



# **CyCon K11 BIOS 5.04 Monitoring system**

## **Operation and Maintenance Manual**



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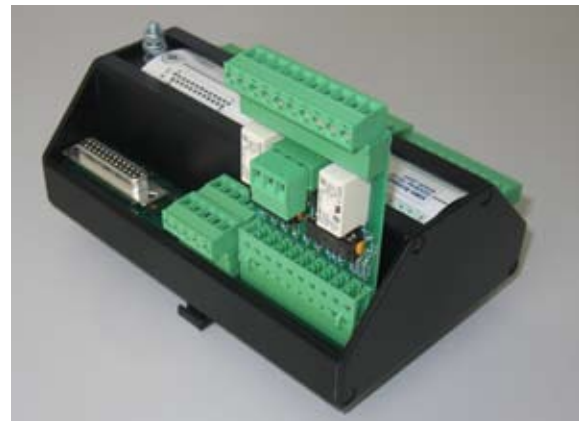
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## Monitoring of clamping with controller K11 BIOS 5.04

### 1 Technical information

The K11 controller is a versatile microcontroller, which was designed especially for monitoring and safety functions of machine tools. It works at usual voltage levels (24 V) and can be connected to any usual control system (PLC) to communicate via parallel digital I/O.



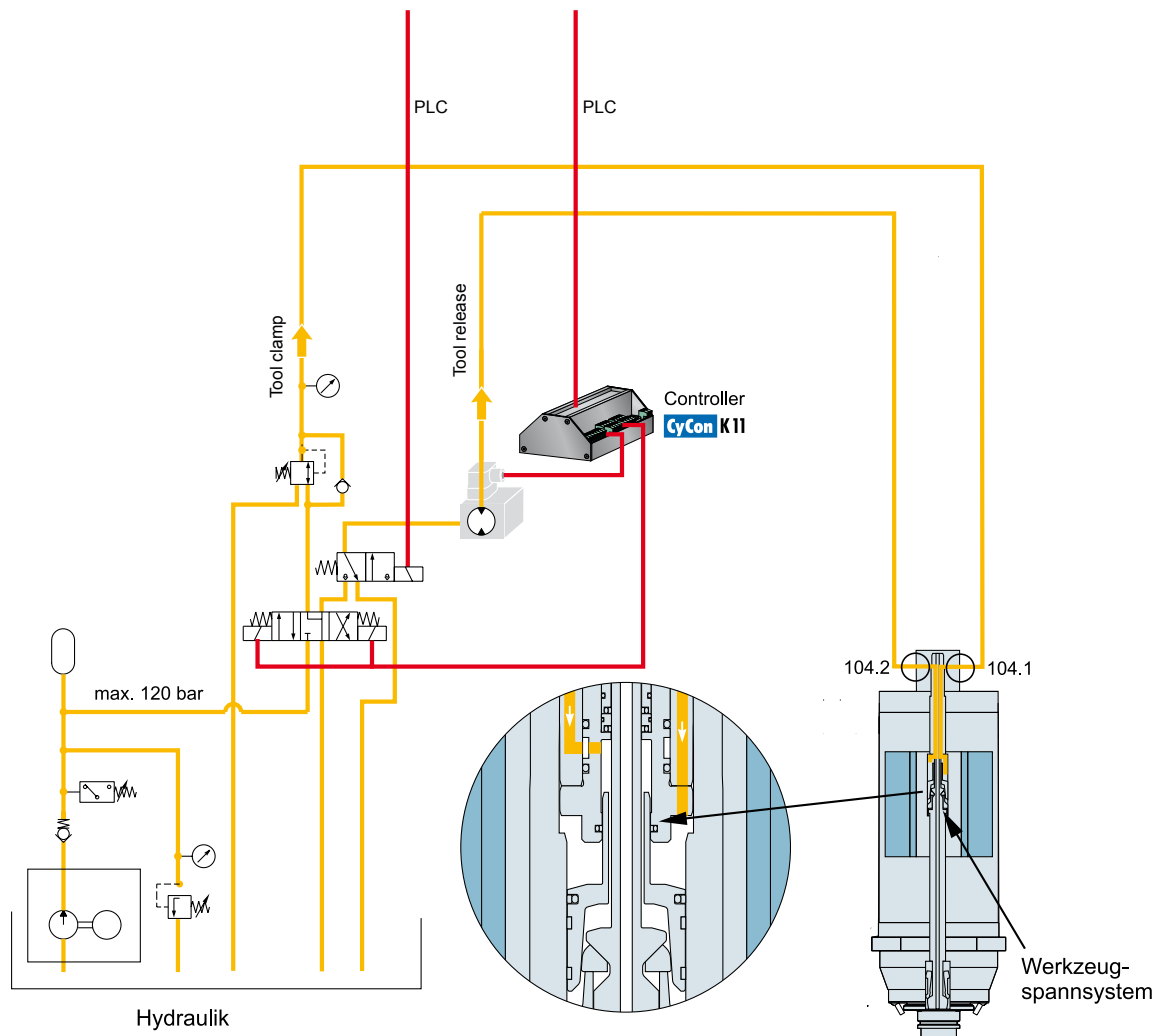
The K11-Controller for monitoring of motor spindles is mostly used together with PLC's to monitor clamping and release functions in tool clamping systems or automatic head exchange systems.

Communication between K11 and an external PLC is performed by digital I/O-signals only (8 bit).

The PLC selects a function by these digital input signals. The result is sent back by digital output signals.

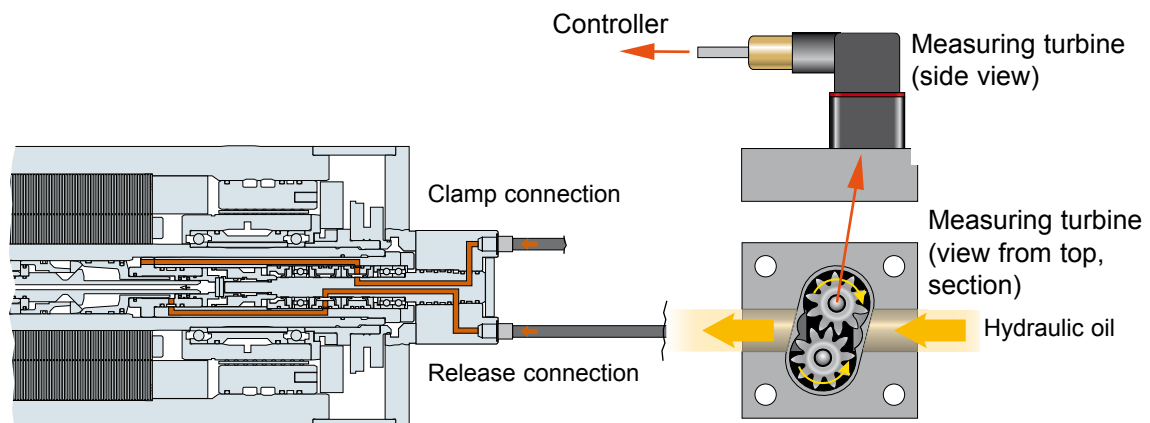
All function parameters and limits of the K11-Controller are set via a windows program.

## 2 Function



For monitoring clamp and release of the tool, the hydraulic oil, which is conveyed to the clamping system, is measured volumetrically. The detection is carried out by a measuring turbine that is integrated in the release circuit. It is rotated by the through-passing hydraulic oil.





These rotations are detected by initiators and measured as frequency by the controller. This oil volume is always proportional to the clamping distance. So not only the final position is monitored but even the entire effective range of the clamping circle.

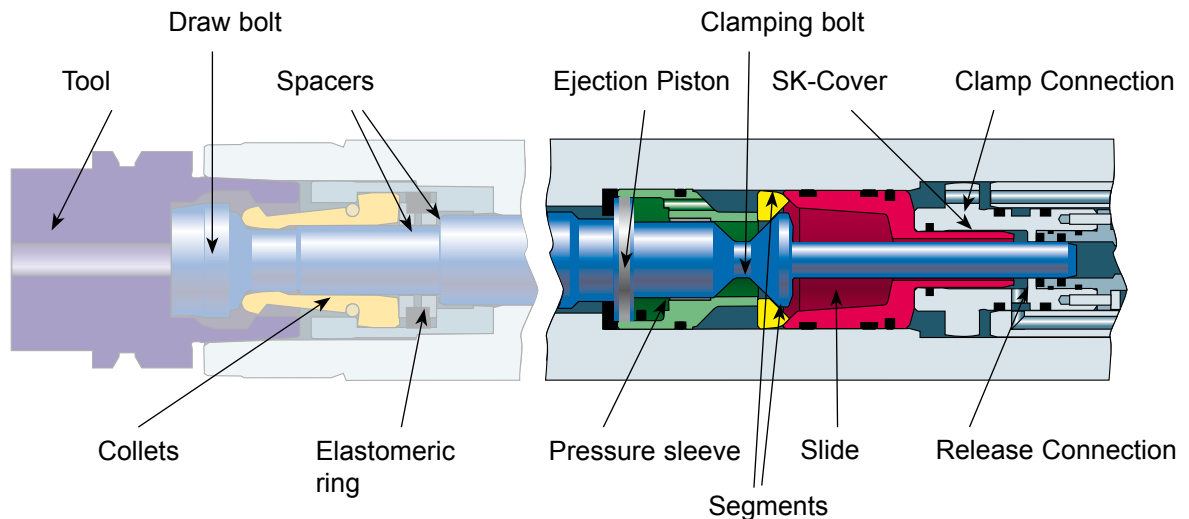
For this, the operator must define a dwell time before the check of the final condition is carried out. The number of counted pulses between start and stop (= oil volume) must be within the set window, otherwise the control system will switch off the motor spindle.

Differences in tool-length which are beyond the pre-set tolerances (DIN, ISO) are recognized.

The operator can apply the K11-operating program as graphical user interface that is installed on a usual PC with serial port to communicate with the controller.

The clamping sequence is divided in characteristic phases which each are indicated by a determined oil volume in the clamp and release line. According to this, the turbine sends a determined number of pulses for each phase, from which the position of the clamping slide can be recognized, depending on the tool size.

## The clamping system

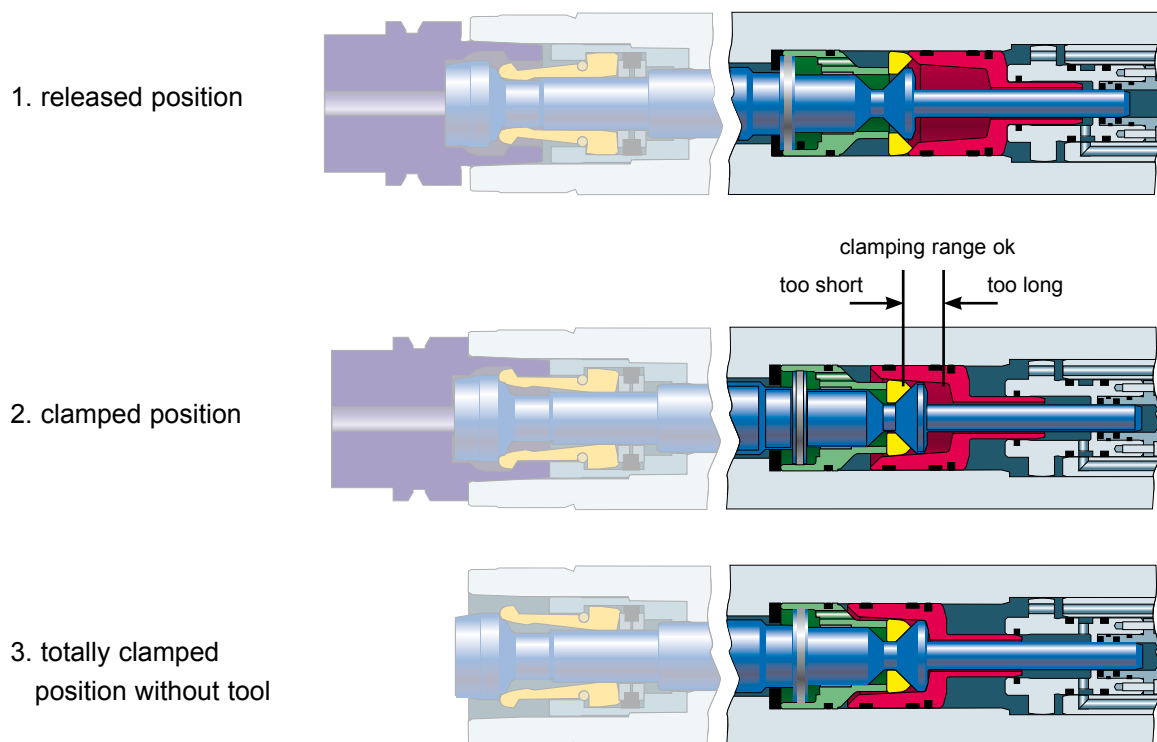


The collet kit is operated by the clamping cartridge. Its main components are: the centrally located tension bolt, the function segments which are placed concentric around it, and the slide enclosing these elements. In a hydro-mechanical system the slide is displaced directly by the pressurized hydraulic oil.

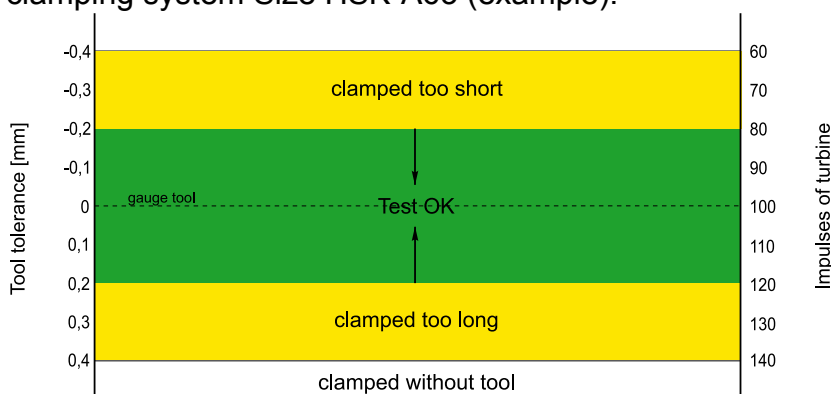
The clamping system acts with positive lock utilizing the force amplification of the wedge principle: the draw bolt grips the tool, pulls it inwards and clamps it.

In the clamped position the positive lock is active. Clamping pressure can now be relieved as the clamping force is mechanically maintained by the self retention of the wedge system.

The following example shows different positions of the clamping slide during the clamping sequence of a HSK-A63 clamping system:



The classification of the clamping phases can be displayed in a diagram for a clamping system Size HSK-A63 (example):



Typical for an HSK-63 tool is the ratio of approx. 10 pulses per 0,1 mm clamping stroke. The following values are entered into the register card CLAMP of the user program:

Clamp	short	80 (pulses)
	long	120 (pulses)
	without tool	140 (pulses).

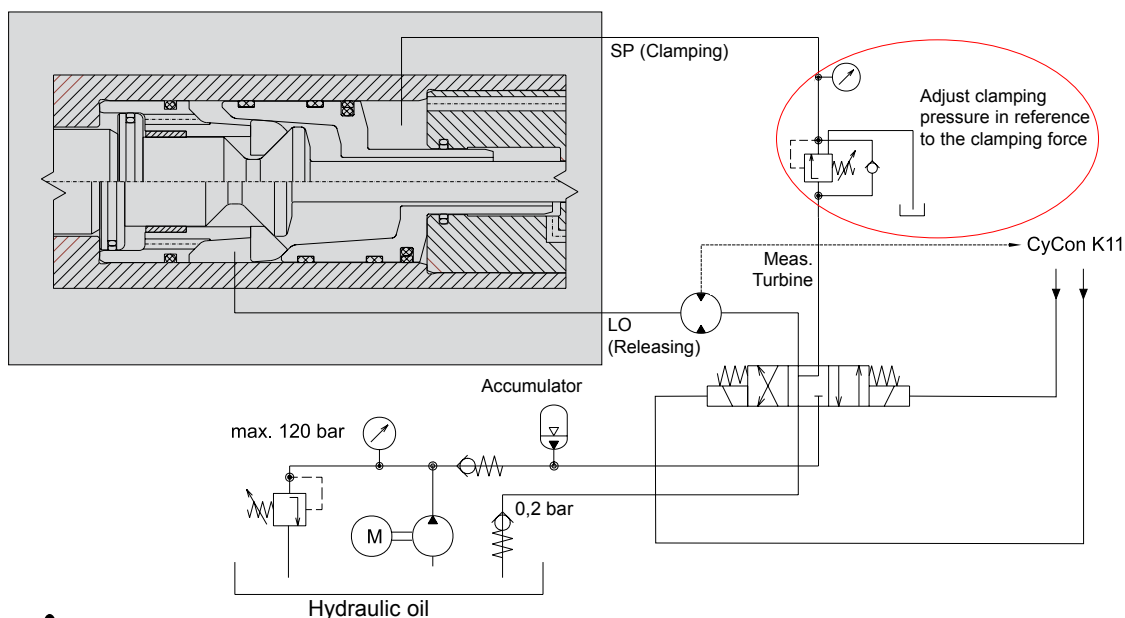
### 3 Prepare for usage

#### 3.1 Media connections/Adjustment of clamping system

For proper function of the clamping system, the following must be checked:

- All media connections for function and pressure settings
- Clamp and release pressure for clamping system
- Function test - clamp and release
- correctly adjusted clamping force with clamping force meter (refer also to chap. 6 Assemblies: motor spindle)

Hydro-mechanical clamping system



#### Caution:

- When the clamping system is released never push draw bolt into the spindle. This can destroy the tool clamping system. When the tool is ejected, release pressure should always be applied.
- The spindle may only be rotated with a tool or a tool dummy. It must never be rotated with the clamping system in the release position!
- Without tool in the spindle and the clamping system in the clamped position the maximum permissible speed is 100 rpm.

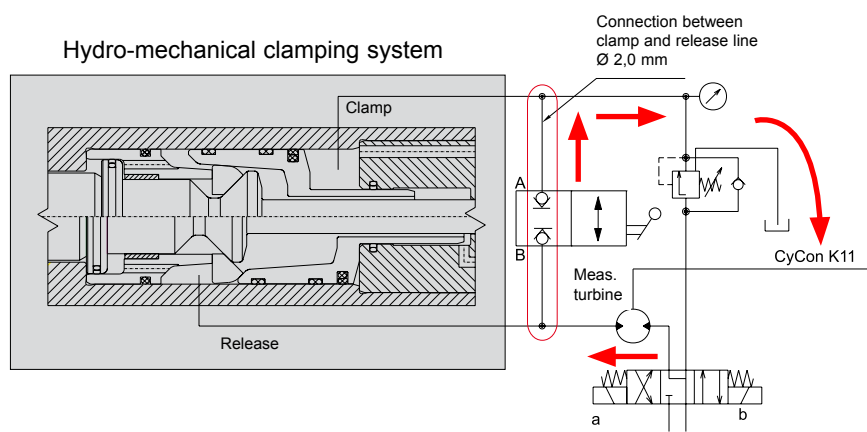




- No pressure may be applied to the clamp and release port. This will lead to destruction of the ceramic seals in the rotary union.
- No pneumatic pressure may be applied to port “DA” as it would destroy the seals.
- Spindle may only be rotated with switched on cooling system for spindle and rotary union.

### 3.2 Bleeding the clamping system

When bleeding the clamping system, the releasing pressure of a released tool fitting is used to bleed the clamping system. A sealed connection between the clamping- and the releasing-cycle has to be built, which will be removed after bleeding the system.



Bleeding set with closed blocking tap, attached to the ports of the clamp and release line on the swivel housing of the milling head.

To guarantee a failsafe function of the tool clamping system no air bubbles must be trapped in the hydraulic lines. An invasion of smallest amounts of air cannot be avoided completely but they would disrupt the continuous transmission of pressure to the tool clamping and lead to failure.

So in the following the most important procedure steps are shown that are necessary to remove any trapped air out of the hydraulic system. For this a bleeding set (dump tap, tube, fittings) is required to short cut the clamp and release line.

It is assumed that the hydraulic power unit for the tool drawbar and for the axis clamping has previously been set up properly. It is assumed also that the operation personnel is qualified and is instructed about the function of the tool clamping system. Otherwise there is danger of severe function failure with damage to the machine or person.

### 3.2.1 Procedure steps

Step 1: Before attempting to bleed air from the hydraulic lines it is important to have allowed the oil in the hydraulic tank to have stood for a minimum of 3 hours. Failure to do this may mean that air bubbles could still be present in the oil that is going to be used for bleeding. This is especially true when new oil has been added to the hydraulic tank. Failure to observe this point could reduce the effectiveness of the whole set up procedure of the tool clamping system.

Step 2: Put the A-axis in a swivel position (+45 °) to expose the two bleed points on the rear part of A-axis swivel housing and to fit the connections of the bleeding set.

**The tool clamping system must be in clamped position to avoid pressure in the clamp line.**



Swivelled A-axis with stems and fittings on bleeding points

- Step 3: Remove the two plugs of the bleeding drills on the swivel housing of A-axis and fit the bleeding set. Make sure the two steel stems have their copper washer to seal and do not over tighten.



Bleeding set with closed dump tap

- Step 4:



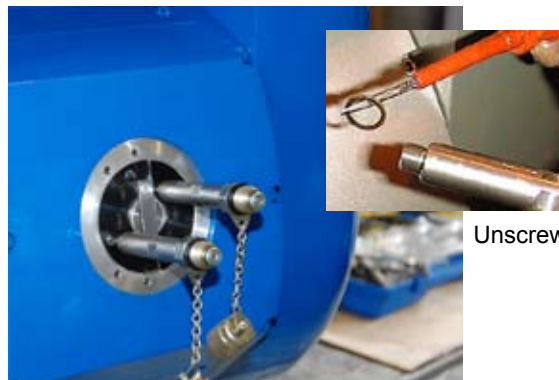
**Attention: Make sure that during fitting the bleeding set no clamp or unclamp cycles are operated.**

The dump tap of the bleeding set must be in closed position. Operate the clamping system several times for clamping and releasing. Check for any oil leaks in the range of bleeding set (dump tap, tube, fittings). Finish this step with the **clamping system in the clamped position** without tool.

Step 5: Bleed the clamp hydraulics by running through the following procedure 5 times (**initial position: clamped**):

- Release the clamping system.
- Open the bleed tap for 1 minute.
- Close the bleed tap.
- Clamp the system without tool.

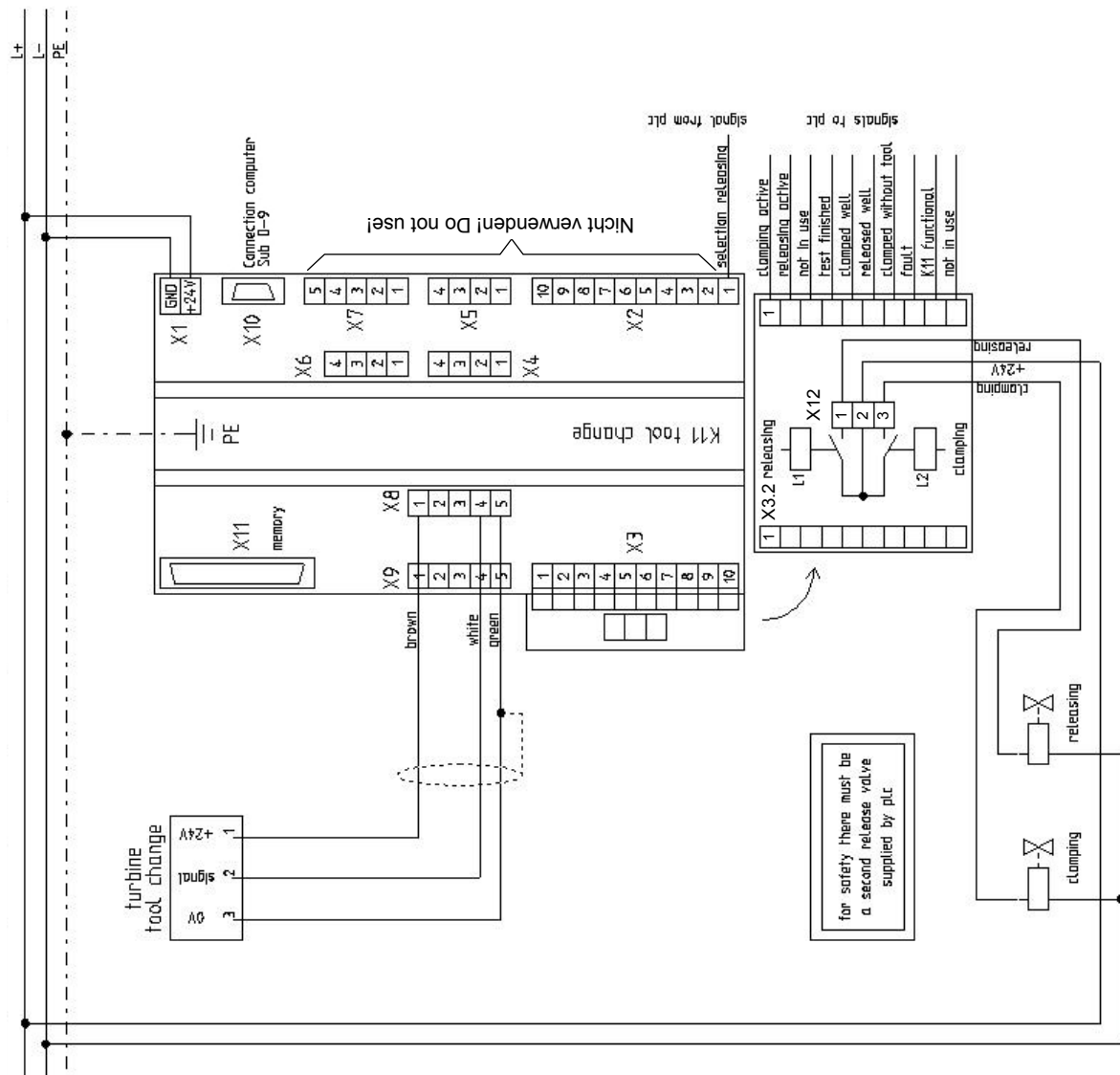
Step 6: Remove the bleed tap assembly as swiftly as possible and replace the plugs. Some oil will be lost but this is unavoidable. Try to minimise this oil loss as much as possible by putting a finger over the ports as each stem is removed from the head. Also check that the copper washer is removed with the stem and not left in the port as shown  
The screw torque must be sufficient that the plugs are sealing tight.



Unscrewed stem with copper washer

Step 7: Now machine power can be re-established and the clamping system should be seen to release and clamp properly.

### 3.3 Pin layout



The monitoring functions of the K11 controller can be chosen via its digital input (input 0).

#### Designations on plug X2:

Input	Selection function	Logic level
I 0	clamp / release	HIGH (24 V)
I 1	-	HIGH (24 V)
I 2	(tool face contact)	HIGH (24 V)
I 3	(vibration)	HIGH (24 V)
I 4	Analog input 1	HIGH (24 V)
I 5	Analog input 2	HIGH (24 V)
I 6	Analog input 3	HIGH (24 V)
I 7	not used	HIGH (24 V)

The chosen function and the result of the selection are emitted via the digital outputs:

#### Designations on plug X3.2:

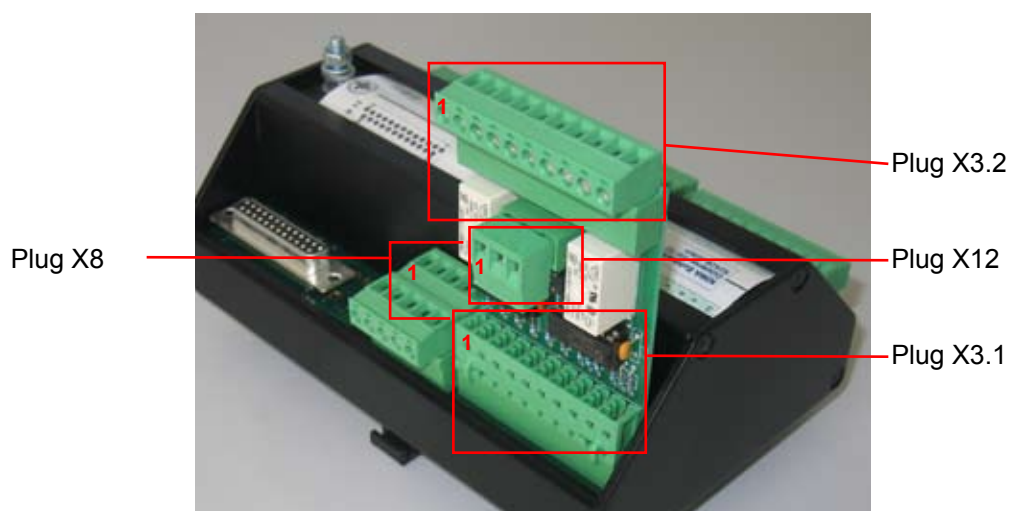
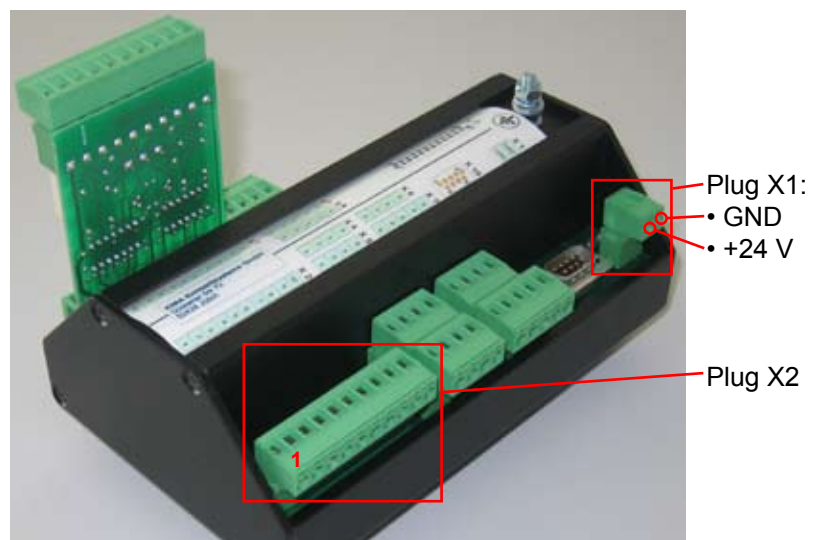
Output	Result for functions clamp and release	Logic level
O 0	selected function (binary coded)	HIGH (24 V)
O 1	O2 O1 O0	
O 2	0 0 0 = IDLE 0 0 1 = CLAMP 0 1 0 = RELEASE	
O 3	Test finished	
O 4	Clamped OK	HIGH (24 V)
O 5	Released OK	HIGH (24 V)
O 6	Clamped without tool	HIGH (24 V)
O 7	Error (Timeout)	HIGH (24 V)

### Designations on plug X8:

Input	Function	Logic level
1	Voltage supply	+24 V
2	-	-
3	-	-
4	Signal PNP	HIGH (24 V)
5	GND	0 V

### Designations on plug X12:

Output	Function	Logic level
1	Relais release	HIGH (24 V)
2	Voltage supply	+24 V
3	Relais clamp	HIGH (24 V)

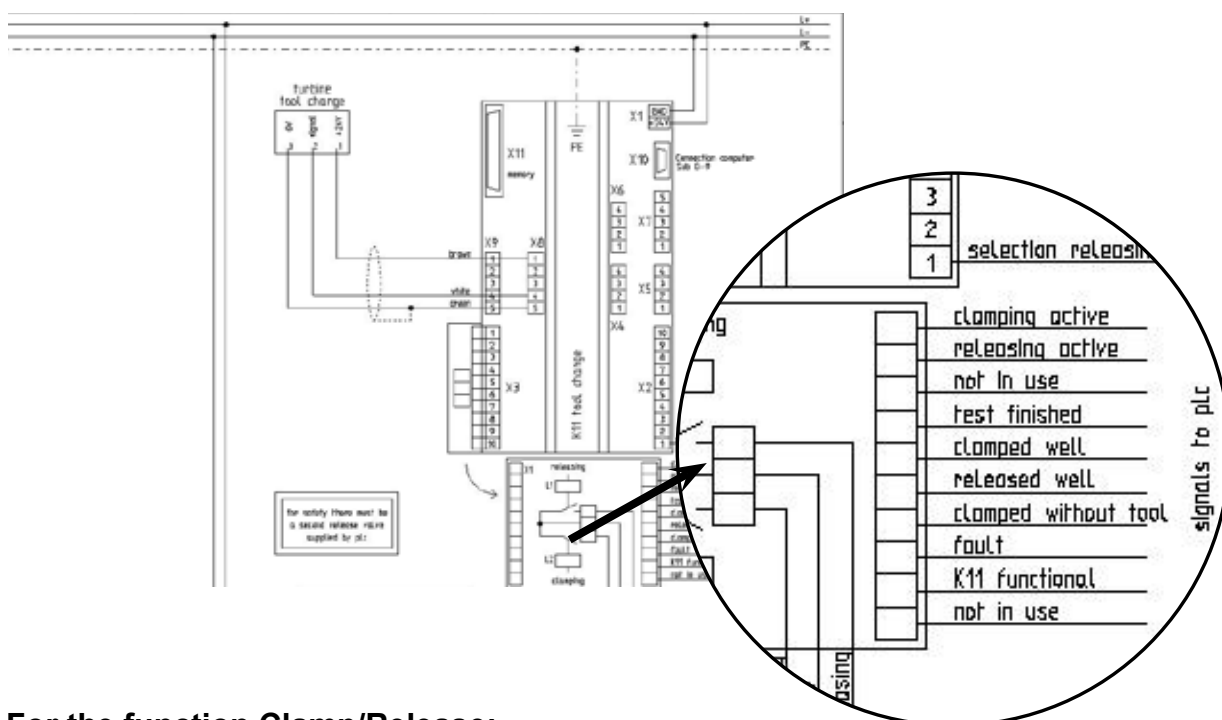


### 3.4 Safety advice



#### General:

The K11-Controller is a low voltage system (24 V DC) for monitoring of high speed spindles. Unqualified usage may lead to injuries or machine damage. The system is to be installed by qualified personel only!



For the function Clamp/Release:



**Attention:** While the spindle is rotating, never apply voltage to the input I0 on plug X2! The tool will be loosened from the spindle and hurled away uncontrollably! There is danger for personnel and material.





- Clamp and release lines and the clamping system must be vented according to the manual.
- The hydraulic lines must be secured against coasting. Most suitable is a non-return valve (0.2 bar) in the tank line of the hydraulic unit.
- The clamping pressure must be adjusted according to the clamping force. Therefore a pressure reduction valve must be integrated into the clamp line.
- It must be assured that there is no back pressure in the non pressurized hydraulic line (maybe caused by the pressure reduction valve, pressure reduction by draining off the volume flow into the tank line).
- The measuring turbine must be located in the release line and be attached as close as possible to the clamping system. If possible, the line between turbine and connection to the milling head should be hard-piped.
- The clamp/release valves should be attached as close as possible to the milling head (but in a position that they are accessible without effort).
- A bladder accumulator with approx. 0.75 to 1 liter content should be integrated in the pressure line (preferably on the clamp/release valve block).
- A security valve "Release" must be provided in alignment with the valve "Release". As soon as all safety conditions for tool release are fulfilled, this security valve must be switched directly by the PLC. Only after actuation of the security valve the selection "Release" on K11 may be carried out. The actual release valve must be triggered by the relay "Release" on the relay circuit board on the K11. It must not be actuated until the K11 has confirmed the selection "Release" on plug X3 pin 1. The release and the security valve must not be closed until the K11 has finished the release process by deselection on plug X3 pin 1.
- The clamping valve must be actuated by the relay "Clamp" on the relay circuit board of the K11. It must not be triggered until the K11 has confirmed the selection "Clamp" on plug X3 pin 0. The clamp valve must not be closed until the K11 sends the signal "Measure finished" or "Timeout".
- The controller K11 must have priority concerning the collection of clamp and release times and the evaluation of data. In the higher-level PLC no clamp and release times must be programmed, because that would cause malfunctions during tool changing processes. As well additional pressure switches in the hydraulic system can cause malfunctions of the control system.

**The controller K11 must be adjusted correctly.**

## 4 Operation

To parameterise the K11 – Controller exists a user program. With this program it is possible to parameterise the register cards / functions as well to see the measuring value.

### 4.1 Installation of the software

The operation program is designed for installation under operating system Windows up to version 7. The installation disk contains an installation directory \CYTEC with the data file CytecXXX.exe (the XXX stands for the version number, e.g. Cytec312.exe)

Copy **the directory \CYTEC** on the hard disk of the computer. The data file CytecXXX.exe is a self extracting file.

With a double click on this data file the following data files were extracted in the same directory:

- |                |                                  |
|----------------|----------------------------------|
| • Read_me.txt  | Informations to the installation |
| • Supercom     | a data file                      |
| • Supercom.dll | a program library                |
| • Cytec_03.exe | the user program                 |

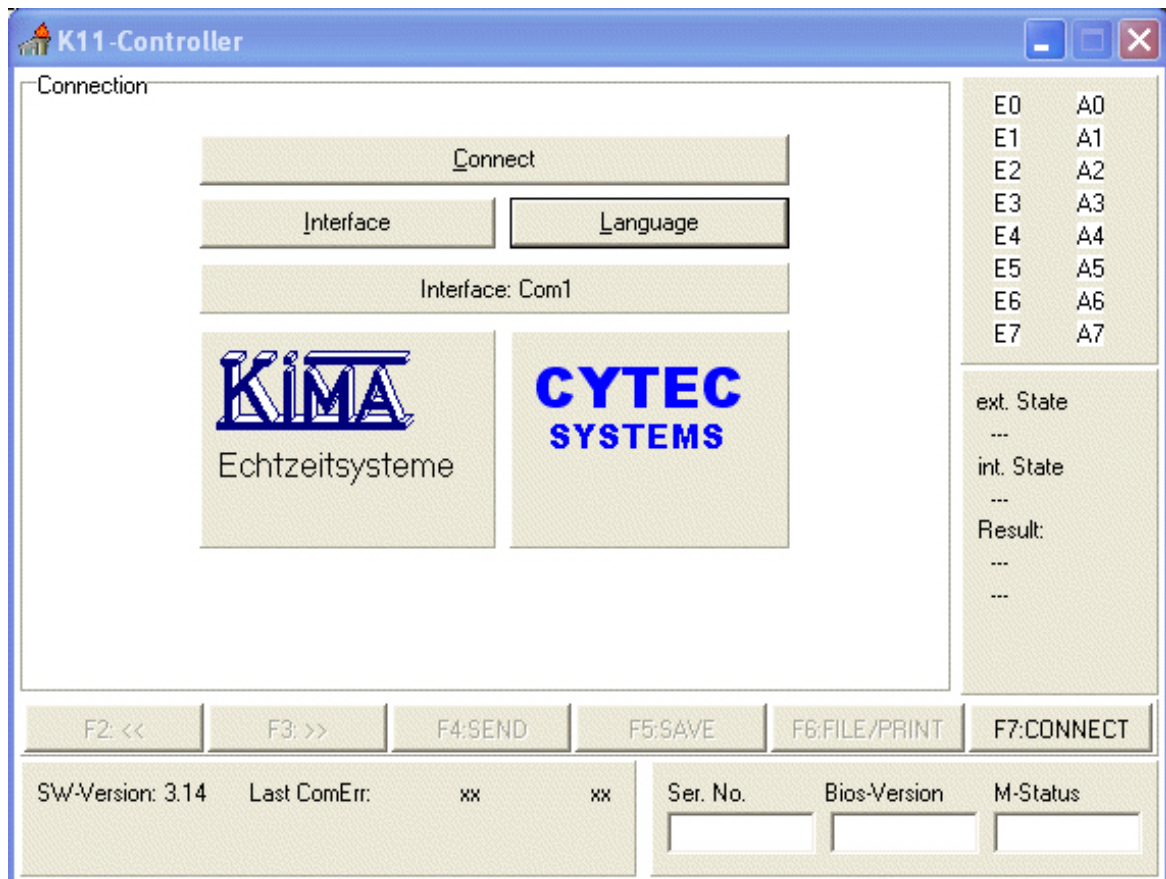
To start the user program Cytec\_03.exe the data files Supercom.dll and Supercom must exist in the same dictory as the user program!

Note:

No system files or registry entries were changed. For deinstallation delete the directory X:\cytec with the K11 program.

## 4.2 Start of program

Start program CYTEC\_03.EXE in directory \CYTEC (double click).  
The following screen is displayed:



Up to now the program is not connected to the K11-Controller.

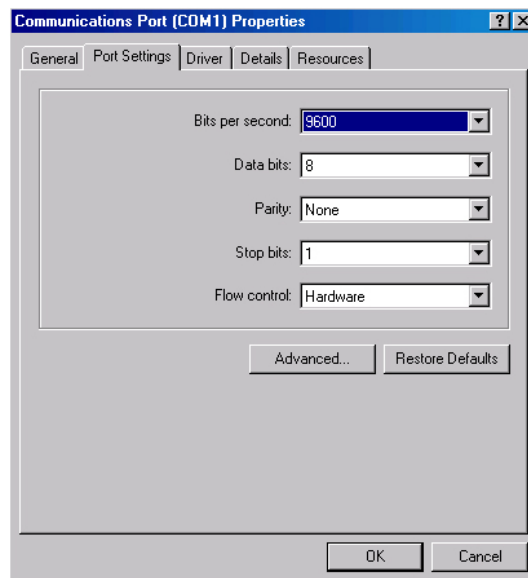
Only now connect the controller with the PC (with the shipped 0-modem-cable).  
Adjust the desired interface (see next chapter).

### 4.3 Language choice/interface

By clicking of the button “Language“ the language of the program can be chosen. You can use either german or english.



Select a language and click **OK**. The chosen adjustment is stored.

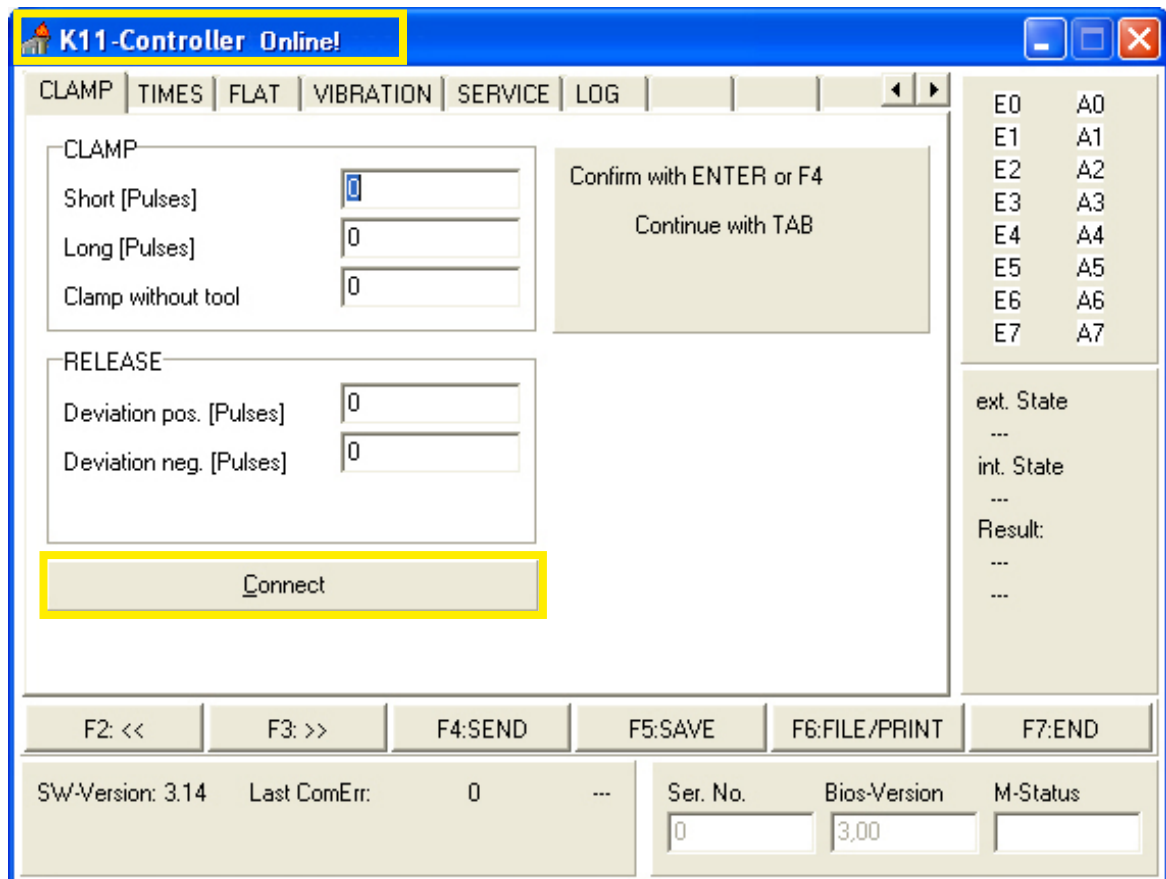


To set the interface click on the button Interface after the start of the user program (COM1 - COM4 are available).

Check the settings of the interface you want to use. Bring the setting to standard values (Button "Restore Defaults").

Choose the com-port your K11-Controller is connected to. Click on button OK and then the setting is saved.

To connect to the K11-Controller Click on button **Connect** or press the button **F7**.



**K11-Controller Online!**

CLAMP TIMES FLAT VIBRATION SERVICE LOG

CLAMP

Short [Pulses]

Long [Pulses]

Clamp without tool

RELEASE

Deviation pos. [Pulses]

Deviation neg. [Pulses]

Confirm with ENTER or F4

Continue with TAB

ext. State

...

int. State

...

Result:

...

...

Connect

F2: << F3: >> F4: SEND F5: SAVE F6: FILE/PRINT F7: END

SW-Version: 3.14 Last ComErr: 0 ... Ser. No.  Bios-Version  M-Status

After successful connection to K11-Controller, the program changes to the register card CLAMP. A small window in the middle left of the screen first shows “connect” and afterwards “read”. The caption of the user program shows K11-Controller Online!.

The Programm can now exchange information with the K11-Controller. Serial number and software version of K11-Controller are displayed.

## 4.4 The program window

**K11-Controller Online!**

CLAMP TIMES FLAT VIBRATION SERVICE LOG

CLAMP

Short [Pulses] 100

Long [Pulses] 115

Clamp without tool 150

RELEASE

Deviation pos. [Pulses] 100

Deviation neg. [Pulses] 115

Confirm with ENTER or F4

Continue with TAB

E0 A0  
E1 A1  
E2 A2  
E3 A3  
E4 A4  
E5 A5  
E6 A6  
E7 A7

ext. State  
...  
int. State  
...  
Result:  
...  
...

F2: << F3: >> F4: SEND F5: SAVE F6: FILE/PRINT F7: END

SW-Version: 3.14 Last ComErr: 0 ... Ser. No. 0 Bios-Version 3.00 M-Status

**The program window shows four areas:**

1. the status display on the bottom
2. the control panel with the function keys
3. the register cards on the left side
4. the display group on the right side

to 1) The status display:

SW-Version: 3.14 Last ComErr: 0 ... Ser. No. 0 Bios-Version 3.00 M-Status

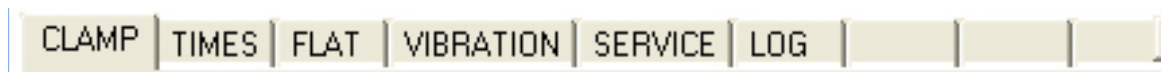
shows the software version of the user program, the serial number, the software version and machine status of the K11 – Controller.

to 2) The control panel:



Button <<	or <b>Button F2</b> :	Go to the next register card on the left site
Button >>	or <b>Button F3</b> :	Go to the next register card on the right site
Button <b>SEND</b>	or <b>Button F4</b> :	Transfer the parameter to the controller
Button <b>SAVE</b>	or <b>Button F5</b> :	Save the parameter in the EEPROM
Button <b>FILE/PRINT</b>	or <b>Button F6</b> :	Print of all parameter, measuring values and logfile
Button <b>FINISH</b>	or <b>Button F7</b> :	Close the user programm and finish the connection to the K11 – Controller

to 3) With the register cards it is possible to change the parameter for



- CLAMP
- TIMES
- (• FLAT)\*
- (• VIBRATION)\*
- (• Analog inputs 1-3)\*



The with (\*) designated register cards can be selected, but do not have any function in this BIOS version of the controller.

to 4) the display group

E0	A0
E1	A1
E2	A2
E3	A3
E4	A4
E5	A5
E6	A6
E7	A7

ext. State
---
int. State
---
Result:
---
---

The display shows the actual status of

- **Input bits** (I0 – I7)
- **Output bits** (O0 – O7)
- **Status of measuring** (internal states)

The display “Result“ is programmed for an earlier BIOS version and shows here wrong values.



## 4.5 Register card CLAMP

Starting with the version 2.11 of the K11 – Bios, the card Clamp looks like this:

**K11-Controller Online!**

CLAMP | TIMES | FLAT | VIBRATION | SERVICE | LOG | ANALOG1 | ANALOG2

**CLAMP**

Short [Pulses]

Long [Pulses]

Clamp without tool

Confirm with ENTER or F4  
Continue with TAB

**RELEASE**

Deviation pos. [Pulses]

Deviation neg. [Pulses]

**HYDRAULIC CHECK**

☐ active

Pulses

Duration [ms]

E0 A0  
E1 A1  
E2 A2  
E3 A3  
E4 A4  
E5 A5  
E6 A6  
E7 A7

ext. State  
IDLE  
int. State  
IDLE  
Result:  
--  
--

F2: << F3: >> F4: SEND F5: SAVE F6: FILE/PRINT F7: END

SW-Version: 3.14 Last ComErr: 0 --- Ser. No. 1753 Bios-Version 5.04 M-Status 0

Here the deviation of the release distance compared with the last clamp distance is entered. All boxes can be edited directly.

### The box Hydraulic Monitoring must not be activated!

Use Enter-key or the button **SEND** or the **key F4** to commit). Integers only will be accepted (no comma or dot). Changed parameters are transferred immediately and checked for validity range. Out-of-range values are rejected. Accepted values are in use only after committing the **Enter** or **F4-Key**. Permanent saving can be performed with the field Save or the key F5.

Valid ranges:

- short ( 0...500 )
- long ( 0... 3000 )
- clamp without tool ( 0... 2000 )
- deviation pos. pulses ( -500...500 )
- deviation neg. pulses ( -500...500 )

## 4.6 Register card TIMES

Set timing parameters for clamp and release. All fields can be edited (use **Enter-key** or the button **SEND** or the **key F4** to commit). Integers only will be accepted. Changed parameters are transferred immediately and checked for valid range. Out-of range values are rejected. Accepted values are in use only after committing the **Enter** or **F4-Key**. Permanent saving can be performed with the box **SAVE** or the **key F5**.

The screenshot shows the 'K11-Controller Online!' window with the 'TIMES' tab selected. The interface is divided into several sections:

- Navigation Tabs:** CLAMP, TIMES (selected), FLAT, VIBRATION, SERVICE, LOG, ANALOG1, ANALOG2.
- CLAMP Section:**
  - Min. time of Measure [ms]: 500
  - Stopfreq [ms]: 150
  - Timeout [ms]: 10000
- RELEASE Section:**
  - Min. time of Measure [ms]: 500
  - Stopfreq [ms]: 150
  - Timeout [ms]: 10000
- Instructions:** Confirm with ENTER or F4, Continue with TAB.
- Right Panel:**
  - Ext. State: A0 through A7 (E0-E7).
  - int. State: IDLE.
  - Result: --
- Function Keys:** F2: <<, F3: >>, F4: SEND, F5: SAVE, F6: FILE/PRINT, F7: END.
- Status Bar:**
  - SW-Version: 3.14, Last ComErr: 0, ---
  - Ser. No.: 1753, Bios-Version: 5.04, M-Status: 0

Valid ranges:

- Minimum time of measuring ( 0 ... 10000 ms)
- Stopfrequency ( 0 ... 10000 ms)
- Timeout ( 0 ... 10000 ms)

## 4.7 Register card SERVICE

No parameters can be edited here. Actual measured values of the cards **CLAMPING** and **TIMES** and frequencies or pulse counts (right bar; scale is logarithmic in 1/10 Hz) according to the actual function selected by the PLC are displayed.

**K11-Controller Online!**

CLAMP | TIMES | FLAT | VIBRATION | **SERVICE** | LOG | ANALOG1 | ANALOG2

Service information		Vibration	Frequency
Clamp [Pulses]	0	- 10.0	- 10000
Release [Pulses]	0	- 7.5	- 1000
Release Deviation [Pulses]	0	- 5.0	- 100
Frequency [0,1 Hz]	0	- 2.5	- 10
T_Duration [ms]	0	- 0	- 1
Vibration [mm/sec]	0,00		

ext. State: IDLE  
int. State: IDLE  
Result: --

F2: << | F3: >> | F4: SEND | F5: SAVE | F6: FILE/PRINT | F7: END

SW-Version: 3.14 | Last ComErr: 0 | ... | Ser. No. 1753 | Bios-Version 5,04 | M-Status 0

Values displayed for:

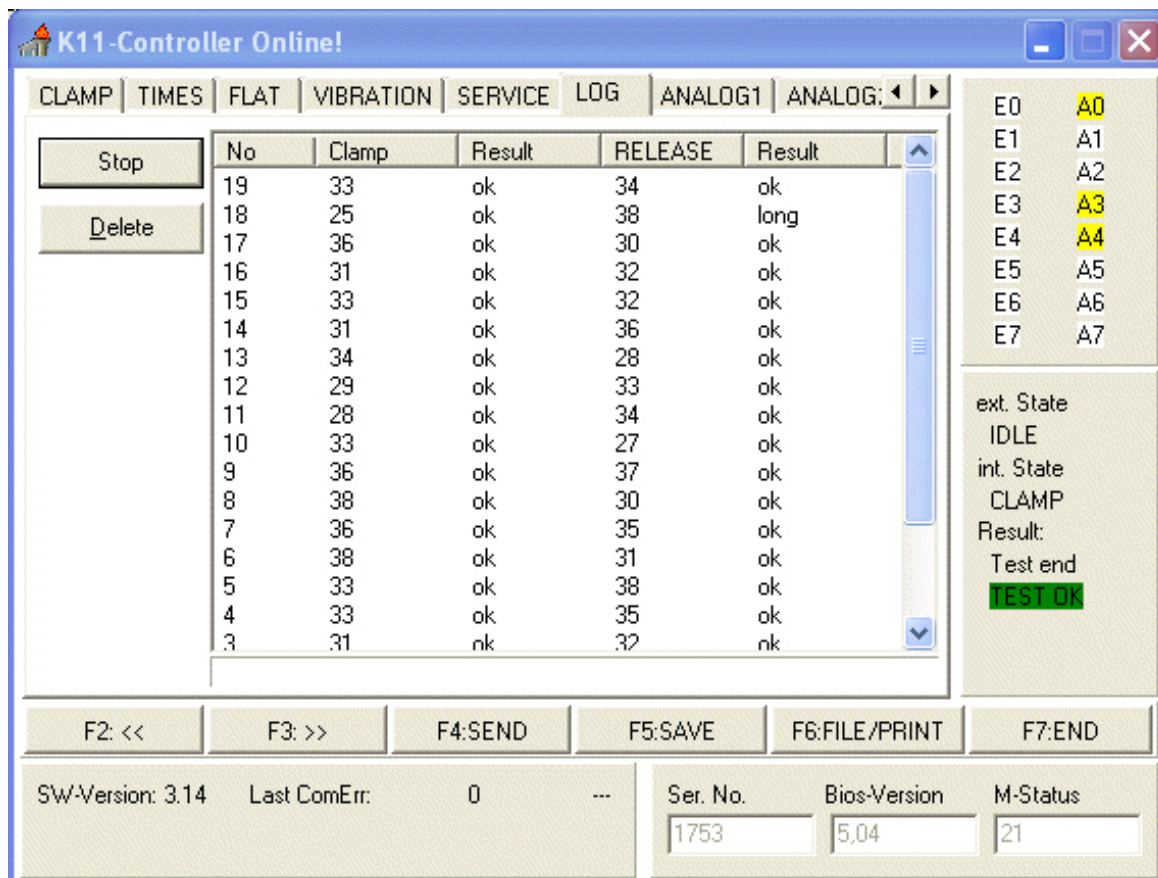
Clamp / Release

- Clamp (pulses)
- Release (pulses)
- Release deviation (pulses)
- actual frequency (frequency)
- Duration of measuring (T\_Duration = 0, if Timeout was exceeded)

These values are useful hints to find parameters for all modes.

## 4.8 Register card LOG

The function logfile exists for the error diagnostic of clamp/release – processes and as documentation of the settings of the controller. Every clamp/release – process is written in the logfile with its corresponding value. The last 100 clamp/release – processes are saved.



The button Read activates the logfile. As soon as a complete cycle (clamp and subsequent release) is finished, a new line with measuring data and results is displayed. With pushing the button **STOP** the reading ends, pushing the button **DELETE** deletes the screen.

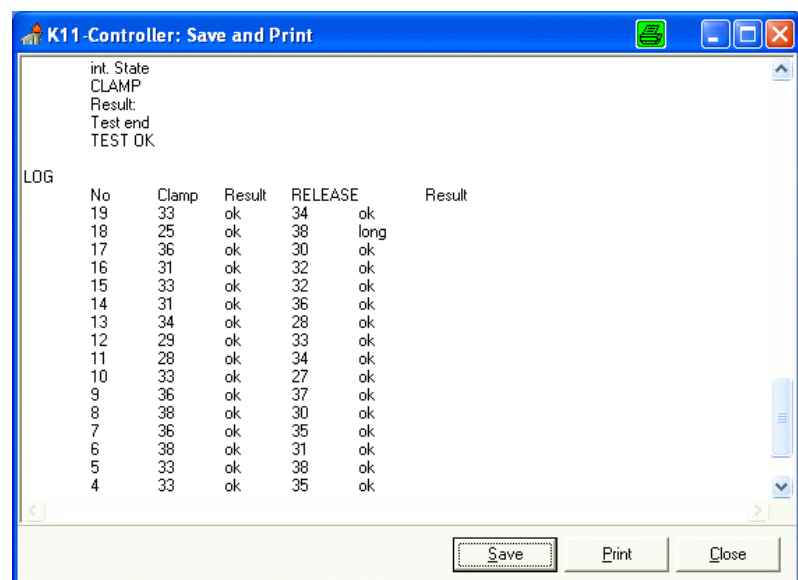
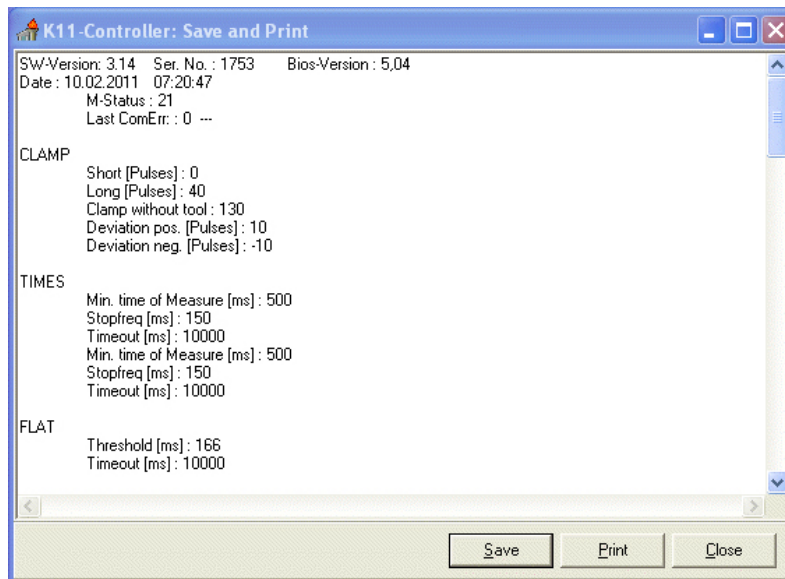
The button File/Print or the key F6 can save the logfile as file or print it.

**Warning:** Read should not stay activated in the normal use of the K11. In some cases errors of the measurement (Clamp / Release) can occur while reading the log.



## 4.9 Save and print LOG

The button FILE/PRINT is available with version 2.91. The machine and the parameters of the controller can be displayed, printed or saved into a datafile. The program itself suggests datanames containing series number, date and a continuing index. The logfiles were saved in the directory "Cytec\Log". These log data can be used to document the parameters or to detect errors.



## 5 Arranging the monitoring system

For a successful initial commissioning, the personnel must have read and understood the complete manual of the K11 controller. The following instructions apply especially for the operation of motor spindles.

### 5.1 Clamp- and release control

With clamp-/release control the hydraulic oil flow is detected by a measuring turbine. The revolutions of the turbine are captured by sensors (PNP- or NPN-type) and measured as frequency by the controller counting the pulse-sequence. For a correct clamp- and release procedure the following conditions must be fulfilled :

1. For a period of time determined by the user it must be waited until the check of the final condition takes place (Stop frequency).
2. Underrunning the stop frequency
3. The number of counted pulses between start and stop (=oil amount) must be within a pre-determined range.



**If one of these conditions is not fulfilled, the clamping/releasing was not correct. The spindle must be switched off**

The minimum measuring time can be set to “0” in most cases.

Only with systems without continuous oil flow must this time be modified (e. g. 2 spindles connected to one hydraulic supply).



**A pre-adjustment of parameters or parameter specifications by the manufacturer are not possible, because all parameters must be adjusted to the on-site hydraulic system of the machine.**

## 5.2 Determination and setting of parameters

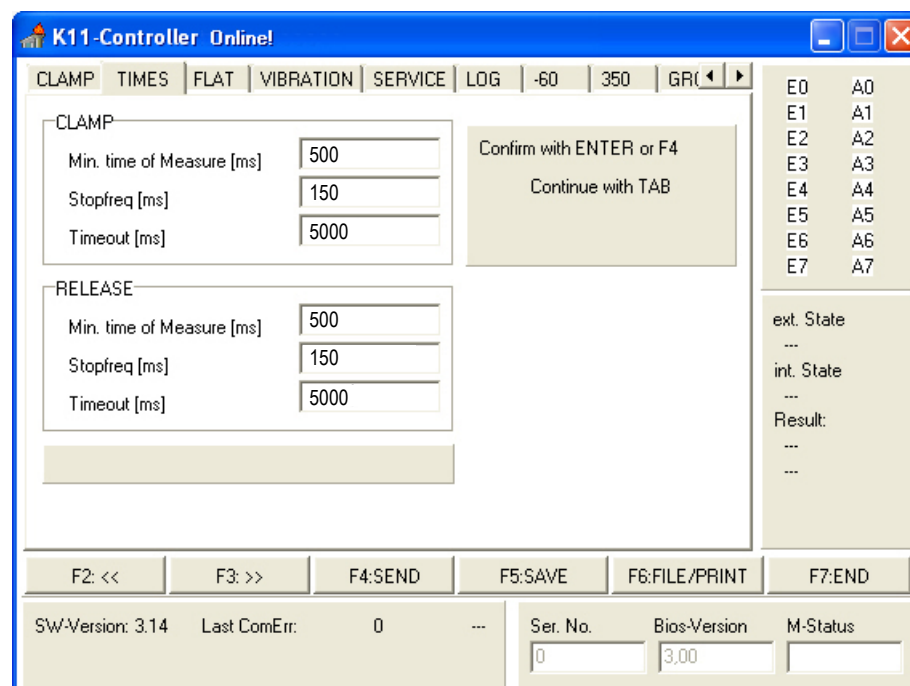
Procedural steps:

- Step 1: Make sure that the controller is connected correctly und integrated to hydraulic system and the machine control.
- Step 2: Connect controller and PC and start the user software as described in chap. 10.1.4. Each input must be confirmed with RETURN/ENTER and each register card must be saved by double-clicking the SAVE-button.

- Step 3: Select register card CLAMP and input the following values:

CLAMP:      **short**            = 0  
                  **long**             = 1000  
 CLAMP without tool                    = 1020

RELEASE:    Deviation pos.:        = 1000  
                  Deviation neg.:       = -1000



Step 4: Select register card TIMES and input the following values:

CLAMP:      Min. measuring time      = **500**  
                  Stop frequency                = **150**  
                  Timeout                         = **5000**

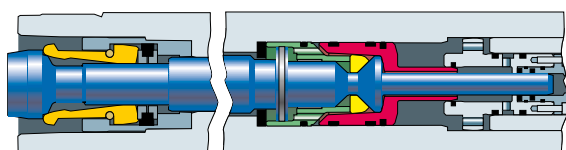
RELEASE:    same as CLAMP



**During the value collection no automatic tool changes must be executed!**

Step 5: Select register card SERVICE. Read the values indicated during the following procedure and chart them into a table.

Step 6: Operate the clamping system repeatedly without tool (at least 15 times). Note the displayed values for clamping [pulses] and release deviation [pulses] and calculate the average value.



Clamping system  
clamped without tool



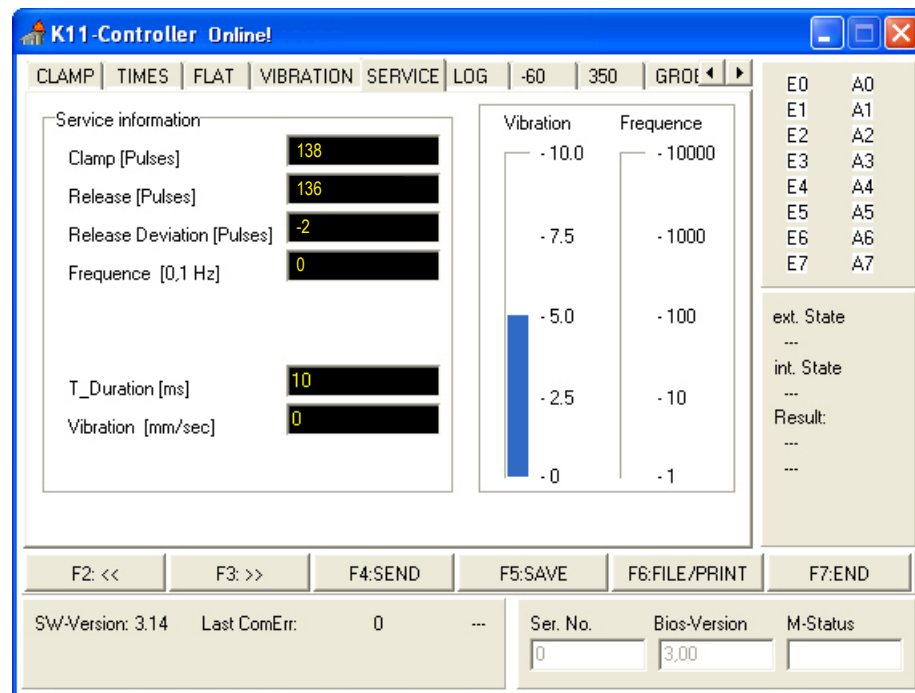


Table 1 (example)

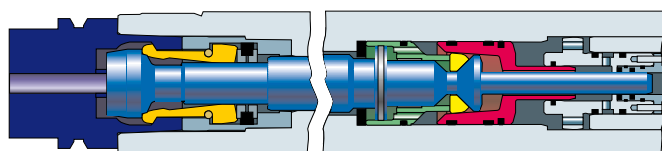
Nr.	Pulses clamp	Release deviation
1	138	-2
2	134	-8
3	140	-2
4	139	-6
5	140	-3
:	:	:
:	:	:
:	:	:
15	135	-4

maximum value

Ø 138

If the values vary significantly from one clamping cycle to the next (difference >10 pulses), probably there is still air in the hydraulic lines. The bleeding must be repeated.

- Step 7: Clamp a tool with a tool length within the normal range. This tool is designated as “zero“-tool. For this a clamping force measuring device can be used or a tool that was scanned on the measuring machine. Here too the clamp and release pulses should be counted 15 times and the average value should be calculated.



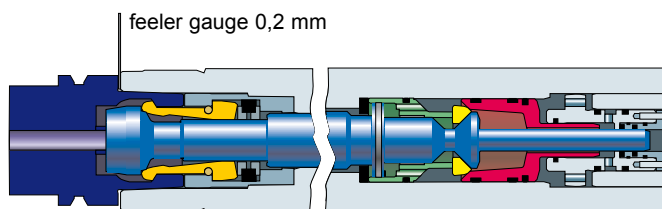
Clamping system clamped with zero-tool

Table 2 (example)

Nr.	pulses clamp	release deviation
1	88	-2
2	91	-6
3	88	-2
4	89	-2
5	87	-1
:	:	:
:	:	:
:	:	:
15	89	-4

**Ø 89**

- Step 8: In released condition place three feeler gauges each 0,2 mm thick between tool and spindle nose. The clamping cone now is 0,2 mm too close to the spindle's planar surface. This tool is labeled “minus“ - tool. The drawbar movement will now be reduced compared with the clamped “zero“-tool.



Clamping system clamped with zero tool

Table 3 (example)

Nr.	pulses clamp	release deviation
1	66	-2
2	70	-6
3	66	-2
4	68	-2
5	68	-1
:	:	:
:	:	:
:	:	:
15	66	-4

minimum value

Ø 67

Step 9: Select register card CLAMP

Enter following values according to the measured and noted values from the 3 previous clamp cycles (Examples from tab. 1-3, values may vary):

### 1. Lower limit for “Clamp/short“:

It results from the lowest measured pulse-number from table 3 minus 5:

$$65 - 5 = \underline{60}$$

**2. Upper limit for “Clamp/long“:**

It results from the difference of the average measured values of “zero“- and “minus-tool“ (tab. 2 and 3), which is added to the value of the “zero“-tool plus 5:

$$89 - 67 = 22; 89 + 22 + 5 = \underline{116}$$

The min. difference between the **Upper limit for Clamp long** and **Limit for Clamp without tool** (see step 5) must be 10. If the difference is less than 10, you must calculate without the “plus 15“:

$$89 - 67 = 22; 89 + 22 = \underline{111}$$

**3. Limit for “Release/deviation pos.“:**

It results from the smallest indicated release-deviation from Tab. 3 plus 10:

$$-1 + 10 = \underline{9}$$

**4. Limit for “Release/deviation neg.“:**

It results from the biggest indicated release-deviation from Tab. 1 minus 10:

$$-8 - 10 = \underline{-18}$$

**5. Limit for “Clamp without tool“:**

It results from the average value from Tab. 1 minus 10:

$$138 - 10 = \underline{128}$$

If the signal “clamp without tool“ is not used, enter the value 999 into the register card.

The screenshot shows the 'K11-Controller Online!' window with a blue header. Below the header is a tabbed interface with tabs for CLAMP, TIMES, FLAT, VIBRATION, and SERVICE. The 'CLAMP' tab is selected. Inside the CLAMP tab, there are two sections: 'CLAMP' and 'RELEASE'. The 'CLAMP' section has three input fields: 'Short [Pulses]' with the value 60, 'Long [Pulses]' with the value 111, and 'Clamp without tool' with the value 128. The 'RELEASE' section has two input fields: 'Deviation pos. [Pulses]' with the value 4, and 'Deviation neg. [Pulses]' with the value -13.

After entering the values, the register card CLAMP looks like this (in our example).

Each modified entry must be confirmed by pressing the Return/enter key and each register card must be saved by double clicking the "Save"-buttons.

### 5.3 Adjustment of minimum measuring time

The precise calculation of the minimum measuring time is only necessary in case of time-critical clamping cycles. The higher the value for "stop frequency" is entered, the slower the turbine must turn before the signal "Test finished" is indicated.

As standard value a stop frequency of 150 is recommended.

"Minimum measuring time" is the time set to count all pulses, however, without considering the "Stop frequency". The signal "Test finished" is only read out after the minimum measuring time has elapsed and after the subsequent check whether the stop frequency was underrun.

Procedural steps:

Step 10: Select register card TIMES and enter the following values:

CLAMP:	Minimum measuring time	= 0
	Stop frequency	= 150
	Timeout	= 5000

RELEASE same as CLAMP

The screenshot shows the 'K11-Controller Online!' window with a blue title bar. Below the title bar are five tabs: CLAMP, TIMES, FLAT, VIBRATION, and SERVICE. The 'TIMES' tab is selected and highlighted. Inside the TIMES tab, there are two sections: 'CLAMP' and 'RELEASE'. Each section contains three input fields: 'Min. time of Measure [ms]', 'Stopfreq [ms]', and 'Timeout [ms]'. The values entered in these fields are 0, 150, and 5000 respectively for both CLAMP and RELEASE sections.

After entering the values, the register card TIMES looks like this (in our example).

Step 11: Select register card SERVICE.

Step 12: Execute several clamp/release cycles (at least 15) without tool. Note the displayed times and subtract the adjusted stop frequency (150) from the longest time. Enter two-thirds of the result as minimum measuring time into register card TIMES.

K11-Controller Online!

CLAMP | TIMES | FLAT | VIBRATION | SERVICE | L

Service information

Clamp [Pulses]	285
Release [Pulses]	263
Release Deviation [Pulses]	22
Frequency [0,1 Hz]	0

After the first clamping cycle, the register card SERVICE looks like this (in our example)

Table 4 (example)

Nr.	Times clamp	Times release
1	285	263
2	281	270
3	283	267
4	291	269
5	282	264
:	:	:
:	:	:
:	:	:
15	286	286

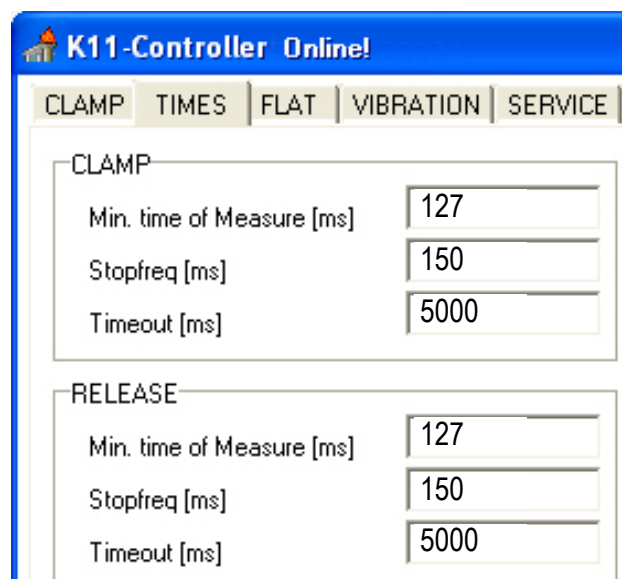
maximum value

longest time = 291 ms

Stop frequency = 150 ms

$$\frac{2 \times (291 \text{ ms} - 150 \text{ ms})}{3} = 94 \text{ ms}$$

**Minimum measuring time to be set = 94 ms.**



**K11-Controller Online!**

CLAMP TIMES FLAT VIBRATION SERVICE

**CLAMP**

Min. time of Measure [ms] 127

Stopfreq [ms] 150

Timeout [ms] 5000

**RELEASE**

Min. time of Measure [ms] 127

Stopfreq [ms] 150

Timeout [ms] 5000

After entering the minimum measuring time, the register card TIMES looks like this (in our example).

## 6 Communication with the control system

By using clearance signals for “Test finished” and “Test OK” a defined flowchart, that is only depending on events and conditions, results from the interaction with external controls or automation devices. Time warps are not required and mostly lead to mismeasurements.

### 6.1 Evaluation of feedback signals

#### “Clamped ok!”

- Clamping: The spindle can be used with max. speed without restriction. Tool is clamped correctly.

#### “Released ok!”

- Releasing: The tool is released correctly and can be removed from the fitting. An automated change cycle can be continued.

#### “Clamped without tool!”

- Clamping: The spindle was clamped without a tool and so the max. speed is restricted to 100 r.p.m.

#### “Timeout!” or “Error!”

The error “timeout” can be caused by four different problems, which can be classified on the service display by the number of pulses:

**Case 1:** A triggering of the K11 over I0 takes place, but during the time set in “timeout” there are no pulses from the turbine. An error message will not occur until timeout is reached.

Service display for clamping and releasing mostly = Null.

**Conclusion: Check hydraulics and valves!**

**Case 2:** A triggering of the K11 over I0 takes place, but during the time set in “timeout” pulses are constantly sent from the turbine, the stop frequency does not stop the measurement procedure. “Test finished” is not displayed. An error message will not occur until timeout is reached.

Service display for clamping and releasing mostly = very high values

**Conclusion: Check hydraulics and valves! Leakage possible!**



**Case 3:** When “Clamp” is selected, too less or too many pulses are sent. The tool is not clamped properly and the spindle must not run.

**Case 4:** When “Release” is selected, too less or too many pulses are sent. The tool is not released properly and cannot be taken out of the interface. An automatic tool change cycle must be aborted.

## 6.2 PLC signals to the controller

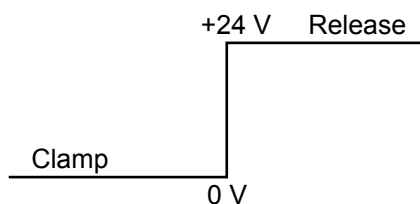
### For function clamp/release:

The input for manual or automatic clamping and release is **Input I0** on **plug X2** of the K11-controller. The input can be triggered by the PLC or a switch 24 V.

For releasing the tool, the signal must be +24V, holding as long, as the tool system is intended to be open. This input must be blocked, when the spindle is running.



**Attention: Never switch on voltage to Input I0 to the K11 connector X2, when the spindle is running! The tool system will release the tool and it will hurl away uncontrollably. There is danger for life and material!**

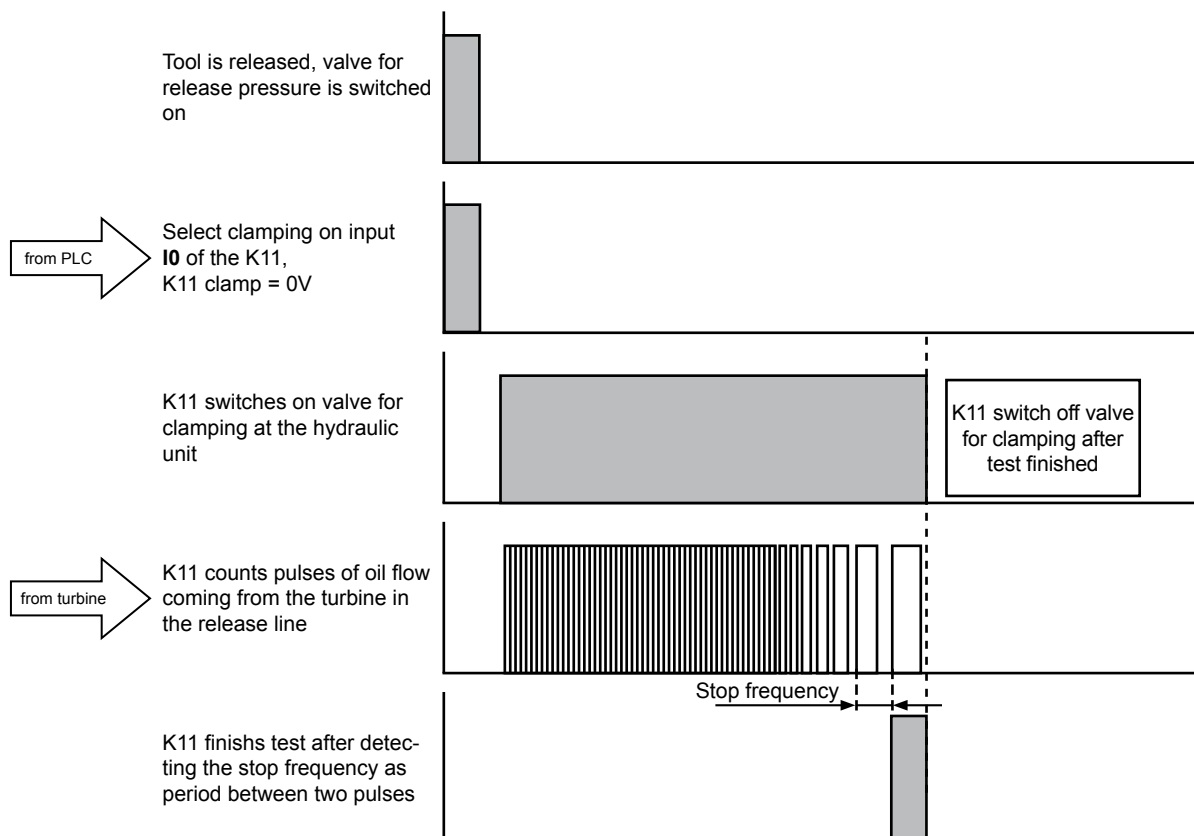


If the signal is set back to 0V, the tool system will clamp again. Even if only a short pulse (24 V) is applied to the input and interrupted immediately afterwards (0 V), the release cycle definitely will be finished completely, before it will be switched over to „clamp“.

**Input E0:** When the tool system is released, the release line stays pressurised as long as the input E0 receives the clamp-signal again. After clamping, the pressure is switched off at the hydraulic line for clamping.

## 6.3 Control sequence (BIOS 5.04)

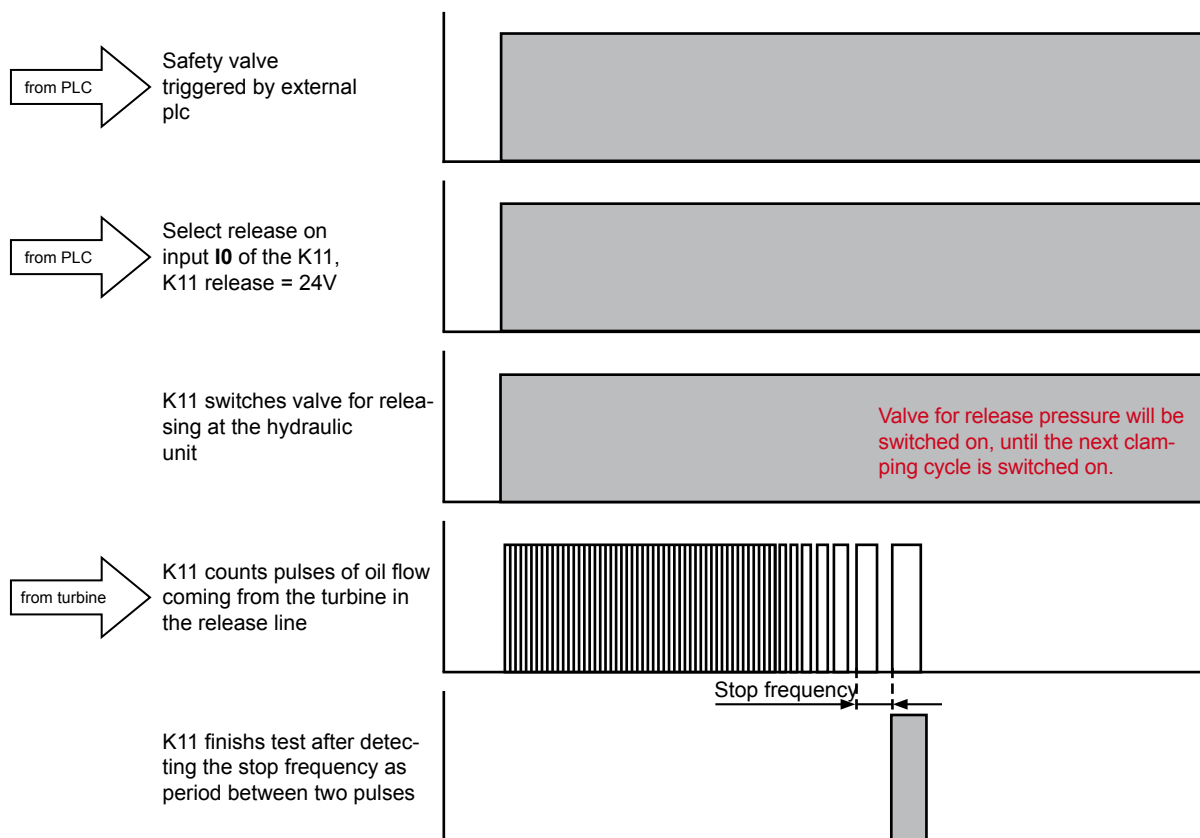
### Logic for “clamp tool”, starting position: tool interface released



### Results of clamp-monitoring

	O0 Clamp	O1 Release	O3 Test finished	O4 Clamped OK	O5 Released OK	O6 Clamped without tool	O7 Error	Result	Allowed spindle speed
← to PLC	X	-	X	X	-	-	-	Clamped OK	No speed limit
	X	-	X	-	-	X	-	Clamped without tool	Max. speed 100 rpm
	X	-	X	-	-	-	X	Error with clamping	Do not run spindle

### Logic for “release tool”, starting position: tool interface clamped



### Results for release-monitoring

	O0 Clamp	O1 Release	O3 Test finished	O4 Clamped ok	O5 Released ok	O6 Clamped without tool	O7 Error	Result	Spindle condition
← to PLC	-	X	X	-	X	-	-	Released OK	No spindle clearance
	-	X	X	-	-	-	X	Error with releasing	No spindle clearance

**Attention: Never set spindle into operation with released clamping system!**

## 7 Technical data

### Controller

- CPU: Motorola 68HC11 Microprocessor
- Memory: 512 Byte EEPROM (internal for Parameters)  
32 KB EPROM  
32 KB RAM
- I/O: 8 Digital-In 24 V (15 - 30 V)  
8 Digital-Out 24 V (je 20 mA; short circuit protected)  
4 Analog-In (0 - 5V or 0 -10V or 0 - 20mA or 4 - 20mA)  
2 Counters 24 V max. 500 Hz for NPN- and PNP-Initiators  
1 serial port RS 232  
1 spare port
- Connectors: Phoenix-Connectors Typ MSTB for
  - Inputs
  - Outputs
  - Counter
  - Power supplySerial port: SubD 9 pol  
Spare port: SubD 25 pol.
- Power supply: 24 V DC +/- 20%, ca. 1 A A
- Extension options:
  - K11-memory module: Can be used to save the last state of Clamp or Release permanently (even after loss of power). It is connected to the X11-connector
- Power supply for external sensors or devices:
  - 24 V DC and 5 V DC; by internal power supply of K11. **Total current is max. 500 mA, which must not be exceeded.**
  - If there are foreign sensors, which need other voltages, connect power supplies to the K11-controller.

## Measuring turbine



- Characteristics:
  - Flow metering with volumetric principle
  - suitable for viscose liquid self-lubricating, non-abrasive media
- Measure principle: A pair of geared wheels is set into rotation by hydraulic flow rate. The volume between the geared wheels transports an exact amount, which is detected by a biased Hall sensor with one pulse per tooth. The sensor sends signals proportionally to the flow-through ratio.
- Measuring range: VHZ 10 = 0,1 - 6l/min
- Accuracy:  $\pm 3\%$  of measured value (in reference to 20 mm<sup>3</sup>/s)
- Reproducebility:  $\pm 0,3\%$
- Max. pressure: 200 bar
- Media temperature: -25 up to 85°C
- Current consumption: 20 mA without load
- Output: PNP, Frequency output 200 mA max.
- Connection: Plug DIN 43650-A  
short-circuit proof  
reverse polarity protected
- Material:
 

Housing	Al anodised
Gear and axis	Stainless steel 1.4462
Bearing	IGLIDUR X
Seal	Viton
- Protection class: IP 65
- Weight: 0,50 kg

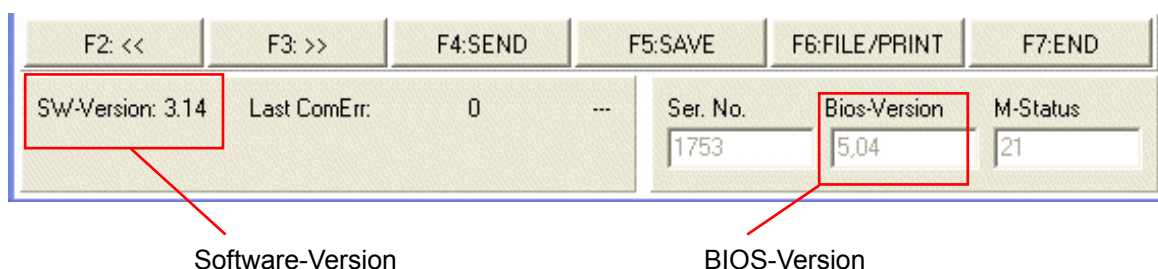
## 8 Ordering advice

Because of technical development and functional extensions of our controllers and software in the meantime several versions exist.

In case of a required spare part, please give us accordant information about your special software or BIOS-version.

Otherwise we ship the update version.

Please read the designations of your controller on the screen display:



Deliverable versions:

### Controller:

- BIOS version 3.05: **ID-Nr. 156-024**
- BIOS version 5.04: **ID-Nr. 156-038**  
related relay circuit board: **ID-Nr. 156-040**

**Software** (for all Windows-operation systems up to version 7):

- 2.96 (for all BIOS versions up to 2.11): **ID-Nr. 156-005**
- 3.16 (Attention: for all installed version from 3.14 up to 3.16, on the screen the version "3.14" is displayed; for all BIOS versions > 2.11): **ID-Nr. 156-031**