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.
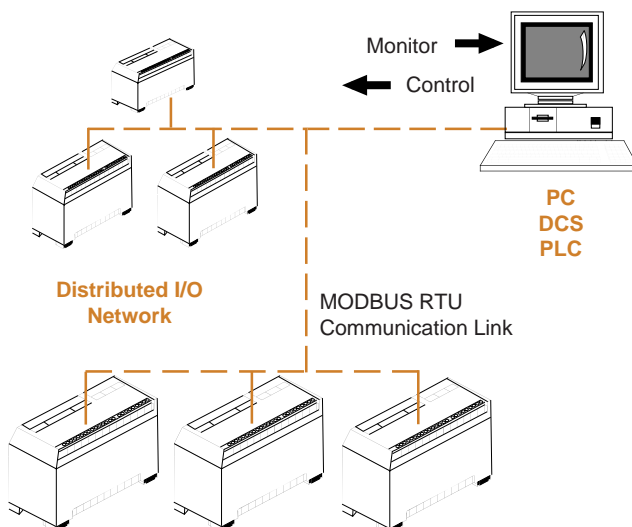
Distributed I/O System

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 petro-chemical production plants; tank farms; water/waste-water pump stations; oil/gas distribution lines; pulp and paper mills; food processing plants; facility lighting control; environmental and pollution control systems; and utilities.

*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.

All product names are registered trademarks of their respective companies.

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

Monitor
Control

PC
DCS
PLC

Distributed I/O Network

MODBUS RTU Communication Link

IO EXPRESS

Distributed Data System

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.
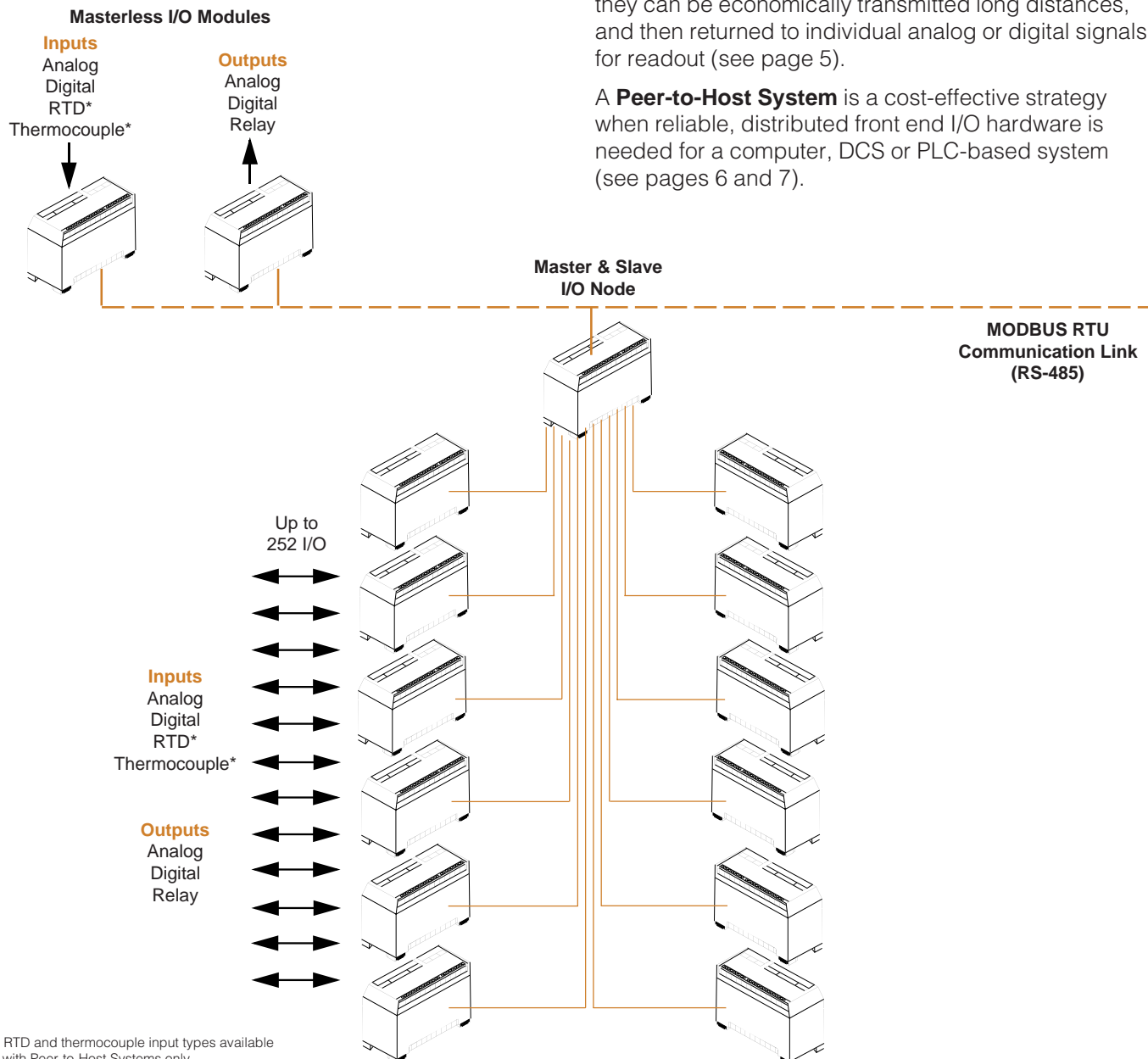
Module Types

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).

Masterless I/O Modules

Inputs
Analog
Digital
RTD*
Thermocouple*

Outputs
Analog
Digital
Relay

Master & Slave I/O Node

MODBUS RTU Communication Link (RS-485)

Up to 252 I/O

Inputs
Analog
Digital
RTD*
Thermocouple*

Outputs
Analog
Digital
Relay

* RTD and thermocouple input types available with Peer-to-Host Systems only.

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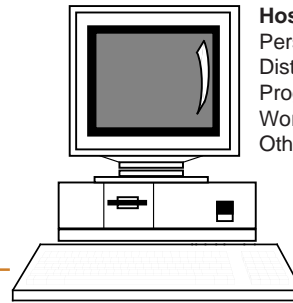
Host Computer-Based System
Personal Computer (PC)
Distributed Control System (DCS)
Programmable Logic Controller (PLC)
Work Station
Other Host Computer Systems

Masterless I/O Modules
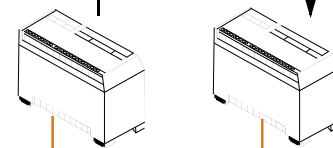
Outputs
Analog
Digital
Relay

Inputs
Analog
Digital

Peer-to-Host System

or

Peer-to-Peer System

Master & Slave I/O Node

Up to
252 I/O

Inputs
Analog
Digital

Outputs
Analog
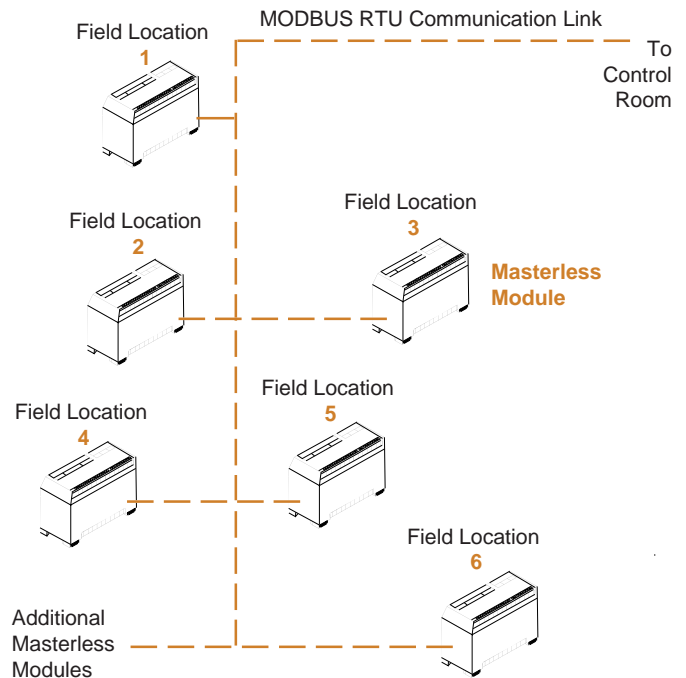Digital
Relay
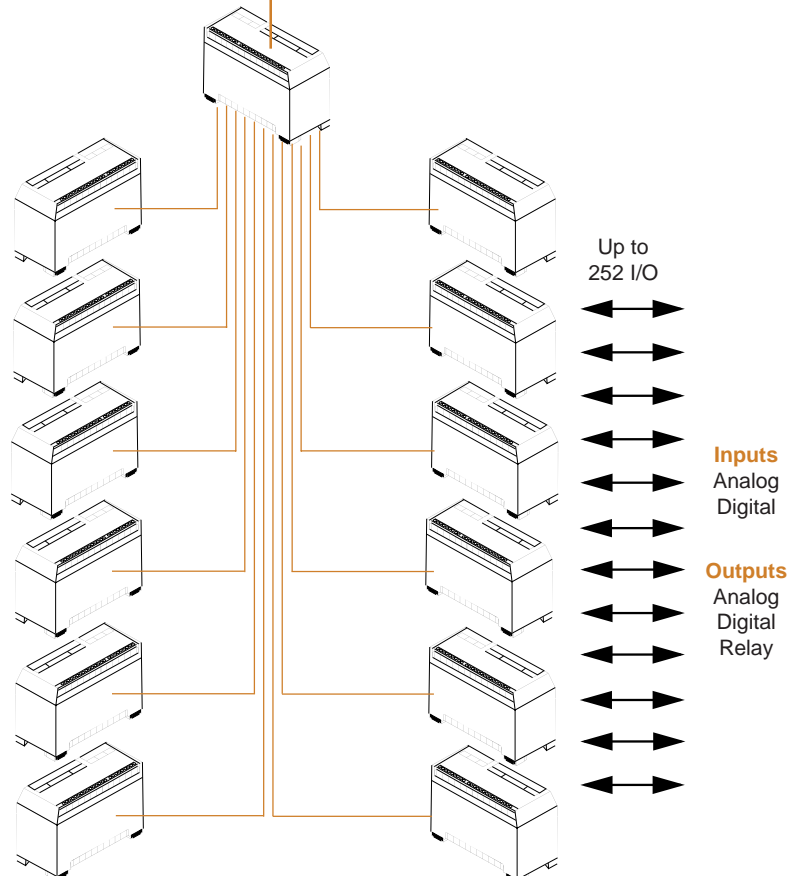
Module Types

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.
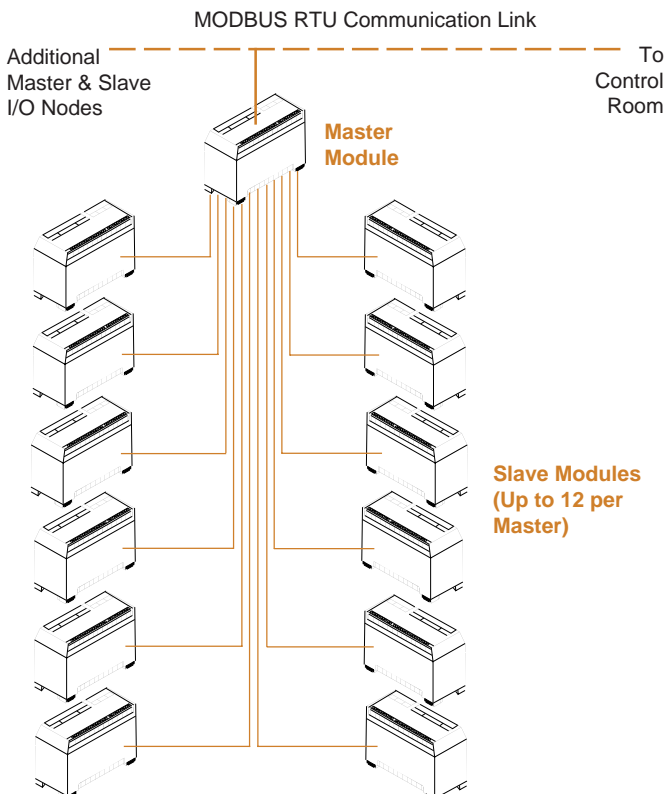
Masterless I/O Modules

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.*

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.

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.*

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.*

I/O EXPRESS

Distributed Data System
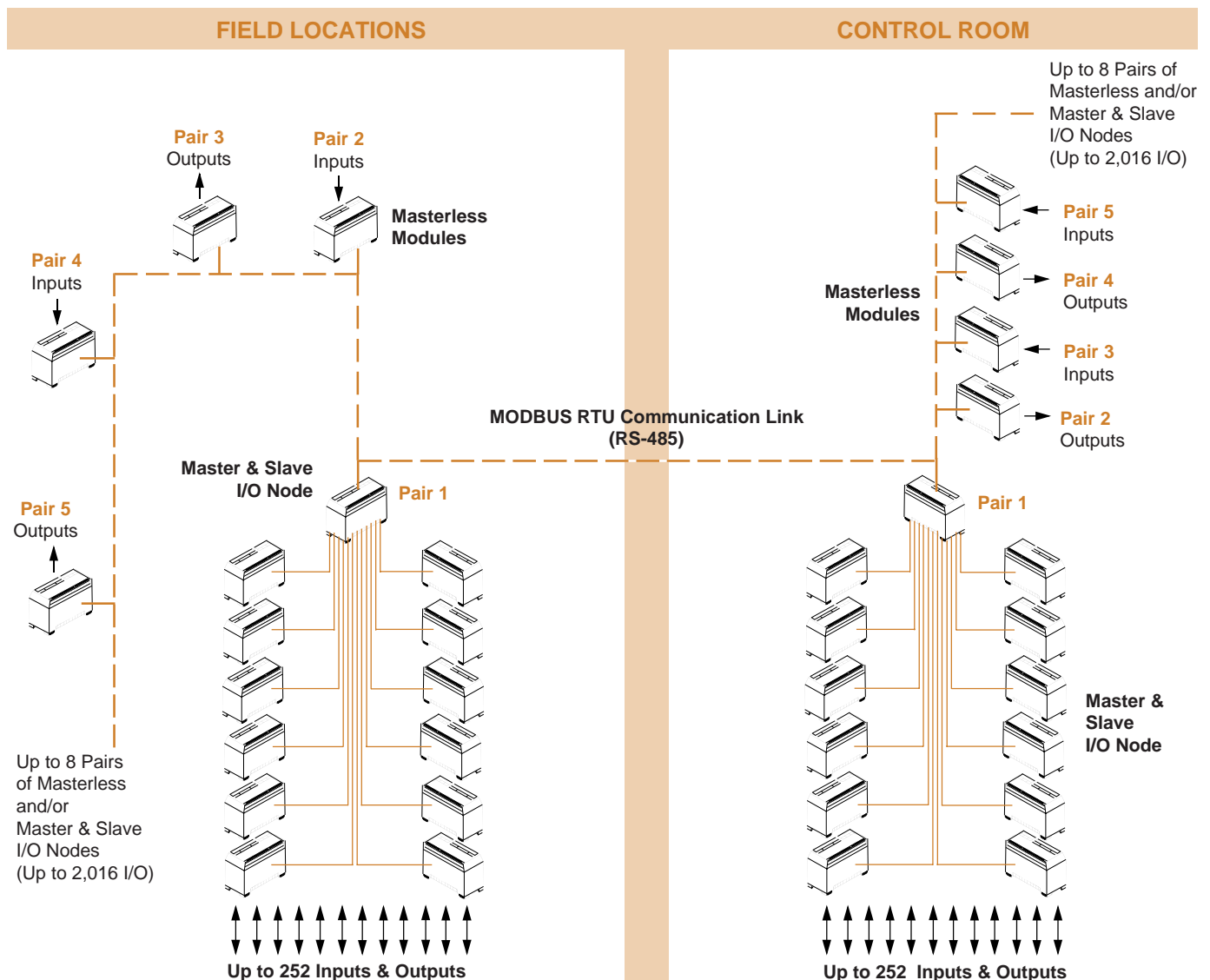
Peer-to-Host Systems

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.
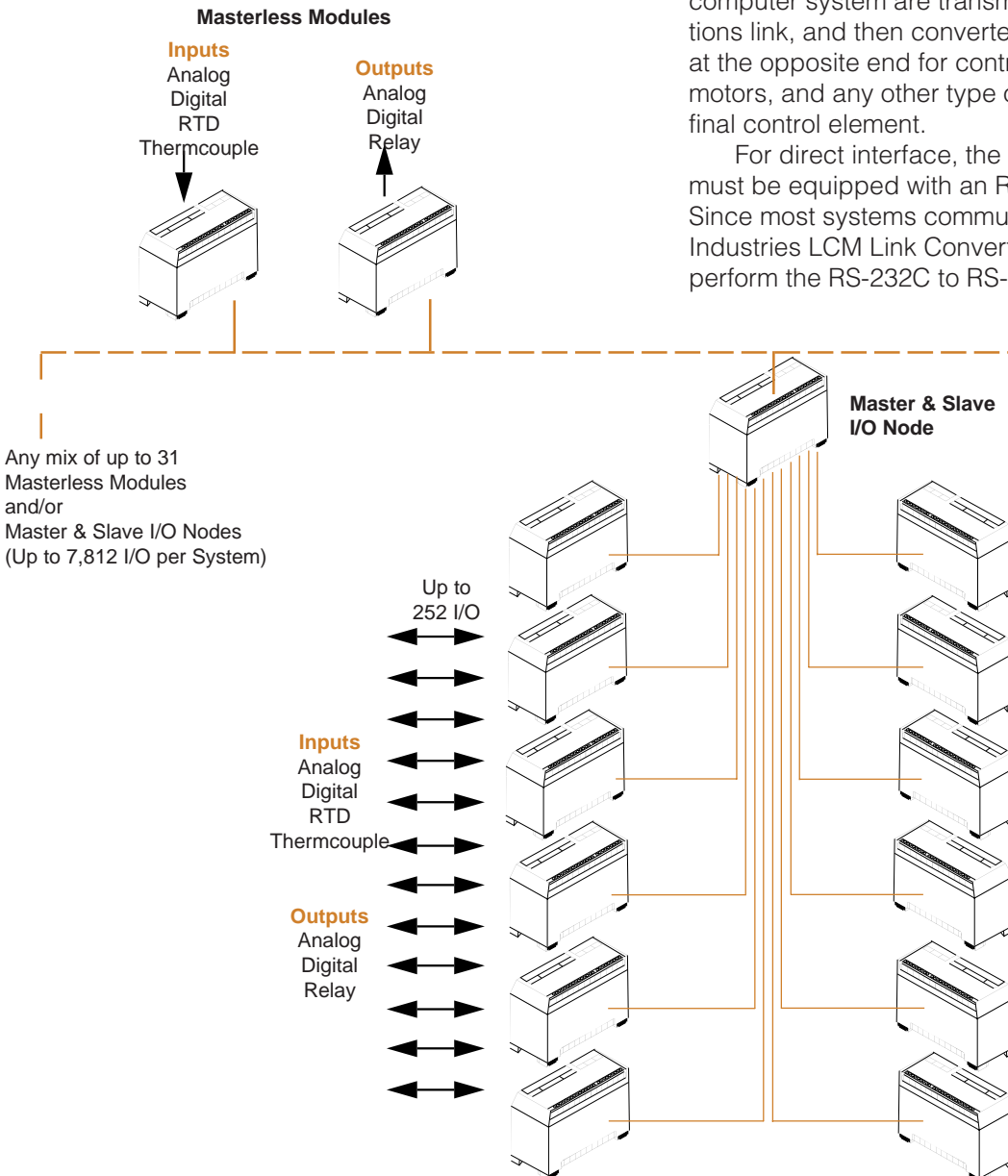
Figure 6. *Peer-to-Host Systems deliver low-cost and versatile distributed I/O.*
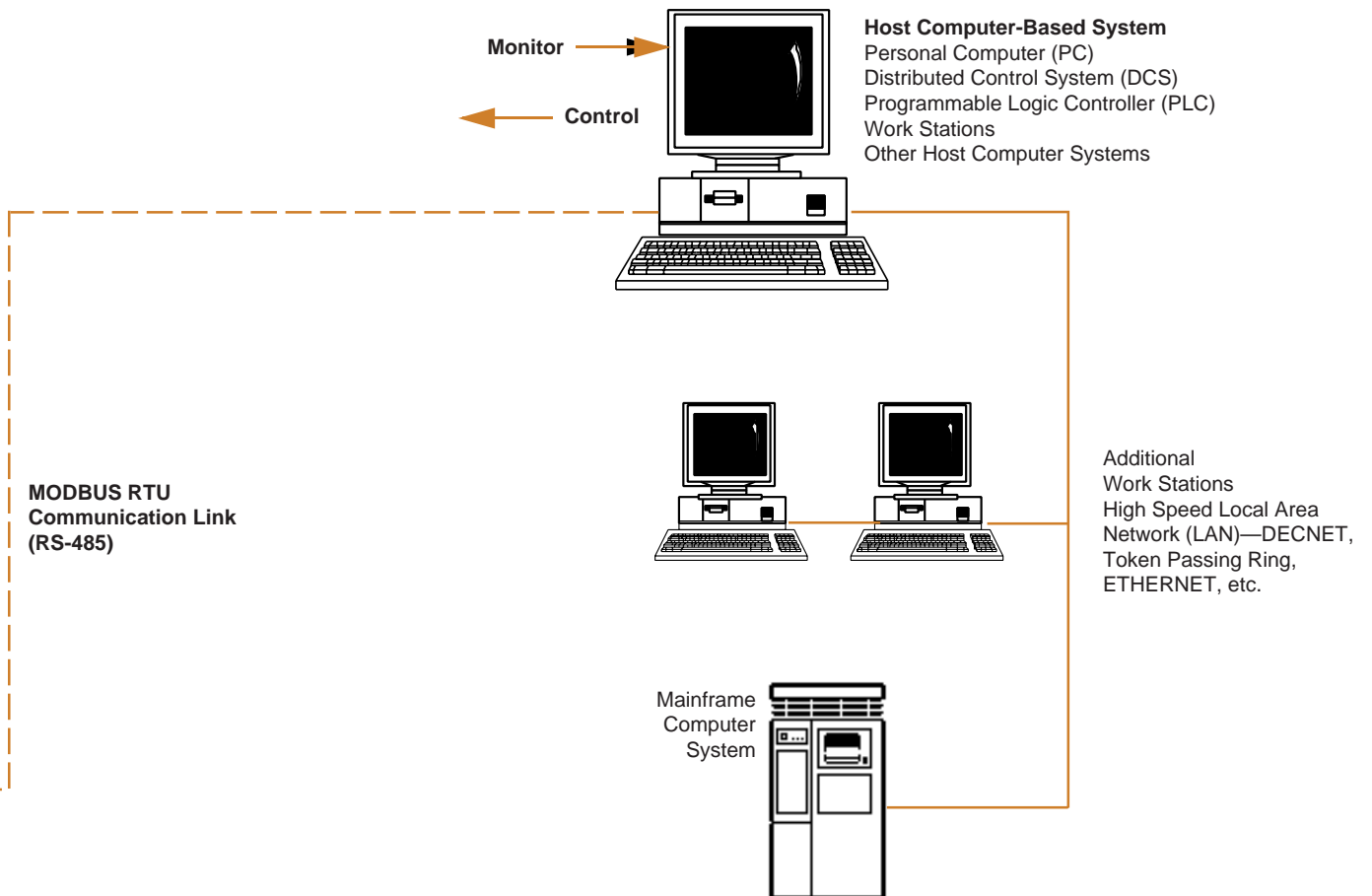
Connected in a multidrop network along the communication link, there can be up to 31 Master and/or Masterless Modules per **I/O EXPRESS** system. Up to 7,812 I/O points can be accommodated (21-Channel Slaves x 12 Slaves per Master x 31 Masters = 7,812).

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.


Masterless Modules

Inputs
Analog
Digital
RTD
Thermcouple

Outputs
Analog
Digital
Relay

Master & Slave I/O Node

Any mix of up to 31 Masterless Modules and/or Master & Slave I/O Nodes (Up to 7,812 I/O per System)

Up to 252 I/O

Inputs
Analog
Digital
RTD
Thermcouple

Outputs
Analog
Digital
Relay

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

Monitor

Control

Additional
Work Stations
High Speed Local Area
Network (LAN)—DECNET,
Token Passing Ring,
ETHERNET, etc.

**MODBUS RTU
Communication Link
(RS-485)**

Mainframe
Computer
System

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.

REACTOR #1
REACTOR #2
MIXER #1
OFF
210°C
35%
157°C
51%
SITE 2
OPEN
OPEN
CATALYST
CLOSED
ALARM #1
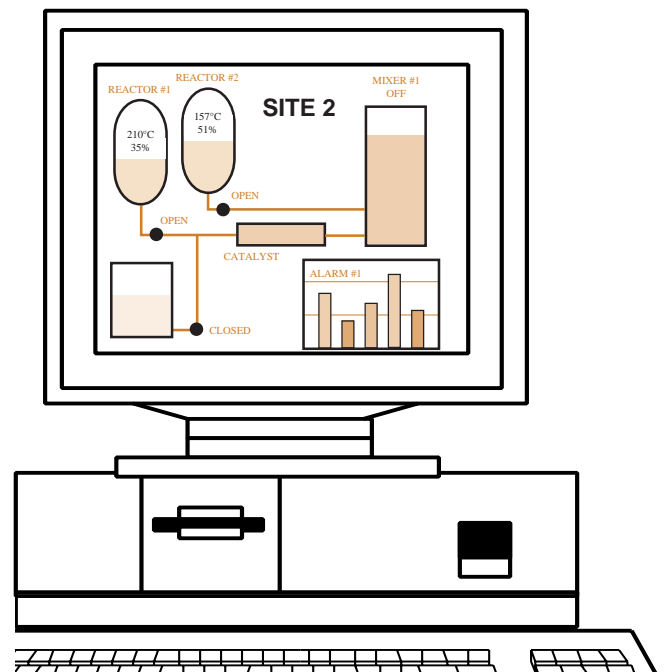
Redundant COMM Links

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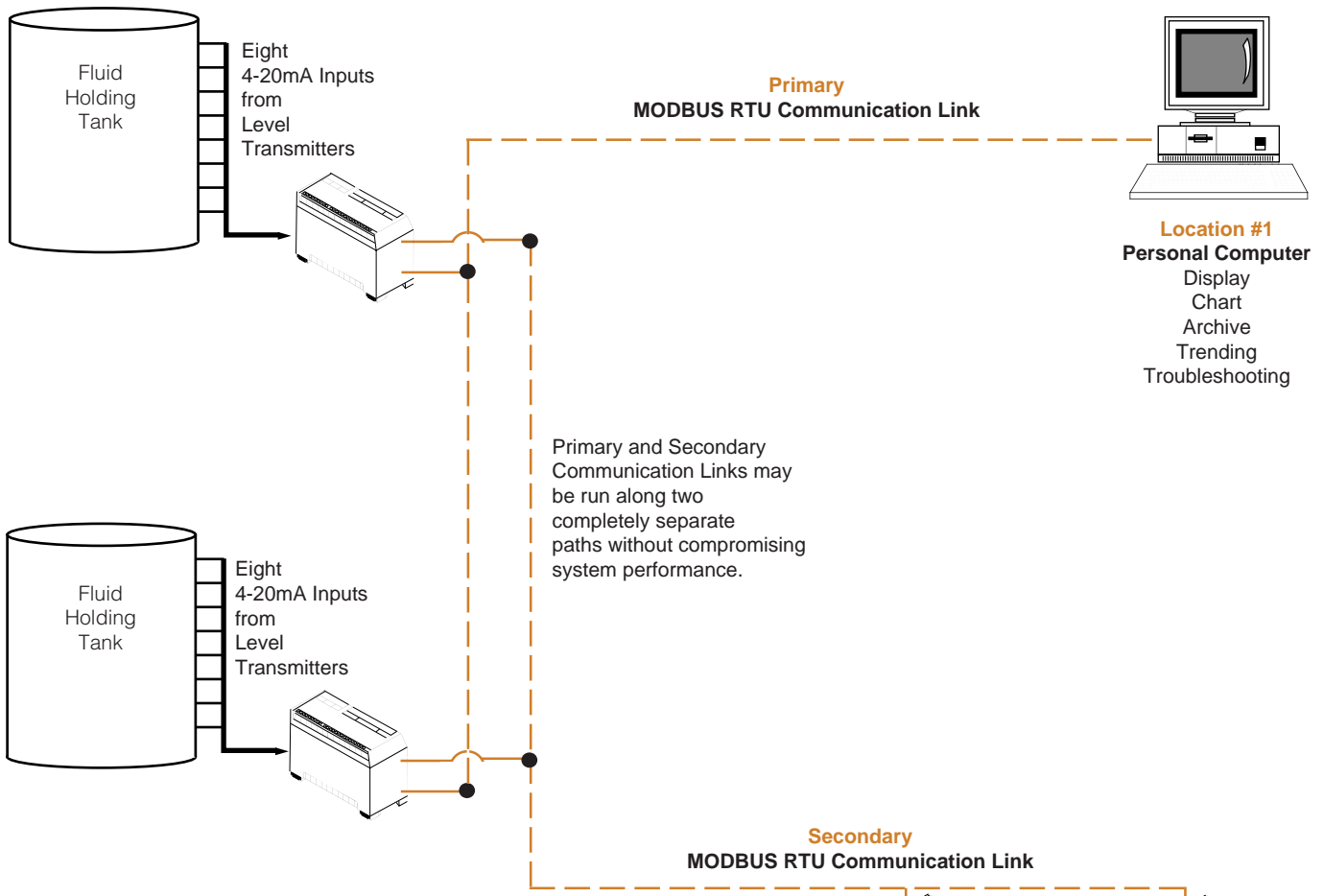
At Location #2, the multiplexed signals are sent over the Secondary Communication Link, and converted back to their original analog form for readout on digital panel meters.

Figure 7. *Redundant communications links assure continuous data flow should one of the links be compromised.*
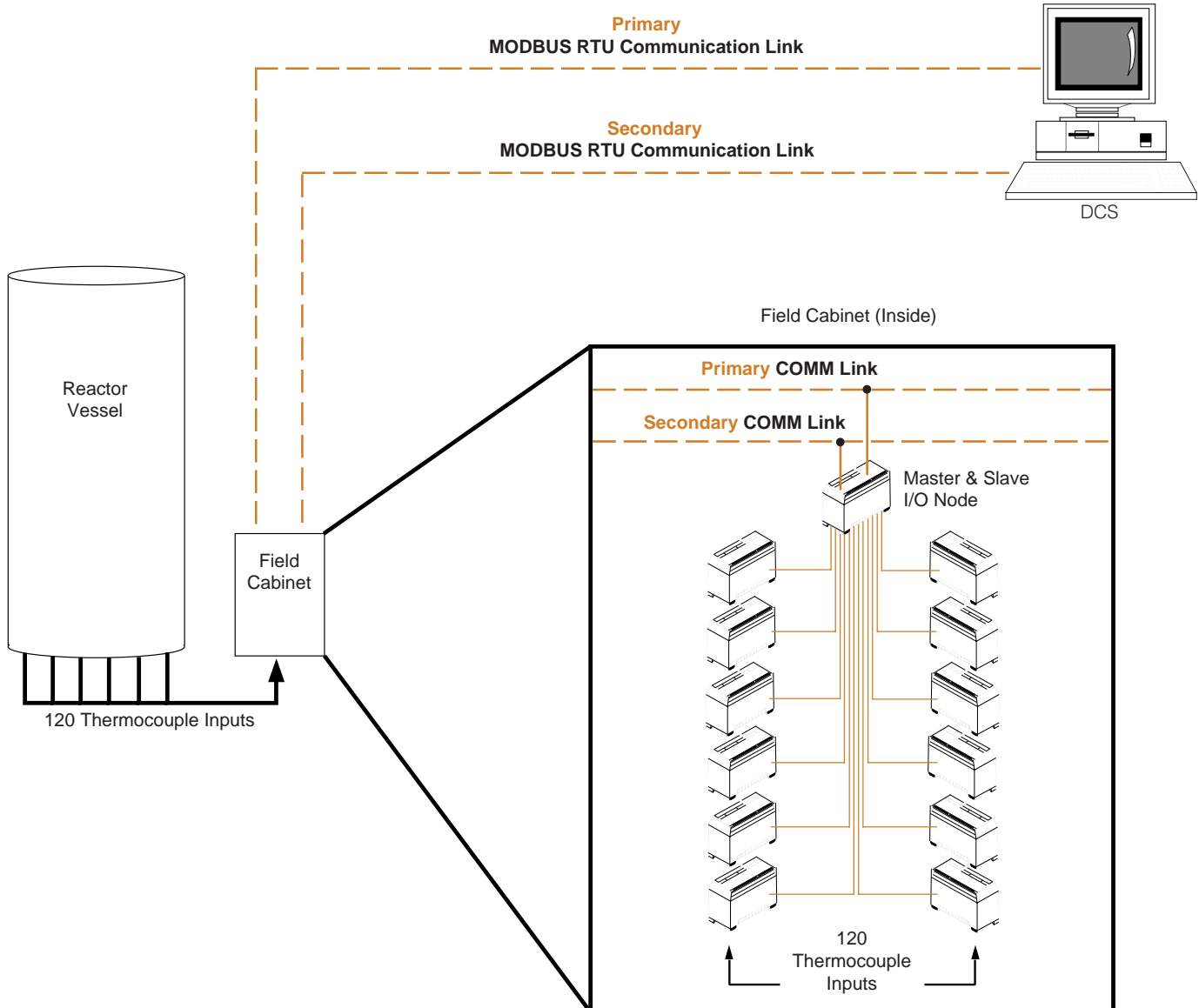
Figure 8. The **I/O EXPRESS**'s dual communication links can be used to simultaneously send identical process data to two separate locations.
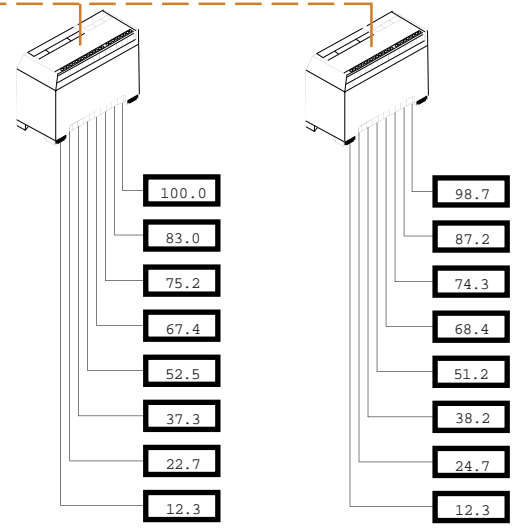

Primary
MODBUS RTU Communication Link

Location #1
Personal Computer
Display
Chart
Archive
Trending
Troubleshooting

Primary and Secondary
Communication Links may
be run along two
completely separate
paths without compromising
system performance.

Secondary
MODBUS RTU Communication Link

Location #2
16 Panel Meters
Readout

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.

i/o EXPRESS

Distributed Data System

Specifications

Performance (Master Module)
Scan Rate: 12 Slave channels updated every 50 to 150 msec, depending upon the I/O configuration of the connected Slave module
Isolation: 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and Slave modules

(Analog Input Modules)
Accuracy: ±0.15% of span (12-bit resolution)
Scan Rate: Each channel updated 200 times per sec.
Isolation: 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
Impedance: Current, 250Ω; Voltage, 1MΩ minimum
Common Mode Rejection: <115dB @ 60Hz

(Analog Output Modules)
Accuracy: ±0.15% of span (12-bit resolution)
Scan Rate: Each channel updates 100 times per sec.
Isolation: 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and output channels
Drive Capability: 700Ω
Ripple: 1µA peak-to-peak

(RTD Modules)
Accuracy: ±0.25% of reading, ±0.25°C
Resolution: ±0.1°C
Scan Rate: Each channel scanned every 1.3 seconds
Isolation: 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and input channels

(Thermo-couple Input Modules)
Accuracy: ±3°C
Resolution: 0.5°C
Update Rate: Each channel scanned 200 times per second
Isolation: 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and input channels
Impedance: >10MΩ
Sensor Burnout: Upscale Drive

(Digital Input Modules)
Scan Rate: Each channel is updated 100 times per second
Isolation: 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and input channels
Impedance: 3300Ω
Maximum Input Voltage: 30Vdc
Threshold: Guaranteed high state above 7V, guaranteed low state under 0.5V

(Digital Output Modules)
Scan Rate: Each channel updated 100 times per second
Isolation: 500Vdc between each COMM link; 500Vdc between either of the COMM links and power; and 500Vdc between COMM links, power, and output channels
Output Transistor Rating: Maximum ON current, 200mA; Maximum OFF voltage, 40Vdc

(Relay Output Modules)
Scan Rate: Each channel updated 100 times per second
Isolation: 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
Contact Ratings: 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

COMM Link
Range: 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
Baud Rate: 2400, 4800, 9600, and 19200 rates are configurable
Throughput Rate: 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)

Power Supply
11-30Vdc (2 to 4 watts for most modules-any analog current or relay output has a 6 watt max.)

Ambient Conditions
Operating Range: -5°C to +65°C (+23°F to +185°F)
Storage Range: -25°C to +85°C (-13°F to +185°F)
Relative Humidity: 10 to 90%, non-condensing
Ambient Temperature Effect: from ±0.015% of span/°C to ±0.02% of span/°C (depends on module type; consult the factory for details)

Adjustments
External jumpers used to set baud rate and module address

Weight
580 g (1.7 lbs)

Ordering Specifications

Unit	Module Type	Input/Output Configuration	Power	Housing
DDS	**MASTER MODULES FOR PEER-TO-PEER AND PEER-TO-HOST SYSTEMS:** **MH** Master Module for Peer-to-Host Systems (31 per system maximum) **MP** Master Module for Peer-to-Peer Systems (8 pair—16 modules—per system maximum)	**FOR MASTER MODULE IN PEER-TO-HOST AND PEER-TO-PEER SYSTEMS (MH and MP):** **S12** 12 input or output channels to accept signals from, or send signals to, up to 12 Slave (S) Modules	**11-30DC**	**DIN** A.B.S. Nylon housing with removable terminal blocks mounts on standard Top Hat rail (DIN 46277-3)
	SLAVE AND MASTERLESS MODULES FOR PEER-TO-HOST SYSTEMS: **S** Slave Module for Peer-to-Host Systems (12 per MH Master Module; 372 per system maximum for Peer-to-Host Systems) **MLH** Masterless Module for Peer-to-Host Systems (31 per system maximum)	**FOR SLAVE AND MASTERLESS MODULES IN PEER-TO-HOST SYSTEMS (S and MLH):** **RTI8** 8 RTD Input Channels (3-wire; 100 ohm platinum; -100°C to 700°C) **TJI10** 10 Thermocouple Input Channels (J-type; -100°C to 760°C) **TKI10** 10 Thermocouple Input Channels (K-type; -100°C to 1372°C) **AI12XX** 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) **AO820MA** 8 Analog Output Channels (4-20mA) **DI21** 21 Discrete Input Channels (externally-powered, 11-30Vdc) **DO21** 21 Discrete Output Channels (open collector 200mA, 40Vdc) **RO8** 8 Relay Output Channels (see Specifications for contact ratings) **RO12** 12 Relay Output Channels (see Specifications for contact ratings)		
	SLAVE AND MASTERLESS MODULES FOR PEER-TO-PEER SYSTEMS: **S** Slave Module for Peer-to-Peer Systems (12 per MP Master Module; 192 per system maximum for Peer-to-Peer Systems) **MLP** Masterless Module for Peer-to-Peer Systems (8 pair—16 modules—per system maximum)	**FOR SLAVE AND MASTERLESS MODULES IN PEER-TO-PEER SYSTEMS (S and MLP):** **AI12XX** 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) **AO820MA** 8 Analog Output Channels (4-20mA) **DI21** 21 Discrete Input Channels (externally-powered, 11-30Vdc) **DO21** 21 Discrete Output Channels (open collector 200mA, 40Vdc) **RO8** 8 Relay Output Channels (see Specifications for contact ratings) **RO12** 12 Relay Output Channels (see Specifications for contact ratings)		

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 / TJI10 / 11-30DC / [DIN]
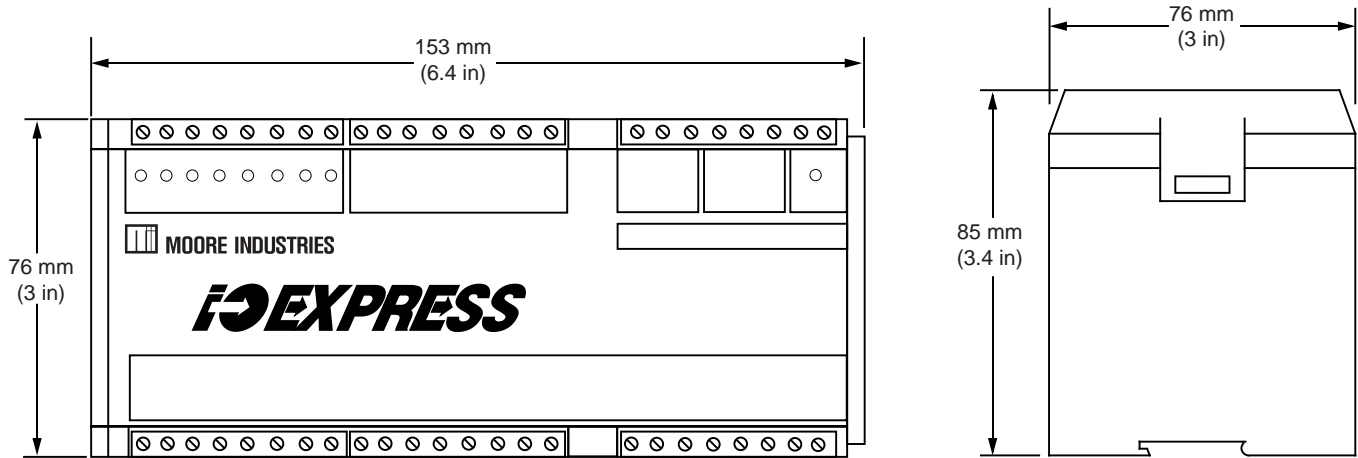
Master Module | **Slave Module** | **Masterless Module**

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

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**

MOORE INDUSTRIES

United States • info@miinet.com	**Belgium** • mii.belgium@pandora.be	**China** • sales@mooreind.com.cn
Tel: (818) 894-7111 • FAX: (818) 891-2816	Tel: 03/448.10.18 • FAX: 03/440.17.97	Tel: 86-21-58313053 • FAX: 86-21-68752927
Australia • sales@mooreind.com.au	**The Netherlands** • sales@mooreind.demon.nl	**United Kingdom** • sales@mooreind.com
Tel: (02) 9525-9177 • FAX: (02) 9525-7296	Tel: (0)344-617971 • FAX: (0)344-615920	Tel: 01293 514488 • FAX: 01293 536852