

Digital I/O Extender
Models 232IOEXT & 422IOEXT
Document No. IOEXT4395

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Chapter 1- Introduction

Overview

The I/O EXTENDER provides an easy solution for extending discrete digital I/O lines. It provides sensing of ON/OFF conditions and control of devices from a remote location. Here is how it works. The I/O EXTENDER transfers the states of its 16 discrete digital I/O lines to serial data. It then transmits the data out the serial communications port. Conversely, when an I/O Extender receives serial I/O data, it relays the serial input data to its digital output lines. When an input changes state, or at every one second increment, the I/O Extender transmits the states of the I/O lines out the serial port. Extending I/O lines requires two modules.

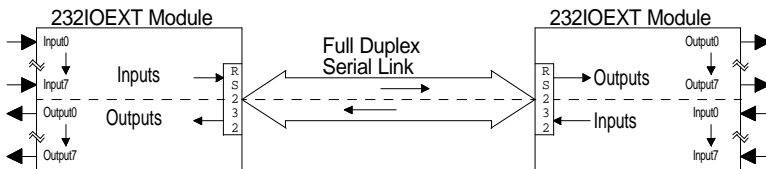


Figure 1.1: Simplified Functional Diagram

Features

The I/O EXTENDER module has eight digital inputs, eight digital outputs, serial communication port, communications timer, and a status LED indicator.

Digital I/O Lines

The eight digital inputs and eight digital outputs have a zero to positive five volts DC range and are CMOS/TTL compatible. All digital I/O lines are available through a DB-25S (female) connector.

All input lines have pull-up resistors to +5 Vdc and are normally HIGH. This means that output lines are normally HIGH (+5 Vdc). When an input line of one module is LOW (pulled down to signal ground) the serial input data sent to the second module will set the corresponding output line to the LOW state. To invert the state of all output lines so they are normally LOW, simply set a DIP switch inside the module. Refer to Table 2.2 and Figure 2.4.

The state of the output lines at power-up and during a communication time-out conditions is DIP switch selectable. Refer to Table 2.2 and Figure 2.4.

Serial Port

The serial port is an asynchronous full-duplex port with the signals brought out to a DB-25P (male) connector. Baud rates from 1200 to 115,200 are available. The communication format consists of 8 data bits, 1 stop bit and no parity. Two versions of the I/O EXTENDER module are available, an RS-232 version Model 232IOEXT for use with full-duplex lease line modems, and an RS-422 version Model 422IOEXT for remote applications up to 4,000 feet.

Power

The I/O EXTENDER requires +12 Vdc unregulated power. Connect power through the 2.5mm jack or through the DB-25S I/O Port connector.

Communication Timer

The communication timer is useful for fail safe operations. It forces all output lines to their power-up state if the I/O Extender does not receive serial I/O data within a preselected time. Use the DIP switch on the printed circuit board to enable and disable the communication timer, select the power-up state, and to select the time-out interval. Time-out intervals available are: 3 seconds, 10 seconds, or 30 seconds. Refer to Table 2.2 and Figure 2.4.

Status LED

The Status LED indicates normal operating and communications time-out conditions. The LED will flash every two seconds when the module is operating normally. If there is a communications time-out, the LED will flash every one-half second. Restoring communication returns the LED to a normal flash rate.

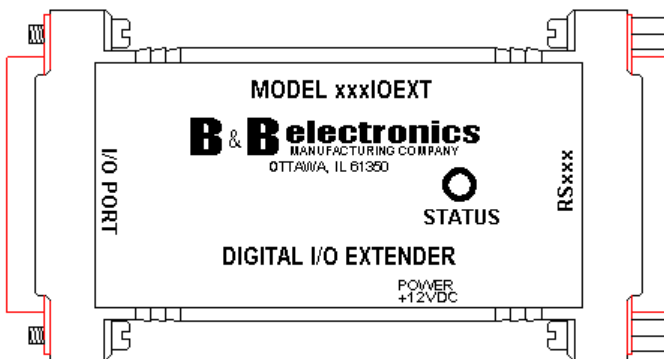


Figure 1.2: I/O EXTENDER Module

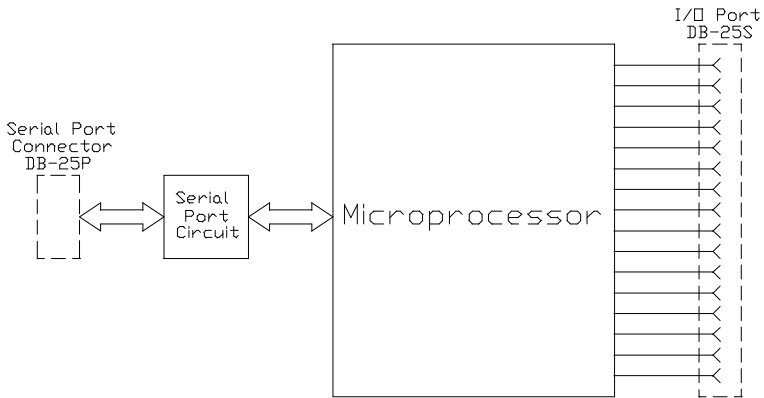


Figure 1.3: Simplified Block Diagram

I/O Timing

It is important to understand that time plays a factor when scanning the input states of one I/O Extender and relaying that data to the output states of another I/O Extender. Two elements determine this transfer time: the serial transmit time, and the input scan time. The transmission time consists of the baud rate and the number of characters transmitted. The input scan time is the minimum time an input level must be present before the I/O Extender can sense it. Use the following formulas when calculating the transfer time:

Transfer Time (TT) = Scan Time + Transmission Time

Scan Time (ST) = 50 microseconds

Transmission Time (XT) = $[(1/\text{baud rate})50] + 25$ microseconds

Example1: Baud rate is 115,200 baud.

$$XT = [(1/115,200)50] + 25 \text{ microseconds}$$

$$XT = 459 \text{ microseconds}$$

$$TT = 50 \text{ microseconds} + 459 \text{ microseconds}$$

$$TT = 509 \text{ microseconds.}$$

Example2: Baud rate is 1200 baud.

$$XT = [(1/1200)50] + 25 \text{ microseconds}$$

$$XT = 41.692 \text{ milliseconds}$$

$$TT = 50 \text{ microseconds} + 41.692 \text{ milliseconds}$$

$$TT = 41.74 \text{ milliseconds.}$$

This means that when there is a change in an input state, it will take the length of the transfer time before that change will appear on the output line of the other I/O Extender. Note that there is no checking of the input lines during the transmission time. Refer to Figure 1.4.

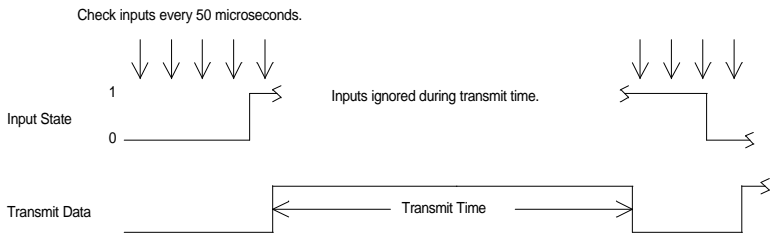


Figure 1.4: Data Transfer Timing

Packing List

Examine the shipping carton and contents for physical damage. The following items should be in the shipping carton:

1. I/O EXTENDER unit
2. This instruction manual

If any item has shipping damage or is missing contact B&B Electronics immediately.

I/O EXTENDER Specifications

I/O Lines

Total:	16
I/O to Serial Transfer Time:	509 microsec. min (115.2k baud) 417 millisc. max. (1200 baud)
Connector:	DB25S (female)

Digital Inputs

Lines:	8
Voltage Range:	0 Vdc to 5 Vdc
Low Voltage:	0.8 Vdc max.
High Voltage:	2.0 Vdc min.
Leakage Current:	1 microamp max.
Pull-up current:	100 microamps
Input Scan Time:	50 microseconds

Digital Outputs

Lines:	8
Low Voltage:	0.6 Vdc @ 8.3 milliamps (Sink)
High Voltage:	4.3 Vdc @ -3.1 milliamps (Source)

Power Supply

Input Voltage:	+8 Vdc to +16 Vdc
232IOEXT power -	+12 Vdc @ 15 milliamps min.*
422IOEXT power -	+12 Vdc @ 25 milliamps min.*

* Does not include the power consumption of external devices.

Communications

232IOEXT:	RS-232 (DCE/DTE selectable)
422IOEXT:	RS-422
Baud Rate:	1200 to 115,200
Format:	8 data bits, 1 stop bit, no parity
Connector:	DB25P (male)

Size 0.82" x 2.15" x 4.14"

Chapter 2 - Setup and Connections

This chapter will cover the setup and connections of the digital I/O lines, serial port and input power for the I/O EXTENDER. Do not make any connections to the I/O EXTENDER until you have read this chapter and the I/O Interfacing chapter.

Digital I/O Connections

The I/O port connector (DB25S) provides connections to the Digital I/O lines. Refer to Table 2.1 and I/O Interfacing chapter 3.

Digital Inputs

The input lines are CMOS/TTL compatible and can handle voltages from 0 Vdc to +5 Vdc. Inputs lines have pull-up resistors to +5 Vdc and are normally HIGH. Connect only external devices having a 0 Vdc to +5 Vdc output range to inputs of the I/O Extender. Failure to do so may damage unit and void warranty.

Digital Outputs

The digital output lines have a minimum LOW voltage of 0 Vdc and a maximum HIGH voltage of +5 Vdc. The outputs are CMOS/TTL compatible. By setting a DIP switch the output states can follow the input states (non-inverted) or be the opposite of the input states (inverted). The state of the output lines at power-up and during a communication time-out conditions is also DIP switch selectable. Refer to Table 2.2 and Figure 2.4.

Make sure external devices do not require more output current than the I/O Extender outputs can provide. Failure to do so may result in damage to the unit and void the warranty. Refer to the I/O Extender Specifications in chapter 1.

Table 2.1: I/O Port Pinout

DB-25S Pin #	Function	DB-25S Pin #	Function
1	No connection	14	Output #7
2	No connection	15	Output #6
3	No connection	16	Output #5
4	No connection	17	Output #4
5	No connection	18	Output #3
6	No connection	19	Output #2
7	Ground	20	No connection
8	+12 Vdc Input	21	Output #1
9	Input #0	22	Output #0
10	Input #1	23	Input #7
11	Input #2	24	Input #6
12	Input #3	25	Input #5
13	Input #4		

Table 2.2: DIP Switch Settings

Switch Positions								SETTING
1	2	3	4	5	6	7	8	
0	0	0	X	X	X	X	X	1200 Baud*
1	0	0	X	X	X	X	X	2400 Baud
0	1	0	X	X	X	X	X	4800 Baud
1	1	0	X	X	X	X	X	9600 Baud
0	0	1	X	X	X	X	X	19.2K Baud
1	0	1	X	X	X	X	X	38.4K Baud
0	1	1	X	X	X	X	X	57.6K Baud
1	1	1	X	X	X	X	X	115.2K Baud
X	X	X	0	0	X	X	X	Communication Time-out Disabled*
X	X	X	1	0	X	X	X	3 Second Communication Time-out
X	X	X	0	1	X	X	X	10 Second Communication Time-out
X	X	X	1	1	X	X	X	30 Second Communication Time-out
X	X	X	X	X	0	X	X	Non-inverted outputs*
X	X	X	X	X	1	X	X	Inverted outputs
X	X	X	X	X	X	0	X	Power-up output state = LOW*
X	X	X	X	X	X	1	X	Power-up output state = HIGH
X	X	X	X	X	X	X	0	not used

0 = OFF 1 = ON X = Don't Care * = Factory Default

NOTE: To change the settings on the switch, remove power from unit. Open enclosure by using a flat blade screwdriver, placing the blade into each of the four slots and twisting the screwdriver. After setting the switch, align the top and bottom of the enclosure and squeeze both sides simultaneously. Restoring power to the unit will validate the new switch settings.

Serial Port Connections

The I/O Extender is available with an RS-232 serial port Model 232IOEXT or with a RS-422 serial port Model 422IOEXT. The serial port receives and transmits the states of the digital I/O lines. The serial port's baud rate has a range from 1200 to 115,200 baud. The baud rate largely determines how fast a change in an input state changes the state of the corresponding output line. To set the baud rate use the DIP switch on the printed circuit board. Refer to Table 2.2 and Figure 2.4. The serial communications format is 8 data bits, 1 stop bit, and no parity.

RS-232

Model 232IOEXT has a full-duplex RS-232 serial port and requires only three signals for serial communications: transmit data (TD), receive data (RD), and signal ground (SG). Refer to Table 2.3. The module is DCE or DTE selectable by setting two jumpers inside the module, refer to Figure 2.5. NOTE: When selecting DCE or DTE make sure both jumpers are in the same position.

The RS-232 port can extend I/O lines up to 50 feet. However, by connecting the RS-232 port to a full-duplex lease line modem over a leased telephone line increases the distance by the length of the leased line.

**Table 2.3: RS-232 Connector Pinout
Model 232IOEXT**

DB-25P Pin #	Signal	Signal Description	DTE Signal Direction of Serial Port	DCE Signal Direction of Serial Port
2	TD	Transmit Data	Output	Input
3	RD	Receive Data	Input	Output
7	SG	Signal Ground	<----->	<----->

The following handshake lines are tied together:

RTS (pin 4) to CTS (pin 5), and DTR (pin 20) to DSR (pin 6).

When connecting two 232IOEXT modules together, set one of the modules as a DTE device and the other as a DCE device. Refer to Figure 2.1.

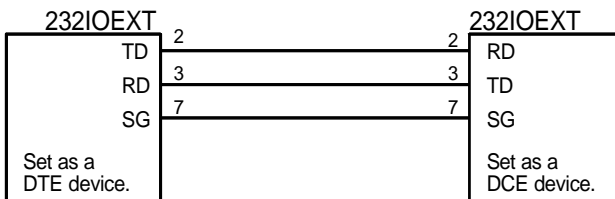


Figure 2.1: RS232 DTE/DCE Hookup Diagram

If connecting a 232IOEXT to a full-duplex leased line modem, configure the I/O Extender as a DTE device. Refer to Figure 2.2.

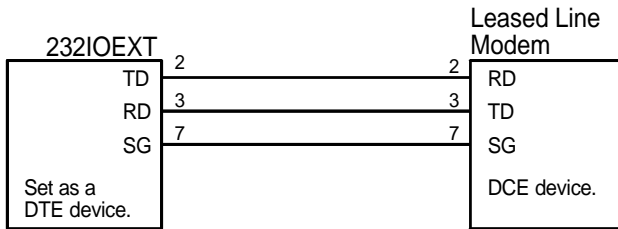


Figure 2.2: Leased Modem Hookup Diagram

RS-422

Model 422IOEXT has a four-wire full-duplex RS-422 serial port. For pinouts refer to Table 2.4. This model can extend I/O lines up to 4,000 feet.

**Table 2.4: RS-422 Connector Pinout
Model 422IOEXT**

DB-25P Pin #	Signal	Signal Description	Signal Direction of Serial Port
2	TD(A)	Transmit Data A	Output
3	RD(A)	Receive Data A	Input
7	SG	Signal Ground	<----->
14	TD(B)	Transmit Data B	Output
16	RD(B)	Receive Data B	Input

When connecting two 422IOEXT modules together refer to Figure 2.3

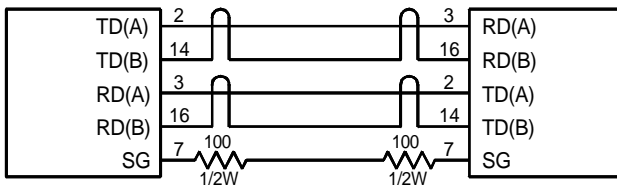


Figure 2.3: RS-422 Hookup Diagram

For more information regarding RS-422 communications request B&B's RS-422/485 Application Note.

Power Supply Connections

The I/O EXTENDER requires an external power supply. Make connections through the 2.5mm power jack or through the I/O Port connector. Refer to Table 2.1. An external power supply needs to supply +8 Vdc to +16 Vdc.

NOTE: The power requirement of the module does not include any power consumption of external devices connected to the module. Do not exceed the maximum individual output current. Refer to the I/O EXTENDER Specification Section of Chapter 1.

Figure 2.4: Top View of Printed Circuit Board

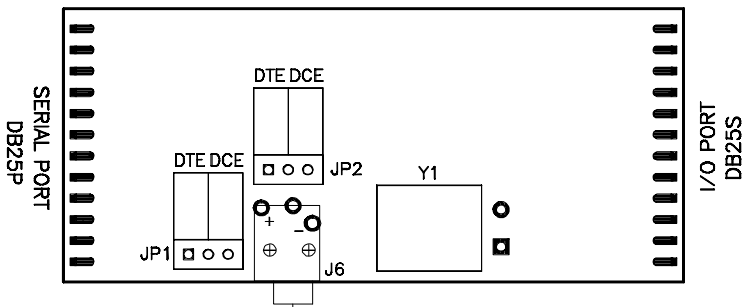


Figure 2.5: Bottom View of Printed Circuit Board

Chapter 3 - I/O Interfacing

This chapter will explain HIGH and LOW states and show some general examples of how to interface to the I/O lines. Caution: Do not to exceed the I/O EXTENDER specifications listed in Chapter 1 when interfacing to external devices. Failure to stay within these specifications could result in damage to the unit and will void the warranty.

Digital Inputs

As stated earlier, digital input lines are CMOS/TTL compatible and can only handle voltages from 0 Vdc to +5 Vdc.

Digital inputs sense a HIGH or a LOW state. Switch closures, contact closures, or a solid state digital signals accomplish this task. Inputs can also sense AC voltages by using mechanical or solid state relays. Solid state relays are available from many manufacturers.

Figures 3.1 - 3.4 show examples of some typical input interfaces.

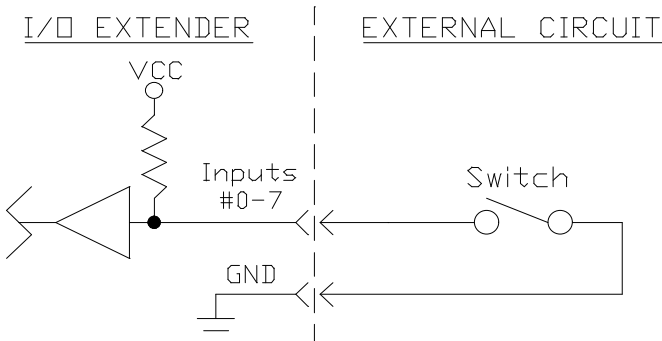


Figure 3.1: Switch Input

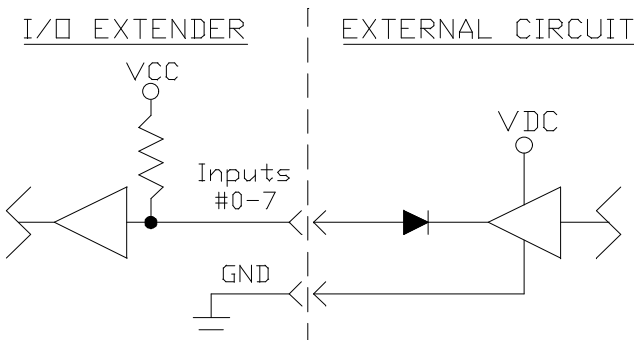


Figure 3.2: Solid State Input

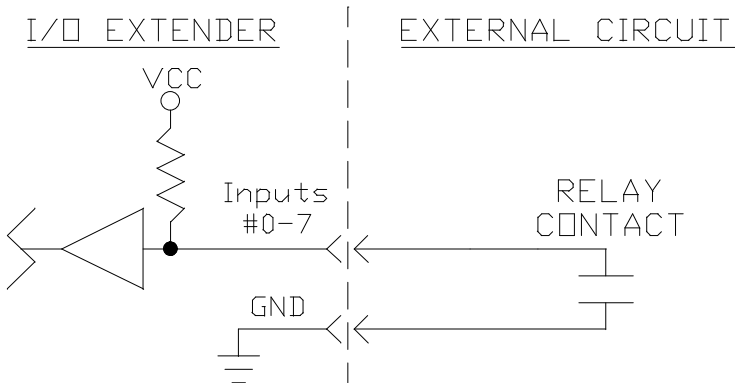


Figure 3.3: Isolated Mechanical Input

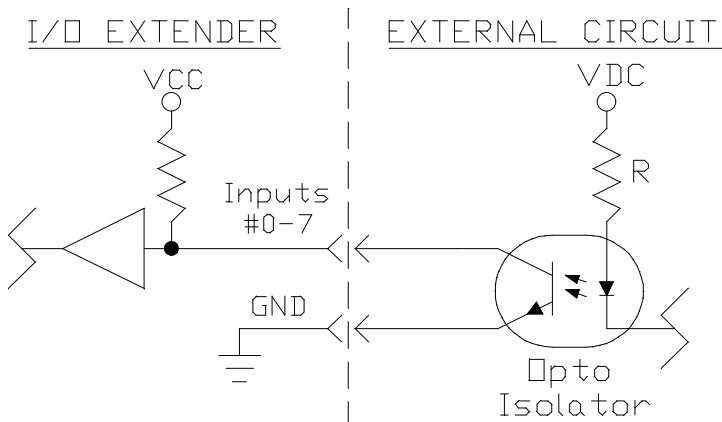


Figure 3.4: Isolated Solid State Input

Digital Outputs

Digital outputs TURN ON or TURN OFF external devices. Digital outputs are CMOS/TTL compatible and operate between 0 Vdc and +5 Vdc. The outputs can control solid state output modules, and CMOS/TTL logic circuits. Caution: Do not exceed the power capability of the outputs. Refer to the output specifications in Chapter 1. Figures 3.5 - 3.6 show examples of some typical output interfaces. Figure 3.6 is an example of an inverted output driving an opto isolator.

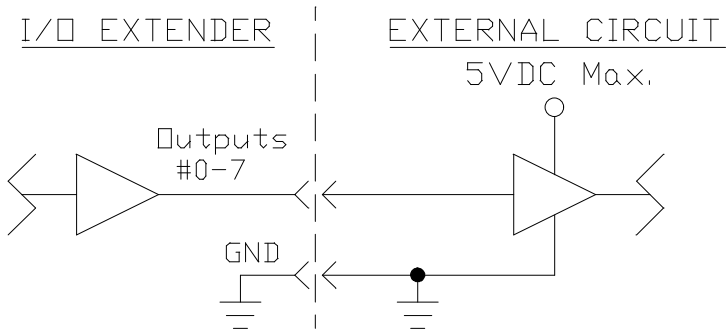


Figure 3.5: Solid State Output

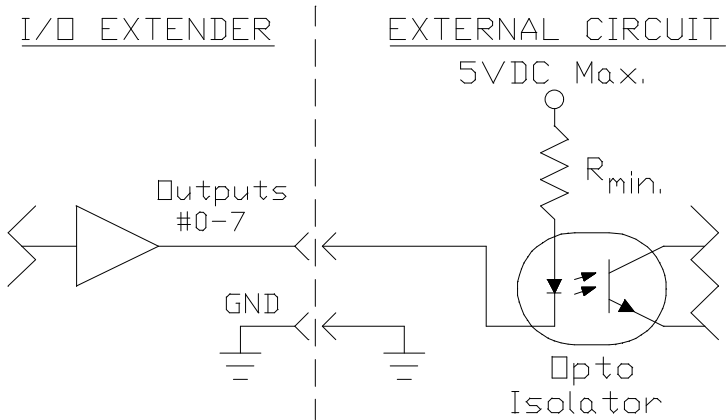


Figure 3.6: Isolated Solid State Output

Chapter 4 - Commands

This chapter explains the serial communications of the I/O Extender. Read this chapter if you are intending to use a computer to communicate with an I/O Extender. Using the I/O Extender in this fashion requires that the user has knowledge of a programming language that is capable of accessing the computer's serial port.

There is only one command transmitted and received by the I/O EXTENDER: I/O Data. The command string is five bytes in length (See Table 4.1).

Table 4.1: I/O EXTENDER Command

Function	Command
I/O Data	!IO{Output data}{Input data}

Symbols: {...} represents one byte

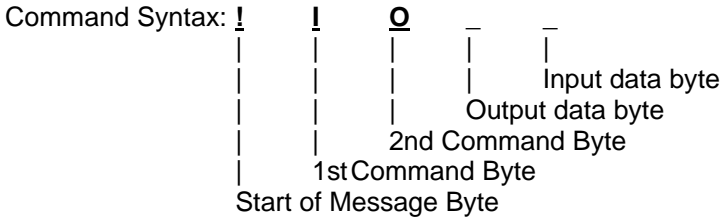
Before explaining the specifics of the command, it is important to understand that a byte has a numeric value from 0 to 255. This value may be represented in decimal (0 - 255) format, hexadecimal (00 - FF) format, binary (00000000 - 11111111) format or as an ASCII character. The fixed bytes of the command will be represented as ASCII characters: "!IO". Refer to Table 4.1. However, it is important to remember that an ASCII character has a numeric value. Example: The ASCII "0" (zero) does not have a value of zero but has a value of decimal 48. The decimal and hexadecimal equivalents of some ASCII characters appear in Table 4.2. Refer to Appendix A for more ASCII and decimal equivalents.

Table 4.2: Equivalent Values

ASCII	Decimal	Hexadecimal
!	33	21h
I	73	49h
O	79	4Fh

Command Syntax

The command string consists of five bytes. The first byte is the start of message byte, and is always the ASCII "!" (33 dec.) character. The second and third bytes are the ASCII characters "I" (73 dec.) and "O" (79 dec.). The next two bytes represent the current state of the Output and Input lines respectively.



I/O Data Bytes

When constructing commands to manipulate the outputs lines or when reading the state of the I/O lines, it is necessary to know how to select and interpret the I/O data bytes. The eight output lines and eight input lines take up two data bytes. The Output data bytes represent outputs #7 through #0 and the Input data bytes represent input #7 through #0. The Output data byte precedes Input data byte in the command string.

One byte represents an eight-bit binary number (11111111), and therefore represents eight I/O lines. Each I/O line has a bit position and a weight (value). Refer to Table 4.3.

Table 4.3: Bit Assignments for I/O Lines

OUTPUT DATA BYTE								
Output Line #	7	6	5	4	3	2	1	0
Bit Position	7	6	5	4	3	2	1	0
Hex Weight	80	40	20	10	8	4	2	1
Dec. Weight	128	64	32	16	8	4	2	1
INPUT DATA BYTE								
Input Line #	7	6	5	4	3	2	1	0
Bit Position	7	6	5	4	3	2	1	0
Hex Weight	80	40	20	10	8	4	2	1
Dec. Weight	128	64	32	16	8	4	2	1

When interpreting an output data bit, a "1" equals a HIGH on the output line and a "0" equals a LOW on the output line. When interpreting an input data bit, a "0" equals a LOW at the input line and a "1" equals a HIGH at the input line.

Example 4.1: Module is set for non-inverted outputs. Set outputs 7, 1, and 0 to a HIGH state, and all other outputs to a LOW state the input data byte transmitted to the module is (in bold face):

	<u>Input Data Byte</u>
Shown in binary -	1000011
Shown in decimal -	131 (128+2+1)
Shown in hexadecimal -	83 (80h+2h+1h)

Example 4.2: Module is set for inverted outputs. Set outputs 7, 1, and 0 to a LOW state, and all other outputs to a HIGH state the input data byte transmitted to the module is (in bold face):

	<u>Input Data Byte</u>
Shown in binary -	1000011
Shown in decimal -	131 (128+2+1)
Shown in hexadecimal -	83 (80h+2h+1h)

Example 4.3: Received I/O Data bytes (in bold face):

	<u>Output Data Byte</u>	<u>Input Data Byte</u>
Shown in binary -	10010010	11001000
Shown in decimal -	146 (128+16+2)	200 (128+64+8)
Shown in hexadecimal -	92 (80h+10h+2h)	C8 (80h+40h+8h)

Output lines #7,4,1 are HIGH and all other output lines are LOW. Input lines #7, 6, 3 are HIGH and all other input lines are LOW.

I/O Data Command

The I/O Data command contains an output data byte and an input data byte. The I/O Extender transmits and receives this command. When transmitted, it reflects the current states of its input and output lines. When received, it uses the input's data byte to set its output lines and it ignores the output data byte.

The first data byte contains the state of the Output lines (7 - 0). The second data byte contains the state of the Input lines (7 - 0). If an output bit is "0" then the state of that output line is LOW. Conversely if the bit is a "1" then the output line is HIGH.

If an input bit is a "0" then the state of the input line is LOW, conversely if the bit is a "1" then the input line is HIGH.

Command: !IO

Argument: {Output byte}{Input byte}

ASCII Example: !IO \bar{E} R

Dec. Example: !IO<200><82>

Hex. Example: !IO<C8><52>

Bin. Example: !IO<11001000><01010010>

Description: The Output byte indicates that Output lines # 7, 6, & 3 are HIGH and Output lines # 5, 4, 2, 1 & 0 are LOW. The Input byte indicates that Input lines # 6, 4, & 1 are HIGH and Input lines # 7, 5, 3, 2, & 0 are LOW. Should the I/O Extender receive this command, the module will set its output lines to reflect the state of the input data byte received.

APPENDIX A

ASCII Character Codes

<u>Decimal</u>	<u>ASCII</u>
0	NUL
1	SOH
2	STX
3	ETX
4	EOT
5	ENQ
6	ACK
7	BEL
8	BS
9	HT
10	LF
11	VT
12	FF
13	CR
14	SO
15	SI
16	DLE
17	DC1
18	DC2
19	DC3
20	DC4
21	NAK
22	SYN
23	ETB
24	CAN
25	EM
26	SUB
27	ESC
28	FS
29	GS
30	RS
31	US
32	SP
33	!
34	"
35	#
36	\$
37	%
38	&

<u>Decimal</u>	<u>ASCII</u>
39	"
40	(
41)
42	*
43	+
44	"
45	-
46	.
47	/
48	0
49	1
50	2
51	3
52	4
53	5
54	6
57	9
58	:
59	;
60	<
61	=
62	>
63	?
64	@
65	A
66	B
67	C
68	D
69	E
70	F
71	G
72	H
73	I
74	J
75	K
76	L
77	M
78	N
79	O

Decimal ASCII

80	P
81	Q
82	R
83	S
84	T
85	U
86	V
87	W
88	X
89	Y
90	Z
91	[
92	\
93]
94	^
95	_
96	'
97	a
98	b
99	c
100	d
101	e
102	f
103	g
104	h
105	i
106	j
107	k
108	l
109	m
110	n
111	o
112	p
113	q
114	r
115	s
116	t
117	u
118	v

Decimal ASCII

119	w
120	x
121	y
122	z
123	{
124	
125	}
126	~
127	DEL
128	
129	
130	
•	
•	
•	
255	

APPENDIX B

Hexadecimal/Decimal Conversions

The decimal (base 10) numbering system represents each position in successive powers of 10, with each decimal symbol having a value from 0 to 9. The hexadecimal (base 16) numbering system represents each position in successive powers of 16 with each hex symbol having a value of 0 to 15. Since each hex position must have a single symbol, the symbols "A" through "F" are values 10 through 15 respectively. Refer to Table 1. The information and examples to follow will explain how to convert from a decimal number to a hexadecimal number and vice versa.

Table 1.

Decimal Value	Hexadecimal Symbol
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

Hexadecimal to Decimal Conversion:

$$\begin{aligned} \text{Decimal} = & (1\text{st Hex digit} \times 4096) + \\ & (2\text{nd Hex digit} \times 256) + \\ & (3\text{rd Hex digit} \times 16) + \\ & (4\text{th Hex digit}) \end{aligned}$$

Each "Hex digit" is the decimal equivalent value of the hexadecimal symbol.

Example: Convert 10FC hexadecimal to decimal.

$$\begin{array}{r} 1 \times 4096 = 4096 \\ 0 \times 256 = 0 \\ 15 \times 16 = 240 \\ 12 \times 1 = 12 \\ \hline 4348 \end{array}$$

10FC hex equals 4348 decimal.

Decimal to Hexadecimal Conversion:

Example: Convert 4348 decimal to hexadecimal.

$$\begin{array}{r} 4096 \overline{) 4348} = 1 = 1 \quad (1\text{st Hex digit}) \\ \underline{4096} \\ 252 \overline{) 252} = 0 = 0 \quad (2\text{nd Hex digit}) \\ \underline{0} \\ 16 \overline{) 252} = 15 = F \quad (3\text{rd Hex digit}) \\ \underline{240} \\ 1 \overline{) 12} = 12 = C \quad (4\text{th Hex digit}) \\ \underline{12} \\ 0 \end{array}$$

4348 decimal equals 10FC hexadecimal.

APPENDIX C

Interface Modules for I/O Extender Models

DTB25

The DTB25 connects to the I/O Extender models to provide easy access to the available I/O lines. The DTB25 connector plugs into the I/O Extender's DB25S I/O Port connector. Each of the twenty-five pins on the connector connects to a terminal block. Refer to Table C.1. Dimensions: 0.5" x 2.1" x 4.3". An enclosure for the DTB25 is available.

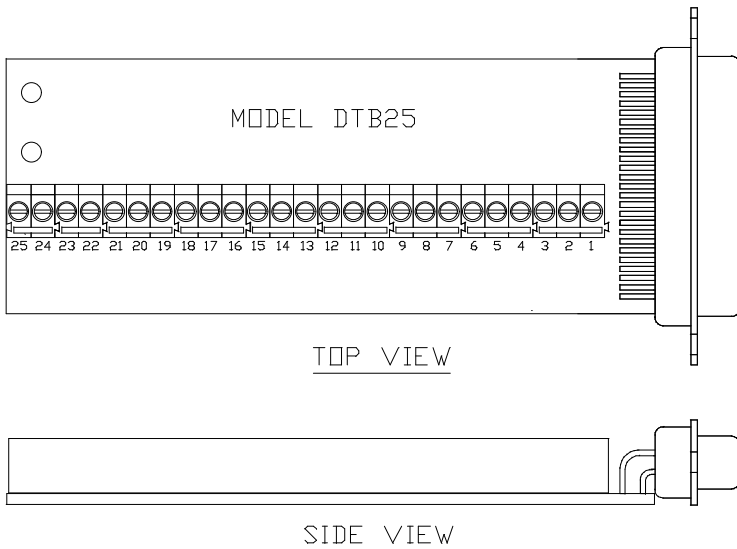


Figure C.1: DTB25 Outline Drawing

When connecting any external devices to the DTB25, make sure they are compatible with the I/O Extender module. This will avoid possible damage to the module and to the external devices. Make sure not to exceed the voltage and current limits of the I/O Extender module, failure to do so could result in damage to the module and will void the warranty. Refer to the Specification Section of this Manual.

Table C.1: DTB25 Connections

DB-25P Pin #	Function	T.B. #	DB-25P Pin #	Function	T.B. #
1	Unused.	1	14	Output #7	14
2	Unused.	2	15	Output #6	15
3	Unused.	3	16	Output #5	16
4	Unused.	4	17	Output #4	17
5	Unused.	5	18	Output #3	18
6	Unused.	6	19	Output #2	19
7	Ground	7	20	Unused.	20
8	+12 Vdc Input	8	21	Output #1	21
9	Input #0	9	22	Output #0	22
10	Input #1	10	23	Input #7	23
11	Input #2	11	24	Input #6	24
12	Input #3	12	25	Input #5	25
13	Input #4	13			

DBM16

The DBM16 module provides buffering and increased power handling for all the sixteen I/O lines of the I/O Extender models. Each of the I/O lines is selectable as an input or as an output by setting a jumper on the board. The DBM16 module connects directly into the I/O Extender module's DB25S I/O Port connector. Terminal blocks provide for all I/O line, power, and ground connections. Refer to Table C.2. An enclosure for the DBM16 is available.

Table C.2: DBM16 I/O Connections

T.B.1 Label	I/O Extender Function	T.B.2 Label	I/O Extender Function
I/O7	Input Line #7	I/O8	Output Line #0
GND	Ground	GND	Ground
I/O6	Input Line #6	I/O9	Output Line #1
I/O5	Input Line #5	I/O10	Output Line #2
GND	Ground	GND	Ground
I/O4	Input Line #4	I/O11	Output Line #3
I/O3	Input Line #3	I/O12	Output Line #4
GND	Ground	GND	Ground
I/O2	Input Line #2	I/O13	Output Line #5
I/O1	Input Line #1	I/O14	Output Line #6
GND	Ground	GND	Ground
I/O0	Input Line #0	I/O15	Output Line #7
GND	Ground		
+12	+12 Vdc Input		
ITS	Inductive-load Transient Suppression		

DBM16 Interfacing

This section will show some general examples of how to interface the DBM16 I/O lines to external devices. Caution: Do not exceed the DBM16 specifications, failure to do so could result in damage to the DBM16 and will void the warranty.

Important: Do not make any connections to the DBM16 module until setting the DBM16 I/O lines as follows: I/O lines #0 - 7 as inputs and I/O lines #8 - 15 as outputs. Refer to Figure C.2. Set the I/O Extender's DIP switch so the output are inverted.

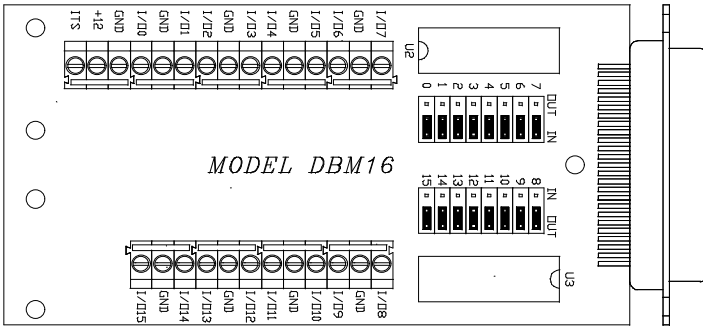


Figure C.2: DBM16 Outline Drawing

Inputs

Digital inputs sense HIGH and LOW states based on voltage levels. Switch closures, contact closures, or solid state digital signals accomplish this task. Each DBM16 input is normally HIGH (pulled up through a resistor) and the I/O Extender will read a logic "1". When an input on the DBM16 is grounded (below +1.5 Vdc), the I/O Extender will read a logic "0". Figures C.3 - C.6 show examples of some typical input interfaces.

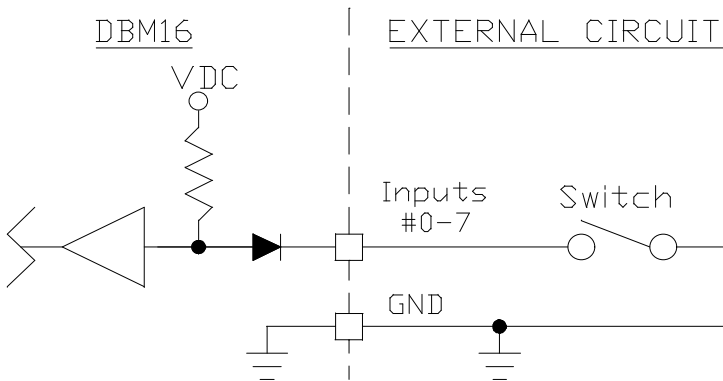


Figure C.3: Switch Input

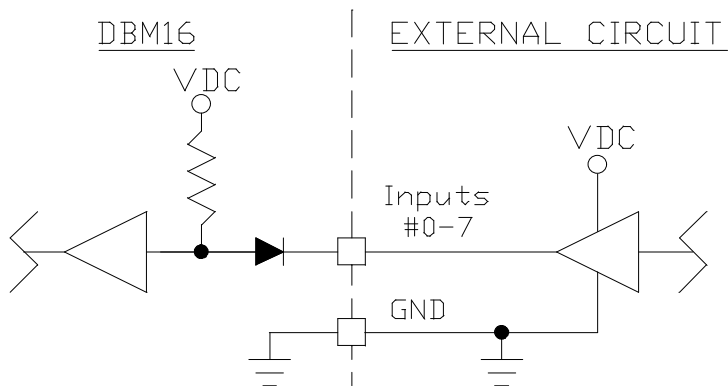


Figure C.4: Solid State Input

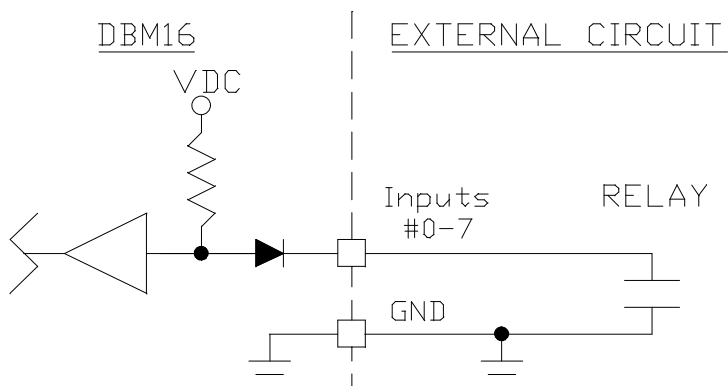


Figure C.5: Isolated Mechanical Input

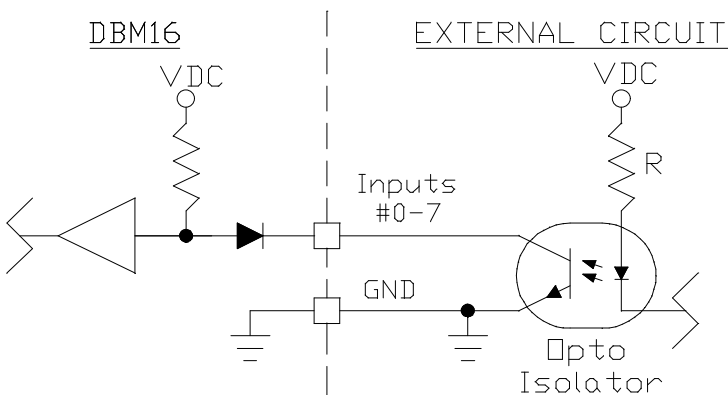


Figure C.6: Isolated Solid State Input

Outputs

Digital outputs turn "ON" or "OFF" external devices. The DBM16 Digital outputs operate between 0 Vdc and +50 Vdc. The outputs can control solid state output modules, CMOS/TTL logic circuits, relays, solenoids, and lamps. Caution: Do not exceed the power capability of the outputs. Refer to the DBM16 output specifications.

Set the I/O Extender module's output lines as inverted outputs, refer to Table 2.2. The DBM16 outputs are open collector current sinking drivers. Figures C.7 - C.9 show examples of some typical output interfaces.

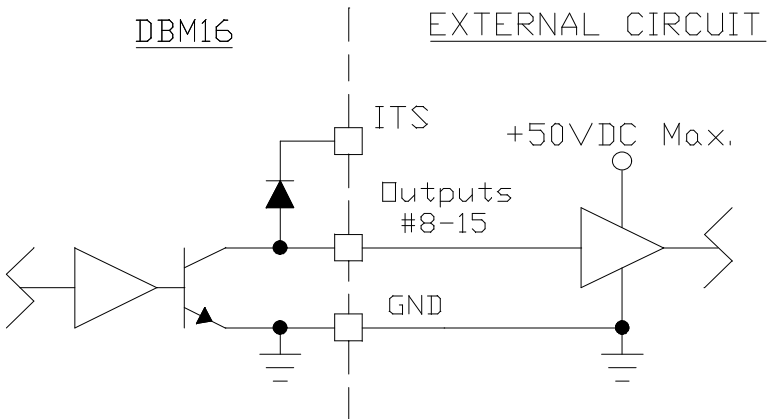


Figure C.7: Solid State Output

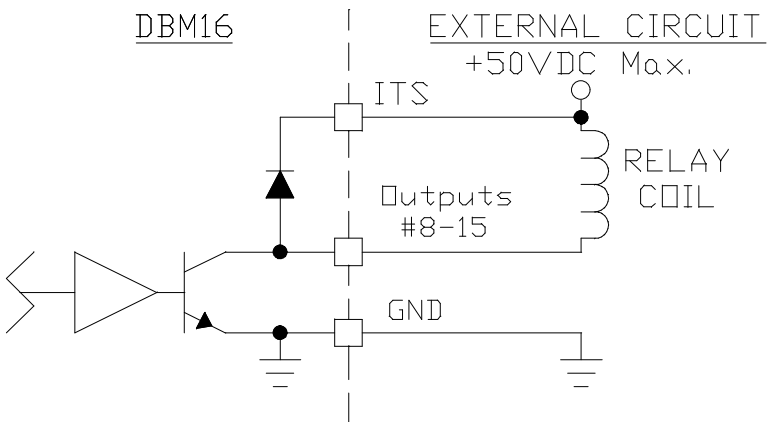


Figure C.8: Isolated Mechanical Output

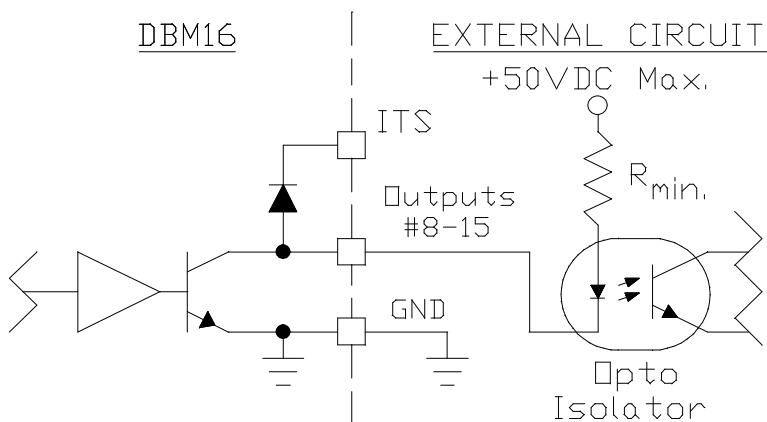


Figure C.9: Isolated Solid State Output

DBM16 Specifications

I/O Lines

Total: 16 (Factory default - set to inputs)

Inputs

Voltage range: 0 Vdc to +50 Vdc
 Low Voltage: 0 Vdc to +1.5 Vdc
 High Voltage: +2.5 Vdc to +50 Vdc
 Internal pull-up current: 0.5 ma

Outputs

Output Voltage: +50 Vdc max.
 Output current: 350 ma max. - only 1 output on
 100 ma max. - all outputs on
 Output leakage current: 50 micro amp max.
 Output saturation voltage: 1.1 Vdc max. @ 100ma

CAUTION: Total output power cannot exceed 2 watts for I/O's #0-7 and 2 watts for I/O #8-15 @ 25 degrees C.

Power Supply

Input Voltage: 8 Vdc to 16 Vdc @ 10 milliamps
 (Doesn't include the power consumption of external devices.)

Connections: Terminal Blocks

Size: 0.5" x 2.1" x 4.5"

FEDERAL COMMUNICATIONS COMMISSION RADIO FREQUENCY INTERFACE STATEMENT

Class A Equipment

This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at personal expense.