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Ersteller MTX		Datum 21.02.2006

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2 RS232 Commands

3 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.

4 Interface

After a reset, the serial interface of the servo positioning controller has the following default settings:

Parameter	Value
Baud rate	9600 baud
Data bits	8
Parity	none
Stop bits	1

In order to operate an interface with a terminal program, e.g. for test purposes, the following settings are required (recommendations):

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Parameter	Value
Flow control	none
Emulation	VT100
ASCII configuration	<ul style="list-style-type: none"> • Characters entered end with a line feed • Characters entered are output locally (local echo) • During reception, a line feed is added to the end of line

Please note that the servo positioning controller automatically issues a turn-on message through the serial interface immediately after a reset.

Example:

```

> ***** ARS 2000 series *****
> Bootcode       : Rev. 2.3
> external Ram   : 00512 KB
> internal Flash : 00256 KB
> external Flash : 00512 KB
> Clock          : 0029491200 Hz
> Code for CPU   : SH7045
> Program cycles : 00008 of 00100
> Waiting.....
> Starting application...
> Standardsoftware ARS 2000
> Version: 3.1
> Application: 0
> Release: 1.2

```

A reception program at the control end, for example, has to process the characters received or reject them.

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5 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 Parameter commands with check sum

 This section describes parameter commands combined with a check sum. The basic use of parameter commands is described in the preceding chapter!

As an option, the following commands can be used with a check sum:

- **OW**
- **OR**
- **OI**
- **ON**
- **OX**

This means: If the parameterisation program transmits a communication with a check sum, the firmware checks this check sum for correctness. If the check sum is correct, the reply to the parameterisation program will also be transmitted with a check sum. If the check sum transmitted and the check sum calculated do not match, the reply **CHK-ERR!** will be transmitted. If the program transmits a string without a check sum, the reply will also be transmitted without a check sum.

Table 1: Command syntax of communication objects with a check sum

Command	Reply
Write object: OW:M:NNNN:DDDDDDDD:CC	OK! or OW:FFFF FFFF or CHK-ERR!
Read object: OR:M:NNNN:CC	NNNN:DDDDDDDD or OR:FFFF FFFF or CHK-ERR!
Read internal value: OI:M:NNNN:CC	NNNN:DDDDDDDD or OI:FFFF FFFF or CHK-ERR!
Read minimum value: ON:M:NNNN:CC	NNNN:DDDDDDDD or ON:FFFF FFFF or CHK-ERR!
Read maximum value: OX:M:NNNN:CC	NNNN:DDDDDDDD or OX:FFFF FFFF or CHK-ERR!

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The check sum is calculated as follows:

- ":" is added to the transmission string.
- The sum of the ASCII values of all characters included in the string is formed.
- The sum is masked with 0xFF (bit 0..7).
- The hexadecimal value of the sum is added to the transmission string.

Example: Transmission string = **OR:1:000F**

Action	Result
Before the algorithm	OR:1:000F
":" added to the transmission string	OR:1:000F:
Summation:	"O" = 0x4F "R" = 0x52 ":" = 0x3A "1" = 0x31 ":" = 0x3A "0" = 0x30 "0" = 0x30 "0" = 0x30 "F" = 0x46 ":" = 0x3A Sum = 0x256
Masking of the sum	0x256 AND 0xFF = 0x56
Hexadecimal value of the sum added to the string	OR:1:000F:56

7 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

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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.

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8 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.

9 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! or
Speed control	OW:0234:00000008	
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.

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10 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: 0x0000A800 = 10.5 rpm
Actual speed	0x017B	
Actual speed (filtered)	0x0179	

11 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

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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!
Starting a homing run	OW:1:0010:00000022	or
Stopping a homing run	OW:1:0010:00000026	OW:EEEEEEEE,
Starting a positioning run	OW:1:0010:PPPP0021	OR:EEEEEEEE ¹⁾
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	nxxx:HHHHHHHH or
Reading the current actual position (long long, lower 32 bits, fraction of a revolution) ²⁾	OR:01AF	OR:EEEEEEEE ¹⁾
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:

nxxx: Number of the communication object (hexadecimal format)
HHHHHHHH: 32 bits data (hexadecimal format)
PPPP: Position data set (hexadecimal format)

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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

12 Start-up

Usually, some of these commands are only used by the Metronix ServoCommander™ 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! or OW:EEEEEEEE
Starting the automatic determination of the parameters of the current controller	OW:02C8:00000001	
Starting the automatic determination of the offset angle of the angle encoder and of the number of pairs of poles	OW:02C8:00000002	

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13 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

14 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!

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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: CCCCCCD	OK! OK!
Starting a positioning run with positioning set 5:	OW:1:0010:00050021	OK!

15 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:

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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 I ² t monitoring system or power stage has reached 100 %	I ² t monitoring threshold not exceeded
7	0x0000 0080	Brake chopper I ² t monitoring system has reached 100 %	I ² t 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 I ² t monitoring system has reached 100 %	I ² t 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.