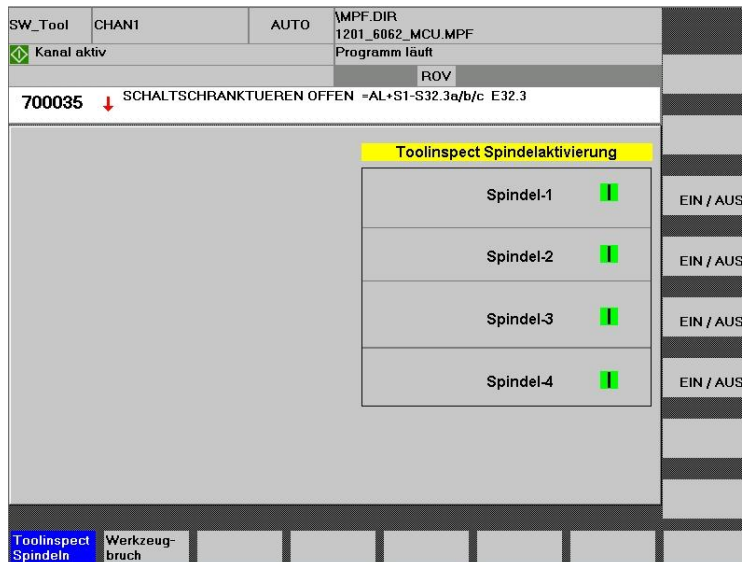
Displays

In the left-hand section of the screen, displays show the increased and deactivated limits in yellow or orange. In the middle of this display, an alarm of the relevant limit is shown in red.

Operation SW- spindle Interface:

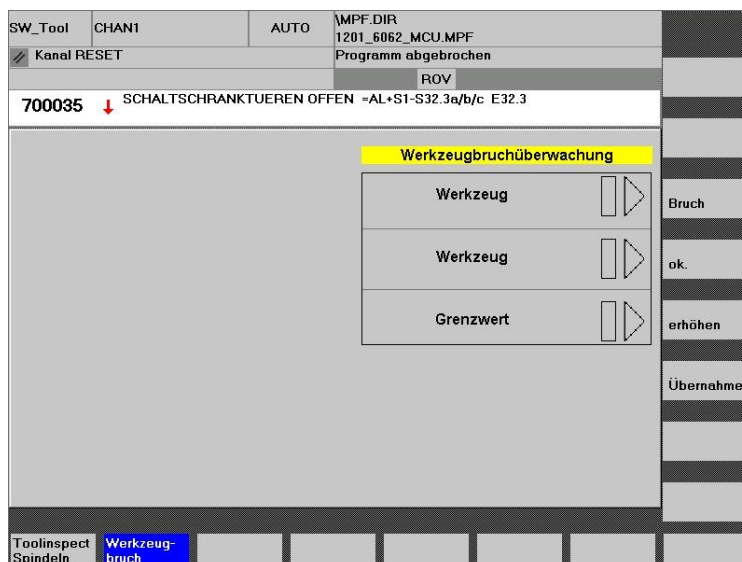
SW – interface for Toolinspect – spindle selection

This interface can be used to select and deselect the various spindles which should be taken into account by monitoring.



SW – Interface for the Toolinspect – Break monitoring

On this interface, the tools are registered as broken and for tool management detected more accurately. In addition, a marginal increase in alarms per alarm will be generated.



Summary:

The operation is imaginable simple and only a few modifications are required to the CNC program. The operator does not have to set any limits or parameters for monitoring. Not even at a change of the machined workpiece type or when new NC programs were written. The system adapts automatically to various operating states of the machine (wear, changes in temperature, etc) and selects the appropriate monitoring strategy automatically.

The installation was proportional easy. The modifications in the PLC program, the integration of Toolinspect into the control and the data transfer via Profibus DP is extremely flexible and well structured. It's also possible to connect **Toolinspect**® via TCP-IP or a serial interface with a Windows computer.

MCU GmbH & Co. KG:

If you have any further questions concerning this application report, please contact the sales office of MCU GmbH & Co. KG in Winnenden.

Address:



MCU GmbH & Co. KG
Global Sales Office
Max – Eyth – Str.51
D-71364 Winnenden/Germany

Telefon +49 (0) 7195-137538
Fax. +49 (0) 7195-137539

Email : sales@mcu-gmbh.de

Internet : www.mcu-gmbh.de



SW Schwäbische Werkzeugmaschinen GmbH:

If you have any further questions concerning this application report, please contact the sales office of SW Schwäbische Werkzeugmaschinen GmbH.

SW Schwäbische Werkzeugmaschinen GmbH

Seedorferstr. 91
D-78713 Schramberg- Waldmössingen

Telefon +49(0)7402- 74- 0

Fax. +49(0)7402- 74- 211

E-Mail: info@sw-machines.com

Internet: www.sw-machines.com

Information on the data sheet

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