

APPLICATION NOTE

ONLine Access

This document describes how to detect errors and make right setup of RS485 network with EWS controllers

A006

As older generations of access control equipment use slow speed communication, that have very wide tolerances of the line parameters, quality and end of line terminations, and in many cases is functioning without any tuning. EWS utilizes higher speed communication-38.4 Kbps that is more demanding and sometimes require more careful approach to the network design and installation. For the most of the installers "RS485 is a RS485" and are used to slow speed communication which may lead them to conclusion that the equipment cannot function properly over RS485.

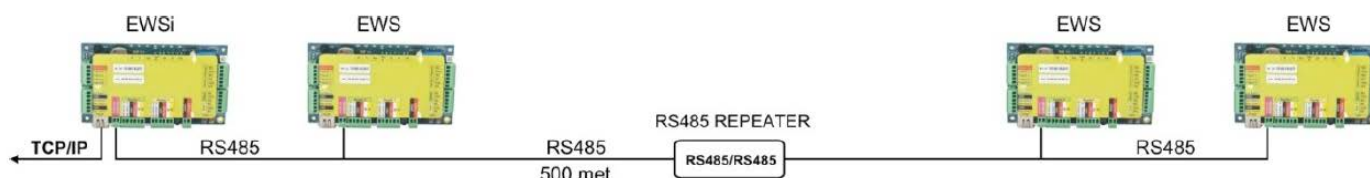
Other mistakes during the installation time can cause problems with communication As RS485 network can be long, stretching over entire site and connecting lot of devices, finding point of error can be very unpleasant task, so it is important to read and understand this document if you intend to use EWS over RS485 network.

1. CABLES

As a communication media, cable with twisted pair must be used, declared by manufacturer as a communication cable that can be used for RS485 communication with speed of 38.4 Kbit or higher. Total length of the cable in one RS485 line is 1000 meters, however for specific cables can be less if declared by manufacturer. Long lines are more difficult to tune, so if on the path of the line TCP network is available, communication lines can be shortened using EWSi built in TCP/Serial convertor.



Other way of shortening a long line is by using RS485 repeater. When using repeater, lines at both sides must be treated and tuned as individual RS485 lines. When choosing a repeater, take care that speed of 38.4 Kbps is supported. Some of the repeaters can add additional delays in the messages flow that can cause confusion in the communication, so test the selected model before installing it on the site. Avoid using more than one repeater, as each repeater will insert delays that can corrupt the data.



Before starting installation of the cable, test should be done to check for wire cut, short circuit between wires and wires with shield. Wires with same thickness should have same resistance. If possible, professional cable tester should be used.

Cables from unknown suppliers, cables improperly stored, heavy loads on top of the cable, heated and too cold storage environments can lead to installing bad cable.

Do not mix different cable types in the same RS485 line.

While installation process, care should be taken that cable is not stepped on, dragged, forced or damaged in any way. Cables should not be passing near extremely hot or cold object or environment. Sharp bending cables can lead to wire insulation damage or even accidental connection of the wires.

Using cables with more twisted pairs is recommended. In case of damaged pair, there will be spare one to replace. Do not use spare pairs for other purposes as power supply or signaling.

CAT 5 compatible cables can be used as a good solution. These cables can be used in future to replace RS485 with TCP communication if needed.

With low quality CAT 5 cable, green and blue pair can be with lower quality, so use brown or orange pair.

2. MOST FREQUENT ERRORS

a. Wiring. A and B line can be connected in reverse at some terminal. At some terminal complete twisted pair can be switched with other. As example, in low light condition, when network cable is used, orange wire or pair can be easily mixed with brown one. As EWS has pluggable terminals, it is easy to make mistake when holding the terminal in hand to fix the wires.

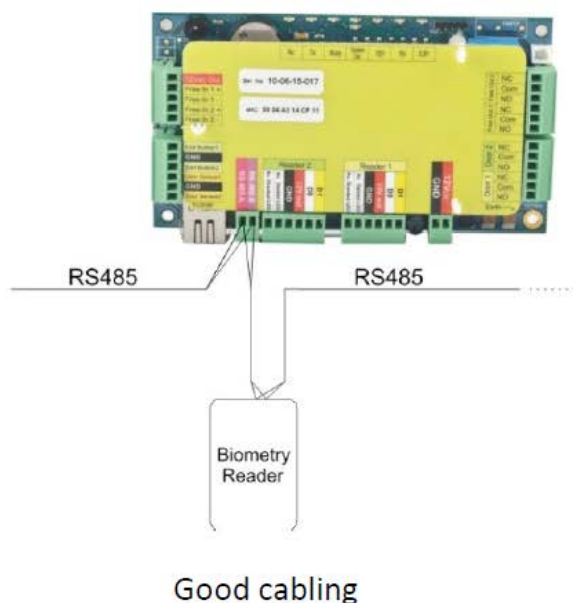
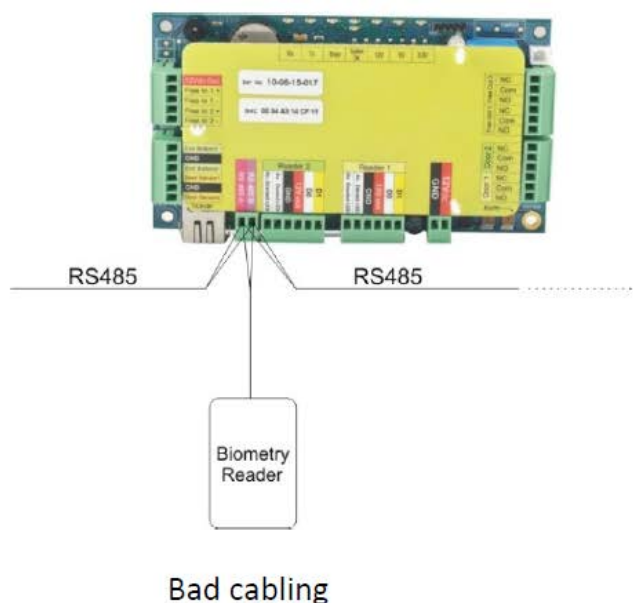
b. Fixing at the terminal. As in terminal except for the first and the last unit, 2 wires are needed, one of the wires can be loose in the terminal causing constant or periodic problems in the communication. The best way to prevent this is to twist both wires together and then fix it at the terminal. After fixing, apply reasonable force to each wire to be sure that it is properly fixed.

c. Striping insulation. Using unsuitable tools (knife, scissors, cutter...) for wire stripping may leave cut in the copper, especially on single core wires. After some handling, wire will break at this point.

d. Cable tension. At the terminal, make sure that no force is pooling the cable away from terminal.


e. Cut by over tightening. Screwing at the terminal with higher force can cut the wire at the terminal. Use screwdrivers with thinner handle, it will give better feeling of the force applied.


f. Stub. All devices must be connected in the chain. If the device is away from the cable trace, use one pair to the device, and another to bring back the line to the main cable.



3. DIAGNOSTICS

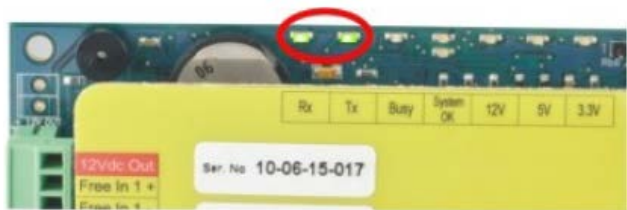
3.1 PROS

Before troubleshooting RS485 network, make sure that the PROS Software had established connection with portal (built in EWS or other type of TCP/RS485 converter). If connection does not exist, the portal icon will change background color to red . If this is the case, this connection must be fixed before you move to checking the connection to the controllers.

If the connection to some EWS is not good, EWS image will change background to red . Even if it seems that all controllers are online and events are flowing from EWS to PROS Software, still it is possible that RS485 network is not good enough. To check it, packets with larger data should be sent from PROS to all controllers in the network. The best way is to use "Reload users" function (supposing that in the PROS some number of users entry exists). If biometric devices exist in the system, they can be checked by uploading of user templates using biometry upload table.

3.2 EWS

EWS has two LED at the top of the PCB marked as Rx and Tx with behavior as follows:



a. PROS Software is not running. Both LED must be OFF. If Rx LED is ON or showing some activity (dimmed), there is a fault in the line. Reasons could be that one of the lines is discontinued, A and B lines are switched, A or B line is shorted to other wires in the system (power, Wiegand...)

b. PROS Software is running. When PROS is addressing any of the controllers or other devices in the same RS485 bus, Rx LED will be simultaneously ON at all EWS units. Observing one EWS, Rx led will be continuously ON/OFF. This sequence will have pauses when LED is OFF if the system have other controllers that are not on the same bus or PROS is executing other tasks that require break in the communication (reloading users, uploading finger templates, Users management window is ON...). When the controller recognizes that message is for it, it will respond and Tx LED will be shortly ON. Observing communication flow using Rx and Tx signals at each unit, following situations can occur:

- Rx LED is constantly OFF. RS485 line has a problem.
- Tx LED is constantly OFF, while Rx LED is blinking normal. First check if the ID number of the EWS is entered correctly in the PROS, otherwise check RS485 network.

3.3 INSTALLATION

- Power off entire system
- At each terminal, check if wire colors are OK. Make sure you have enough light to recognize the colors of the wires.
- Check if pairs used are from the communication cable and not from cables for other purposes
- Try to pull out wires from the terminal using reasonable force to check if wires are fixed well and not broken
- Remove terminations from both ends of the line and check if A, B and Ground (0V DC) are not shorted
- Short at one end A line with Ground and check at other end is A line is not switched with B line along the cabling. If by any case A and B line are switched twice, test will give correct result, even if error is present
- Disconnect A and Ground
- Repeat step f-g with B line
- Power the system (do not run PROS)
- Check at each controller that Rx and Tx LED are OFF
- Check voltage between Ground and B - should be slightly above 0V, B positive respected to Ground
- Check voltage between Ground and A - should be between 3-5 V, A positive respected to Ground
- If all tests give right results, move to RS485 tuning

4. TUNING

Tuning of the line is done at the both ends of the line with resistors. For this purpose in the EWS is built 120 Ohm resistor that can be attached to the line by closing termination jumper.

If the system uses TCP/RS485 convertor built in EWSi, end of the line are EWSi with TCP network and the last device at the other side of the line (EWS, Biometry...)

If the system uses separate convertor (USB/RS485, RS232/RS485, TCP/RS485) then one end of the line is the convertor used.

- a) Terminate both ends of the line with 120 Ohm resistor. If end of line is EWS, use built in resistor by closing termination jumper
- b) Check communication with PROS as described above
- c) If communication is not established and stabile, decrease resistor value by 10 Ohm using external resistors. Lowest value used can be 30 Ohm. On each resistor values change, restart PROS to check communication.

When using CAT 5 compatible cable, in most of the cases, termination with external resistor of 50 Ohm or combination of external 50 Ohm and termination resistor from EWS (120 Ohm), should be solution.

As tuning the line in the most cases is relatively simple task, sometime it can require more than described above. Bellow is part from the datasheet of the RS485 chip (MAX13412) explaining that sometimes the best result could be achieved by other termination values or asymmetric termination.

Proper Termination and Cabling/ Wiring Configurations

When the data rates for RS-485 are high relative to the cable length it is driving, the system is subject to proper transmission line design. In most cases, a single, controlled-impedance cable or trace should be used and should be properly terminated on both ends with the characteristic impedance of the cable/trace. RS-485 transceivers should be connected to the cable/ traces with minimum-length wires to prevent stubs. Star configurations and improperly terminated cables can cause data loss. Refer to the Application Notes section of the Maxim website or to TIA/EIA publication TSB-89-A for further information. While proper termination is always desirable, in some cases, such as when data rates are very low, it may be desirable and advantageous to not properly terminate the cables. In such cases, it is up to the designer to ensure that the improper termination and resultant reflections (etc.) will not corrupt the data.