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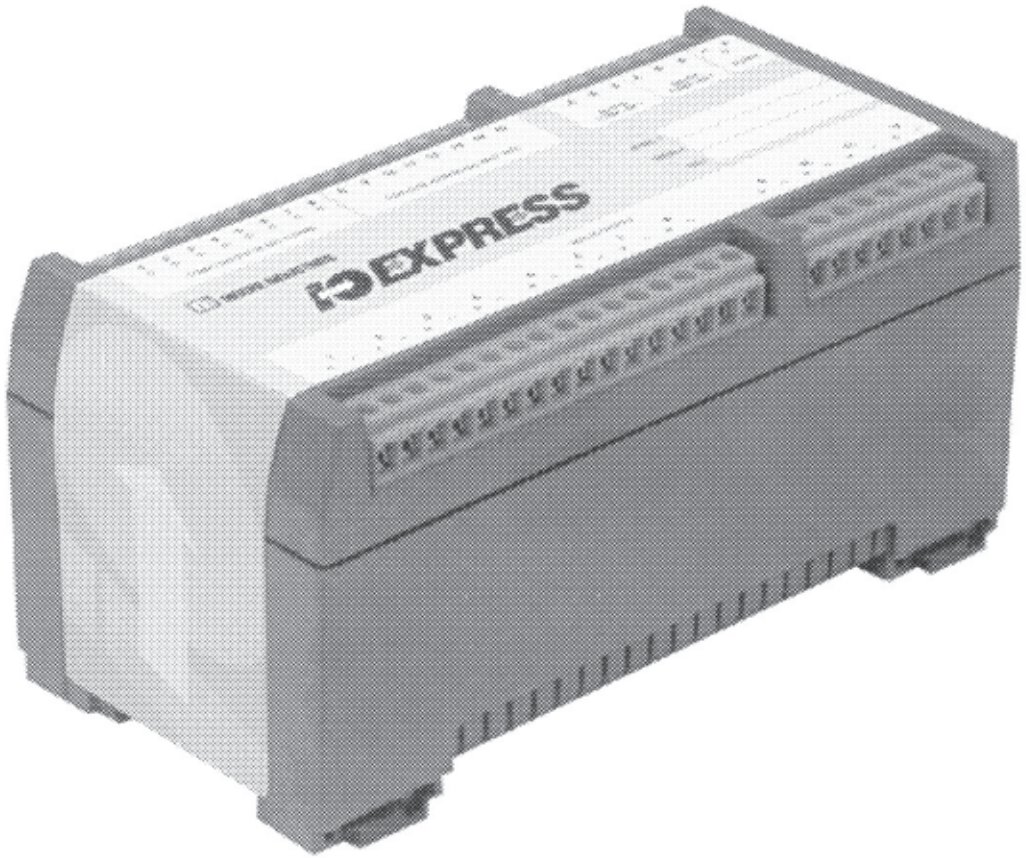
I/O Express Peer-to-Peer Distributed Data System

DDS



DDS *I/O Express Peer-to-Peer Distributed Data System*

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Introduction

I/O EXPRESS is the family of modules that make up Moore Industries' Distributed Data System (DDS). The DDS is a group of interface modules that provide a cost-effective communications link between multiple dispersed points of input, output and control. Modules serve as everything from platforms for two-way communications between control room computers and analog and/or discrete field devices, to multiplexers that squeeze the signals of more than 7,000 points of input or output (I/O) over a single, digital Communications Link (Comm Link).

Peer-to-Peer vs. Peer-to-Host System

There are two basic types of ***I/O EXPRESS*** systems: Peer-to-Host and Peer-to-Peer. This manual provides information on Peer-to-Peer systems. A Peer-to-Peer ***I/O EXPRESS*** system functions without any host device, continuously communicating the inputs and/or outputs (I/O) of field instrumentation from point to point over a digital data Communications Link.

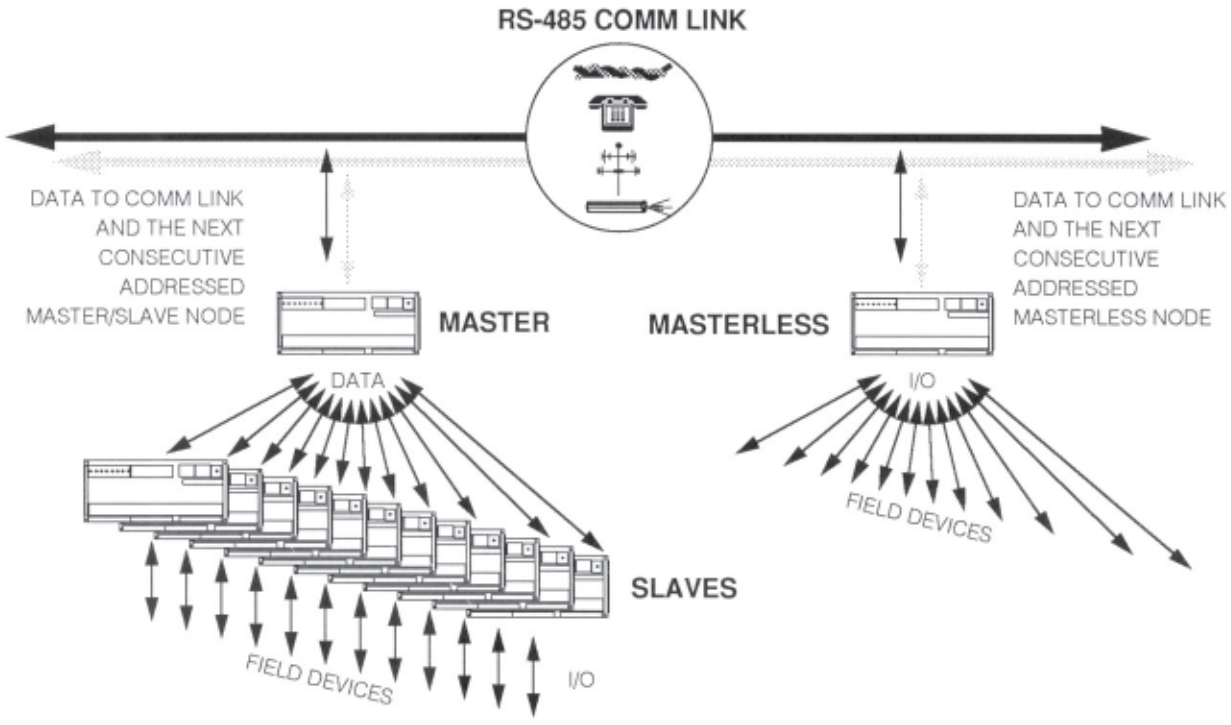
Module Types — Masters, Slaves and Masterless

Figure 1 is a general overview of half of a Peer-to-Peer system. The illustration shows all three types of Peer-to-Peer ***I/O EXPRESS*** modules. In an actual application diagram, each of these I/O "nodes" would be paired over the Comm Link with a similar configuration of modules some distance away.

Master modules multiplex the signals of up to 12 Slave modules. They do not accommodate field I/O signals directly, but combine the signals from all connected Slaves into a single digital signal that is communicated with its mate over the Comm Link. They can also communicate this information to the host. (See the Operation section of this manual.)

Slave modules take input from, and/or provide output to field devices. They communicate these signals, in digital form, to Master modules, which then send the data over the Comm Link.

Figure 1. *Understanding the* ***I/O EXPRESS***



NOTE: THIS IS NOT AN INSTALLATION DIAGRAM.

Masterless modules take input directly from, and/or provide output directly to field devices. They are installed in pairs and send signals digitally over the Comm Link between pair mates. They can also communicate directly with the host. (See the Operation section of this manual.)

Specifications

I/O EXPRESS modules accommodate analog inputs and outputs, discrete (digital) inputs and outputs, RTD and thermocouple inputs, and relay outputs. The following Specifications are organized by I/O type.

Master Modules

Performance	**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	**Comm Link (continued)**	**Range:** 1.6km (1 mile) typical, between Master modules communicating at 9600 baud over 20AWG twisted pair; 0.8km (0.5 miles), typical, for the same modules communicating at 19.2k baud; 15m (50 feet) between Masters and Slaves See NOTE below **Protocol:** Master and Masterless modules are capable of communicating with a host using MODBUS RTU[1] commands; all communications in a standard, Peer-to-Peer or Master-Slave system use a proprietary protocol.	**Comm Link (continued)**	**Baud Rate:** 9600 between Masters and Slaves; user-set between Masters, 2400, 4800, 9600, or 19200. **Addressing:** 16 available between Masters, User-set, 48-63
Comm Link	**Between pairs of Masters:** RS-485 multi-drop; two, independent Comm Links continuously maintained **Between Masters and Slaves:** RS-232 direct connection; each Slave to one channel on the Master			**Power Supply**	11-30Vdc; Load: 2-4 Watts
				Ambient Conditions	**Operating Range:** –5°C to +65°C (23°F to 150°F) **Storage Range:** –25°C to +85°C (–13°F to 185°F) **Relative Humidity:** 10 to 90%, non-condensing
				Controls	External jumpers used to set baud rate and address
				Weight	580g (1.7 lbs)

Analog Input* Modules – Slave or Masterless

Performance	**Accuracy:** ±0.15% of span (12-bit resolution) **Scan Rate:** Each channel updated 200 times per second **Isolation:** 500Vdc between each Comm Link; 500Vdc between either of the Comm Links and Power; 500Vdc between Comm Links, Power, and input channels; ±7Vdc, (common mode) channel-to-channel **Impedance:** 4-20mA inputs: 250Ω; Voltage inputs: 1MΩ **Common Mode Rejection:** >115dB @ 60Hz	**Comm Link (continued)**	**Between Slaves and Masters:** RS-232 direct connection; each Slave to one channel on the Master **Range:** 1.6 km (1 mi) typical, between Masterless modules communicating at 9600 baud over 20AWG twisted pair; 0.8 km (0.5mi), typical, for the same modules communicating at 19.2k baud; 15 m (50 ft) between Slaves and Master modules See NOTE, below. **Protocol:** Masterless modules are capable of communicating with a host using MODBUS RTU[1] commands; all communications in a standard, Peer-to-Peer or Master-Slave system use a proprietary protocol	**Comm Link (continued)**	**Baud Rate:** 9600 between Slaves and Master modules; user-set between Masterless modules, 2400, 4800, 9600, or 19200 **Addresses:** 16 available between Masterless units, user-set, 48-63
Comm Link	**Between pairs of Masterless modules:** RS-485 multidrop; two, independent Comm Links continuously maintained			**Power Supply**	11-30Vdc; Load: 2-4 Watts
				Ambient Conditions	**Operating Range:** –5°C to +65°C (23°F to 150°F) **Storage Range:** –25°C to +85°C (–13°F to 185°F) **Relative Humidity:** 10-90%, non-condensing **Ambient Temperature Effect:** ±0.018% per °C
				Controls	External jumpers used to set baud rate and address (Masterless modules only)
				Weight	580g (1.7 lbs)

* Excluding RTD or Thermocouple inputs, which are accommodated by other modules.
Note: Practical system range and throughput may be greater in many applications.
[1]MODBUS and MODBUS RTU are products of MODICON, Incorporated.

Specifications *(continued)*

Analog Output Modules – Slave or Masterless

Performance	**Accuracy:** ±0.15% of span (12-bit resolution) **Scan Rate:** Each channel updated 100 times per sec **Isolation:** 500Vdc between each Comm Link; 500Vdc between Comm Links and Power; 500Vdc between Comm Links and output channels **Drive Capability:** 4-20mA units, 700Ω, maximum **Ripple:** 1μA peak-to-peak
Comm Link	**Between pairs of Masterless Modules;** RS-485 multi-drop; two, independent, Comm Links continuously maintained **Between Slaves and Masters**, RS-232 direct connection; one Slave to one Slave channel on the Master
Comm Link (continued)	**Range:** 1.6 km (1 mi) typical, between Masterless modules communicating at 9600 baud over 20AWG twisted pair wiring; 0.8 km (0.5 mi), typical, for the same modules communicating at 19.2k baud; 15 m (50 ft) between Slave and Master modules See NOTE below **Protocol:** Master and Masterless modules are capable of communicating with a host using MODBUS RTU[1] commands; all communication in a standard, Peer-to-Peer and Master-Slave system use a proprietary protocol **Baud Rate:** 9600 between Slave and Masters; user-set between Masterless modules, 2400, 4800, 9600, or 19200
Comm Link (continued)	**Addressing:** 16 available between Masterless modules, user-set, 48-63
Power Supply	11-30Vdc; Load: 2-4 Watts
Ambient Conditions	**Operating Range:** –5°C to +65°C (23°F to 150°F) **Storage Range:** –25°C to +85°C (–13°F to 185°F) **Relative Humidity:** 10-90%, non-condensing **Ambient Temperature Effect:** ±0.015% per °C
Controls	External jumpers used to set baud rate and address (Masterless modules only)
Weight	580 g (1.7 lbs)

Digital Input Modules – Slave or Masterless

Performance	**Scan Rate:** Each channel is updated 100 times per sec **Isolation:** 500Vdc between each Comm Link; 500Vdc between Comm Links and Power connections; 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 **Between pairs of Masterless Modules:** RS-485 multi-drop; two, redundant independent, Comm Links continuously maintained **Between Slaves and Masters:** RS-232 direct connection, one Slave to one Slave channel on the Master
Comm Link	**Between pairs of Masterless Modules:** RS-485 multi-drop, two, independent, Comm Links continuously maintained **Between Slaves and Masters:** RS-232 direct connection; one Slave to one Slave channel on the Master **Range:** 1.6 km (1 mi) typical, between Masterless modules communicating at 9600 baud over 20AWG twisted pair wiring; 0.8 km (0.5 mi) typical, for the same modules communicating at 19.2K baud; 15 m (50 ft) between Slave and Master modules See NOTE below **Protocol:** Master and Masterless modules are capable of communicating with a host using MODBUS RTU[1] commands; all communication in a standard, Peer-to-Peer or Master to Slave system use a proprietary protocol
Comm Link (continued)	**Baud Rate:** 9600 between Slaves and Masters; user-set between Masterless modules, 2400, 4800, 9600, or 19200 **Addressing:** 16 available between Masterless modules, user-set, 48-63
Power Supply	11-30Vdc; Load: 2-4 Watts
Ambient Conditions	**Operating Range:** –5°C to +65°C (23°F to 150°F) **Storage Range:** –25°C to +85°C (–13°F to 185°F) **Relative Humidity:** 10 to 90%, non-condensing
Controls	External jumpers used to set baud rate and address (Masterless modules only)
Weight	580 g (1.7 lbs)

NOTE: Practical system range and throughput may be greater in many applications.

[1]MODBUS and MODBUS RTU are products of Modicon, Incorporated.

Specifications *(continued from page 3)*

Digital Ouput Modules (Open collector) – Slave or Masterless

Performance	**Scan Rate:** Each channel updated 100 times per sec **Isolation:** 500Vdc between each Comm Link; 500Vdc between Comm Links and Power; 500Vdc between Comm Links and ouput channels **Output Transistor Rating:** Maximum ON current, 200mA; Maximum OFF Voltage: 40Vdc	**Comm Link (continued)**	**Between Slaves and Masters:** RS-232 direct connection; one Slave to one Slave channel on the Master **Range:** 1.6 km (1 mi) typical, between Masterless modules communicating at 9600 baud over 20AWG twisted pair wiring; 0.8 km (0.5 mi) typical, for the same modules communicating at 19.2k baud; 15 m (50 ft) between Slaves and Master modules See NOTE below **Protocol:** Master and Masterless modules are capable of communicating with a host using MODBUS RTU[1] commands; all communication in a standard, Peer-to-Peer or Master-Slave system use a proprietary protocol	**Comm Link (continued)**	**Addresses:** 16 available between Masterless modules; user-set, 48-63
Comm Link	**Between pairs of Masterless Modules:** RS-485 multi-drop; two, independent , Comm Links continuously maintained			**Power Supply**	11-30Vdc; Load: 2-4 Watts
				Ambient Conditions	**Operating Range:** –5°C to +65°C (23°F to 150°F) **Storage Range:** –25°C to +85°C (–13°F to 185°F) **Relative Humidity:** 10-90%, non-condensing
				Controls	External jumpers used to set baud rate and address (Masterless modules only)
				Weight	580g (1.7 lbs)

Relay Ouput Modules – Slave or Masterless

Performance	**Scan Rate:** Each channel updated 100 times per sec **Isolation:** 500Vdc between Comm Links and Power; 500Vdc between Comm Links, Power, and output channels; and 250Vdc between output channels	**Comm Link (continued)**	**Between Slaves and Masters:** RS-232 direct connection; one Slave to one Slave channel on the Master **Range:** 1.6 km (1 mi) typical, between Masterless modules communicating at 9600 baud over 20AWG twisted pair wiring; 0.8 km (0.5 mi) typical, for the same modules communicating at 19.2k baud; 15 m (50 ft) between Slaves and Master modules See NOTE below **Protocol:** Master and Masterless modules are capable of communicating with a host using MODBUS RTU[1] commands; all communication in a standard, Peer-to-Peer or Master to Slave system use a proprietary protocol	**Comm Link (continued)**	**Addresses:** 16 available between Masterless modules, user-set, 48-63
Contacts	8-channel modules are SPDT, rated for 3A at both 24Vdc and 110Vac; 12-channel modules are normally open (NO), SPST, rated for 1A at 24Vdc, and 0.5A at 110Vac			**Power Supply**	11-30Vdc; Load: 2-4 Watts
				Ambient Conditions	**Operating Range:** –5°C to +65°C (23°F to 150°F) **Storage Range:** –25°C to +85°C (–13°F to 185°F) **Relative Humidity:** 10-90%, non-condensing
				Controls	External jumpers used to set baud rate and address (Masterless modules only)
Comm Link	**Between pairs of Masterless Modules:** RS-485 multidrop; two independent , Comm Links continuously maintained			**Weight**	580g (1.7 lbs)

NOTE: Practical system range and throughput may be greater in many applications

[1] MODBUS and MODBUS RTU are products of Modicon, Incorporated

Throughput

The ***I/O EXPRESS*** throughput rate, system-wide, is dependent upon the number of modules in a system, the individual module rates, the system's baud rate setting, and any limitations on the type of Comm Link used (fiber optic, modems, etc.). Consult your Moore Industries Sales Representative for the specifics in your application.

Typically, a single pair of Masterless modules achieves a throughput of 100-150 milliseconds at 9600 baud, over a 20AWG twisted wire pair. An additional 100-150 milliseconds is added for each pair of modules on the link.

Over the same type of link, all-digital (discrete) Master/Slave nodes attain a 150-200 millisecond throughput rate between a single pair of Masters. For the total system throughput, the 50-100 millisecond rate btween Masters and Slaves on each end of the link must be added. Total throughput is thus 250 to 400 milliseconds. Also, if the system is comprised of more than one pair of nodes, an additional 250 to 400 milliseconds must be added for each pair of Masters.

I/O EXPRESS Order Numbers

To order additional or replacement modules for your system, specify the following, in order:

Product / Module / I/O Configuration / Power / Options (if installed) [Housing]

- For a Slave accepting 12, 4-20mA inputs:

  DDS / S / AI1220MA / 11-30DC [DIN]

- For a Masterless module accepting discrete inputs:

  DDS / MLP / DI21 / 11-30DC [DIN]

Remember these points when ordering:

- Modules in Peer-to-Peer applications must be installed in pairs (typically on either end of the Comm Link).
- Master modules communicate only with their respective pair mates and with Slaves (no Master-to-Masterless communications).
- Slaves can only communicate with each other through Master modules (no Slave-to-Masterless communications).

Ordering Information

Unit	Module Type	Input/Output Configuration	Power	Options	Housing
DDS	**MP** Master Module (16 per system (8 pairs), maximum) **S** Slave Module (12 per Master; 192 per system, maximum) **MLP** Masterless Module (16 per system (8 pairs), maximum)	**S12** 12 Slave channels (Selection is required for Master modules) **AI12xx** 12 Analog Inputs (replace **xx** with **20MA** for 4-20mA, with **2V** for 0-2Vdc, **5V** for 0-5Vdc, or with **10V** for 0-10Vdc) **AO820MA** 8 Analog Outputs, 4-20MA **DI21** 21 Discrete Inputs (externally powered, 11-30Vdc) **DO21** 21 Discrete Outputs (open collector 200mA, 40Vdc) **RO8** 8 Relay Outputs (Normally Open, rated 3A@24Vdc) **RO12** 12 Relay Outputs (Normally open, rated 1A@110Vac)	**11-30DC**	Consult factory for information on optional baud rate and parity settings	**DIN** A.B.S. Nylon housing with removable terminal blocks; mounts on standard Top Hat rail (DIN 46277-3)

Communications Overview

Peer-to-Peer ***I/O EXPRESS*** applications typically involve moving multiple field signals from one point to another over the Comm Link(s). In applications calling for a large number of I/O points to communicate, this is accomplished with Master-Slave nodes. Masterless nodes are used where the demand for multiplexing is not as high. (Master-Slave and Masterless nodes may also be mixed in an application if required).

Traffic is transmitted serially, with one of the Master or Masterless modules configured by the user to serve as a Link Controller. As is shown in Figure 1, intervening modems, radio modems, or fiber optic converters may be used to extend the practical range of the Comm Links.

Module baud rate and addressing is set by the user. Instructions for this configuring appear in the Installation section of this manual.

A maximum of eight Master-Master and/or Masterless-Masterless pairs may be "mixed" on the same Comm Link. Each Master accommodates I/O from a maximum of 12 Slaves. A maximum of 4032 points of I/O (2016 inputs and 2016 outputs) can be accommodated by the Comm Links of a standard Peer-to-Peer system; 21 points per Slave, 12 Slaves per Master, and 8 pairs of Masters.

Master-Slave Nodes

In this type of application, field I/O is input to a Slave module, where it is converted to digital data and sent over an RS-232 connection to a channel on a Master. The Master module combines the data of that Slave with the data from all the other Slaves connected to it, and sends a multiplexed signal over one or both of the available RS-485 Comm Links to a receiving Master, its "mate" in the system.

The receiving Master breaks out the multiplexed signal and provides data to its connected Slaves via individual, RS-232 connections. The Slave modules then convert the data back to the appropriate analog and/or discrete field signals.

Masterless Nodes

Here, field I/O is input directly to a Masterless module, which both converts and multiplexes the data over the RS-485 Comm Link(s) to a receiving Masterless module, its "mate". The receiving unit performs the de-multiplexing and provides the appropriate converted output to field instrumentation.

Channel Mapping

All modules in an ***I/O EXPRESS*** application are installed in pairs. The architecture used in a standard system dictates that input at channel #1 of a particular Slave or Masterless module becomes output at the corresponding channel of the receiving module. That is, input at channel #1 of Slave #1 on Master #1 is output at Master #2, Slave #1, channel #1.

Installation

Perform the steps for ***I/O EXPRESS*** installation as follows:

1. **Configure the baud rate and communications address of each Master and Masterless module to be installed in the application.**

   IMPORTANT
   DO NOT set any baud rate or address jumpers on Slave modules.

2. **Connect the Slaves (if any) to their Masters. Make sure to use the same Slave channel (set of terminals) on each of the Masters in any given Master pair for the Slaves that are to communicate with each other during system operation.**

3. **Physically install each module and wire the Comm Link(s).**

4. **Connect the appropriate power supply (supplies) and sensors/transmitters/discrete devices.**

Setting Master/Masterless Baud Rate

To set Master and Masterless baud rate, connect wire jumpers between terminals 14, 15, and "C". Table 1 lists the available jumper combinations.

Table 1. *Setting the **I/O EXPRESS** Baud Rate*

To get this Baud Rate ▼	Connect each ● terminal to "C" ▼ 14	▼ 15
2400	●	●
4800	●	
9600		
19200		●

(No jumpers)

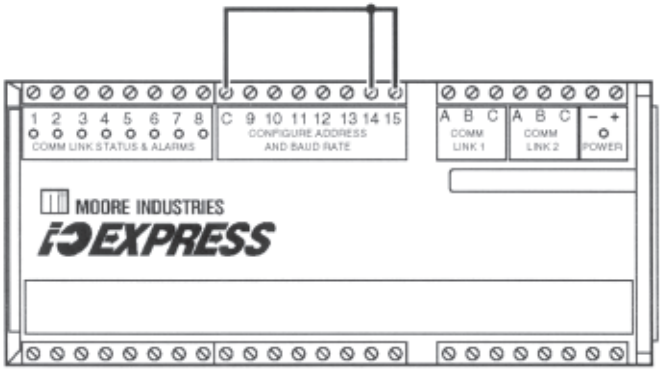
IMPORTANT

Set the baud rate the same for all Masters and/or Masterless modules in a system.

DO NOT set the baud rate jumpers on Slave modules.

Figure 2 illustrates setting 2400 baud.

Figure 2. *Setting **I/O EXPRESS** Module Baud Rate to 2400 (Masters and Masterless Modules ONLY)*



Setting the Masterless/Master Communications Address

As with the baud rate, Master and Masterless modules' addresses are "programmed in" by connecting a particular combination of terminals to the "C" terminal in the "Configure Address and Baud Rate" block on each unit's top panel. Terminals 9 through 12 are set aside for this purpose. Table 2 gives the combinations of jumpers needed to configure each unit with its address. There are 31 available.

Table 2. *Setting **I/O EXPRESS** Module Address*

To get this address ▼	Connect each terminal with a ● to "C" ▼ 9	▼ 10	▼ 11	▼ 12
48	●	●	●	●
49		●	●	●
50	●		●	●
51			●	●
52	●	●		●
53		●		●
54	●			●
55				●
56	●	●	●	
57		●	●	
58	●		●	
59			●	
60	●	●		
61		●		
62	●			
63				

(No jumpers)

IMPORTANT:

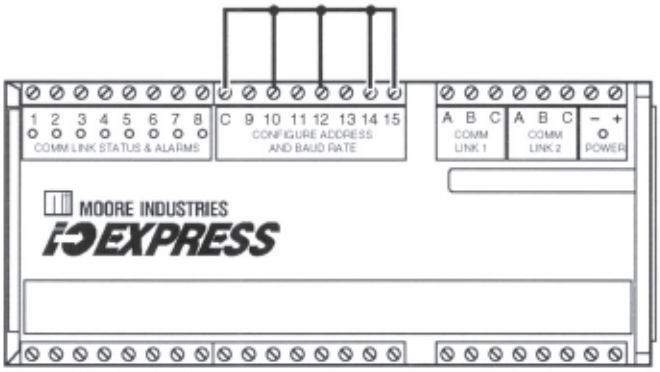
Addressing must begin with #48 and #49.

Figure 3 shows the module from Figure 2 with additional configuration for an address of 53.

IMPORTANT

DO NOT set the address jumpers on Slave modules.

Figure 3. *Setting **I/O EXPRESS** Module Address (Masters and Masterless Modules ONLY)*



Consecutive Addressing

Each of the modules in a pair of Masters or Masterless units in a Peer-to-Peer ***I/O EXPRESS*** must be given consecutive addresses, beginning with numbers 48 and 49. Each address pair must also be consecutive, and must continue from lowest to highest without interruption.

In figure 4, Master (or Masterless) #48 communicates exclusively with Master (Masterless) #49, Master (Masterless) #50 communicates exclusively with Master (Masterless) #51, and so on. If there are more module pairs to be added to the Comm Link, each pair added would be assigned the next consecutive address pair.

Designating the Communications Link Controller

At least one of the Master or Masterless modules in a Peer-to-Peer system ***MUST*** be designated "Link Controller". This is accomplished by connecting terminal "13" in "Configure address and baud rate" to "C".

The highest ***even*** addressed Master (or Masterless) module becomes the Link Controller of Comm Link #1. The highest ***odd*** addressed Master (or Masterless) module becomes the Link Controller of Comm Link #2. Refer to "Redundant Links", later in this section, for information on using both Comm Links simultaneously.

Module #52 in Figure 4 is designated the Link Controller, and since this module has the highest even address, it is the Link Controller of Comm Link #1.

Figure 5 shows the same module from Figures 2 and 3, configured as the Link Controller. Since it has the highest odd address, it would automatically become the Controller of Link #2.

Figure 4. I/O EXPRESS Consecutive Addressing

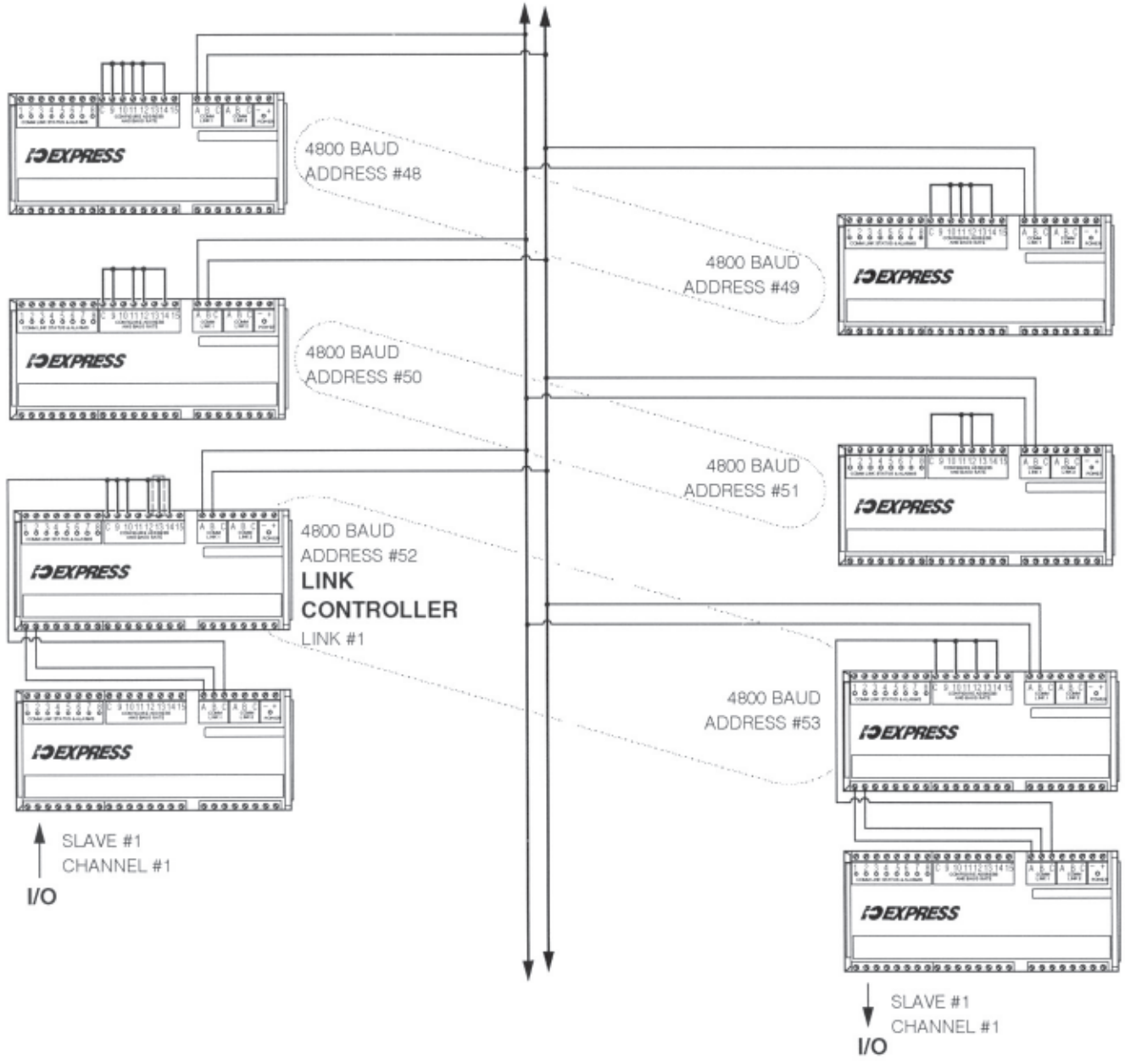
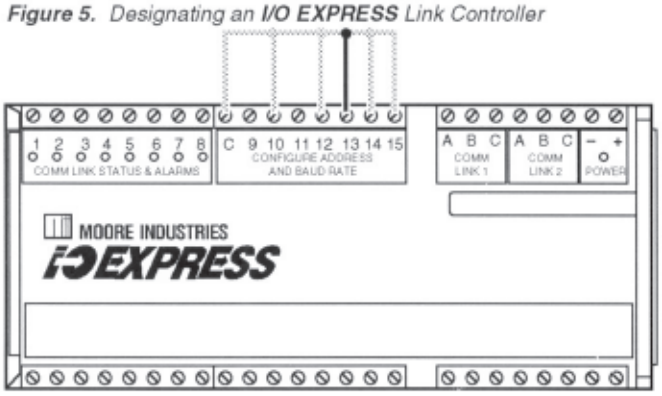


Figure 5. *Designating an* ***I/O EXPRESS*** *Link Controller*



NOTE:
Peer-to-Peer Systems can, under certain circumstances, be monitored or controlled by a Host device.

If using a Host, make sure to remove the Link Controller jumper from all modules on the Comm Link that is to be used by the Host.

For more information on adding a Host to a Peer-to-Peer System, refer to the Operation section of this manual.

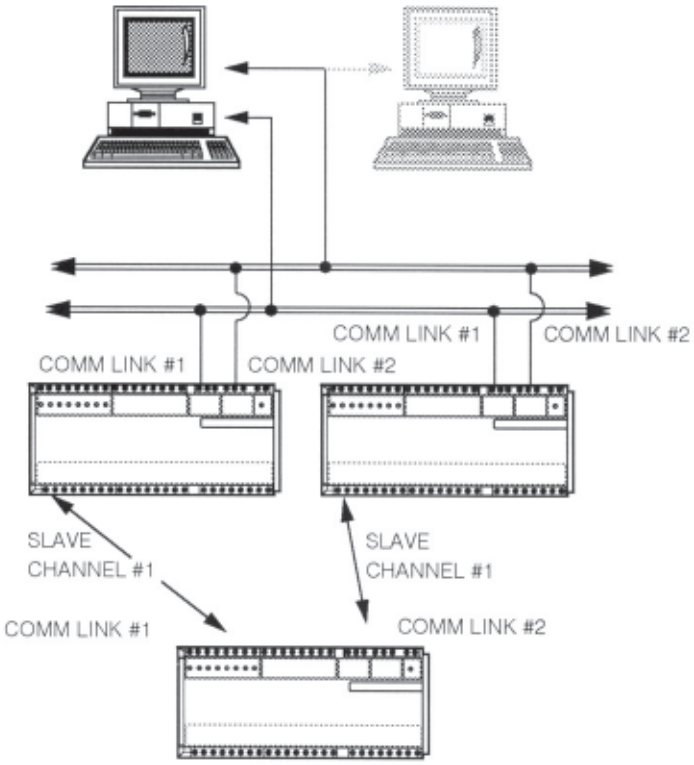
Redundant Links

Both of the ***I/O EXPRESS*** Comm Links are fully functional during normal system operations. Either can be used for the peer-to-peer connection, or both can be used for redundant, backup communication. Both links maintain a database of all system I/O and data during normal operation. If traffic over Link #1 is ever interrupted, all of the data in the system is accessible through Link #2, and vice-versa. Communications may continue without loss of data.

Since Comm Link #1 and Comm Link #2 are redundant in this way, a single Slave can be connected to two Master modules to provide backup of critical I/O. Figure 6 illustrates this type of backup redundancy.

Connecting two Slave modules to the same I/O, and connecting each Slave to two Masters provides excellent backup.

Figure 6. *Using I/O Express Redundant Hookups*



Mounting the *I/O EXPRESS* on DIN Rail

A compact, DIN-style unit, ***I/O EXPRESS*** modules mount on standard, 35 mm, Top Hat rail (EN50022 or 46277-3). Figure 7 shows the housing dimensions.

To install the ***I/O EXPRESS*** on DIN rail:

1. **Locate the mounting clips; two, black, sliding fixtures on the back of the housing. Each is equipped with a locking tab (see Figure 8).**
2. **Slide each clip downward and while sliding, press the locking tabs inward, until the tabs lock into an open position. A small screwdriver or the point of a pencil works well for pressing the locking tabs in.**

   With the tabs locked, the mounting clips will stay in an open position.
3. **Seat the top extrusions of the housing over the upper edge of the Hat Rail, and pivot the module around that upper edge of the rail until the mounting clips slide over the bottom edge of the rail.**
4. **Use a small screwdriver or pencil tip to release the locking tabs by pressing them outward, away from the unit.**

To remove the I/O Express from DIN rail, slide a screwdriver into each of the mounting clips. Pull the clips down with the tip of the screwdriver while pivoting the I/O Express and screwdriver handles upward.

*Figure 7. Dimensions of the **I/O EXPRESS** Housing*

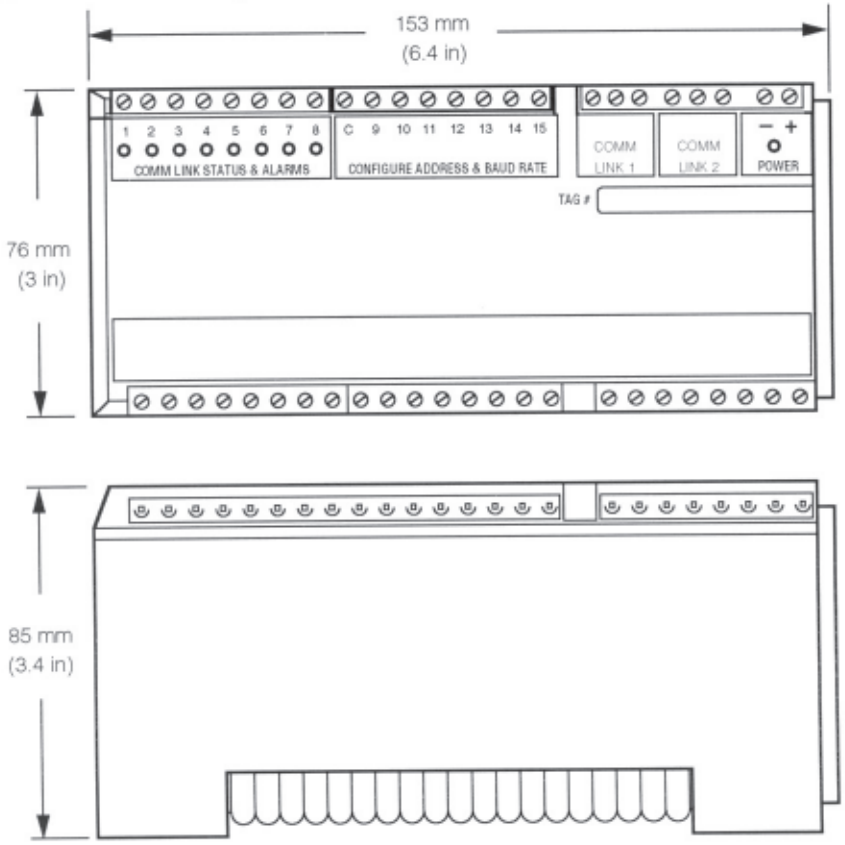
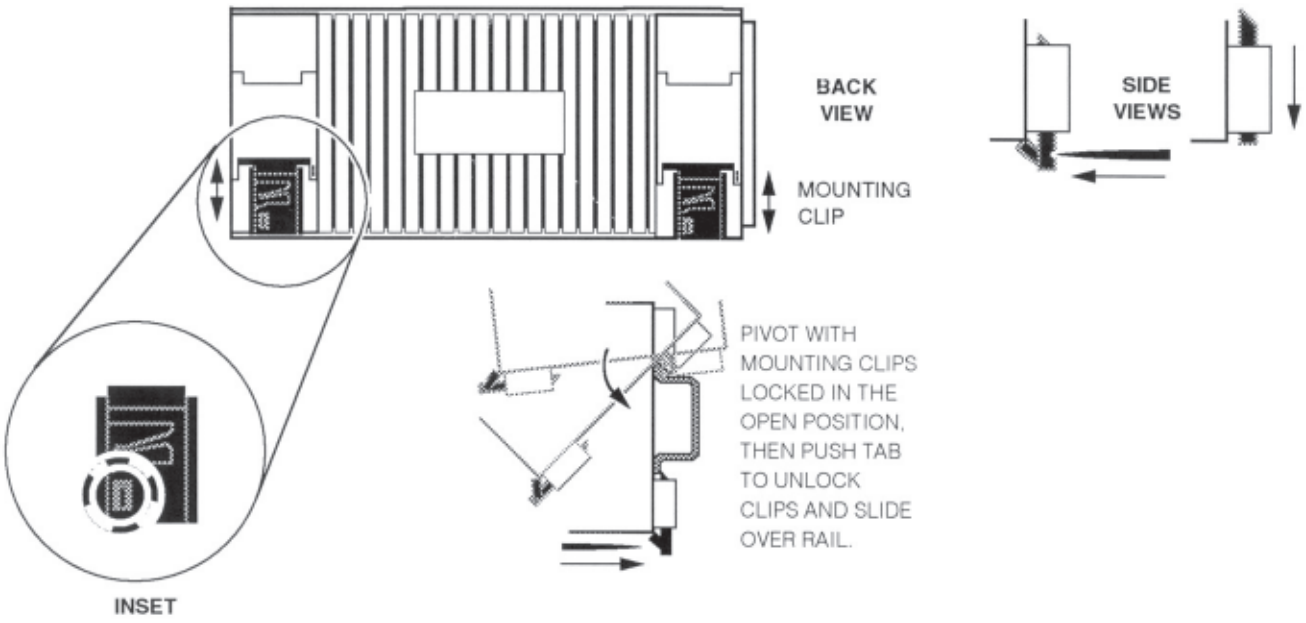


*Figure 8. Installing the **I/O EXPRESS** – Mounting Clips and Locking Tabs*



NOTE:
*When mounting the **I/O EXPRESS** in multi-tiered applications, allow enough vertical space between rows of units to permit removal of the unit.*

To remove the ***I/O EXPRESS*** from DIN rail, slide a screwdriver into each of the mounting clips. Pull the clips down with the tip of the screwdriver while pivoting the ***I/O EXPRESS*** and screwdrvier handles upward.

Making Electrical and Communications Link Connections

Figure 9 shows how to multi-drop Masters and Masterless modules along the Comm Link(s), how to connect Slaves to Masters, and how to connect power to all modules in the system.

Recommended Ground Wiring Practices

The following ground wiring practices must be followed to ensure proper performance of the ***I/O EXPRESS***:

- Any Moore Industries product in a metal case or housing should be grounded.
- All input signals to, and output signals from, Moore Industries' products should be wired using a shielded, twisted pair technique. Shields are to be connected to an earth or safety ground at the unit itself.
- The maximum length of any unshielded input and/or output signal wiring is 2 inches.

CE Conformity

Installation of any Moore Industries products that carry the CE certification (Commission Electrotechnique) ***must*** adhere to the guidelines above in order to meet the requirements set forth in applicable EMC (Electromagnetic Compatibility) directives (EN55011, EN 50082-1, EN50082-2, etc.)

Consult the factory for the most current information on products that have been CE certified.

Making Connections to Field Instruments—Summary

Note that Figure 9 does not show field device (I/O) hook-ups to the Masterless and/or Slave modules. The illustrations following Figure 9 provide that information.

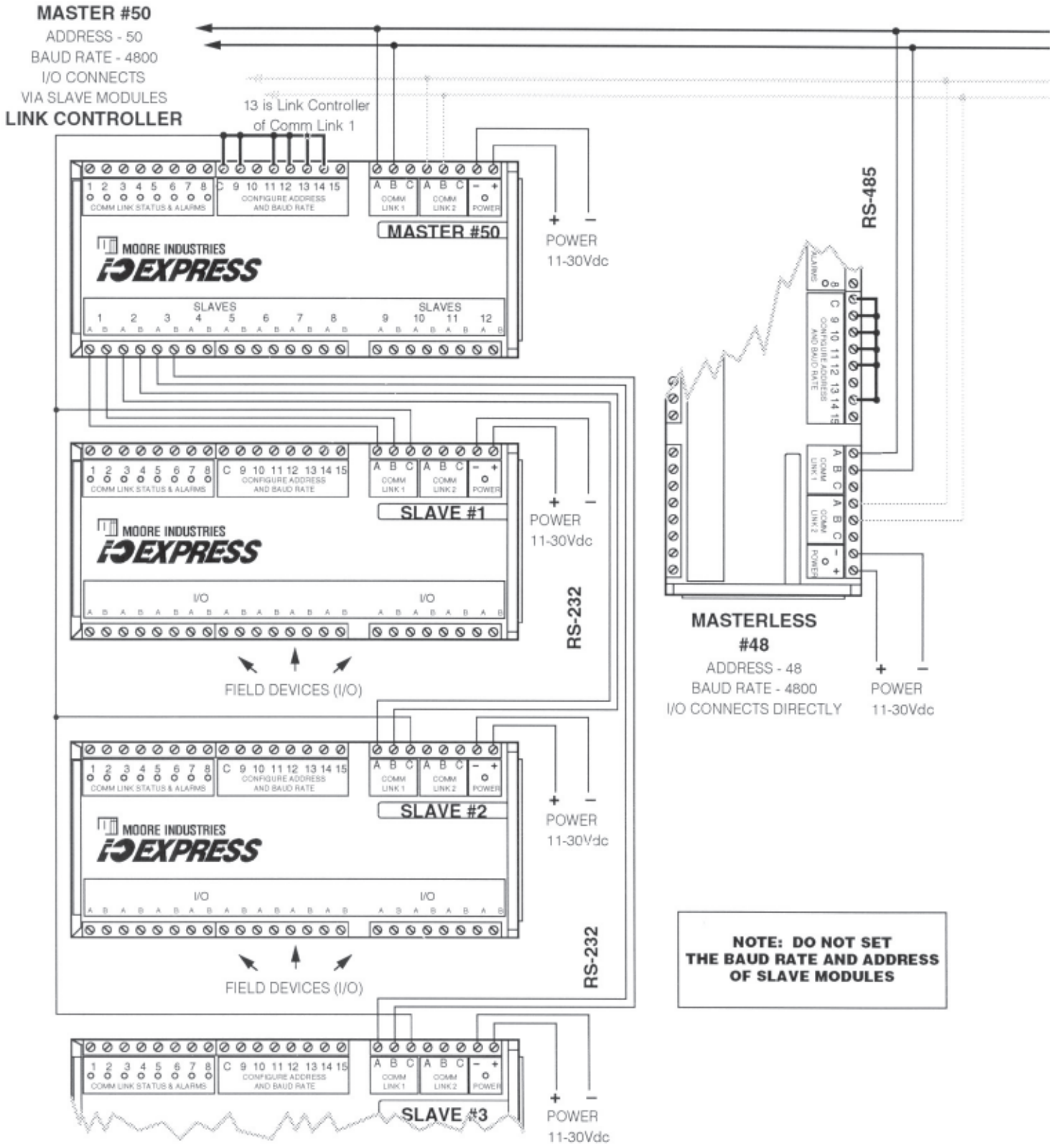
- Figure 10 shows how to connect analog inputs
- Figure 11 shows how to connect analog outputs
- Figure 12 shows how to connect 21 discrete inputs
- Figure 13 shows how to connect 21 discrete (open collector) outputs
- Figure 14 shows how to connect 8 relay outputs
- Figure 15 shows how to connect 12 relay outputs

IMPORTANT:

*Do not attach jumpers or wiring to the "CONFIGURE ADDRESS AND BAUD RATE" terminals of **I/O EXPRESS** Slave modules. The address of each connected Slave is controlled by its Master, and the baud rate for communications between Master and Slave modules is set at the factory (9600 baud).*

Jumpering these terminals will disable communications to the Slave, and cause communications errors, system-wide.

*Figure 9. Connecting Pairs of **I/O EXPRESS** Masters (and Masterless Modules), and Slaves to Masters*



Peer-to-Peer

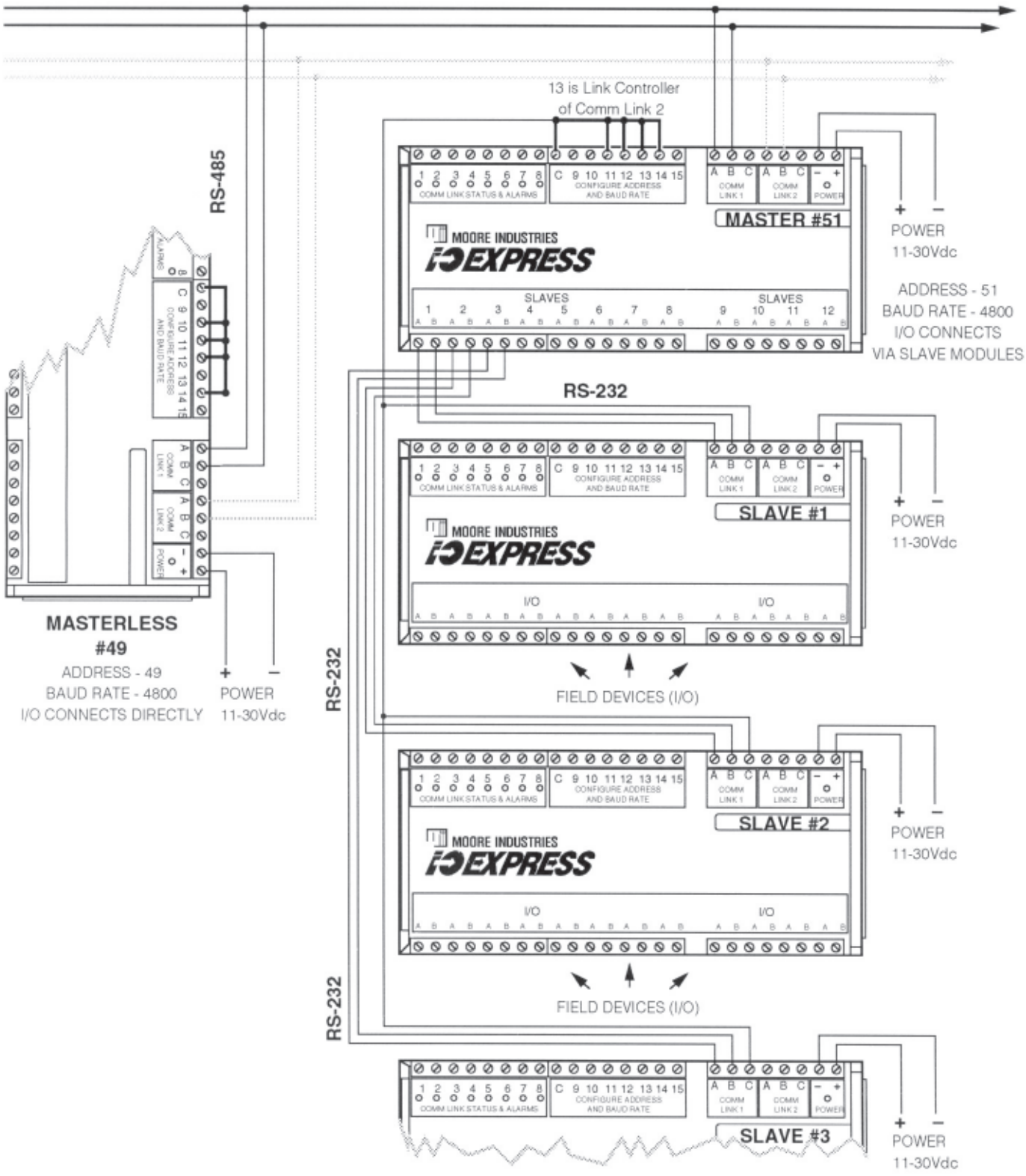

13 is Link Controller
of Comm Link 2
RS-485
MASTER #51
MOORE INDUSTRIES
I/O EXPRESS
POWER
11-30Vdc
ADDRESS - 51
BAUD RATE - 4800
I/O CONNECTS
VIA SLAVE MODULES
RS-232
SLAVE #1
FIELD DEVICES (I/O)
SLAVE #2
SLAVE #3
MASTERLESS
#49
ADDRESS - 49
BAUD RATE - 4800
I/O CONNECTS DIRECTLY

Figure 10. *Connecting Multiple Analog Inputs to* ***I/O EXPRESS*** *Slaves or Masterless Modules*

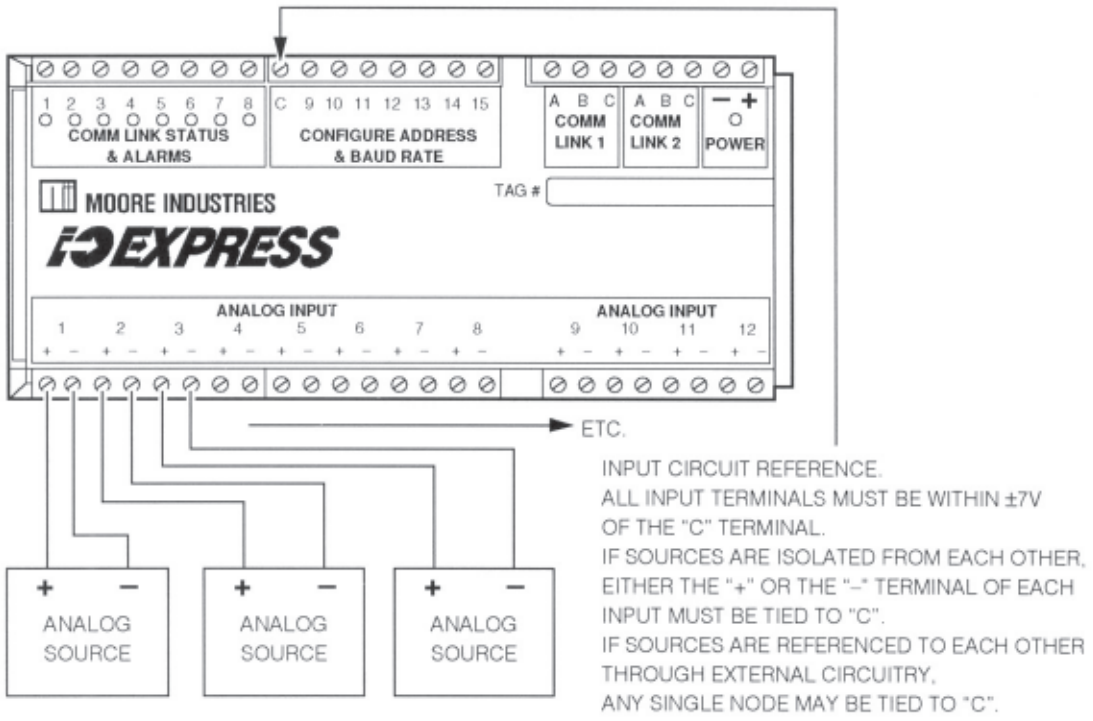
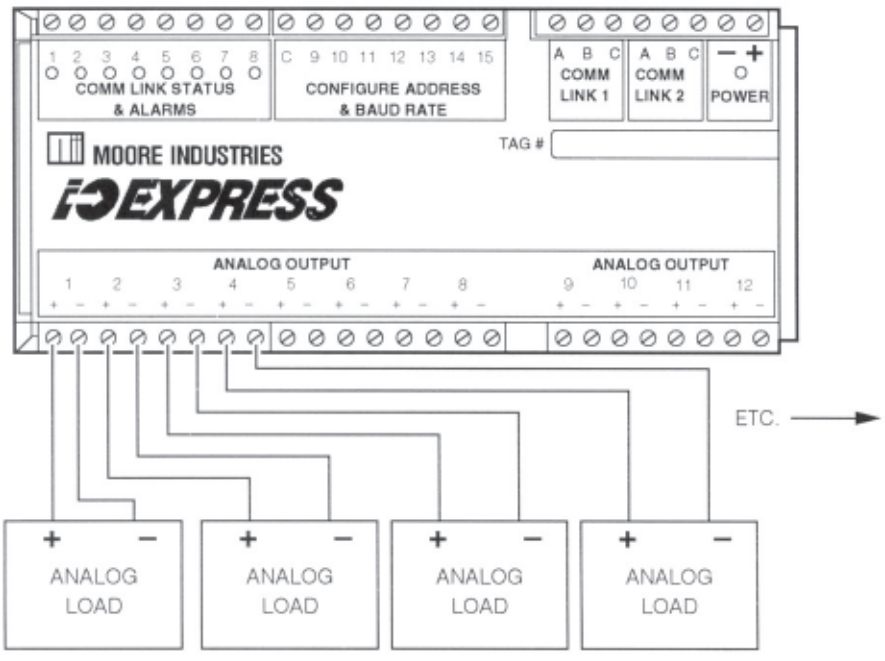
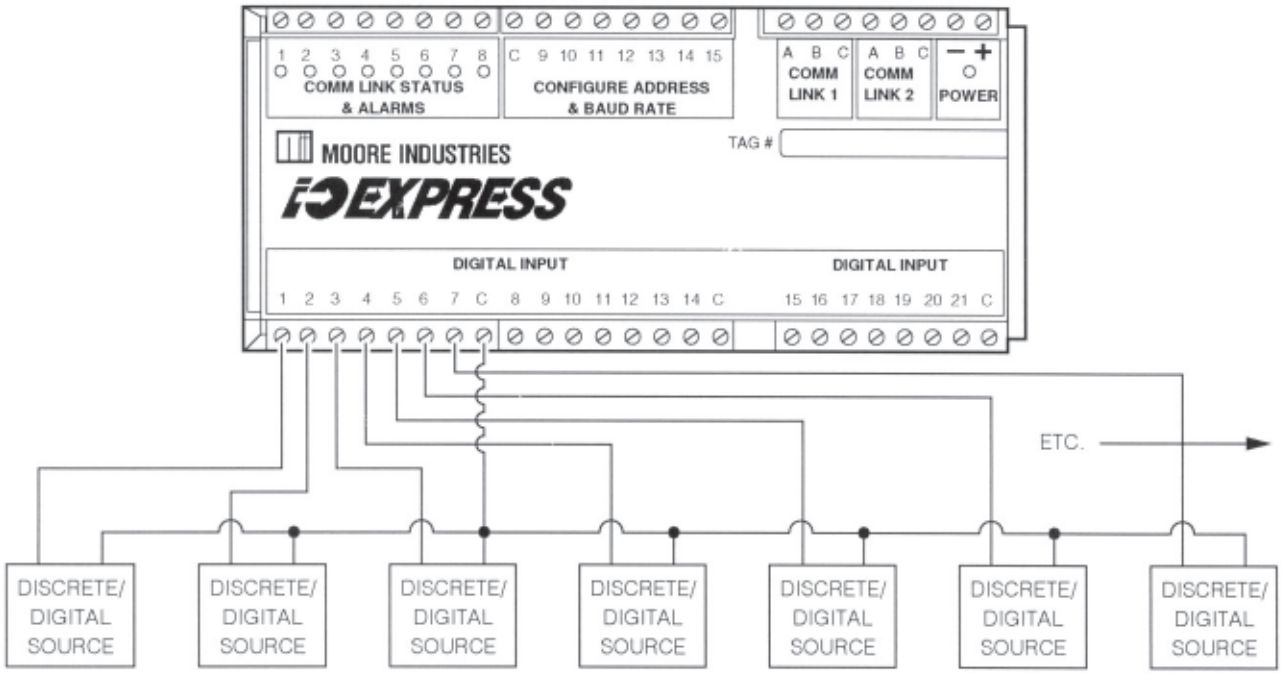


Figure 11. *Connecting Multiple Analog Outputs from* ***I/O EXPRESS*** *Slaves or Masterless Modules to Field Devices*



NOTE: THE "+" TERMINAL OF THIS MODULE PROVIDES THE VARIABLE CURRENT OUTPUT. THE "–" TERMINAL IS TIED, INTERNALLY, TO THE "–" POWER TERMINAL.

*Figure 12. Connecting Multiple, Discrete (Digital) Inputs to **I/O EXPRESS** Slaves or Masterless Modules*



NOTE: POLARITY OF THE INPUT DEVICES IS IMMATERIAL.

*Figure 13. Connecting Multiple, Discrete (Digital), Open Collector Outputs from **I/O EXPRESS** Slaves or Masterless Modules to Field Devices*

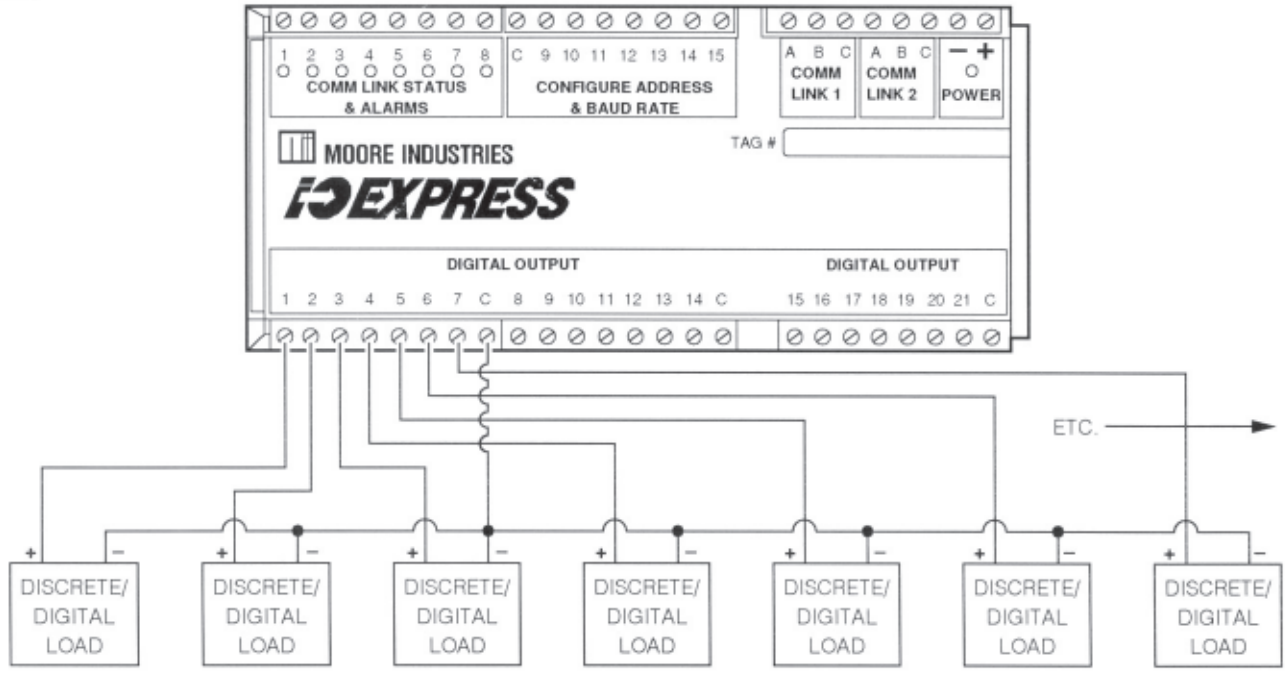


Figure 14. *Connecting 8 Relay Outputs from* ***I/O EXPRESS*** *Slaves or Masterless Modules to Field Devices*

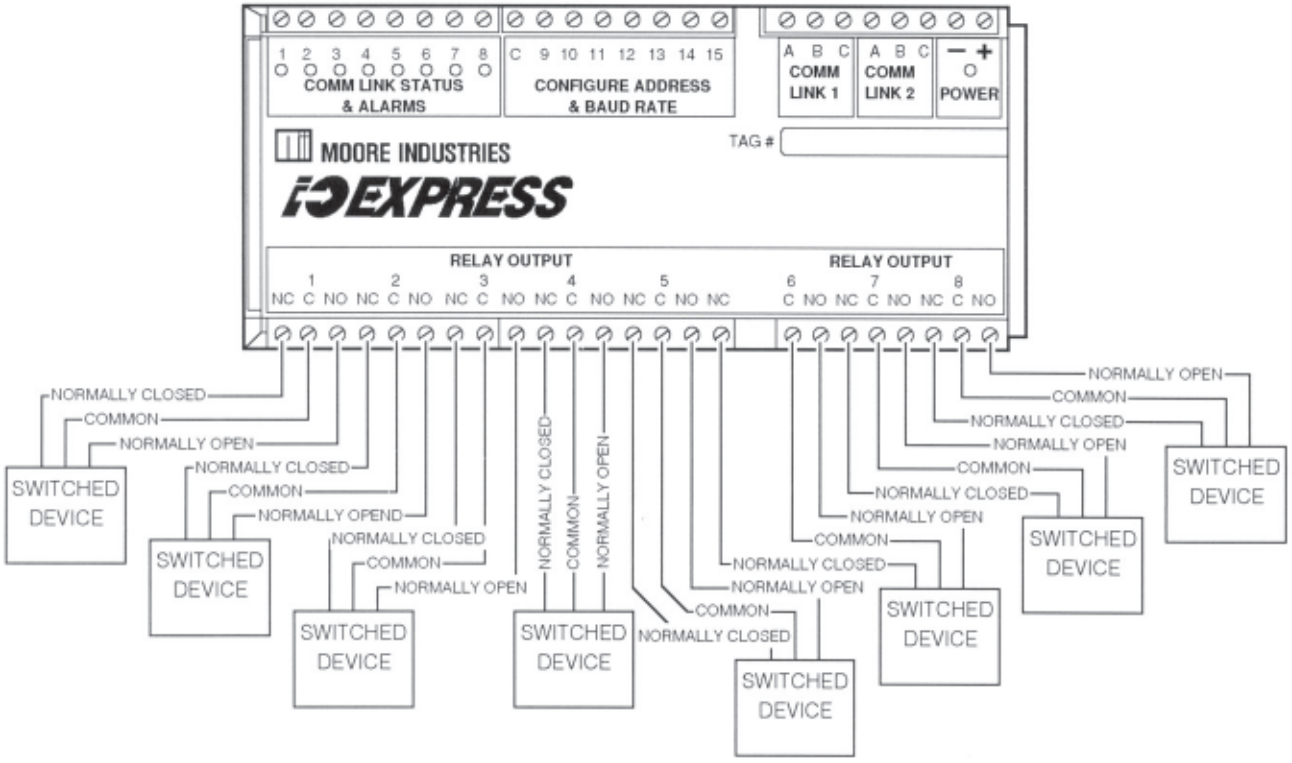
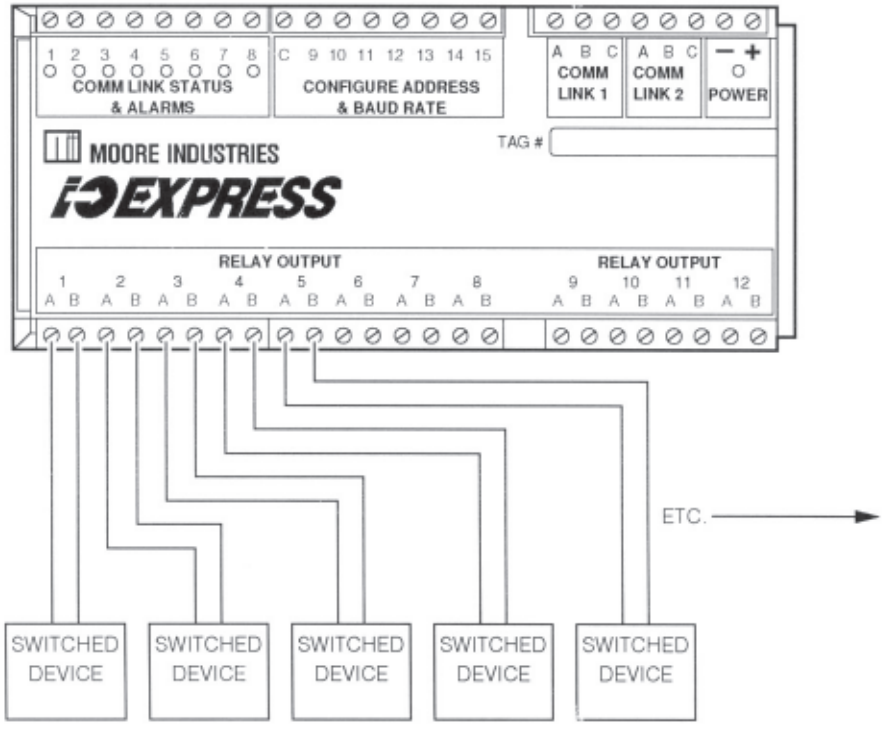


Figure 15. *Connecting 12 Relay Outputs from* ***I/O EXPRESS*** *Slaves or Masterless Modules to Field Devices*



Operation

Once connected properly in the application and supplied with appropriate power, the modules in your ***I/O EXPRESS*** will operate without further intervention. Moore Industries recommends a periodic check of terminals for tightness and cleanliness.

Status LEDs and Communications Alarms

There are 8 LEDs in the area of each unit's top panel labeled "Comm Link Status and Alarms". These indicate the status of both the unit's communications to and from the other modules connected on the Comm Link.

Each unit also has 4 open collector transistor outputs tied to the LEDs at terminals 5, 6, 7, and 8. These can be used with simple discrete devices to warn of communications faults.

Table 3 summarizes the way the LEDs and outputs work.

NOTE:
Terminals 1 through 6 DO NOT necessarily indicate that either link is "good" or "bad". If they are not pulsing, it may simply mean that there is no communications activity on that particular Comm Link.

Using a Host with Peer-to-Peer Systems

It is possible to connect and use a Host with either of the Comm Links in a Peer-to-Peer ***I/O EXPRESS*** system. When one comm link is connected in Peer-to-Peer mode, the other comm link can be used in Peer-to-Host mode. This allows the host to read all I/O data. A host should not write to an output module unless the Peer-to-Peer comm link is broken.

Any comm link that communicates with a host cannot be designated Link Controller. Just connect the Comm Link to the RS-485 port of a personal computer, or some similar type of Host.

***Table 3. I/O EXPRESS** Comm Link Status and Alarm Outputs*

	Terminals/LEDs						
Indication	**1**	**2**	**3**	**4**	**5**	**6**	**7&8**
Peer-to-Peer activity on Comm Link #1	PULSING	OFF	**DO NOT USE**	**DO NOT USE**	PULSING	OFF	7 is OFF 8 is PULSING
Peer-to-Peer activity on Comm Link #2	OFF	PULSING	**DO NOT USE**	**DO NOT USE**	OFF	PULSING	7 is OFF 8 is PULSING
No Comm Link Activity	OFF	OFF	**DO NOT USE**	**DO NOT USE**	OFF	OFF	7 is ON 8 is OFF

Using a subset of the standard, MODBUS RTU commands, the newly-installed Host can monitor and log data from all of the Slaves and Masterless modules in the system while the other Comm Link is operating normally.

To use the Host for system control, disable the other Comm Link. Refer to the Peer-to-Host Users' Manual for a list of the MODBUS commands and an explanation of how they work with ***I/O EXPRESS*** modules.

Complete Systems

Moore Industries configures complete, "turn-key" SCADA systems using the latest command and control software, the ***I/O EXPRESS***, and our proven line of premium signal conditioners and transmitters. For more information, or for information on how to use the ***I/O EXPRESS*** with a Host, obtain a copy of the Peer-to-Host Users' Manual from your Moore Industries Sales Representative, or contact the factory.

Customer Support

Moore Industries is recognized as the industry leader in delivering top quality to its customers, both in products and services. We perform a battery of stringent quality assurance checks on every unit we ship. If any Moore Industries product fails to perform up to rated specifications, call us for help. Our highly skilled staff of trained technicians and engineers pride themselves on their ability to provide timely, accurate, and practical answers to your process instrumentation questions.

If problems involve a particular DDS, there are several pieces of information you can gather ***before*** you call the factory that will help our staff to get you answers more efficiently. When you call, please have:

- The model number of the unit in question.
- The serial number of the unit in question.
- The job number (if available).
- The purchase order under which the unit was shipped (if available).

Factory phone numbers are on the back cover.

Moore Industries

STAR CENTER

Providing Instrumentation fast from our Quick-Ship Facilities!

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- Temperature Transmitters
- I/P and P/I Converters
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- Alarm Trips
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RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

   Warranty Repair –
   If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

   Non-Warranty Repair –
   If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
   a) A note listing the symptoms that indicate the unit needs repair
   b) Complete shipping information for return of the equipment after repair
   c) The name and phone number of the person to contact if questions arise at the factory

3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.

4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

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August 1996

Correction

Data in the *Ordering Information* Table on Page 5 of the DDS I/O Express Peer-to-Peer Distributed Data System User's Manual, P/N: 293-701-00, Revision B, lists incorrect specificatons in the "Input/Output Configuration" column for the Relay Outputs. The correct information is described below:

RO8: 8 Relay Outputs (SPDT, rated 3A@24Vdc and 110Vac)

RO12: 12 Relay Outputs (Normally Open, SPST, rated 1A@24Vdc and 0.5A@110Vac)

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