

Connecting Devices to iCex – Rules and Tips

There are 2 general ways to connect devices to iCex – via RS232/485 and via Ethernet/LAN.

1. Cable connection

1.1. General recommendations:

- Use only the proper cables and connectors for specific connection.
- Make proper grounding.
 - Use relatively thick grounding wires – at least 1.0 mm².
 - Usually communication cable's shield needs to be connected to a good grounding point
 - use as short as possible grounding wires. Long wires become antennas to high frequency harmonics.
 - If power devices are connected already to the grounding point – like motors, pumps, power transformers... sometimes is better to connect cable shield and DC powered devices ground to 0V of DC power supply.
- Avoid passing communication cables close to electromagnetic noise generating devices – like power transformers, frequency inverters, power transformers, power contactors.
- Avoid passing communication and low power cables along with power cables. The worst generator of electromagnetic noise are power cables from frequency inverters to motors/pumps. If this can not be avoided, use shielded cables for low voltage DC power supply, as well as common chock and ferrite filters.

1.2. RS232 connection

- RS232 is “pear to pear” connection. This means, that only one device can be connected to iCex.
- According to standard, max cable length is 50 ft (15 m).
- iCex uses 3 of RS232 standard leads – RxD (receive); TxD (transmit) and SG (signal ground or just GND – ground)
- RS232 cable is crossed – RxD lead in one side goes to TxD in other side and TxD in one side is going to RxD in other side.

Connector COM Pin Out	Function RS232
Pin 1	GND
Pin 2	
Pin 4	Tx
Pin 6	RTS
Pin 8	Rx

Fig 1.2.1. iCex RS232 pin assignments

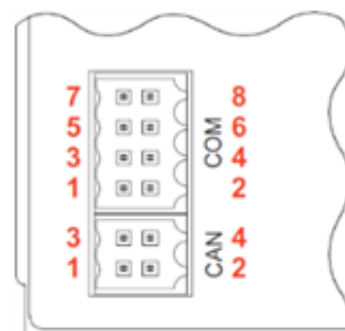


Fig. 1.2.2. iCex connector pin numbering

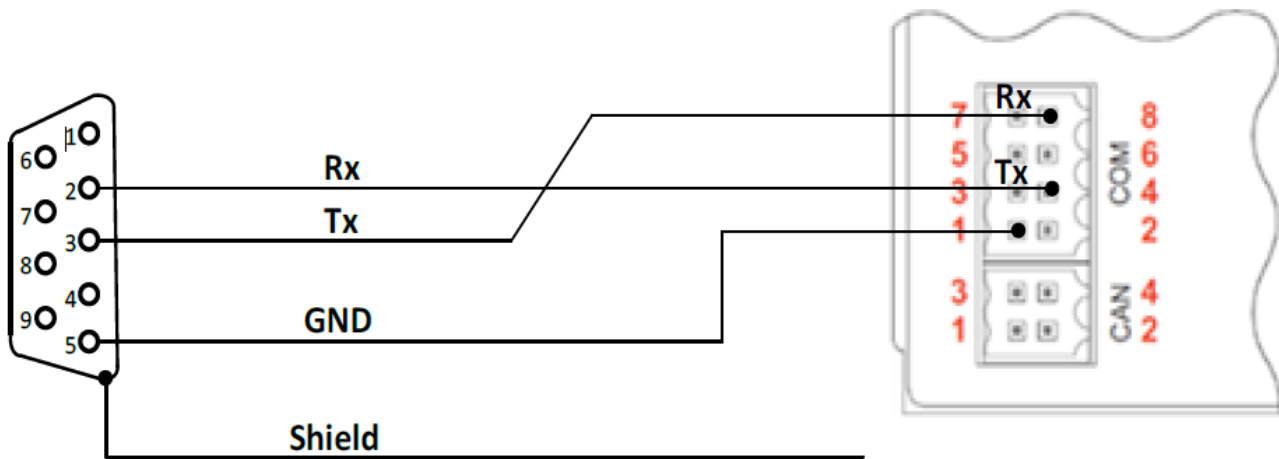


Fig. 1.2.3. Example of RS232 connection to iCex

- Shield needs to be connected on one side only to a good ground point. If existing ground point is used by devices, generating strong electromagnetic noise (power transformers, motor/pumps – especially driven by VFD, FVD itself...) in some cases it's better to connect the shield to 0V of DC power supply.

1.3. RS485 connection

- RS 485 is “daisy chain” connection. According to the standard, up to 31 devices can be connected in RS485 network. This means, that up to 30 devices max can be connected to one iCex.
- Some producers, usually of non-expensive devices, state in their documentation, that only up to 16 of their devices can be connected. Check device's user manual for details.
- Max RS485 cable length according to the standard is 4000 ft (1200 m).
- RS485 uses two leads – Tx/Rx+ and Tx/Rx-. Usually Tx/Rx+ is marked as **A** and Tx/Rx- as **B**. In iCex documentation anyway they are marked as **Z**, and **Y** too. **See Fig. 1.3.1. and fig. 1.3.3.**
- Connection is direct – RX/TX+ to RX/TX+; RX/TX- to RX/TX-

Connector COM Pin Out	Function RS485
Pin 3	B (+/Z)
Pin 5	A (-/Y)
Pin 7	Termination B

Fig. 1.3.1. iCex RS485 pin assignments numbering

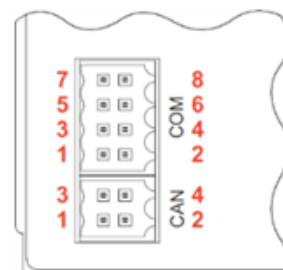


Fig. 1.3.2. iCex connector pin

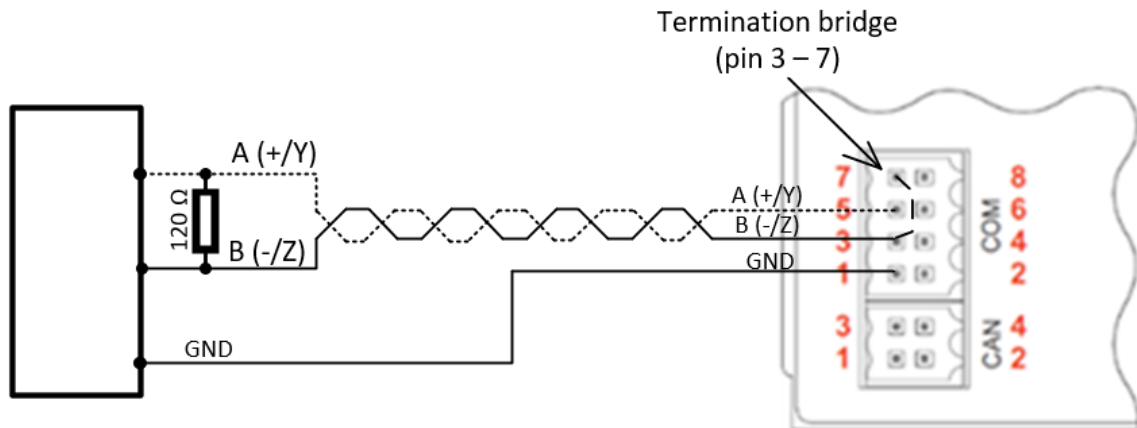


Fig. 1.3.3. Example of connecting single device to iCex via RS485

- Connection needs to be strictly “daisy chain”. Cable needs to go from unit to unit. Junction boxes and stubs are not allowed.

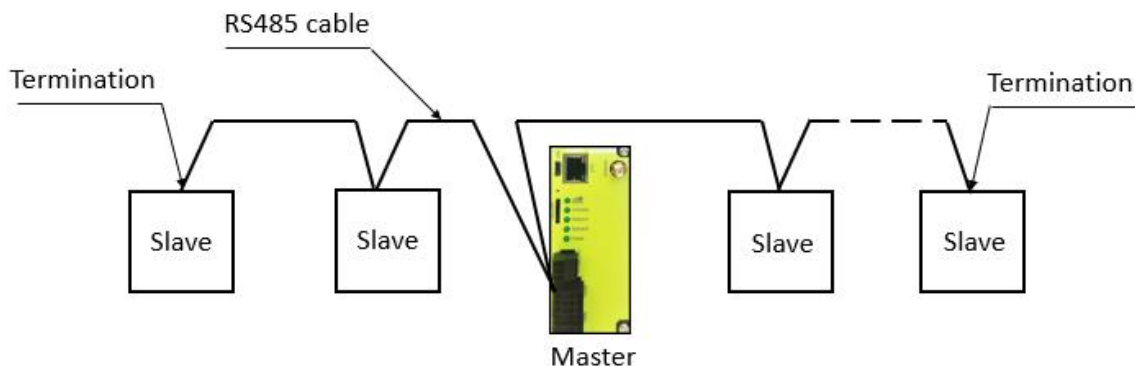


Fig. 1.3.4. Right connection

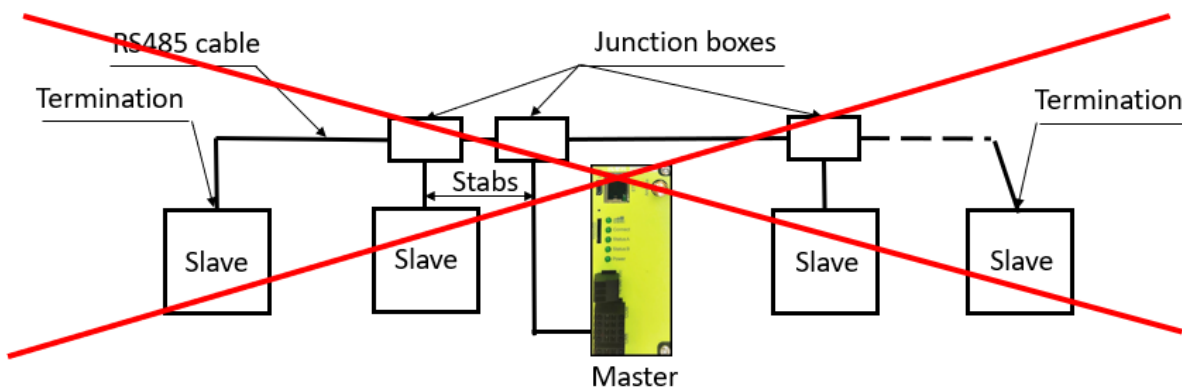


Fig. 1.3.5. Wrong connection

- Cables
- Use cables, especially dedicated for RS485 connection. The most important parameters of such cables are:
- twisted pair;
 - shielded pair and
 - impedance 100 – 120 ohms.

Below are links to RS485 cables of two of world large cable producers:

Belden: <https://www.belden.com/products/industrial/cable/bus-cable/rs485>

Lapp/Unironic: <https://www.lapptannehill.com/wire-cable/bus-cable/rs485-rs422>

If your local cable supplier offers you cables from another producer, you need to check specification of the cable to see if it answers at least to the 3 main requirements stated above.

- Shield needs to be connected all over the length of the cable. In one point only, it needs to be connected to a good grounding point.
- Termination.

The purpose of termination is to prevent in time of “silence” the potential of Rx/Tx- to be higher than the potential of Rx/Tx+, which can damage the hardware.

Termination must be set in both ends of the cable.

In some of the devices’ termination is built in and can be activated via software command, via jumpers, DIP-switches or bridge between two contacts.

In iCex termination is applied by bridging between points 3 and 7. See Fig. 1.3.3.

In case there is no built-in termination, resistor, usually 120 ohms/1/4W/1% accuracy needs to be applied between Tx/Rx+ and Tx/Rx- at the relevant end of the cable. See Fig.1.3.3. Anyway, check the third party devices’ user manual. Some producers recommend resistor 100 ohm.

1.4. Ethernet connection

- iCex can be connected via Ethernet to one single device (peer to peer), as well to existing LAN. Ethernet connection is type “star”. This means, that all devices in network or subnet are connected to one central router/switch – see Fig. 1.4.2.



Fig 1.4.1. Ethernet connection to single device

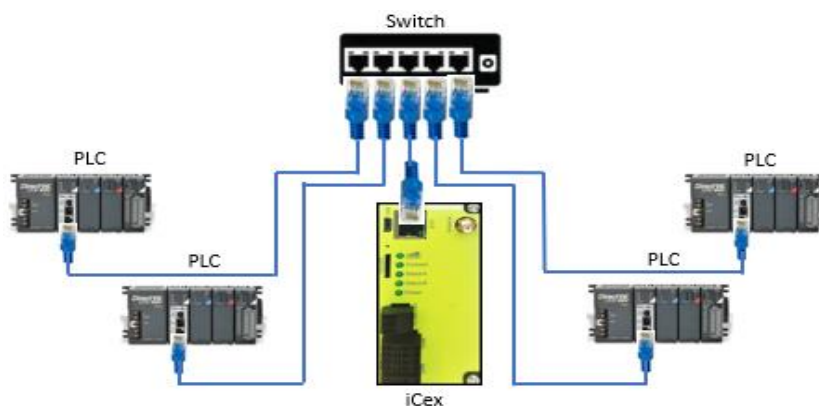
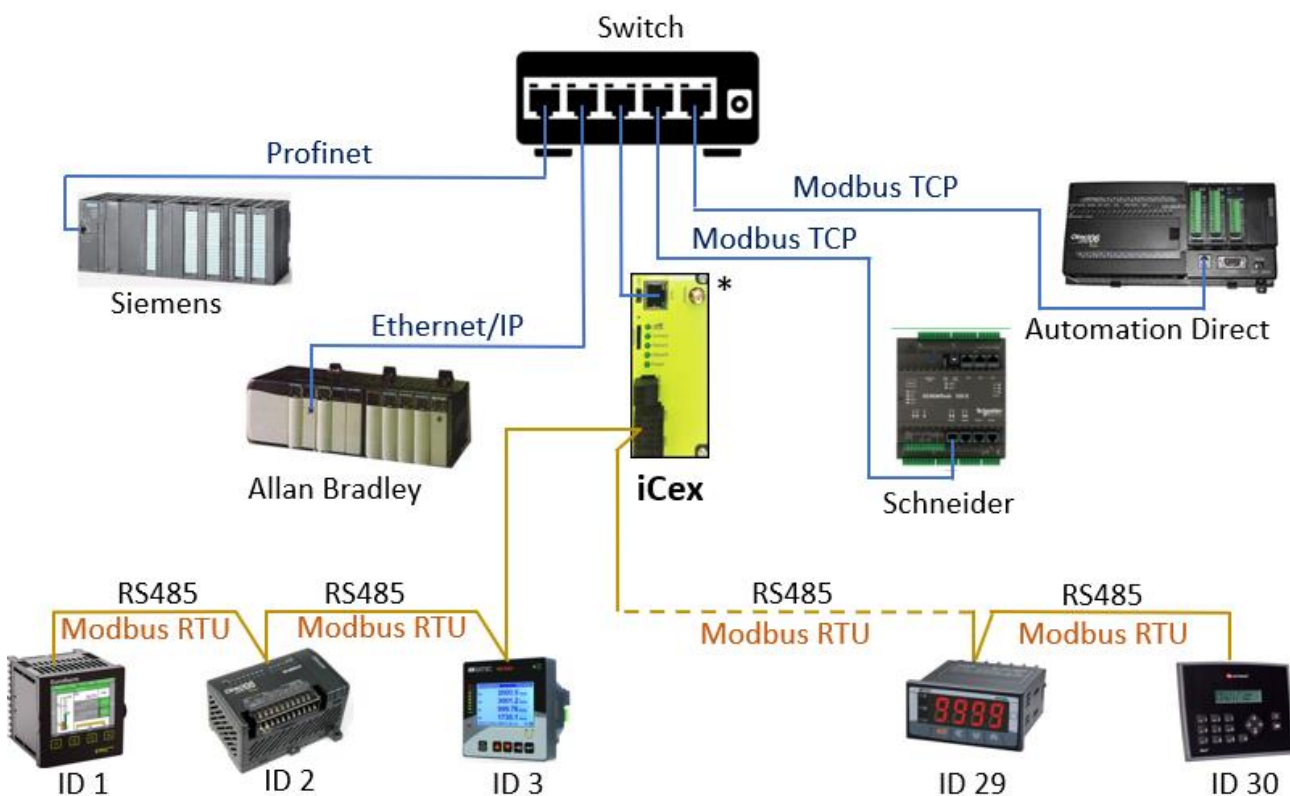


Fig 1.4.2. Ethernet connection to LAN

- Connection is via standard LAN cable – RJ45 – CAT5 – RJ45.
- Standard cable length is up to 100 meters. It is between switch/router and device.
- In case of environment with high level of electromagnetic noise, it is recommended to use CAT 6 shielded cable and even CAT 7, which comprises four individually shielded pairs inside an overall shield.
- When using shielded LAN cables – CAT 6 and CAT7, use shielded RJ45 connectors too.
- It is recommended not to exceed length of 50-60 meters, especially using “ordinary” CAT 5 cable.

1.5. Connecting both via Ethernet and serial connection

You can connect devices to iCex via serial (RS232 or RS485) and Ethernet simultaneously. Below is an example of connecting devices both via RS485 and Ethernet.



* iCex supports up to 3 different protocols at a time

Fig. 1.5.1. Example of connecting different devices to one iCex

2. Connection via Wi-Fi

In Some cases passing cable between local devices/PLC and iCex is not possible, or is very complicated technically, or is too expensive. In such cases using wireless connection – Wi-Fi or radio for part of the way can be applied instead cables. At the end anyway connection to iCex is via cable – between Wi-Fi transmitter or radio modem.

Below there is example for connection, using Wi-Fi for part of the distance.

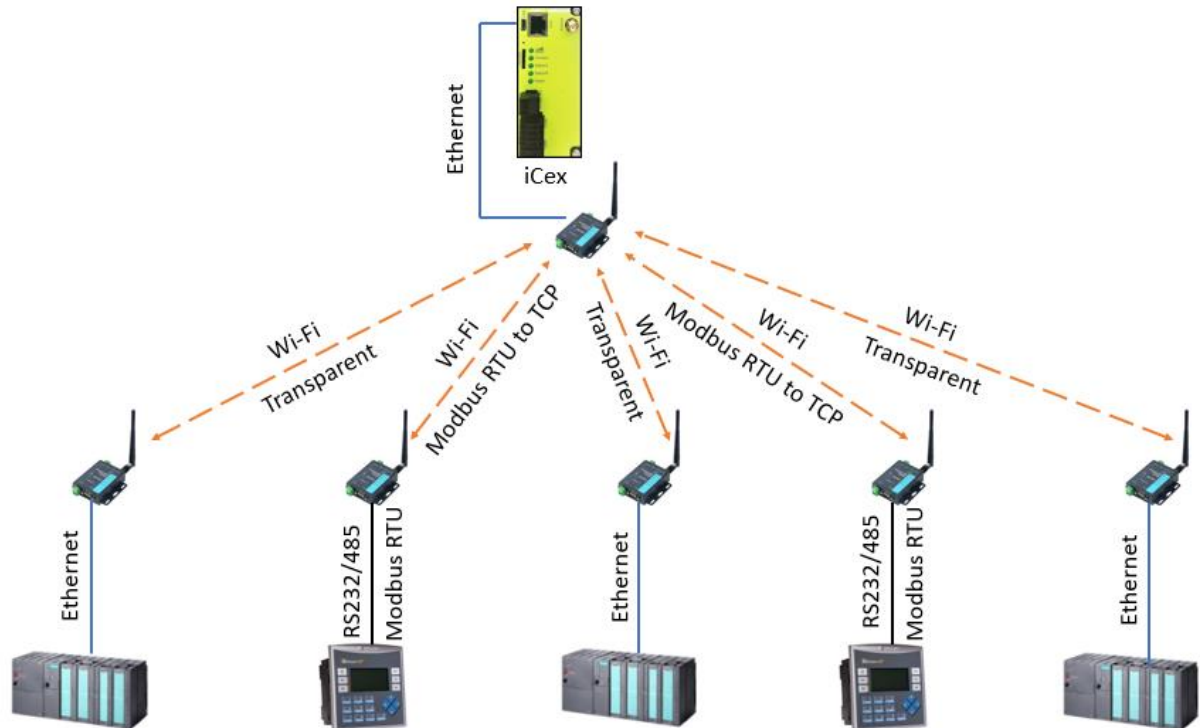


Fig. 2.1. Typical industrial Wi-Fi connection of multiple devices to iCex

There are different industrial Wi-Fi transmitters with different parameters. Follow device's spec for Wi-Fi transmit distances. The distance is sensitive to landscape too.

- To increase distance, locate antenna higher or use high gain antennas.
- Follow Wi-Fi device's User Manual for specific settings.