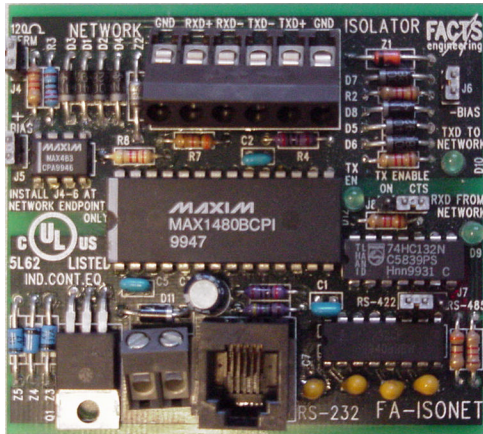


Network Adapter



The FA-ISONET Universal Isolated Network Adapter is used to place **Automationdirect.com**™ CPUs and other RS-232 devices such as operator interfaces and industrial computers on a RS-422 (4-Wire) or RS-485 (2-Wire) multi-drop network. The Network Adapter converts RS-232 signal levels to isolated RS-422 or RS-485 signal levels. All **Automationdirect.com** CPUs that support multi-drop networking protocols can be used with the FA-ISONET.

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Benefits of Network Isolation

- ✓ Isolation removes ground loop currents from data lines. The resultant noise voltages due to transformer like coupling are also eliminated.
- ✓ Completely eliminates common mode noise effects.
- ✓ Many forms of radiated noise are reduced to negligible limits.

Example: A host computer and a PLC are linked via a RS-422 4 wire plus ground connection. When an electric motor near the PLC is started up, a momentary difference in ground potentials at the host computer and the PLC may occur due to the surge in current required by the motor. If no isolation is used then data may be lost during the surge interval. A substantial surge could damage the computer.

Hardware Features

- ✓ Converts most RS-232 data interfaces to an isolated RS-422 (4-wire) or RS-485 (2-wire) data interface. The minimum RS-232 interface requirement is a TXD and a RTS output and a RXD input. RS485 (2-wire) connections require that the RS232 device correctly controls RTS.
- ✓ Isolated network drivers are short-circuit current limited and over-load protected.
- ✓ Network connections have substantial transient over-voltage protection.
- ✓ Flexible mounting, the included cable and the pre-wired connectors make the Network Adapter very easy to install on **Automationdirect.com** CPUs.
- ✓ The 5V RS-232 power source is either inside the communication cable connected to the PLC CPU or is derived from the +24V user power supply built into the PLC CPU base power supply.
- ✓ Both 4-wire plus ground (RS-422 full duplex) and 2-wire plus ground (RS-485 half duplex) networks are supported.
- ✓ The termination resistors required at the extreme ends of the network are built-in.
- ✓ Built-in bias resistors prevent reception of erroneous data when the network is idle (all receiver inputs are floating when no transmitter on the network is active).
- ✓ Drivers are slew-rate-limited to minimize EMI and reflections. Provides errorless data transmission.
- ✓ Transmit and receive LED indicators simplify troubleshooting.
- ✓ Designed and tested with **Automationdirect.com** PLCs for use in a noisy industrial environment.

FA-ISONET Components

- (A) FA-ISONET Isolated Network Adapter PCB.
- (B) PCB mounting rail for direct panel mounting.
- (C) DIN rail brackets for mounting rail (2).
- (D) One foot reverse modular cable with two RJ12 6P6C plugs to connect the FA-ISONET Network Adapter either directly to the bottom network port on a DL240 CPU or to the pre-wired DB-25 to modular connector for DL405 CPUs or DCM.
- (E) One foot Cable with RJ12 6P6C plug and RJ12 4P4C plug to connect the FA-ISONET Network Adapter directly to the bottom network port on a DL340 CPU.
- (F) DB25 Male to RJ12 6P6C Connector (for 405 CPUs, DCM, or 25-Pin PC DTE Serial Ports)
- (G) DB9 Female to RJ12 6P6C Connector (for 9-Pin PC Serial Ports)

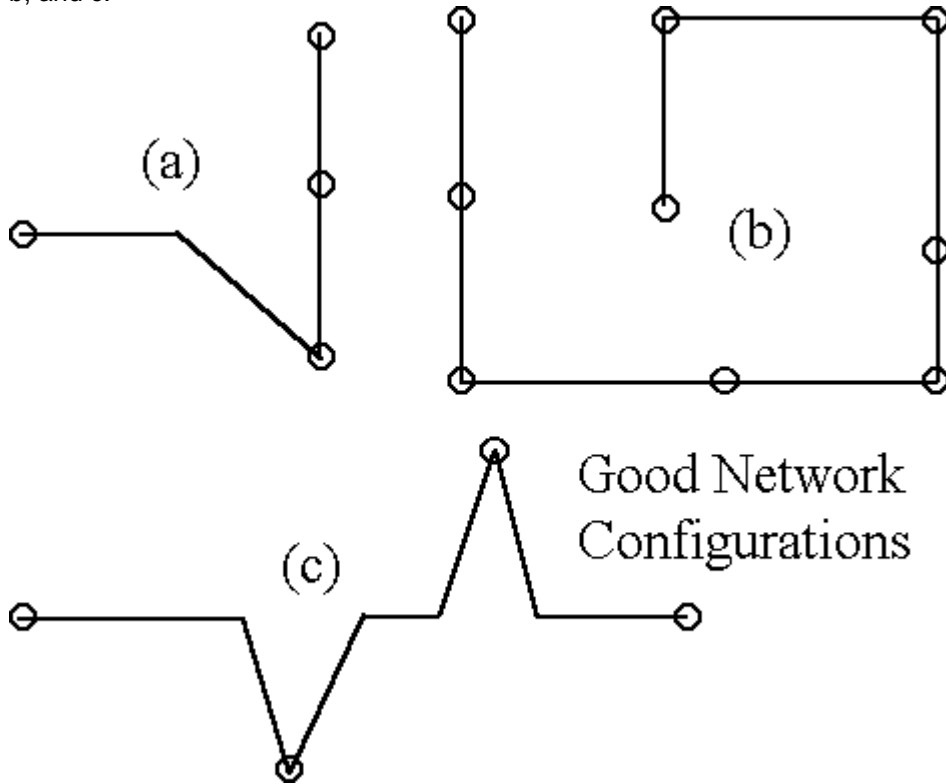
Specifications

Maximum Network Cable Length	4000 feet
Maximum Number of Devices	32 per network
Maximum Data Rate	115,200 bits per second
Maximum Driver Load	62 Ω
Network Driver Voltage	$\pm 1.5V$ minimum
Minimum Network Driver Active State	RXD+ 1.5V less than RXD-
Current from CPU +5Vdc Supply	
No Load	65 ma
Typical Load	82 ma (120 Ω Termination)
Maximum Load	100 ma (62 Ω Termination)
External 24VDC Power Supply	21.6 to 26.4 VDC 65mA Max
Voltage Withstand	1.2KV _{rms} /1 sec, 1.0KV _{rms} /1 min
Isolation Resistance	100 M Ω minimum
Operating Temperature	0 to 60 ⁰ C

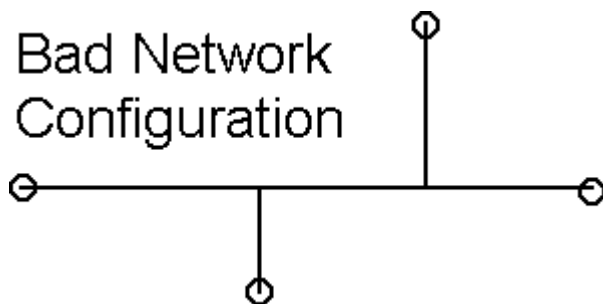
Installation

Network Configuration

RS-422 and RS-485 networks must be connected in a true daisy-chain configuration to avoid data errors. The network must form a single continuous path as shown in the following good network configurations a, b, and c.



Do not create a network with long branches, spokes, or subs as shown in the following bad network configuration.



Network Adapter RS-422/485 Connections

The connection to the RS-422 (4-wire) or RS-485 (2-wire) multi-drop network is made at a six-position European style screw terminal block. The following diagrams show 4-wire and 2-wire network connections.

Connecting Cables and Line Termination

A dual, RS-422, or single, RS-485, shielded twisted pair connection between devices is recommended. No signal ground connect is required if all devices on the network are isolated.

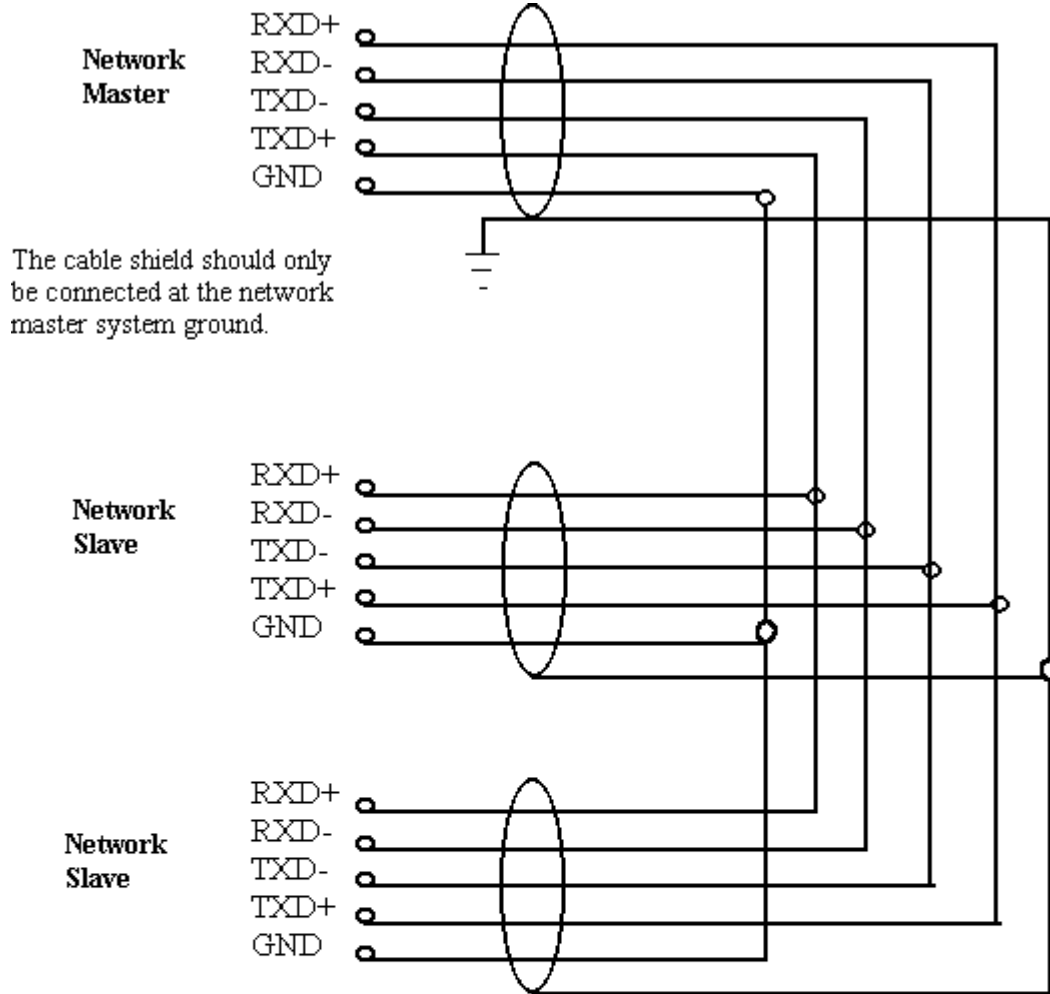
Proper termination of the balanced transmission line is required to prevent data errors. A typical AWG 22 solid wire with .060 inch plastic cover, twisted 4.5 times per foot has a characteristic impedance of about 120 Ω . Termination must only be done at the extreme end of the cable runs. Addition of intermediate terminations will adversely load the line.

Cable Shielding

Shielding improves noise immunity (magnetic field protection).

It is important to ground the shield at one end only. Grounding both ends of the shield will cause magnetic field induced noise currents to flow through ground. Noise may then appear on the data lines due to transformer like coupling with the shield.

RS422 / 4-Wire Connection



* Recommended cable is Belden 8102 or equivalent.

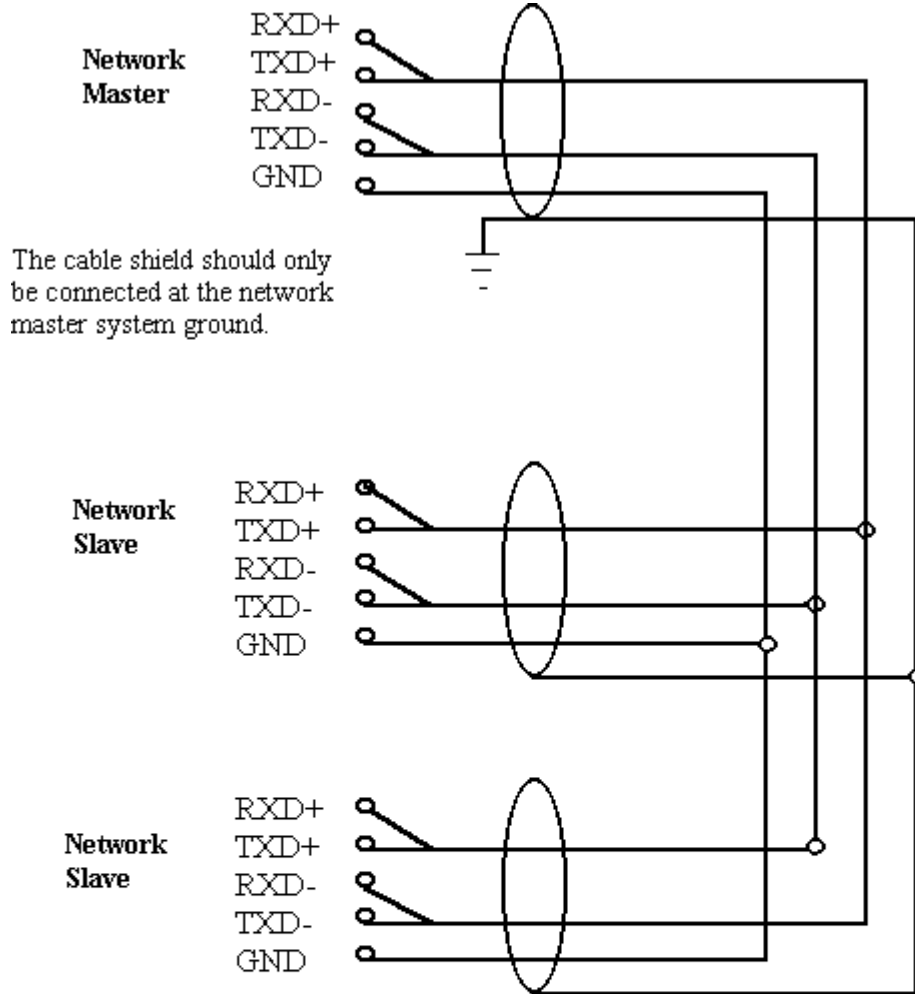
* A 4-wire connection should be used for multi-dropping Automationdirect.com PLCs.

* When extending the network cable to an outside environment precautions must be observed to protect the network from outside elements such as lightning, water, snow, ice, etc.

Transient suppression is provided on the FA-ISONET, F2-UNICON, and FA-UNICON but it is not sufficient for protection from induced voltage spikes due to nearby lightning strikes.

If network cable is run in an outdoor environment then external lightning protection must be added. There are several methods to reduce the induced voltage spikes from nearby lightning strikes including but not limited to spark gap protection and large transient suppressors. Protection for each installation must be considered on a case by case basis.

RS485 / 2-Wire Connection



* Recommended cable is Belden 8102 or equivalent.

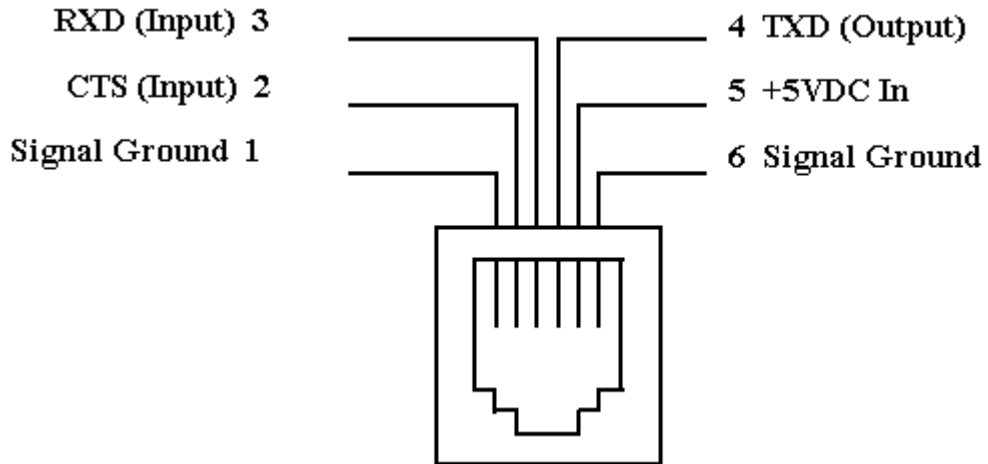
* When extending the network cable to an outside environment precautions must be observed to protect the network from outside elements such as lightning, water, snow, ice, etc.

Transient suppression is provided on the FA-ISONET, F2-UNICON, and FA-UNICON but it is not sufficient for protection from induced voltage spikes due to nearby lightning strikes.

If network cable is run in an outdoor environment then external lightning protection must be added. There are several methods to reduce the induced voltage spikes from nearby lightning strikes including but not limited to spark gap protection and large transient suppressors. Protection for each installation must be considered on a case by case basis.

RS232 Pin Outs

The telco style RJ12 connector (6P6C, 6 Position 6 Conductor) is used to make the RS232 connection to various RS232 devices. If your RS232 device supplies 5VDC, it can be connected to pin 5 to power the FA-ISONET, do not connect this pin if you are using 24VDC to power the FA-ISONET.



24VDC Connection

24VDC can be supplied to power the FA-ISONET at the two-position European style screw terminal block beside the RJ12 connector. If you connect 24VDC at this terminal do not connect 5VDC to pin 5 of the RJ12 connector.

Mounting

There are two ways to mount the FA-ISONET Isolated Network Adapter.

- (1) Panel mount next to the CPU.
- (2) Din #3 rail or A Series rail mount using supplied hardware.

RS-422 (4-Wire) Selection

To connect the FA-ISONET to a RS-422 (4-Wire) network, position the "J7" shunt on the two pins labeled "RS-422" (factory default).

RS-485 (2-Wire) Selection

To connect the FA-ISONET to a RS-485 (2-Wire) network, position the "J7" shunt on the two pins labeled "RS-485". In this position, the receive circuit is disabled whenever the FA-ISONET is transmitting (half duplex, no echo).

Install wire jumpers on the terminal block from "RXD-" to "TXD-" and from "RXD+" to "TXD+". This converts the FA-ISONET from a four-wire to a two-wire connection.

Transmit Enable Selection

(Revision E and above - Board revision is beside RJ12 connector)

The default position of the J8 shunt is on the two pins labeled CTS. In this position the RS422/485 transmitter is controlled by the status of the CTS input on the RS232 port. This setting allows the FA-ISONET to be used for any 2-wire or 4-wire network node as long as the CTS input is properly controlled by the device connected to the RS232 port.

Setting the J8 shunt to the two pins labeled ON causes the RS422/485 transmitters to always be ON regardless of the status of the CTS input on the RS232 port. This setting can only be used if the FA-ISONET is the master node on a RS422 (4-wire) multi-drop network or if the FA-ISONET is used in a RS422 (4-wire) point to point configuration.

Terminating Resistor

To install a 120 Ω termination resistor, position a shunt over the two "J4" pins labeled "120 Ω TERM.". Place the jumper on a single post for all intermediate drops along the network (factory default).

Network Biasing

For optimum performance, RS-422 and RS-485 receivers should be in the inactive state (mark) when their inputs are open or floating. A receiver's inputs will be floating when all transmitters on the network are disabled. The FA-ISONET includes bias resistors to force the receivers into the inactive state when the network is idle. The network biasing must only be done at the extreme ends of the cable runs.

To install the bias resistors, position a shunt over the two "J5" and "J6" pins labeled "+ BIAS" and "- BIAS". Place the jumpers on a single post for all intermediate drops along the network (factory default).

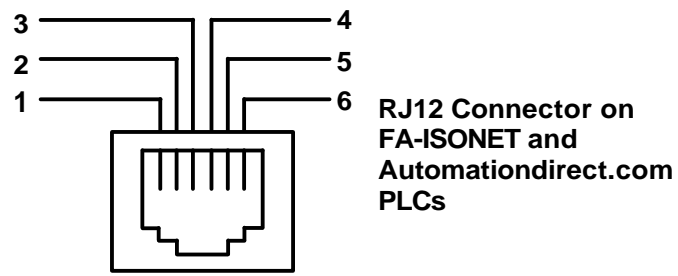
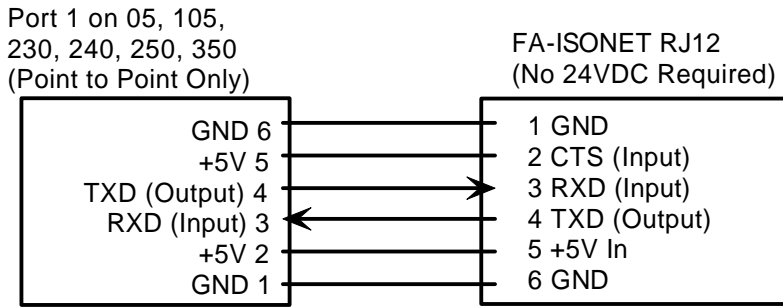
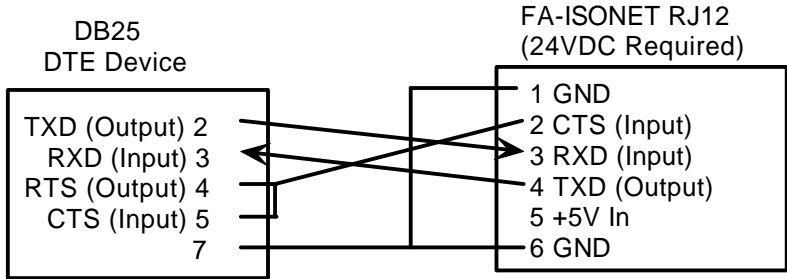
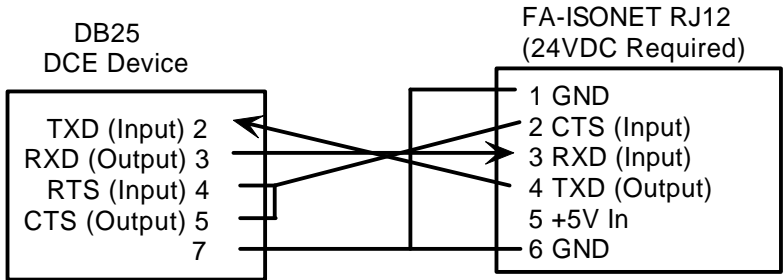
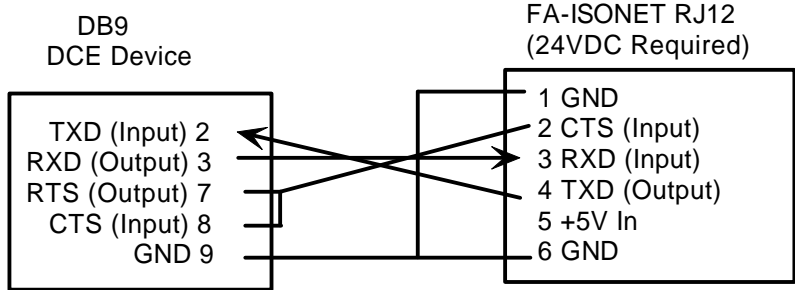
If the RS-422 driver of the network master is always enabled then the last slave does not need to be biased. In all other configurations it is normally better to bias the network at both ends. Some host computer software packages will not work without network biasing resistors on the host computer RS-422 or RS-485 receivers.

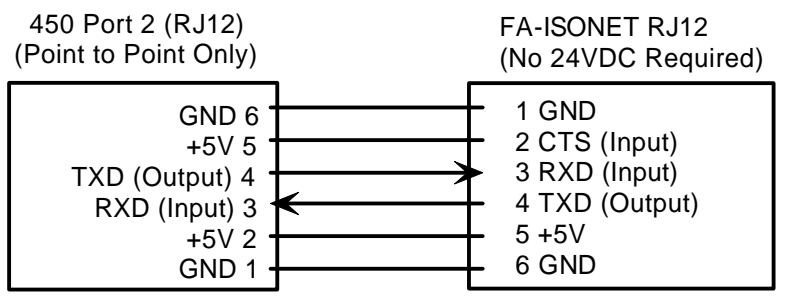
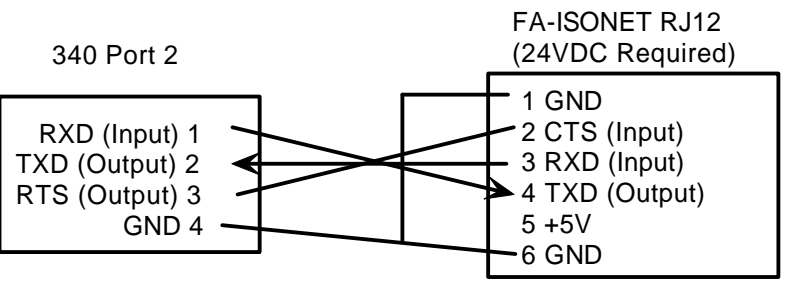
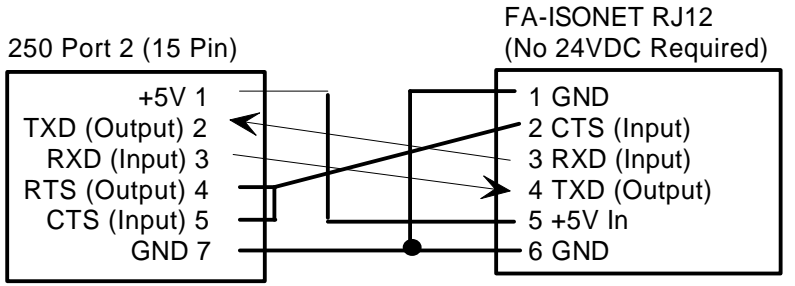
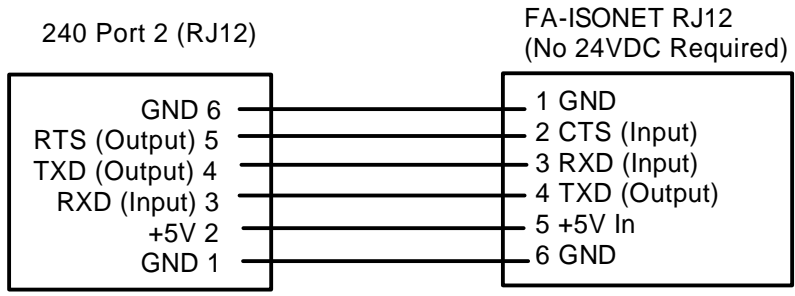
RS232 Connections using FA-ISONET Components

The FA-ISONET comes with four components (1' 6P6C Cable, 1' 6P4C Cable, DB25 connector, DB9 connector) that allow you to make RS232 connections without having to build a cable. The following table shows which components are used in various configurations.

Connection	6P6C Cable	6P4C Cable	DB25	DB9	External 24VDC Required	Comments
05, 105, 230, 240, 250, 350 Port1 (RJ12)	Y	N	N	N	N	4-Wire Point to Point Only
05, 240 Port 2 (RJ12)	Y	N	N	N	N	4-Wire
340 Port 1 (RJ11)	N	Y	N	N	Y	4-Wire Point to Point Only
340 Port 2 (RJ11)	N	Y	N	N	Y	4-Wire
350 Port 2	Y	N	Y	N	Y	4-Wire Use in applications requiring isolation
430, 440, 450 25-Pin Port	Y	N	Y	N	Y	4-Wire Use in applications requiring isolation
25 Pin PC Connection	Y	N	Y	N	Y	2-Wire or 4 Wire PC must properly control RTS
9 Pin PC Connection	Y	N	N	Y	Y	2-Wire or 4 Wire PC must properly control RTS

Common RS232 Pin-Outs





Troubleshooting

Normal Operation FA-ISONET As Network Master

4-Wire Connection / TX ENABLE set for CTS Control

- J4 J5 and J6 ON, J8 CTS position, J7 RS422 position
- TX EN LED turns ON
- TXD TO NETWORK LED flashes (Data Sent to Network)
- TX EN LED turns OFF
- RXD FROM NETWORK LED flashes (Data Received from Network)

4-Wire Connection / TX ENABLE set for Always On

- J4 J5 and J6 ON, J8 ON position, J7 RS422 position
- TX EN LED turns ON and stays ON
- TXD TO NETWORK LED flashes (Data Sent to Network)
- RXD FROM NETWORK LED flashes (Data Received from Network)

2-Wire Connection / TX ENABLE must be set for CTS Control

- J4 J5 and J6 ON, J8 CTS position, J7 RS485 position
- TX EN LED turns ON
- TXD TO NETWORK LED flashes (Data Sent to Network)
- RXD FROM NETWORK LED flashes (Echo of Data Sent to Network)
- TX EN LED turns OFF
- RXD FROM NETWORK LED flashes (Data Received from Network)

Normal Operation FA-ISONET As Network Slave

4-Wire Connection / TX ENABLE set for CTS Control

- J4 J5 and J6 OFF (ON if at end of network), J8 CTS position, J7 RS422 position
- RXD FROM NETWORK LED flashes (Data Received from Network)
- TX EN LED turns ON
- TXD TO NETWORK LED flashes (Data Sent to Network)
- TX EN LED turns OFF

4-Wire Connection / TX ENABLE set for Always On

- J4 J5 and J6 OFF (ON if at end of network), J8 ON position, J7 RS422 position
- TX EN LED turns ON and stays ON
- RXD FROM NETWORK LED flashes (Data Received from Network)
- TXD TO NETWORK LED flashes (Data Sent to Network)

2-Wire Connection / TX ENABLE must be set for CTS Control

- J4 J5 and J6 OFF (ON if at end of network), J8 CTS position, J7 RS485 position
- RXD FROM NETWORK LED flashes (Data Received from Network)
- TX EN LED turns ON
- TXD TO NETWORK LED flashes (Data Sent to Network)
- RXD FROM NETWORK LED flashes (Echo of Data Sent to Network)
- TX EN LED turns OFF

Common Problems

TXD TO NETWORK LED flashes but data is not transmitted / TX EN LED does not turn ON

The TX EN (Transmit Enable) LED indicates when the RS422/485 transmitters are enabled. If the transmitters are not enabled then no data is transmitted even though the TXD TO NETWORK LED may be flashing.

If the TX ENABLE jumper is in the CTS position then the RS422/485 transmitters are controlled by the CTS input on the RJ12 connector (pin 2).

If the application is a 4-wire network and FA-ISONET in the network master or is used in a point to point configuration then move the TX ENABLE jumper to the ON position so the RS422/485 transmitters are always enabled. (Revision E and above - Board revision is beside RJ12 connector)

RXD FROM NETWORK LED never flashes

If the FA-ISONET is the network master then the network slave is not responding. There are many possible causes for this so you will need to look at all available troubleshooting information on the master and slave nodes to isolate the problem. Some possibilities include:

- Baud Rate mismatch
- Framing mismatch
- Protocol mismatch
- Wiring problem
- Network Slave configuration problem

RXD FROM NETWORK LED stays ON solid

A network wiring problem or a defective node could cause this problem.

- Verify cabling and cable type
- Disconnect one node at a time to isolate the problem

RXD FROM NETWORK LED flashes as expected but the RS232 data is corrupted

A network wiring problem or a defective node could cause this problem.

- Verify cabling and cable type
- Disconnect one node at a time to isolate the problem

