PRODUCT INFORMATION

OTT JAKOB Spanntechnik

MSU Sensor System

LONG-LIFE CLAMPING TECHNOLOGY INSIDE

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JAKOB GRUPPE

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symbol explanation:

keep attention - dangerous!

keep attention - malfunction!

Approvals

We hereby declare that the device, both in its basic design and construction and in the version marked by us, conforms to the relevant requirements of the EMV directive 2014/30/EG.

Norms applied:

DIN EN 61000-6-2:2005	(interference immunity for industry applications)
DIN EN 61000-6-3:2007+A1:2011	(emitted interference for living, business and small business areas)

WEEE Directive (2012/19/EU)

This device is regarding to article 2, paragraph 3b under the following exception:

„equipment which is specifically designed and installed as part of another type of equipment that is excluded from or does not fall within the scope of this Directive, which can fulfil its function only if it is part of that equipment"

RoHS- Directive (2011/65/EU)

This device is regarding to article 2, paragraph 4c under the following exception:

„equipment which is specifically designed, and is to be installed, as part of another type of equipment that is excluded or does not fall within the scope of this Directive, which can fulfil its function only if it is part of that equipment, and which can be replaced only by the same specifically designed equipment"

The device complies with all required tolerances as described in annex 2 of the RoHS-Directive.

CE

1 SAFETY NOTES

Always consider the following points:

- Follow the operating instructions
- Avoid impacts and vibrations to the system
- The system has to be connected following the safety directions for electrical equipment
- Protect wire against damage
- Check the correct wiring on all connections before starting the system
- Power supply may not exceed indicated values
- Observe the notes about shielding! → # 3.1.2 // 12
- The system may be operated only within the specified technical values and limits.
- Commissioning, adjustments and operation is allowed only by qualified personnel.
- In the cases of improper system adjustment or use, the OTT-JAKOB company will not accept any liability.

1.1 INTENDED USE

The stroke measuring system that is integrated in the unclamp unit detects the position of the drawbar and thus the current tool position.

The querying of piston position is integrated in the release unit and monitors the position of the release piston.

This sensor technology is designed for industrial use only.

The measuring system may be operated only within the values given in the technical data.

The corresponding technical and safety related regulations apply to assembly, commissioning and the consecutive operation. All thus related EC laws and guidelines and all necessary EMC, TAB, VDE and accident prevention regulations.

The measuring system must be programmed in such a way that during malfunction or total failure of the measuring system, no persons are harmed or machines are damaged.

The Sensor System is not a safety device per the EG-Manufactures Standards, and because of this reason, it is not allowed to be used in safety related ports of the machine controls!

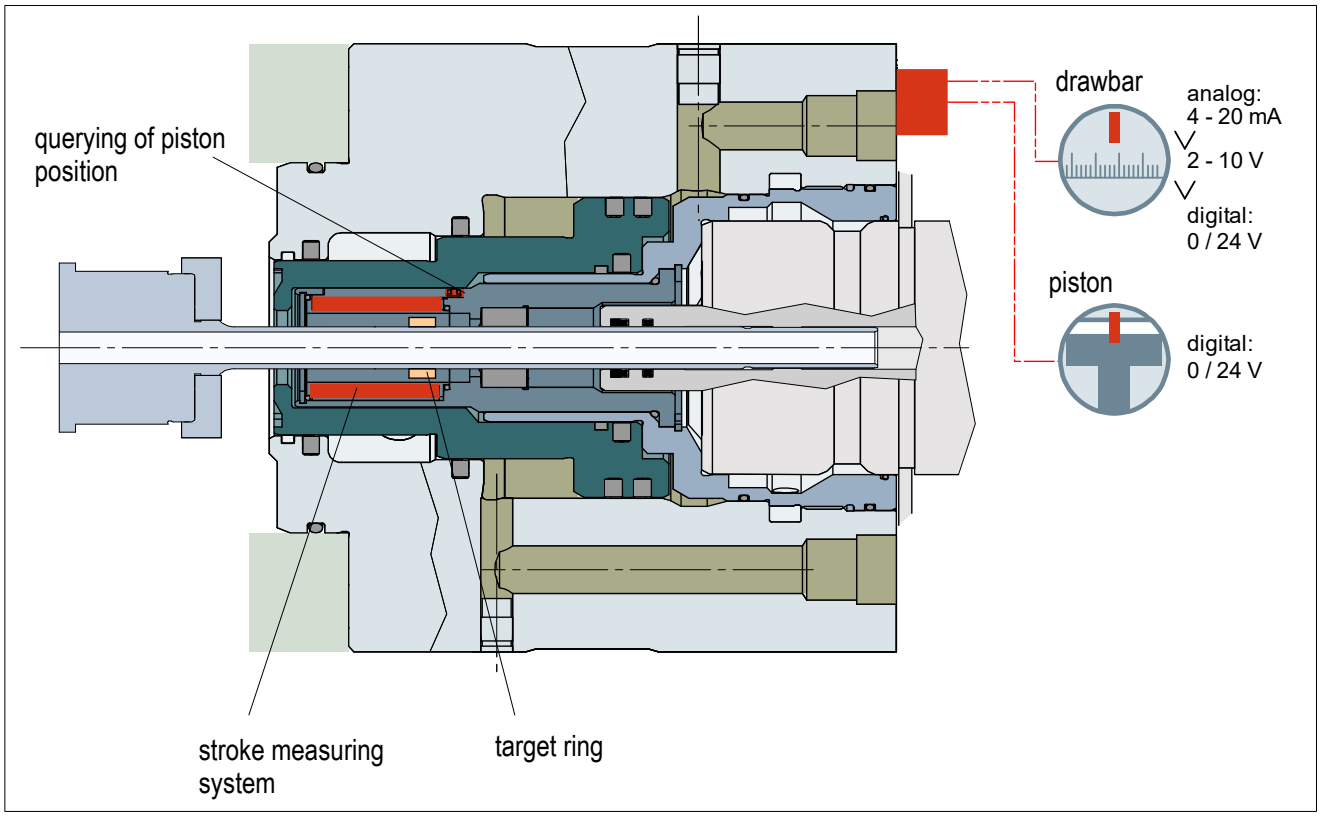
The limit values may be adjusted only by instructed specialists.

2 PRODUCT DESCRIPTION

Modern tooling machines perform the tool change automated. The spindle rotation should start shortly afterwards. To prevent damages, hazards, abrasion on the clamping system and scrap parts it is necessary to check if the tool is clamped correctly and if the release piston is in the right position.

It is possible to design compact release units by using the MSU - sensor system because all necessary sensors are already built in.

For the first electrical commissioning it is only necessary to plug in one sensor wire.
There is no need to adjust the mechanical part of the measuring system. The monitoring is accomplished by inductive measuring wear-free.



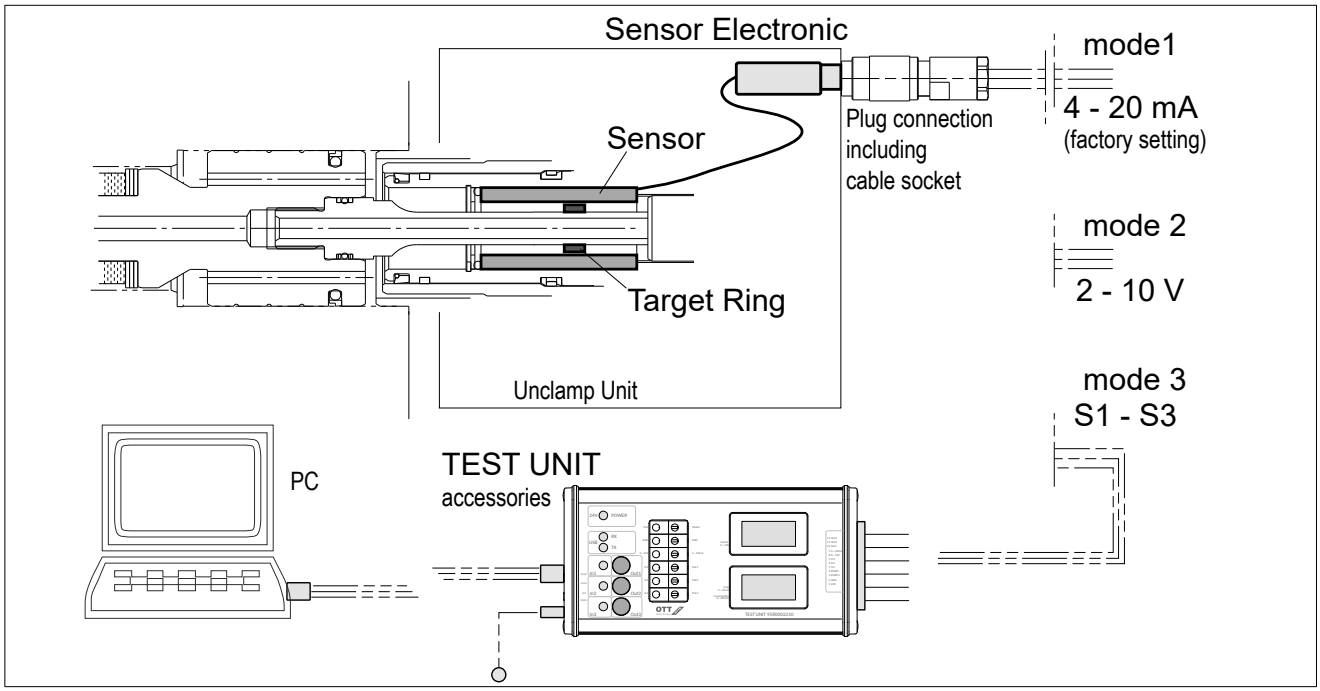
It is possible to set switch values and to relate the position of the pull rod with the position of the piston. As a result there is no need to invest time in programming to check if the spindle rotation is enabled. For setting up the sensor OTT-Jakob offers a tried and tested procedure, which considers the real tolerances of the tool and of the clamping system.

2.1 SENSOR SYSTEM

2.1.1 Position of the drawbar

- The stroke measuring system that is integrated in the unclamp unit detects the position of the drawbar and thus the current tool position.
- Tool unclamped
- Tool clamped
- Clamped without tool

The unclamp unit contains a cylindrical, inductive sensor.
The drawbar connection moves axially through the sensor. A target ring on the drawbar connection triggers the output signal. The signal increases the further the target ring enters the sensor (view from the line exit).
The signal is also available during rotation.



2.1.2 Piston

The querying of piston position, which is integrated in the release unit, monitors the position of the release piston. This prevents that the piston is touching the rotating expansion chuck during rotation of the spindle.

2.2 OPERATING MODES

The following signal output options are available:

	Position of the drawbar	Piston
Mode 1	analogue output signal 4 – 20 mA	digital output signal 0 / 24 V
Mode 2	analogue output signal 2 – 10 V	digital output signal 0 / 24 V
Mode 3	S1 / S2 / S3 3x digital output signal	

2.2.1 Mode 1

Position of the drawbar: Current-signal

- 4 mA ≙ min. measuring range
- 20 mA ≙ max. measuring range

Compared to a voltage signal, the 4 - 20 mA current signal is less sensitive to electrical interference (e.g. Linear drives, motors, power cable, HF-technology ...).
The analog current-signal can be transferred over longer distances (up to 50 m line length).

Piston: digital output signal

- 0 V ≙ piston extended (unclamped)
- 24 V ≙ piston retracted (clamped)

2.2.2 Mode 2

Position of the drawbar: Voltage-signal
- 2 V ≙ min. measuring range
- 10 V ≙ max. measuring range

The voltage signal depends upon the total resistance. If the spindle manufacturer gives certain values for adjustment, the following factors must be considered
- cable resistance / cable length
- inner resistance of the measuring devices and the controls

These factors may falsify the predefined setting values; may result in system failure.

Piston: digital output signal
- 0 V ≙ piston extended (unclamped)
- 24 V ≙ piston retracted (clamped)

2.2.3 Mode 3

Digital switching points
- S1 – S3; Interpretation and adjustment of the switching points → # 4.4 // 17

2.3 SELECTING THE OPERATING MODE

2.3.1 Factory setting

Factory setting by OTT-JAKOB. Please specify when ordering!
- Default: Mode 1

2.3.2 MSU CONFIGURATOR

Necessary equipment:
- TEST UNIT
- PC-program MSU CONFIGURATOR

2.3.3 USER SELECT

USER SELECT offers the possibility to select the mode by the use of the wiring in the switch cabinet. The free input of PIN2 is used. Immediately after start-up, the sensor electronics queries the cable assignment and determines the mode accordingly.
This selection variant is only possible if this selection option was previously activated with the TEST UNIT.
User Select - connection scheme → # 3.1.3 // 13
User Select - Activation with TEST UNIT → # 4.3.1 // 17

2.4 TECHNICAL DATA

supply voltage U_B	21 ... 27 V DC polarity-safe
supply current J_B	< 50 mA (without switch outputs)
universal output	Mode 1: 4 – 20 mA (standard) Mode 2: 2 – 10 V (adjustable) Mode 3: 0 / 24 V (adjustable)
digital input (1x)	0 / 24 V
digital output (2x)	0 / 24 V
load resistance RL	< 500 Ω
switch outputs	max. 100 mA
temperature range	0° C ..... +85° C
safety standard	IP 67

2.5 ORDER NUMBERS

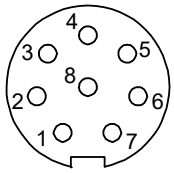
Designation	Order number
MSU Sensor System	depending on the unclamp unit used
Accessories	
cable box loose, shielded	0961121013
cable box, connected with 2m wire, shielded	0961121015
cable box, connected with 5m wire, shielded	0961121016
cable box, connected with 20m wire, shielded	0961121020
cable box 90° angled, h = 40 mm connected with 2m wire, shielded	0961121017
cable box 90° angled, h = 30 mm connected with 2m wire, shielded	9580007132
cable box 90° angled, h = 40 mm connected with 5m wire, shielded	0961121018
cable box 90° angled, h = 30 mm connected with 5m wire, shielded	9580007932
TEST UNIT including AC-adapter and USB wire	9580002210
connector strip for TEST UNIT	0961220003

3 START-UP

3.1 ELECTRIC CONNECTION

The sensor is pre-assembled in the unclamp unit and connected with the sensor electronics.
A connector is supplied at the output of the sensor electronics unit.

3.1.1 Pin assignment

		*	Mode 1	Mode 2	Mode 3
	1	white	24 V		
	2	brown	IN 1: is only required for User Select → # 3.1.3 // 13		
	3	green	RS485- (optional)		
	4	yellow	analogue output signal 4 – 20 mA (drawbar position)	analogue output signal 2 – 10 V (drawbar position)	S3 0 / 24 V
	5	grey	digital output signal 0 / 24 V (piston position indication)	digital output signal 0 / 24 V (piston position indication)	S1 0 / 24 V
	6	pink	-		S2 0 / 24 V
	7	blue	GND		
	8	red	RS485+ (optional)		

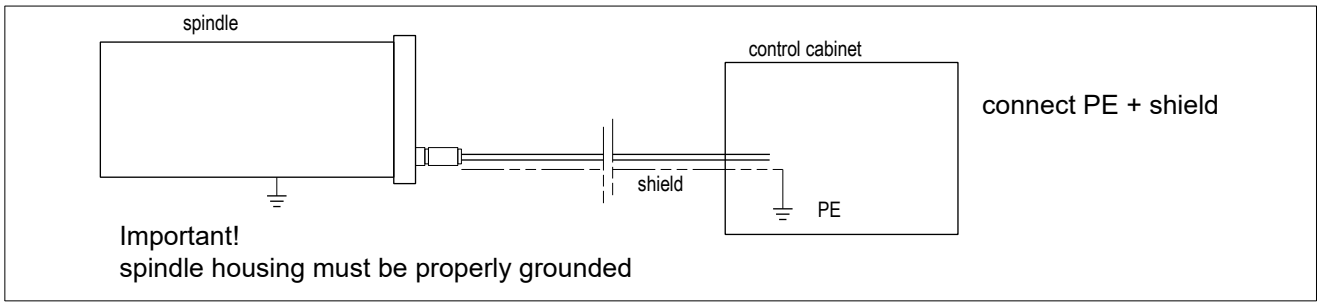
* core colour at OTT-JAKOB

Requirements to the connection line (not in the scope of delivery) when using the cable box loose:
- exterior diameter 3.5 - 5 mm
- 4 (up to 8) x 0,14 mm2 (AWG 26)
- shielded
- highly flexible suitable for use in drag chains
- maximum length with corresponding interference elimination: 50 m

◢ Connect shield at plug housing → # 3.1.2 // 12
◢ Connect shield to PE in the control cabinet

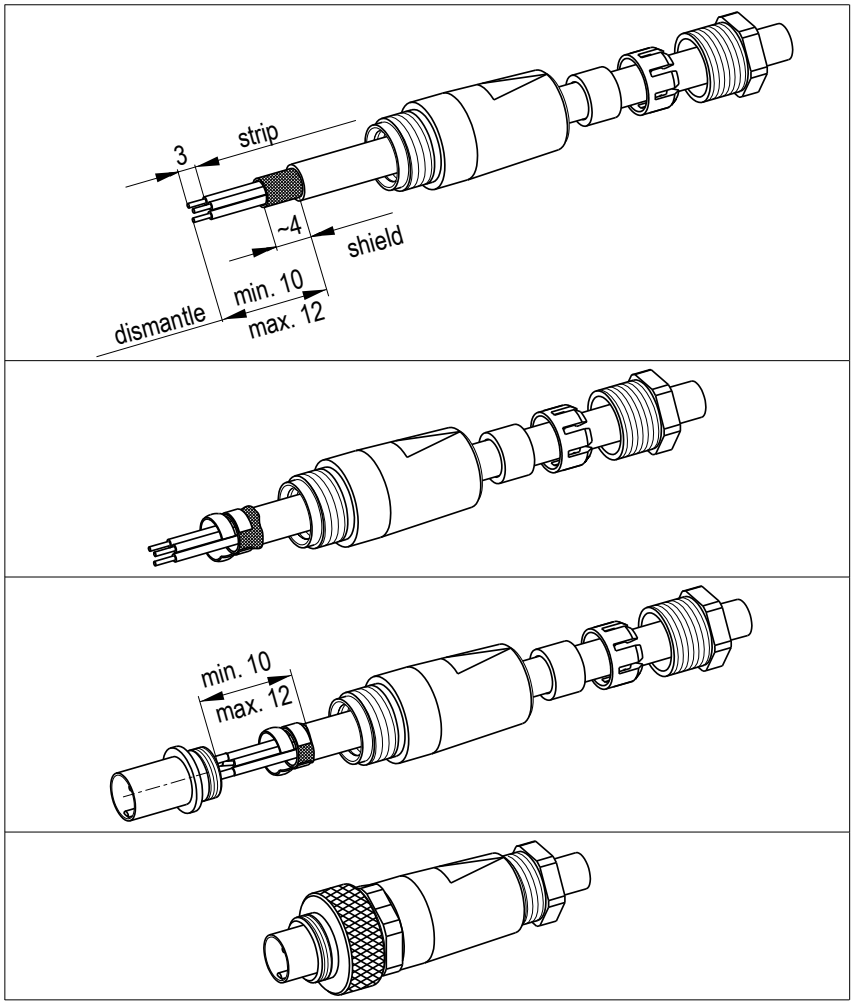
3.1.2 Shielding

Recommendation when using the cable box loose:



When using non-conductive bearings (between rotor shaft and spindle) the shield must be connected to the plug of the unclamp unit. The other end must be connected to GND / PE in the control cabinet.

Correct shield wiring



- Bead parts
- dismantle isolation
- shorten shield
- strip wire

- Fold shield back
- fit collar to outside diameter and solder with shield

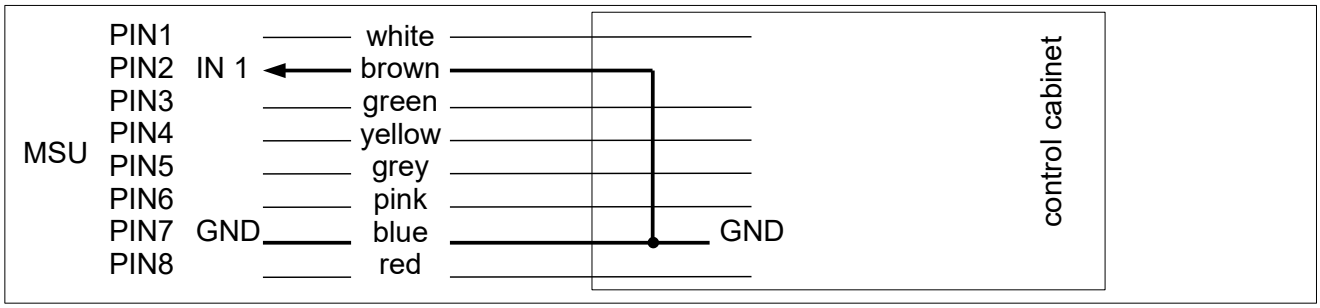
- Cut off projecting shielding braid
- solder insert

- Mount remaining parts acc. to figure

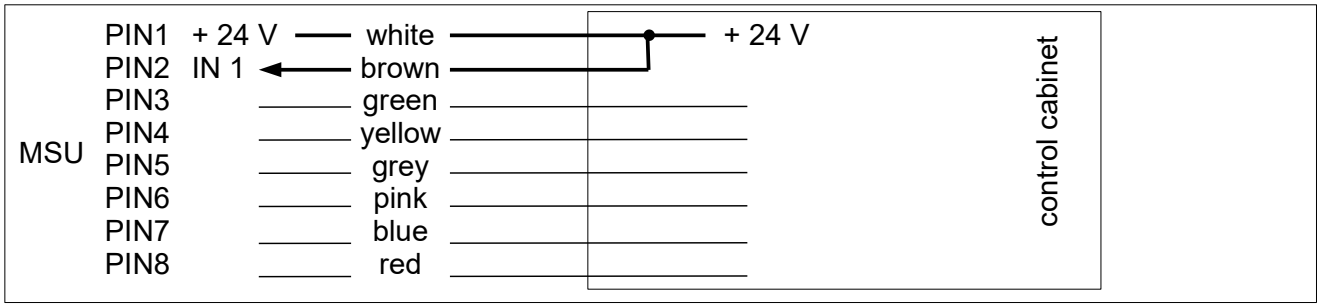
3.1.3 User Select - Connection scheme

description → # 2.3.3 // 9

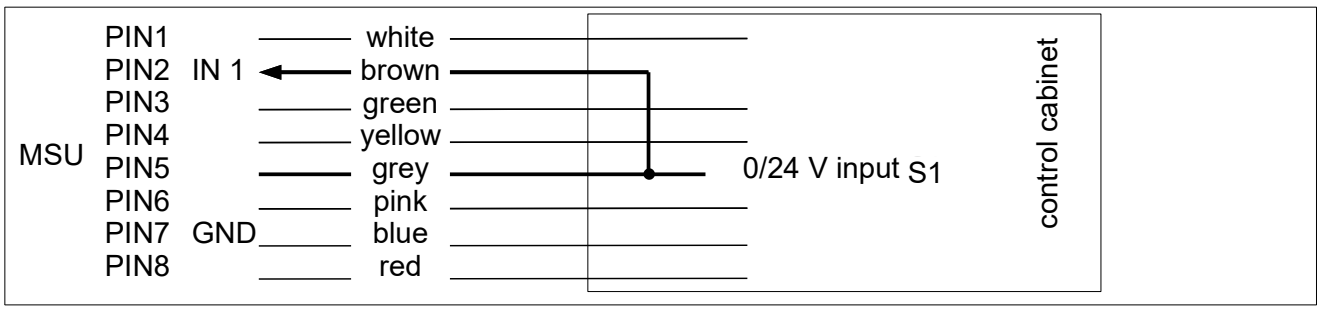
Mode 1: Current-signal



Mode 2: Voltage-signal



Mode3: digital



4 SETTINGS AND DIAGNOSTICS

Option

The manual analysis of the pullrodposition-signal and the piston position signal (operation mode 1 and 2) by programming the machine control offers the advantage that the switching points can be set easily on the user interface. Additional information, for example the length of the release process or the number of tool changes, can be derived as well.

In many cases a fast commissioning of the machine is priority. In this case OTT-JAKOB offers to save the switch limits in the sensor (operation mode 3). It is sufficient to read three switch signals with the machine control if those switching limits have been saved during manufacturing of the spindle. The time effort to program the release of the spindle rotation is reduced to a minimum. At the same time mistakes during commissioning due to a false control of spindle components are more unlikely.

The MSU sensor can be configured with a PC program. The sensor system is connected with the PC by using the TEST UNIT from OTT-JAKOB. This device is also capable of showing a voltage signal, a current signal and three digital signals with LEDs. The effect of changed sensor signals or configuration parameters can be checked in real time and it can be ensured that afterwards the machine control gets the right sensor signals. The TEST UNIT can be connected during sensor operation if a re-configuration or a function test is required.

Required accessories:

- **TEST UNIT**
- Connection Sensor - TEST UNIT
- connector strip
- PC-Program MSU CONFIGURATOR (MSU.exe)
  system requirements:
  - windows pc (starting at WIN XP)
  - USB - port

4.1 INSTALL PROGRAM

- At the windows PC:
  start **msu.exe**
  Mind the hints on the windows PC!

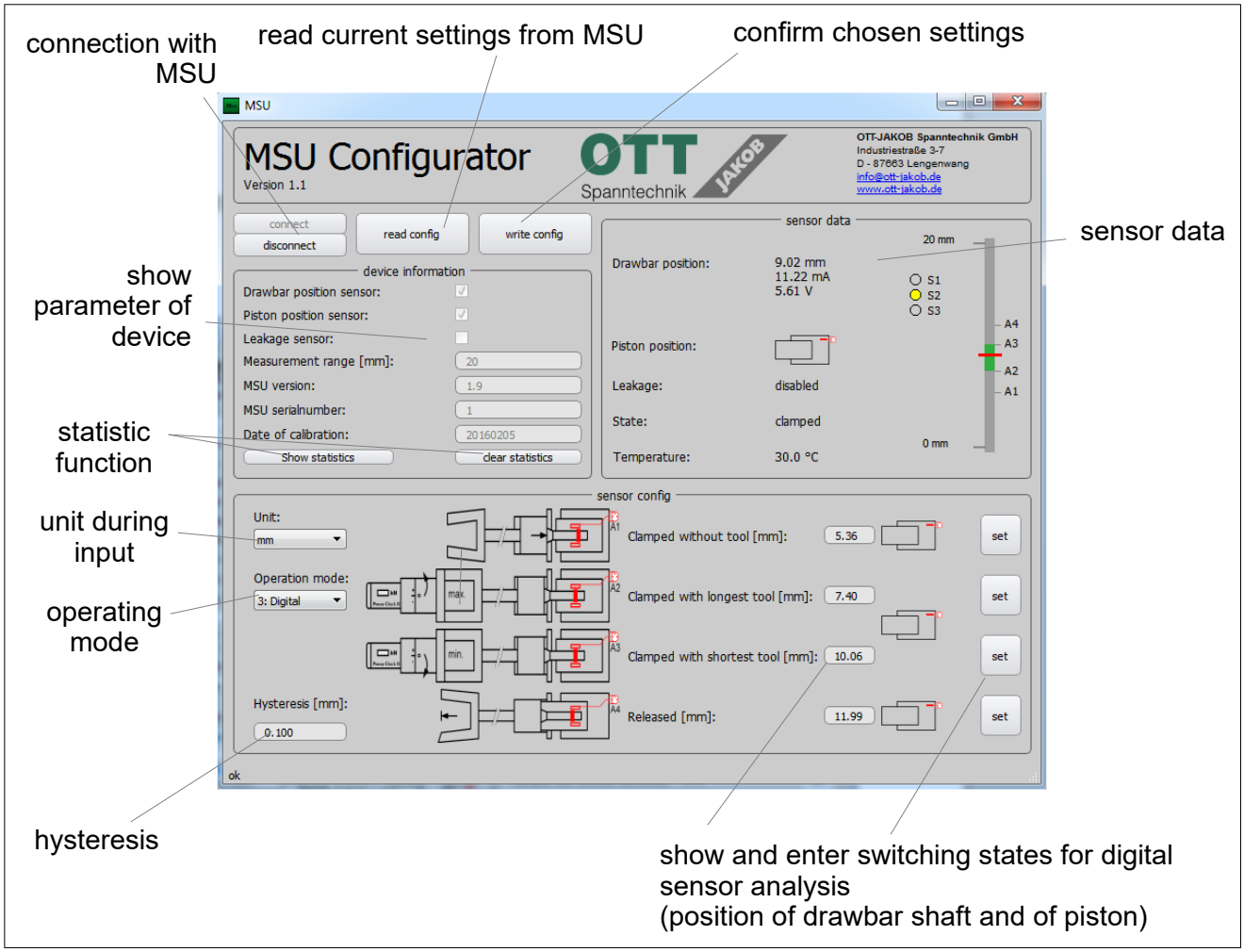
The program is installed. A shortcut is added to the Desktop and a directory is added to the windows start menu.

4.2 START PROGRAM

- supply TEST UNIT with power via the AC-adapter
- connect TEST UNIT with sensor system
- connect TEST UNIT with PC
- start **MSU CONFIGURATOR**
- press **connect**

connecting -> Statusbar OK

4.2.1 The user interface



4.3 SELECT OPERATING MODES

- disconnect yellow core (position of drawbar) from TEST UNIT
- select the desired operation mode in the program
- confirm with **write config**
- connect yellow core on the appropriate position:
  - 9: current signal 4 – 20 mA (factory default)
  - 8: voltage signal 2 - 10 V
  - 7: In3 digital switching values

4.3.1 User Select - Activation

With **User Select**, it is necessary to activate this function beforehand. This is also done in the **Operation Mode** selection field.

4.4 DIGITAL SIGNAL ANALYSIS

(Mode 3)

The sensor is capable of showing digital switching points S1-S3 (0 / 24 V).

In order to get digital signals the switching points have to be set. This is possible by using the TEST UNIT and the SOFTWARE MSU CONFIGURATOR.

4.4.1 Configuration of the switching points

- The configuration of the limit values A1 to A4 must be done for each tool spindle!
- Changing the clamping units requires a new configuration.

When sensors connected:

- Select the desired unit (mm, mA or V) in the UNIT selection box.

- clamping system must be in position **"clamped without tool"**
- when querying of piston:
  retract piston
- press appropriate **set**-button

- clamping system must be in position **"clamped with permitted max. tool"**
  Use a appropriate reference tool for this purpose.
  we suggest to use **Power-Check** with appropriate configuration
- when querying of piston:
  retract piston
- press appropriate **set**-button

- clamping system must be in position **"clamped with permitted min. tool"**
  Use a appropriate reference tool for this purpose.
  we suggest to use **Power-Check** with appropriate configuration
- when querying of piston:
  retract piston
- press appropriate **set**-button

- clamping system must be in position **"unclamped"**
- when querying of piston:
  extend piston
- press appropriate **set**-button

The values are shown in the chart. The program checks the plausibility of the values. Values A1 to A4 are increasing when configuration is correct.

- **press write config** to use the values;
  the values are saved and shown in the column **sensor data**

Finished! You can disconnect the USB-connection and connect it to the next release unit if necessary. Press again connect for a new configuration.

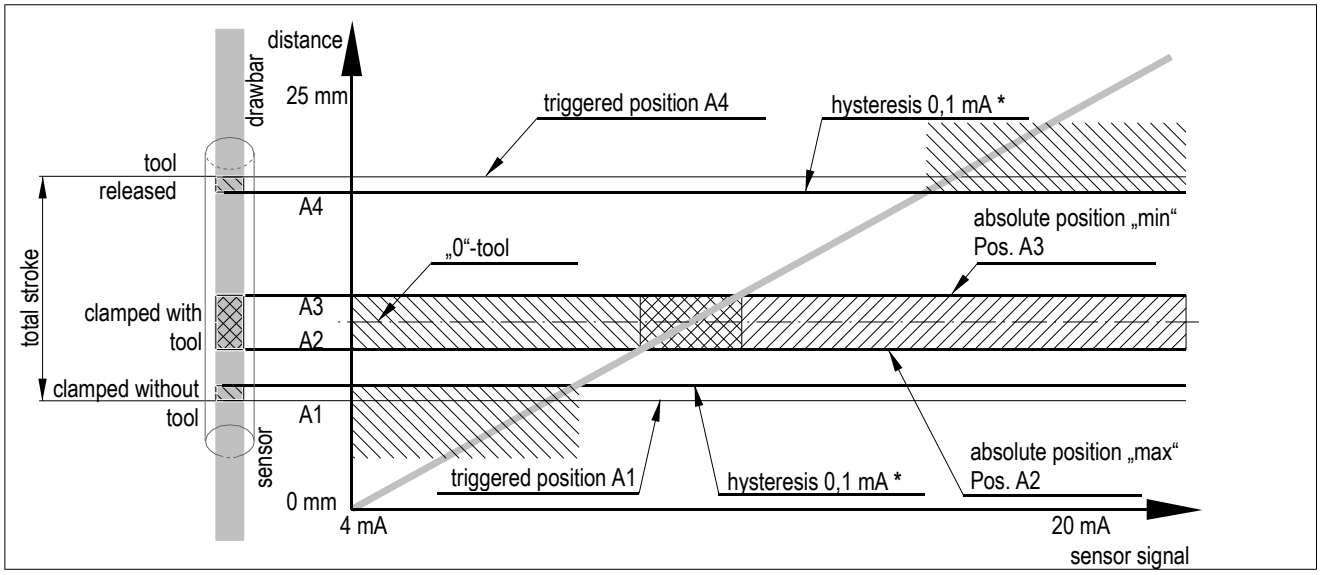
4.4.2 Switching Point Analysis

(0 ≙ 0 V / 1 ≙ 24 V)

	S1	S2	S3
not ready	0	0	0
tool unclamped	0	0	1
tool clamped	0	1	0
Interference: tool clamped and unclamped: failure. S2 and S3 are set briefly during working stroke	0	1	1
clamped without tool	1	0	0
failure	1	0	1
Interference: clamped with and without tool: failure	1	1	0
piston fail: ● tool clamped and piston extended ● tool unclamped and piston retracted ● clamped without tool and piston extended	1	1	1

Analysis of the Switching Points

With the switching values A1-A4 (which are configured via the PC - Software) three switching states can be indicated: clamped, clamped without tool and unclamped (see following graphic)



In practice, the signal "clamped with tool" has a special meaning. Normally here is specified in which axial area the pull rod connection in the sensor has to be and that the release piston is in the retracted position. To find a valid area for the pull rod position is often not easy. When the area is too big it is possible that the tool is not clamped correctly and the work process starts nevertheless. When the area is too small different tools can cause error messages due to tolerances. Still, the area for "clamped with tool" depends on the clamping system and the tool interface.

OTT-JAKOB offers with his measuring device "POWER CHECK 2" the possibility to set this area very precisely. The POWER CHECK 2 can readjust and set the shortest or longest tool (A2 and A3) which is allowed according to the standard. In practice, if the switching values are set with this procedure the correct clamping and clamping failures can be indicated precisely.

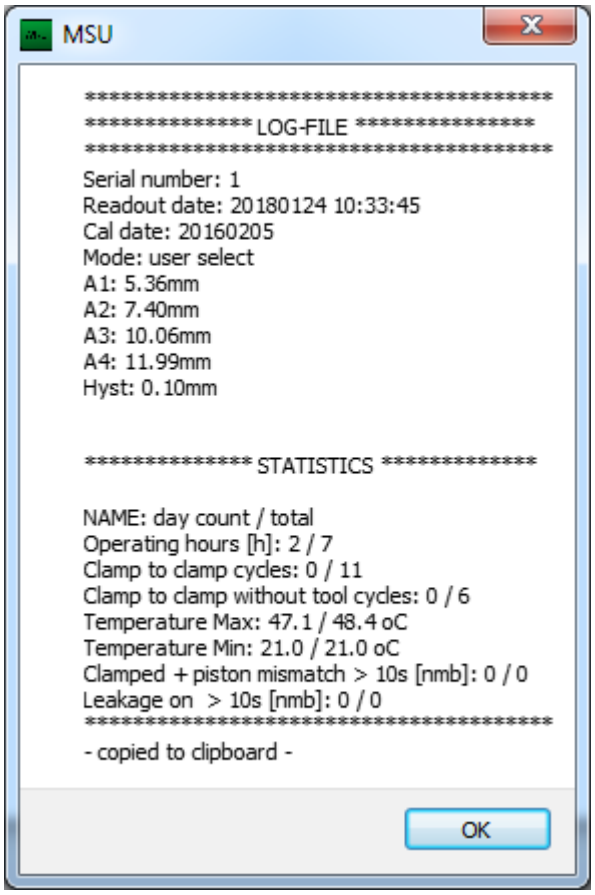
The two states "clamped without tool" and "loosened" require to define an additional hysterisis. The pull rod positions are moved up or down depending on how big the hysteresis is. As a result fluttering of the three switch outputs is prevented and the allocation of the two situations is clear. We suggest for a pullrod position sensor with a measuring path of 25 mm a hysteresis of 150 µm and for a 15 mm measuring path we recommend 90 µm. The value has to be set with the PC-program. As an alternative it is possible to set the hysteresis to 0 and to add or subtract a appropriate safety to the positions A1 and A4.

4.5 STATISTICS FUNCTION

The **MSU CONFIGURATOR** has a statistics function.

In order to obtain correct data, it is necessary to store valid switching points in mode 3 (digital) beforehand. The statistics function is then activated in all modes.

Call statistics:
◢ push **Show statistics**
The following display appears and is copied as text into the temporary memory of the PC for further use.



Two data are output for each parameter:
Resettable data (day count)
Continuous data (total)

Resettable data set to zero:
◢ push **clear statistics**