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Input/Output Expander, 8 Status

Model: IO2000-8S

Revised 03/09/06 Corrected RTU2000 Configuration screen shots.

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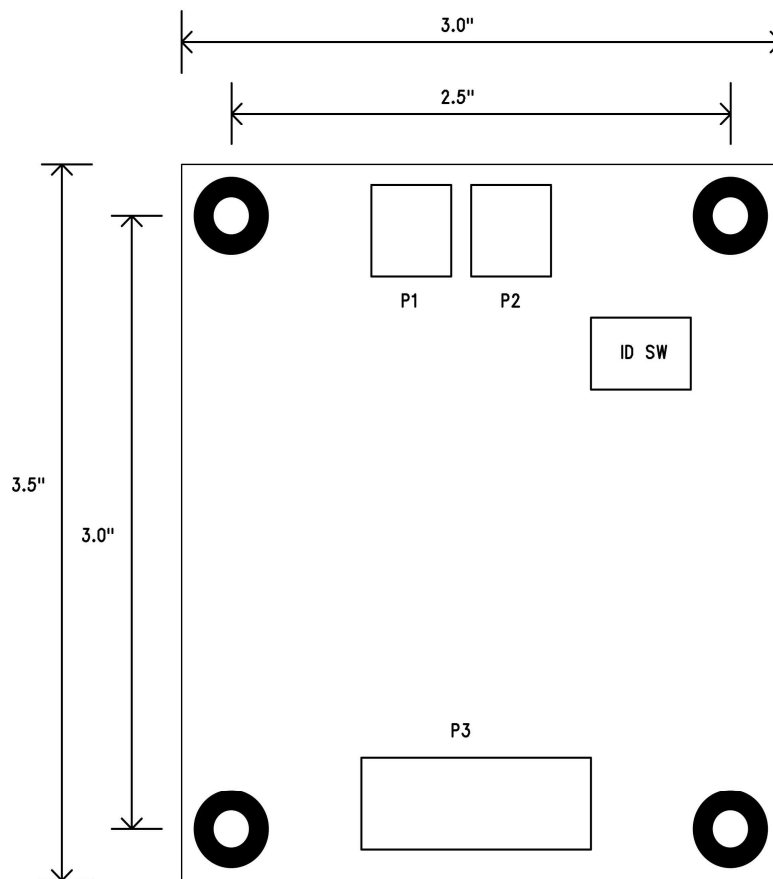
Introduction

This product is designed for connection to a RTU2000, and adds 8 status inputs to the RTU's IO configuration.

Specification

Parameter	Condition/Description	Value
Size		Inches 3.5" L x 3.0" W x 1.0 H MM 89 L x 76 W x 25 H
Temperature range		-40 to 176° F -40 to +80° C
Power Supply Voltage		10 - 30 VDC
Power Supply Current		< 10 mAmps
Status Inputs (8 ea.)		
max. safe input voltage	Continuous at 25° C	60
threshold voltage	Input on (AC RMS or DC)	< -3 or > +3V
input current	Input to common = +12V	2 mAmps
Surge withstand capability -		
Status inputs	ANSI/IEEE C37.90-1989	
Communications interface	EIA type RS-485	

Mechanical



The diagram above shows the mounting and overall dimensions.

Standoffs are permanently mounted to the IO2000 board, allowing the board to be directly mounted to a flat surface, using #4 screws.

Electrical

Connectors

The IO2000 field connections are by pin and socket type connectors, identical to those used on the RTU2000. The pins are located on the printed circuit board (PCB), shrouded by a nylon housing (header). The sockets are each crimped onto a wire, then inserted into a nylon receptacle. This receptacle then plugs into the PCB header. A positive lock on the receptacle engages the header to prevent accidental disconnection.

The receptacle and socket pins are not supplied with the IO2000. They are available as an option from Reliatronics, or may be purchased separately from a number of sources.

A wiring kit is available from Reliatronics, with color coded wires pre-attached to the connectors. Part number H20008S is described at the end of this document.

Part numbers are listed below. The parts are manufactured by Molex, (Mini-Fit, Jr. Series 5557-NR), and are available from many sources, a few which are listed below:

4 Position Connector (Power, EIA-485)

Molex	Allied	Mouser	Digi-Key
39-01-2040	863-1123	538-39-01-2040	WM3701

14 Position Connector (Status Inputs)

Molex	Allied	Mouser	Digi-Key
39-01-2140	863-1128	538-39-01-2140	WM3706

Socket pins, for 24-18 AWG wire (Insulation range 0.051-0.122 inches)

Molex	Allied	Mouser	Digi-Key	Newark
39-00-0039	863-1116	538-39-00-0039	WM2501	89F1646

Socket pins, for 28-22 AWG wire (Insulation range 0.035-0.071 inches)

Molex	Allied	Mouser	Digi-Key	Newark
39-00-0047	863-1118	538-39-00-0047	WM2503	89F1647

Tools

An ordinary crimp tool can be used to crimp the pins onto the wire, but you may want to buy Molex part number 11-01-0014. It costs less than \$15, and is sized specifically for these contacts.

A much better tool is also available. Molex part number 11-01-0197 for the 24-18 AWG pins, and 11-01-98 for the 28-22 AWG pins. These tools are more expensive (> \$200 cost) but make a secure, controlled pressure crimp. There are also much faster.

Removing a contact from a receptacle can be a daunting task. You can use a couple of miniature screwdrivers and lots of patience, or you can use Molex part number 11-03-0044 (which replaces 11-03-0038) to easily remove the pin. This tool costs about \$30.

Wiring the connector

Strip about 1/8" of the insulation from the wire end, then crimp to the socket (the larger "U" of the pin crimps onto the insulation, the smaller to the conductor).

Next, insert the socket from the top of the receptacle (away from the RTU). Note that the socket must be rotated correctly when inserted. (There are two small anti-rotation tabs on the socket, which should face the same direction as the receptacle's latch).

Sources

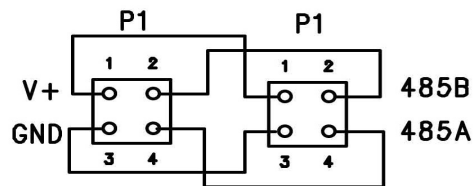
Name	Phone
Molex Incorporated	(708) 969-4550
Allied Electronics	(800) 433-5700
Mouser Electronics	(817) 483-4422
Digi-Key	(800) 344-4539

Wiring

Power and Communications Wiring

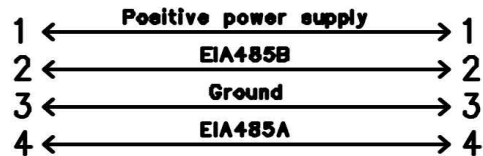
Two identical 4 pin connectors (P1 and P2) are provided. The two connectors are wired in parallel via the IO2000's internal connection.

Figure 1 Internal P1, P2 Connections



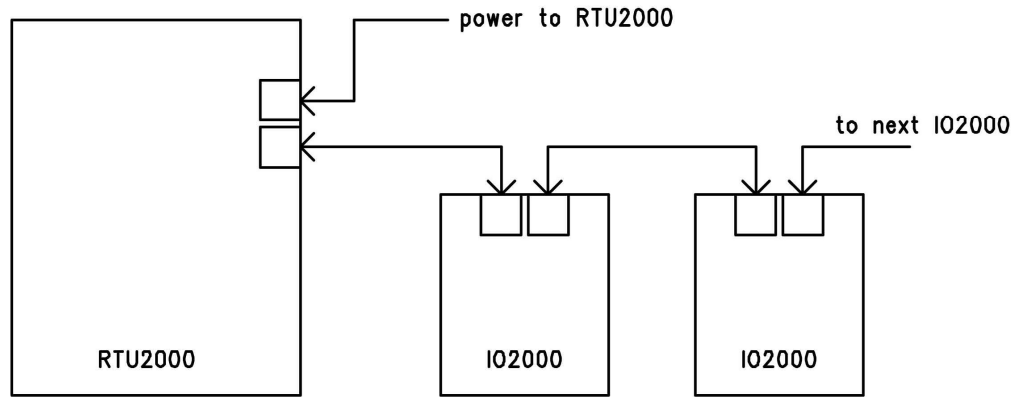
IO2000 modules and RTU2000s may be connected together using 4 wire cables, with a 4 position Molex receptacle on each end.

Figure 2 Power/EIA485 Connecting Cable



You can connect a number of IO2000 modules to a RTU2000, using these cables.

Figure 3 Connecting multiple devices

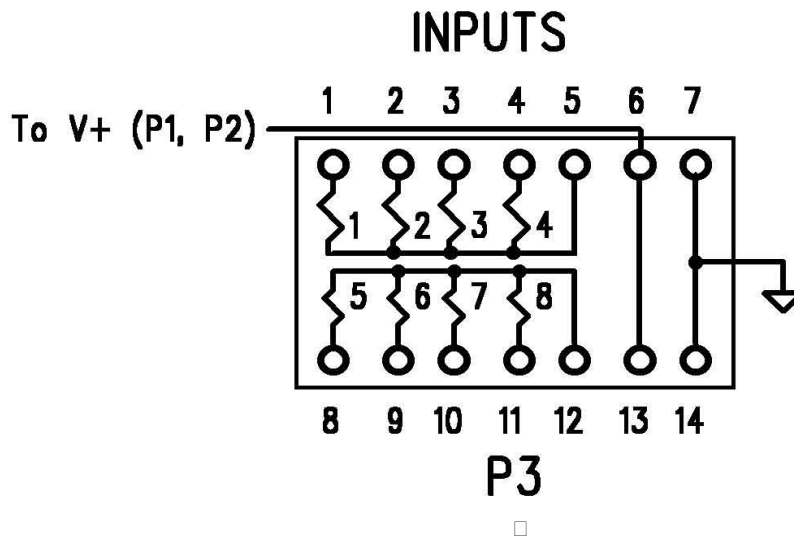


Input voltage can range from 9 to 30 volts DC. The current drain remains almost constant over the entire voltage range.

Status Input Wiring

The eight status inputs are solid state, optically isolated, and surge protected. The simplified wiring diagram below illustrates the connection scheme used.

Figure 4 - Status Input Wiring



Each input is represented by the resistor symbol, with the number of the input next to the symbol. The input is “on” when current flows through the symbol, and “off” when it does not. To turn on one of the status inputs you simply apply a voltage to the input that is different from the voltage connected to the common. If this voltage is greater than about 3 volts, the input will be turned on.

If input 1 is on, then bit 0 of MR[INPUTS] will be set to one. Inputs 2-7 control bits 1-7, respectively.

The status input circuit is isolated from the RTU power supply (note however, that the surge protection circuit will limit the voltage range at the inputs to about 30 V).

The surge protection circuit protects the RTU from high voltage surges that may be present on the status and analog inputs caused by lightning, inductive switching, etc. The protection scheme limits the input current to a level that the RTU components can withstand, rather than clamping the surge voltage at the input terminal. The input surge protection limit is therefore specified in terms of voltage, not current.

WARNING! The protection circuitry is designed to protect the RTU from short duration, high voltage surges. If the maximum safe input voltage is exceeded for any appreciable amount of time, overheating and subsequent permanent damage to the RTU will result.

Metal oxide varistors (MOV's) act as voltage clamps to ground when the voltage exceeds a preset value, while a large wire-wound resistor limits the current. If the voltage on a status input is less than 30 volts, the MOV has an insignificant effect. A 3000 volt surge causes the MOV to clamp at about 45 volts (at a current of less than one amp), which is easily within the survival range of the rest of the circuitry.

Note the physical connector, and electrical characteristics of the IO2000-8S status inputs, are identical to the RTU2000 status inputs (RTU2000 connector P3).

Status inputs are sampled by the IO2000-8S 1000 times a second (once each millisecond), with a debounce filter preset to 10 milliseconds.

An input change is stored, along with the relative time, with 1 millisecond resolution. The time corresponds to the **output** of the debounce filter.

LED Indicators

COMM LED - Flashes each time that the device communicates to an external device (RTU2000).

INPUT LED - Flashes once for each of the 8 inputs, then pauses for two seconds. A short flash indicates the input is off, a long flash that the input is on.

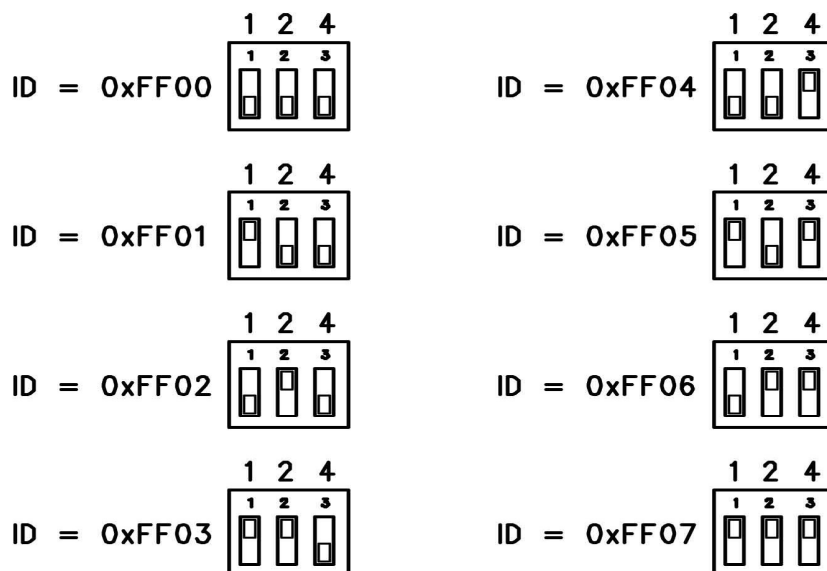
Setting the Address Switch

A 3 position switch is used to set the network address. The RTU2000 communicates to the IO2000 modules, using DNP 3.0 protocol. The ID, listed below in the diagram, is the DNP "outstation address", expressed in hexadecimal.

Each device on the EIA485 network must have a unique address.

Addresses for devices connected to the RTU2000 EIA485 port must be consecutive, and must start at 0xFF00. For example, if there is only one device, it must be addressed as 0xFF00. If there are two devices, one must be addressed as 0xFF00, and the other as 0xFF01.

Figure 5 - IO2000 ID switch settings.



RTU2000 configuration

To configure a single IO2000-8S, connected to a RTU2000:

- Set the IO2000-8S address switch to 0xFF00.
- Configure the RTU2000 to read 8 inputs on the device with this ID.
- Configure the RTU2000 to locate these starting at an index not used by the RTU2000's internal inputs. The internal inputs use index 0 through 7. If we start the IO2000-8S inputs at index 8, then these inputs will appear to a DNP master, as index 8-15 on the RTU2000.
- Configure the DNP Static Binary output range to include these additional inputs. This insures that output status will be read by a DNP query that does not specifically stipulate a range (such as a class 0 query).

Configure RTU2000

Save, Restore, Upload Basic Communications I/O and Diagnostic LED Analog, Sensor Setup Fault Detection

DNP - Basic DNP - Var/Class/Range DNP - Analog Inputs External IO / RS-485 port

External IO / RS-485 port

RS-232/RS-485 Router
Route messages to/from RS-485 port, starting with
Outstation ID = Route a total of IDs.

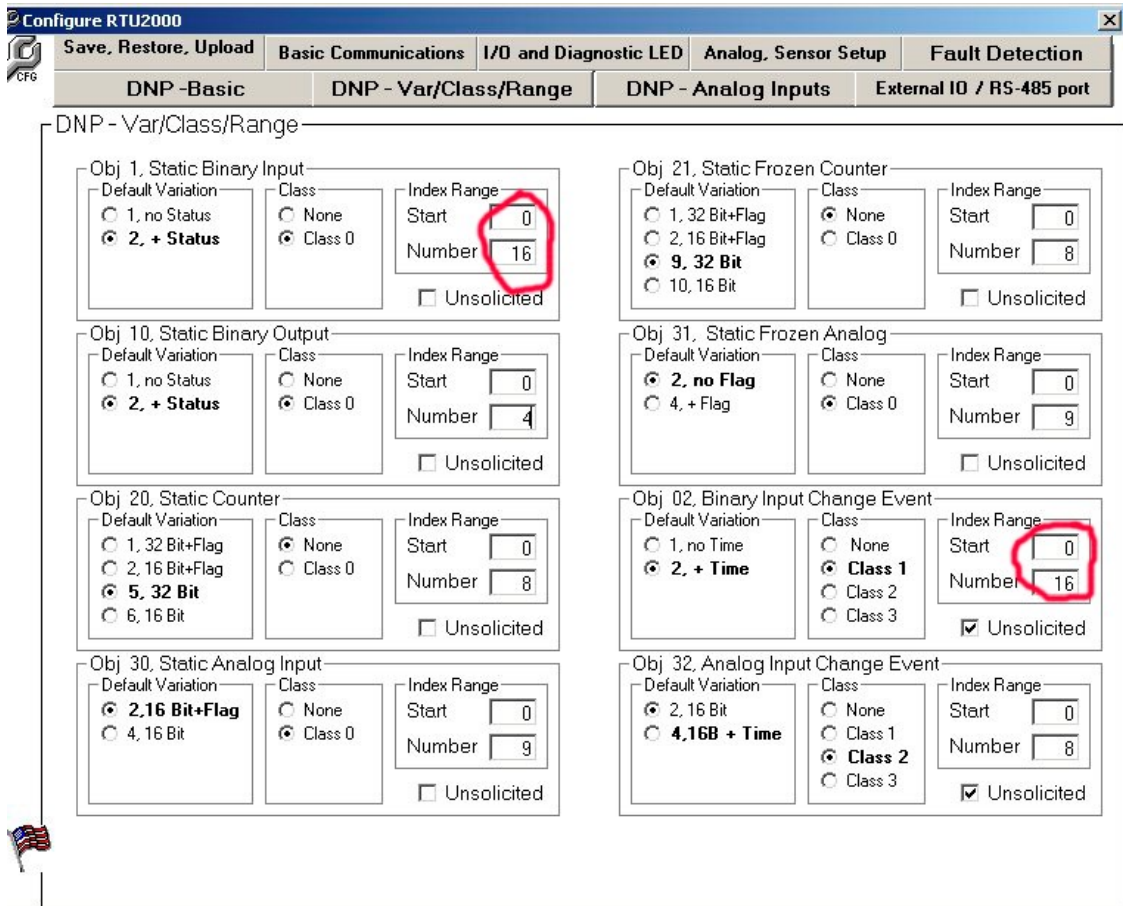
Data Concentrator, External IO

	Status Inputs		Control Outputs		Analog Inputs	
	Start Index	Get this Number	Start Index	Control this Number	Store at Ext 1 +	Get this Number
Remote ID = <u>0xFF00</u>	8	8	0	0	0	0
Remote ID = 0xFF01	0	0	0	0	0	0
Remote ID = 0xFF02	0	0	0	0	0	0
Remote ID = 0xFF03	0	0	0	0	0	0
Remote ID = 0xFF04	0	0	0	0	0	0
Remote ID = 0xFF05	0	0	0	0	0	0
Remote ID = 0xFF06	0	0	0	0	0	0
Remote ID = 0xFF07	0	0	0	0	0	0

Start Index - Report external index 0 at this local index.
Note: Index 0-15 reserved for local status inputs, or 0-32 if fault detection is enabled.
Index 0-3 reserved for local control outputs.

Analog Inputs - Store in External memory block, then select with "DNP - Analog Input" tab.

The screen above configures the RTU2000 to read 8 inputs on device 0xFF00, and to locate them starting at DNP index 8.



The screen above increases the range for points that will be returned in a response, where the number of points is not specified.

Note that the range is increased for both object 1 and object 2.

To configure a IO2000-8S and a IO2000-4R, connected to a RTU2000:

- Set the IO2000-8S address switch to 0xFF00*.
- Set the IO2000-4R address switch to 0xFF01*.
- Configure the RTU2000 to read 8 inputs on the device with ID = 0xFF00.
- Configure the RTU2000 to control 4 outputs on the device with ID = 0xFF01.
- Configure the RTU2000 to locate these inputs and outputs at DNP indexes not otherwise used.

Configure RTU2000

Save, Restore, Upload Basic Communications I/O and Diagnostic LED Analog, Sensor Setup Fault Detection

DNP -Basic DNP - Var/Class/Range DNP - Analog Inputs External IO / RS-485 port

External IO / RS-485 port

RS-232/RS-485 Router
Route messages to/from RS-485 port, starting with
Outstation ID = Route a total of IDs.

Data Concentrator, External IO

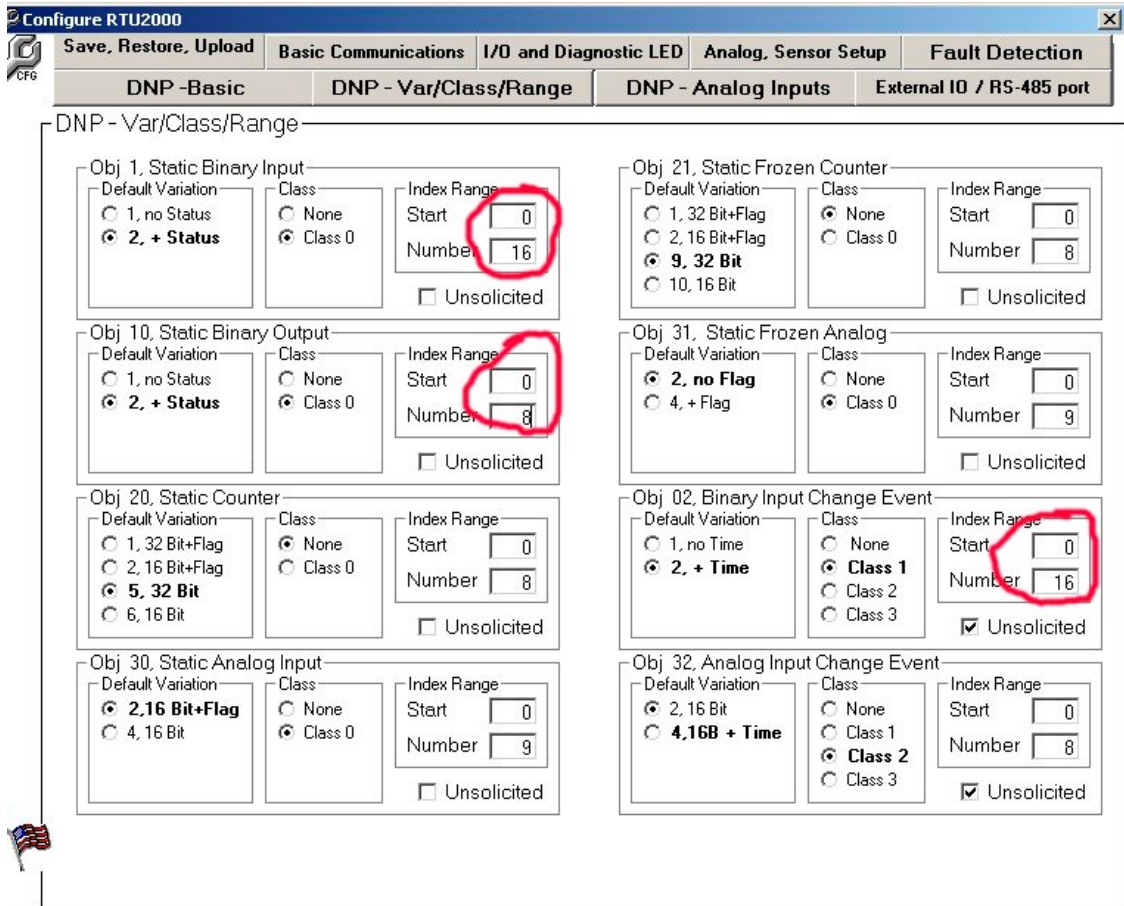
	Status Inputs		Control Outputs		Analog Inputs	
	Start Index	Get this Number	Start Index	Control this Number	Store at Ext 1 +	Get this Number
Remote ID = <u>0xFF00</u>	<u>8</u>	<u>8</u>	0	0	0	0
Remote ID = <u>0xFF01</u>	0	0	<u>4</u>	<u>4</u>	0	0
Remote ID = 0xFF02	0	0	0	0	0	0
Remote ID = 0xFF03	0	0	0	0	0	0
Remote ID = 0xFF04	0	0	0	0	0	0
Remote ID = 0xFF05	0	0	0	0	0	0
Remote ID = 0xFF06	0	0	0	0	0	0
Remote ID = 0xFF07	0	0	0	0	0	0

Start Index - Report external index 0 at this local index.
Note: Index 0-15 reserved for local status inputs, or 0-32 if fault detection is enabled.
Index 0-3 reserved for local control outputs.

Analog Inputs - Store in External memory block, then select with "DNP - Analog Input" tab.

The screen above configures the RTU2000 to read 8 inputs on device 0xFF00, locate them starting at index 8, and control 4 points on device 0xFF01, locating them starting at index 4

* We could have set the IO2000-8S ID to 0xFF01, and the IO2000-4R ID to 0xFF00, and swapped the "Index/Number" data for the two remote ID rows.



The screen above increases the range for points that will be returned in a response, where the number of points is not specified.

Optional Wiring Harness, PN H2000-8S

Power, EIA485 Connection

Molex part number 39-01-2040 mounted on both ends of 12" wires.

Pin Number	Function	Wire Color
1	+12V Power	Red
2	EIA485-A	White
3	Ground	Black
4	EIA485-B	Blue

Status Inputs

Molex part number 39-01-2140 mounted on one end of 48" flying leads.

Pin Number	Function	Wire Color
1	Input 1	Violet
2	Input 2	White
3	Input 3	Green
4	Input 4	Yellow
5	Input 1-4 common	Red w/ Black
6	+12V Power	Red
7	Ground	Black
8	Input 5	Blue
9	Input 6	Orange
10	Input 7	Slate
11	Input 8	Brown
12	Input 5-8 common	Blue w/ Orange
13	+12V Power	
14	Ground	