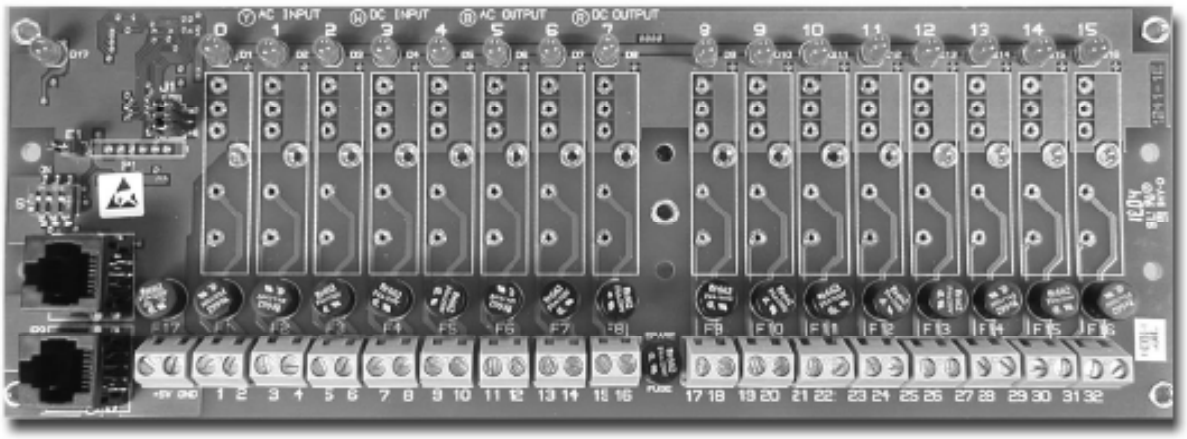
# SCMD SLX101
# Digital I/O Backpanel User Manual
# for
# Standalone Operation




DATAFORTH®

**SCMD isoLynx® SLX101 Digital I/O Backpanel User Manual**
**MA1034 Rev. A – August 2010**


The information in this manual has been checked carefully and is believed to be accurate; however, Dataforth assumes no responsibility for possible inaccuracies or omissions. Specifications are subject to change without notice.

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## Contacting Dataforth Corporation

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## Errata Sheets

Refer to the Technical Support area of Dataforth's website (www.dataforth.com) for any errata information on this product.

# 1.0 SCMD isoLynx® SLX101 Digital I/O Backpanel Description

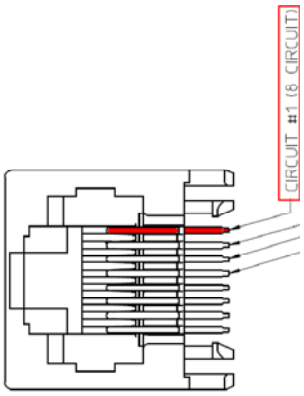
The SCMD isoLynx® SLX101 Digital I/O Backpanel with 16 digital I/O channels accommodates 6 families which include 14 models of the popular Dataforth SCMD-Mxxx miniature isolated AC and DC input and output modules. It communicates via an RS-485 2-wire connection with port settings of 115.2kbps, 8 data bits, 1 stop bit, and no parity. These settings are fixed and cannot be changed. Two RJ-45 connectors allow daisy-chain connection of up to 8 panels.

## 1.1 SCMD isoLynx® SLX101 Digital I/O Backpanel Specifications

| | |
|---|---|
| Interface:<br>Field Connector<br>System Connector<br>Factory Default<br>Termination Network<br>Jumpers<br>ADDR<br>CRST<br>Data Rate<br>Expansion Network | <br>high density screw clamp, 14 AWG max<br>two RJ-45 modular phone jacks<br><br>S1, sections 1-3 ON<br><br>all set = address 0<br>set<br>115.2kbps maximum, also factory default<br>4000 feet max distance, 32 max multidrops<br>non-isolated, -7V/+12V common mode capability |
| Channels<br>Factory Default<br>Configuration<br>Outputs | Maximum 123 channels I/O<br><br>All Vacant<br>All Open |
| Module Type | Industry standard Opto-22 miniature style |
| Throughput | 8 msec for 16 chs digital input or output<br>(~2000 ch/sec) with 115.2kbps RS-232/485 |
| Power Supply Requirements<br>Voltage @ Current<br>Rise Rate<br>Brown-out Reset Voltage Trip Point | <br>+5VDC ±5% @ 40mA Max.<br>+0.05V/ms Min.<br>+3.70V Min., +4.35V Max. |
| Operating Temperature<br>Storage Temperature<br>Relative humidity | -40°C to +85°C<br>-40°C to +85°C<br>95%, non-condensing |

### 1.1.1 SLX101 RJ-45 Connector Pinout

| SLX101 | |
|---|---|
| **RJ-45 Pinout** | **Signal Name** |
| **4** | **B** |
| **5** | **A** |
| **6** | **Sig Gnd** |

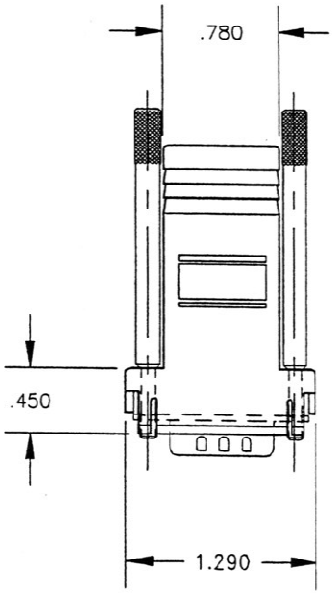


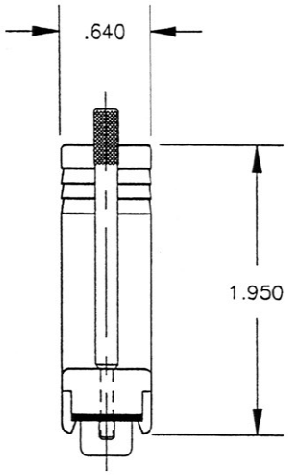

## 1.2 SCMD isoLynx® SLX101 Digital I/O Backpanel Ordering Information

SLX101 Backpanel Digital: 16-Ch
SLX101-D Backpanel Digital: 16-Ch, DIN Rail Mount

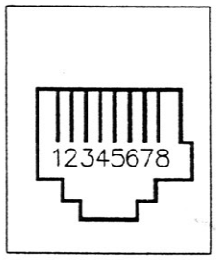
### 1.2.1 Accessories

| | |
|---|---|
| SLX141-xx | CAT5 cable with options -01, -02, and -07 for 1, 2, and 7 meter lengths. |
| SLX143-P | RJ-45 to DB9 male adapter. DB9 pinout is configurable. |
| SLX143-S | RJ-45 to DB9 female adapter. DB9 pinout is configurable. |




THUMBSCREW: 4-40 THREAD




1 ---------- BLUE
2 ---------- ORANGE
3 ---------- BLACK
4 ---------- RED
5 ---------- GREEN
6 ---------- YELLOW
7 ---------- BROWN
8 ---------- WHITE

## 1.3 SCMD isoLynx® SLX101 Backpanel Dimensions

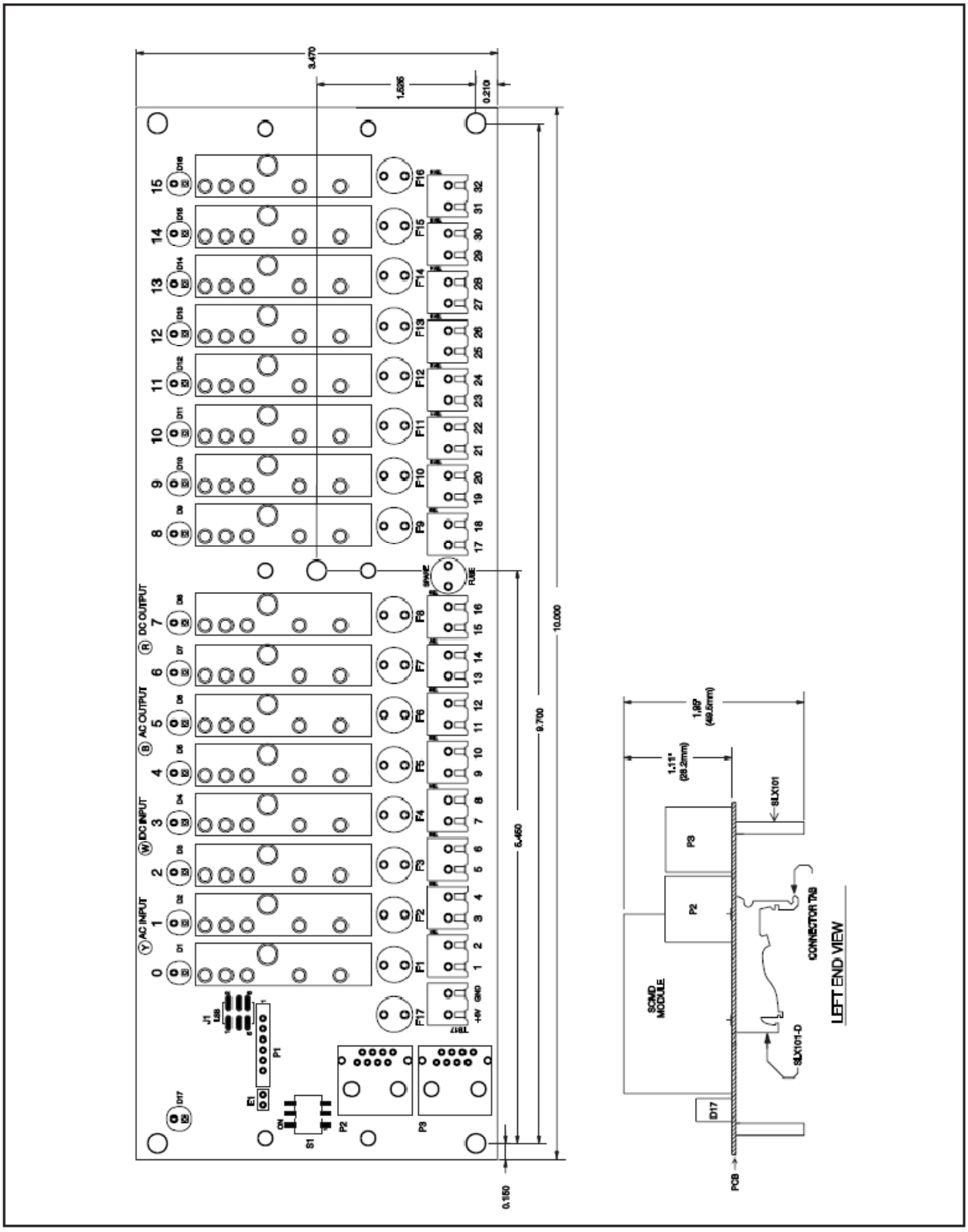



Figure 1: SCMD isoLynx® SLX101 Backpanel Dimensions

## 1.4 SCMD Modules

### 1.4.1 SCMD Module Selection Guide

**Digital Input Modules, Miniature** **Digital Output Modules, Miniature**

| MODEL | INPUT RANGE | SUPPLY VOLT | MODEL | INPUT RANGE | SUPPLY VOLT |
|---|---|---|---|---|---|
| SCMD-MIAC5 | 90 to 140VAC/DC | 5V | SCMD-MOAC5 | 12 to 140VAC/DC | 5V |
| SCMD-MIAC5A | 180 to 280VAC/DC | 5V | SCMD-MOAC5A | 24 to 280VAC/DC | 5V |
| SCMD-MIAC5E | 10 to 36VAC/DC | 5V | SCMD-MOAC5B | 24 to 280VAC/DC | 5V |
| SCMD-MIDC5 | 3.3 to 32VDC | 5V | SCMD-MODC5 | 3.0 to 60VAC/DC | 5V |
| SCMD-MIDC5F | 4.0 to 32VDC | 5V | SCMD-MODC5A | 5.0 to 200VDC | 5V |
| SCMD-MIDC5N | 10 to 60VDC | 5V | SCMD-MODC5ML | 1.0 to 50VDC | 5V |
| | | | SCMD-MORO5 | 100/125 VDC/Vrms | 5V |
| | | | SCMD-MORC5 | 100/125 VDC/Vrms | 5V |

**Digital Input Modules – Model No. Suffixes Identifying Optional Features**

| Suffix | Feature |
|---|---|
| **A** | High voltage version (280VAC for AC modules) |
| **E** | Low Voltage 10VAC input for AC modules |
| **F** | Fast-switching version of DC modules |
| **N** | Enhanced noise immunity version of DC Modules |

**Digital Output Modules – Model No. Suffixes Identifying Optional Features**

| Suffix | Feature |
|---|---|
| **A** | High voltage versions (280VAC for AC modules, 200VDC for DC modules). |
| **B** | High voltage version (280VAC for AC modules) with low leakage output current. |
| **ML** | FET output version of DC module, 5.0A, 50VDC |

### 1.4.2 Installation

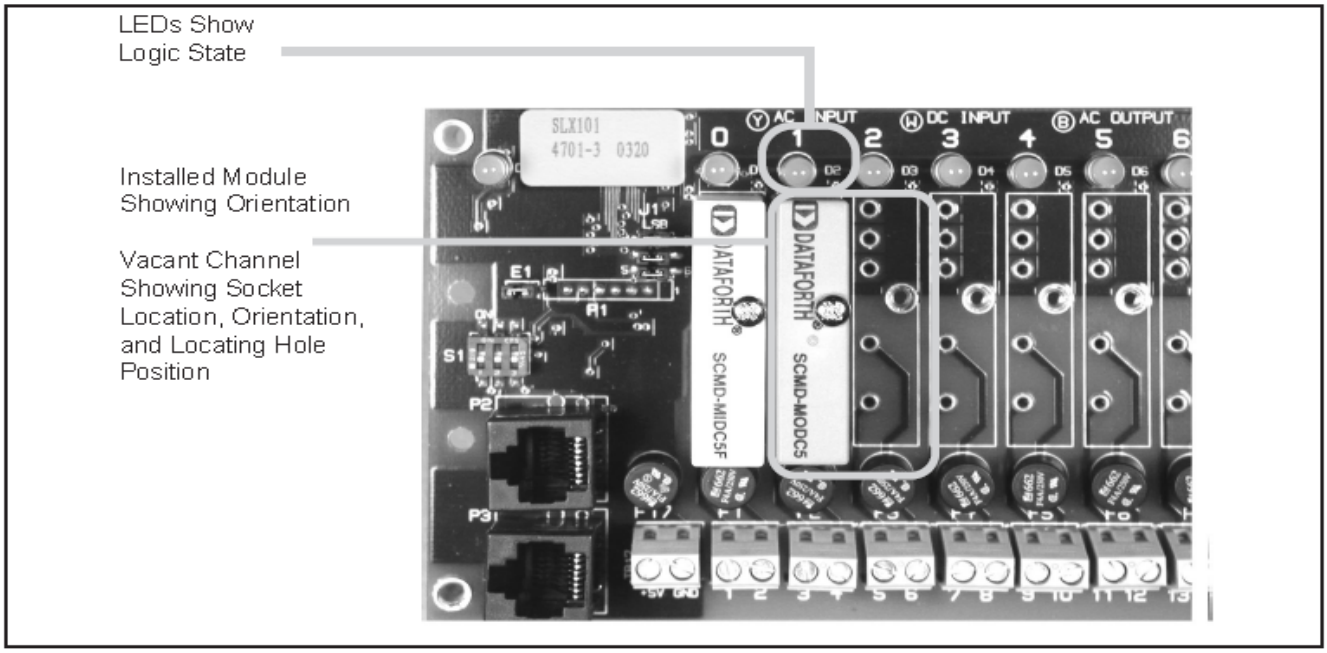



Figure 2: SCMD Module Installation

Each channel position on the backpanel has five sockets and a threaded insert. An SCMD module plugs into the socket pattern and is secured in place using the mounting screw.

### 1.4.3 LEDs

Each channel has an LED above the module sockets which indicates the logic state of the channel input or output. When the LED is on, the input or output function is asserted and when the LED is off, the input or output function is disasserted.

### 1.4.4 Wiring

Field connections are made through the screw terminal blocks below the channels and are numbered 1 - 32. Figure 3 shows the polarity of the field connections.

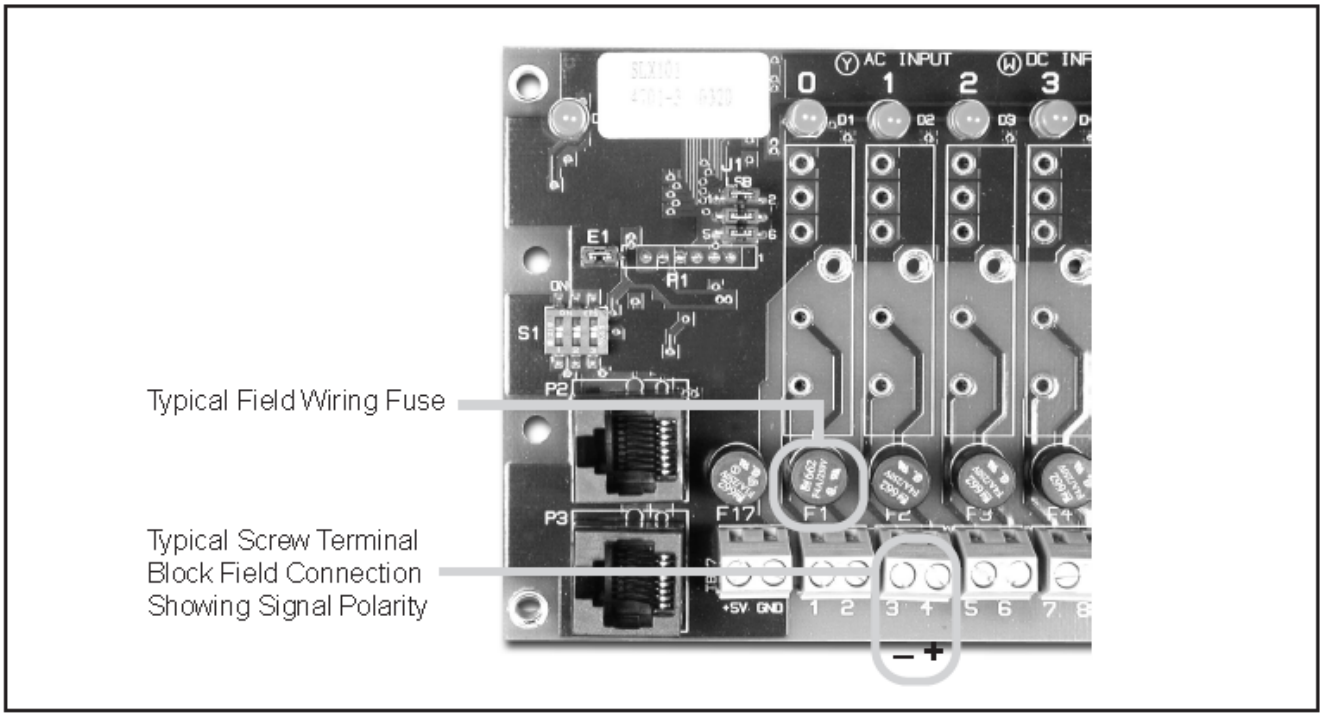



Figure 3: Signal Polarity of Field Connections

### 1.4.5 Fusing

Each channel has a replaceable fuse between the module and the field wiring screw terminal blocks. A spare fuse is located between the terminal blocks for channel 7 and channel 8.

## 1.5 Expansion Considerations

### 1.5.1 Digital I/O Panel ID Selection

The J1 jumpers shown in Figure 4 set the Digital I/O Backpanel Panel ID. This ID must be used when communicating with the backpanel. Valid ID numbers are 0 – 7. The factory default is Panel ID 0.

There is a three jumper group, J1, which allows for eight Panel IDs. The LSB (Least Significant Bit) of the address line is the jumper designated as LSB on the backpanel. A jumper over both pins of any jumper position corresponds to a 0 (zero) in the Panel ID, and an open (a jumper over one pin) in any jumper position corresponds to a 1 (one) in the Panel ID. To obtain a particular Panel ID, arrange jumpers in the binary weighted pattern of the hexadecimal value desired.

Unique addresses must be set for each backpanel in a multidropped Digital I/O Expansion Network. For more on this topic, refer to Section 1.5.3 Expansion Network Termination Network Switches and Appendix B: AN302 RS-485 Digital I/O Expansion Network Configurations.

### 1.5.2 Expansion Network Connectors (P2, P3)

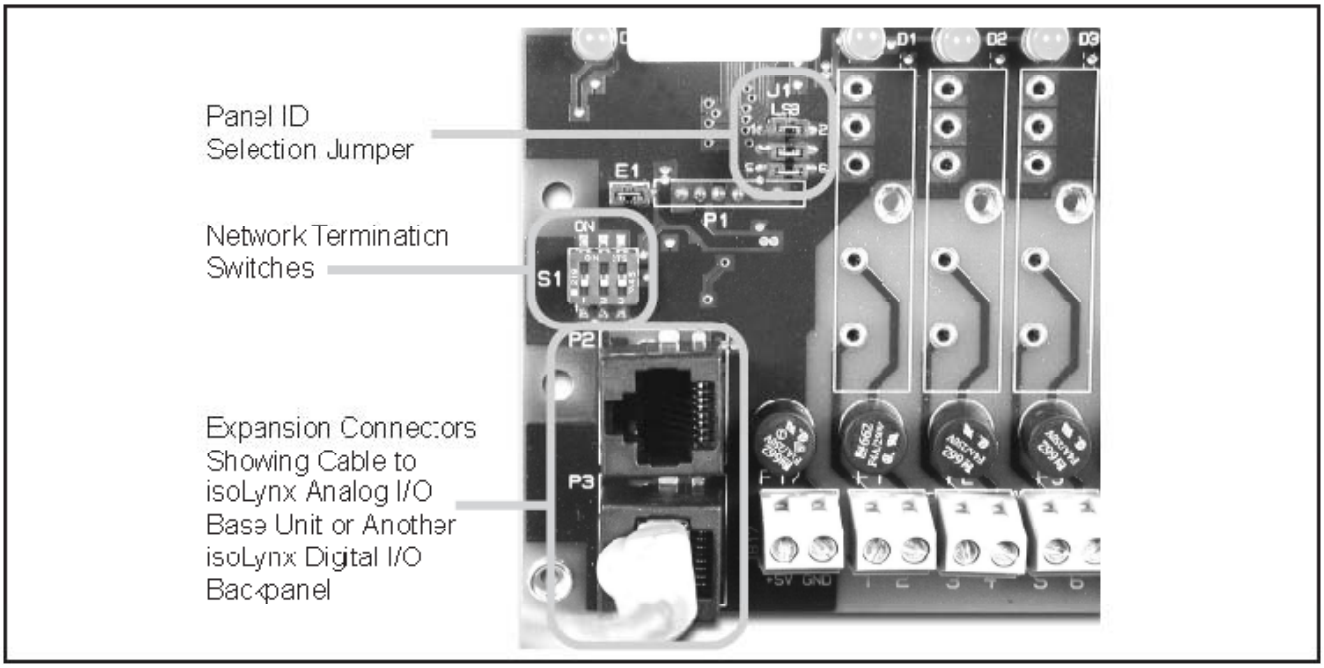



Figure 4: Expansion Network Connectors

### 1.5.3 Expansion Network Termination Network Switches

In general, for differential trunk line lengths over 100 ft (30.5m), the two devices at the extreme ends of the trunk line should be terminated and all other devices in between should not be terminated. The Digital I/O Backpanel offers a built-in termination network for the 2-wire digital I/O network accessed through dip-switches. The location of the Digital I/O Backpanel termination dip-switches is shown in Figure 4.

Sections 1 through 3 of dip-switch S1 are used for the 2-wire digital I/O network. Section 1 switches in a pull-down resistor for the A line of the differential signal, and Section 3 switches in a pull-up resistor for the B line of the differential signal. The pull-down pull-up network provides the idle line biasing for the differential input. Section 2 switches the line impedance terminating resistor across the differential signal. In most cases, the installation will require sections 1 through 3 to all be switched to ON (termination network in). Some cases may allow fewer or no terminating elements to be in the network. This can be determined by experimentation. Use the combination of elements which gives the most reliable data transfer.

Factory default is all dip-switch sections ON (termination network in).

For proper termination of all RS-485 devices in a 2-wire multidrop SLX101 Digital I/O Expansion Network, reference the application note in Appendix B: AN302 RS-485 Digital I/O Expansion Network Configurations.

## 1.6 Power Considerations

### 1.6.1 Power Supply, Connector, and LED

The Digital I/O Backpanel requires external +5VDC ±5% power. The following Dataforth power supplies have adequate capacity to power any combination of modules:

SCMXPRT-001 Power supply, 1A, 5VDC, 120VAC U.S.
SCMXPRE-001 Power supply, 1A, 5VDC, 220VAC European
SCMXPRT-003 Power supply, 3A, 5VDC, 120VAC U.S.
SCMXPRE-003 Power supply, 3A, 5VDC, 220VAC European

Connect power through the 2-position screw terminal block as shown in Figure 5. The Power Indicator LED outlined in the figure lights when a proper power connection has been made.

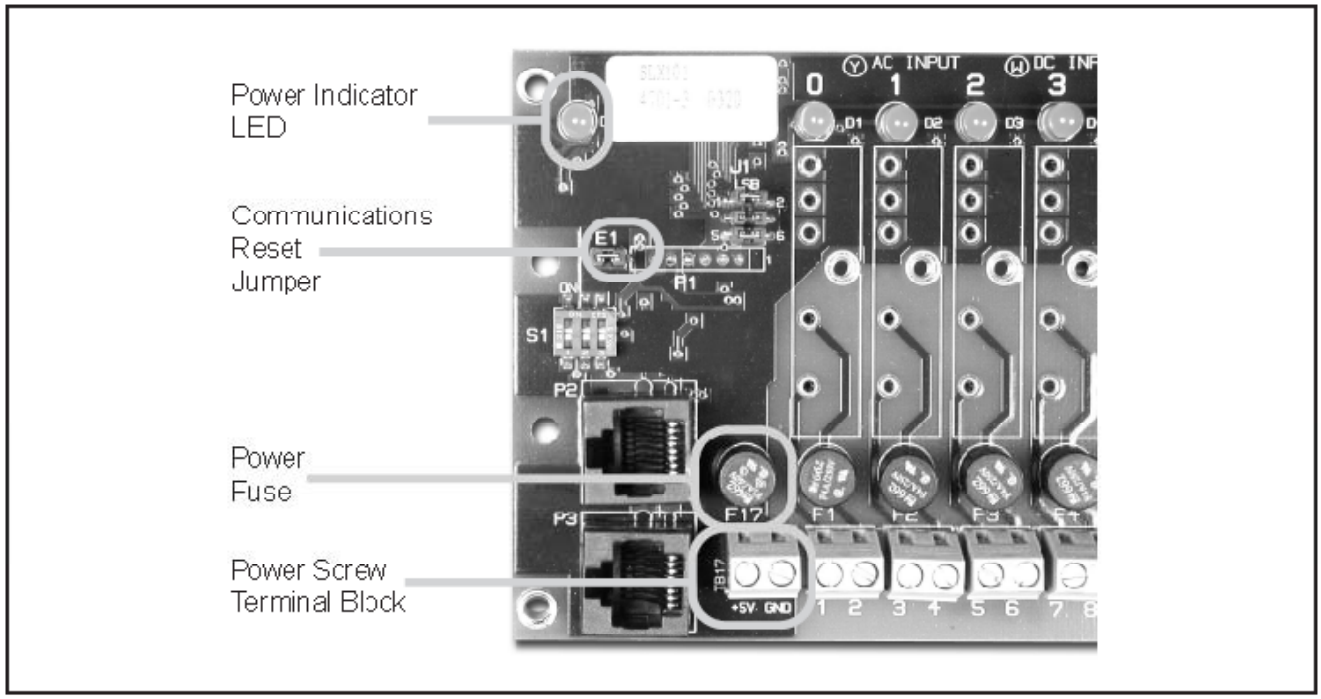



Figure 5: Digital I/O Backpanel Power Supply, Connector, and LED

### 1.6.2 Fusing

The Digital I/O Backpanel power is fuse protected through F17 which is a 4-amp device. A shunt Zener diode provides additional protection by clamping the input power voltage to +5.6V. If the input supply voltage connection is reversed, this Zener diode will be forward biased and fuse F17 will be blown.

## 1.7 Other Considerations

### 1.7.1 Communications Reset Jumper

The system communications settings of RS-485 2-wire interface, 115.2kbps baud rate, 8 data bits, 1 stop bit, no parity are fixed and cannot be changed. However, if communications with the panel cannot be established and corrupted communications setup is suspected as the source of the problem, a communications reset jumper has been provided. This jumper is near the termination network dip-switch as outlined in Figure 5. Opening the header pins momentarily by removing the mini-link shunt jumper resets the Digital I/O Backpanel data rate to 115.2kbps. The shunt jumper must be re-installed over both pins for the reset operation to complete and for continuous operation to begin. This function is one of the troubleshooting guidelines discussed in Appendix A: Digital I/O Backpanel Does Not Communicate or Sends Garbled Data.

# 2.0 Software Protocol

## 2.1 I/O Configuration Commands

### 2.1.1 Read I/O Configuration – Group Command Y

**Description**

This command causes the addressed backpanel to send back a response to the host that includes module presence and module type (input or output) for each configured channel.

**ASCII Command Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 1 |
|---|---|---|---|---|---|---|
| | > | i | P | Y | DVF | CR |

Where:
> = ASCII Character > (3E Hex)
i = 0
P = Panel Address* 8-F
Y = Command Character (59 Hex)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**ASCII Response Format**

**Success Response Format**

| # characters | 1 | 1 | 1 | 1 | 4 | 2 to 32 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|
| | A | i | P | Y | MMMM | TT | DVF | CR |

Where:
A = Good Response Character (41 Hex)(Ack)
i = 0
P = Panel Address*
Y = Command Character (59 Hex)
MMMM = Module Presence
TT = Module Type
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Channel Binary Format MMMM (4 Character)**
1 = Module Present
0 = Module Not Present

| Data Character | 3 | 2 | 1 | 0 |
|---|---|---|---|---|
| Module Presence | 15 - 12 | 11 - 8 | 7 - 4 | 3 - 0 |
| Example | 1 0 0 0 | 0 0 0 0 | 1 1 1 1 | 0 0 0 1 |
| Hex ASCII Char | 8 | 0 | F | 1 |

Module type TT:
00 Hex = Digital Input
80 Hex = Digital Output

**Error Response Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | N | i | P | Y | EC | DVF | CR |

Where:

N = Error Response Character (4E Hex)(Nack)
i = 0
P = Panel Address*
Y = Command Character (59 Hex)
EC = Error Code (Reference Error Code Summary, Section 2.4)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

***Example*:**

Command `> 08 Y D7 CR`
Response `A 08 Y 0A 05 80 80 00 00 7E CR`

Sends a Read I/O Configuration – Group command in ASCII format to SLX101 Digital I/O Backpanel Panel 0 at address 0 Hex. Channels 11 and 09 are configured as outputs, and channels 03 and 00 are configured as inputs.

* Subtract 8 from the panel address to get the physical Digital I/O Backpanel address.

Data verification method is 8-bit checksum.

***Note:*** *Blank spaces in the above examples are added for visual clarity only. They do not actually appear in the command or in the response.*

### 2.1.2 Set I/O Configuration – Group Command G

**Description**

This command builds a table of module presence and type in the addressed SLX101 Digital I/O Backpanel. Module present is 1, vacant is 0, and location is encoded as bit position. Module types are Digital Input and Digital Output. If this command sets a channel to output, it will also set that channel's output to the current default output value from EEPROM. This command writes the I/O configuration to EEPROM.

**ASCII Command Format**

| # characters | 1 | 1 | 1 | 1 | 4 | 2 to 32 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|
| | N | i | P | G | MMMM | TT | DVF | CR |

Where:

> = ASCII Character > (3E Hex)
i = 0
P = Panel Address* 8-F
G = Command Character (47 Hex)
MMMM = Modules to be configured
TT = Module Type
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Channel Binary Format MMMM (4 Character)**

| Data Character | 3 | 2 | 1 | 0 |
|---|---|---|---|---|
| Module Presence | 15 - 12 | 11 - 8 | 7 - 4 | 3 - 0 |
| Example | 0 0 0 0 | 1 0 1 0 | 0 0 0 0 | 0 1 0 1 |
| Hex ASCII Char | 0 | A | 0 | 5 |

Module type TT:
00 Hex = Digital Input
80 Hex = Digital Output

**ASCII Response Format**

**Success Response Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 1 |
|---|---|---|---|---|---|---|
| | N | i | P | G | DVF | CR |

Where:
A = Good Response Character (41 Hex)(Ack)
i = 0
P = Panel Address*
G = Command Character (47 Hex)
MMMM = Module Presence
TT = Module Type
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Error Response Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | N | i | P | G | EC | DVF | CR |

Where:
N = Error Response Character (4E Hex)(Nack)
i = 0
P = Panel Address*
G = Command Character (47 Hex)
EC = Error Code (Reference Error Code Summary, Section 2.4)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

***Example:***

Command `> 08 G 0A 05 80 80 00 00 2B CR`
Response `A 08 G 06 CR`

Sends a Set I/O Configuration – Group command in ASCII format to the SLX101 Digital I/O Backpanel Panel 0 at address 0 Hex. This example sets I/O configuration for channels 11, 09, 03, and 00 (see Channel Binary Format MMMM table above). Channels 11 and 09 are selected to be outputs (80 Hex), and channels 03 and 00 are selected to be inputs (00 Hex).

* Subtract 8 from the panel address to get the physical Digital I/O Backpanel address.

Data verification method is 8-bit checksum.

***Note:*** *Blank spaces in the above examples are added for visual clarity only. They do not actually appear in the command or in the response.*

## 2.2 Input Commands

### 2.2.1 Read Digital Inputs – Group Command R

**Description**

This command reads the digital input channels specified in data field MMMM. Data type field TT must be set to read current values (00 Hex). Only one DDDD field will be returned. The DDDD field represents data for the entire backpanel and is presented in hexadecimal format by 4 ASCII characters. Each bit corresponds to a single channel on the digital panel. For any channel in MMMM that was set to 1, the corresponding bit in DDDD will be the current value for that channel. For any channel in MMMM that was set to 0, the corresponding bit in DDDD will be set to 0.

An error is returned for attempting to read vacant channels. Reading output channels is allowed and results in returning the last value written to the channel.

**ASCII Command Format**

| # characters | 1 | 1 | 1 | 1 | 4 | 2 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|
| | A | i | P | R | MMMM | TT | DVF | CR |

Where:

> = ASCII Character > (3E Hex)
i = 0
P = Panel Address* 8-F
R = Command Character (52 Hex)
MMMM = Modules for which data is to be returned
TT = Data Type
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Channel Binary Format MMMM (4 Character)**

| Data Character | 3 | 2 | 1 | 0 |
|---|---|---|---|---|
| Module Presence | 15 - 12 | 11 - 8 | 7 - 4 | 3 - 0 |
| Example | 1 1 1 1 | 1 1 1 1 | 1 1 1 1 | 1 1 1 1 |
| Hex ASCII Char | F | F | F | F |

Data type TT:

00 Hex = Digital Module

**ASCII Response Format**

**Success Response Format**

| # characters | 1 | 1 | 1 | 1 | 4 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | A | i | P | R | MMMM | DVF | CR |

Where:

A = Good Response Character (41 Hex)(Ack)
i = 0
P = Panel Address*
R = Command Character (52 Hex)
DDDD = All digital channels
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Data Format (DDDD)**

| Data Character | 3 | 2 | 1 | 0 |
|---|---|---|---|---|
| Module Presence | 15 - 12 | 11 - 8 | 7 - 4 | 3 - 0 |
| Example | 0 0 0 0 | 0 0 1 0 | 0 0 0 0 | 0 1 0 0 |
| Hex ASCII Char | 0 | 2 | 0 | 4 |

**Error Response Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | N | i | P | R | EC | DVF | CR |

Where:

N = Error Response Character (4E Hex)(Nack)
i = 0
P = Panel Address*
R = Command Character (52 Hex)
EC = Error Code (Reference Error Code Summary, Section 2.4)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

***Example:***

Command `> 08 R FFFF 00 48 CR`
Response `A 08 R 0204 D7 CR`

Sends a Read Inputs – Group command in ASCII format to the SLX101 Digital I/O Backpanel Panel 0 at address 0 Hex. Current values are requested from all 16 channels (see Channel Binary Format MMMM table above). Channels 15 through 10 return a logic 0, channel 09 returns a logic 1, channels 08 through 04 return a logic 0, channel 02 returns a logic 1, and channels 01 and 00 return a logic 0. (For channel to bit state correlation, use Channel Binary Format MMMM table above.)

* Subtract 8 from the panel address to get the physical Digital I/O Backpanel address.

Data verification method is 8-bit checksum.

***Note:*** *Blank spaces in the above examples are added for visual clarity only. They do not actually appear in the command or in the response.*

### 2.2.2 Read Digital Input **Command r**

**Description**

This command reads the digital input channel specified in data field CC. Data type field TT must be set to read the current value (00 Hex). The logic state of the channel is returned in the D field. D is represented by 1 ASCII character and may be either '0' or '1'.

An error is returned for attempting to read a vacant channel. Reading an output channel is allowed and results in returning the last value written to the channel.

**ASCII Command Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|
| | A | i | P | r | CC | TT | DVF | CR |

Where:
> = ASCII Character > (3E Hex)
i = 0
P = Panel Address* 8-F
r = Command Character (72 Hex)
CC = Channel number to be read (00-0F Hex)
TT = Data type
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

Data type TT:
00 Hex = Current Digital Data

**ASCII Response Format**

**Success Response Format**

| # characters | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | A | i | P | r | D | DVF | CR |

Where:
A = Good Response Character (41 Hex)(Ack)
i = 0
P = Panel Address*
r = Command Character (72 Hex)
D = Digital Channel
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Error Response Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | N | i | P | r | EC | DVF | CR |

Where:

N = Error Response Character (4E Hex)(Nack)
i = 0
P = Panel Address*
r = Command Character (72 Hex)
EC = Error Code (Reference Error Code Summary, Section 2.4)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

***Example:***

| | |
|---|---|
| Command | `> 08 r 0B 00 C2 CR` |
| Response | `A 08 r 0  61 CR` |

Sends a Read Input command in ASCII format to the SLX101 Digital I/O Backpanel Panel 0 at address 0 Hex. Channel 11 (0B Hex) returns a logic 0.

* Subtract 8 from the panel address to get the physical Digital I/O Backpanel address.

Data verification method is 8-bit checksum.

***Note:*** *Blank spaces in the above examples are added for visual clarity only. They do not actually appear in the command or in the response.*

## 2.3 Output Commands

### 2.3.1 Set Default Output Values **Command &**

**Description**

This command sets the digital output channels specified in data field MMMM to a default bit (digital) value specified in data field DDDD. A single DDDD field represents the entire backpanel and is represented in hexadecimal format by 4 ASCII characters.

The default output values are stored in EEPROM. Upon system reset due to watchdog timeout, brownout, power cycling, or issue of the Reset command (B), these values will be read from EEPROM and used as default data for setting all output channels. Upon system reset due to a Reset Parameters to Default command ( [ ), the default output values in EEPROM will be overwritten by factory defaults. Default output values can be read from EEPROM using the Read Default Output Values command (*).

**ASCII Command Format**

| # characters | 1 | 1 | 1 | 1 | 4 | 4 to 64 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|
| | A | i | P | & | MMMM | DDDD | DVF | CR |

Where:

> = ASCII Character > (3E Hex)
i = 0
P = Panel Address* 8-F
& = Command Character (26 Hex)
MMMM = Module(s) to be set for Digital
DDDD = Data for all 16 channels (4 Chars)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Channel Binary Format MMMM (4 Characters)**

| Data Byte | 3 | 2 | 1 | 0 |
|---|---|---|---|---|
| Channel #s | 15 - 12 | 11 - 8 | 7 - 4 | 3 - 0 |
| Example | 1 1 1 1 | 1 1 1 1 | 1 1 1 1 | 1 1 1 1 |
| Hex ASCII Char | F | F | F | F |

**Data Format (DDDD)**

| Data Byte | 3 | 2 | 1 | 0 |
|---|---|---|---|---|
| Channel #s | 15 - 12 | 11 - 8 | 7 - 4 | 3 - 0 |
| Example | 0 0 0 0 | 0 0 0 0 | 0 0 0 0 | 1 0 1 0 |
| Hex ASCII Char | 0 | 0 | 0 | A |

**ASCII Response Format**

**Success Response Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 1 |
|---|---|---|---|---|---|---|
| | A | i | P | & | DVF | CR |

Where:

A = Good Response Character (41 Hex)(Ack)
i = 0
P = Panel Address*
& = Command Character (26 Hex)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Error Response Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | N | i | P | & | EC | DVF | CR |

Where:

N = Error Response Character (4E Hex)(Nack)
i = 0
P = Panel Address*
& = Command Character (26 Hex)
EC = Error Code (Reference Error Code Summary, Section 2.4)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

***Example:***

Command `> 08 & FFFF 0204 82 CR`
Response `A 08 & E5 CR`

Sends a Set Default Output Values command in ASCII format to the SLX101 Digital I/O Backpanel Panel 0 at address 0 Hex. Outputs are set on all 16 channels (see Channel Binary Format MMMM table above). Channels 15 through 10 set to a logic 0, channel 09 sets to a logic 1, channels 08 through 04 set to a logic 0, channel 02 sets to a logic 1, and channels 01 and 00 set to a logic 0. (For channel to bit state correlation, use Channel Binary Format MMMM table above.)

* Subtract 8 from the panel address to get the physical Digital I/O Backpanel address.

Data verification method is 8-bit checksum.

***Note:*** *Blank spaces in the above examples are added for visual clarity only. They do not actually appear in the command or in the response.*

### 2.3.2 Read Default Output Values **Command *

**Description**

This command reads the default digital output values of the channels specified in data field MMMM. Default outputs are configured with the Set Default Output Value command (&). The bit (digital) values read are returned in data field DDDD represented in hexadecimal format by 4 ASCII characters. Each bit corresponds to a single channel on the Digital I/O Backpanel. For any channel in MMMM that was set to 1, the corresponding bit in DDDD will be the default output value for that channel. For any channel in MMMM that was set to 0, the corresponding bit in DDDD will be set to 0.

**ASCII Command Format**

| # characters | 1 | 1 | 1 | 1 | 4 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | N | i | P | * | MMMM | DVF | CR |

Where:

> = ASCII Character > (3E Hex)
i = 0
P = Panel Address* 8-F
* = Command Character (2A Hex)
MMMM = Module(s) to be read
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Channel Binary Format MMMM (4 Character)**

| Data Character | 3 | 2 | 1 | 0 |
|---|---|---|---|---|
| Channel #s | 15 - 12 | 11 - 8 | 7 - 4 | 3 - 0 |
| Example | 1 1 1 1 | 1 1 1 1 | 1 1 1 1 | 1 1 1 1 |
| Hex ASCII Char | F | F | F | F |

**ASCII Response Format**

**Success Response Format**

| # characters | 1 | 1 | 1 | 1 | 4 to 64 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | N | i | P | * | DDDD | DVF | CR |

Where:

A = Good Response Character (41 Hex)(Ack)
i = 0
P = Panel Address*
* = Command Character (2A Hex)
DDDD = Data for all 16 channels (4 Chars), Factory default value is logic 1
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Data Format (DDDD)**

| Data Character | 3 | 2 | 1 | 0 |
|---|---|---|---|---|
| Channel #s | 15 - 12 | 11 - 8 | 7 - 4 | 3 - 0 |
| Example | 0 0 0 0 | 0 0 1 0 | 0 0 0 0 | 0 1 0 0 |
| Hex ASCII Char | 0 | 2 | 0 | 4 |

**Error Response Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | N | i | P | * | EC | DVF | CR |

Where:

N = Error Response Character (4E Hex)(Nack)
i = 0
P = Panel Address*
* = Command Character (2A Hex)
EC = Error Code (Reference Error Code Summary, Section 2.4)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

***Example:***

Command `> 08 * FFFF C0 CR`
Response `A 08 * 0204 AF CR`

Sends a Read Default Output Values command in ASCII format to the SLX101 Digital I/O Backpanel Panel 0 at address 0 Hex. Current values are requested from all 16 channels (see Channel Binary Format MMMM table above). Channels 15 through 10 return a logic 0, channel 09 returns a logic 1, channels 08 through 04 return a logic 0, channel 02 returns a logic 1, and channels 01 and 00 return a logic 0. (For channel to bit state correlation, use Channel Binary Format MMMM table above.)

* Subtract 8 from the panel address to get the physical Digital I/O Backpanel address.

Data verification method is 8-bit checksum.

***Note:*** *Blank spaces in the above examples are added for visual clarity only. They do not actually appear in the command or in the response.*

### 2.3.3 Set Digital Outputs – Group Command X

**Description**

This command sets the digital output channels specified in data field MMMM to the bit (digital) values specified in data field DDDD. Data field DDDD is a 16-bit hexadecimal number represented by 4 ASCII characters and represents the value to write to an entire panel. The SLX101 firmware cross checks with the I/O configuration on the SLX101 Digital I/O Backpanel and sends an error code for writing input or vacant channels.

**ASCII Command Format**

| # characters | 1 | 1 | 1 | 1 | 4 | 4 to 64 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|
| | A | i | P | X | MMMM | DDDD | DVF | CR |

Where:

> = ASCII Character > (3E Hex)
i = 0
P = Panel Address* 8-F
X = Command Character (58 Hex)
MMMM = Module(s) to be set for Digital
DDDD = Data for all 16 channels (4 Chars)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Channel Binary Format MMMM (4 Characters)**

| Data Byte | 3 | 2 | 1 | 0 |
|---|---|---|---|---|
| Channel #s | 15 - 12 | 11 - 8 | 7 - 4 | 3 - 0 |
| Example | 1 1 1 1 | 1 1 1 1 | 1 1 1 1 | 1 1 1 1 |
| Hex ASCII Char | F | F | F | F |

**Data Format (DDDD)**

| Data Byte | 3 | 2 | 1 | 0 |
|---|---|---|---|---|
| Channel #s | 15 - 12 | 11 - 8 | 7 - 4 | 3 - 0 |
| Example | 0 0 0 0 | 0 0 0 0 | 0 0 0 0 | 1 0 1 0 |
| Hex ASCII Char | 0 | 0 | 0 | A |

**ASCII Response Format**

**Success Response Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 1 |
|---|---|---|---|---|---|---|
| | A | i | P | X | DVF | CR |

Where:

A = Good Response Character (41 Hex)(Ack)
i = 0
P = Panel Address*
X = Command Character (58 Hex)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Error Response Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | N | i | P | X | EC | DVF | CR |

Where:

N = Error Response Character (4E Hex)(Nack)
i = 0
P = Panel Address*
X = Command Character (58 Hex)
EC = Error Code (Reference Error Code Summary, Section 2.4)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

***Example:***

Command `> 08 X FFFF 0204 B4 CR`
Response `A 08 X 17 CR`

Sends a Set Output – Group command in ASCII format to the SLX101 Digital I/O Backpanel Panel 0 at address 0 Hex. Outputs are set on all 16 channels (see Channel Binary Format MMMM table above). Channels 15 through 10 set to a logic 0, channel 09 sets to a logic 1, channels 08 through 04 set to a logic 0, channel 02 sets to a logic 1, and channels 01 and 00 set to a logic 0. (For channel to bit state correlation, use Channel Binary Format MMMM table above.)

* Subtract 8 from the panel address to get the physical Digital I/O Backpanel address.

Data verification method is 8-bit checksum.

***Note:*** *Blank spaces in the above examples are added for visual clarity only. They do not actually appear in the command or in the response.*

### 2.3.4 Set Digital Output **Command x**

**Description**

This command sets the digital output channel specified in data field CC to the bit (digital) value specified in data field DDDD. D is a 1-bit number represented by 1 ASCII character and can be either '0' or '1'. The SLX101 firmware cross checks with the I/O configuration on the SLX101 Digital I/O Backpanel and sends an error code for writing input or vacant channels.

**ASCII Command Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 1 to 4 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|
| | A | i | P | x | CC | DDDD | DVF | CR |

Where:
> = ASCII Character > (3E Hex)
i = 0
P = Panel Address* 8-F
x = Command Character (78 Hex)
CC = Channel number to be set (00-0F Hex)
DDDD = Data for channel specified (1 Chars)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Channel Binary Format MMMM (4 Characters)**

| Data Byte | 3 | 2 | 1 | 0 |
|---|---|---|---|---|
| Channel #s | 15 - 12 | 11 - 8 | 7 - 4 | 3 - 0 |
| Example | 1 1 1 1 | 1 1 1 1 | 1 1 1 1 | 1 1 1 1 |
| Hex ASCII Char | F | F | F | F |

**Data Format (DDDD)**

| Data Byte | 3 | 2 | 1 | 0 |
|---|---|---|---|---|
| Channel #s | 15 - 12 | 11 - 8 | 7 - 4 | 3 - 0 |
| Example | 0 0 0 0 | 0 0 0 0 | 0 0 0 0 | 1 0 1 0 |
| Hex ASCII Char | 0 | 0 | 0 | A |

**ASCII Response Format**

**Success Response Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 1 |
|---|---|---|---|---|---|---|
| | A | i | P | x | DVF | CR |

Where:

A = Good Response Character (41 Hex)(Ack)
i = 0
P = Panel Address*
x = Command Character (78 Hex)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Error Response Format**

| # characters | 1 | 1 | 1 | 1 | 2 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | N | i | P | x | EC | DVF | CR |

Where:

N = Error Response Character (4E Hex)(Nack)
i = 0
P = Panel Address*
x = Command Character (78 Hex)
EC = Error Code (Reference Error Code Summary, Section 2.4)
DVF = Data Verification Field
CR = Carriage Return (0D Hex)

**Example:**

Command `> 08 x 0A 1 98 CR`
Response `A 08 x 37 CR`

Sends a Set Output command in ASCII format to the SLX101 Digital I/O Panel 0 at address 0 Hex. Channel 10 sets to a logic 1.

* Subtract 8 from the panel address to get the physical Digital I/O Backpanel address.

Data verification method is 8-bit checksum.

***Note:*** *Blank spaces in the above examples are added for visual clarity only. They do not actually appear in the command or in the response.*

## 2.4 Error Code Summary – Error Messages

The SCMD isoLynx® SLX101 Digital I/O Backpanel is capable of detecting and reporting errors to the host computer. It always returns an acknowledgment message after successfully executing a command. If the SLX101 detects an error, it will not execute the command, but will return an error message containing a code describing the exact nature of the error.

The error codes are:

01 Undefined Command
The command character was not a legal command character.

02 Checksum Error
The checksum received did not match the value calculated from the command.

03 Reserved

04 Reserved

05 Data Field Error
Address specified not in bounds or wrong number of characters received.

06 Communications Link Watchdog Timeout Error
The digital I/O communications link watchdog timer has expired.

Possible causes: the addressed Digital I/O Backpanel is not present, not powered, faulty, or the communications cable is not connected or faulty.

07 Specified Data Invalid Error
One or more data fields contain an illegal value. Valid data is decimal 0-9 or hexadecimal A-F .

08 Reserved

09 Invalid Module Type Error
This code is returned when one or more specified modules are not of the type expected by the command.

Possible causes: attempting to read from an unconfigured channel or write to an input or unconfigured channel.

10 Reserved

11 Reserved

12 Reserved

13 Invalid Panel Type
One or more module (M) bits for channels 15-12 were set for panel 0 for the Set I/O Configuration – Group command (G).

Or panel requested for any network command was not panel 0.

Or panels 4-7 were requested for any command.

14 I/O Configuration Type Error
The number of type fields does not match the number of module (M) bits in Set I/O Configuration – Group command (G).

15 Reserved

16 Reserved

17 Invalid Requested Data Type
Requested data type is undefined.

## Appendix A: Digital I/O Backpanel Does Not Communicate or Sends Garbled Data

If communications with the panel cannot be established or received data is garbled, system communications setup can be reset using the procedure in Section 1.7.1 Communications Reset Jumper.

Garbled data may also be received if the expansion network termination network settings are not correct. Refer to Section 1.5.3 Expansion Network Termination Network Switches and verify settings for termination network switches are correct for the installation. Further details are found in Appendix B: AN302 RS-485 Digital I/O Expansion Network Configurations.

## Appendix B: AN302 RS-485 Digital I/O Expansion Network Configurations

### General Notes on Termination

- For SLX101 Digital I/O Backpanel or other RS-485 device at the extreme ends of the line:

The need for termination depends on data rate, line length, cable electrical characteristics and environment, and if applicable, the number of multidropped devices. This is best determined by switching each termination network in or out for the most reliable data transfer.

- For RS-485 devices other than the isoLynx® RS-485 or Digital I/O Backpanel, termination networks may need to be added externally.

- For TD and RD:

For TD (Transmit Data), 120Ω across the lines is standard. For RD (Receive Data), 120Ω across the lines may suffice. However, some cases may need line bias resistors as well. The line bias resistors hold the true data line (B', +, DATA) at least 0.2V more positive than the inverted data line (A', –, DATA*) in the MARK (idle) state. The line bias resistors consist of one 1kΩ pull-up resistor connected from the true data line to +5V and another 1kΩ pull-down resistor connected from the inverted data line to Return (ground). If +5V and/or Return are not available externally, contact the device manufacturer to determine how to access these internally. Alternately, an external +5V power supply can be used. Connect the negative terminal to the RS-485 device's RS-485 Return. If the RS-485 circuits are isolated, use an isolated output power supply.

- Digital I/O Backpanel, or other RS-485 device multidropped between the extreme ends of the line:

All terminations should be disconnected from the line.

Figures B-1 and B-2 show 2-wire configurations.

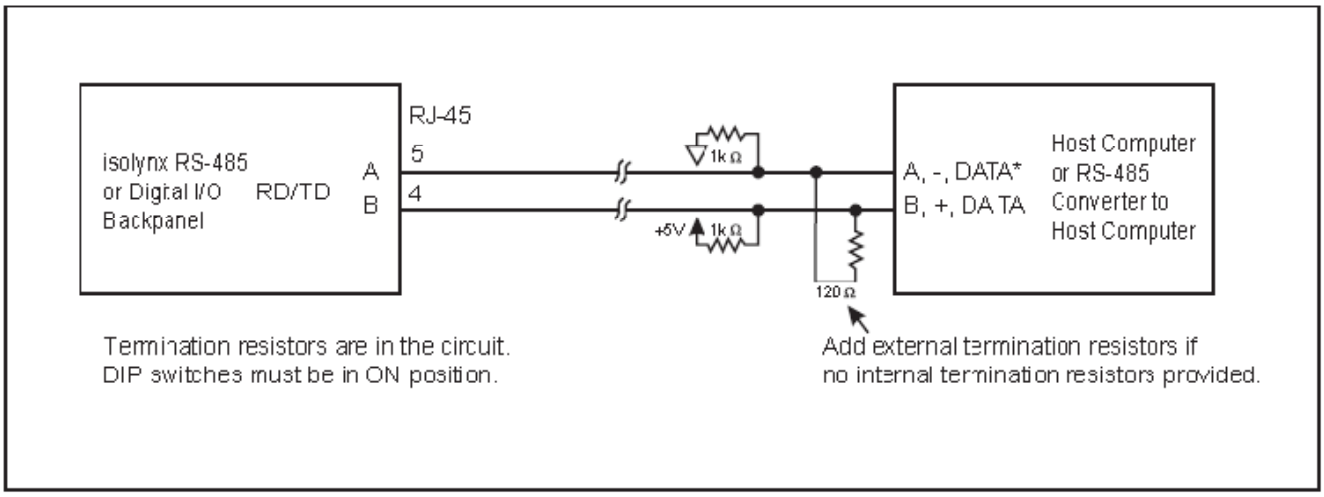



Figure B-1: Digital I/O Expansion Network Connections, Half Duplex – 2-wire, Point-to-Point

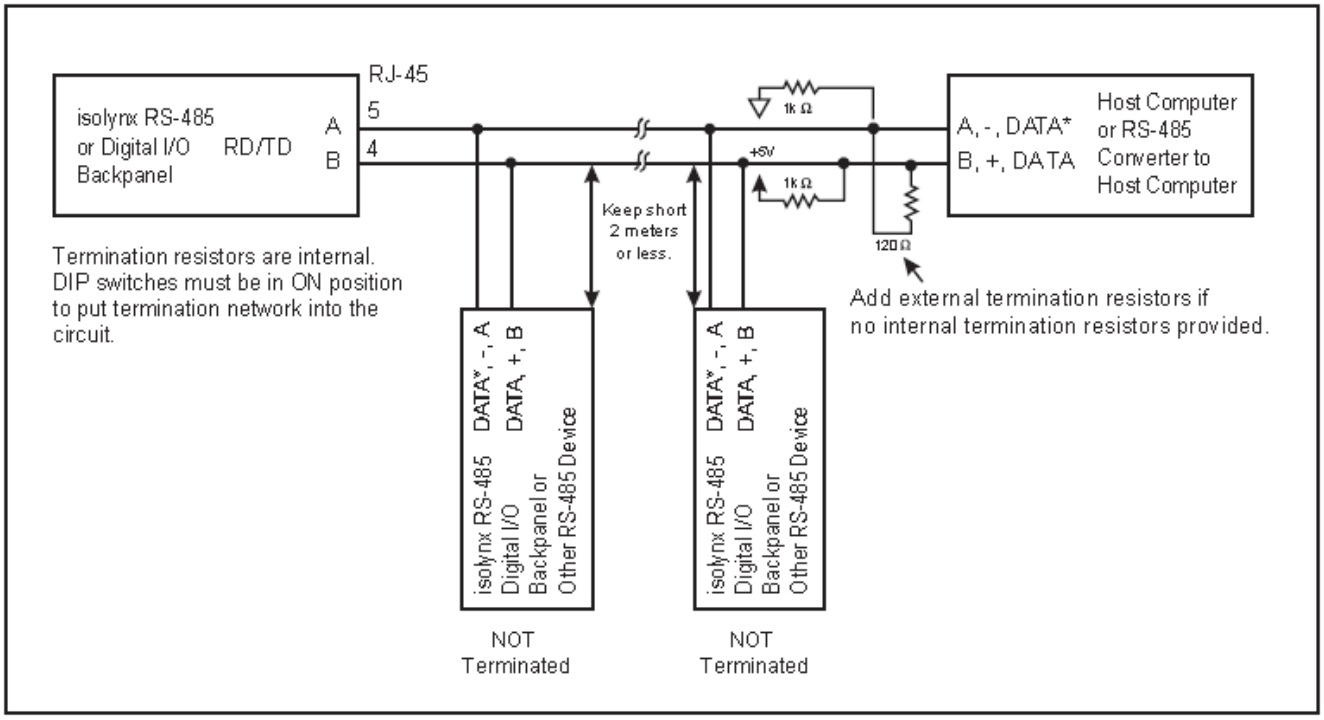



Figure B-2: Digital I/O Expansion Network Connections, Half Duplex – 2-wire, Multidrop

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2. Product serial number.
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**Dataforth Corporation**
**3331 E. Hemisphere Loop**
**Tucson, AZ 85706 USA**

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**SCMD isoLynx® SLX101 Digital I/O Backpanel User Manual**
**MA1034 Rev. A – August 2010**