VX500
Fiberoptic Switch

Operation Manual

91500 Revision B

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Contents

Product Overview

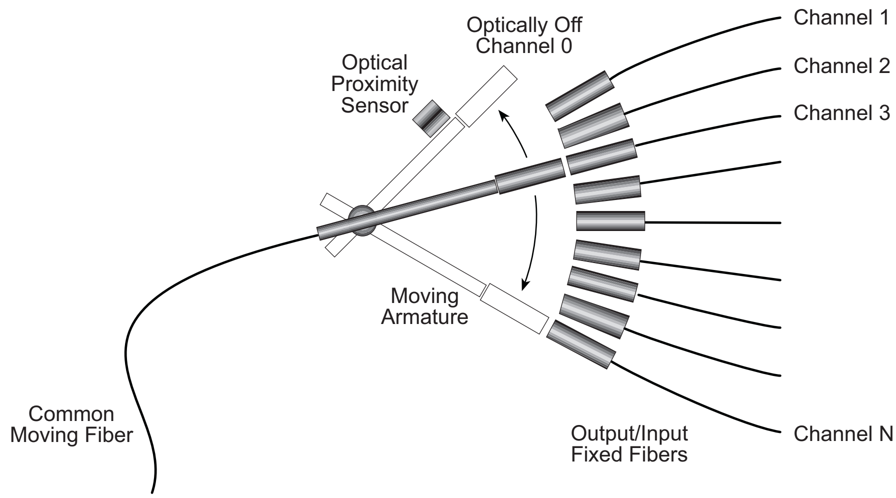
DiCon's VX500 Fiberoptic Switch is a multi-channel fiberoptic switch designed for integration within products that require 1×N or 2×N optical switch routing. The design of the VX500 is based on patented technology which enables precise fiber-to-fiber positioning of either singlemode or multimode fibers.

Optical Switch Module

The VX500 optical switch module is an opto-mechanical switch that allows selection of an individual fiber channel by means of a high-resolution stepper motor. The stepper motor moves one or two common fibers into direct alignment with one or two of several output fibers using DiCon's patented moving fiber technology.

The VX500 is optically passive, operating independently of data rate, data format, and optical signal direction. Some of the terms used to describe the internal components of VX500 optical switch module are illustrated in Figure 1.

Figure 1: *The Internal Components of the VX500*



VX500 Interface Board

The VX500 switch module contains an electronic interface board that converts TTL input signals to the switch's optical channel position. The important components of the interface are labeled in Figure 2.

The twelve-pin interface connector has six data inputs (RESET and <D4:D0>) and a STROBE input as well as two status outputs. The BUSY output indicates whether the device is busy performing an operation or ready to receive new switching instructions. The ERROR output indicates when an error has occurred.

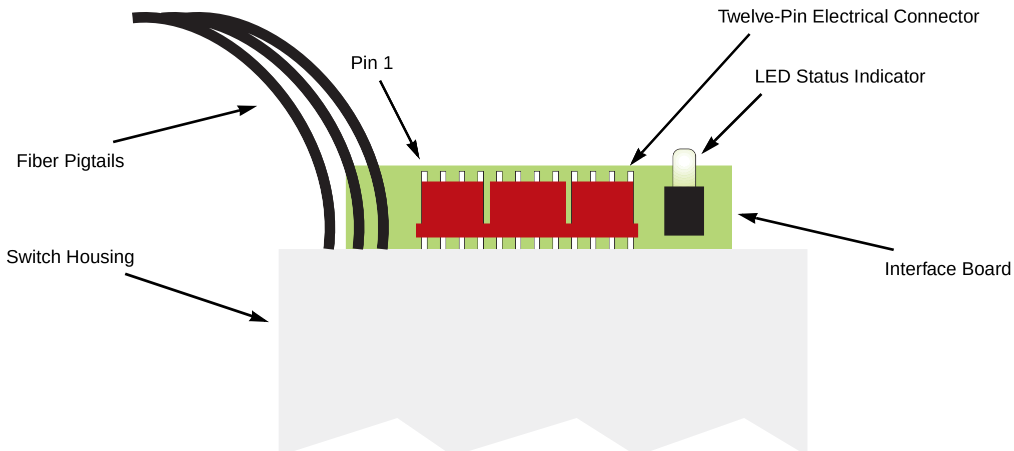
The board requires a constant +12 VDC supply both during switching and switch hold.

Connecting to the Interface

The electrical connector on the DiCon VX500 Switch is a male twelve-pin 0.100-inch right-angle square-pin friction-lock header (Molex part number 22-12-2124). To mate to this connector, use a corresponding female receptacle housing (Molex part number 22-01-3127 or equivalent) and contacts (Molex part number 08-56-0110 or equivalent). The mating connector can be obtained from Molex (Tel: (708)969-4550) or from DiCon Fiberoptics, Inc.

The maximum length of the control cable is two meters. Use shielded cable for lengths greater than one meter.

Figure 2: *The VX500 Interface Board (Top View)*



Reading the Status LED

The status LED provides a constant visual indication of the state of the switch. The four possible states are defined in the following table.

Appearance	State
Green	Ready. The switch is operating properly and ready to receive switching instructions.
Yellow	Busy. The device is performing a switch operation.
Red	Error. A user error or device malfunction has occurred.
None	Off. No power to the switch.

Thermal Considerations

The VX500 generates about 3 watts of heat continuously. The switch may not perform correctly if it is allowed to overheat (50°C max.). Under some circumstances, a vented air flow may be necessary in order to keep the housing temperature within range.

Warning

The switch may not perform correctly if it is allowed to overheat (50°C max.). Under some circumstances, a vented air flow may be necessary in order to keep the housing temperature within range.

Switch Operation

The twelve-pin interface is used for supply power, channel selection, and status checking. The following table defines the signals associated with each pin.

Table 1: *Interface Pin Assignments*

Pin Number	Signal Name	Signal Type	Description
1	GND	Power	Signal ground.
2	GND	Power	Power ground.
3	D0	Input	The D0 input is the LSB of the channel address.
4	D1	Input	The D1 input is bit 1 of the channel address.
5	D2	Input	The D2 input is bit 2 of the channel address.
6	D3	Input	The D3 input is bit 3 of the channel address.
7	D4	Input	The D4 input is the MSB of the channel address.
8	STROBE	Input	The STROBE input is a falling-edge-trigger clock signal.
9	BUSY	Output	The BUSY output is high when the switch is busy, and low when the switch is ready.
10	ERROR	Output	The ERROR output is low during normal operation. A high ERROR output indicates that the requested channel is out of range (user error) or that a stepper motor or proximity switch error has occurred (device malfunction).
11	RESET	Input	Set RESET to low to return the switch to the reset position, and to high to choose a different output channel.
12	POWER	Power	Power supply input (+12 VDC ±5%, 300 mA max.)

Starting the Switch

To start the switch, apply power (+12 VDC ±5%, 300 mA max.) to the POWER line. A stable voltage with less than 10 mV RMS ripple is recommended.

The switch requires a 970-ms initialization period upon power up while the switch armature returns to reset position. Do not apply TTL input to the data lines (D0, D1, D2, D3, D4, STROBE, and RESET) during initialization. Switch control may lock up if data is applied during initialization. If the switch locks up, cycle the supply power and restart the switch.

Warning

Applying TTL-level signals to the data lines before or during switch initialization may lock up switch control. Do not apply TTL-level signals to the data lines until power has been applied to the POWER input for 970 ms.

During the 970-ms initialization period, the BUSY and ERROR outputs as well as the optical outputs are invalid.

Resetting the Switch

When the VX500 is in the reset position (also called the park position, channel zero, or optical off), there is no optical connection to any output channel. Set the switch to the reset position to prevent optical data from passing through the switch, or to reset the stepper motor. During a reset operation, optical noise may appear on various output channels as the armature rotates.

One way to reset the switch is to cycle the supply power to the switch. The switch returns to the reset position following the initial application of power to the POWER pin (see “Starting the Switch” on page 7).

To return the switch to the reset position without interrupting the supply power, set the RESET input to low and apply a STROBE pulse. The RESET input is latched by the falling edge of the STROBE signal, respecting hold, setup, and pulse width constraints (see Table 6). The BUSY output remains high until the reset operation is complete and the device is ready to receive additional instructions.

Losing Power to the Switch

If the supply power is interrupted the switch *does not* latch in its current position. Instead, it loses direct fiber-to-fiber alignment, breaking the optical connection. When supply power is restored the switch automatically restarts, returning to the reset position.

Selecting an Output Channel

To choose a specific channel, set the RESET input to high, set the channel address inputs (<D4:D0>) to the appropriate value (see Tables 2, 3, 4, and 5), and apply a STROBE pulse. The inputs are latched by the falling edge of the STROBE signal, respecting hold, setup, and pulse width constraints (see Table 6). The BUSY output will go high until the STROBE pulse has ended, the switch operation is complete, and the device is ready to receive additional instructions. Note that the BUSY signal will remain high until the end of the STROBE pulse, even if the switch operation is complete and the optical connection is stable.

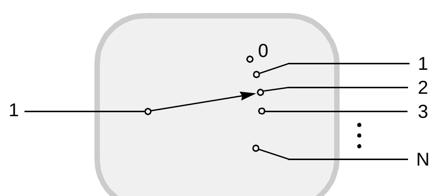
If the latched value of the channel address (<D4:D0>) is the same as the previous latched value, the BUSY signal will go high for 60–80 ms even though there is no switch movement. If the latched value of the channel address (<D4:D0>) indicates an out-of-range position, the BUSY and ERROR signals will go high for 60–80 ms.

The following sections list the switch channel number associated with each data-input setting for simplex 1×N, synchronous duplex 1×N, 2×N blocking, and 2×N non-blocking switches, respectively.

Simplex 1×N Configurations

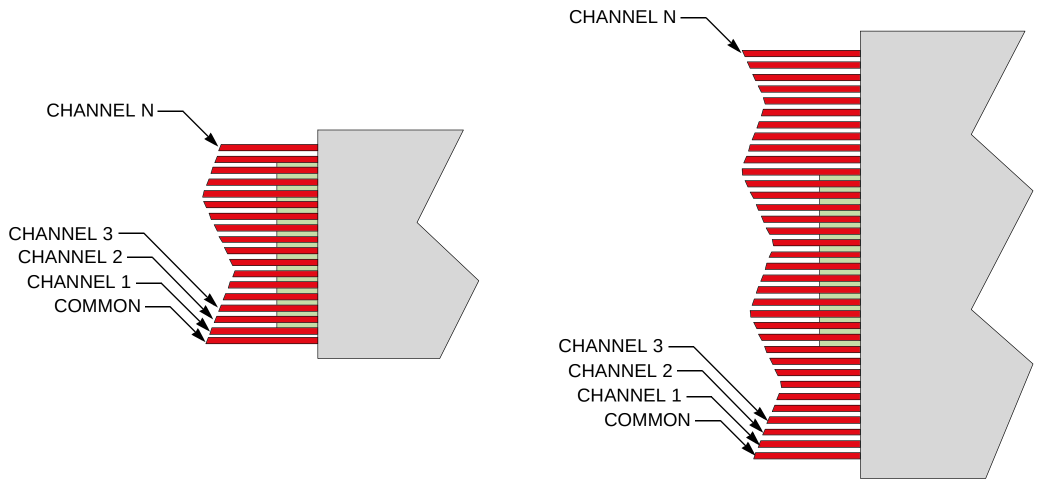
The relationship between the optical inputs and outputs in a VX500 simplex 1 × N switch is shown in Figure 3.

Figure 3: *Simplex 1×N Switch Configuration*



The arrangement of the fiber pigtails on a VX500 1×N switch is shown in Figure 4. The left diagram applies to switch units with up to 16 output channels. The right diagram applies to units with 17–32 output channels.

Figure 4: *Simplex 1×N Channel Order (Top View)*



To select the output channel of a simplex 1×N switch with up to 32 output channels, set the five channel address inputs (<D4:D0>) and the RESET input as indicated in Table 2, then strobe the device.

Table 2: *Control Codes For Simplex 1×N Configurations*

RESET	D4	D3	D2	D1	D0	Active Channel
0	x	x	x	x	x	0 reset
1	0	0	0	0	0	1
1	0	0	0	0	1	2
1	0	0	0	1	0	3
1	0	0	0	1	1	4
1	0	0	1	0	0	5
1	0	0	1	0	1	6
1	0	0	1	1	0	7
1	0	0	1	1	1	8
1	0	1	0	0	0	9
1	0	1	0	0	1	10
1	0	1	0	1	0	11
1	0	1	0	1	1	12
1	0	1	1	0	0	13
1	0	1	1	0	1	14
1	0	1	1	1	0	15
1	0	1	1	1	1	16
1	1	0	0	0	0	17
1	1	0	0	0	1	18
1	1	0	0	1	0	19
1	1	0	0	1	1	20
1	1	0	1	0	0	21
1	1	0	1	0	1	22
1	1	0	1	1	0	23
1	1	0	1	1	1	24
1	1	1	0	0	0	25
1	1	1	0	0	1	26

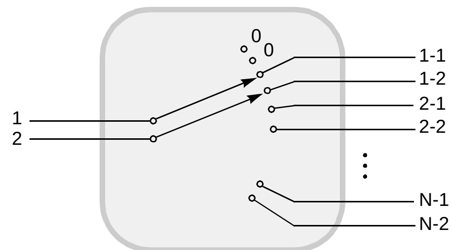
Table 2: *Control Codes For Simplex 1×N Configurations (Continued)*

RESET	D4	D3	D2	D1	D0	Active Channel
1	1	1	0	1	0	27
1	1	1	0	1	1	28
1	1	1	1	0	0	29
1	1	1	1	0	1	30
1	1	1	1	1	0	31
1	1	1	1	1	1	32

Synchronous Duplex 1×N Configurations

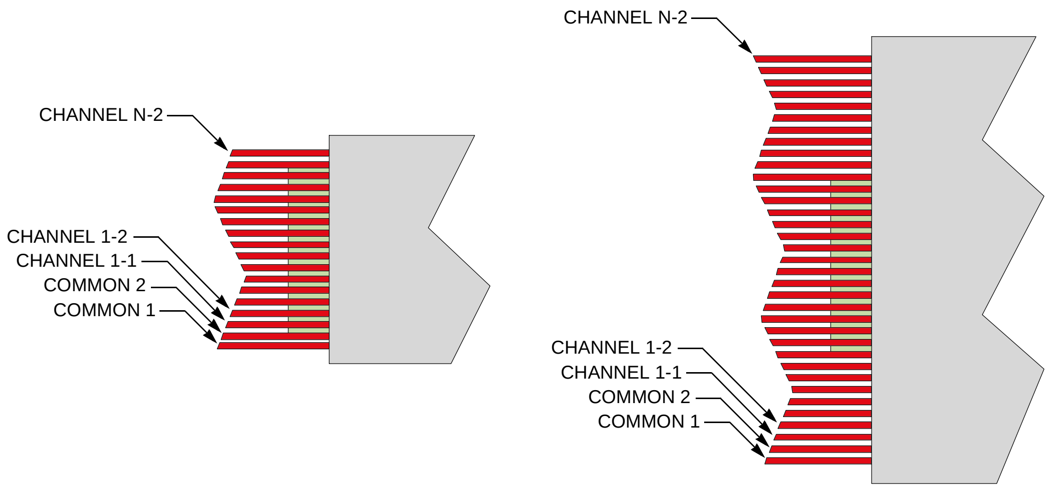
The relationship between the optical inputs and outputs in a VX500 synchronous duplex 1×N switch is shown in Figure 5.

Figure 5: *Synchronous Duplex 1×N Switch Configuration*



The arrangement of the fiber pigtails on a VX500 synchronous duplex 1×N switch is shown in Figure 6. The left diagram applies to switch units with up to 16 output channels (1×8). The right diagram applies to units with 18–32 output channels (1×9 to 1×16).

Figure 6: *Synchronous Duplex 1×N Channel Order (Top View)*



To select the output channel of a simplex 1×N switch with up to 50 output channels (1×25), set the five channel address inputs (<D4:D0>) and the RESET input as indicated in Table 3, then strobe the device.

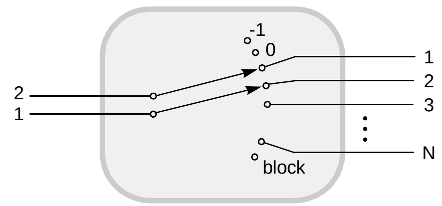
Table 3: *Control Codes for Synchronous Duplex 1×N Configurations*

RESET	D4	D3	D2	D1	D0	Common 1 Active Channel	Common 2 Active Channel
0	x	x	x	x	x	0 reset	0 reset
1	0	0	0	0	0	1-1	1-2
1	0	0	0	0	1	2-1	2-2
1	0	0	0	1	0	3-1	3-2
1	0	0	0	1	1	4-1	4-2
1	0	0	1	0	0	5-1	5-2
1	0	0	1	0	1	6-1	6-2
1	0	0	1	1	0	7-1	7-2
1	0	0	1	1	1	8-1	8-2
1	0	1	0	0	0	9-1	9-2
1	0	1	0	0	1	10-1	10-2
1	0	1	0	1	0	11-1	11-2
1	0	1	0	1	1	12-1	12-2
1	0	1	1	0	0	13-1	13-2
1	0	1	1	0	1	14-1	14-2
1	0	1	1	1	0	15-1	15-2
1	0	1	1	1	1	16-1	16-2
1	1	0	0	0	0	17-1	17-2
1	1	0	0	0	1	18-1	18-2
1	1	0	0	1	0	19-1	19-2
1	1	0	0	1	1	20-1	20-2
1	1	0	1	0	0	21-1	21-2
1	1	0	1	0	1	22-1	22-2
1	1	0	1	1	0	23-1	23-2
1	1	0	1	1	1	24-1	24-2
1	1	1	0	0	0	25-1	25-2

2×N Non-Blocking Configurations

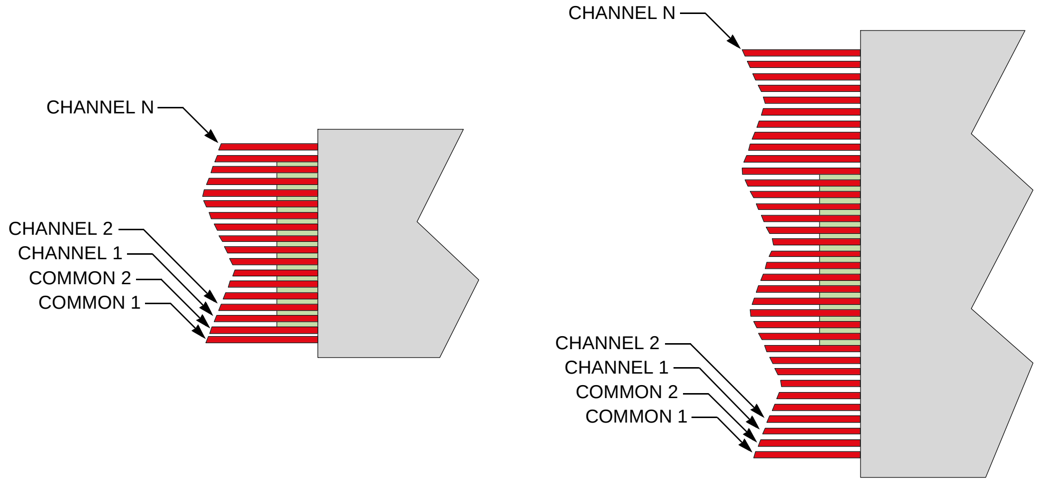
The relationship between the optical inputs and outputs of a VX500 2×N non-blocking switch is shown in Figure 7.

Figure 7: *2×N Non-Blocking Switch Configuration*



The arrangement of the fiber pigtails on a VX500 2×N non-blocking switch is shown in Figure 8. The left diagram applies to switch units with up to 16 output channels. The right diagram applies to units with 17–32 output channels.

Figure 8: *2×N Non-Blocking Channel Order (Top View)*



To select the output channel of a 2×N non-blocking switch with up to 32 output channels, set the five channel address inputs (<D4:D0>) and the RESET input as indicated in Table 4, then strobe the device.

Table 4: *Control Codes For 2×N Non-Blocking Configurations*

RESET	D4	D3	D2	D1	D0	Common 1 Active Channel	Common 2 Active Channel
0	x	x	x	x	x	0 reset	-1 reset
1	0	0	0	0	0	1	0 block
1	0	0	0	0	1	2	1
1	0	0	0	1	0	3	2
1	0	0	0	1	1	4	3
1	0	0	1	0	0	5	4
1	0	0	1	0	1	6	5
1	0	0	1	1	0	7	6
1	0	0	1	1	1	8	7
1	0	1	0	0	0	9	8
1	0	1	0	0	1	10	9
1	0	1	0	1	0	11	10
1	0	1	0	1	1	12	11
1	0	1	1	0	0	13	12
1	0	1	1	0	1	14	13
1	0	1	1	1	0	15	14
1	0	1	1	1	1	16	15
1	1	0	0	0	0	17	16
1	1	0	0	0	1	18	17
1	1	0	0	1	0	19	18
1	1	0	0	1	1	20	19
1	1	0	1	0	0	21	20
1	1	0	1	0	1	22	21
1	1	0	1	1	0	23	22
1	1	0	1	1	1	24	23
1	1	1	0	0	0	25	24

Table 4: *Control Codes For 2×N Non-Blocking Configurations (Continued)*

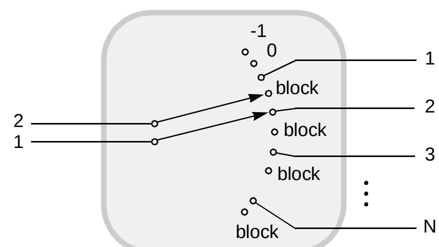
RESET	D4	D3	D2	D1	D0	Common 1 Active Channel	Common 2 Active Channel
1	1	1	0	0	1	26	25
1	1	1	0	1	0	27	26
1	1	1	0	1	1	28	27
1	1	1	1	0	0	29	28
1	1	1	1	0	1	30	29
1	1	1	1	1	0	31	30
1	1	1	1	1	1	block[a]	31

a. When the channel address is set to N (the highest input channel), Common 1 is blocked and Common 2 is aligned with Channel N.

2×N Blocking Configurations

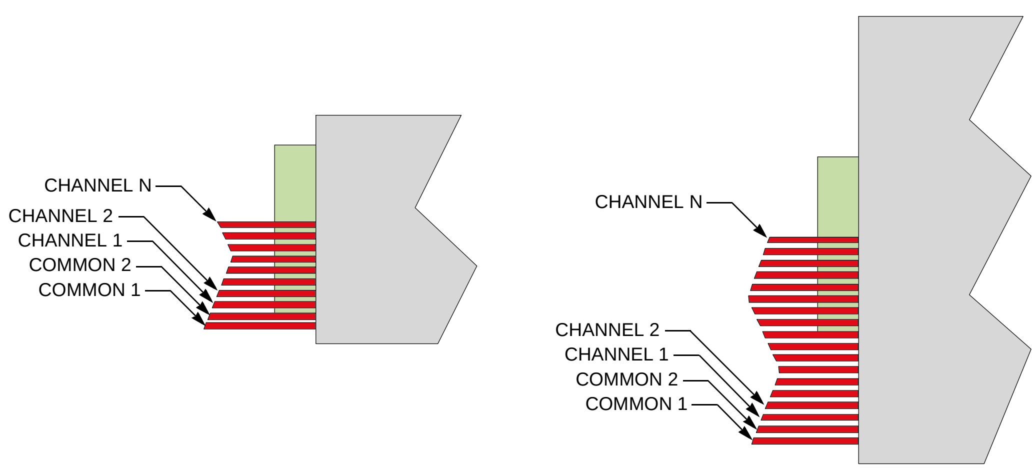
The relationship between the optical inputs and outputs of the VX500 2×N blocking switch is shown in Figure 9.

Figure 9: *2×N Blocking Switch Configuration*



The arrangement of the fiber pigtails on a VX500 2×N blocking switch is shown in Figure 10. The left figure applies to switch units with up to 8 output channels. The right figure applies to units with 9–16 output channels.

Figure 10: *2×N Blocking Channel Order (Top View)*



To select the output channel of a 2×N blocking switch with up to 16 output channels, set the five channel address inputs (<D4:D0>) and the RESET input as indicated in Table 5, then strobe the device.

Table 5: *Control Codes For 2×N Blocking Configurations*

RESET	D4	D3	D2	D1	D0	Common 1 Output Channel	Common 2 Output Channel
0	x	x	x	x	x	0 reset	-1 reset
1	0	0	0	0	0	1	0 block
1	0	0	0	0	1	block	1
1	0	0	0	1	0	2	block
1	0	0	0	1	1	block	2
1	0	0	1	0	0	3	block
1	0	0	1	0	1	block	3
1	0	0	1	1	0	4	block
1	0	0	1	1	1	block	4
1	0	1	0	0	0	5	block
1	0	1	0	0	1	block	5
1	0	1	0	1	0	6	block
1	0	1	0	1	1	block	6
1	0	1	1	0	0	7	block
1	0	1	1	0	1	block	7
1	0	1	1	1	0	8	block
1	0	1	1	1	1	block	8
1	1	0	0	0	0	9	block
1	1	0	0	0	1	block	9
1	1	0	0	1	0	10	block
1	1	0	0	1	1	block	10
1	1	0	1	0	0	11	block
1	1	0	1	0	1	block	11
1	1	0	1	1	0	12	block
1	1	0	1	1	1	block	12
1	1	1	0	0	0	13	block
1	1	1	0	0	1	block	13
1	1	1	0	1	0	14	block
1	1	1	0	1	1	block	14
1	1	1	1	0	0	15	block
1	1	1	1	0	1	block	15
1	1	1	1	1	0	16	block
1	1	1	1	1	1	block	16

Maintaining Channel Position

To maintain channel position, keep the STROBE signal high and do not interrupt supply power.

Timing Parameters

Figure 11: *VX500 Switch Timing*

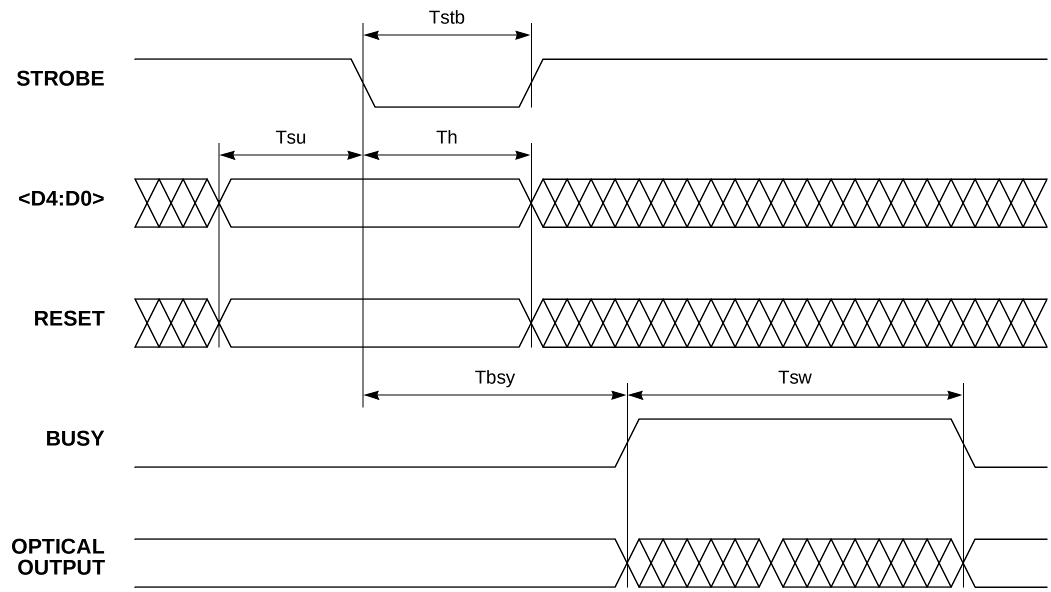


Figure 12: *VX500 Power-Up Timing*

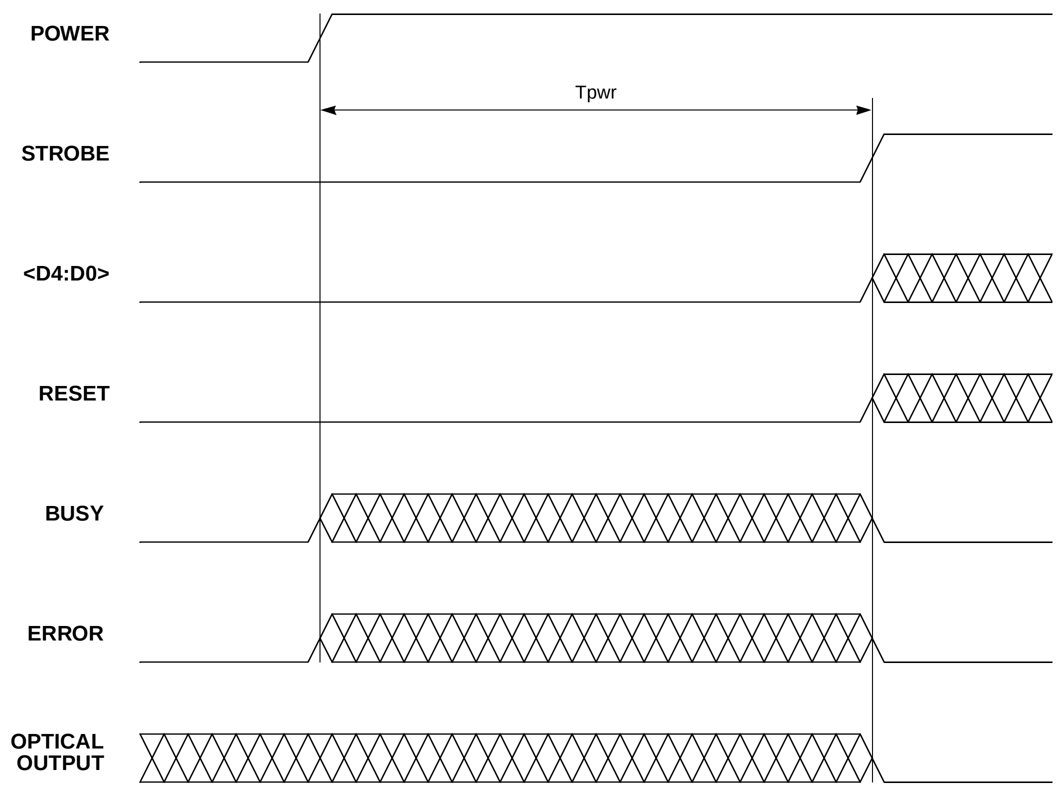


Table 6: *VX500 Timing Parameters*

Parameter	Description	Min.	Max.	Units
Tsu	Setup time. The channel address (<D4:D0>) and RESET inputs must remain stable preceding the falling edge of STROBE.	100	—	ns
Th	Hold time. The channel address (<D4:D0>) and RESET inputs must remain stable following the falling edge of STROBE.	150	—	ns
Tstb	STROBE pulse width.[a]	150	6×10^7	ns
Tbsy	STROBE low to BUSY high. During this period the switch maintains a valid connection to the previous output channel.	—	500	ns
Tsw	Switching time. During this period there may be invalid optical transmission on all channels.	—	300 + (16 × N)	ms
Tpwr	Power-up delay. The switch may lock up if TTL-level signals are applied to the data inputs during this period. Status and optical outputs are unreliable.	—	970	ms

a. DiCon recommends a low pulse width of 1 µsec to 10 µs.

Calculating Switching Time

The time period that begins at the falling edge of the STROBE signal and ends upon completion of the switching operation can be divided into three constituent periods. The first period begins when STROBE goes low and ends when BUSY goes high. During this period (500ns max.), the optical connection for the previous channel selection remains valid.

The second period begins when BUSY goes high and the switch armature begins to move. It ends when the armature reaches the specified output channel. The period lasts for 16ms per switched channel, including blocked and duplex channels. During this period, optical output is invalid; optical noise may appear on various output channels as the armature rotates.

The final period is called the debounce period. It ends when the armature is steady, the switch has established a valid optical connection, and BUSY goes low. The debounce period lasts for 300ms.[1]

Switching time is the sum of final two periods. For example, consider the calculation of total switching time for the following two scenarios:

Switch From Channel 15 To Channel 1 (Simplex 1×N Switch)
(14 × 16 ms) + 300 ms = 524 ms

Switch From Channel 2 To Channel 6 (2×N Blocking Switch)
(8 × 16 ms) + 300 ms = 428 ms

Additionally, there are two special cases for calculating switching time. First, if a STROBE pulse is applied with no change in the latched value of the channel address (<D4:D0>), the BUSY line will go high for 60–80ms. Second, if a reset instruction is given twice in a row, the BUSY line will go high for 410ms max. For example, consider the total switching time for the following two scenarios:

Switch From Channel 3 To Channel 3
60–80ms

Switch From Channel 0 To Channel 0
410ms max.

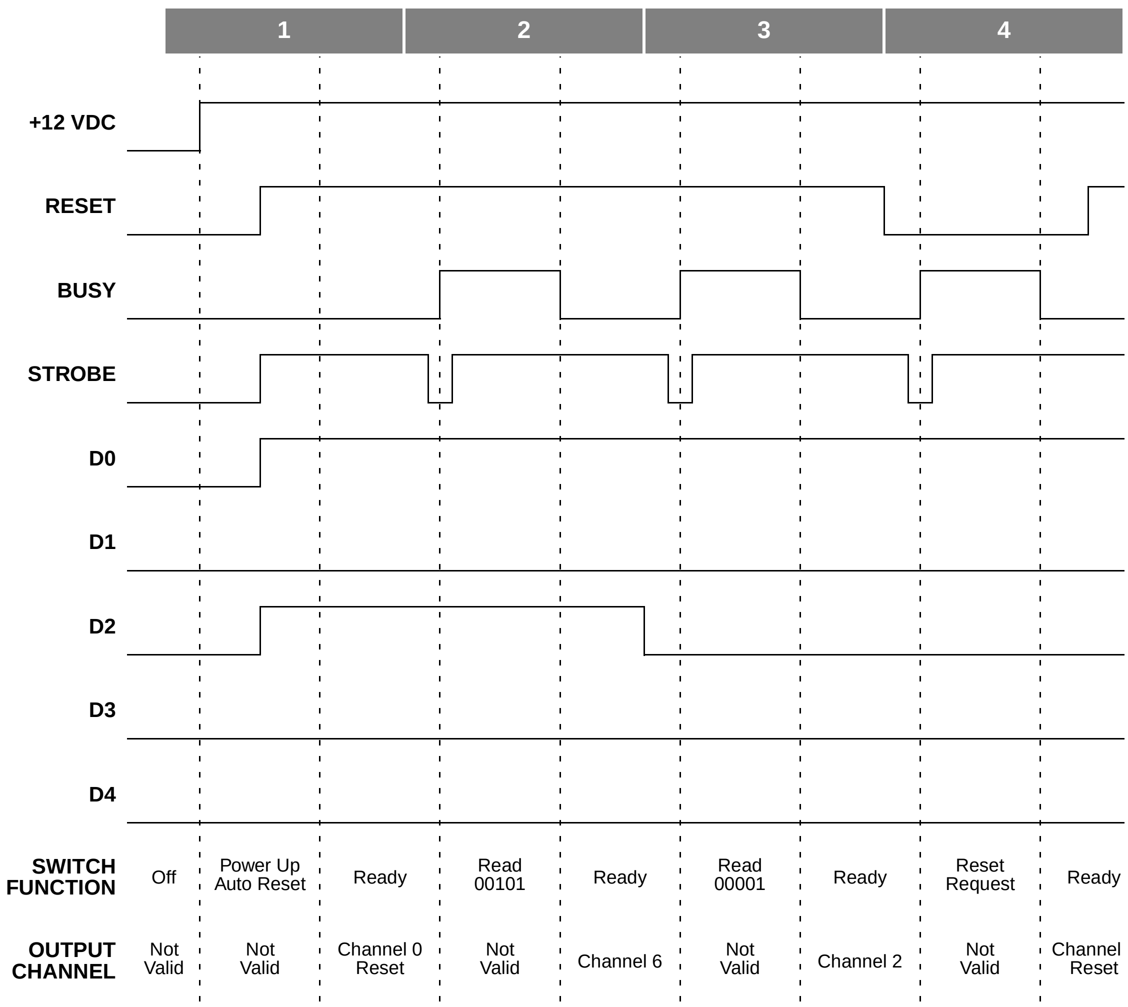
1. The BUSY line will remain high until the end of the STROBE pulse, even if the switch operation is complete and the optical connection is stable.

Switch Control

Figure 13 illustrates the following sample control sequence for a 1×N simplex switch.

1. Following power-up, the switch returns to reset position. After the initialization period, the device is ready to receive instructions.
2. The user brings STROBE high, brings RESET high to enable channel selection, and sets the desired channel address. The user applies a strobe pulse, sending the BUSY line high while the switch moves into alignment with channel 6. The BUSY line returns to low when the switch operation is complete and the device is ready to accept new instructions.
3. With the RESET line still high, the user changes the channel address and applies another STROBE pulse, the BUSY line goes high while the switch moves into alignment with channel 2.
4. Finally, the user brings RESET low and applies another STROBE pulse. The device disregards the channel address inputs. The BUSY line goes high while the switch returns to the reset position.

Figure 13: *Sample Control Sequence*



Controlling the VX500 Using a PC Printer Port

It is possible to control the VX500 switch by connecting the interface board to a PC printer port and a power supply (+12VDC ±5%, 300 mA max.). The printer port has a 25-pin, D-shell connector. The recommended cable configuration for connection to the printer port is shown in Figure 15. The basic control flow for the VX500 is illustrated in Figure 14. For specific procedures for sending reset and switch instructions, see “Switch Operation” on page 7, “Timing Parameters” on page 15, and “Selecting an Output Channel” on page 8.

Figure 14: *Switch Control Flow*

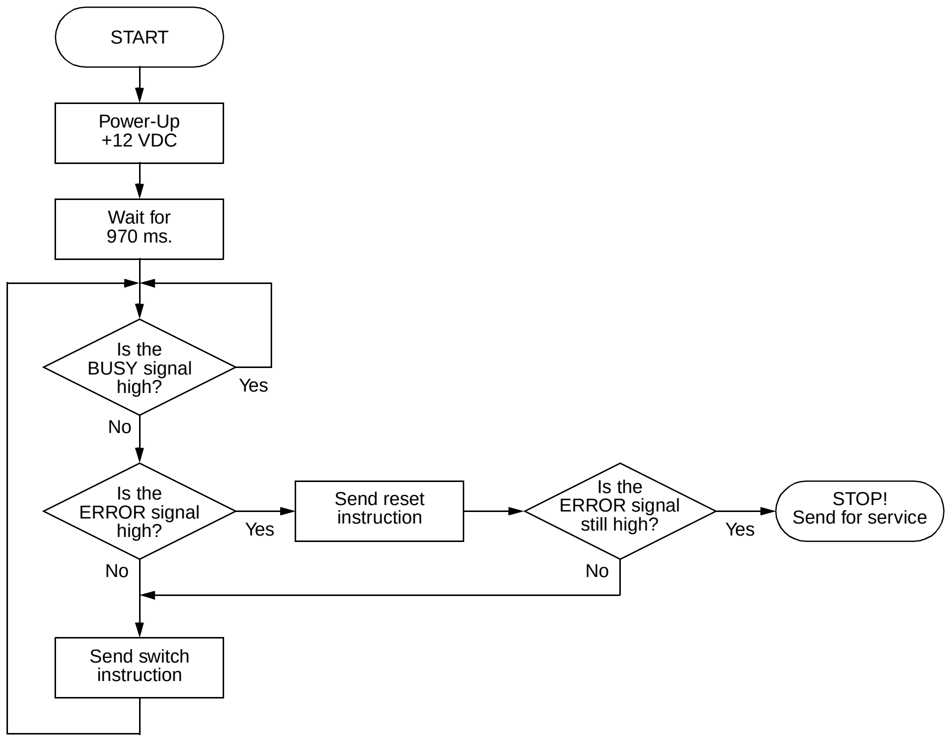
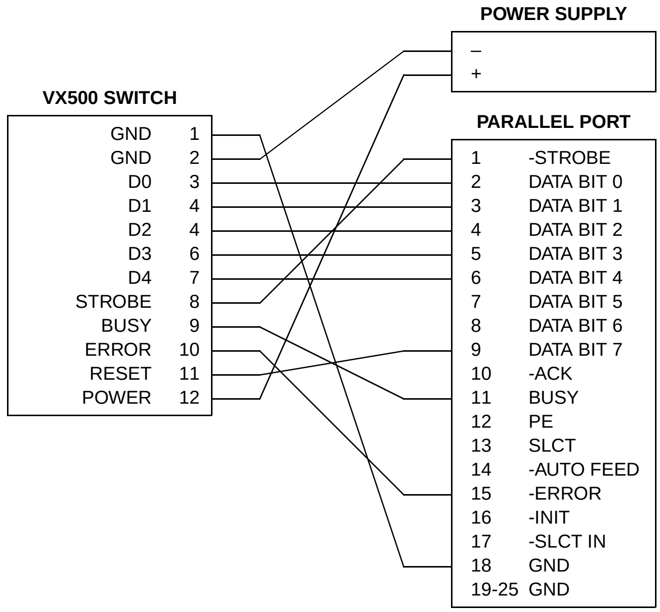


Figure 15: *Parallel Port Line Assignments*



The following BASIC program can be used to control the VX500 from a PC printer port. The program switches channel-by-channel from channel 1 through channel 8. If an error is encountered, the program resets the switch. If the error persists, the program exits. The program expects the VX500 to be connected to the printer port as outlined in Figure 15. Depending on the speed of your PC, you may have to insert a delay after the STROBE low commands (lines 90, 150) in order to satisfy minimum pulse width constraints.

```
1   REM Testing program for VX500 controlled through PC printer port (PP).
2   REM Address 379H is PP input byte (BIT3=ERROR; BIT7=BUSY).
3   REM Address 378H is PP output byte (<BIT4:BIT0>=<D4:D0>; BIT7=RESET).
4   REM Address 37AH is PP STROBE output (BIT0=STROBE).
5   REM The printer port inverts the STROBE output.
6   REM Note: Some computers use addresses 3BC, 3BD, & 3BE.
10  WAIT 1                              'wait during power-up (970 ms min.)
20  FOR K = 1 TO 8 STEP 1               'step through channels 1 through 8
30  INBYTE = INP(&H379)                 'read BUSY signal
40  IF (INBYTE AND 128) <> 128
    THEN GOTO 30                        'BUSY = HIGH, check again
50  INBYTE = INP(&H379)                 'read ERROR signal
60  IF (INBYTE AND 8) = 8
    THEN GOTO 130                       'ERROR = HIGH, reset device
70  OUT &H378, K + 127                  'send channel & RESET to data bus
80  OUT &H37A, 0                        'set STROBE high
90  OUT &H37A, 1                        'bring STROBE low
100 OUT &H37A, 0                        'set STROBE high
110 NEXT K                              'do the next channel
120 STOP                                'done!
130 OUT &H378, 127                      'set RESET low
140 OUT &H37A, 0                        'set STROBE high
150 OUT &H37A, 1                        'bring STROBE low
160 OUT &H37A, 0                        'set STROBE high
170 WAIT 1                              'wait for reset
180 INBYTE = INP(&H379)                 'check ERROR
190 IF (INBYTE AND 8) = 8 THEN STOP     'reset failed, send for service
200 GOTO 20                             'reset succeeded, proceed with test
```

Specifications

Table 7: *Performance Specifications*

Parameter	Minimum	Typical	Maximum	Units
Optical[a]				
insertion loss[b]	—	0.6	1.2	dB
back-reflection (singlemode fiber)[c]	—	-60	-55	dB
back-reflection (multimode fiber)[c]	—	-20	—	dB
switching time[d]	—	—	300+(16×N)	ms
isolation	—	—	-80	dB
durability	10 million			cycles
repeatability[e]	—	—	±0.03	dB
PDL[f]	—	—	0.05	dB
wavelength range	780	—	1650	nm
Environmental				
operating temperature:	0	—	50	°C
storage temperature	-20	—	70	°C
humidity	40°C / 90% RH / 5 days			—

a. All specifications referenced without connectors.
b. Measured at 23±5°C.
c. Based on standard 1-meter pigtail length.
d. Based on BUSY output pulse. Actual optical switching time may be faster.
e. Sequential repeatability for 100 cycles at constant temperature after warm-up.
f. Measured at 1550 nm.

Device Housing

The VX500 Switch is suitable for mounting on a panel or printed circuit board. Four mounting holes are provided. Do not remove the housing cover. Removal of housing cover voids warranty.

Table 8: *Housing Dimensions*

Parameter	Size 1 1 to 17 Channels[a]	Size 2 18 to 32 Channels[a]	Units
Height	23.6 [0.93]	23.6 [0.93]	mm [in.]
Width	72.0 [2.83]	140.0 [5.51]	mm [in.]
Depth	120.0 [4.72]	140.0 [5.51]	mm [in.]
Weight[b]	0.4 [0.8]	0.9 [2.1]	kg [lb.]

a. Including blocked and duplex channels
b. Actual weight depends upon switch configuration.

Figure 16: *VX500 Chassis Size 1 Housing*

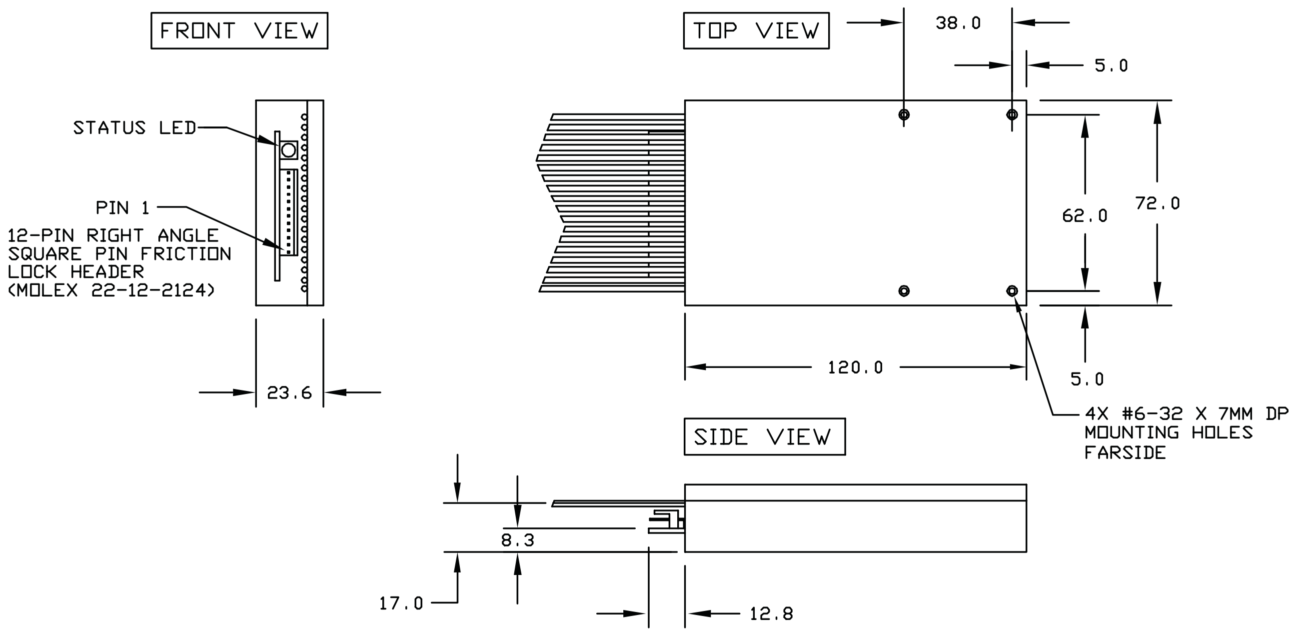
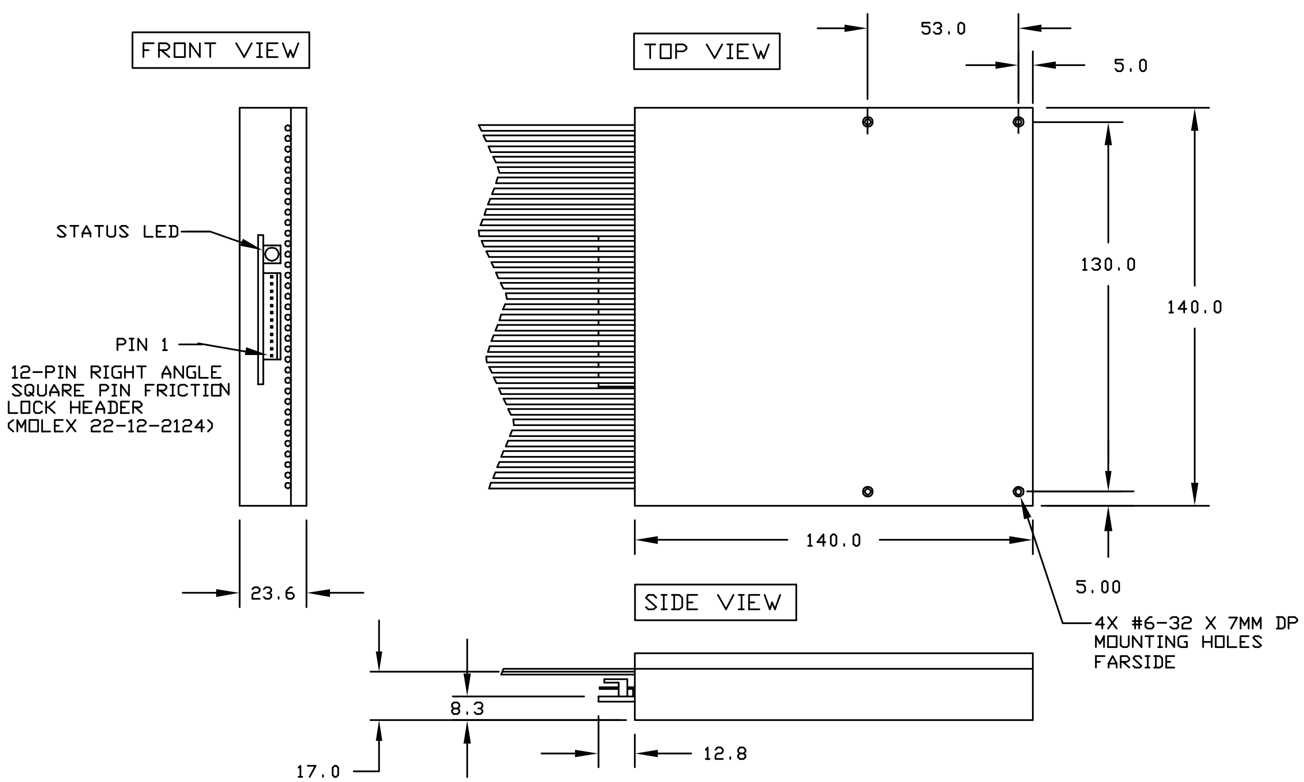


Figure 17: *VX500 Chassis Size 2 Housing*

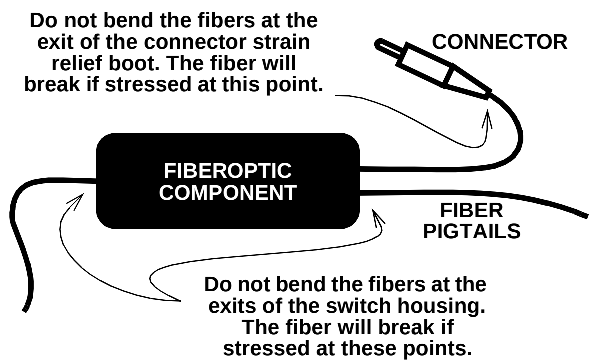


Handling Fiberoptic Components and Cables

Handling Fiberoptic Cables

Your switch may come with fiber pigtail outputs. Treat cables with care to avoid cable damage and minimize optical loss. The minimum bend radius for most optical cables is 35mm. Never bend an optical cable more sharply than this specification. Optical performance will degrade and the cable may break.

- Avoid bending the optical cable near a cable strain relief boot. Bending an optical cable near a strain relief boot is one of the easiest ways to permanently damage the optical fiber.
- Avoid bending the optical cable over a sharp edge.
- Avoid using cable tie wraps to hold optical cable. Tie wraps when tightened can create micro-bends or break an optical cable. Microbends can cause a dramatic reduction in optical performance.
- Do not pull on the bare fiber as this can break the fiber inside the component.
- Avoid using soldering irons near optical cable. Accidental damage can easily occur when an soldering iron is used near an optical cable. In addition, solder splatter can contaminate and permanently damage optical fiber connectors.
- In order to obtain the most stable, repeatable optical performance, immobilize optical cables using wide pieces of tape or some form of mechanical cushion after the optical cables have been connected.



Storing Optical Connectors

All switches are shipped with dust caps in place covering all optical connectors. Optical connectors should remain covered at all times when the instrument is not in use.

Cleaning Optical Connectors

Clean any exposed connector using a cleaning kit supplied by the connector manufacturer or high-grade isopropyl alcohol and a cotton swab. To clean with alcohol and a swab, dab the tip of a cotton swab in alcohol and then shake off any excess alcohol. The tip should be moist, *not* dripping wet. Stroke the swab tip gently across the surface of the connector and around the connector ferrule. Either allow the connector a minute to dry, or blow dry the connector using compressed air. Be careful when using compressed air because improper use may deposit a spray residue.

Mating Optical Connectors

- Clean both connectors prior to mating. Any small particles trapped during the mating process can permanently damage the connector.
- Insert the appropriate connector ferrule into the adapter smoothly. Do not allow the fiber tip to contact any surface. If the tip accidentally contacts a surface before mating, *stop*. Re-clean the connector and try again.
- Tighten the connector until it is finger tight, or to the torque specified by the connector manufacturer. Do not over-tighten the connector as this can lead to optical loss and connector damage.
- Check the optical insertion loss. If the loss is unacceptable, Remove the connector, re-clean both ends of the mate, and reconnect. You may have to repeat this process several times before a low-loss connection is made.
- After you make the connection, monitor the stability of the optical throughput for a few minutes. Optical power trending (slowly increasing or decreasing) is caused by the slow evaporation of alcohol trapped in the connection. Continue to monitor optical power until it stabilizes. If the loss is unacceptable, reclean the connectors and start again.

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