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servo drives

Software Manual

Servo Positioning Controller ARS 2000

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1 General

1.1 Documentation

This product manual serves the purpose of safe use of the parameterisation software Metronix ServoCommander™ for the servo positioning controller ARS 2000 series servo controller.

For more information, please refer to the following manuals of the ARS 2000 series products:

- **Product Manual “Servo Positioning Controller ARS 2100”:** Description of the technical specifications and the device functionality as well as notes on the installation and the operation of the servo positioning controller ARS 2100.
- **Product manual "Servo Positioning Controller ARS 2302 - 2310":** Description of the technical data and the device functionality plus notes concerning the installation and operation of ARS 2302, 2305 and 2310 servo positioning controllers.
- **Product manual "Servo Positioning Controller ARS 2320 and 2340":** Description of the technical data and the device functionality plus notes concerning the installation and operation of ARS 2320 and 2340 servo positioning controllers.
- **CANopen Manual “Servo Positioning Controller ARS 2000“:** Description of the implemented CANopen protocol as per DSP402.
- **PROFIBUS Manual “Servo Positioning Controller ARS 2000”:** Description of the implemented PROFIBUS-DP protocol.
- **SERCOS Manual “Servo Positioning Controller ARS 2000”:** Description of the implemented SERCOS functionality.
- **Product manual "Ethernet Technology Module":** Description of the technical data and the device functionality plus notes concerning the installation and operation Ethernet Technology Module.

The implementation of the entire software functionality of the ARS 2000 series will be subject to a step-by-step development process.

This version of the software manual describes the functions of firmware 3.5 and those of firmware 3.x, which is currently being developed.

Some headings and text passages in this manual contain notes in the form of <FW3.x> indicating the availability of the functions in the corresponding firmware version.

Some of the shown windows of the parameterisation program Metronix ServoCommander™ do not yet correspond to the final version and may deviate from the actual parameterisation software Metronix ServoCommander™.

1.2 Scope of Delivery

The scope of delivery includes:

Table 1: Scope of delivery

1	CD-ROM with installation program Metronix ServoCommander™

2 Safety Notes for Electrical Drives and Controllers

2.1 Used Symbols

Information

Important information and notes.

Application

Additional Information for application purposes

Caution!

Nonobservance may result in severe property damages.

DANGER !

Nonobservance may result in property damages and in personal injuries.

Caution! Dangerous voltages.
The safety note indicates a possible perilous voltage.

Further symbols:

Table 2: General symbols

	Floppy disk symbol:	All subsequent steps concern settings in the parameterisation program Metronix ServoCommander™.
	Plug symbol:	All subsequent steps concern the hardware, i.e. the servo positioning controller ARS 2000.

2.2 General Notes

In case of damage resulting from non-compliance with the safety notes in this manual, Metronix Meßgeräte und Elektronik GmbH will not assume any liability.

Prior to the initial use you must read the chapters *Safety Notes for Electrical Drives and Controllers* starting on *Page 15*.

If the documentation in the language at hand is not understood accurately, please contact and inform your supplier.

Sound and safe operation of the servo drive controller requires proper and professional transportation, storage, assembly and installation as well as proper operation and maintenance. Only trained and qualified personnel may handle electrical devices:

TRAINED AND QUALIFIED PERSONNEL

in the sense of this product manual or the safety notes on the product itself are persons who are sufficiently familiar with the setup, assembly, commissioning and operation of the product as well as all warnings and precautions as per the instructions in this manual and who are sufficiently qualified in their field of expertise:

- Education and instruction or authorisation to switch devices/systems on and off and to ground them as per the standards of safety engineering and to efficiently label them as per the job demands.
- Education and instruction as per the standards of safety engineering regarding the maintenance and use of adequate safety equipment.
- First aid training.

The following notes must be read prior to the initial operation of the system to prevent personal injuries and/or property damages:

These safety notes must be complied with at all times.

Do not try to install or commission the servo drive controller before carefully reading all safety notes for electrical drives and controllers contained in this document. These safety instructions and all other user notes must be read prior to any work with the servo drive controller.

In case you do not have any user notes for the servo drive controller, please contact your sales representative. Immediately demand these documents to be sent to the person responsible for the safe operation of the servo drive controller.

If you sell, rent and/or otherwise make this device available to others, these safety notes must also be included.

The user must not open the servo drive controller for safety and warranty reasons.

Professional control process design is a prerequisite for sound functioning of the servo drive controller!

DANGER!

Inappropriate handling of the servo drive controller and non-compliance of the warnings as well as inappropriate intervention in the safety features may result in property damage, personal injuries, electric shock or in extreme cases even death.

2.3 Danger Resulting from Misuse

DANGER!

High electrical voltage and high current!

Danger to life or serious personal injury from electrical shock!

DANGER!

High electrical voltage caused by wrong connections!

Danger to life or serious personal injury from electrical shock!

DANGER!

Surfaces of device housing may be hot!

Risk of injury! Risk of burning!

DANGER!

Dangerous movements!

Danger to life, serious personal injury or property damage due to unintentional movements of the motors!

2.4 Safety Notes

2.4.1 General Safety Notes

The servo drive controller corresponds to IP20 class of protection as well as pollution level 1. Make sure that the environment corresponds to this class of protection and pollution level.

Only use replacements parts and accessories approved by the manufacturer.

The devices must be connected to the mains supply as per EN regulations, so that they can be cut off the mains supply by means of corresponding separation devices (e.g. main switch, contactor, power switch).

The servo drive controller may be protected using an AC/DC sensitive 300 mA fault current protection switch (RCD = Residual Current protective Device).

Gold contacts or contacts with a high contact pressure should be used to switch the control contacts.

Preventive interference rejection measures should be taken for control panels, such as connecting contactors and relays using RC elements or diodes.

The safety rules and regulations of the country in which the device will be operated must be complied with.

The environment conditions defined in the product documentation must be kept. Safety-critical applications are not allowed, unless specifically approved by the manufacturer.

For notes on installation corresponding to EMC, please refer to a product manual of the ARS 2000 family. The compliance with the limits required by national regulations is the responsibility of the manufacturer of the machine or system.

The technical data and the connection and installation conditions for the servo drive controller are to be found in this product manual and must be met.

DANGER!

The general setup and safety regulations for work on power installations (e.g. DIN, VDE, EN, IEC or other national and international regulations) must be complied with.

Non-compliance may result in death, personal injury or serious property damages.

Without claiming completeness, the following regulations and others apply:

VDE 0100	Regulations for the installation of high voltage (up to 1000 V) devices
EN 60204	Electrical equipment of machines
EN 50178	Electronic equipment for use in power installations

2.4.2 Safety Notes for Assembly and Maintenance

The appropriate DIN, VDE, EN and IEC regulations as well as all national and local safety regulations and rules for the prevention of accidents apply for the assembly and maintenance of the system. The plant engineer or the operator is responsible for compliance with these regulations:

The servo drive controller must only be operated, maintained and/or repaired by personnel trained and qualified for working on or with electrical devices.

Prevention of accidents, injuries and/or damages:

Additionally secure vertical axes against falling down or lowering after the motor has been switched off, e.g. by means of:

- Mechanical locking of the vertical axle,
- External braking, catching or clamping devices or
- Sufficient balancing of the axle.

The motor holding brake supplied by default or an external motor holding brake driven by the drive controller alone is not suitable for personal protection!

Render the electrical equipment voltage-free using the main switch and protect it from being switched on again until the DC bus circuit is discharged, in the case of:

- Maintenance and repair work
- Cleaning
- long machine shutdowns

Prior to carrying out maintenance work make sure that the power supply has been turned off, locked and the DC bus circuit is discharged.

The external or internal brake resistor carries dangerous DC bus voltages during operation of the servo drive controller and up to 5 minutes thereafter. Contact may result in death or serious personal injury.

Be careful during the assembly. During the assembly and also later during operation of the drive, make sure to prevent drill chips, metal dust or assembly parts (screws, nuts, cable sections) from falling into the device.

Also make sure that the external power supply of the controller (24V) is switched off.

The DC bus circuit or the mains supply must always be switched off prior to switching off the 24V controller supply.

Carry out work in the machine area only, if AC and/or DC supplies are switched off. Switched off output stages or controller enablings are no suitable means of locking. In the case of a malfunction the drive may accidentally be put into action.

Initial operation must be carried out with idle motors, to prevent mechanical damages e.g. due to the wrong direction of rotation.

Electronic devices are never fail-safe. It is the user's responsibility, in the case an electrical device fails, to make sure the system is transferred into a secure state.

The servo drive controller and in particular the brake resistor, externally or internally, can assume high temperatures, which may cause serious burns.

2.4.3 Protection against Contact with Electrical Parts

This section only concerns devices and drive components carrying voltages exceeding 50 V. Contact with parts carrying voltages of more than 50 V can be dangerous for people and may cause electrical shock. During operation of electrical devices some parts of these devices will inevitably carry dangerous voltages.

DANGER!

High electrical voltage!

Danger to life, danger due to electrical shock or serious personal injury!

The appropriate DIN, VDE, EN and IEC regulations as well as all national and local safety regulations and rules for the prevention of accidents apply for the assembly and maintenance of the system. The plant engineer or the operator is responsible for compliance with these regulations:

Before switching on the device, install the appropriate covers and protections against accidental contact. Rack-mounted devices must be protected against accidental contact by means of a housing, e.g. a switch cabinet. The regulations VGB4 must be complied with!

Always connect the ground conductor of the electrical equipment and devices securely to the mains supply. Due to the integrated line filter the leakage current exceeds 3.5 mA!

Comply with the minimum copper cross-section for the ground conductor over its entire length as per EN 60617!

Prior to the initial operation, even for short measuring or testing purposes, always connect the ground conductor of all electrical devices as per the terminal diagram or connect it to the ground wire. Otherwise the housing may carry high voltages which can cause electrical shock.

Do not touch electrical connections of the components when switched on.

Prior to accessing electrical parts carrying voltages exceeding 50 V, disconnect the device from the mains or power supply. Protect it from being switched on again.

For the installation the amount of DC bus voltage must be considered, particularly regarding insulation and protective measures. Ensure proper grounding, wire dimensioning and corresponding short-circuit protection.

The device comprises a rapid discharge circuit for the DC bus as per EN60204 section 6.2.4. In certain device constellations, however, mostly in the case of parallel connection of several servo drive controllers in the DC bus or in the case of an unconnected brake resistor, this rapid discharge may be rendered ineffective. The servo drive controllers can carry voltage until up to 5 minutes after being switched off (residual capacitor charge).

2.4.4 Protection against Electrical Shock by Means of Protective Extra-Low Voltage (PELV)

All connections and terminals with voltages between 5 and 50 V at the servo drive controller are protective extra-low voltage, which are designed safe from contact in correspondence with the following standards:

International: IEC 60364-4-41

European countries within the EU: EN 50178/1998, section 5.2.8.1.

DANGER!

High electrical voltages due to wrong connections!

Danger to life, risk of injury due to electrical shock!

Only devices and electrical components and wires with a protective extra low voltage (PELV) may be connected to connectors and terminals with voltages between 0 to 50 V.

Only connect voltages and circuits with protection against dangerous voltages. Such protection may be achieved by means of isolation transformers, safe optocouplers or battery operation.

2.4.5 Protection against Dangerous Movements

Dangerous movements can be caused by faulty control of connected motors, for different reasons:

- Improper or faulty wiring or cabling
- Error in handling of components
- Error in sensor or transducer
- Defective or non-EMC-compliant components
- Error in software in superordinated control system

These errors can occur directly after switching on the device or after an indeterminate time of operation.

The monitors in the drive components for the most part rule out malfunctions in the connected drives. In view of personal protection, particularly the danger of personal injury and/or property damage, this may not be relied on exclusively. Until the built-in monitors come into effect, faulty drive movements must be taken into account; their magnitude depends on the type of control and on the operating state.

DANGER!

Dangerous movements!

Danger to life, risk of injury, serious personal injuries or property damage!

For the reasons mentioned above, personal protection must be ensured by means of monitoring or superordinated measures on the device. These are installed in accordance with the specific data of the system and a danger and error analysis by the manufacturer. The safety regulations applying to the system are also taken into consideration. Random movements or other malfunctions may be caused by switching the safety installations off, by bypassing them or by not activating them.

2.4.6 Protection against Contact with Hot Parts

DANGER!

Housing surfaces may be hot!

Risk of injury! Risk of burning!

Do not touch housing surfaces in the vicinity of heat sources! Danger of burning!

Before accessing devices let them cool down for 10 minutes after switching them off.

Touching hot parts of the equipment such as the housing, which contain heat sinks and resistors, may cause burns!

2.4.7 Protection during Handling and Assembly

Handling and assembly of certain parts and components in an unsuitable manner may under adverse conditions cause injuries.

DANGER!

Risk of injury due to improper handling!

Personal injury due to pinching, shearing, cutting, crushing!

The following general safety notes apply:

Comply with the general setup and safety regulations on handling and assembly.

Use suitable assembly and transportation devices.

Prevent incarcerations and contusions by means of suitable protective measures.

Use suitable tools only. If specified, use special tools.

Use lifting devices and tools appropriately.

If necessary, use suitable protective equipment (e.g. goggles, protective footwear, protective gloves).

Do not stand underneath hanging loads.

Remove leaking liquids on the floor immediately to prevent slipping.

3 General Information on the Parameterisation Program Metronix ServoCommander™

3.1 Basic Information

Metronix ServoCommander™ allows the parameterisation of the ARS 2000 series servo controller. Users already familiar with the parameterisation program WMEMOC 3.5 Gamma, will easily work with the Metronix ServoCommander since the user interface design as well as many functions are similar.

The information contained in this manual refers to the following firmware and hardware versions:

- Servo positioning controller ARS 2000 firmware versions up to 3.5
- Parameterisation software Metronix ServoCommander™ version up to 2.8

If not explicitly documented, functions available in older versions are also avilable in new versions.

The firmware of the servo positioning controller ARS 2000 and the parameterisation program Metronix ServoCommander™ must be harmonised, i.e. functional extensions of a new firmware usually also require the corresponding new version of Metronix ServoCommander™.

The parameterisation program Metronix ServoCommander™ cannot be used to parameterise devices of the following series: DIS-2, IMD/F, ARS-310 or ARS-560!

3.2 Metronix ServoCommander™ Features

The parameterisation program Metronix ServoCommander™ can be used to optimally adapt the servo positioning controller ARS 2000 to your applications.

The parameterisation program offers the following features:

- Parameterisation of the servo positioning controller ARS 2100 and ARS 2300
- Configuration of all parameters via PC
- Display of operating parameters
- User-assisted commissioning
- Loading of new firmware versions
- Loading and storing of parameter sets
- Printing of parameter sets
- Offline parameterisation
- Oscilloscope functions
- Language support: German, English, French, Spanish
- Windows®-based application
- Online help

3.3 Hardware and Software Requirements

Requirements for the installation of the parameterisation program:

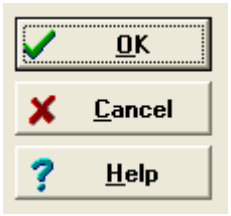
- IBM-compatible PC-AT, Pentium processor with minimum 32 MB RAM and minimum 200 MB of free hard disk space
- Operating system Windows® 95, Windows® 98, Windows NT®, Windows 2000 or Windows® XP
- CD-ROM drive or floppy disk drive
- One free serial port

Some languages (e.g. Chinese) need a special font (Arial Unicode MS). This font has to be selected for all display elements in the system configuration of your computer.

3.4 Using the Parameterisation Program

3.4.1 Standard Buttons

If a Metronix ServoCommander™ window is open, this window will have a button bar, which often looks like this:



The buttons have the following functions:

OK: All changes will be accepted and the window will be closed.

Cancel: All changes will be undone and even already transferred values will be restored and the window will be closed.

Help: Opens a help menu, which provides information on the currently open window.

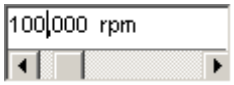
To actuate a button, click on it with your left mouse button or press the TAB key to activate it and then press the ENTER key to acknowledge. If the appearance of the buttons in some menus differs from the form described here, you will find more detailed information in the manual or the online help.

3.4.2 Numerical Input Fields

Many windows of the parameterisation program Metronix ServoCommander™ contain fields for numerical entries similar to the one shown below:

There are several ways of entering data:

1. Directly via the keyboard: Enter the value directly in the entry line. As long as the entry is not finalised, the text will appear in a thin font and has not yet been accepted by the parameterisation program (see illustration).



To finalize the entry, press ENTER or move on to another input field by pressing TAB. The numeric value will then appear in bold.

2. Clicking on the arrow buttons: The value will change in small increments. (fine adjustment)
3. Clicking on the scroll bar between the gray scroll box and the arrow buttons: The value will change in large increments. (coarse adjustment)

4. Clicking on the gray scroll box and moving it with the mouse while pressing the left mouse button: The value can be easily set within the entire value range.

3.4.3 Control Elements

Guiding the user is preferred by graphically orientated windows.

The following table shows and describes the control elements used in the individual windows:

Table 3: Control elements

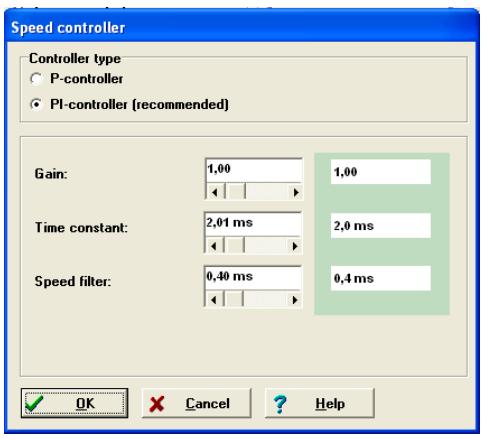
Control Element	Name	Description
	Check box	An option, which the user can activate or deactivate by checking the corresponding box. It is possible to check several boxes at once.
	Radio button	With this button the user can choose one of several options.
	General button	A button, which opens another menu or initiates an action when clicked on by the user
	"..." button	A button, which opens another window when clicked on by the user

3.4.4 Display of Setpoints and Actual Values

As compared to WMEMOC, the parameterisation program Metronix ServoCommander™ uses a modified concept for displaying setpoints, corresponding to a desired user value, and the actual values used by the device.

The new mode of operation is the following:

1. The user changes the value in the input field by moving the scroll box on the scroll bar or by directly entering a new value.
2. Metronix ServoCommander™ transfers this value to the servo positioning controller ARS 2000.
3. Metronix ServoCommander™ immediately reads the currently valid parameter and displays it in the green field. The input field itself remains unchanged.



Definition of terms:

- Setpoint: Target value transferred to the servo positioning controller ARS 2000 (setting desired by the user).
- Actual value: This value is currently effective in the servo positioning controller ARS 2000. A deviation from the setpoint can have different reasons.

  Examples:

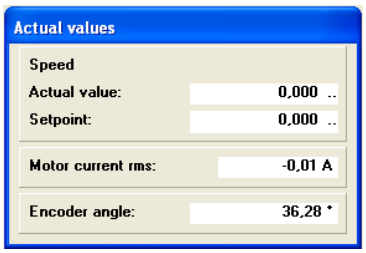
  - Quantisation effects, truncation effects, etc.
  - The changed parameter only has an impact after saving followed by a reset
  - Temporary value range overrun, e.g. rated current > maximum current
  - Wrong value ranges, e.g. during loading of a parameter set from a servo controller with a higher class of performance (rated current > device's rated current)

The idea behind the concept of different setpoints and actual values is the following: It is possible to load a parameter set from a servo controller of one class of performance to a servo controller of a different class of performance and back again. As long as no other parameterisation has been carried out, the setpoints remain unchanged. Only the actual values will be different due to the different classes of performance. This prevents a step-by-step change of a parameter set resulting from the device's class of performance.

3.4.5 Standard Windows

The default configuration always opens the Commands window, the Status window and the Actual values window.

The Actual values window displays the current controller parameters such as currents, speeds, etc. The Actual values window is configured via the menu option Display/Actual values. All values to be displayed must be checked. With the options Enable all or Disable all the Actual values window can be quickly minimised or maximised.



3.4.6 Directories

The installed version of Metronix ServoCommander™ uses the following directories:

Table 4: Directory structure

Directory	Contents
cam	Default directory for the tables of CAM and axis error compensation.
DCO	Default directory for the parameter files
documentation	Directory of the supplied documetation in a PDF file format
EDS	EDS-files for the application of the servo positioning controllers in a CANopen network. The EDS-files are also used by the PDO configuration menus.
FIRMWARE	Firmware versions of the different types of devices
PROFIBUS	GSD file, example projects for SIEMENS S7 with function and data modules
Tools	Tools for the application of the Ethernet technology module.
TXT	Default directory for plain text output of parameter data

3.4.7 Communication via communication objects

The parameterisation program Metronix ServoCommander™ accesses the servo positioning controller ARS 2000 by means of so-called communication objects via a standardised, internal software interface. During the processing of the communication tasks, an internal check for the following errors will be performed:

- Write access to read-only communication objects
- Read access to write-only communication objects
- Overshooting or undershooting of the value range
- Erroneous data transfer (wrong check sum)

The first two cases are fatal errors, which should not occur in practice. In the case mentioned last, Metronix ServoCommander™ tries to perform the read or write process without bit error.

Overshooting and undershooting of the value range of a communication object are indicated by a warning.

4 Installation, First Program Start and Communication

4.1 Installation from CD-ROM

To install from CD-ROM proceed as follows:

1. Insert the CD-ROM into the CD-ROM drive of your computer.
2. Start Windows®-Explorer.
3. Go to the directory DEUTSCH or ENGLISH on your CD-ROM.
4. Start the program by double-clicking on SETUP.EXE.

The installation program creates a new program group named „ServoCommander“. Complete and successful installation will be indicated by a corresponding window.

4.2 Configuring the Communication (RS232)

The parameterisation program Metronix ServoCommander™ provides two communication paths to the servo positioning controller ARS 2000:

- Communication via serial port (RS232)
- Communication via UDP (Ethernet)

The communication via UDP needs for an Ethernet module in technology slot 1. First this has to be parameterized correctly which is normally done via RS232. Hence, the following chapters describe the communication via RS232 first. *Chapter 8.2* describes the communication via UDP (Ethernet).

Communicating via RS232 the parameterisation program needs to know which serial interface (COM port number) and which transmission rate to use.

The default configuration at the time of delivery is:

- Interface COM1
- Transmission rate 9600 Baud (default configuration of servo controller)
- 8 data bits, 1 stop bit, no parity check. This configuration cannot be changed!

Once started, the program tries to establish communication via RS232 with a servo positioning controller. If this fails, Metronix ServoCommander™ will display an error message *(see Chapter 4.4, Page 32)*.

In order to set the data for communication via RS232 correctly, the following steps must be completed:

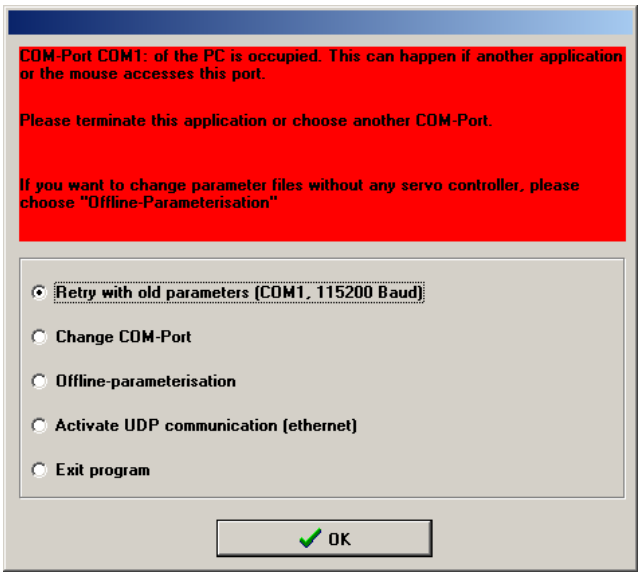
1. Connect the servo positioning controller ARS 2000 completely.
2. Connect a free COM port of the PC with the servo positioning controller ARS 2000 using a null modem cable.
3. Switch on the servo positioning controller ARS 2000.
4. Run the parameterisation program Metronix ServoCommander™.

If the „RS 232”-button in the toolbar is green (see illustration), the communication parameters are correct.

If an error message appears instead, please read *Chapter 4.3 Configuration of the Serial Interface (Page 31)* and *Chapter 4.4 Troubleshooting Serial Communication Problems, (Page 32)*.

4.3 Configuration of the Serial Interface

If the parameterisation program Metronix ServoCommander™ cannot open the serial interface, the following error message will appear as you run the program:



This can be due either to a wrong interface setting (mostly mouse driver setting) or another Windows®- or MS-DOS®-based program accesses this serial interface.

To solve this access conflict, close the other programs (in the case of MS-DOS®-based programs also close the shell!) and then click on **Retry with old parameters**.

To correct the interface configuration, click on the radio button **Change COM-Port** and follow the instructions. (Please refer to *Chapter 13.18.1, Page 191)*.

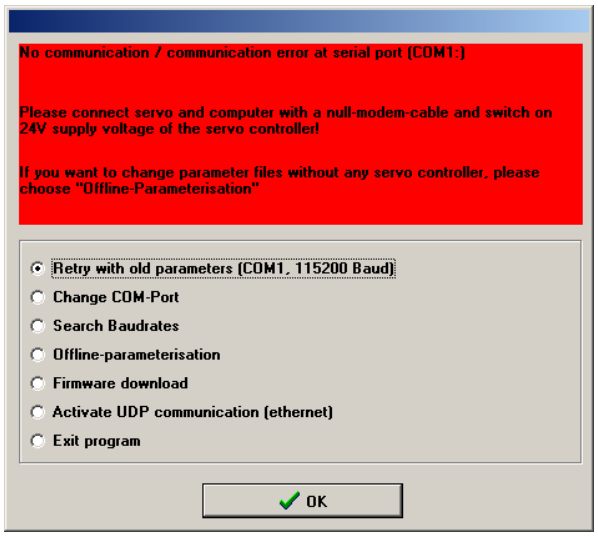
Offline-parameterisation is not a suitable option for commissioning. You find further information in *Chapter 9.2*.

Die Option **Activate UDP communication (Ethernet)** is also not a suitable option for commissioning. You find further information in *Chapter 8.2*.

Clicking on the radio button **Exit program** will immediately terminate Metronix ServoCommander™.

4.4 Troubleshooting Serial Communication Problems

If the parameterisation program Metronix ServoCommander™ cannot establish communication with the servo positioning controller ARS 2000 via RS232, the following error message will appear:



The following table describes possible error causes and error recovery strategies:

Table 5: Recovering problems with serial communication

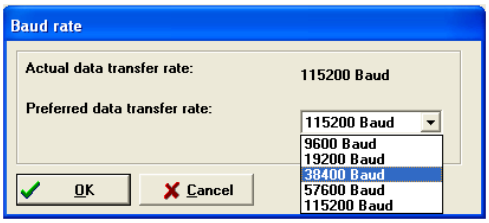
Cause	Measure
Communication is ‘choking’	Click on **Retry with old parameters**.
Wrong Com port selected	Click on **Change COM-Port** and follow the instructions.
Baud rates of parameterisation program Metronix ServoCommander™ and servo positioning controller ARS 2000 do not match	Click on **Search Baudrates**.

Cause	Measure
Servo positioning controller ARS 2000 communication malfunction	RESET the servo positioning controller ARS 2000, and then click on Retry with old parameters.
Servo positioning controller ARS 2000 has no or incomplete firmware.	Select **Firmware download** option and follow the instructions.
UDP-communication is desired instead of RS232-communication	Select the option **Activate UDP communication (Ethernet)**. (See also *Chapter 8.2*).
Hardware error: ❖ Servo positioning controller ARS 2000 switched off	Recover the error, and then click on **Retry with old parameters**.
❖ Connecting cable not plugged in	
❖ Connecting cable broken	
❖ Connecting cable too long	Reduce the baud rate or use a shorter cable.

Offline parameterisation only makes sense, if you want to edit parameter set files without the servo positioning controller ARS 2000. (Please refer to *Chapter 9.2, Page 96)*.

4.5 Optimizing of serial communication

The default transmission rate of the servo controller is 9600 Baud (RS232). This baud rate can be increased in the menu option **Options/Communication/Communication parameters RS232/Baudrate…** based on the current transmission rate.



The **Preferred data transfer rate** is selected and Metronix ServoCommander™ will try to establish communication at this baud rate. The desired transmission rate is then either accepted or the software switches back to a lower baud rate. The established baud rate is now shown as the **Actual data transfer rate**.

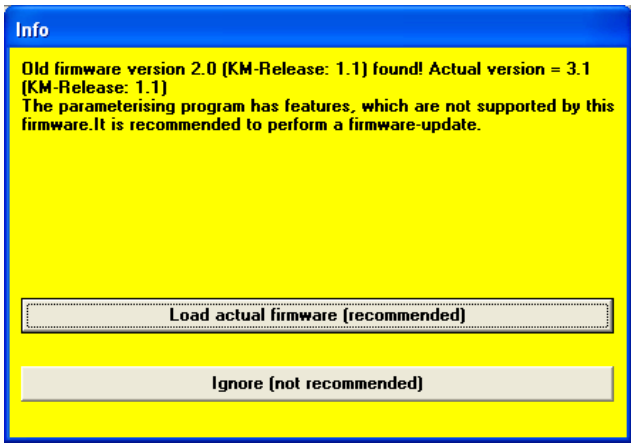
This baud rate applies for "normal" online communication. A special baud rate selection will be made for the firmware download.

5 Loading of Firmware and Performing Commissioning

5.1 Loading Firmware

The firmware is the "operating system" of the servo positioning controller ARS 2000. By default, the servo positioning controller ARS 2000 are delivered with firmware. However, the following circumstances may require the loading of new firmware:

- **Updating to a new firmware version:** Due to continuous product developments, the parameterisation program Metronix ServoCommander™ may comprise options, which require a correspondingly advanced firmware version. If the version of the firmware is too old compared to Metronix ServoCommander™, the following window appears:



  Here, a firmware download is recommended! Choose the option **Load actual firmware**.

- **Loading of a custom specific firmware:** Here, start the download of the firmware from the main menu (see below).

- **Incomplete firmware (e.g. due to an interrupted firmware download):**
  If the servo positioning controller ARS 2000 has no firmware or just an incomplete version, the following window will appear:

Here, a firmware download is absolutely required! The firmware download window will open automatically.

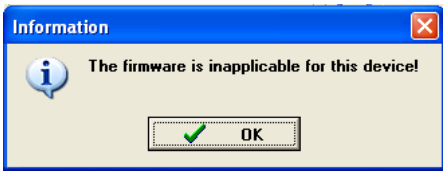
If the servo positioning controller already has the correct firmware, the upper given message windows do not appear. In this case, you can skip this chapter!

The firmware download may also be started from the menu **File/Firmware download**!

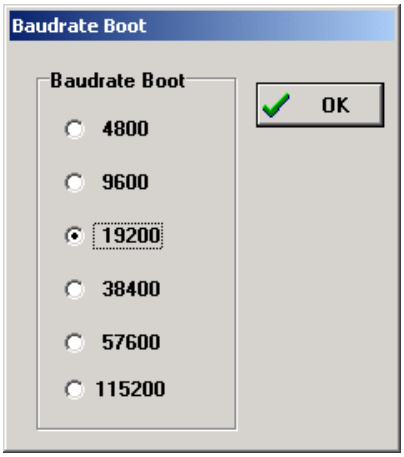
First, when starting the firmware download a window appears. Here, select the firmware file. The standard firmware is available for two different configurations:

- "Standard". The firmware files for these devices have no name suffix (e.g. A**RS2000_3p4_1p1.MOT**). These are the (single-phase supplied) devices ARS 2100 up to serial no. #999. Please contact the Technical Support for further information.
- Standard firmware for devices with integrated safe stop. The firmware files for these devices have the name suffix "_iS" (e.g. **ARS2000_3p4_1p1_iS.MOT**). These are all three-phase supplied devices ARS 2300 as well as the single-phase supplied devices ARS 2100 starting with the serial no #1000. These devices also have the [X3] connector on the front side. Please contact the Technical Support for further information.

Due to the different hardware configurations of the devices the corresponding firmware has to be loaded. Unsuitable firmware will cause the following message to be displayed:

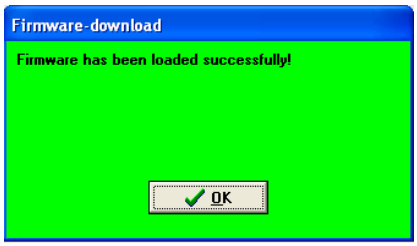


The next window to appear is the window for selecting the transmission rate (baudrate).



Try a baudrate of 115200 Baud. If there are problems with the data transfer (error messages), you must reduce the baudrate.

The following message will appear after a successful firmware download:



If the firmware download was not successful, the message Error at firmware boot will be shown. In most cases this can be attributed to a communication error during the data transfer to the servo positioning controller ARS 2000. Repeat the procedure described above at a lower baud rate.

5.2 Commissioning

Commissioning is a feature to help users, who are no experts, with the initial operation of the motor / drive. The user is guided through several dialog menus, some of which use automatic identification mechanisms of the firmware.

Commissioning of the servo positioning controller is possible, when

1. the parameterization program Metronix ServoCommander™ has been properly installed and
2. communication with the servo positioning controller ARS 2000 has been established

DANGER!
Carry out the steps for basic setting in the proper sequence shown in the manual!
Noncompliance can damage the motor and/or the servo positioning controller!

The following steps and menus are part of the commissioning process:

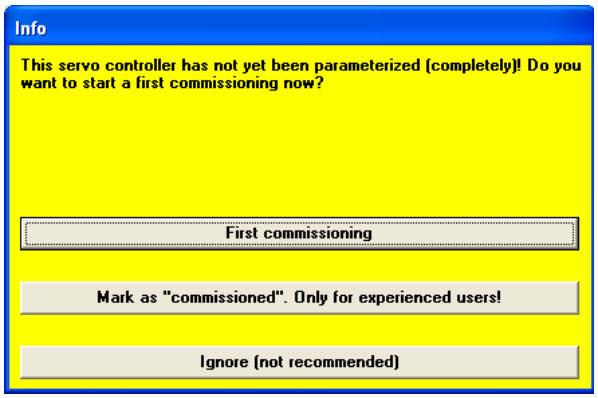
1. Resetting of the commissioning information (recommended)
2. Inquiry: "Standard" drive or special motor?
3. Loading of a parameter set (optional)
4. General configuration
5. Display units
6. Input limits
7. I/O configuration
8. Motor data / motor selection
9. Safety parameters
10. PFC parameters
11. Temperature monitoring
12. Commutation encoder
13. Angle encoder settings / angle encoder indentification
14. Current controller settings / current controller identification

15. Limit switch settings
16. Parameterization of speed controller
17. Parameterization of position controller
18. Saving of parameter set in the servo positioning controller / as file

Most of the functional elements described in the following chapters are also available directly in the parameterization software via the menu bar.

5.2.1 Commissioning Warning

The parameterization program Metronix ServoCommander™ detects a missing commissioning of the servo positioning controller. The following message will be displayed:



Inexperienced users should at this point perform a commissioning. The following chapters explain how to proceed.

You can also commission an ARS 2000 series servo positioning controller which has already been in operation. To do so, select the menu option **File/Commissioning**.

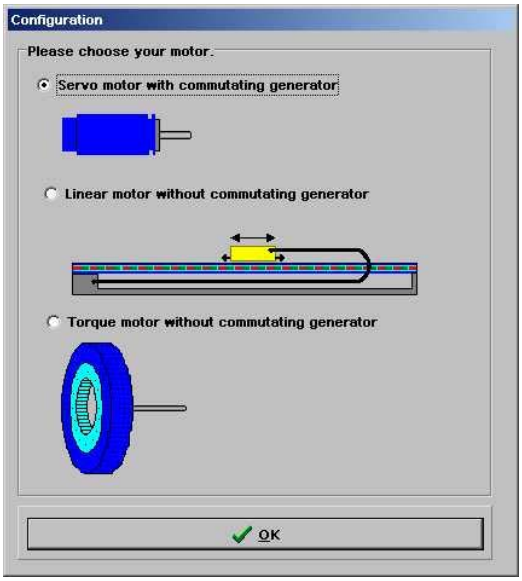
If the default parameter set is stored in the EEPROM of the controller (default setting) the controller status is „not commissioned“. In this case, the 7-segment display shows the letter "A".
As soon as one of the windows relevant for commissioning (e.g. the menu for setting the angle encoder) is opened and a value is changed, the displayed letter "A" will disappear again.

5.2.2 Resetting of Commissioning Information

The commissioning status of the issues to be handled will be stored in the servo positioing controller in separate bits. They show, whether the corresponding function or setting has been put into operation or not. Therefore, if complete commissioning is desired, we recommend resetting the entire commissioning information first.

5.2.3 Inquiry Standard Drive or Special Motor

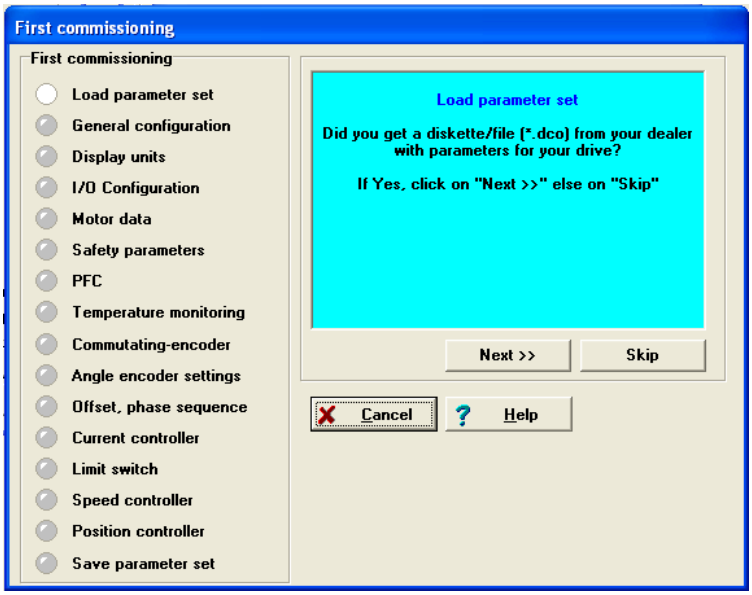
The menu-assisted commissioning procedure is optimized for motors with encoders that support commutation signal. So the first step is to determine the type of the encoder:



A menu-assisted commissioning procedure specifically adapted to linear motors or motors without a commutation encoder (e.g. some torque motors) is not supported in parameterisation software 2.7 and lower. Only a suitably preset parameter set can be loaded. If desired, the user can perform the remaining commissioning procedure and check or change parameters. Please select the appropriate configuration.

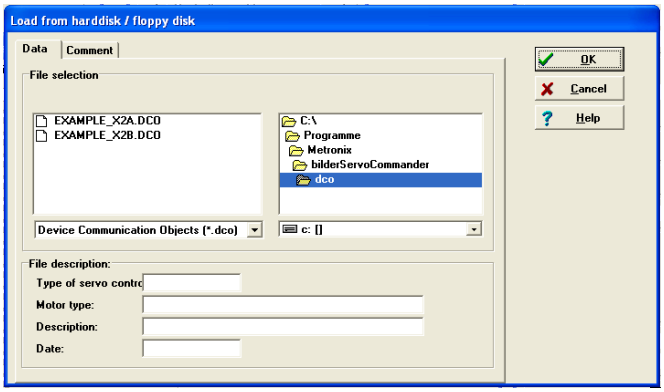
5.2.4 Loading of a Preset Parameter Set

The commissioning control now provides you with the following information:



You can access this menu option directly via **File/Parameter set/Open file**.

The following window will appear:



If you received a parameter set file for your drive from your sales partner, you can now load it:

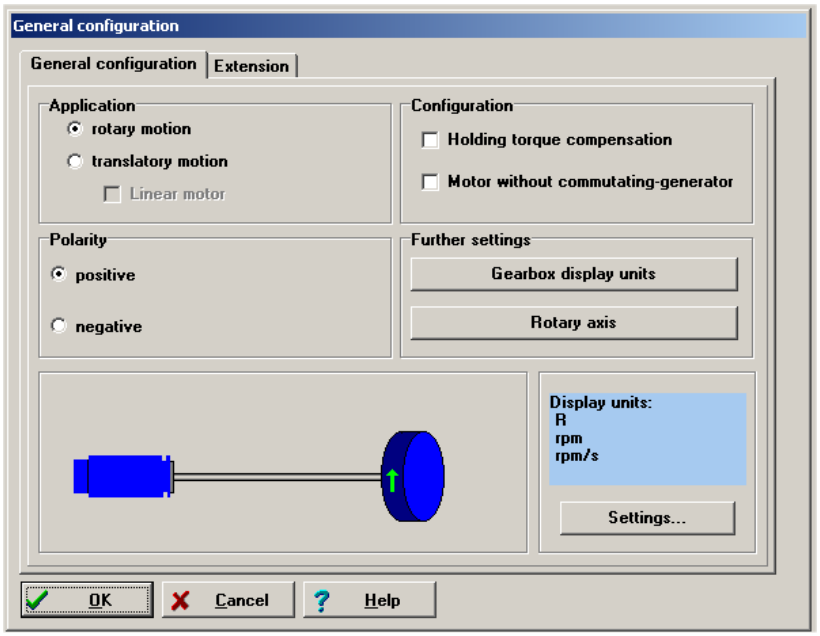
1. Select the desired parameter set. Parameter sets have the extension ***.DCO**.
2. Click on **OK** to transfer the parameter set to the servo positioning controller ARS 2000.

Now, the parameter set is transmit to the servo positioning controller. A progress bar indicates the state of the transmission.

Depending on the contents of the *.DCO file, another commissioning is either necessary or just optional. We recommend performing a complete commissioning.

5.2.5 General Configuration

Outside of the commissioning procedure, the window can be opened via the menu **Parameters/Application parameter/General configuration**. The following window appears:

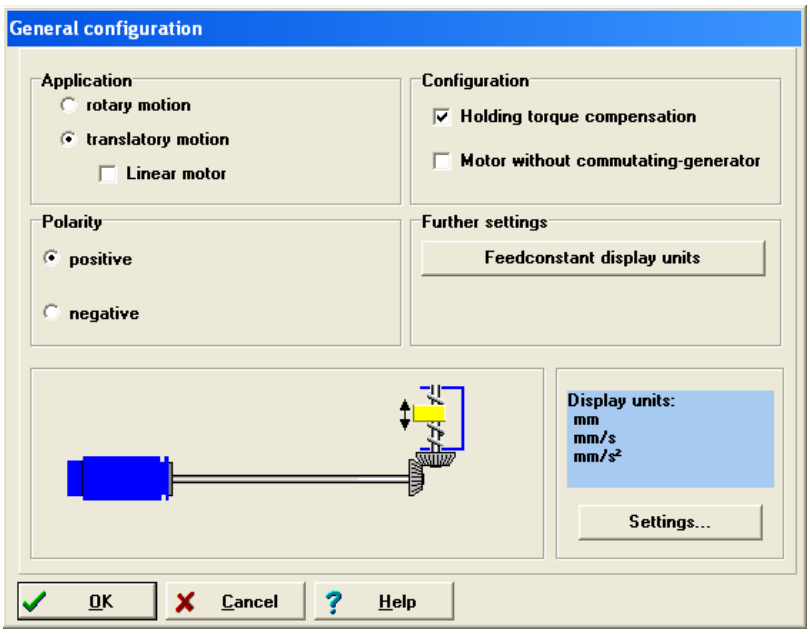


In the "commissioning" state, some window elements are blocked!

In the “Application” section the user can choose from a rotary application (display units in revolutions, degrees or radian) or a translatory application (display in distance units). The check box “Linear motor” can be selected as an option. As a result, the picture in the lower window pane changes. When using linear motors, make sure to select the check box “Motor without commutating-generator”, see below.

The check box “Holding torque compensation” must be checked, in the case of permanent torque in either direction (e.g. weight in the case of a vertical axis.) In this case, the holding torque of a servo positioning controller of type ARS 2000 will be pilot-controlled when the holding brake is released during torque and position control or during positioning, in order to minimise the sagging of the axis due to its own weight. The ARS 2000 servo positioning controller automatically updates the required holding torque when the controller is enabled. As a result, possible load changes are continuously tracked. In the case of a controller enabling after the first activation of the holding torque compensation, the pilot-controlled holding torque is still zero. If the holding torque compensation is not activated, the pilot-control is automatically set to zero.

In torque control mode, no holding torque is pilot-controlled.



The checkbox **Motor without commutating-generator** must be activated for all drives, where the connected angle encoder does not provide any commutation signals, e.g. linear motors. The checkbox also has to be selected if it is a rotary application which does not supply any commutation signals.

The section **Polarity** still has no function yet.

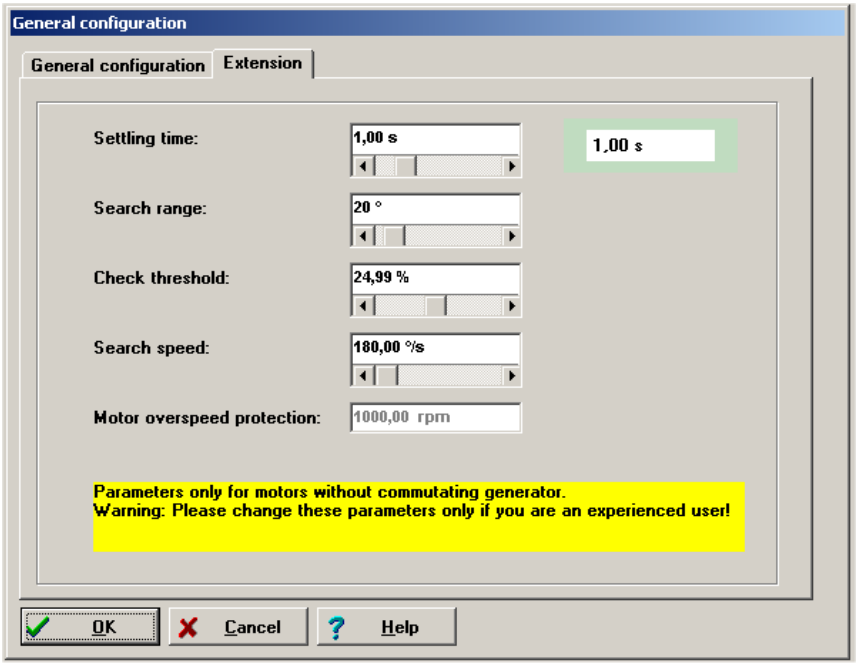
The appearance of the section **Further settings** depends on the application:

Rotary: The button **Gearbox display units** opens the menu **Display units**, where you can enter values for your gearbox.
(*See also Chapter 5.2.6, Page 44*).

The button **Rotary axis** is used in case of presetting the positioning ranges and to set the behaviour of a positioning run in case of having such a rotary positioning range. (*See also Chapter 5.2.6, Page* 44).

Translatory: The button **Feedconstant display units** opens the menu **Display units**, where you can enter values for your gearbox.
(*See also Chapter 5.2.7, Page46*).

The field displayed in light blue shows the display units that are currently valid. Clicking on the button **Settings …** will also open the window **Display units** (*Chapter 5.2.7*).



These parameters are only valid for applications with encoders without commutation signals, e.g. linear motors.

Unfavourable settings may cause an unsuccessful automatic determination of the commutation position. So change these settings only if you are an experienced user or after consultation!

Motor overspeed protection

Protection against counting errors when applying pure incremental encoders. The method monitors the drive against “uncontrolled movements“.

The mechanism of the motor overspeed protection depends on the operating mode:

Operating Mode	**Mechanism**
Torque control	Comparison to the actual speed value. There is no useful speed setpoint available.
Speed control Positioning	Comparison to the difference between speed setpoint and actual speed.

This parameter is not identical to the motor overspeed protection which is available by the menu **Parameters/Safety parameters...**

Mode

Before the first enabling after power-on of the servo positioning controller the commutation position has to be valid in order to ensure a correct commutation of the motor. This needs for the knowledge of

the encoder angle correlated to 1 revolution. This is not true for pure incremental encoder systems for example. For these configurations there are different methods for the determination of the commutation position during the first enabling. These methods differ from each other by the specifically required movement and its edge conditions, e.g. the physical attributes of the drive.

The user can set following methods:

- **Self adjustment method**

  This method moves the motor over twice the search interval. Depending on the initial position a jerky movement may occur at the beginning. Not suitable for horizontal applications.

- **Reaction method (recommended)**

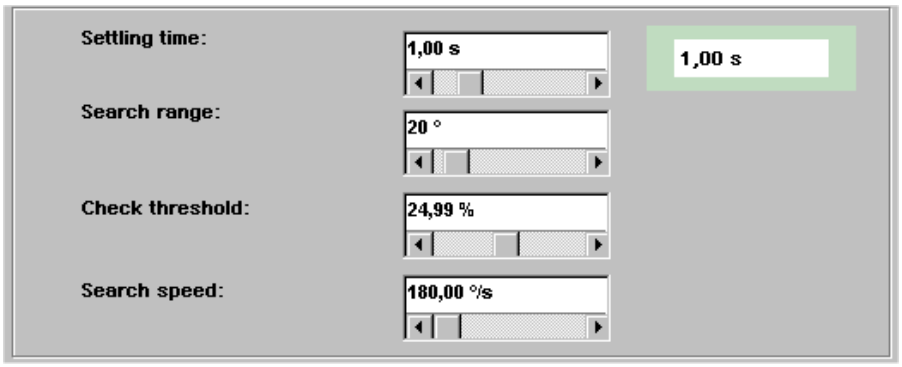
  Suitable for horizontal and vertical applications without brakes. A small movability is sufficient for the determination of the commutation position (virtually without movement).

- **Saturation method**

  This method is not suitable for ironless motors. Furthermore it requires a locked motor as there is not any movement allowed during the determination of the commutation position (without movement). Suitable for horizontal and vertical applications.

Each mode requires appropriate process parameters. Only the relevant parameters are displayed on the surface.

Self adjustment method



- **Settling time**

  Wear off delay of transients of e.g. the motor current, the mechanical start-up movement into the commutation position etc. Adapt this parameter to the particular inert mass of your application.

- **Search range**

  The search range determines the (electrical) angular range which the commutation angle covers during the determination of the commutation position.

- **Check threshold**

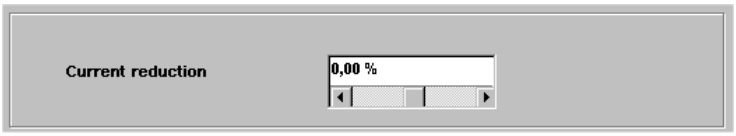
  The mechanical position must follow at least for this part of the search range. Due to pure setting of the commutation angle (no position control) the mechanical position may not change by the same absolute value e.g. due to cogging torques. Among others the check threshold serves for the detection of a mechanical end stop.

Example: The mechanical position must follow by at least 30° for a search range of 60° and a check threshold of 50 %.

❖ **Search speed**

Angular velocity of the commutation angle over the search range. Adapt this parameter to the particular inert mass, cogging torques etc. of your application.

Reaction method, Saturation method



❖ **Scaling test current**

If the application tends to oscillations, the current may need to be reduced when applying the reaction method. Otherwise the result is invalid and leads to an error message (35-5). If an error occurs during the identification process, the current should be reduced in a stepwise manner.

LED „Commutating position valid“

The LED indicates the successful evaluation of the commutating position. The status is cleared e.g. if an encoder error occurs. This signal is only relevant for drives with encoders without commutating signals

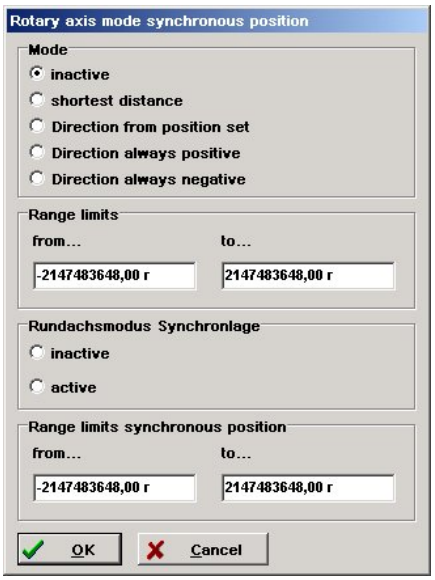
Reset

This button serves as a help during the first commissioning process. If the drive is adapted to the application for the first time, the adaptation of the parameters can be eased. By resetting the "Commutating position valid" status the identification process will be started again if the drive is enabled. So the identification process can be repeated in a controlled manner.

5.2.6 Rotary axis operation

Rotary axis applications can be activated in this menu. Such axes are used in case of having a rotation plate or turning arrangement for instance.

In an rotation plate application the actual position is restricted artificial to a certain interval. If the boundaries are reached on the right hand side it passed to the left maximum position and vice versa.



In the modes area of the rotary axis menu the following items are given:

1. inactive: The rotary axis is not active. The limitation does not happen.
2. shortest distance: The rotary axis is active. In case of positioning mode the shortest distance is used for travelling to the next target position. In case of having a rotary axis in the range of 0 ..5R and the actual position is 4.5R, a positioning run to 0.5R happens in positive direction because this is the shortest distance to the target.
3. Direction from position set: The rotary axis is active. The direction of the movement is taken from the positioning set. (See also chapter 11.3.4.1.3, on page 126).
4. Direction always positive: The rotary axis is active. The positive direction is always taken during positioning runs
5. Direction always negative: The rotary axis is active. The negative direction is always taken during positioning runs

The area range limits is given to set the interval for limiting the actual position.

The lower limit is included in the interval and the upper limit is not included . This is for easily adjust the ranges of the rotary axis.

Example: A rotary axis for exactly one revolution should be defined:

A wrong set-up is : start = 0 R, end = 0,99999 R

The right set-up is: Start = 0 R, end = 1 R

Activate or deactivate a rotary axis functionality in the field **Rotary axis mode Synchronous position**. This can be separately applied for the selected synchronous position independently from the ranges set for the standard rotary axis functionality resp. its mode. So, master position (synchronous position) and slave position may use different position ranges.

Set the interval for the limitation of the synchronous position in the field **Range limits synchronous position**. The interval limits the numerical range of the position values. The current position value automatically switches over to the opposite if it exceeds one limit.

A rotary axis set-up has advantages in case of a given turning arrangement in addition with course programs and position triggers.

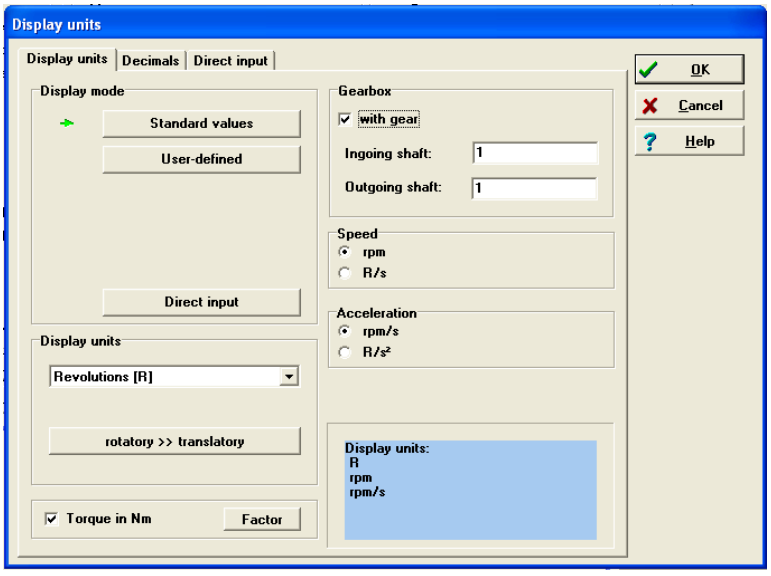
The following advantages are given:

- ❖ No added position shift in case of continuous strokes in the same direction (A gear factor with integer ratio is necessary to reach this).
- ❖ By use of a course program a stepping for clamping or relaxing of parts on the turning arrangement can be implemented
- ❖ Position trigger can be used for flagging certain positions or index points around the turning arrangements circumference
- ❖ Reduction of programming effort on the superposed PLC

5.2.7 Configuration of Display Units

As the configuration of the display units is a complex subject, only the basic principles will be discussed in this section. For a detailed description, please refer to *Chapter 7 Display units* **(details)**, *Page 83*.

Outside of the commissioning procedure, the window can be opened via the menu **Options/Display units**. The following window appears:



In the "commissioning" state, some window elements are blocked!

In the section **Display mode** the display units can be set “roughly”. The mode **Standard values** covers 90 % of all applications. The modes **User-defined** and **Direct input** are explained in *Chapter 7, Page 83*.

5.2.7.1 Rotary Operation

The following is possible for rotary systems:

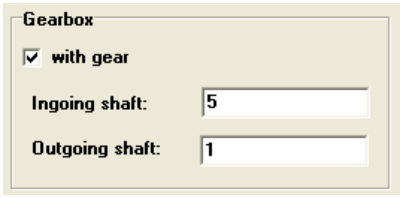
- Positions in revolutions, degree or radian
- Speed in [position units]/s (*)
- Acceleration in [position units]/s² (*)

(*): In “Revolutions” mode, the following combinations of speed and acceleration are possible:

Table 6: Display units Rotary operation

Combination	Position	Speed	Acceleration
1.	R	RPM	RPM/s
2.	R	RPM	R/s²
3.	R	R/s	R/s²

In rotary mode you can enter a gearbox, if you want to set your application on the output side. To do so, select the checkbox **with gear**.

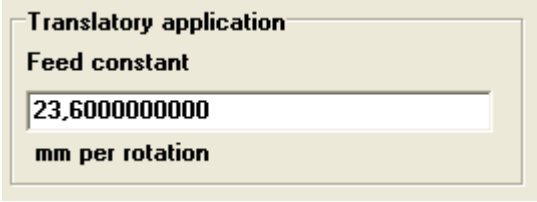


5.2.7.2 Translatory Operation

The following is possible for translatory systems:

- Positions in distance units (m, mm, µm)
- Speed in [distance units]/s
- Acceleration in [distance units]/s²

In the translatory mode, you need to define which distance unit corresponds to one motor revolution. This value has to be entered into the **Feed constant** field.

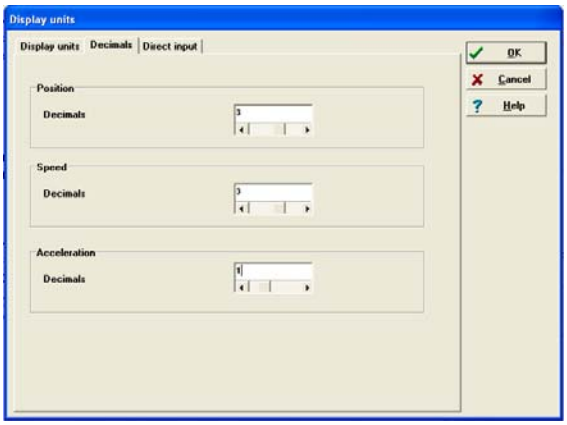


5.2.7.3 Other Possible Configurations

In the section **Display units** the appropriate units can be selected (rotary or translatory mode). If you want to change the default setting, click on the button **rotary >> translatory** or **translatory >> rotary**.

You can define whether you want torques to be displayed in A or Nm. For Nm select the checkbox **Torque in Nm**. This requires a correct conversion constant (A→Nm). You can set the conversion constant by clicking on the button **Factor**.

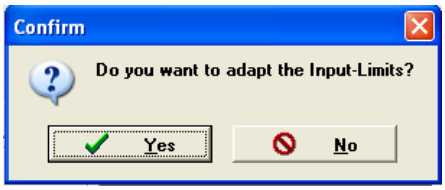
On the **Decimals** tab you can select, how many decimals are to be displayed for position, speed and acceleration values.



The tab **Direct input** is explained in *Chapter 7.2 Page 85*.

5.2.7.4 Quitting the Menu (Applies only to Commissioning)

If you quit the menu during commissioning, the program will display the following question:

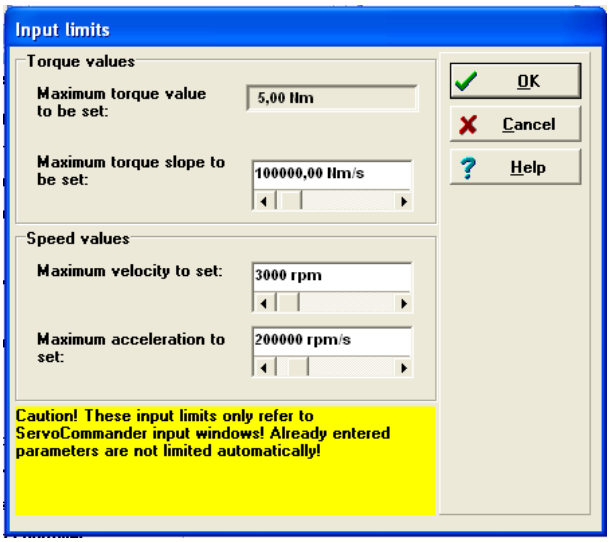


Caution!
If you select **No**, the input limits of the Metronix ServoCommander™ will not be adapted.
This setting may cause serious equipment damage.

Click **Yes** to open the window **Input limits** (see *Chapter 5.2.8, Page 48*).

5.2.8 Configuration of Input Limits

Select **Options/Input limits** to open the following window:

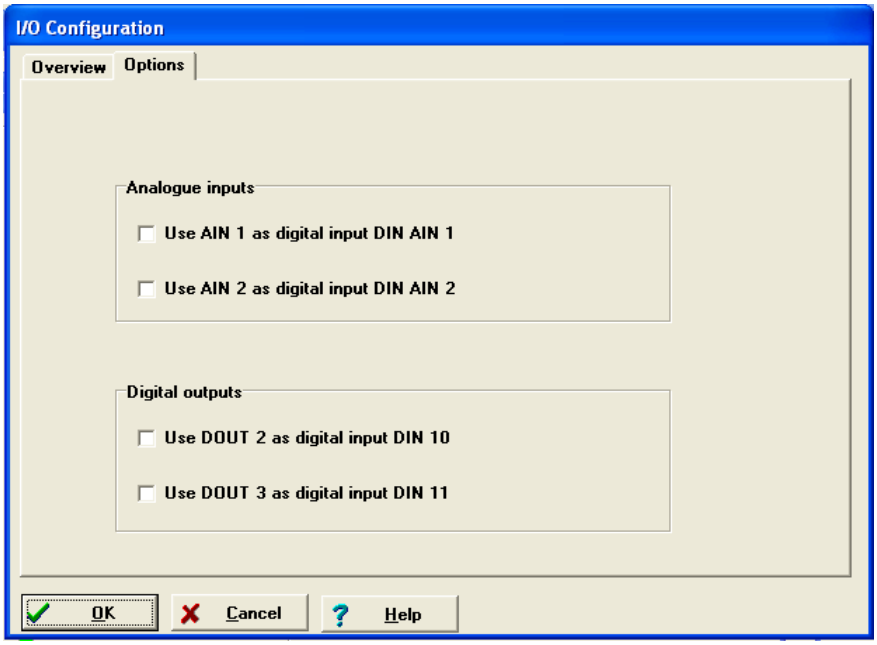


Enter the maximum speeds and accelerations you expect for your application. Metronix ServoCommander™ uses these inputs for the display of the input boxes.

- ❖ The input limits can be modified at any time.
- ❖ The input limits only affect the input fields of the parameterisation program!
- ❖ Speeds and accelerations will not be physically limited!

5.2.9 IO Configuration

The menu **Parameter/IOs/IO configuration** opens the following window:



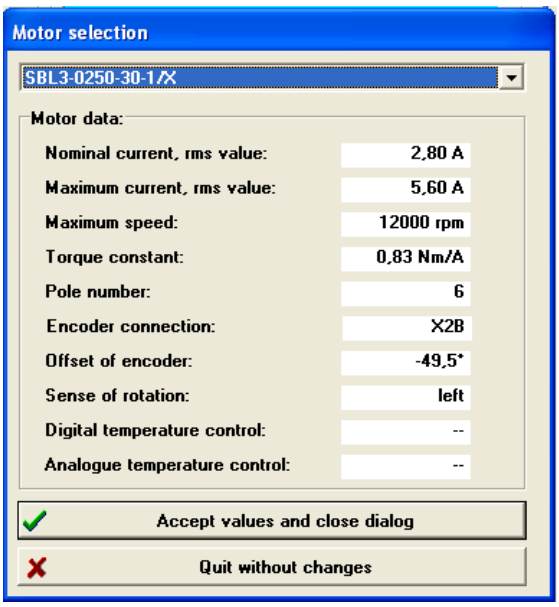
You can configure four additional digital inputs (if required) in this menu. The following variants are possible:

- Analogue input AIN1 can be used as a digital input
- Analogue input AIN2 can be used as a digital input
- Digital output DOUT2 can be used as a digital input
- Digital output DOUT3 can be used as a digital input

Click on the **Overview** tab to view the current configuration of the inputs and outputs.

5.2.10 Motor Identification via List

As part of the commissioning process the motor specifications must now be determined. This function can also be accessed via **Parameters/Device parameters/Motor data/Select new motor**. A list will be shown, from which you can select the motor you are using:



Select the motor if you can find it in the list and click on **Accept values and close dialog**. Otherwise click on **Quit without changes**. The specifications are then queried directly (see next *Chapter 5.2.11*).