Application Note AN0204:
Setting up communication on TC-S1 / M2 and TC500 series controllers
(Windows based Hardware)

1.) General Informations

Setting up a PC communication (either RS485 network or one-to-one RS232) is quite simple. However, some basic guidelines must be observed to ensure proper bus operation.

2.) Basic Considerations: Should I use RS232 or RS485?

If you intend to connect one single controller to a PC with is located only a couple of meters away from the controller you can use RS232. RS232 is commonly known as "serial port" (COM1, COM2 etc.) and on most PCs no additional hardware needs to be added.

RS485 is the industrial type of communication. You can connect up to 32 controllers in bus topology to a PC. RS485 is designed for difficult electrical environments and allows distances of up to several hundred meters (for details refer to corresponding IEEE publications). RS485 ports are not included on standard PCs, i.e. an additional interface card needs to be installed.

Electrical isolation of the communication is desirable on industrial communication (due to electrical noise decoupling and safety). High-End RS485 interface board do provide this features.

2.1.) RS232 or RS485 on Controller Side

Note that a TC500 controller can be fitted with either RS232 or RS485 interface board. Make sure that you select the communication before you place order.

TC-S1 and TC-M2 come with an RS485 interface by default. If you intend to connect a TC-S1/M2 to a PC via RS232, ask bentrup for the "passive converter cable" which allows direct link between the TC-S1/M2 and a serial PC port (default length 3 meters, under certain conditions 10 meters).

2.2.) RS232 or RS485 on PC Side

RS232: On most PCs a RS232 port is available and ready to be used. Just make sure that the port is properly configured (check in the Windows System Manager). If you are not sure connect an input device (like a mouse) to verify proper IRQ handling.

RS485: Make sure your RS485 interface card supports AutoRxD/TxD mode (many low cost models don't). bentrup supplies a compatible model also providing electrical isolation and surge protection according to industrial standards.

When using external RS232 to RS485 interface boxes it needs to support automatic direction control of RS485, too. Also make sure RS485 (and not RS422) DIP-Switch setting on the box.

If you are unsure about automatic direction mode test 'PC to TC..-Controller' transfer by sending commands like "#START" or "#RESET" where you can see immediate controller reaction. If controller reacts but error message is given by PC, the 'PC from TC..-Controller' transfer is faulty pointing to a lack of direction control of your interface card/converter.

For most flexible and convenient operations we recommend 'bentrup TCP/IP-RS485' option which allows you to access to your controller via LAN (and therefore over the www).

2.2.1) Setting up the RS485 Interface Card (ISA version only – see chapter 2.2.2 for PCI)

We recommend configuring the RS485 interface card to the first 2 available serial ports (usually COM3 and COM4). Assign address 0x3E8 / IRQ4 and 0x2E8 / IRQ3 to channel #1 resp. channel #2. Make sure that transmission control is set to "AUTO" and bus type to "485".
Using the bentrup RS485 card therefore needs the jumpers to be set as follows:
SW1:0 1 0 0 0 0 SW2:0 1 0 0 0 1 0 JP1:IRQ4 JP2:IRQ3 JP4:AUTO JP5:AUTO JP6:485 JP7:485

In some configurations IRQ 5 must be used to avoid overlap if IRQ channels. Note that in this scenario the IRQ 5 must be assigned manually in the Windows Device Manager. After power up you can verify proper card addressing by checking the information shown by the BIOS (should give you 4 serial ports total) as well as in the device manager of WINDOWS (4 serial ports COM1 to COM4).

Note that the device drivers coming with the RS485 interface card **must <u>NOT</u>** be installed. Windows uses the on board drivers. Depending on the version of Windows, you need to call "hardware" in the system console to start the recognition of the new installed ports. After completion you get the corresponding COM ports (COM3 and COM4) shown in the system manager.

2.2.2) Setting up the RS485 Interface Card (PCI version only – see chapter 2.2.1 for ISA)

Setup of the PCI version of the RS485 interface card is very simple. Install the board in a free PCI slot and turn on the computer.

Insert the driver disks supplied with the RS485 board as prompted by Windows during the boot procedure. Accept the warning message when Windows claims the drives as not as digitally signed.

After installation completed check the 2 additional COM ports installed (usually shown as COM3 and COM4). This assignment can be changed if necessary in the device manager (separate section).

3.1.) RS232 cabling

Use a 1:1 9-pole SUB-D9 cable to connect the controller to the PC. So called "zero modem cables" do **NOT** work.

3.2.) RS485 cabling

As defined in by IEEE standards RS485 requires twisted pair cabling. We recommend shielded cables - shield connected to earth on <u>one side only</u>.

Note that RS485 requires terminating resistors (usually 120 Ohms) on each end of the entire RS485 network. The terminating resistor connects RXTX+ and RXTX-. If the RS485 interface card represents one end of the bus there is a built in terminating resistor which needs to be activated by setting the corresponding resistor (one per channel).

Connect all RXD- , all RXD+ and all GND of the network together. Make sure that the RXD+ and RXD use a twisted pair. For network topology details see RS485 board manual.

5.) Notes on TC500 series <u>built before 2011</u> controllers RS485 cabling

TC500 controllers fitted with interface release earlier 2.0 (see mark on PCB) use different Pin assignment from shown on the schematic: Pin 1 = RXD+ / Pin 2 = RXD- / Pin 5 = GND (also RXD polarity is different vs. RS485 board!)

For all current models Pin assignment as shown in this Application Note applies (Pins 3/5/8).

4.) WinControl Software setup

Complete WinControl installation procedure as desribed in the manual coming with the software (electronic PDF document).

The basic communications settings are done in the bentrup FIELDBUS <u>server</u>. Click on the "config" button.

<u>Set the COM port to corresponding number assigned by Windows</u>. If your are not sure check in the Windows System Manager.

<u>Set the "baud rate" to correct value</u>:
TC500 controller series: baudrate 38400
TC-S1/M2: baudrate 115200 (older version are adjustable 96000 baud resp 19200 baud – check the baudrate setting in the TC-S1/M2 configuration list "misc adjustments" parameter 06)
TC806: baudrate up to 38400 – see configuration list

<u>Set "bus type" to the proper communication type</u>. When using RS485 choose "RS485" (most RS485 boards are <u>non-echo</u> type

On a RS485 network assign to each controller a unique ID number. This ID is used for identification.

On RS232 make sure that the ID on the controller is set to 0 (default).

5.) Communication Problems

If communication does not work right away, double check the settings of the FIELDBUS server. Most problems are caused by mismatch of baudrate and COM port!

Additional useful tests:
- when using WinControl, use the "Scan Bus" feature to check whether the device responds. On WinControl light (works on TC500 series controllers only) the scan is done on startup automatically. If the unit is found your communication works well and any other problems are not related to the communication!
- When using RS485, check the little LEDs on the RS485 board inside the PC. Reduce the baudrate to 1200 baud and you must see the LED flashing for a short moment whenever WinControl tries to access the bus. If the LED stays OFF, your COM port setting is wrong! Make sure to return the baudrate to the proper setting after the test is completed
- To monitor the communication traffic move the slide on the FIELDBUS server window from OFF to "A". You can see all activities and controller reply. Set the slide to OFF when tests completed to save Windows workload
- To manually initiate bus access use the free CLIENT software coming with WinControl: Start the CLIENT software, set the communication ID and press the LOGIN button. Now you can do requests as decribed in the WinControl appendix. Example: enter #SY1 in the very upper left hand line and press "receive". If communication works properly the controller will return the model specification ("TC-M2")
- On RS485, reverse the polarity (RXTX+ and RXTX-). Some manufacturers use reverse pin description

If you feel completely lost setting up a communication, use a PC Notebook and a TC500 controller with RS232 interface for test. Set the Port to COM1 and baudrate to 38400. Use the cable supplied with the TC500 controller. Startup WinControl light and it will work right way. From that point transfer the communication step by step to your application.

6.) Additional Notes

RS485/232 signal converters: These commonly available converters are cheap, they look nice but most of them will not work for such kind of applications. Most converters do not have the automatic direction control and therefore will mismatch the signals.
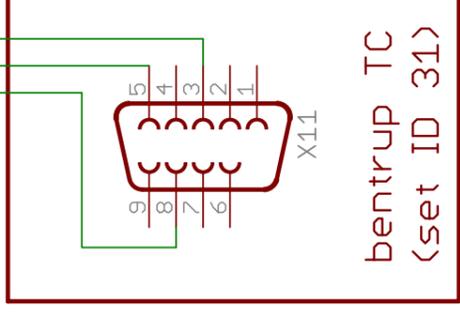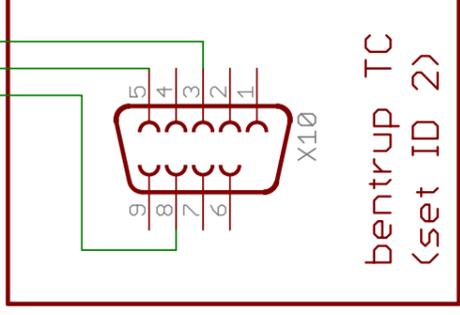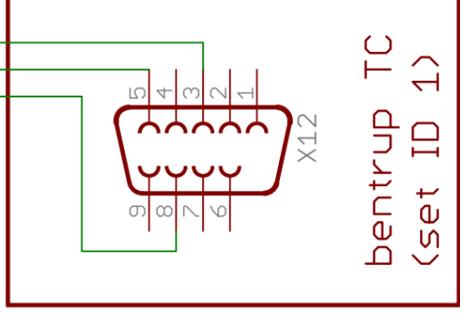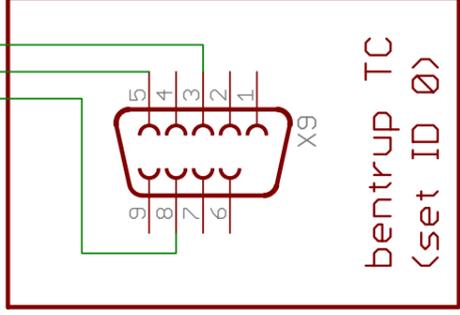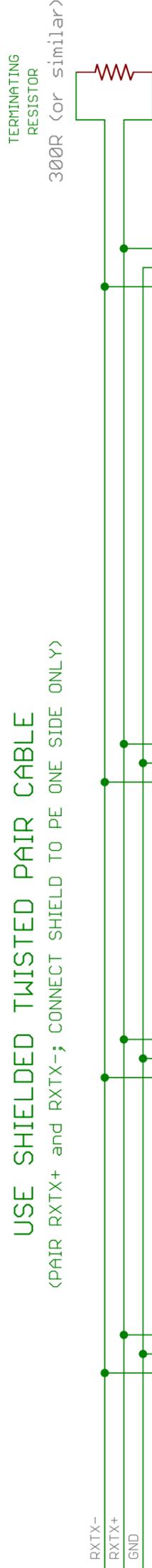
Older TC-S1/M2 devices (version 6.26 or earlier): These bentrup controllers providing the 19200/96000 baud option, you need to choose 96000 if systembus clients (like SW808, DIO808 etc.) are connected to the controller. Ask us for additional support if required.

USE SHIELDED TWISTED PAIR CABLE
(PAIR RXTX+ and RXTX-; CONNECT SHIELD TO PE ONE SIDE ONLY)

TERMINATING RESISTOR
300R (or similar)

bentrup TC
(set ID 31)
X11

bentrup TC
(set ID 2)
X10

bentrup TC
(set ID 1)
X12

bentrup TC
(set ID 0)
X9

MOXA CP132

RXTX-
RXTX+
GND

X7
COM A

X8
COM B

TYPICAL SCHEMATIC
RS485 INDUSTRIAL NETWORK

TITLE: RS485cabling

Document Number:
ADDENDUM AN0204

Date: nicht gespeichert!

REV:
1.0

Sheet: 1/1

Initial Issue	March 18th 2002		Be
Updated	April 15th 2003	added PCI and TC500 notes	Be
Extended	June 5th 2003	extended to RS232, troubleshooting	Be
Updated	September 07th 2012	Rel. 2.0 TC500 Interface & TCP/IP	Be