

## Description

The **I/O EXPRESS** delivers hundreds of ways to cost-effectively interface dispersed, field-mounted monitoring and control devices with computer-based equipment and readout devices. A versatile money-saver and problem-solver, the **I/O EXPRESS** is a:

### Long-Distance Field Multiplexer

Concentrate just a few—or up to 7,812—monitoring and control signals on to a MODBUS RTU digital communication link. Then safely send the data miles between the field and the control room. You'll dramatically reduce wire, conduit, installation, and overall signal transmission costs.

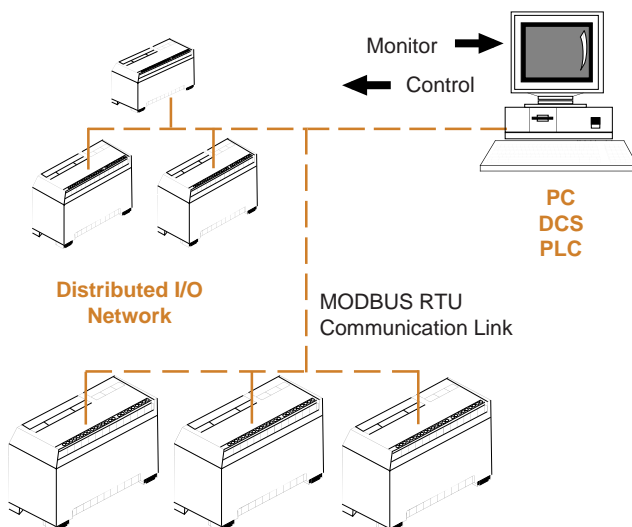
### Distributed I/O System

Convert noise-sensitive sensor and analog signals to noise-immune digital signals in the field... before they can be damaged during long-distance transmission through a noisy plant.

### Solution for Every Industry

The **I/O EXPRESS** is the economical answer for an array of distributed I/O needs: chemical and petrochemical production plants; tank farms; water/wastewater pump stations; oil/gas distribution lines; pulp and paper mills; food processing plants; facility lighting control; environmental and pollution control systems; and utilities.

**Figure 1.** The **I/O EXPRESS** is the perfect distributed I/O front end for PC, DCS and PLC-based systems.



*Flexible **I/O EXPRESS** distributed I/O provides a multitude of innovative solutions for saving time and money in industrial monitoring and control applications.*

## Features

- **Complete I/O Options.** Available modules incorporate 8 to 21 channels per I/O brick to handle current, voltage, RTD, thermocouple, digital, and relay process signals.
- **Distributed, Sensor-Level I/O Saves Money.** The **I/O EXPRESS** will handle up to 7,812 monitoring and control points, eliminating the need to run expensive point-to-point wiring to dispersed field locations.
- **Industry-Standard MODBUS RTU Communication.** Universal RS-485 communication protocol provides trouble-free interface with popular MMI and SCADA software packages, PC, PLC and DCS systems, and with other networkable instrumentation.
- **Transmit Any Distance, Over Any Terrain.** Use a twisted wire pair, fiber optic cable, radio link, or telephone modem data link to overcome rugged, long-distance, normally impassable, and hazardous environments.
- **Standard Redundant Communication Links.** Every **I/O EXPRESS** has dual communication links that help assure uninterrupted data transfer.

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### Distributed I/O Networks

The **I/O EXPRESS** substantially reduces costs by multiplexing multiple process signals onto one MODBUS RTU (RS-485) digital communication link. This eliminates the need to install expensive point-to-point wiring for each monitoring and control point.

Versatile module types and system architectures provide an economical solution for both small and large data acquisition and control strategies.

### Module Types

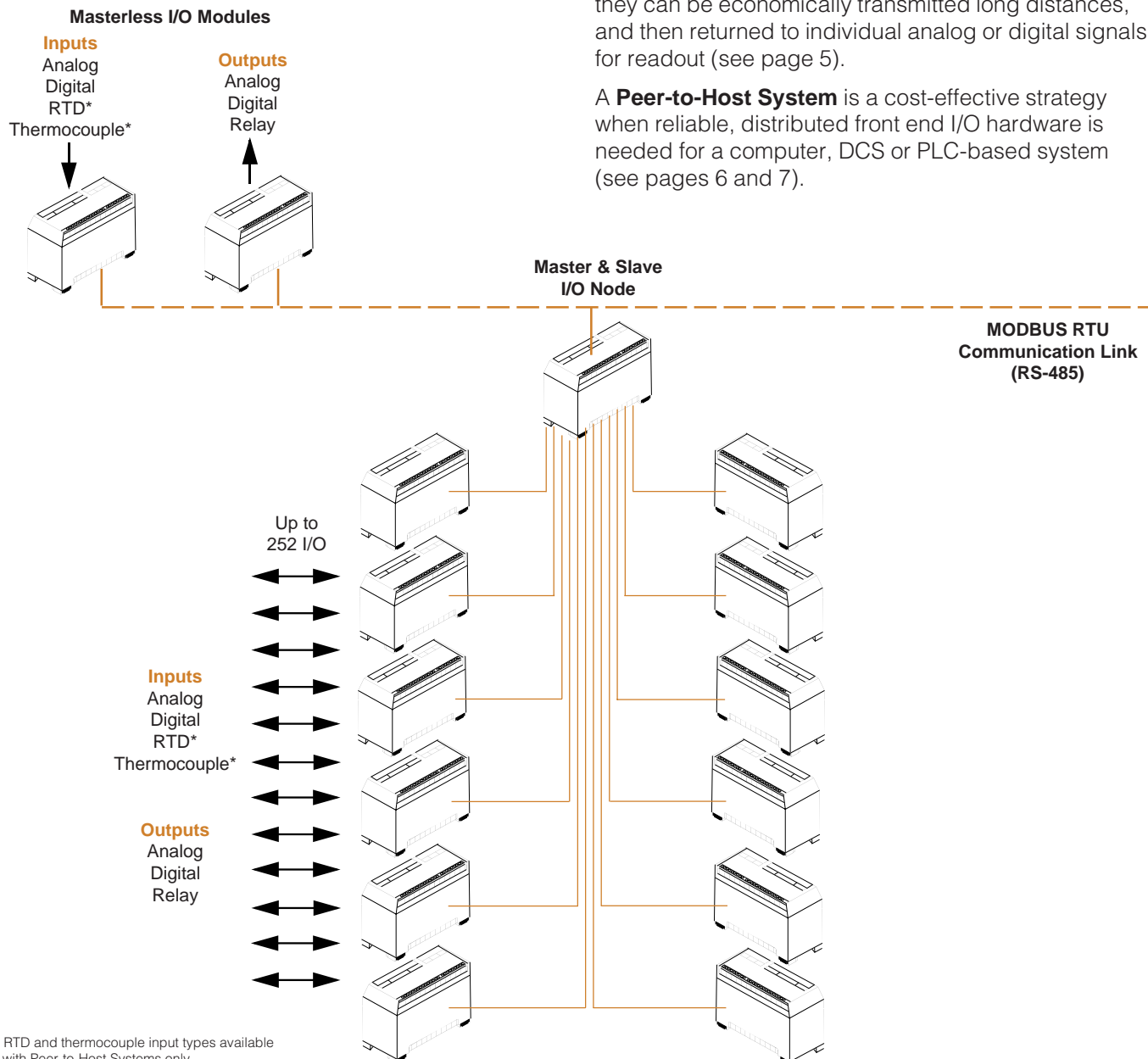
**Masterless I/O Modules** operate as complete, stand-alone I/O stations. Use these when a small-to-medium number of points are in each location (see page 4).

**Master & Slave I/O Nodes** are economical when large concentrations of points are in each process location (see page 4).

### System Architectures

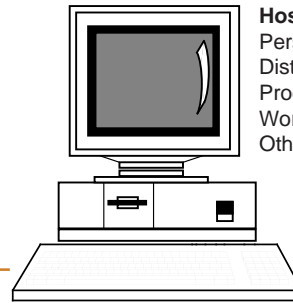
A **Peer-to-Peer System** is used when multiple analog and digital signals need to be collected, multiplexed so they can be economically transmitted long distances, and then returned to individual analog or digital signals for readout (see page 5).

A **Peer-to-Host System** is a cost-effective strategy when reliable, distributed front end I/O hardware is needed for a computer, DCS or PLC-based system (see pages 6 and 7).

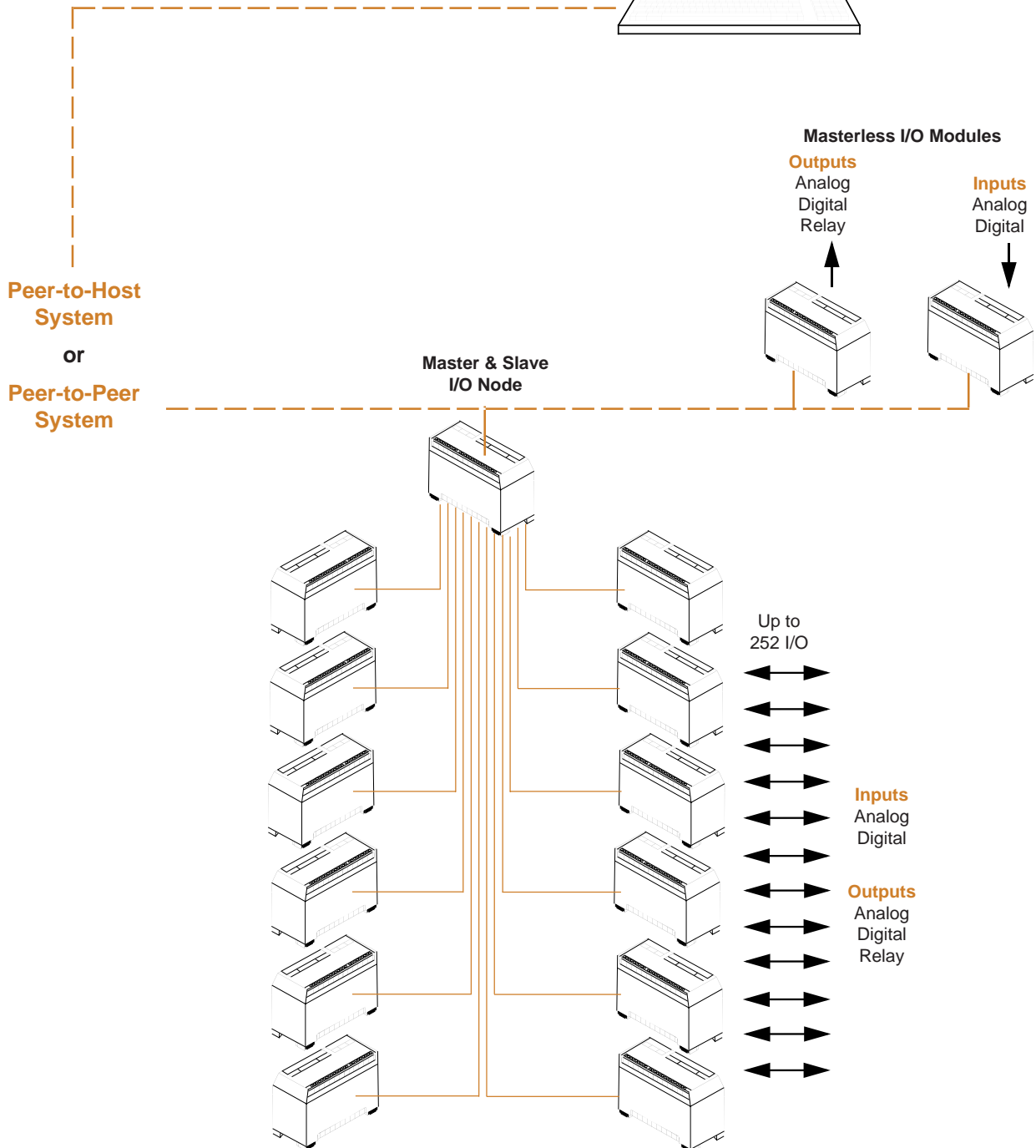


## MODBUS RTU Communication

For the system's RS-485 communication link, the **I/O EXPRESS** uses standard MODBUS RTU. This "open" protocol facilitates interface with numerous computer, DCS and PLC-based systems, third party software packages, and other networkable instruments.



**Host Computer-Based System**  
Personal Computer (PC)  
Distributed Control System (DCS)  
Programmable Logic Controller (PLC)  
Work Station  
Other Host Computer Systems



### Module Types

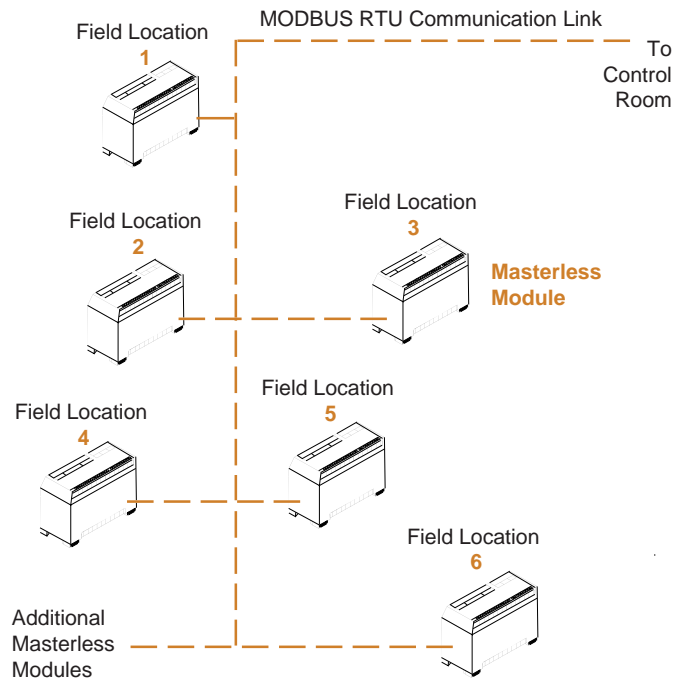
Flexible module options offer solutions for collecting just a few—or thousands—of signals from field devices and/or delivering data to final control elements.

#### Masterless I/O Modules

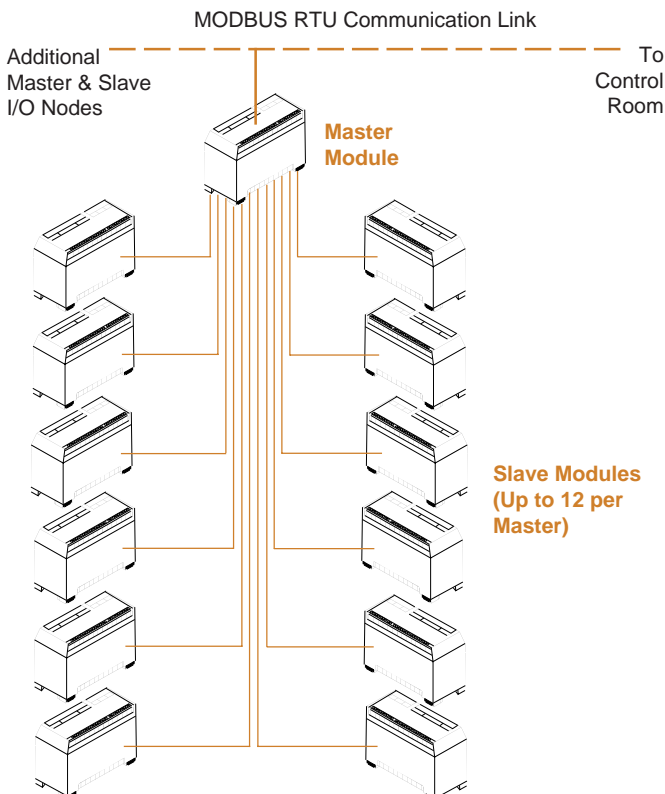
Masterless Modules are the cost-effective strategy when a small number of process points are located in dispersed field locations (Figure 3). These stand-alone I/O stations take input directly from, and/or output control signals directly to, field devices.

Available models handle current, voltage, RTD\*, thermocouple\*, digital, and relay signals, and 8 to 21 channels per module (see the Ordering Specifications table on page 11 for details). Any mix of I/O types may be integrated into an **I/O EXPRESS** system.

**Figure 3.** Masterless Modules are ideal when a small number of I/O points are required in dispersed field locations.



**Figure 4.** Master and Slave I/O Nodes provide money- and time-saving field multiplexing when large quantities of I/O are in each field location.



#### Master & Slave I/O Nodes

Use Master & Slave I/O Nodes when large numbers of points are in each process location (Figure 4).

**Master Module**—The same size as other system modules, the Master Module collects data from up to 12 Slave Modules. It multiplexes the Slave’s multiple signals, and sends the digitized data long distances between the field and control room over a MODBUS RTU communication link.

**Slave Modules**—These collect monitoring signals from primary sensors, analog transmitters, and digital devices. Or, they deliver control signals to on/off devices (relays, motors, pumps, etc.) and proportional final control elements like valves and positioners. Up to 12 Slaves connect to the Master Module in a “Star” configuration. Slaves can be dispersed up to 50 feet (15 meters) from the Master Module. Available modules handle 8 to 21 channels of current, voltage, RTD\*, thermocouple\*, digital, or relay signals (see Ordering Specifications for details). Any mix of I/O types may be integrated into a system.

#### Mixed Systems

When some locations have extensive I/O requirements and others just a few, any combination of Masterless and Master & Slave I/O Nodes integrate into a system.

\* RTD and Thermocouple inputs are available with Peer-to-Host Systems only.

## Peer-to-Peer Systems

In this architecture, for every module situated in the field there is a matching module on the opposite end of the MODBUS RTU communication link.

**Monitor and Control**—For data acquisition, the system collects signals from analog transmitters and digital devices. It multiplexes the signals, and sends the data to a matching module on the opposite side of the link. The matching module outputs the data in analog or digital form for readout.

For control, multiple signals can be digitized by the **I/O EXPRESS** in the control room, and sent over the data link to a matching module in the field. The field

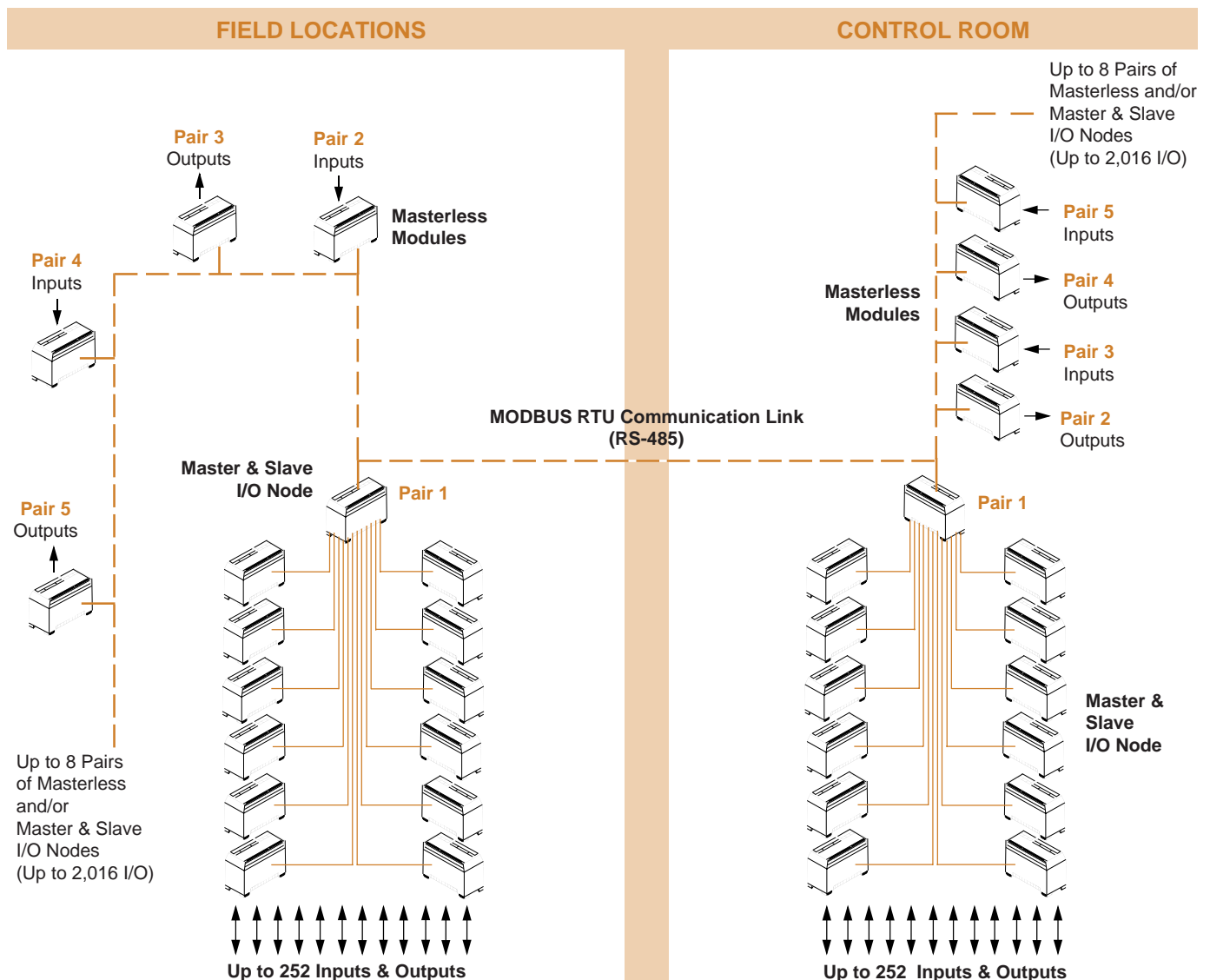
module converts the signals back to analog or discrete form for proportional or on/off control.

There can be up to 8 pairs of Masterless Modules per system. A full system handles up to 168 process points (21-Channel Modules x 8 Pairs per System = 168).

A Master & Slave I/O Node accommodates up to 252 points (21-Channel Slaves x 12 Slaves per Node = 252 Points). This configuration expands to include up to 8 pairs of I/O Nodes, and up to 2,016 points (21-Channel Slaves x 12 Slaves per Node x 8 Nodes per System = 2,016).

A Peer-to-Peer System can include any combination of up to 8 pairs of Masterless Modules, and/or Master & Slave I/O Nodes.

**Figure 5.** A Peer-to-Peer System can be any mix of I/O types, and combinations of Masterless Modules and Master & Slave I/O Nodes.



### Peer-to-Host Systems

The **I/O EXPRESS** is the perfect I/O front end for computer-based distributed data acquisition and control strategies.

**Any Module Combination**—Peer-to-Host Systems may incorporate any combination of Masterless Modules and/or Master & Slave I/O Nodes.

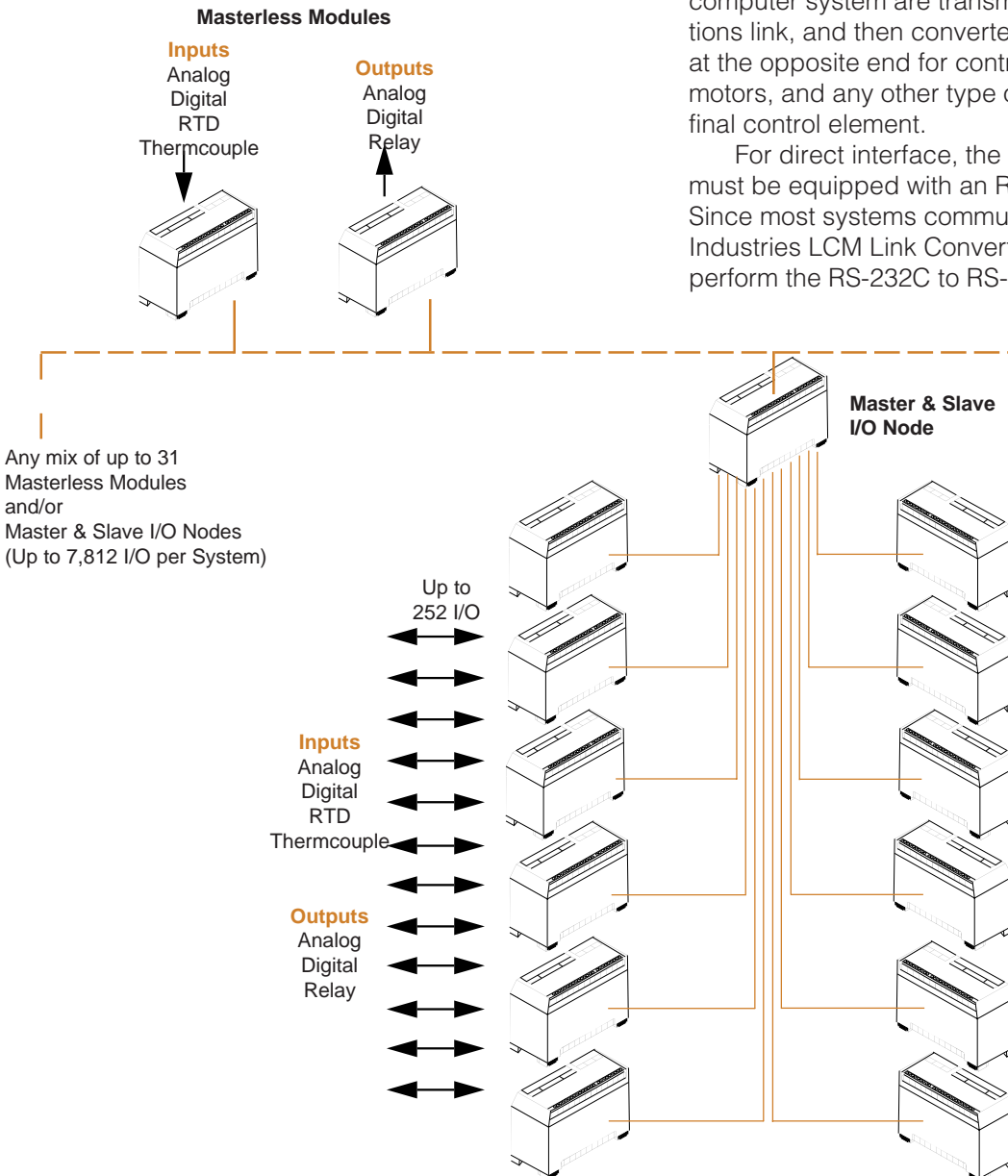
**Figure 6.** Peer-to-Host Systems deliver low-cost and versatile distributed I/O.

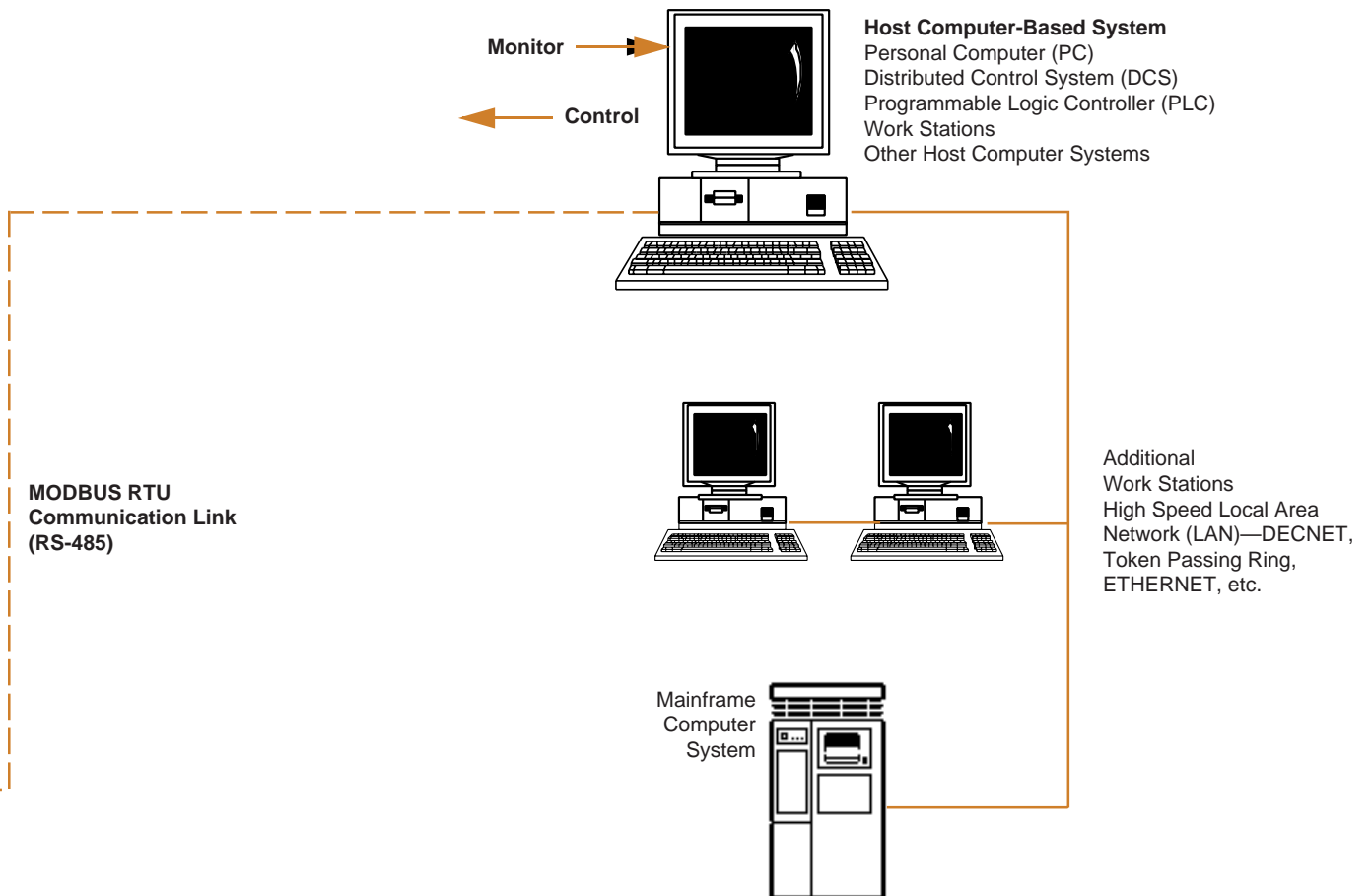
Connected in a multidrop network along the communication link, there can be up to 31 Master and/or Masterless Modules per **I/O EXPRESS** system. Up to 7,812 I/O points can be accommodated (21-Channel Slaves x 12 Slaves per Master x 31 Masters = 7,812).

**Monitor and Control**—For monitoring applications, the **I/O EXPRESS** modules collect signals from analog transmitters, sensors (RTD and thermocouple), or digital devices. Signals are multiplexed in the field, and sent over the RS-485 communications link directly to a computer-based host.

For control, process commands from the host computer system are transmitted over the communications link, and then converted to analog or digital form at the opposite end for controlling valves, pumps, motors, and any other type of proportional or on/off final control element.

For direct interface, the host computer system must be equipped with an RS-485 computer card. Since most systems communicate via RS-232C, Moore Industries LCM Link Converter Module can be used to perform the RS-232C to RS-485 conversion.





## Compatible with MMI Software

Once the computer-ready data is delivered to the host computer or DCS, leading third-party Man Machine Interface (MMI) software packages can be used to create custom data acquisition and control strategies:

- Intellution® FIX DMACS™
- USDATA® FactoryLink®
- Wonderware® InTouch™
- INTEC Paragon
- Ci Technologies Citect for Windows™

These, and other, available packages allow a multitude of strategies that incorporate data acquisition, alarm summary and management, data logging and reporting, historical data collection and trending, and supervisory control functions.



### Redundant COMM Links

Every **I/O EXPRESS** module incorporates dual communication ports. For critical applications, dual communication links act as a safety net should one of the links be compromised (see Figure 7).

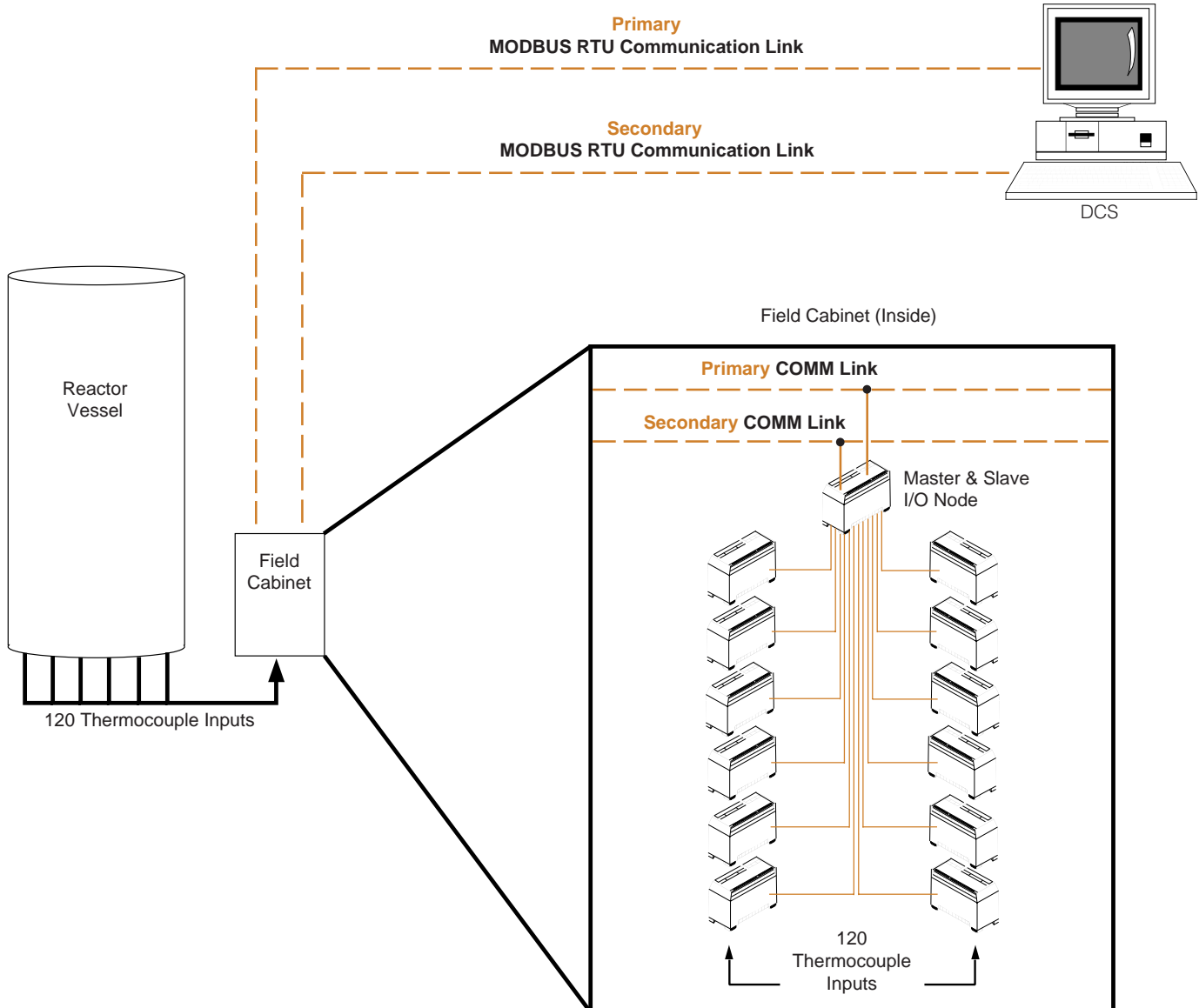
Both communication links continually operate, so there is no interruption of data transfer if the primary link is broken, and the secondary link must take over. For added safety, the links can even be run along two completely different paths without compromising system performance.

**Dual Links Add Flexibility**—The dual link capability can be used to provide unique data gathering solutions. For example, in Figure 8 the dual links are used to send identical data from multiple analog level transmitters to two separate readout locations.

At Location #1, digital data sent over the Primary Communication Link is input to a computer where MMI software is configured to display, chart, and archive trending information.

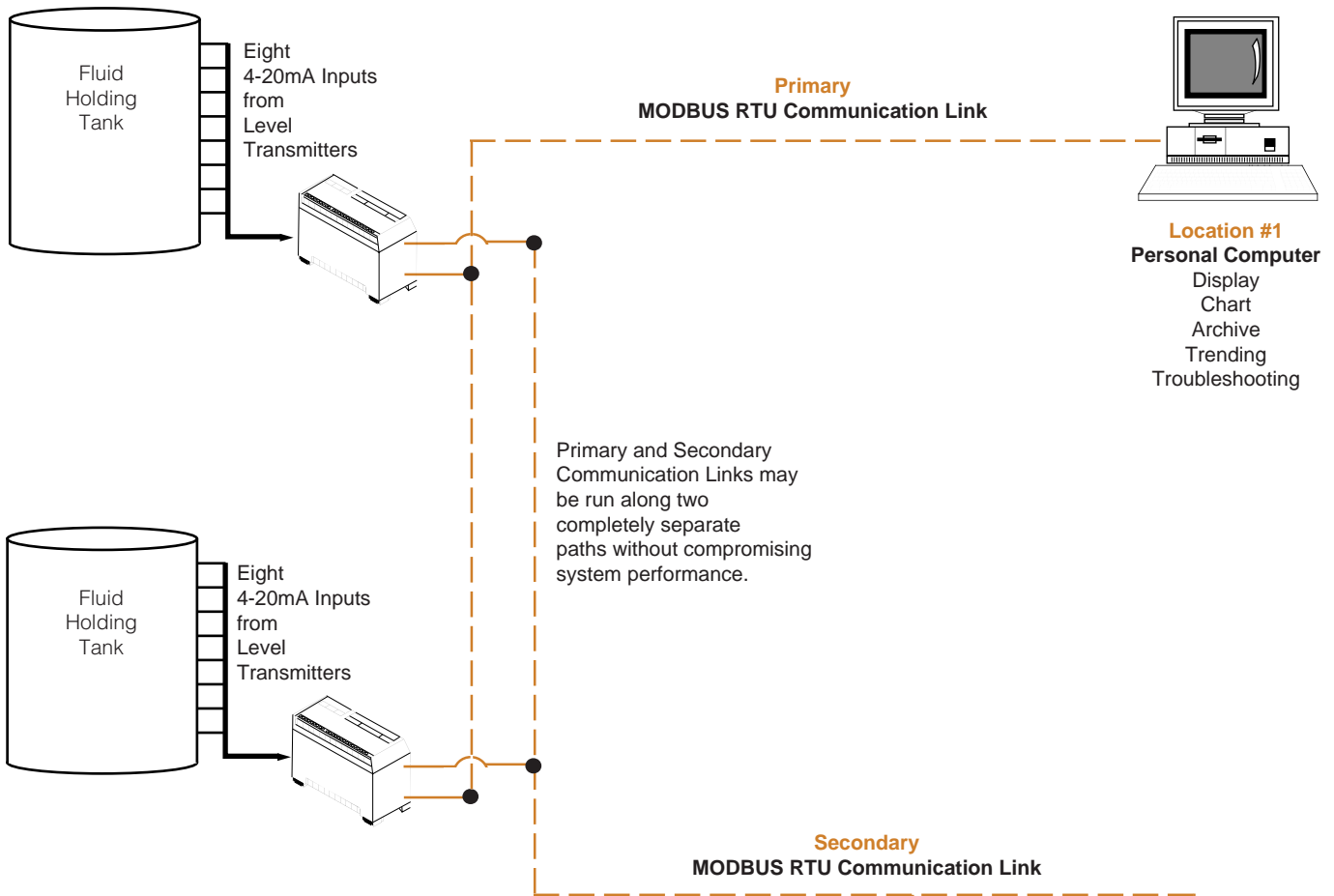
At Location #2, the multiplexed signals are sent over the Secondary Communication Link, and converted back to their original analog form for readout on digital panel meters.

**Figure 7.** Redundant communications links assure continuous data flow should one of the links be compromised.





**Figure 8.** The I/O EXPRESS's dual communication links can be used to simultaneously send identical process data to two separate locations.



## Versatile COMM Link Options

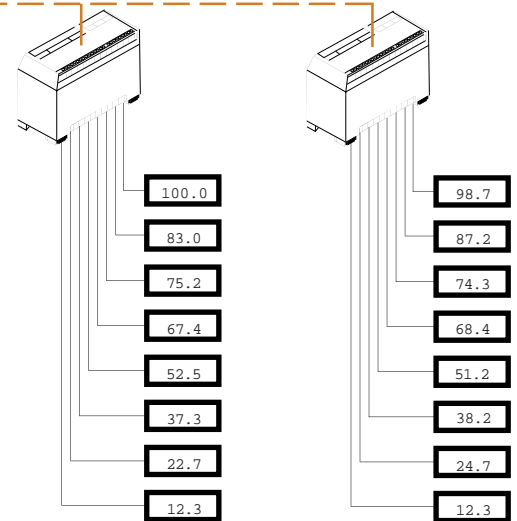
Versatile communication link options overcome long-distance, normally impassable, and hazardous environments:

**Twisted Wire Pair**—The solution for the majority of applications, a standard 24AWG shielded twisted pair is a low-cost solution to send data long distances.

**Telephone Modem**—Inexpensively transmit process data unlimited distances over leased or dial-up telephone lines. We offer modems and RS-485 to RS-232C (for modem) converters.

**Radio**—Where wires can't be run, such as over water, radio (RF) communication provides accurate and reliable signal transmission.

**Fiber Optic Cable**—For hazardous or exceptionally noisy environments, light is an effective strategy. We offer all of the accessories needed for interface.



**Location #2**  
16 Panel Meters  
Readout

### Specifications

<p><b>Performance (Master Module)</b></p> <p><b>Scan Rate:</b> 12 Slave channels updated every 50 to 150 msec, depending upon the I/O configuration of the connected Slave module</p> <p><b>Isolation:</b> 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and Slave modules</p>	<p><b>(Thermo-couple Input Modules)</b></p> <p><b>Accuracy:</b> ±3°C</p> <p><b>Resolution:</b> 0.5°C</p> <p><b>Update Rate:</b> Each channel scanned 200 times per second</p> <p><b>Isolation:</b> 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and input channels</p> <p><b>Impedance:</b> &gt;10MΩ</p> <p><b>Sensor Burnout:</b> Upscale Drive</p>	<p><b>(Relay Output Modules)</b></p> <p><b>Scan Rate:</b> Each channel updated 100 times per second</p> <p><b>Isolation:</b> 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and input channels; and 250Vdc between output channels</p> <p><b>Contact Ratings:</b> 8-channel (RO8) modules are SPDT, rated for 3A at both 24Vdc and 110Vac; 12-channel (RO12) modules are normally open (NO), SPST, rated for 1A at 24Vdc, and 0.5A at 110Vac</p>
<p><b>(Analog Input Modules)</b></p> <p><b>Accuracy:</b> ±0.15% of span (12-bit resolution)</p> <p><b>Scan Rate:</b> Each channel updated 200 times per sec.</p> <p><b>Isolation:</b> 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and input channels; 7Vdc, (common mode) channel-to-channel</p> <p><b>Impedance:</b> Current, 250Ω; Voltage, 1MΩ minimum</p> <p><b>Common Mode Rejection:</b> &lt;115dB @ 60Hz</p>	<p><b>(Digital Input Modules)</b></p> <p><b>Scan Rate:</b> Each channel is updated 100 times per second</p> <p><b>Isolation:</b> 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and input channels</p> <p><b>Impedance:</b> 3300Ω</p> <p><b>Maximum Input Voltage:</b> 30Vdc</p> <p><b>Threshold:</b> Guaranteed high state above 7V, guaranteed low state under 0.5V</p>	<p><b>COMM Link Range:</b> 1 mile (1.6 km) typical on 24AWG wire at 19200 baud; 2 miles at 4800 baud (transmission range is dependent on wire size, capacitance of wire and environment); 15 m (50 feet) between Master Modules and Slave Modules</p> <p><b>Baud Rate:</b> 2400, 4800, 9600, and 19200 rates are configurable</p> <p><b>Throughput Rate:</b> Dependent upon number of modules in system, baud rate, type of COMM link used; and total COMM link distance (consult the factory for specifics for your application)</p>
<p><b>(Analog Output Modules)</b></p> <p><b>Accuracy:</b> ±0.15% of span (12-bit resolution)</p> <p><b>Scan Rate:</b> Each channel updates 100 times per sec.</p> <p><b>Isolation:</b> 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and output channels</p> <p><b>Drive Capability:</b> 700Ω</p> <p><b>Ripple:</b> 1µA peak-to-peak</p>	<p><b>(Digital Output Modules)</b></p> <p><b>Scan Rate:</b> Each channel updated 100 times per second</p> <p><b>Isolation:</b> 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and output channels</p> <p><b>Output Transistor Rating:</b> Maximum ON current, 200mA; Maximum OFF voltage, 40Vdc</p>	<p><b>Power Supply</b> 11-30Vdc (2 to 4 watts for most modules-any analog current or relay output has a 6 watt max.)</p> <p><b>Ambient Conditions</b></p> <p><b>Operating Range:</b> -5°C to +65°C (+23°F to +185°F)</p> <p><b>Storage Range:</b> -25°C to +85°C (-13°F to +185°F)</p> <p><b>Relative Humidity:</b> 10 to 90%, non-condensing</p> <p><b>Ambient Temperature Effect:</b> from ±0.015% of span/°C to ±0.02% of span/°C (depends on module type; consult the factory for details)</p>
<p><b>(RTD Modules)</b></p> <p><b>Accuracy:</b> ±0.25% of reading, ±0.25°C</p> <p><b>Resolution:</b> ±0.1°C</p> <p><b>Scan Rate:</b> Each channel scanned every 1.3 seconds</p> <p><b>Isolation:</b> 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and input channels</p>	<p><b>Adjustments</b> External jumpers used to set baud rate and module address</p> <p><b>Weight</b> 580 g (1.7 lbs)</p>	

## Ordering Specifications

Unit	Module Type	Input/Output Configuration	Power	Housing						
DDS	<b>MASTER MODULES FOR PEER-TO-PEER AND PEER-TO-HOST SYSTEMS:</b>  <b>MH</b> Master Module for Peer-to-Host Systems (31 per system maximum)  <b>MP</b> Master Module for Peer-to-Peer Systems (8 pair—16 modules—per system maximum)	<b>FOR MASTER MODULE IN PEER-TO-HOST AND PEER-TO-PEER SYSTEMS (MH and MP):</b>  <b>S12</b> 12 input or output channels to accept signals from, or send signals to, up to 12 Slave (S) Modules	11-30DC	<b>DIN</b> A.B.S. Nylon housing with removable terminal blocks mounts on standard Top Hat rail (DIN 46277-3)						
		<b>FOR SLAVE AND MASTERLESS MODULES IN PEER-TO-HOST SYSTEMS (S and MLH):</b>  <b>RTI8</b> 8 RTD Input Channels (3-wire; 100 ohm platinum; -100°C to 700°C)  <b>TJ110</b> 10 Thermocouple Input Channels (J-type; -100°C to 760°C)  <b>TKI10</b> 10 Thermocouple Input Channels (K-type; -100°C to 1372°C)  <b>AI12XX</b> 12 Analog Input Channels (replace XX in model number with 20MA for 4-20mA; 2V for 0-2V; 5V for 0-5V; 10V for 0-10V)  <b>AO820MA</b> 8 Analog Output Channels (4-20mA)  <b>DI21</b> 21 Discrete Input Channels (externally-powered, 11-30Vdc)  <b>DO21</b> 21 Discrete Output Channels (open collector 200mA, 40Vdc)  <b>RO8</b> 8 Relay Output Channels (see Specifications for contact ratings)  <b>RO12</b> 12 Relay Output Channels (see Specifications for contact ratings)								
	<b>SLAVE AND MASTERLESS MODULES FOR PEER-TO-PEER SYSTEMS:</b>  <b>S</b> Slave Module for Peer-to-Host Systems (12 per MH Master Module; 372 per system maximum for Peer-to-Host Systems)  <b>MLH</b> Masterless Module for Peer-to-Host Systems (31 per system maximum)	<b>FOR SLAVE AND MASTERLESS MODULES IN PEER-TO-PEER SYSTEMS (S and MLP):</b>  <b>AI12XX</b> 12 Analog Input Channels (replace XX in model number with 20MA for 4-20mA; 2V for 0-2V; 5V for 0-5V; 10V for 0-10V)  <b>AO820MA</b> 8 Analog Output Channels (4-20mA)  <b>DI21</b> 21 Discrete Input Channels (externally-powered, 11-30Vdc)  <b>DO21</b> 21 Discrete Output Channels (open collector 200mA, 40Vdc)  <b>RO8</b> 8 Relay Output Channels (see Specifications for contact ratings)  <b>RO12</b> 12 Relay Output Channels (see Specifications for contact ratings)								
		<b>SLAVE AND MASTERLESS MODULES FOR PEER-TO-PEER SYSTEMS:</b>  <b>S</b> Slave Module for Peer-to-Peer Systems (12 per MP Master Module; 192 per system maximum for Peer-to-Peer Systems)  <b>MLP</b> Masterless Module for Peer-to-Peer Systems (8 pair—16 modules—per system maximum)				<b>FOR SLAVE AND MASTERLESS MODULES IN PEER-TO-PEER SYSTEMS (S and MLP):</b>  <b>AI12XX</b> 12 Analog Input Channels (replace XX in model number with 20MA for 4-20mA; 2V for 0-2V; 5V for 0-5V; 10V for 0-10V)  <b>AO820MA</b> 8 Analog Output Channels (4-20mA)  <b>DI21</b> 21 Discrete Input Channels (externally-powered, 11-30Vdc)  <b>DO21</b> 21 Discrete Output Channels (open collector 200mA, 40Vdc)  <b>RO8</b> 8 Relay Output Channels (see Specifications for contact ratings)  <b>RO12</b> 12 Relay Output Channels (see Specifications for contact ratings)				
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**To order, specify:** Unit / Module Type / Input or Output Configuration / Power / [Housing]

**Modul number examples:** DDS / MH / S12 / 11-30DC / [DIN]    |    DDS / S / AI1220MA / 11-30DC / [DIN]    |    DDS / MLH / TJ110 / 11-30DC / [DIN]

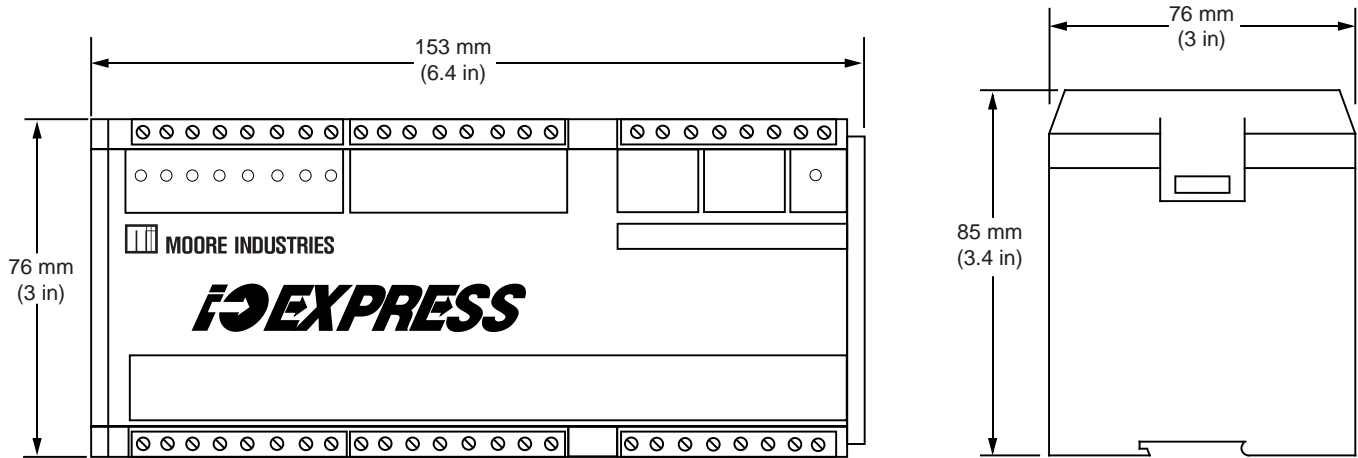
**Master Module**
**Slave Module**
**Masterless Module**

**IMPORTANT NOTE:** Upon communication link failure, all outputs hold last value. Consult the factory for other default conditions.

# I/O EXPRESS

## Distributed Data System

Figure 9. Installation Dimensions.



## System Accessories

For use with the **I/O EXPRESS**, we offer:

- Short Haul and Dial-Up Modems
- RS-485 Repeaters
- RS-485 to RS-232C Converters
- RS-485 to Fiber Optic Converters
- Data Link Protectors
- Power Supplies

Consult your Moore Industries Sales Representative for details.



The Interface Solution Experts • [www.miinet.com](http://www.miinet.com)

United States • [info@miinet.com](mailto:info@miinet.com)  
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