

Project ARS2000	Application Note No. 102 RS485 Communication	Page 1 v. 7
Created by Metronix		Date 26.05.2008

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2 Introduction

In a lot of applications multiple axes have to be connected to one single control. In this case the communication between the control and the single drives is done by the use of field bus systems. A cost-effective alternative to common field bus systems, like CANopen, Profibus or SERCOS is the use of a RS485 network.

The servo positioning controllers of the Metronix ARS2000 family support the RS485 network. In this case the already known RS232 commands are transmitted via the RS485 network. Additionally all commands can be guarded by a checksum of transmission errors as an option.

This application note shall describe the connection of the RS485 network to the ARS2000, the general build up of a RS485 network and all special settings and protocol issues, that must be considered, if using the ARS2000 in a RS485 network.

3 Build up of a RS485 network

The communication in a RS485 network is done by using only two wires. On this wires the digital data is transmitted in an differential manner. Therefore the digital data is the voltage difference value between the two wires with the signals +RS485 and –RS485. By using the differential signal transmission, common mode noise can be suppressed in an effective way. As an option the GND signal can be connected between drive and control.

By using the RS485 interface up to 256 drives can be connected to one master (control). In this case the connection between the single drives and the master is done in a line structure. Both ends of the line must be terminated with a 120 Ω resistor to avoid reflections, that would interfere the data transmission.

The following picture shall illustrate such a network build up.

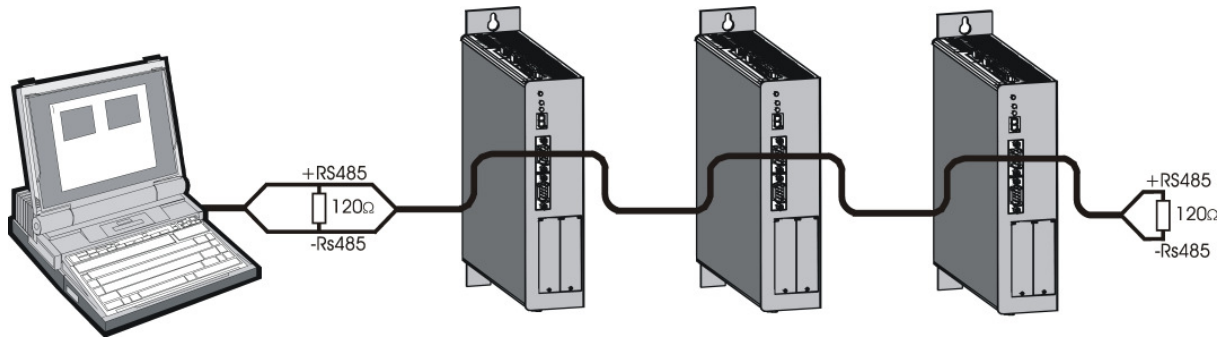


Figure 1: build up of a RS485 network

The build up can also be realised as star topology. This is not recommended as on the end of all branch lines reflections may occur.

4 Connection of the RS485 interface to the ARS2000

The RS485 interface is connected to the ARS2000 on the connector X5 “RS232 interface”. Only the pin 4 (+RS485) and pin 9 (-RS485) are used.

Table 1: Pin configuration RS232 interface [X5]

Pin No.	Denomination	Value	Specification
1	-	-	Not occupied
6	-	-	Not occupied
2	RxD	10 V / $R_I > 2k\Omega$	Receive line, RS232 specification
7	-	-	Not occupied
3	TxD	10 V / $R_A < 2k\Omega$	Transmitting line, RS232 specification
8	-	-	Not occupied
4	+RS485	7 V to 12 V / $R_I \approx 12 k\Omega$	Data line for RS485 signal (pos)
9	-RS485	-7 V to -12 V / $R_I \approx 12 k\Omega$	Data line for RS485 signal (neg)
5	GND	0V	Interfaces GND, galvanically connected to GND DGND

It is recommended to use a shielded cable for the connection to the RS485 interface, as it is used for RS232 communication, too. Additionally to the signals +RS485 and -RS485, the cable shield can be connected to the pin 5 (GND) on the ARS2000.

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To build up the line structure, the single wires are simply looped through from drive to drive.

5 Activation of the RS485 communication in the ARS2000

The access to the RS485 communication parameters (node number and activation) can currently only be done by direct access to the according communication objects (KO). The access is done by using the “transfer” window of the Metronix ServoCommander software.

The following KOs must be configured to activate the RS485 communication.

KO Number	0332 _{hex}
Description	By the use of this KO, the RS485 communication can be activated / deactivated in the drive. For this purpose the KO has to be changed by an “read-modify-write” access. This means, that first the KO is read. Afterwards the Bit 0 is changed as desired and finally the value is written back into the drive. If activating the RS485 communication, please note, that the interface only gets active after “Save and Reset” of the drive.
Values	Access via “read-modify-write” Bit 0: 0: RS232 active 1: RS485 active

KO Number	0333 _{hex}
Description	By the use of this KO the node number that the drive will use in the RS485 network, can be changed. The drive will only answer telegrams which are send either on the drives node number, or the broadcast node number 0.
Values	0: not allowed. Reserved for broadcast node 1 - 255: node number of drive

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Information

If the RS485 communication is active in the ARS2000, the drive will no longer communicate on the RS232 interface. It is only able to receive incoming RS232 messages but may not send any answer anymore. Therefore the access to the drive via the Metronix ServoCommander is not possible anymore, if the RS485 communication is active.

To deactivate the RS485 communication in the drive, a terminal program, such as "Hyperterm" must be used. Simply connect to the ARS2000 via RS232 and start the terminal program. Afterwards send the following RS232 command to the drive:

OW: 0332 : 00010000

The parallel access to the drive via RS232 and RS485 will be possible from FW version 3.5.0.1.6.

6 RS485 protocol for ARS2000 drives

As communication protocol on the RS485 network the same commands are used, that are transmitted via RS232. This communication protocol is described in detail in application note 38 for ARS2000.

Nevertheless there are some RS485 specific enhancements of the communication protocol. A complete RS485 telegram has the following structure:

XTNN : <RS232 command> : CC

The single parts have the following meaning:

XT	Identifier for outgoing telegram (master → ARS2000)
NN	Node number of target drive as hexadecimal value: 00 _{hex} : broadcast node 01 _{hex} – FF _{hex} : node number of ARS2000
<RS232 command>	This is replaced by the RS232 command, that shall be executed in the drive. Please see application note 38 for its content.
CC	In this field the value of the checksum is entered. This is optional and may also be omitted.

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If the ARS2000 is receiving a telegram, that is built up as described above, it will answer with a telegram of the following structure:

XRNN: <RS232 command response>:CC

The only difference between the two telegrams is the identifier “XR” instead of “XT”. This signals an incoming telegram (Master ← ARS2000). The checksum is only appended to the telegram by the ASR2000, if the outgoing telegram (Master → ARS2000) was equipped with a checksum, too.

The checksum is calculated as follows:



CC = <Summe aller Zeichen> & 000000FF_{hex}

Figure 2: calculation of checksum

If a checksum is used to guard the transmission against transmission errors, it is calculated by simply adding up all the binary values of the single ASCII chars, starting with the first char of the RS232 command. The last char is the colon right before the checksum itself.

After adding up all the ASCII chars, the resulting value is combined with the logic “AND” operation and the hexadecimal value 000000FF_{hex}. The resulting value is simply appended to the telegram. In this case only the last byte is used for the checksum.



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Telegrams, that are guarded with a checksum field and whose checksum is not correct are always acknowledged by the ARS2000 with an error message “CHK-ERR!”. The RS232 command, that was included in this RS485 message is ignored in this case.

The checksum can be used in the same way for the normal RS232 commands. In this case the additional protocol enhancements for RS485 communication (XTNN: and XRNN:) is not added to the telegrams.



Caution!

The use of the broadcast node 00_{hex} in telegrams with RS232 commands, the ARS2000 has to send an answer for makes no sense, as in this case all the ARS2000 drives in the RS485 network would try to answer at the same time. This will cause the data on the RS485 network to be corrupted and the single answers from the drives can not be evaluated in the master anymore.

7 Example communication

As already described in chapter 6 the RS485 protocol is based on the commands, that are used for the RS232 protocol. This commands are simply enhanced by the RS485 protocol overhead.

The following figure shall describe an example communication between one single RS485 master and two ARS2000 drives as slave devices.

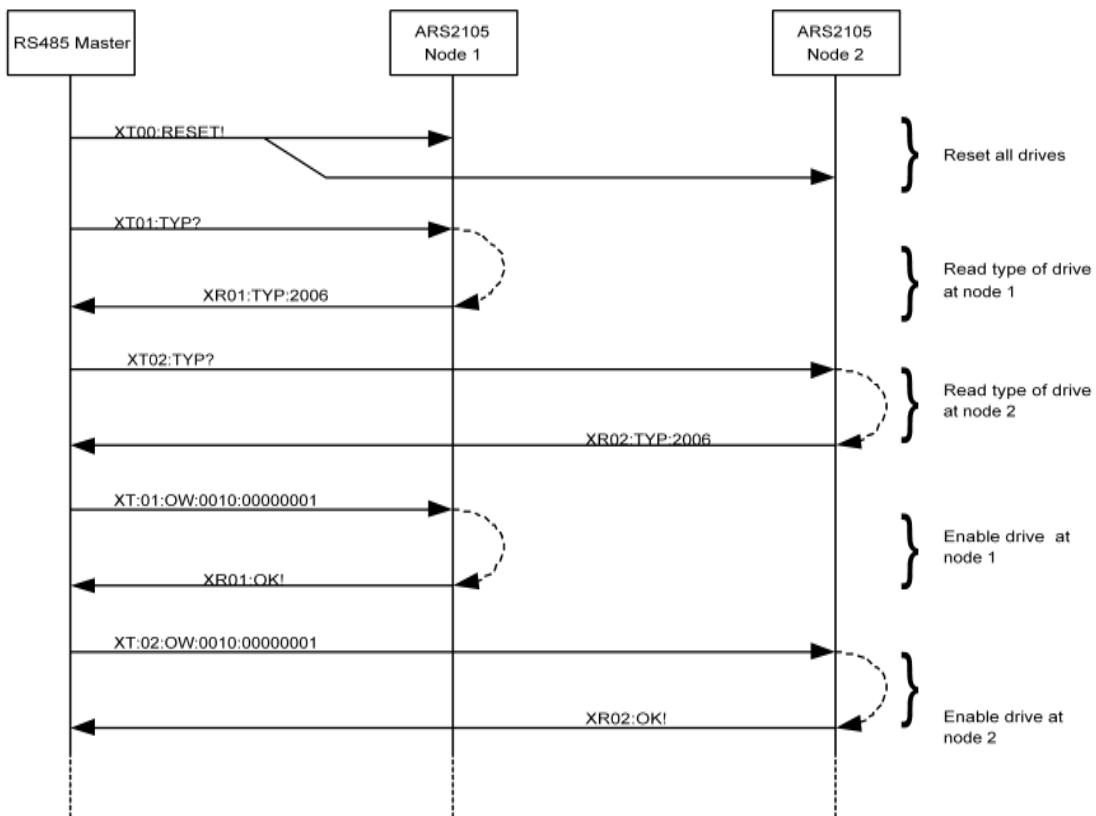


Figure 3: example communication on a RS485 network

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8 Tested RS232 to RS485 converters

The following RS232 to RS485 converters were already tested successfully at Metronix:

1.)

Manufacturer	Security Center www.security-center.de
Type	TV8469