Product Manual

Ethernet Technology Module

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Verzeichnis der Revisionen			
Ersteller:	Metronix Meßgeräte und Elektronik GmbH		
Handbuchname:	Produkthandbuch „Technologiemodul Ethernet"		
Dateiname:	ENET-HB_ARS2000_3p0_EN.doc		
Speicherort der Datei:			
Lfd. Nr.	Beschreibung	Revisions-Index	Datum der Änderung
001	Release for distribution	1.0	19.08.2005
002	Revision	1.1	03.09.2005
003	Revision	1.3	04.10.2005
004	Updated Corporate Identity – No technical changes	2.0	18.04.2011
005	Changes in chapter 2.2	3.0	28.06.2011

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1   General

1.1   Documentation

This manual describes the field bus connection of ARS 2000 servo positioning controllers using Ethernet. It is intended for persons who are already familiar with these servo positioning controllers. It contains safety notes which have to be complied with.

Further information can be found in the following manuals of the ARS 2000 product range:

❖ **Software Manual "Servo Positioning Controller ARS 2000"**: Description of the device functionality and the software functions of the firmware including RS232 communication. Description of the parameterisation program Metronix ServoCommander with instructions on the commissioning of an ARS 2000 series servo positioning controller.

❖ **Product manual "Servo Positioning Controller ARS 2100":** Description of the technical data and the device functionality plus notes concerning the installation and operation of ARS 2100 servo positioning controllers.

❖ **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 +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 in accordance with 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.

1.2   Abbreviations

ARP   -   Adress Resolution Protocol

BSD   -   Berkeley Software Design

FTP   -   File Transfer Protocol

IEEE   -   Institute of Electrical and Electronics Engineers

IPv4   -   Internet Protocol Version 4

MAC   -   Medium Access Control

MSC   -   Metronix ServoComannder™

MTX   -   Metronix

STP   -   Shielded Twisted Pair

UDP   -   User Datagram Protocol

UTP   -   Unshielded Twisted Pair

1.3   Scope of supply

The supply comprises:

Table 1:   Scope of supply

1x	Ethernet technology module for the ARS 2000 servo positioning controller

2   Safety notes for electrical drives and controllers

2.1   Used symbols

> ℹ️ **Information**
>
> Important information and notes.

> ⚠️ 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.

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.

> ℹ️ Prior to the initial use you must read the *Chapters Safety notes for electrical drives and controllers* starting on *Page 10*.

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 PERSONAL

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 voltages and high load currents!

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 300mA 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 Product Manual ARS 2000. 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 VBG 4 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 EN60617!

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 Volts, 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 Volts 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 Volts.

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   Product Description

3.1   General

The Ethernet technology module is used to connect the ARS 2000 servo positioning controller to the Ethernet field bus system. The communication through the Ethernet interface (IEEE-802.3u) uses a standard cable configuration and is possible between the ARS 2000 as of **firmware version 3.2.0.1.3** and the **Metronix ServoCommander™ parameterisation software as of version 2.3.0.1.1**.

The Metronix ServoCommander™ allows a direct UDP connection with the ARS 2000, e.g. for remote maintenance. Just press the "UDP" button on the upper menu bar to activate the UDP communication. The "RS 232" button reactivates the communication via the RS 232 interface.

> The Ethernet technology module can only be used in three-phase ARS 2300 servo positioning controllers or single-phase ARS 2100 servo positioning controllers with integrated "Safe Stop" safety technology (indicated by the [X3] connector on the front panel).

> The Ethernet technology module can **only be used in the TECH1 technology slot**. It is not possible to use other technology modules in technology slot TECH 2, except for the service memory module.
>
> If you have more complex requirements, please contact your distributor to find a solution for your specific application.

3.2   Ethernet technology module characteristics

The Ethernet technology module has the following characteristics:

❖ Complete mechanical integration possible in Metronix ARS 2000 servo positioning controllers

❖ Fast Ethernet in accordance with IEEE-802.3u (100Base-TX) with 100 Mbps

❖ Star and line topology

❖ Connectors: two female RJ45 connectors

❖ Ethernet floating through transformer

❖ LED displays for readiness for operation and Link-Detect

4   Technical Data

Table 2:   Technical data: Ambient conditions and qualification

Range	Values
Storage temperature range	-25 °C to +75°C
Operating temperature range	0°C to 50°C
Atmospheric humidity	0..90%, non-condensing
Altitude	Up to 1000 m above msl
External dimensions (LxWxH):	approx. 92 x 65 x 19mm suitable for technology slot TECH1 only
Weight:	approx. 55g

4.1   Display elements

The Ethernet technology module is equipped with two LED displays at the front to display the operating status.

Table 3:   Display elements

Element	Function
green LED	Link Detect
two-colour LED	Ready for operation (green) or system error (red)

4.2   Ethernet interface

Table 4:   Signal level and differential voltage

Signal level	0 ... 2.5 VDC
Differential voltage	1.9 ... 2.1VDC

5   Function Overview

The Ethernet technology module uses the packet-oriented UDP protocol of a TCP/IP stack (version 4) for communication. Only one parameterisable port is used. The opposite station (e.g. Metronix ServoCommander™) can use any ports. A BSD4.4-conforming socket is used for the implementation of the program.

5.1   Tunnelling in UDP

The existing communication of the Metronix ServoCommander™ uses the RS232 interface (see chapter 6 RS232 Commands, page 25). The proven telegram will be received and tunnelled in UDP/IP, i.e. the content of the serial telegrams will be transported in the data field of the UDP packets.
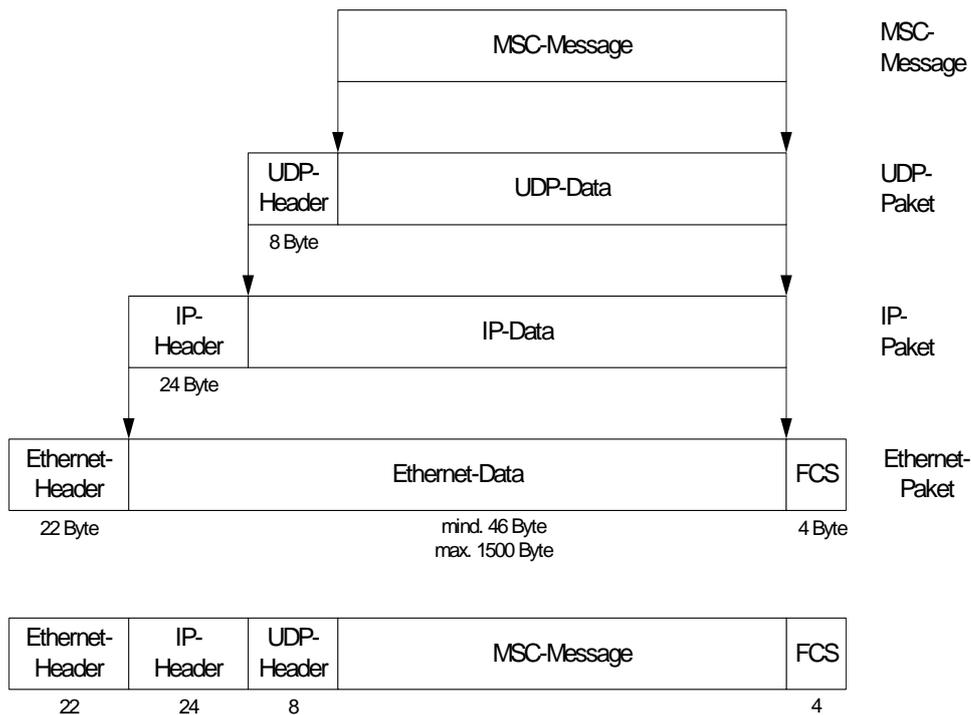
The structure of messages between the host and the ARS 2000 is as follows:

Header				Message	Abschluß
ID	Kennung	Paket-info	Reserve	Message	CR
4	8	4	4	n	1 char
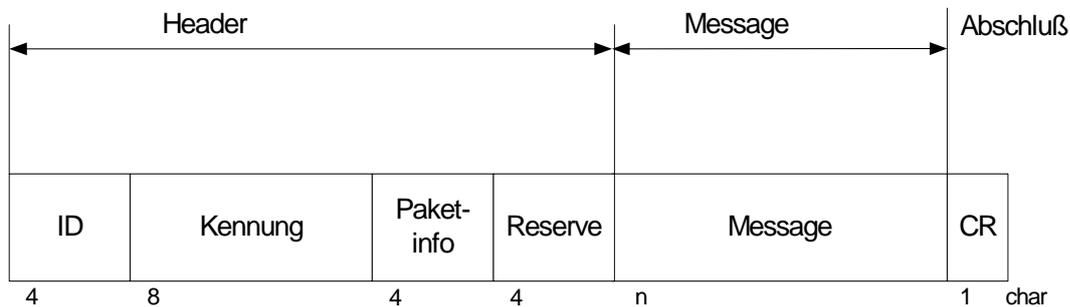
ID : 4 characters Identifier, serial number in ASCII,

used to monitor the communication.

Identifier : 8 characters Identifier of the connected device in ASCII,

at present the system supports only one device ("MTX")

Packet info : 4 characters Packet information in ASCII,

used to identify different message types

Bit	Assignment	Meaning
15	0	Tunnelling to ARS 2000
	1	Command for the Ethernet module
14	0	OK, packet received without problems
	1	Packet lost
13...0	0	Reserved

Example:

0x0000   Packet to ARS 2000

0x8000   Packet to Ethernet module

Reserve : 4 characters not used

Message : n characters Message in ASCII

CR : Message terminator (CR)

5.2   Supported commands

> See chapter 6 RS232 Commands, page 25.

Command	Syntax	Response
General commands		
Re-initialisation	RESET!	None (turn-on message)
Saving of data	SAVE!	DONE!
Reading of device type	TYP?	TYP:TTTT
Reading of version number	VERSSOFT?	VERSSOFT:MMMM.SSSS
Start-up		
Initialisation	INIT!	DONE!
Communication commands		
Reading of a communication object	OR:NNNN	NNNN:HHHHHHHH or OR:EEEEEEEE
Writing of a communication object	OW:NNNN:HHHHHHHH	OK! or OW:EEEEEEEE
Simulated access to elements of a CANopen object directory		
Reading of a CANopen element	?XXXX or ?XXXXSI	=XXXX:WW[WW[WWWW]] or = XXXXSI:WW[WW[WWWW]]
Writing of a CANopen element	=XXXX:WW[WW[WWWW] or =XXXXSI:WW[WW[WWWW]	=XXXX:WW[WW[WWWW]] or = XXXXSI:WW[WW[WWWW]]
Service		
Start homing	REFGO!	
System inquiry	BOOT?	APPLICATION or SERVICE

Error messages		
Communication object	OR	OR:EEEEEEEE
	OW	OW:EEEEEEEE
CANopen	?XXXX	!EEEEEEEE
	=XXXX	
Formatting error		!FORMATERROR! or ERR!
Command not available or cannot be executed at present		NOT AVAILABLE
Check sum error		CHK-ERR!

CC	:	Check sum (8 bits, hexadecimal)
EEEEEEEE	:	Return value in the event of an access error
HHHHHHHH	:	Data / value (32 bits, hexadecimal)
NNNN	:	Number of a communication object (16 bits, hexadecimal)
MMMM	:	Main version
SSSS	:	Subversion
TTTT	:	Type code of the device (16 bits, hexadecimal)
XXXX	:	Index of the object in the CANopen object directory (hexadecimal)
SI	:	Subindex of the object (hexadecimal)
WW	:	Value of the object (8 bits, hexadecimal)
WWWW	:	Value of the object (16 bits, hexadecimal)
WWWWWWWW	:	Value of the object (32 bits, hexadecimal)

All commands can be extended by an optional check sum. The reply will get a check sum only if the order is received with a check sum!

The check sum is the sum of all characters of the MSC message

„<Command>:CC"

UDP communication example:

0001MTX.....0000....or:0146

0002MTX.....0000....?604100

6   RS232 Commands

6.1   Introduction

The list of commands in this chapter is included in ARS 2000 servo positioning controllers with the following version of the standard firmware version:

3.2.0.1.3

Please contact your distributor if you need an update or visit the Metronix website under
http://www.metronix.de.

The commands are not case-sensitive. Invalid characters will be ignored.

6.2   General commands

Command	Syntax	Response
Re-initialisation of the servo positioning controller	RESET!	None (turn-on message)
Saving of the current parameter set and of all position sets in the non-volatile flash memory.	SAVE!	DONE
Setting of the baud rate for serial communication	BAUD9600 BAUD19200 BAUD38400 BAUD57600 BAUD115200	
Reading of the device type of the servo positioning controller	TYP?	TYP:HHHH
Unknown command	any	ERR!
Reading of the version number of the CM release (configuration management) of the firmware	VERSSOFT?	VERSSOFT:MMMM.SSSS

The abbreviations have the following meaning:

MMMM   Main version of the CM release (hexadecimal format)

SSSS   Subversion of the CM release (hexadecimal format)

HHHH   Type code of the device (hexadecimal format)

Type code	Device
0x2005	ARS 2102
0x2006	ARS 2105
0x2009	ARS 2302
0x200A	ARS 2305
0x200B	ARS 2310
0x200C	ARS 2320
0x200D	ARS 2340

6.3   Parameter commands

Parameters and data are exchanged using so-called "communication objects" (CO). They have a fixed syntax. Special return values have been defined for write or read errors.

Command	Syntax	Response
Reading of a CO	OR:nnnn OR:k:nnnn	nnnn:HHHHHHHH or OR:EEEEEEEE
Writing of a CO	OW:nnnn:HHHHHHHH OW:k:nnnn:HHHHHHHH	OK! or OW:EEEEEEEE

The following abbreviations are used for parameter commands:

nnnn: Number of the communication object (CO), 16 bits (hexadecimal format)

k: Component number of the CO. The component number can be omitted if it = 0.

HHHHHHHH: 32 bits data / values (hexadecimal format)

EEEEEEEE: Return value in the case of an access error

The return values have the following meaning:

Return value	Meaning
0x0000 0002	The data are smaller than the lower limit. The data were not written.
0x0000 0003	The data are bigger than the upper limit. The data were not written.
0x0000 0004	The data are smaller than the lower limit. The data were limited to the lower limit and then adopted.
0x0000 0005	The data are bigger than the upper limit. The data were limited to the upper limit and then adopted.
0x0000 0008	The data are beyond the valid value range and were not written.
0x0000 0009	The data are currently beyond the valid value range and were not written.
0x0004 0000	The desired communication object does not exist.
0x0005 0000	The communication object must not be written.

Please contact your distributor if you are using these commands for communication objects which are not described in this application note. The commands allow access to nearly all parameters of the servo positioning controller. Please contact your distributor to get more detailed information concerning the required communication objects.

Metronix reserves the right to change the numbers of communication objects.

6.4   Function commands

Command	Syntax	Response
Activate controller enable. The controller enabling logic has to be set to "DIN5 and RS232".	OW:1:0010:00000001	OK! or OW:EEEEEEEE[1]
Deactivate controller enable. The controller enabling logic has to be set to "DIN5 and RS232".	OW:1:0010:00000002	OK! or OW:EEEEEEEE[1]
Switch off the output stage. The controller enabling logic has to be set to "DIN5 and RS232".	OW:1:0010:00000003	OK! or OW:EEEEEEEE[1]
Acknowledge an error	OW:0252:00000001	OK!

[1]: Incorrect return values may be caused by a controller enabling logic with unsuitable adjustment, or an uncharged intermediate circuit etc.

6.5   Selecting the operating mode

Due to a necessary synchronisation of internal processes, the change of the operating mode may take some cycle times of the controllers. You should verify the desired operating mode and wait.

Operating mode	Syntax	Response
Torque control	OW:0234:00000004	OK!
Speed control	OW:0234:00000008	or
Positioning	OW:0234:00000010	OW:EEEEEEEE

Incorrect return values may be caused by invalid values not originating from the above-mentioned group. The current operating mode can be read using the "OR" command.

6.6   Speed setpoint and actual speed

To specify a speed setpoint via RS232, one of the selectors (A, B or C) has to be set to "Fixed value 1". Make sure that the associated function selector is set to "speed setpoint". Make these settings using the Metronix ServoCommander™ parameterisation program. Do this in the "Operating mode - Setpoint selector" menu.

The parameters can be addressed with the help of the parameter commands "OR" and "OW" under the following CO numbers:

Parameter	CO no.	Scaling
Speed setpoint	0x0152	$1/2^{12}$ rpm, example:
Actual speed	0x017B	0x0000A800 = 10.5 rpm
Actual speed (filtered)	0x0179	

6.7   Homing and positioning

The parameterisation of the position data sets is controlled by a pointer: CO number 0x0555. Once the pointer is set to the desired position data set, the parameters can be read or modified. They can be addressed using the parameter commands "OR" and "OW" and the following CO numbers:

Parameter	KO-Nr.	Scaling
Control word of the position data set. It defines the positioning mode.	0x0590	Bit 0,1: 00 = Ignore start during running positioning run 01 = Interrupt current positioning run 10 = Add positioning to current one Bit 6,7: 00 = absolute 01 = relative 10 = relative to last destination Other bits must not be changed!
Destination (upper 32 bits)	0x0594	1 = 1 revolution (with sign)
Destination (lower 32 bits)	0x0595	Part of 1 revolution
Running speed [1]	0x0596	$1/2^{12}$ rpm, without sign, example: 0x0000A800 = 10.5 rpm
Final speed	0x0597	$1/2^{12}$ rpm, without sign
Acceleration[1]	0x0598	$1/2^{8}$ rpm/s
Deceleration[1]	0x0599	$1/2^{8}$ rpm/s
Remaining distance trigger	0x059A	Upper 16 bits: revolutions Lower 16 bits: part of 1 revolution

[1]: Parameter can be used to parameterise the homing run

Command	Syntax	Response
Setting the pointer to a position data set	OW:0555:0000PPPP	OK! or OW:EEEEEEEE, OR:EEEEEEEE[1]
Starting a homing run	OW:1:0010:00000022	
Stopping a homing run	OW:1:0010:00000026	
Starting a positioning run	OW:1:0010:PPPP0021	
Aborting a running positioning run	OW:1:0010:00000025	
Jogging in the positive direction (TIPP 0)	OW:1:0010:00000027	
Jogging in the negative direction (TIPP 1)	OW:1:0010:00000028	
Reading the current actual position (high long, upper 32 bits, revolutions)[2]	OR:01AE	nnnn:HHHHHHHH or OR:EEEEEEEE[1]
Reading the current actual position (long long, lower 32 bits, fraction of a revolution)[2]	OR:01AF	
Reading the current actual position (32 bits), upper 16 bits: revolutions lower 16 bits: fraction of a revolution	OR:01AB	
Reading the position setpoint (32 bits), upper 16 bits: revolutions lower 16 bits: fraction of a revolution	OR:01AA	

[1]: Incorrect return values may be caused by invalid values, a missing controller enable etc.

[2]: Always read the high long before the low long

The following abbreviations apply to positioning commands:

nnnn: Number of the communication object (hexadecimal format)

HHHHHHHH: 32 bits data (hexadecimal format)

PPPP: Position data set (hexadecimal format)

PPPP	Position data set
0x0000 .. 0x00FF	Standard position data set 0 .. 255
0x0100	Data set homing for search run
0x0101	Data set homing for crawl run
0x0102	Data set homing for follow-up positioning run to zero position
0x0103	Data set positive jogging (TIPP 0)
0x0104	Data set negative jogging (TIPP 1)
0x0108	Reserved for positioning via RS232
others	Reserved

6.8   Start-up

Usually, some of these commands are only used by the Metronix ServoCommander^{TM} parameterisation program. They are hidden behind buttons in the various menus and do not have to be entered directly by the user. We recommend using the parameterisation program for these functions.

Command	Syntax	Response
Loading the default parameter set. Then the system performs an automatic save and reset (should be performed only if the controller enable is deactivated).	INIT!	Turn-on message
Stopping any automatic start-up function	OW:02C8:00000000	OK!
Starting the automatic determination of the parameters of the current controller	OW:02C8:00000001	or
Starting the automatic determination of the offset angle of the angle encoder and of the number of pairs of poles	OW:02C8:00000002	OW:EEEEEEEE

6.9   Simulated access to elements of the CANopen object directory

The RS232 communication allows also read and write SDO accesses (Service Data Objects) to CANopen objects. The following abbreviations are used:

XXXX:	Index of the object in the CANopen object directory (hexadecimal format)
SI:	Subindex of the object (hexadecimal format). If the subindex is 00, it can be stated as an option
WWWWWWWW:	Value of the object (hexadecimal format).

Command	Syntax	Response
Read CAN object	?XXXXSI (optionally for SI=00)	=XXXXSI:WW (8 bits) =XXXXSI:WWWW (16 bits) =XXXXSI:WWWWWWWW (32 bits)
Write CAN object (8 bits)	= XXXXSI:WW	= XXXXSI:WW
Write CAN object (16 bits)	= XXXXSI:WWWW	= XXXXSI:WWWW
Write CAN object (32 bits)	= XXXXSI:WWWWWWWW	= XXXXSI:WWWWWWWW

6.10   Parameterisation example

Setting the positioning mode and enabling the controller:

Command	Syntax	Response
Setting the fixed speed setpoint 1 to 0	OW:0152:00000000	OK!
Setting and verifying the positioning mode	OW:0234:00000010 OR:0234	OK! 0234:00000010
Acknowledging an error	OW:0252:00000001	OK!
Controller enable: Only possible if the controller enabling logic is set to "DIN5 and RS 232".	OW:1:0010:00000001	OK!

Changing position data set 5 and starting positioning runs:

Command	Syntax	Response
Setting the pointer for position data sets to position data set 5:	OW:0555:00000005	OK!
Setting the acceleration to 15,000 rpm/s:	OW:0598:003A9800	OK!
Setting the deceleration to 7,500 rpm/s:	OW:0599:001D4C00	OK!
Setting the positioning mode to "relative to last destination" and "interrupt current positioning run":	OR:0590 OW:0590:00000099	0590:00000018 OK!
Setting the running speed to 1500 rpm:	OW:0596:005DC000	OK!
Setting the final speed to 0 rpm:	OW:0597:00000000	OK!
No remaining distance trigger:	OW:059A:00000000	OK!
Destination: 1.5 revolutions	OW:0594:00000001 OW:0595:80000000	OK! OK!
Starting a positioning run with positioning set 5:	OW:1:0010:00050021	OK!
Destination: -2.2 revolutions	OW:0594: FFFFFFFD OW:0595: CCCCCCCD	OK! OK!
Starting a positioning run with positioning set 5:	OW:1:0010:00050021	OK!

6.11 Status word

The standard firmware includes a general status word. It can be read with the help of the following command:

OR:1:000F

The bit information describes the status of the servo positioning controller. The bits in the status word have the following meaning:

Bit no.	Value	High	Low
0	0x0000 0001	Ready for operation	General error
1	0x0000 0002	PWM active	PWM off
2	0x0000 0004	Intermediate circuit charged	Intermediate circuit relay open, intermediate circuit not connected to supply
3	0x0000 0008	Actual position in target window	Actual position not in target window
4	0x0000 0010	Actual speed in reference window	Actual speed not in reference window
5	0x0000 0020	Reserved	
6	0x0000 0040	Motor I²t monitoring system or power stage has reached 100 %	I²t monitoring threshold not exceeded
7	0x0000 0080	Brake chopper I²t monitoring system has reached 100 %	I²t monitoring threshold not exceeded
8	0x0000 0100	Negative limit switch (E0, DIN6) active	Negative limit switch not active
9	0x0000 0200	Positive limit switch (E1, DIN7) active	Positive limit switch not active
10	0x0000 0400	Following error	No following error
11	0x0000 0800	Homing active	No homing active
12	0x0000 1000	Controller enable active	Controller enable inactive
13	0x0000 2000	All digital inputs for controller enable are set	At least one digital input for controller enable is missing
14	0x0000 4000	PFC I²t monitoring system has reached 100 %	I²t monitoring threshold not exceeded
15	0x0000 8000	Reserved	
16	0x0001 0000	Negative speed setpoint is blocked	Negative speed setpoint is not blocked
17	0x0002 0000	Positive speed setpoint is blocked	Positive speed setpoint is not blocked
18	0x0004 0000	Home position valid (homing run successful or absolute value encoder selected)	No homing run completed successfully
19..31		Reserved	

Reserved bits are reserved for internal use or are unused.

7   Mechanical Installation

	DANGER !
	Non-compliance with the information given in chapter 2 Safety notes for electrical drives and controllers (page 10) in the product manual may result in property damage, injury, electric shock and in extreme cases in death.

	DANGER !
	Prior to installing the module, the drive controller has to be disconnected from any current-carrying conductors.

Remove the front plate above the technology slot of the ARS 2000 servo positioning controller using a suitable Phillips screwdriver. Then push the Ethernet technology module into the open technology slot 1 (TECH1) such that the circuit board is held by the lateral guides of the technology slot. Push the technology module in until it reaches the stop. Then fasten the technology module to the housing of the servo positioning controller using the Phillips screw. Make sure that the front plate has conducting contact with the housing of the ARS 2000 servo positioning controller (PE).

The following elements can be found on the front plate of the Ethernet technology module:

❖   a green LED for "Link Detect" display

❖   a two-colour LED to indicate readiness for operation (green) or system error (red)

❖   two female RJ45 connectors

Two elements are located on the front plate:

Table 5:   X2 RJ45, bottom

Pin	1	2	3	4	5	6	7	8
Signal	TX+	TX-	RX+			RX-		

Table 6:   X3 RJ45, top

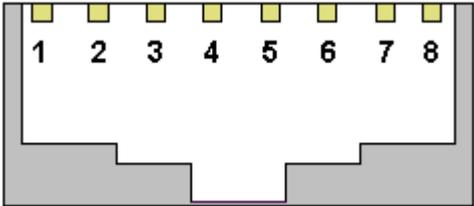| **Pin**	1	2	3	4	5	6	7	8
Signal	RX+	RX-	TX+			TX-		

Figure 1:   RJ45connector

The following Figure 2 shows the position of the connectors and their numbering:
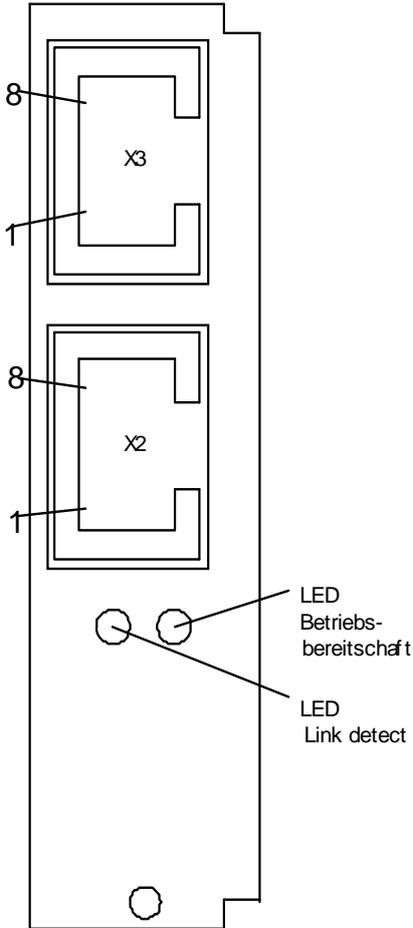

Figure 2:   Position of the connectors on the front plate

8   Electrical Installation

8.1   Pin assignment and cable specification

8.1.1   Connector configuration

❖   Female RJ45 connector

Table 7:   Pin assignment: Ethernet interface (RJ45)

Pin no.	Specification	
1	Transmission signal+ (TX+)	Pair 3
2	Transmission signal- (TX-)	Pair 3
3	Receiver signal+ (RX+)	Pair 2
4		Pair 1
5		Pair 1
6	Receiver signal- (RX-)	Pair 2
7		Pair 4
8		Pair 4

Lower female RJ45 connector: End of a star-shaped connection

Upper female RJ45 connector: Uplink to line-shaped connection of several servo positioning controllers

8.1.2   Cable type and configuration

The system uses twisted-pair cables UTP, cat. 5 or STP. The configuration supports star and line topologies. The network design must comply with the 5-4-3 rule. A maximum of 10 hubs may be connected in a line configuration. The Ethernet technology module contains one hub.
The total cable length is limited to 100 m.

9   Start-up

9.1   General connection notes

9.2   Starting the Ethernet communication

In order to use the Ethernet interface, the IP address, the subnet mask, the port and a possible gateway IP have to be parameterised. The IP address of the gateway is only necessary if the communication will go beyond the limits of the network. Another parameter (timeout time user logout) is used to configure the timeout after which a "disconnected" connection will be logged out automatically by the Ethernet technology module.

These parameters are permanently saved in the ARS 2000 positioning controller. They are adjusted locally in the Metronix ServoCommander™ menu using a serial connection to the basic device: *Options/Communication/Communikation parameters UDP(Ethernet)/Configuration Piggy*

The parameters have the following meaning:

Port   Number of the port of the Ethernet communication via UDP. You have to select a free port between 5000 and 65535.

IP   IP address of the Ethernet communication using TCP/IP. This address has to be <u>unique</u> in the network segment of the Ethernet module !

Subnet mask   The subnet mask is used to divide a network into subnets connected to routers/gateways. Modules on a subnet can communicate directly with each other. Routers/gateways have to be integrated to be able to communicate beyond the limits of the subnets.

Gateway   IP of the gateway located on the subnet of the Ethernet module.

Timeout time

user logout: Maximum timeout of a disconnected connection until it will be logged out automatically by the Ethernet module.

ⓘ	New parameters remain inactive until the next system start (start or reset)!
	Please ask your network administrator about the network parameters to be used on your network.

You can easily check the correct configuration of the Ethernet technology module and the availability on the network as follows:

1.) Start a DOS box.

2.) **Ping** <IP address>

Enter the IP address of the Ethernet module to be tested as the parameter.

If the reply is no timeout, the IP could be reached.

We also recommend testing the hardware address (MAC) of the Ethernet module:

1) Start a DOS box.

2) **Arp –a** <IP address>

The MAC is a 6-digit, worldwide unique number and is defined in a hexadecimal format in the Ethernet technology module as follows:

1	2	3	4	5	6
MTX Manufacturer ID			MTX- Device type	MTX- Serial number	
00	**40**	**55**	**1**x	yy	yy

After the configuration of the Ethernet interface has been completed successfully, you can switch over to UDP communication.

Because of the functionality of the ARS 2000 firmware, the system does not support multisessions at present. This means that only one UDP connection is possible at a time.

9.3   Communication errors

The communication via the Ethernet technology module using UDP tunnelling leads to new possible errors which can be divided into four groups:

1.) Errors on the UDP/IP layer:

> Normally, errors in the IP stack or during the transfer are not reported to the application layer (sockets). This is why all packets get a consecutive packet number (ID) to detect failures.

2.) Errors in the MSC telegram

> Telegram errors can be reduced proportionally with the help of the optional check sum.

3.) Errors of the Ethernet module

> For example, errors during the internal communication with the basic device will be reported.

4.) Errors concerning the access rights:

> Access rights are restricted with the help of the user ID and the restriction of parallel "sessions". At present, only the ID "MTX" is valid and only one session is allowed.

All these errors will be sent to the ordering party in the form of messages:

COMMERR:<nr>:<text>

No.	Message	Meaning
1	COMMERR:0001 USER UNKNOWN	Incorrect identifier
2	COMMERR:0002 DPR_ERROR	Internal error
3	COMMERR:0003 CHECKSUM_ERROR	Incorrect optional check sum
4	COMMERR:0004 CMD UNKNOWN	Unknown command
5	COMMERR:0005 SESSION_ERROR	Too many UDP sessions

10 Firmware Download

Metronix ServoCommander™ version 2.3.0.1.1 does not support a firmware download for the Ethernet technology module. You have to use a separate tool.

First the firmware to be loaded has to be transferred to the Ethernet module using FTP:

1) Start a DOS box

2) Start the FTP client, without login password

   ftp <IP address>

3) Set the transfer type to binary

   binary

4) Send the binary image (case-sensitive)

   send VXWORKS_COMP.BIN

5) Terminate FTP

   bye

Then the flashing of the binary image into the flash memory has to be performed:

6) Start the **DevCont** tool

7) Parameterise the IP and the port of the Ethernet module in DevCont

   IP = 'xxx.xxx.xxx.xxx'

   Port = **8802**

8) Connect DevCont

   connect

9) Start the flash process

   0001MTX…..8000….FLASHPIGGY:VXWORKS_COMP.BIN

   send

The LED on the right goes out. Please wait until the LED on the right lights up green. Then reboot the system by performing a manual reset.

11 Service Functions And Error Messages

11.1 Operating mode and error messages

11.1.1 Error messages

When an error occurs, the ARS 2000 servo positioning controller cyclically displays an error message on the seven-segment-display. The error message consists of E (for error), a main index and a subindex, e.g.: **E 0 1 0**.

Warnings have the same code numbers as error messages. As a distinguishing feature, warnings have centre bar before and after the number, e.g. **- 1 7 0 -**.

More information on the error messages can be found in the product manual of your basic device.

Table 8 shows a summary of the specific Ethernet error messages. These error numbers are already reserved for Ethernet, but not used yet. Please contact the technical support team if you see these error numbers.

Table 8:   Error messages

Error message		Error message explanation	Measures
Main index	**Subindex**		
60	0	Ethernet: user-specific (1)	Please contact the technical support team.
61	0	Ethernet: user-specific (2)	Please contact the technical support team.