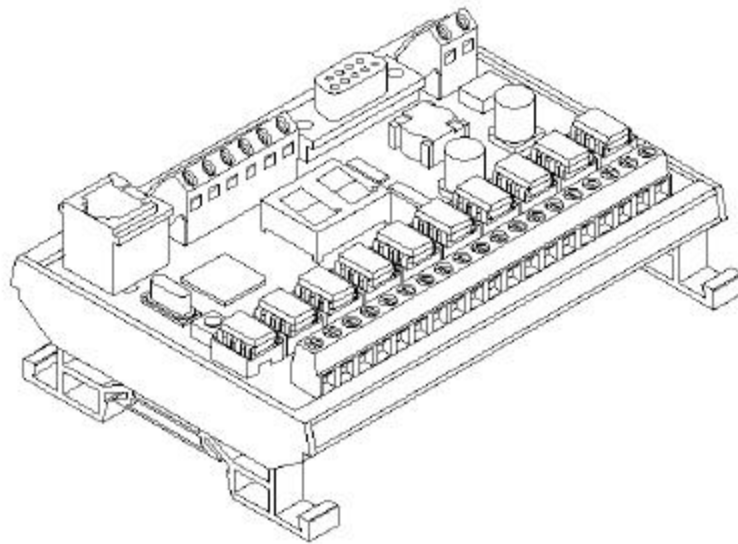# Universal I/O

EDI Distributor Control Interface
Wiring and Setup Instructions

EDI UNIVERSAL I/O INTERFACE MODULE

- ❑ The only interface needed for EDI-V5 controls
- ❑ Network compatible with all older EDI controls
- ❑ Control one or an entire network of EDI drives
- ❑ AC/DC Solid State Relay I/O
- ❑ Individual output relay indicator LEDs
- ❑ On board 2 digit status display
- ❑ Long distance EDI Network communication (4000')
- ❑ Field configurable operating modes
- ❑ EDI Network scanner with Modbus RTU interface
- ❑ DIN rail mounting
- ❑ RS-232 to PLC/Computer communication
- ❑ EMI interference resistant
- ❑ More operating modes in development
- ❑ Field upgradeable as new firmware is developed

UIO_OM 10/5/10

<table>
<tr><td>⚠ **WARNING**</td></tr>
<tr><td>

The UIO module uses low voltage input and outputs but high voltage precautions may be necessary if this module is located in a cabinet containing other electrical equipment. High voltage can kill or seriously injure personnel.

All maintenance personnel must be trained and follow the proper Lock-out/Tag-out procedures established by the facility management.

</td></tr>
</table>

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Table of Contents

UIO Overview

The Universal I/O, or UIO for short, is a microprocessor based interface module designed to allow user devices, like PLCs, computers and custom control panels, to control EDI distributors. It also allows EDI controls to operate external devices, for example alarms, motor starters, relays and solenoids,. With the UIO the user can monitor and operate one or many distributors or setup electrical interlocks depending on spout position.

The UIO is a cost effective, DIN rail mounted multi-function module. It can be placed far from the EDI control unit, usually inside a custom control panel, along side a PLC, MCC or at a remote operator station. It can then be field configured to operate in several different modes depending on the needs of the user.

A standard UIO kit consists of:
- UIO module with the necessary relays installed
- Wall mounted power supply
- 25' communication cable
- One UCOM adapter card for installation on the EDI control.
- RS-232 ribbon cable 5' long

Basic Installation Connections

Every installation requires power to the UIO module and a communications cable between the module and the EDI distributor control(s). See Figure 3 on page 10 for the UIO termination points.

Power

The supplied wall transformer is connected to the Power terminals on the UIO module. This transformer supplies 24 VAC to the UIO module. Alternative power, supplied by the customer, can be from 8 to 30 Volts AC or DC and is not polarity sensitive. The maximum current required is 40 ma.

Communication Cable

The communication cable supplied with the UIO module is Cat5 cable. It is not necessary to use Cat5 cabling but it is readily available and is noise resistant. If other cable is used it must have at least 5 wires, 24 ga. or heaver wire and preferably contain twisted pairs. For testing purposes we have used 1000' of solid 8 conductor thermostat wire in an electrically noisy environment without problems. Of course we don't recommend this – let common sense prevail.

Both ends of the supplied cable have RJ12 plugs. If it is necessary to cut the cable or when using an alternative cable, the ends may be terminated at the screw terminals provided on these boards. If you will be using the screw terminals and are using your own Cat5 cable, we recommend you use our wire color choices for your connections since it organizes the twisted pairs to a signal pair and may be helpful with troubleshooting if needed.

Terminal	Wire Color Terminations For Cat5 Cable
1	Brown - Not used
2	Blue
3	Orange
4	White\Orange
5	White/Blue
6	White/Brown

Table 1. Terminating the communication cable

Power Up/Reset

On power up, or after pressing the Reset button, the UIO will display a 2 digit number representing the firmware version for ½ second, then show a 'Pn' for ½ second. The 'n' is a single digit number representing the configuration mode. Configuring the UIO is discussed on page 9 of this manual.

Mode Selection Overview

There are several operating modes embedded in the UIO and it is up to the user to select and configure the mode that suits their installation. The modes are divided into 2 categories, Digital and Network.

Digital Mode Category

- The digital modes can control only one EDI distributor drive.

- It uses solid state input and output relays to read and control the operation of the distributor.

- The digital modes of the UIO only work with EDI V-5.1 and later controls.

Network Mode Category

- The network modes can read and control 1 to 20 distributor drives.

- It uses a RS-232 connection between a PLC or computer and the UIO module to address, read and operate the EDI drives.

- Network modes on the UIO work with any EDI control, old or new, that have been set up for networking.

- There are 2 embedded scanner modes, Modbus and DF1, that do all of the work of scanning all distributors on the EDI network, report their positions and instruct them to move to new positions. This is accomplished by reading and writing directly to PLC registers, thereby eliminating all PLC communication programming.

Example uses and interconnections for various modes are shown later in this manual.

We highly recommend that you review and experiment with all of the configurations available before making a decision on the best selection for your installation. We have various desktop simulator devices that are available for a limited time period, at no charge, to help you learn the pros and cons of each configuration of control. Our technical support team is also available to answer any questions you may have regarding these options.

Digital Mode Selection

In the context of the UIO module, digital control is a run-by-wire configuration. As an example, using only a set of jumper wires, you could read the position of the EDI distributor spout and position it at will from the remote UIO module location. In practice, the UIO would be hardwired to a control panel or PLC.

There are 2 digital modes to select from; binary mode and discrete mode. The only difference is how the current spout position of the distributor is displayed on the output relays. In both modes the spout position is also displayed numerically on the 2-digit display.

Binary Mode

With binary output the spout position of a 62 duct distributor can be read using only 6 of the output relays: Relay 1 having a value=1, Relay 2=2, Relay 3=4, Relay 4=8, Relay 5=16 and Relay 6=32. Adding the value of each of the relays the UIO simultaneously turns on gives the present spout position (ex: Relays 1,3 and 4 on = position 13). These relays can be read by a PLC using a minimum number of wires. As expected, only 3 relays are needed for a 6 duct distributor.

Discrete Mode

Operation is identical to the Binary mode except that the UIO will only turn on 1 relay at a time, that relay corresponding to the position of the spout. This configuration is limited to the control of a distributor with 16 ducts or less.

With all digital modes it is important to monitor the UIO Confirm relay. See Reading the Confirm Relay below.

For examples on how to use these modes see the Example Digital Layouts starting on page 11.

Using the Run Relay

Both binary and discrete modes allow the user to change spout position by applying a voltage to the Run relay. While the spout moves, it's current position is shown on the output relays and 2 digit display. When the desired position is reached the Run voltage is removed and the spout will stop at the displayed duct. There is usually more then 1/2 second allowed to respond by removing the Run voltage after the desired position is displayed.

Reading the Confirm Relay

One last but very important point; the Confirm relay is closed (on) when the spout is in position and no positioning errors have occurred.

The Confirm relay will open (off) if:
- the spout is moving to another position
- the spout was obstructed during operation and not allowed to move into position
- the spout moved after stopping and is no longer in position
- communication between the EDI control and the UIO module failed.
- the EDI control has been powered down or reset.

Always monitor this relay and make sure it is on before allowing material flow through the distributor.

Network Mode Selection

In the context of the UIO module, the term 'network' refers to the hardware and software we use to link two or more EDI controls together and the ability of the UIO to talk to all of them on a robust, long distance, communication line. The UIO module provides the link to the outside world for PLCs and computers to fully control these multiple distributors via a common RS-232 serial connection. The communication language is straightforward and easy to learn.

Since the communication with the UIO is over the serial port, the solid state relays, used by the digital configuration, are disabled or meaningless for some network modes. Except for the serial port connection, only the basic installation connections, described at the beginning of this manual are necessary. The protocol for all RS-232 serial communication with the UIO module is 9600 baud, 8 data bits, no parity and 1 stop bit. No handshaking is used.

The UIO module can communicate with any existing networked EDI distributors. With this backward compatibility, the smart features of the UIO network configuration can be used with a combination old and new EDI controls.

It is beyond the scope of this manual to detail the functions of each of the available network modes but a brief overview of some of the features of the various network modes is given here:

Pass-Through Binary Mode

In this mode the UIO acts only as a RS-232 to RS-485 converter. The instructions from the PLC or computer are in the proper binary form and are passed to and from the EDI network unfiltered. This is the mode to be set when using our SLC-500 program in an Allen Bradley SLC 500 series PLC. In this case the PLC program generates the messages to the network and converts the responses to register values.

Some of our PC based utilities use this mode for testing and demonstrating the power of the network mode options. These utilities are available free of charge and may be download from our website.

Modbus Scanner Mode

This mode uses the intelligence we have built into the UIO module to directly read and write integer registers in the PLC without the PLC running a special custom program.

With some minor setup in the UIO configuration utility, the user can specify a series of integer registers in the PLC that the UIO can use. The UIO then scans all of the distributors on the network, obtains their position and status and writes this information to the proper position registers in the PLC. The scanner then reads the corresponding request registers and, if different than the position register, directs the proper distributor to move to the position indicated in the request register.

This mode also tells the PLC if a distributor has set an error alarm, is in reset mode is moving to another position or is in the indicated position without error and ready to run. This mode offers the most rapid integration of the EDI network into the plant automation.

DF1 Scanner Mode

This mode is almost identical to the Modbus mode operation described above, but uses the DF1 protocol available in many popular PLCs.

For examples on how to use these modes see the Example Network Layouts starting on page 14.

Other modes are being developed and the UIO firmware can be field upgraded to take advantage these when needed.

Relay Board Mode This configuration does not have anything to do with EDI distributors. It just turns the UIO module into a convenient 17 output, 1 input relay board operated by serial communication. Simple commands can switch any relay or read its status. The moderately high capacity of each relay enables them to switch 24 Volt AC or DC current to starter coils or pilot lamps. Of course the communications cable is not necessary using this mode.

For help on using this special mode, please contact a member of our technical support team.

UIO Configuration   Prior to shipping, the UIO is configured to operate in the mode requested when purchased. The mode can be changed in the field using a PC and a utility program we have made available. This program, *UIO_Cfg.exe*, is available for download from our website. It requires the use of the ribbon cable supplied with the UIO for connection to the serial port of the PC.

Figure 1 UIO Configuration program.

After starting the program, select the correct serial port from the dropdown list of available ports then press the 'Connect' button. Within 5 seconds press the Reset button on the UIO board. If an error message is displayed, either the wrong serial port is connected, the ribbon cable is improperly connected or the PC may need to be re-booted.
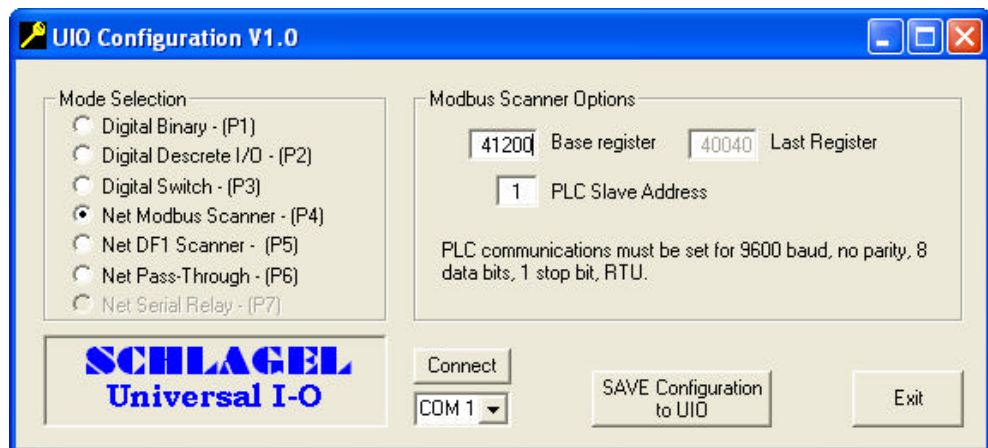

Figure 2 UIO Configuration after a successful connection.

A successful connection will select and show the current UIO mode from the list of modes. You may now select a different mode, change any options for that mode if available and click the 'SAVE Configuration to UIO' button. The UIO must then be Reset again and operation will begin in the newly selected mode.
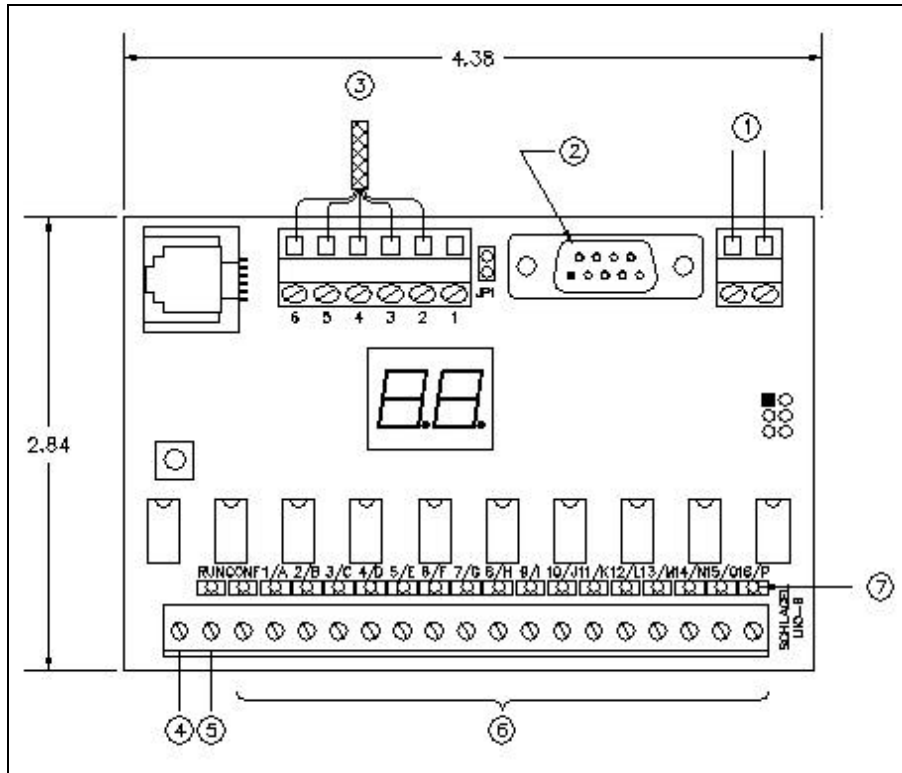
**Identification and
Specifications**

Figure 3 UIO board identification.

The above illustration identifies the following items:

ID	Name	Min	Max	Unit
1	Power Supply	8	50	Volts AC or DC, .060 Amp
2	RS-232 port to PLC or computer			
3	Communication cable to EDI control(s)			
4	Common leg of Input and Output relays			
5	RUN Input terminal	1.5	50	Volts, AC or DC, .004 Amp
6	Solid state output relays, capacity	1.5	50	Volts, AC or DC, .500 Amp
7	LEDs to indicate active Input and Outputs			

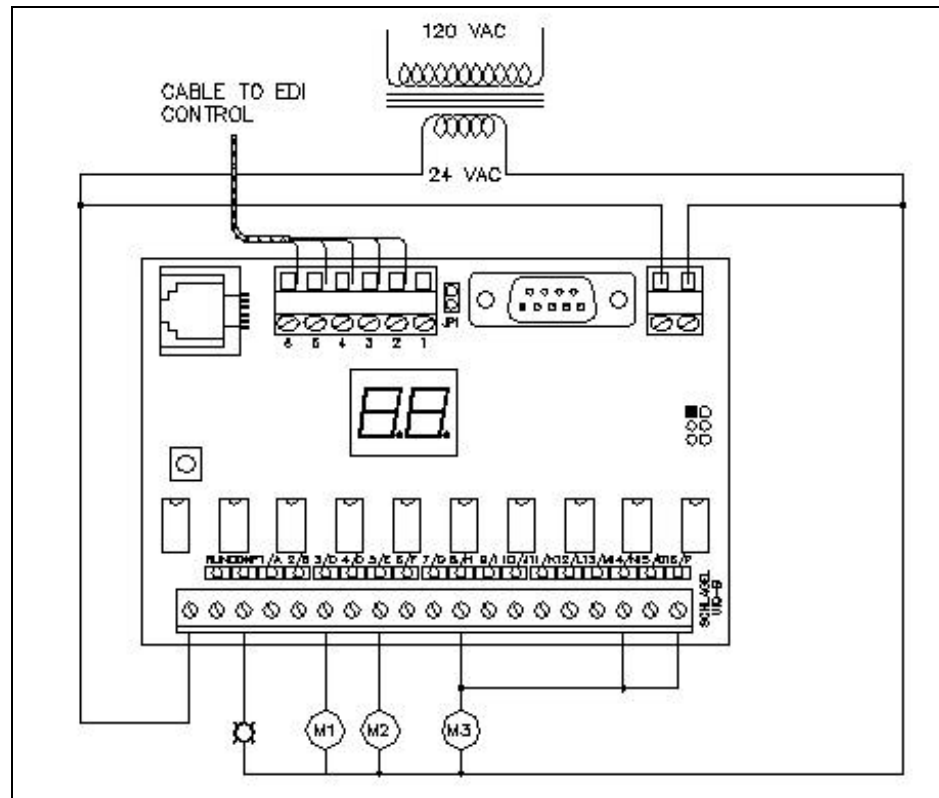**Example Digital
Layouts**

Digital Discrete Mode
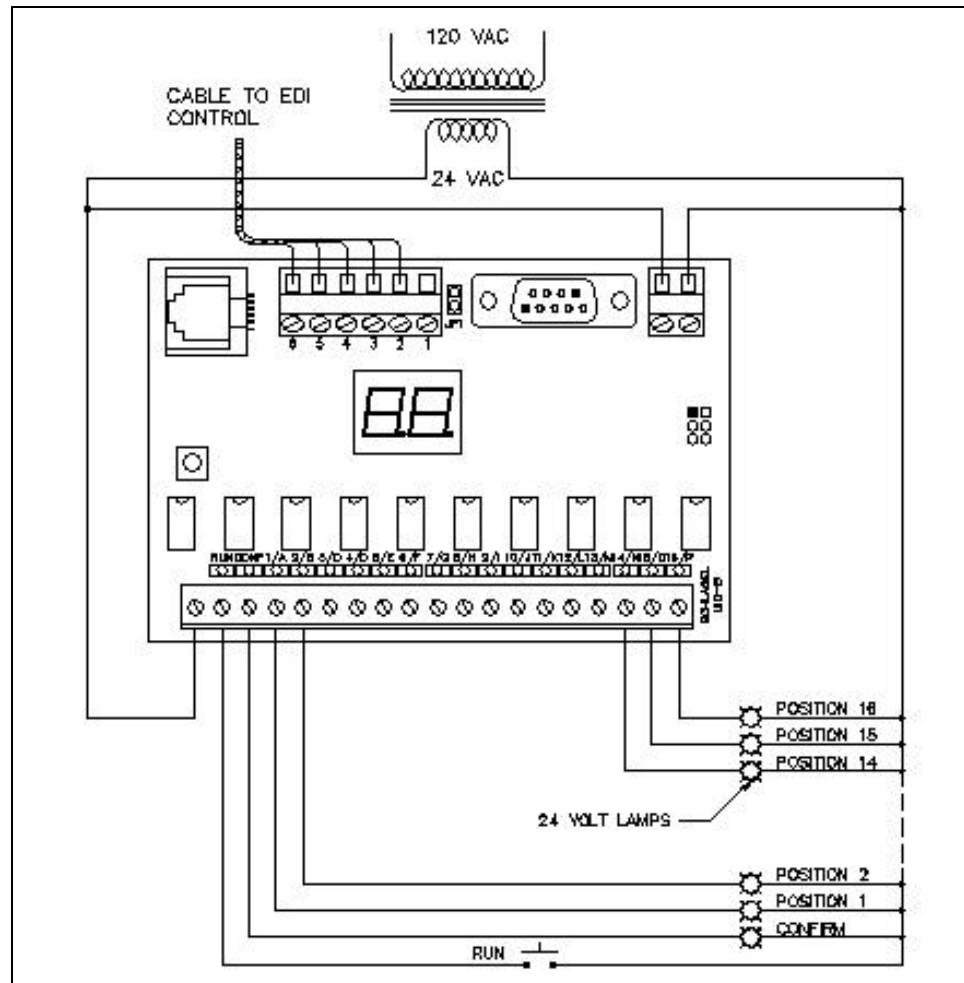
Figure 4 Example wiring for a manual remote control panel. The UIO is configured for Digital Discrete mode.

This is an example of how the Digital Discrete mode may be used for manual control of a distributor from a remote panel. The distributor may be operated from the EDI control panel or this remote panel, both locations showing the proper spout movement and position.

The user presses the RUN button starting spout motion. The RUN button is held until the desired location is indicated. After releasing the button the spout will center and stop, then turn on the confirm light.

A maximum of 16 positions can be indicated by lamps but the 2 digit display will properly show the position of any number ducts.

Digital Switch Mode

Figure 5   Example wiring for interlocking external equipment to specific spout positions. The UIO is configured for Digital Switch mode.

- M1 coil starts an air system when in Position 3
- M2 coil is an air solenoid that opens a gate when in Position 5
- M3 is a starter coil turning on a conveyor when in Position 8, 14 or 16

   Note: If wired as above, all coils must be 24 Volts AC.

This is one way to control various devices interlocked to a particular spout position.

The UIO is in Digital Switch mode. In this mode the output relays do not turn on and off sequentially as the spout moves. Instead they are always off and only the proper one turns on after the spout is stopped and in position. The confirm switch turns on at the same time. The 2-digit display does show the position of the spout as it is moving.

In this case, the RUN input is not, but could be, used. Instead, operation of the distributor is controlled at the EDI control panel. The UIO is just used as an intelligent remote switch.

Digital Binary Mode
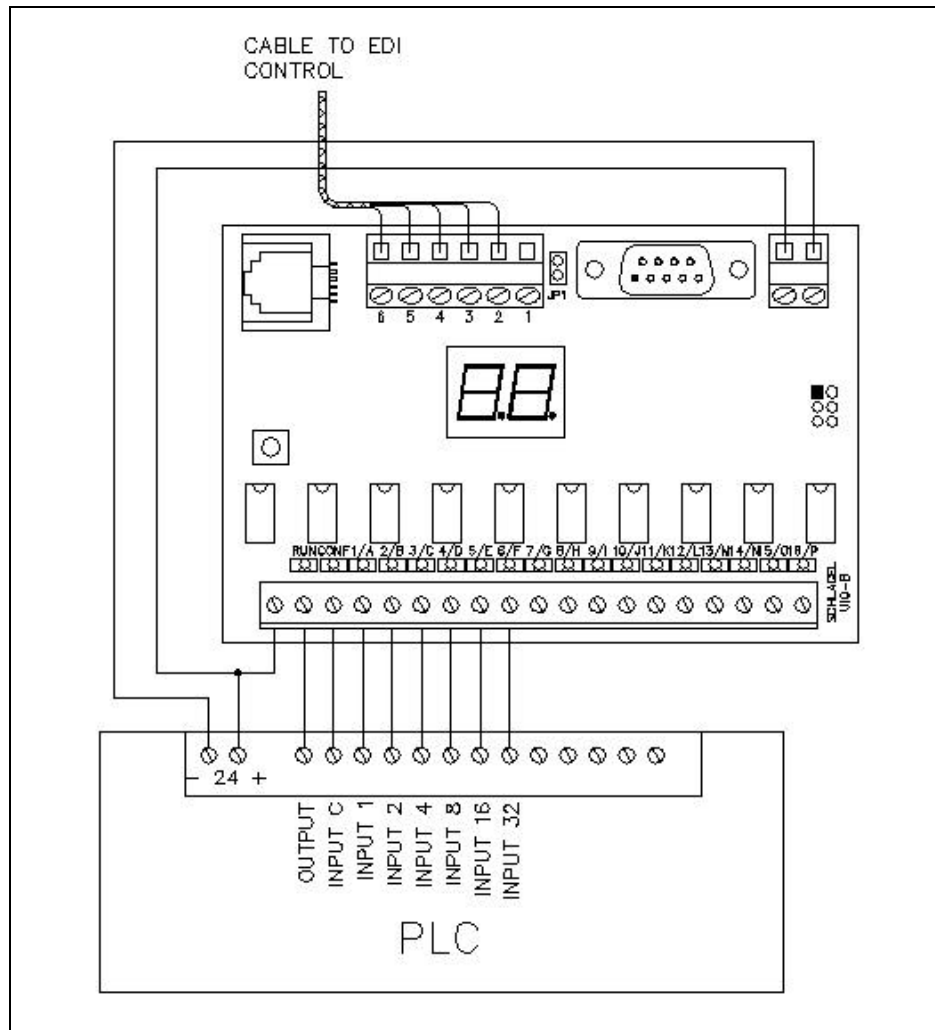
Figure 6 Example wiring for using a PLC to control an EDI distributor with relays. The UIO is configured for Digital Binary mode.

Using a few inputs and 1 output on a PLC, an EDI-V5 distributor with up to 62 ducts can be controlled. This method closely resembles the Digital IO method used on earlier EDI controls.

When the PLC Output is pulled low the spout starts moving. The present position of the spout is represented in binary format on the inputs to the PLC. For example, when PLC Inputs 1, 2 and 8 are the only inputs on, it indicates the spout is near position 11 (1+2+8). When the desired pattern is received, the PLC Output is released and the spout centers and stops on the selected duct. The confirm signal at PLC Input C then goes high indicating the distributor is ready to use.

As shown, the UIO can be powered by the 24 Volt supply of the PLC and requires < .04 Amp.

**Example Network
Layouts**
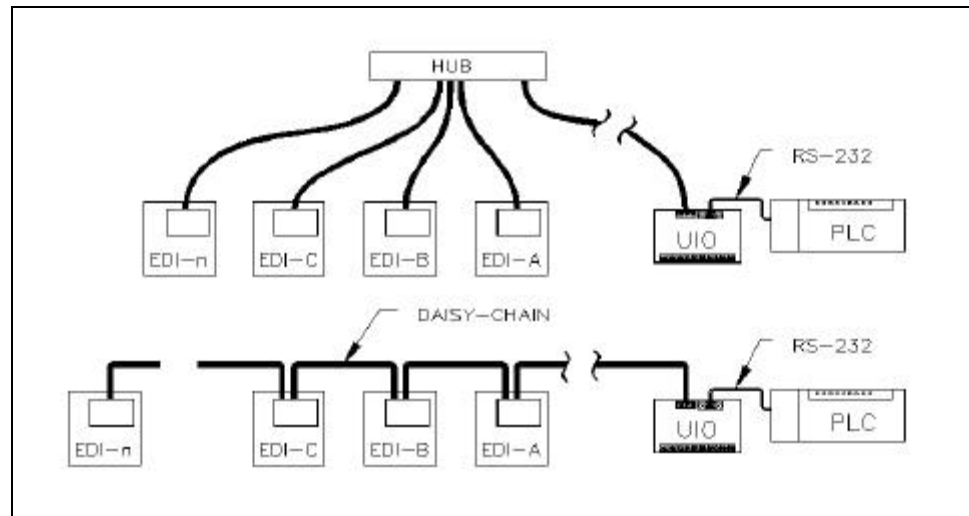
Figure 7 Typical EDI network connections. The UIO is configured for any of the Network modes.

The illustration above shows the basic layout for all network modes. The UIO is normally located along side the PLC and connected to the serial port with a short RS232 cable. The 5 wire network cable (Cat5 or similar) is connected to an EDI control. This connection can be up to 4000' away. Additional EDI controls, if used, are daisy-chained to each other connected by a hub. Using the hub is the preferred method because removing a control from the network does not interrupt the others. *Each EDI control must be configured for networking and must have a unique single character network address*.

Net Pass-Through Mode

The PLC can contain it's own serial communication program, reading and directing each of the connected EDI controls. A computer can replace the PLC and the user can write a simple program using the EDI-Net protocol to control the distributors. The UIO is set to Net Pass-Through mode in both cases.

Net Scanner Modes

Alternatively, the UIO, with its internal programs, can scan all of the EDI controls, place their positions in defined PLC registers, read the corresponding PLC request registers and direct the EDI controls to move to the requested positions. This is accomplished using Modbus RTU. Using this mode eliminates the requirement for the user to write a communication program.

Network connections and EDI-Net protocol information is beyond the scope of this manual. Other manuals are available that cover these points in detail. Please contact out technical support team for assistance in specifying and setting up an EDI network.

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