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Author Metronix		Date 10.12.2009

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2 Introduction

This Application Note describes a function supported by our servo positioning controller series ARS 2000 from the following revision of the standard-firmware and from the following revision of our parameter software Metronix ServoCommander™:

Parameter software Metronix ServoCommander™ Version 2.8.0.2.2

Firmware Version 3.5.0.1.8

If necessary please contact your supplier for an update.

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3 Introduction FAST

Using the parameter software Metronix ServoCommander Version 2.8.0.2.2, firmware Version 3.5.0.1.8 and the Auto-Tuning-Tool **FAST** (Flexible **A**dvanced **S**ervodrive **T**uning) you are able to identify automatically the parameter for the speed and the position controller corresponding to the application.

❖ **Which benefit do you have with the Auto-Tuning-Tool FAST?**

With the Auto-Tuning-Tool FAST you are able to identify automatically the settings for the speed and the position controller.

Please do a plausibility check with the identified data because this is an extension for experts.

❖ **Which systems are supported by the Auto-Tuning-Tool FAST?**

The Auto-Tuning-Tool FAST supports the following systems:

- Rigid systems:
 - Rotary synchronous motor with a rigid coupled mass
 - Linear motor with a rigid coupled mass
- Partly flexible systems:
 - Rotary synchronous motor with a gear and a coupled mass
 - Rotary synchronous motor with or without a gear und translatory ball screw axis with a rigid coupled mass

❖ **Which systems are not supported by the Auto-Tuning-Tool FAST?**

The Auto-Tuning-Tool FAST does not support flexible systems like e.g. motors with toothed drive belt axis.

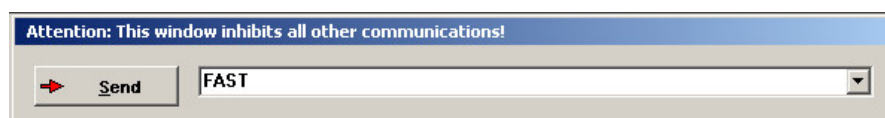
❖ **How to install the Auto-Tuning-Tool FAST?**

Please take following steps to install the Auto-Tuning-Tool FAST:

1. Download of the Auto-Tuning-Tool FAST from the protected area of our homepage at www.metronix.de.
2. Unpack the file „FAST.ZIP“ to the installation-directory of our ServoCommander Version 2.8.0.2.2.
3. Activate the Auto-Tuning-Tool Fast using the ServoCommander.

❖ **How to activate the Auto-Tuning-Tool FAST?**

To activate the Auto-Tuning-Tool FAST please enter in the **Transfer-Window (File - Transfer...)** "**FAST**" and press the "**Send**" button.



Afterwards a Message appears that the Auto-Tuning-Tool FAST is activated.

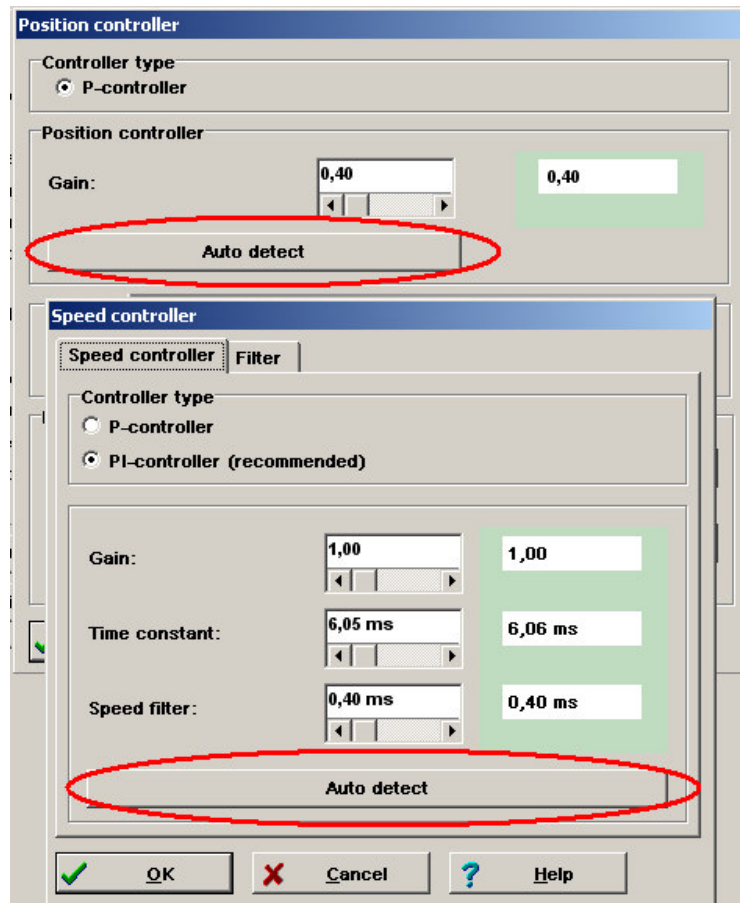


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Now the Auto-Tuning-Tool FAST is available in the Menu for the speed and the position controller.

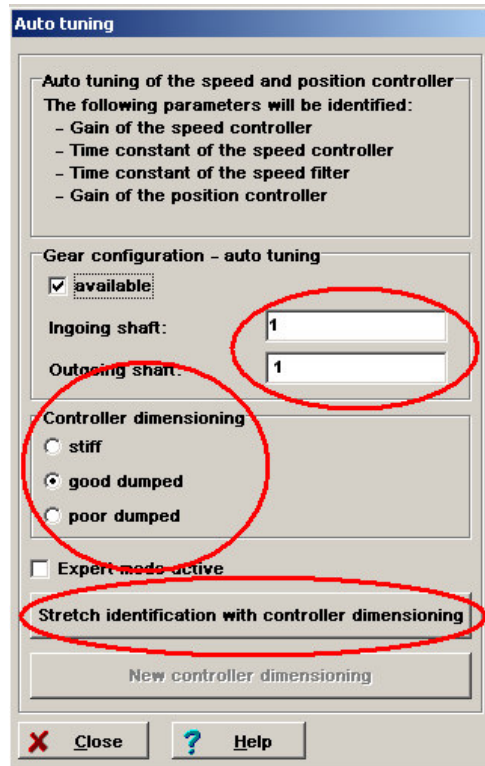
❖ **How to start the Auto-Tuning-Tool FAST?**


Start the Auto-Tuning-Tool FAST using the "Auto detect" button in the Menu with the settings of the parameters for the speed and position controller.



Afterwards the Menu with the settings of the parameters for the Auto-Tuning-Tool FAST will appear.

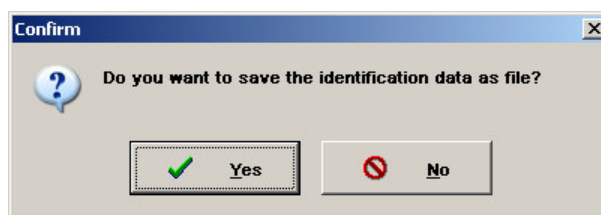
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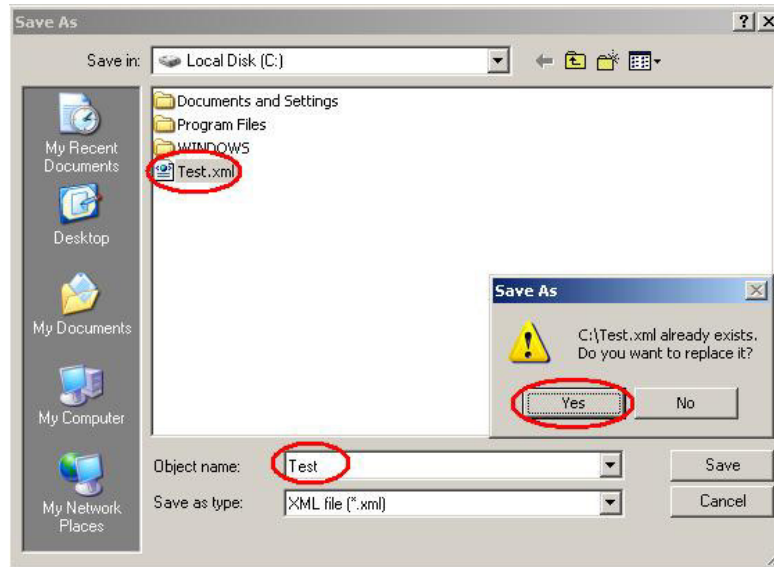


 For the "Stretch identification" it is necessary to set a possibly gear.

After this you choose the "Controller dimensioning" settings and start the system identification with the Auto-Tuning-Tool FAST using the button "Stretch identification with controller dimensioning".

After a successful identification the following message will appear:





If you save the data of this identification we are able to analyse this XML-file if necessary here at Metronix.

For this the file name can be "TEST.XML". For a transmission of this XML-file to Metronix any other name is also valid.

After a successful system identification the controller dimensioning process can be restarted at anytime without a new system identification process. For this the button "New controller dimensioning" needs to be pressed. Now the speed and position controller parameters are set.

In the following figures we show exemplarily the comparison between a poor dumped and a stiff controller setting.

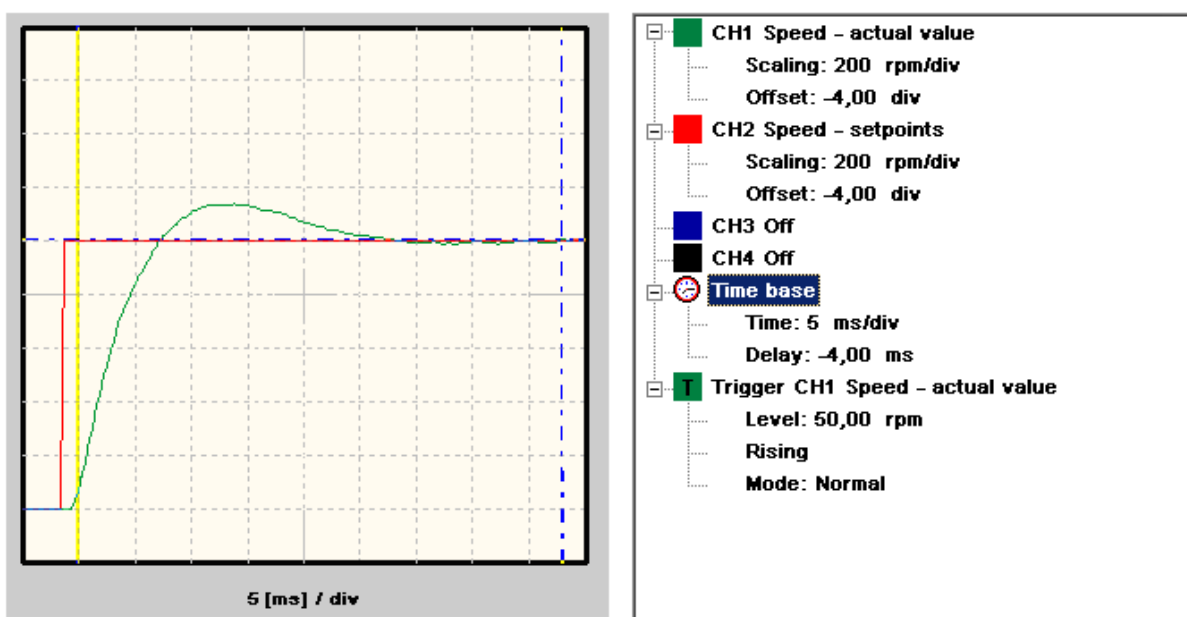


Figure 1: Poor dumped controller settings

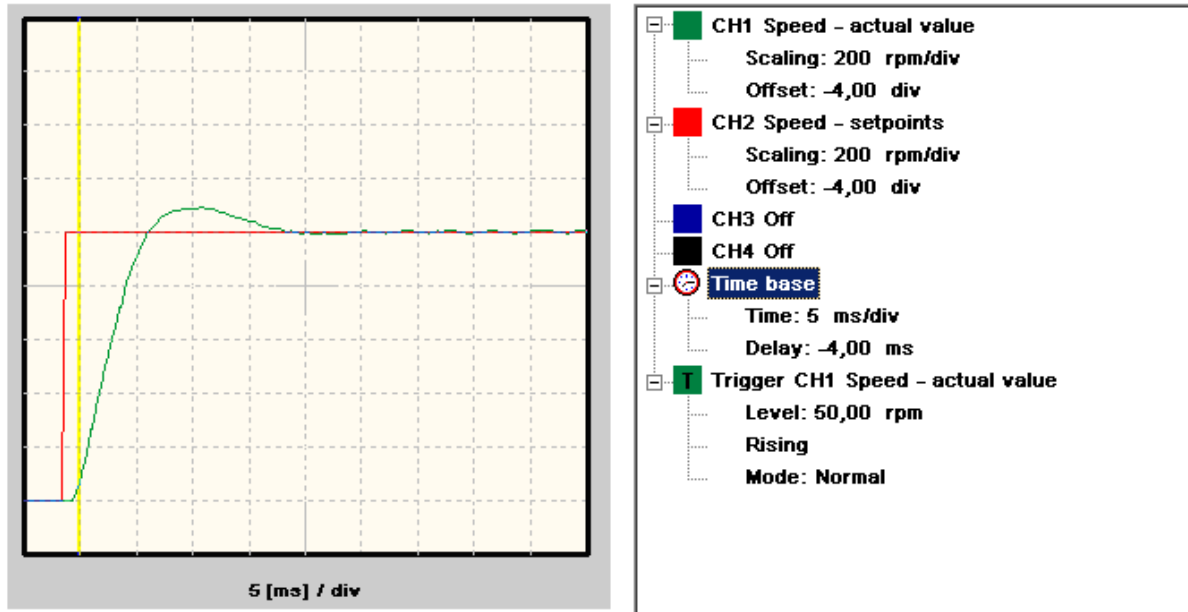


Figure 2: Stiff controller settings

Using the “Expert mode” you can adjust the settings “Speed controller – Stiffness” and “Position controller – Overshooting” manually.

Settings “Controller dimensioning“	Speed controller - Stiffness: 1 = poor dumped 10 = very stiff	Position controller - Overshooting: 1 = low 10 = high
stiff	9	9
Good dumped	5	5
Poor dumped	1	1

❖ How does the Auto-Tuning-Tool FAST work?

1. Automatic adaption of the control process:

In the first step the Auto-Tuning-Tool FAST searches a fitting base frequency of the PRBS-signal (pseudorandom binary sequence). In this step the drive will be stimulated with short PRBS-signal sequences at different base frequencies and logs the deflection of the motor. This deflection needs to be in a range of $2.5^\circ \pm 20\%$ for a valid base frequency (without a gear). If the deflection is outside of this range the parameters of the controlled system (drive and mass) can not be detected and the system identification will be skipped. For applications with a gear the range of the deflection will be modified. A significant move of the mass is necessary, typically the motor with a gear needs a larger deflection.

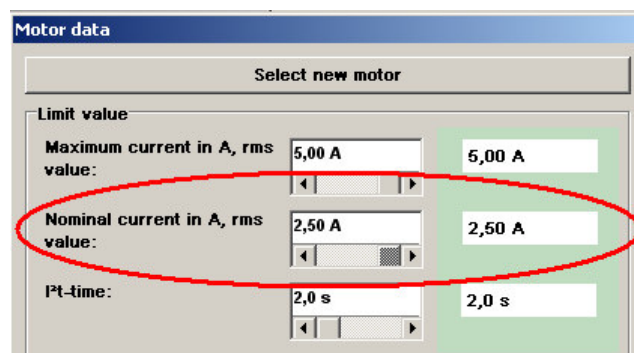
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2. System identification using the PRBS-signal:
For the identification of the base parameters of the control loop the system is stimulated by a specific PRBS-signal sequence of the predefined base frequency. For this step a bigger amount of measurement values is necessary. This indicates a longer signal sequence as before. Because of this bigger amount of data which needs to be transmitted the transmission takes more time.
3. Identification of the model parameters of the controlled system:
In this step the Auto-Tuning-Tool FAST calculates the model parameters from the measured values. Based on this model parameters the controller parameters are designed. Taking this identified model parameters you are able to start another calculation of controller parameters based on different controller dimensioning settings. It is not necessary to start a new system identification each time.
4. Automatic design of the speed and position controller parameters for rigid and partly flexible systems:
Considering the user-adjusted controller dimensioning settings (stiffness and overshooting) the Auto-Tuning-Tool FAST calculates the following parameters in this step:
 - Gain of the speed controller
 - Time constant of the speed controller
 - Time constant of the speed filter
 - Gain of the position controller
Additionally the optional Notch filter will be deactivated.

You can retry Step 4 anytime with different controller dimensioning settings. In this way you are able to identify and test e.g. parameter for different controller – stiffness's.

❖ **Which settings need to be changed if the Stretch identification of the Auto-Tuning-Tool FAST was not successful?**

For small drives with low masses it may happen that a fitting adaption of the base frequency of the PRBS-signals fails. In this case a temporary change of the nominal current (e.g. reduction) in the menu “Motor data” can help to a successful adaption of the fundamental frequency of the PRBS-signal. Then the amplitude is in a range of 2.5° +/- 20% again. In this case an automatic identification of the control process is possible.



❖ **Which Data needs Metronix, to check the function of the Auto-Tuning-Tool FAST?**
After a successful as well as an unsuccessful identification of the controlled system the

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results of the measurement can be saved in an XML-file. This file is important for an analysis at Metronix.

❖ **Which information is inside of the analysis file "TEST.XML" and why is this file so important for the analysis at Metronix?**

Inside of this XML-file we log all results of the measurement during this identification. These loggings help us with product improvement and bug detection and fixing of the "Auto-Tuning-Tool FAST".

❖ **Who should receive this file**

E-Mail address: support@metronix.de

❖ **Who is the counterpart for questions concerning the Auto-Tuning-Tool FAST?**

Please contact the Technical Helpline at **+49 (0)531 / 8668 444**

❖ **Important advice:**



Please Note!

For the optimization of the speed and the position controller with the Auto-Tuning-Tool FAST the "gear configuration" needs to be correct.

Notice: The "gear configuration" has no effect on the display units of the parameter software Metronix ServoCommander.

Caution!

Damaging of the system by vibrations!

The using of this function for the controller settings of the speed and position controller generates vibrations in the drive and the mechanics for a short term.

Under critical conditions it can damage the system:

- Don't use this method if your system is inclined to vibrate.
- Don't use this method if your system can be damaged by vibrations.

Caution: The drive performs autonomous movements when the identification of the control system is started.