1782-JDA8
SmartMux-Lite™ / DeviceNet™
User's Manual

Western Reserve Controls, Inc.

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1. Overview

The 1782-JDA8 SmartMux-Lite™ is a remote industrial I/O device that multiplexes analog and discrete data acquisition and control signals in industrial or commercial applications. The 1782-JDA8 is DIN-mounted and supports serial communications on a DeviceNet™ link.

The 1782-JDA8 (also referred to as "JDA8" or SmartMux-Lite) multiplexes eight (8) points of analog and discrete I/O through WRC's 1781-7B and WRC7 Series Analog I/O Modules and 1781-__XS Series Discrete I/O Modules, which plug directly into the multiplexer assembly. Any channel may be an analog or discrete input, four channels may be analog outputs and two channels may be discrete inputs. A large selection of I/O modules are available for each type of I/O signal.

The SmartMux-Lite multiplexer is designed as a Group 2 Only Server on the DeviceNet system and its I/O is read by and written to by another device on the link defined as a DeviceNet Master. JDA8 supports the Predefined Master/Slave Explicit Message Connection, Polled I/O, Cyclic I/O and Bit-Strobe.

The device address, data rate and other parameters are software-configurable and are changed from the default by a third-party configuration tool. There are no jumpers and switches for the user to set. Each JDA8 has 2 green/red LEDs - one for module status and one for network status. Section 5 of this document describes the installation of the JDA8 multiplexer.

1.1. Features

The 1782-JDA8 has the following features:

- 8 Analog Input Channels - 12-bit conversion
- 4 Analog Output Channels - 12-bit conversion
- Up to 8 points of Discrete Input Signals - 4000V Isolation
- Up to 2 Discrete Outputs - 4000V Isolation
- Point-by-Point Mix-and-Match Analog / Discrete Signals
- Wide Range of Analog Inputs Available - T/C, RTD, Strain Gage, 4-20 mA, etc.
- Isolated Analog Input (1500 V) and non-isolated signals available
- Multiple Data Options:
    - Polled I/O
    - Cyclic Inputs
    - Bit-Strobe I/O
- Software Configurable Parameters
- DeviceNet compatible
- Convenient DIN mounting

1.2. DeviceNet System Architecture

A DeviceNet network is a distributed I/O system that may contain many different products from several different vendors. Products may be configured uniformly, as clusters, or as distributed clusters. Up to 64 devices, including the master, may be attached to a single DeviceNet network. Any of these, except the master, may be a SmartMux-Lite. A typical system will include a master, such as a PLC or industrial PC, and multiple slave devices.

1.3. Basic Operation

The JDA8 operates as an analog and digital I/O device on the DeviceNet network. It is a slave device which can be assigned (allocated) by the system implementer to one specific master. The DeviceNet Master can receive and send analog and discrete data to and from the JDA8 via the several methods described in this section.

I/O methods for the I/O are:

Analog Inputs:	Polled, Cyclic
Discrete Inputs:	Polled, Cyclic, Bit-Strobe
Analog Outputs:	Polled
Discrete Outputs:	Polled, Bit-Strobe

1.3.1. Polled I/O

The master can explicitly poll (interrogate) the analog and discrete input data from the JDA8. When a poll command is received, eight channels of data (2 bytes per channel) will be returned from the JDA8 in a Polled Response Message. Analog inputs (AI's) will be returned as 12-bit values and discrete inputs (DI's) will be returned as a one or zero (1 or 0). Channels configured as outputs will return zeros as data.

If the Poll Command contains data, the JDA8 will accept the data and set the analog outputs (AO's) and discrete outputs (DO's) to the appropriate values. Up to 6 channels of data (2 bytes each) will be received, the first for the four AO's and the last 2 for the DO's. Output data sent to a module position which contains an input module will be ignored.

Poll data must be sent using the DeviceNet Fragmented I/O Protocol.

1.3.2. Cyclic I/O

Cyclic I/O is the function by which a slave device sends all its input data to the master at a specific time period without the host explicitly requesting it. When the specified time interval elapses the entire input data (all eight analog input channels) are transmitted to the master. The only user-defined configuration required is to set up the time interval.

1.3.3. Bit-Strobe Message

A Bit-Strobe Message is a very fast method by which the master can send one bit to and receive up to 8 bytes of data response from each slave device on the network. The JDA8 supports the Bit-Strobe feature and returns its 8 channels of discrete input data as a Bit-Strobe Response when a Bit-Strobe Command is received. For channels that are configured as DI's, then the corresponding bits in the one byte bit-Strobe response will be set or reset according to the state of the actual input signal from the field sensor. Each non-DI bit channel will returned a zero (0) in its bit location.

A Discrete Output module in Channel 7 will be set or reset based upon the JDA8's strobe bit sent from the master. It the last channel is not a DO, the received strobe bit will be ignored.

No user-defined configuration is required.

1.4. Default I/O Configuration

All 8 channels are set as analog inputs at the factory. Polled and Bit-Strobe I/O are enabled. Cyclic I/O is not enabled.

1.5. EDS

An EDS (Electronic Data Sheet), which describes the various parameters of the JDA8, is shipped with your device or is available on WRC's web site: http://www.wrcakron.com

2. Using This Manual

This manual serves to help the user to understand the capabilities of the SmartMux-Lite product family, how to install and configure an I/O subsystem using these products, and how to generate the commands from the system host to read data from or write data to the SmartMux-Lite.

Section 3 describes how to quickly connect your SmartMux-Lite and get it up and running on the DeviceNet link.

Section 4 provides the technical specifications for the products described in this manual.

Section 5 describes the installation of the hardware, including mounting, connection to other I/O subsystem components, power requirements and configuration of the operating parameters of the SmartMux-Lite.

Section 6 describes the DeviceNet Profile and DeviceNet Object data for these products.

Section 7 lists common accessories that are used with the JDA8.

Section 8 provides some troubleshooting hints in the event your SmartMux-Lite or I/O system is not operating as anticipated.

Appendix A provides guidelines in setting up and using the JDA8 with Cutler-Hammer's NetView and NetSolver software packages.

3. Quick Start

To quickly and easily install your SmartMux-Lite in your DeviceNet system, follow the instructions below. For more details, see Section 5.

To Install and DeviceNet Establish Communications

1. Remove the SmartMux-Lite from the box and connect your DeviceNet cable to the 5-pin plug (supplied) according to DeviceNet cable wiring specifications.
2. Make sure that the DeviceNet network is terminated properly.
3. Make sure that there is power on the DeviceNet network and plug the cable into the SmartMux-Lite.
4. The SmartMux-Lite will undergo its initialization sequence, flashing both LEDs. After approximately 5 seconds, the Module Status LED (labeled "MS") will go on solid green and network LED will flash green.
5. The green Network Status LED (labeled "NS") will go on solid once the Master recognizes the unit on the link and allocates the connection.
6. The SmartMux-Lite is now operating on the network.

To Configure the Node Address and Baud Rate

1. You may change the device address and/or the baud rate, using your configuration tool or a command from the Master. (Defaults are 63 and 125k baud.)
2. If you change the device address, the SmartMux-Lite will reset and assume the address.
3. If you change the baud rate, the new baud rate will not become effective until the unit is power cycled or a Reset command is received from the Master.

To Read Analog Input and/or Discrete Input Data

1. Remove power from the JDA8 and install your WRC AI or DI modules in any or all channels.

(Warning: Do not insert or remove I/O modules under power. You may damage the modules or the JDA8 and unpredictable operation may occur.)

2. Set up the poll input data field to be 16 bytes in your Master's scan table.
3. If necessary, perform a Poll Connection (Connection Instance 2) to the SmartMux-Lite from the Master.
4. Perform a poll command to the SmartMux-Lite from the Master. Each datum value returned in a 2-byte field. The format of the poll input data is:

   AI channels: a 12-bit value

   DI channels: a 1 or 0.

To Write Analog Output and/or Discrete Input Data

1. Remove power from the JDA8 and install your WRC AO and/or DO modules in the appropriate channels.

(Warning: Do not insert or remove I/O modules under power. You may damage the modules or the JDA8 and unpredictable operation may occur.)

2. Set up the poll output data field to be 12 bytes in your Master's scan table.
3. If necessary, perform a Poll Connection (Connection Instance 2) to the SmartMux-Lite from the Master.
4. Perform a poll command to the SmartMux-Lite from the Master. The format of the poll input data is:

   AI channels: a 12-bit value, in 2-byte pairs, bytes 0-7.

   DI channels: a 1 or 0, in 2-byte pairs, bytes 8-11.

4. General Specifications

Product: 1782-JDA8 SmartMux-Lite DeviceNet for Single-Point Analog 7B Input Modules

Description: Remote multiplexer, compatible with ODVA's DeviceNet protocol for analog input signals, which will directly support up to eight (8) WRC 1781-7B or WRC7 series analog input modules

Device Type: Generic Device ($0x00_{hex}$)

Product Revision: 1.00

DeviceNet Conformance: Designed to conform to the ODVA DeviceNet Specification Volume I and II, Version 2.0.

Communications: Predefined Master/Slave Connection Set, Group 2 Only Server

Baud rate: 125k, 250, 500k - software selectable (default = 125k)

Address selection: Address number 1 to 63, software selectable (default = 63)

DeviceNet Connection:

SmartMux-Lite:	5-pin pluggable header (male) Phoenix Contact MSTBA 2.5/5-G-5.08/AU
DeviceNet Cable:	5-contact plug (female contacts) Phoenix Contact MSTB 2.5/5-ST-5.08/AU (included)

Status Indicators:

Module Status:	green/red bi-color LED
Network Status:	green/red bi-color LED

Voltage Isolation: Provided by I/O modules (1500V typical analog, 4000V typical discrete)

Max Power: 15 watts: 1.4 A @ 11 Vdc - 600 mA @ 25 Vdc unregulated power supply, including analog modules (power provided by the DeviceNet network)

Analog Inputs: up to eight (8) WRC 1781-7B or WRC7 Series or equivalent input modules
0-10 Vdc output option
refresh rate <1 ms for all inputs
12-bit ADC
Cold-junction compensation included for each point position

Analog Outputs: up to four (4) WRC 1781-7B or WRC7 Series or equivalent output modules
channel positions 0 - 3
0-10 Vdc output option
refresh rate <500 usec for all inputs
12-bit ADC

Discrete Inputs: up to 8 Discrete Input modules, WRC model 1781-I_XS or 1781-SWXS
any channel position
refresh rate <1 msec for all inputs

Discrete Outputs: up to 2 Discrete Output modules, WRC model 1781-O_XS, -R_XS, W_XS
channel positions 6 - 7
refresh rate <1 msec for all outputs

I/O Wiring: 8, 3-pole screw terminal connectors.
I/O wire size: stranded 12 - 26 AWG
solid 14 - 26 AWG

Mounting: DIN rail mount, EN 50022

Size:	Length:	6.30" (160,0 mm)
	Height:	3.56" (90,4 mm)
	Depth:	1.75" (44,4 mm) - without modules, excluding DIN rail
		3.69" (93,70 mm) - with modules, excluding DIN rail
Operating Temp:	0-70 ºC	
Humidity:	0-95% RH, non-condensing	

5. Hardware Installation and Configuration

5.1. Overview

A SmartMux-Lite analog/digital I/O subsystem consists of a JDA8 multiplexer and one or more analog or digital I/O modules. The SmartMux-Lite is mounted on an EN50022 DIN. The I/O module(s) plug into the top surface of the SmartMux-Lite and are secured to the device by the captive hold-down screw in each module.

Any module position can accept any WRC 1781-7B or WRC7 Series analog input or 1781-I_XS discrete input module. Four positions can be defined as analog output channels, using WRC 1781-7B or WRC7 Series analog output modules, and two positions can be defined as discrete output channels, using WRC 1781-O_XS, 1781-R_XS, or 1781-W_XS modules. Each position can be any voltage or signal level, or not-used. See Table 5-3 for allowable position definitions. Field wiring to the I/O modules is provided by screw terminations on eight (8) 3-pole connectors. Each 1781-7B27/37/47 thermocouple measurement is individually corrected for temperature by an on-board cold-junction circuit.

The JDA8 contains two LEDs to indicate the status of the device and the status of the network. The device can be connected to the main DeviceNet trunk line or to a drop line via screw terminations on the open, pluggable 5-pin DeviceNet connector supplied with your unit.

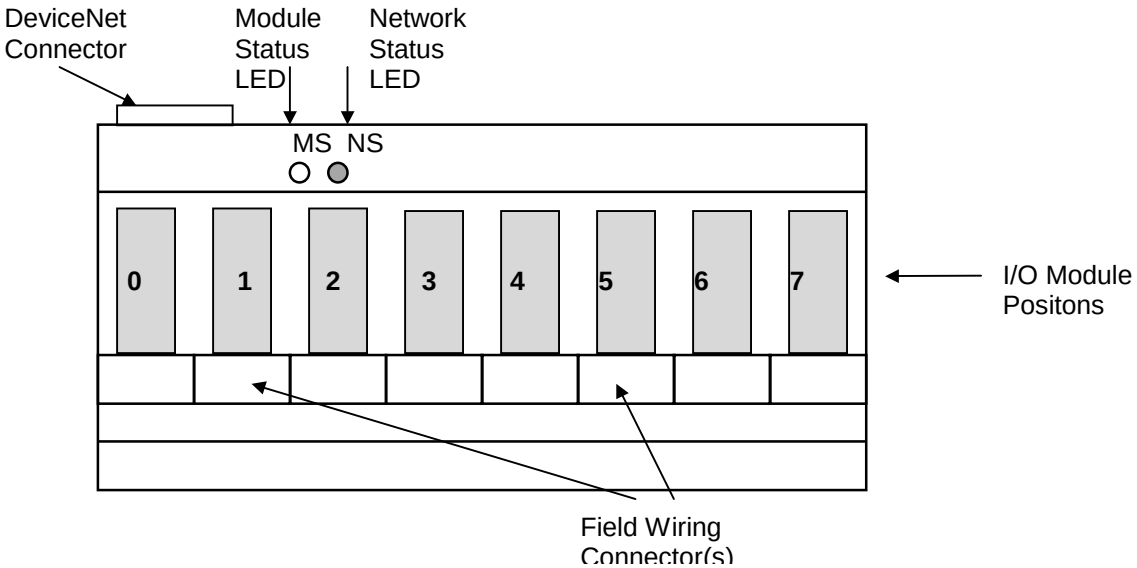

Figure 5-1 1782-JDA8 SmartMux-Lite

5.2. LED Operation

A JDA8 Multiplexer has two LEDs that provide visual status information to the user about the product and the DeviceNet network. See Table 5-1 and Table 5-2 below.

Table 5-1 Module Status LED (labeled MS)

LED State	Module Status	Meaning
OFF	No Power	There is no power through DeviceNet.
Green	Device Operational	JDA8 is operating normally.
Flashing Green	Device in Standby	JDA8 needs commissioning.
Flashing Red	Minor Fault	Recoverable fault.
Red	Unrecoverable Fault	JDA8 may need replaced.
Flashing Red/Green	Device Self-Testing	JDA8 is in self-test mode.

Table 5-2 Network Status LED (labeled NS)

LED State	Module Status	Meaning
OFF	No Power / Not on-line	JDA8 has no power or has not completed the Dup_MAC_ID test.
Flashing Green	On-line, not connected	JDA8 is on-line but is not allocated to a Master.
Green	On-line	JDA8 is operating normally.
Flashing Red	Connection time-out	One or more I/O connections are timed out.
Red	Critical link failure	JDA8 has detected an error which makes it incapable of communicating on the link. (Bus off or Duplicate MAC ID).

5.3. Module Position Options

Table 5-3 explains which module positions on the JDA8 can be used for which I/O signal types.

Table 5-3 Module Type Available by Position

Channel No.	AI	DI	AO	DO
0	✓	✓	✓	
1	✓	✓	✓	
2	✓	✓	✓	
3	✓	✓	✓	
4	✓	✓		
5	✓	✓		
6	✓	✓		✓
7	✓	✓		✓

5.4. Device Configuration

A JDA8 can be configured for MacId, baudrate, the type of I/O implemented and the fault and idle actions. The Mac Id is configured by using a third party tool, or changing attribute 1 of the DeviceNet object (Class 3, Instance 1) to a value between 0 and 63. Upon completion of this command the device will automatically reset and come on line at the new address.

The baudrate can be configured in the same manner. (The baud rate is Attribute 2 of Class 3, Instance 1.) It can be set to values 0,1, or 2, corresponding to 125K, 250K, and 500K baud. The new baudrate will not take effect until the device is reset physically or over the network.

The type of I/O implemented and the output channels parameters are shown in Table 5-4 and Table 5-5.

Table 5-4 Parameter Instance Numbers by Function and Module Position

	PARAMETER NUMBER (Decimal values)					
Channel No. / Module Position	Module Type	**Output Fault Action*	**Output Fault Value*	**Output Idle Action*	**Output Idle Value*	*Reserved*
0	1	*2*	*3*	*4*	*5*	*6-10*
1	11	*12*	*13*	*14*	*15*	*16-20*
2	21	*22*	*23*	*24*	*25*	*26-30*
3	31	*32*	*33*	*34*	*35*	*36-40*
4	41	*42*	*43*	*44*	*45*	*46-50*
5	51	*52*	*53*	*54*	*55*	*56-60*
6	61	*62*	*63*	*64*	*65*	*66-70*
7	71	*72*	*73*	*74*	*75*	*76-80*

*** Note**: Not implemented in JDA8 Release 1.00.

	PARAMETER NUMBER (Hexiecimal values)					
Channel No. / Module Position	Module Type	**Output Fault Action*	**Output Fault Value*	**Output Idle Action*	**Output Idle Value*	*Reserved*
0	01	*02*	*03*	*04*	*05*	*06-0A*
1	0B	*0C*	*0D*	*0E*	*0F*	*10-14*
2	15	*16*	*17*	*18*	*19*	*1A-1E*
3	1F	*20*	*21*	*22*	*23*	*24-28*
4	29	*2A*	*2B*	*2C*	*2D*	*2E-32*
5	33	*34*	*35*	*36*	*37*	*38-3C*
6	3D	*3E*	*3F*	*40*	*41*	*42-46*
7	47	*48*	*49*	*4A*	*4B*	*4C-50*

*** Note**: Not implemented in JDA8 Release 1.00.

Note: After changing the I/O module type for any channel, the JDA8 **must be power cycled** to cause the changes to take effect. However, if you read the module after changing it, but before the power cycle takes place, the value you read will be what you just set – that is, it will reflect the desired new value which will then take effect after the power cycle.

Table 5-5 Configuration Parameters

Parameter	Param. Instance	Parameter Choices	Default Setting	Default Value
Module Type		1 = AI 2 = AO 4 = DI 8 = DO	Analog Input	1
** Output Fault Action*	*AO*	*Hold Last State/Value***	*Fault Value*	*0*
	DO	*Hold Last State/Value***	*Fault Value*	*0*
** Output Fault Value*	*AO*		*Minimum Value*	*0*
	DO	*OFF/ON*	*Turn OFF*	*0*
** Output Idle Action*	*AO*	*Hold Last State/Value***	*Idle Value*	*0*
	DO	*Hold Last State/Value***	*Idle Value*	*0*
** Output Idle Value*	*AO*		*Minimum Value*	*0*
	DO	*OFF/ON*	*Turn OFF*	*0*

Notes: * Not implemented in Release 1.00.

Definitions of these parameters are as follows:

1. **Module Type**: Designates the module type (analog/discrete, input/output) plugged into the module position.
2. **Output Fault Action**: Selection to determine whether each output will hold its last state or assume the value identified in the next parameter upon a device fault.
3. **Output Fault Value**: The value each output will assume after a Fault if hold last state is not selected. The options are:
   0 = Hold Last State
   1 = Low Limit
   2 = High Limit
   3 = User-specified Value
4. **Output Idle Action**: Selection to determine whether each output will hold its last state or assume the value identified in the next parameter if an Idle Command is issued by the Master.
5. **Output Idle Value**: The value each output will assume upon an Idle Command if hold last state is not selected. The options are the same as for the Fault Value.

5.4.1. I/O Module Types

Table 5-6 through Table 5-8 list the selection of analog and discrete I/O modules that can be used with the JDA8 multiplexers. These modules provide signal-to-signal and signal-to-system isolation up to 1500 volts. Refer to WRC's full line catalog for detailed I/O module information.

Table 5-6 Analog Input Modules

1781-	Sensor Type	24 Vdc Power Requirements	24 Vdc Current Requirements
7B14	Non-Isolated RTD	600 mW	25 mA
7B21	V dc	720 mW	30 mA
7B27	Low-Isolation T/C	600 mW	25 mA
7B30	mV/V dc	720 mW	30 mA
7B31	V dc	720 mW	30 mA
7B32	mA dc	720 mW	30 mA
7B33	V dc	720 mW	30 mA
7B34	100Ω Platinum RTD	720 mW	30 mA
7B34N	120Ω Nickel RTD	720 mW	30 mA
7B35	mA dc w/ Loop Power	1.68 W	70 mA
7B37	T/C - J,K,T,E,R,S,B,N	720 mW	30 mA
7B38	Strain Gage	1.92 W	80 mA
7B47	T/C - J,K,T,E,R,S,B,N	720 mW	30 mA
WRC7-			
31	Non-isolated mV, V	960 mW	40 mA
32	Non-isolated mA	960 mW	40 mA

Table 5-7 Analog Output Modules

1781-	Output Signal	24 Vdc Power Requirements	24 Vdc Current Requirements
7B22	0 - 10 V dc	480 mW	20 mA
7B39	0 - 20 mA	1200 mW	50 mA
WRC7-			
39	Non-isolated mA	960 mW	40 mA

Table 5-8 Discrete I/O Modules

1781-	Input / Output	Voltage Type	24 Vdc Power Requirements	24 Vdc Current Requirements
IAXS	Input	AC/DC	65 mW	2.6 mA
IBXS	Input	AC/DC	65 mW	2.6 mA
IMXS	Input	AC/DC	65 mW	2.6 mA
INXS	Input	AC/DC	65 mW	2.6 mA
ITXS	Input	DC	65 mW	2.6 mA
OAXS	Output	AC	65 mW	2.6 mA
OBXS	Output	DC	65 mW	2.6 mA
OCXS	Output	DC	65 mW	2.6 mA
OFXS	Output	DC	65 mW	2.6 mA
OMXS	Output	AC	65 mW	2.6 mA
ROXS	Output	AC/DC/analog	260 mW	10.4 mA
RCXS	Output	AC/DC/analog	260 mW	10.4 mA
WOXS	Output	AC/DC/analog	260 mW	10.4 mA
WCXS	Output	AC/DC/analog	260 mW	10.4 mA

Note: You **must** use Discrete I/O modules with **24V logic**, not 5V logic. This is the 1781-__XS series. 5V logic modules will not work with this product, and may damage the I/O modules.

Warning: Do not insert or remove the I/O modules under power. Doing so may result in unexpected events in your operation and/or damage to the unit.

5.5. Field I/O Wiring

The JDA8 has eight 3-position terminal blocks. Each analog channel has a terminal block marked "X", "-" and "+" and the terminal block is connected as follows:

Table 5-9 Analog Input I/O Terminals

Terminal	Usage
X	Excitation signal for RTD inputs (used for 1781-7B14 or 1781-7B34 modules only)

--	Negative signal for other I/O types
+	Positive signal for all I/O types

Important: All modules are **polarized**. Proper operation requires that they be wired per the above chart. They will not work and may be damaged if the field wiring does not conform to the above chart.

In order to help ensure the integrity of your analog signal, we recommend that you shield low-level signals, such as from thermocouples, RTDs and other millivolt sources. This helps reduce or eliminate common-mode voltage noise that may be present in the installation environment. The shield should be connected at only one point. For an RTD, connect the shield to the "+" terminal; for all other signal inputs, connect the shield to the "-" terminal. Another option is to connect the shield to ground somewhere in your system. (**Note**: The JDA8 is not grounded.)

To read a process current input with the 1781-7B33, you must install a 250Ω resistor into the resistor socket (RS0 - RS3) next to the corresponding module position (0 - 3). Use WRCR250 or equivalent 0.1% metal-film resistor.

The pluggable wiring connector can accept I/O wire gage sizes 12 to 22 AWG, although 14-20 AWG is recommended.

5.6. Power Requirements

The JDA8 SmartMux-Lite subsystem is powered from the 11-25 Vdc provided by the DeviceNet network. The JDA8 consumes 120 mA of current at 24 Vdc, or 2.9 Watts, typical. Table 5-6, 7 and Table 5-8 list the power requirements of the I/O modules used with the JDA8. To determine the total power required by the SmartMux-Lite, be sure to use the total of the JDA8 and the I/O modules selected. The maximums are given in Table 5-10 below.

Table 5-10 JDA8 Power Requirements

Product	Max Power (no 7B35/38 Modules)	Max Power (with 7B35/38 Modules)
JDA8	14.0 W	15.5 W

Except for the 1781-7B35, power to and from the field actuators and sensors connected to the I/O modules is supplied by the user from the field wiring. No other external power supply is required to operate the JDA8.

5.7. Network Configuration

DeviceNet specifications provide for a maximum network distances for the main trunk line and drop lines, depending upon the baud rate used on the network. They are:

Table 5-11 Network Maximum Lengths

	Trunk Line Length		Drop Length			
	Maximum Distance		Maximum		Cumulative	
Baud Rate	Meters	Feet	Meters	Feet	Meters	Feet
125k baud	500 m	1640 ft	6 m	20 ft	156 m	512 ft.
250k baud	250 m	820 ft	6 m	20 ft	78 m	256 ft.
500k baud	100 m	328 ft	6 m	20 ft	39 m	128 ft.

5.7.1. Network Termination

A DeviceNet system **must be terminated at each end of the trunk line**. The host controller and the **last** SmartMux-Lite or other DeviceNet device on the network must always be terminated to eliminate reflections, even if only two nodes are present. The DeviceNet specifications for the terminating resistor are:

- 121 ohm
- 1% metal film
- 1/4 Watt

An appropriate terminating resistor, WRC part number RM121DN, is included with your SmartMux-Lite.

Important: Per the DeviceNet spec -- do not terminate devices on drop lines.

5.7.2. DeviceNet Connection Wiring

The supplied DeviceNet connection plug accepts cable sizes from 12 AWG - 24 AWG. The maximum wire size (12 AWG) has an area of 6530 circular mils and the smallest (24 AWG) has an area of 3265 circular mils.

Where not prohibited by local government or wiring regulations or company policy, multiple wires can be inserted each connection point on the plug as long as the total wire area does not exceed that of a 12 AWG wire. Use the chart below as a guide.

Phoenix Contact recommends using the same size wires when connecting more than one wire in a screw termination.

UL may require the use of crimped ferrules to connect multiple wires together.

Table 5-12 DeviceNet Wiring Termination

Wire AWG	Wire area (circular mils)	Maximum Wires per Terminal
12	6530	1
14	4110	1
15	3265	2
16	2580	2
18	1620	4 *
20	1022	6 *
22	645	9 *
24	404	16 *

* WRC does not recommend using more than 2 wires in any wire terminal.

The conductor sizes for DeviceNet cables are:

Table 5-13 DeviceNet Conductor Sizes

Function	Thick Wire	Thin Wire
Power	15 AWG	22 AWG
Signal	18 AWG	24 AWG

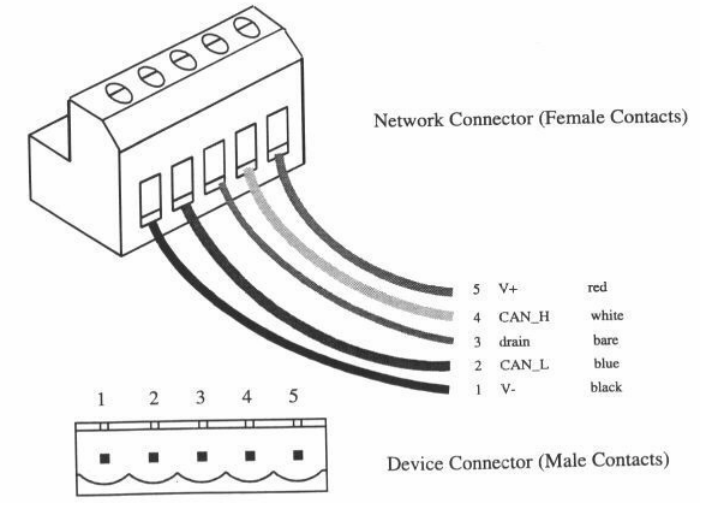

Figure 5-2 DeviceNet cable connector

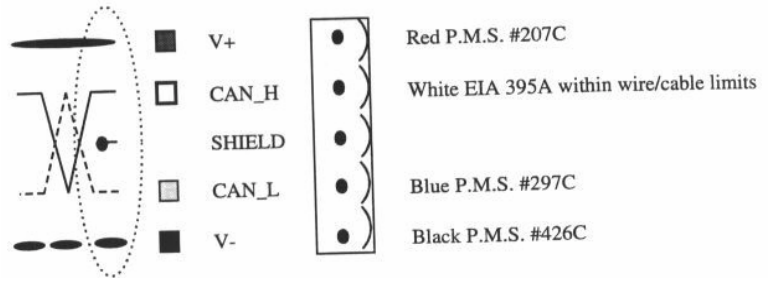

Figure 5-3 DeviceNet cable specifications

6. I/O Data and DeviceNet Profile

This section describes the DeviceNet Objects present in the SmartMux-Lite. The SmartMux-Lite conforms to a Type 7, General Purpose Analog I/O Device.

Table 6-1 JDA8 Device Profile

Object	# of Instances
Identity	1
Message Router	1
DeviceNet	1
Connection	4 (Explicit Msg, Polled I/O, Cyclic, Bit-Strobe)
Parameter	80
Analog Input	8
Analog Output	4
Discrete Input	8
Discrete Output	2
Acknowledgment Handler	1

6.1. I/O Data Formats

The formats of the various I/O messages is provided below.

6.1.1. Poll and Cyclic Input Data

Analog / Digital Input data is returned as a group for Poll and Cyclic messages, as follows. For Discrete Inputs, only Bit 0 is valid data; all other bits will be 0 (zeros).

Table 6-2 Analog/Discrete Poll and Cyclic Input Data Format

Byte	Channel	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1		0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8
2	1	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
3		0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8
4	2	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
5		0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8
6	3	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
7		0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8
8	4	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
9		0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8
10	5	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
11		0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8
12	6	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
13		0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8
14	7	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
15		0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8

6.1.2. Poll Ouput Data

Analog / Digital Output data is sent as a group for Poll messages to the JDA8, as follows. For Discrete Outputs, only Bit 0 is valid data; all other bits will be 0 (zeros).

Table 6-3 Analog/Discrete Poll Output Data Format

Byte	Channel	Type	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	AO	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1			0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8
2	1	AO	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
3			0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8
4	2	AO	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
5			0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8
6	3	AO	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
7			0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8
8	6	DO	0	0	0	0	0	0	0	Bit 0
9			0	0	0	0	0	0	0	0
10	7	DO	0	0	0	0	0	0	0	Bit 0
11			0	0	0	0	0	0	0	0

The DO will turn ON if a 1 is received in Bit 0 and will turn OFF if a 0 is received.

6.1.3. Bit-Strobe Discrete Input Data

A Bit Strobe command to the JDA8 causes all Discrete Input data to be returned as a response. The response is exactly one (1) byte if data. Each bit of represents physical module position on the SmartMux-Lite. For each module position that contains a Discrete Input module, and is properly configured, the status of the field device connected to that module will be given in its corresponding

position, as a 0 or 1. For each module position that is does not contain a Discrete Input module, a value of 0 (zero) will be returned in the corresponding bit location.

Table 6-4 JDA8 Bit-Strobe Discrete Input Data Format

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input 7	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1	Input 0

Example:

Consider a JDA8 with the following configuration:

Channel 7	Channel 6	Channel 5	Channel 4	Channel 3	Channel 2	Channel 1	Channel 0
Output ON	Output OFF	Input ON	Input OFF	Input ON	Analog Input	Analog Input	Analog Output

the Bit-Strobe command will return the binary pattern 00101000, or 28(hex).

6.1.4. Bit-Strobe Output Data

The JDA8 uses to the one bit in its address bit position of a Bit-Strobe command (if data is sent) to turn ON / OFF a Discrete Output Module in position 7. If there is no DO module in position 7, the data will be ignored. If no data is sent with the Bit-Strobe command, the current state of DO 7 will not be changed.

The DO will turn ON if a 1 is received and will turn OFF if a 0 is received.

6.2. Analog/Discrete Input Point

The JDA8 uses Analog Input Objects to store values. There are eight instances, corresponding to the eight analog inputs. The current value can be obtained by using the get attribute on attribute 3 (data) of the appropriate instance. No other instance attributes are supported.

6.2.1. Analog Input Point Data Format

Table 6-5 JDA8 Analog Input Assembly Data Attribute Format

Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	0	0	0	Bit 11	Bit 10	Bit 9	Bit 8

Example:

Consider a poll response for any channel with the following bit pattern:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	1	0	0	0	1	1	1
1	0	0	0	0	1	0	1	0

This corresponds to an analog value of 2631 counts, or 64.233% full scale of the input.

6.2.2. Attributes and Services

Following are the Class Attributes, Instance Attributes and Services are supported by the SmartMux-Lite for the Analog Input Point Object.

Table 6-6 Analog Input Class Attributes

Attribute ID	Access Rule	Name	DeviceNet Data Type	Description of Attribute	Semantics of Value
1	Get	Revision	UINT	Revision of this object	The current value assigned to this is two (2).
2	Get	Max Instance	UINT	Maximum instance number of an object currently created in this class level of the JDA8.	The current value assigned to this is eight (8).
6	Get	Max ID Number of Class Attributes	UINT	The attribute ID number of the last class attribute of the class definition implemented in the JDA8.	The current value assigned to this is seven (7).
7	Get	Max ID Number of Instance Attributes	UINT	The attribute ID number of the last instance attribute of the class definition implemented in the JDA8.	The current value assigned to this is three (3).

Table 6-7 Analog Input Instance Attributes

Attribute ID	Access Rule	Name	DeviceNet Data Type	Description of Attribute	Semantics of Value
3	Get	Value	INT	Input point value	12-bit value

Table 6-8 Analog Input Common Services

Service Code	Class	Instance	Service Name	Description of Service
OE_{hex}	Get	Get	Get_Attribute_Single	Returns the contents of the specified attribute.

6.3. Acknowledge Handler Object - Class 2B $_{hex}$

The DeviceNet specification requires the use of both acknowledged and un-acknowledged cyclic messages. The JDA8 uses the DeviceNet formal Acknowledge Handler to allow the master to request and receive either acknowledged or un-acknowledged cyclic messages. In general the use of acknowledged cyclic messaging provides for the slave device to take action if, for some reason, the master does not acknowledge the cyclic after a certain number of retries. This occurs, however, at the expense of increased network traffic. To reduce this traffic and increase network efficiency, unacknowledged cyclic messages may be desired.

If the JDA8 is operating in acknowledged mode, it will try to send the same cyclic message a second time if the first is not acknowledged. If still no acknowledgment is received, then no further action is taken and the JDA8 continues to operate as normal.

6.3.1. Attributes and Services

Following are the Class Attributes, Instance Attributes and Services are supported by the SmartMux-Lite for the Acknowledge Handler Object.

Table 6-9 Class $2B_{hex}$ Class Attributes

Attribute ID	Access Rule	Name	DeviceNet Data Type	Description of Attribute	Semantics of Value
1	Get	Revision	UINT	Revision of this object.	The current value is 1.
2	Get	Max Instance	UINT	Maximum instance number of an object currently	The current value assigned to this is ().

Table 6-10 Class $2B_{hex}$ Instance Attributes

Attribute ID	Access Rule	Stub /Full	Name	DeviceNet Data Type	Description of Attribute	Semantics of Value
1	Set		Acknowledge Timer	UINT	Time to wait for acknowledge before resending.	Range 1-65,535. Default = 16. (0 is invalid.)
2	Get		Retry Limits	USINT	Number of Ack Time-outs to wait before informing producing application of a Retry_Limit_Event reached.	Range 0-255. Default is 1.
3	Get		Cyclic Producing Instance	UINT	Connection Instance which contains the path of the producing I/O application object which will be notified of Ack Handler events.	Connection Instance ID. Current setting is 8.

Table 6-11 Acknowledge Handler Common Services

Service Code	Class	Instance	Service Name	Description of Service
OE_{hex}	Get	Get	Get_Attribute_Single	Returns the contents of the specified attribute.
10_{hex}	n/a	Set	Set_Attribute_Single	Modifies an attribute value.

7. Accessories

The following components can be used with a 1782-JDA8 SmartMux-Lite for replacements or spare parts.

Part	WRC Part Number
• DeviceNet link connector plug	1782-JD-DN-CK
• DIN rail	WRC 50022
• Terminating resistor	RM121DN
• Discrete I/O - 4 channels	1782-JDB4
• Discrete I/O - 8 channels	1781-JDB8
• Analog Input - 4 channels, 10-bit	1782-JDA4
• DeviceNet Repeater, DIN mount	WRC-CANEXT-DIN
• DeviceNet Repeater, NEMA box	WRC-CANEXT-NEMA

8. Troubleshooting

This section identifies some of the common problems that may be observed when commissioning or operating a DeviceNet and SmartMux-Lite.

Problem:

JDA8 does not power up; both LEDs are off.

Possible Solutions:

1. Power not applied to DeviceNet cable or JDA8 connector.
2. Insufficient power. JDA8 requires close to 1 amp at 11 volts. (Some hand-held configuration devices, e.g., Allen-Bradley 2707-DNC DeviceView, will not provide sufficient power to the JDA8.)

Problem:

Device will not communicate on the network
Module Status LED is solid Green
Network Status LED is flashing Green

Possible Solutions:

1. Network does not have a terminating resistor. Add a 121 ohm resistor across the CAN_H and CAN_L signals at the first and last nodes.
2. Incorrect baud rate.
3. Cabling not properly connected.
4. No messaging connections are allocated.
5. Message sent to incorrect node
6. JDA8 is not is Master device's Scan List

Problem:

Device will not return data
Module Status LED is solid Green
Network Status LED is solid Green

Possible Solutions:

1. Incorrect Messaging connection set up.
   (Poll request when only Explicit connection is allocated)
2. Message sent to incorrect node.
3. JDA8 is not mapped into Master's data map

Problem:

Input value is always zero, or near 0.

Possible Solutions:

1. Input is wired backwards. (A negative reading will bottom out at 0.)
2. Input is not connected.
3. Modules are not plugged into JDA8.
4. Incoming signal is less than the lowest range on the module.
5. Channel is configured as an output

Problem:

Analog input value is always 4095 (full scale).

Possible Solutions:

1. T/C input is not connected. (1781-7B27, -7B37 and -7B47 outputs will go to full-scale if not connected.)
2. Incoming signal is greater than the highest range on the module.

Problem:

Discrete input value is at or near 4095.

Possible Solutions:

I/O position is configured as an Analog Input, instead of a Discrete Input. (JDA8 must be power cycled after changing I/O configuration.)

Problem:

Input value jumps around unexpectedly.

Possible Solutions:

Input signal to JDA8 is noisy. Provide a grounded shield around signal cable.
Make sure the signal cable shield is properly grounded at one location.

Problem:

Discrete Input signal does not operate.

Possible Solutions:

1. Make sure you are using 1781-I_XS (24 Vdc logic) and not 1781-I_5S (5 Vdc logic) modules. 5V logic modules will not work with the JDA8.
2. Position is not configured as a DI. (JDA8 must be power cycled after changing I/O configuration.)
3. There is a loose connection in the field wiring.
4. The field wiring is not properly connected from hot to the module to the actuator to common.
5. For a DC module, field wiring polarity may be reversed.

Problem:

Discrete Output signal does not operate.

Possible Solutions:

1. Make sure you are using 1781-__XS (24 Vdc logic) and not 1781-__5S (5 Vdc logic) modules. 5V logic modules will not work with the JDA8.
2. Module not in positon 6 or 7.
3. Position is not configured as a DO. (JDA8 must be power cycled after changing I/O configuration.)
4. For a DC output, field wiring polarity may be reversed.
5. The user-supplied fuse is blown.
6. There is a loose connection in the field wiring.
7. The field wiring is not properly connected from hot to the module to the actuator to common.
8. The module is damaged.

Problem:

Analog Output signal does not operate.

Possible Solutions:

1. Module may not be a 0-10 Vdc input.
2. Module not in positons 0,1,2, or 3.
3. Position is not configured as an AO. (JDA8 must be power cycled after changing I/O configuration.)
4. Field wiring polarity may be reversed.
5. There is a loose connection in the field wiring.
6. The module is damaged.