



User's Guide

VisionLink XF

Camera Link fiber extender



for base mode through 80-bit operation

Date: 2017 February 15

Rev.: 0000

EDT | Engineering Design Team, Inc.

1400 NW Compton Drive, Suite 315

Beaverton, OR 97006

U.S.A.

Tel: +1-503-690-1234 | Toll free (in U.S.A.): 800-435-4320

Fax: +1-503-690-1243

www.edt.com

EDT[™] and Engineering Design Team[™] are trademarks of Engineering Design Team, Inc. All other trademarks, service marks, and copyrights are the property of their respective owners[†].

© 1997-2015 Engineering Design Team, Inc. All rights reserved.

Terms of Use Agreement

Definitions. This agreement, between Engineering Design Team, Inc. ("Seller") and the user or distributor ("Buyer"), covers the use and distribution of the following items provided by Seller: a) the binary and all provided source code for any and all device drivers, software libraries, utilities, and example applications (collectively, "Software"); b) the binary and all provided source code for any and all configurable or programmable devices (collectively, "Firmware"); and c) the computer boards and all other physical components (collectively, "Hardware"). Software, Firmware, and Hardware are collectively referred to as "Products." This agreement also covers Seller's published Limited Warranty ("Warranty") and all other published manuals and product information in physical, electronic, or any other form ("Documentation").

License. Seller grants Buyer the right to use or distribute Seller's Software and Firmware Products solely to enable Seller's Hardware Products. Seller's Software and Firmware must be used on the same computer as Seller's Hardware. Seller's Products and Documentation are furnished under, and may be used only in accordance with, the terms of this agreement. By using or distributing Seller's Products and Documentation, Buyer agrees to the terms of this agreement, as well as any additional agreements (such as a nondisclosure agreement) between Buyer and Seller.

Export Restrictions. Buyer will not permit Seller's Software, Firmware, or Hardware to be sent to, or used in, any other country except in compliance with applicable U.S. laws and regulations. For clarification or advice on such laws and regulations, Buyer should contact: U.S. Department of Commerce, Export Division, Washington, D.C., 20230, U.S.A.

Limitation of Rights. Seller grants Buyer a royalty-free right to modify, reproduce, and distribute executable files using the Seller's Software and Firmware, provided that: a) the source code and executable files will be used only with Seller's Hardware; b) Buyer agrees to indemnify, hold harmless, and defend Seller from and against any claims or lawsuits, including attorneys' fees, that arise or result from the use or distribution of Buyer's products containing Seller's Products. Seller's Hardware may not be copied or recreated in any form or by any means without Seller's express written consent.

No Liability for Consequential Damages. In no event will Seller, its directors, officers, employees, or agents be liable to Buyer for any consequential, incidental, or indirect damages (including damages for business interruptions, loss of business profits or information, and the like) arising out of the use or inability to use the Products, even if Seller has been advised of the possibility of such damages. Because some jurisdictions do not allow the exclusion or limitation of liability for consequential or incidental damages, the above limitations may not apply to Buyer. Seller's liability to Buyer for actual damages for any cause whatsoever, and regardless of the form of the action (whether in contract, product liability, tort including negligence, or otherwise) will be limited to fifty U.S. dollars (\$50.00).

Limited Hardware Warranty. Seller warrants that the Hardware it manufactures and sells shall be free of defects in materials and workmanship for a period of months from date of shipment to initial Buyer. This warranty does not apply to any product that is misused, abused, repaired, or otherwise modified by Buyer or others. Seller's sole obligation for breach of this warranty shall be to repair or replace (F.O.B. Seller's plant, Beaverton, Oregon, USA) any goods that are found to be non-conforming or defective as specified by Buyer within 30 days of discovery of any defect. Buyer shall bear all installation and transportation expenses, and all other incidental expenses and damages.

Limitation of Liability. *In no event shall Seller be liable for any type of special consequential, incidental, or penal damages, whether such damages arise from, or are a result of, breach of contract, warranty, tort (including negligence), strict liability, or otherwise.* All references to damages herein shall include, but not be limited to: loss of profit or revenue; loss of use of the goods or associated equipment; costs of substitute goods, equipment, or facilities; downtime costs; or claims for damages. Seller shall not be liable for any loss, claim, expense, or damage caused by, contributed to, or arising out of the acts or omissions of Buyer, whether negligent or otherwise.

No Other Warranties. Seller makes no other warranties, express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose, regarding Seller's Products or Documentation. Seller does not warrant, guarantee, or make any representations regarding the use or the results of the use of the Products or Documentation or their correctness, accuracy, reliability, currentness, or otherwise. All risk related to the results and performance of the Products and Documentation is assumed by Buyer. The exclusion of implied warranties is not permitted by some jurisdictions. The above exclusion may not apply to Buyer.

Disclaimer. Seller's Products and Documentation, including this document, are subject to change without notice. Documentation does not represent a commitment from Seller.

Contents

- Overview 5
 - Care and Cautions 5
 - Related Resources 6

- Cabling 7
 - Camera Link 7
 - Fiberoptic 7
 - Power and Auxiliary 7

- Setup 8
 - DIP Switches and LEDs 9

- Mounting and Safetying 10

- Firmware 10

- Transceivers 11

- Pin Assignments 12
 - Camera Link Connectors 12
 - Power Connector 13
 - Cable Assembly – Lemo to Loose Wire 13
 - Cable Assembly – Lemo to Male DB9 13
 - Cable Assembly – Lemo to Female DB9 RS232 14

- Power Supply 15

- Dimensions 16

VisionLink XF Camera Link Fiber Extender

Overview

The VisionLink XF extends Camera Link (base through 80-bit mode) over fiber, providing electrical isolation and extended range. It supports cameras from 20 to 85 MHz, and serial data rates up to 115.2 kb/s.

The VisionLink XF extender works with EDT or third-party framegrabbers (see [Related Resources](#)). The extender units are designed to work in pairs: one unit connects to the camera and the other to the framegrabber with Camera Link cabling; then the two units connect to each other with fiberoptic cabling. [Figure 1](#) shows an example setup.

Figure 1. VisionLink XF extender pair – example setup (medium or 80-bit mode)



Care and Cautions

When opening and handling EDT products, always follow electrostatic dissipative procedures (see edt.com/static).

Each EDT product, though built to withstand a wide range of conditions as listed in its datasheet specifications, is still a high-performance component which requires proper care for best results.

In particular, the connectors – especially the fiberoptic transceivers – must be kept clean and dry. If you suspect the presence of moisture or debris in the connectors, use compressed air to do the following...

- 1) Blow the compressed air away from the equipment to clear any moisture or debris from the air nozzle.
- 2) Blow the compressed air directly into each connector to clear any moisture or debris there.

CAUTION To avoid damaging your eyesight, never look directly into any fiberoptic transceiver.

Related Resources

The resources below may be helpful or necessary for your applications. For complete resources and documentation on any EDT product, visit edt.com and navigate to the product page.

EDT resources

- VisionLink XF datasheet / specifications edt.com/product-data
- VisionLink XF quick start guide “
- Videos and tutorials “
- All EDT extenders edt.com/product-lines/camera-link-extend-ers/
- All EDT frame grabbers edt.com/product-lines/camera-link-frame-grabbers/

Third-party resources

- Camera Link specifications visiononline.org
- Providers of fiberoptic cabling assemblies:
 - Borg Technologies borg-tech.com
 - Cypress Industries cypressindustries.com
 - Molex molex.com

Cabling

The VisionLink XF requires Camera Link, fiberoptic, and power cables, as explained below.

Camera Link

Use standard Camera Link cables (SDR-to-SDR or SDR-to-MDR) to connect the VisionLink XF units to the camera and the framegrabber. EDT recommends that these cables should be one meter or less in length. You may use longer cables, but they may introduce noise into your image data – particularly if you use a camera with a high pixel clock rate. For Camera Link pin assignments, see [Pin Assignments on page 12](#).

Fiberoptic

Use fiberoptic cabling to connect the two VisionLink XF units to each other. The type of cabling you need will depend on where you install the system, and which transceivers you use (for transceiver specifications, see [Transceivers on page 11](#)). EDT stocks a small number of options for fiberoptic cable assemblies; if these options do not meet your needs, you should contact a provider of such assemblies (see [Related Resources](#) for some of these providers).

Power and Auxiliary

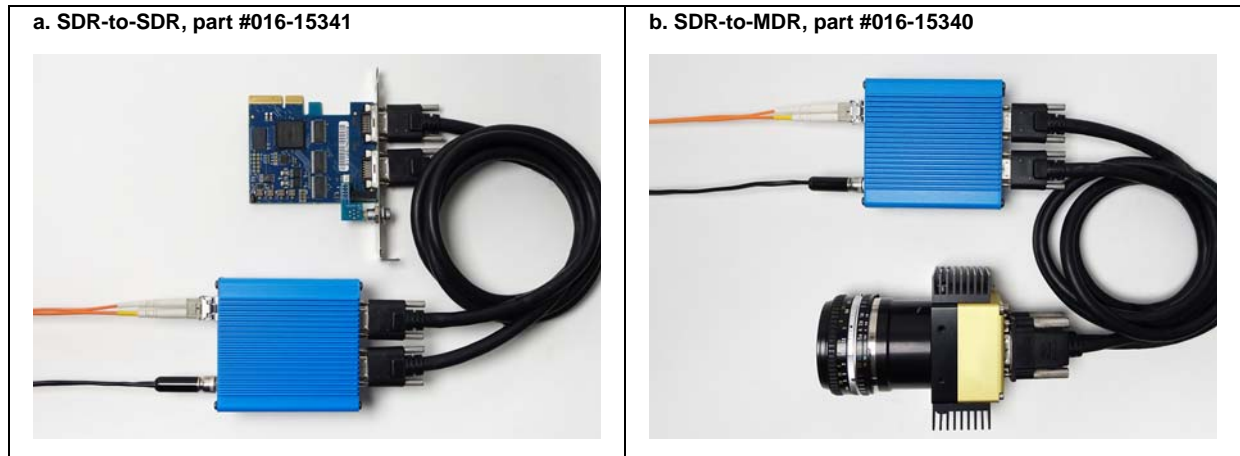
EDT ships your VisionLink XF extenders with a power adapter and a connecting cable. For options and pin assignments, see [Power Supply on page 15](#) and (under Pin Assignments) [Power Connector on page 13](#).

Setup

To set up your VisionLink XF extender pair...

1. Power off all devices.
2. In the host computer, install the framegrabber according to its user's guide (for EDT framegrabbers, see edt.com).
3. Connect the camera-end unit to the camera and the framegrabber-end unit to the framegrabber with Camera Link cabling – either SDR-to-SDR or SDR-to-MDR, as shown in [Figure 2](#).

Figure 2. Camera Link cabling options from EDT

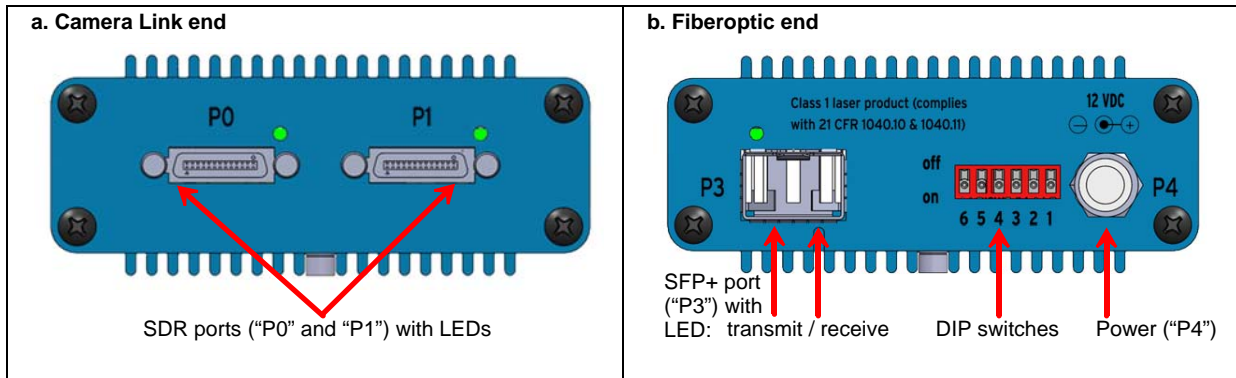


4. In each unit, insert a fiberoptic transceiver into the SFP+ port; then connect the two units with fiberoptic cabling and close the bale straps on the transceivers.
5. Verify that each DIP switch is set correctly (see [DIP Switches and LEDs on page 9](#)).
6. Connect each extender to its power supply (see [Power Supply on page 15](#)).
7. Power on, in this order: the framegrabber (in the host computer); the framegrabber-end extender; the camera-end extender; the camera.
8. Verify that each LED is steady green (see [DIP Switches and LEDs on page 9](#)).

DIP Switches and LEDs

Figure 3 shows the extender's ports and features, including the DIP switches and LEDs.

Figure 3. Ports and features



- The DIP switches indicate which device (camera or framegrabber, as labeled on the Camera Link end of the unit); whether Power over Camera Link (PoCL) is on or off; and whether the unit is set for program mode or normal mode.
- The LEDs indicate the status of each port.

Table 1 and Table 2 explain the details.

Table 1. DIP switch settings

#	Function	On	Off	Details
1	Which device to connect	camera	framegrabber	System reads this switch at boot time only.
2	Port 1 (P1): PoCL	P1: PoCL on	P1: PoCL off	Valid for camera-end units only. This switch always should be "off" for the framegrabber-end unit (that is, whenever switch 1 is "off").
3	Port 0 (P0): PoCL	P0: PoCL on	P0: PoCL off	Valid for camera-end units only. This switch always should be "off" for the framegrabber-end unit (that is, whenever switch 1 is "off").
4	Program vs. normal mode	program	normal	System reads this switch at boot time only.
5	undefined	--	--	--
6	undefined	--	--	--

Table 2. LED behaviors

Unit	LED location	Behavior	Meaning
Camera	SDR	Green, no flash	Good; the camera (pixel clock) is detected
		Green, quick flash (10Hz)	Error; the camera (pixel clock) is not detected
		Red, no flash	Good; PoCL is enabled
	SFP+	Green, no flash	Good; the other unit is detected at the framegrabber end
		Red, slow flash (1Hz)	Error; the other unit is not detected at the framegrabber end
		Red, quick flash (10Hz)	Error; the other unit is detected, but it is a camera-end unit (it should be a framegrabber-end unit)
Framegrabber	SDR	Green, no flash	Good; data is transferring between the unit and the framegrabber
	SFP+	Green, no flash	Good; the other unit is detected at the camera end
		Red, slow flash (1Hz)	Error; the other unit is not detected at the camera end
		Red, quick flash (10Hz)	Error; the other unit is detected, but it is a framegrabber-end unit (it should be a camera-end unit)

Mounting and Safetying

In some applications – for example, aircraft or other high-vibration environments – you may need to mount the extender, safety the transceiver, or do both.

- To mount the extender, you can attach a custom (user-provided) bracket via the two 4-40 mounting posts on the bottom of the case; for the precise locations of these holes, see [Dimensions on page 16](#).
- To safety the fiberoptic transceiver, you can use aviation safety wire.

For details on how to use the mounting holes and safety wire, see [Figure 4](#).

Figure 4. Mounting and safetying

a. Mounting holes	b. Transceiver with safety wire
<div data-bbox="261 632 824 1010" data-label="Image"> </div> <p data-bbox="261 1024 824 1203"> To use the 4-40 thread mounting holes: Add your own custom bracket, designed to match the exact location of the holes (see Dimensions on page 16). CAUTION – Internal damage will occur if 4-40 mounting screws extend into the case more than 0.250 inches from standoff. </p>	<div data-bbox="873 632 1442 1010" data-label="Image"> </div> <p data-bbox="873 1024 1442 1251"> To safety the transceiver: Thread the safety wire through the bale strap and the hole and notch in the backshell. EDT recommends .020 dia. aviation safety wire from an aviation supplier – for example, Aircraft Spruce and Specialty (www.aircraftspruce.com). For aviation applications, follow relevant Federal Aviation Administration (FAA) guidelines and best practices; see the FAA Advisory Circular (AC) 43.13-1B at www.faa.gov. </p>

Firmware

Each extender is preconfigured with EDT firmware which controls its operation. EDT provides periodic firmware updates which currently must be performed onsite at EDT. If you are notified that an update is available or needed, contact EDT.

Transceivers

The VisionLink XF extender supports various types of small form-factor pluggable (SFP+) transceivers with matching multimode fiber (MMF) or single mode fiber (SMF), as shown in [Table 3](#).

Table 3. Transceiver + fiber combinations

Wavelength	Cable	Range at 10 Gb/s *
850 nm	62.5-micron MMF (OM1)	33 meters
850 nm	50-micron MMF (OM3)	300 meters
1310 nm	9-micron SMF	Up to 10 kilometers

Alternatively, the following transceivers are available as options...

- Bidirectional transceivers – These support data transmit and receive over a single fiber using two separate wavelengths (for example, 1310 nm and 1550 nm). They can be used in a matched pair, 1310/1550 and 1550/1310. Typical usage is with an optical rotary joint.
- CWDM transceivers – These support data transmission on a specific wavelength (1270 nm to 1610 nm). They can be used with a CWDM multiplexer and demultiplexer which can support up to 16 wavelengths over a duplex fiber between the multiplexer and demultiplexer. Typical usage is with an optical network of devices to be served by one duplex fiber.

Typically, it is easiest to connect all transceivers using LC duplex fiber; but if you want to use fewer fibers, in some atypical cases it is possible to do so – for example, when using single-fiber (bidirectional) transceivers, as above.

Pin Assignments

This section provides pin assignments for each connector.

Camera Link Connectors

Below are the pin assignments for the Camera Link SDR26 connectors.

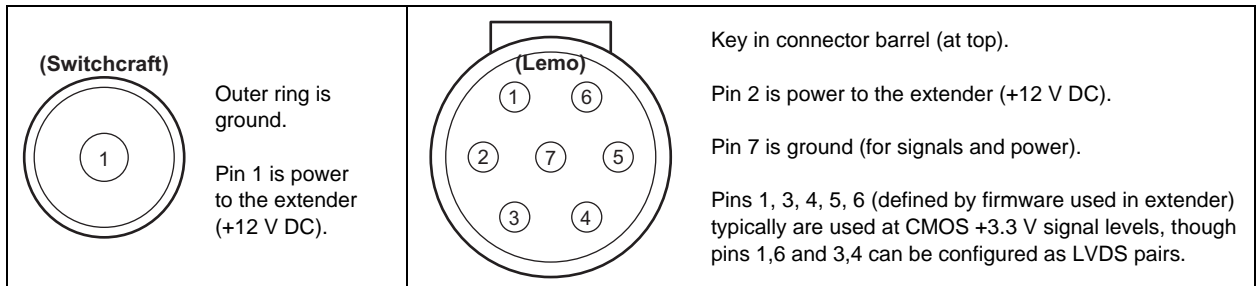
Camera or simulator end	Frame grabber end	Camera Link signal (base mode, primary connector)	Camera Link signal (medium mode, secondary connector)	Camera Link signal (full mode, secondary connector)
1*	1*	inner shield / ground*	inner shield / ground*	inner shield / ground*
14*	14*	inner shield / ground*	inner shield / ground*	inner shield / ground*
2	25	X0-	Y0-	Y0-
15	12	X0+	Y0+	Y0+
3	24	X1-	Y1-	Y1-
16	11	X1+	Y1+	Y1+
4	23	X2-	Y2-	Y2-
17	10	X2+	Y2+	Y2+
5	22	Xclk-	Yclk-	Yclk-
18	9	Xclk+	Yclk+	Yclk+
6	21	X3-	Y3-	Y3-
19	8	X3+	Y3+	Y3+
7	20	SerTC+	unused	100 ohms
20	7	SerTC-	unused	terminated
8	19	SerTFG-	unused	Z0-
21	6	SerTFG+	unused	Z0+
9	18	CC1-	unused	Z1-
22	5	CC1+	unused	Z1+
10	17	CC2+	unused	Z2-
23	4	CC2-	unused	Z2+
11	16	CC3-	unused	Zclk-
24	3	CC3+	unused	Zclk+
12	15	CC4+	unused	Z3-
25	2	CC4-	unused	Z3+
13*	13*	inner shield / ground*	inner shield / ground*	inner shield / ground*
26*	26*	inner shield / ground*	inner shield / ground*	inner shield / ground*

* With PoCL enabled, pins 1 and 26 change to +12 V DC power, while pins 13 and 14 change to +12 V DC power return.

Power Connector

Below are the pin assignments for the power connector – either a standard coaxial Switchcraft or an optional Lemo.

Figure 5. Pin assignments – standard Switchcraft or optional Lemo connector



With the Lemo, you can use various cables that allow auxiliary signals.

Cable Assembly – Lemo to Loose Wire

The Lemo to loose wire cable assembly (EDT part #016-12650) can be wired as needed or connected to various types of connectors, depending on your application.

Table 4. Pin assignments – Lemo to loose wire

Lemo pin	Wire color	Standard firmware	Signal level	Comments
1 (output)	green	AUX_TX, primary auxiliary transmit UART	CMOS +3.3 V	All five CMOS 3.3 V signals go to FPGA I/O 3.3V pins using series 100-ohm resistors. Custom firmware can be used to configure these pins as input or output.
2	red	power to extender	+12 V	
3 (output)	orange	AUX2_TX, secondary auxiliary transmit	CMOS +3.3 V	
4 (input)	brown	AUX2_RX, secondary auxiliary receive	CMOS +3.3 V	
5	white	SYNC, can be configured as an outgoing copy of the camera's frame-valid signal	CMOS +3.3 V	
6 (input)	blue	AUX_RX, primary auxiliary receive UART	CMOS +3.3 V	
7	black	ground	ground	

Cable Assembly – Lemo to Male DB9

The Lemo to male DB9 cable assembly (EDT part #016-12718) supports signals that can be used as an auxiliary signaling system for a variety of purposes.

For example, with custom firmware you could control the camera's pan and servo motors, or set up a hardware trigger that is local to either end. If you wish to explore these options, contact EDT.

Unlike the DB9 in the female assembly, this DB9 has no looped-back signals or integrated level conversion.

Table 5 shows the pin assignments and how the standard firmware uses each wire.

Table 5. Pin assignments – male DB9 cable

Lemo pin	Color	DB9 pin	Standard firmware	Signal level	Comments
–	–	1	[unused]	–	All five CMOS 3.3 V signals go to FPGA I/O 3.3V pins using series 100-ohm resistors. Custom firmware can be used to configure these pins as input or output.
–	–	6	[unused]	–	
1 (output)	green	2	AUX_TX, primary auxiliary transmit UART	CMOS +3.3 V	
2	red	9	power to extender	+12 V	
3 (output)	orange	7	AUX2_TX, secondary auxiliary transmit	CMOS +3.3 V	
4 (input)	brown	8	AUX2_RX, secondary auxiliary receive	CMOS +3.3 V	
5	white	4	SYNC, can be configured as an outgoing copy of the camera's frame-valid signal	CMOS +3.3 V	
6 (input)	blue	3	AUX_RX, primary auxiliary receive UART	CMOS +3.3 V	
7	black	5	ground	ground	

Cable Assembly – Lemo to Female DB9 RS232

The Lemo to female DB9 cable assembly (EDT part #016-12445) supports integrated CMOS +3.3 V to RS232 level converters on a small circuit board inside the DB9 connector shell.

This cable is designed to plug in directly to a host computer serial port. The cable offers an auxiliary serial UART connection over the fiber, in addition to the UART normally associated with the Camera Link standard. This auxiliary UART can be used, for example, to control the camera's pan and zoom servo motors from the host at 115.2 kb/s or less. Alternatively, it can be used for other low bandwidth signals.

Unlike the DB9 in the male assembly, this DB9 does not supply power to the extender. Instead, a red wire (power) and a black wire (ground), each 24 inches long, are left loose so you can hook up your own power source. The required power is 12 V DC.

Table 6 shows the pinout and how the standard firmware uses each wire. DB9 pins 1, 4, and 6 are wired together and unconnected, 7 and 8 also are wired together, and 9 also is unconnected; these signals are not otherwise used.

Table 6. Pin assignments – female DB9 cable

Lemo pin	Wire color	DB9 pin	Standard firmware	Signal level
–	–	1	[unused]	–
–	–	6	[unused]	–
1 (output)	green	2	AUX_TX, primary auxiliary transmit UART	RS232 (at DB9) to CMOS +3.3 V (at Lemo)
2	red	–	power to extender	+12 V
3	orange	7	reserved	–
4	brown	8	reserved	–
5	white	4	reserved	–
6 (input)	blue	3	AUX_RX, primary auxiliary receive UART	RS232 (at DB9) to CMOS +3.3 V (at Lemo)
7	black	–	ground	ground

Power Supply

Each extender has an internal switching regulator which supports 12 V DC. For pin information and polarity on the standard Switchcraft or optional Lemo power connector, see [Power Connector on page 13](#).

[Table 7](#) shows the base-mode power supply requirements.

Table 7. Power supply requirements – base mode

	U.S.	International
Voltage in	100–240 V, 50–60 Hz from AC mains	100–240 V, 50–60 Hz from AC mains
Voltage out	12 V DC; power supply includes a U.S.-standard power plug	12 V DC; power supply includes four international power plug adapters
Connector, standard	Switchcraft 760K	Switchcraft 760K
Connector, Lemo option	FGG.0B.307.CLAD.56	FGG.0B.307.CLAD.56

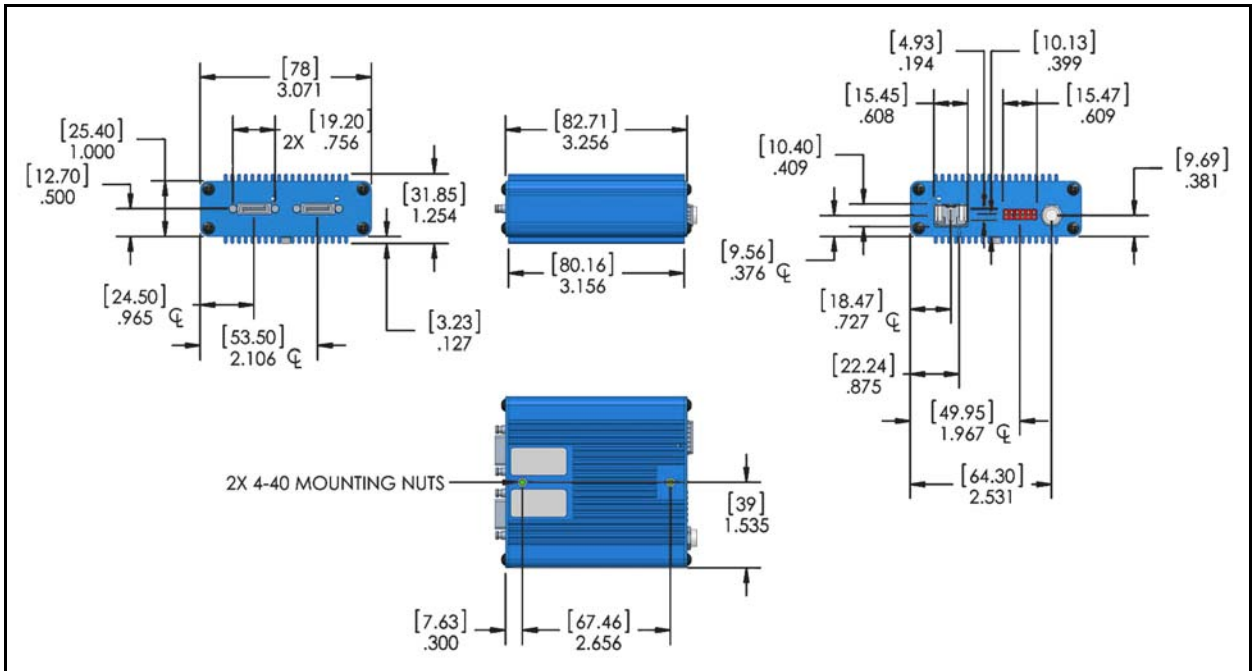
Dimensions

This section shows the dimensions of the VisionLink XF.

The Switchcraft power connector has an outside diameter of 0.31 inch; the optional Lemo power connector has an outside diameter of 0.35 inch.

NOTE Connector dimensions are approximate; for precise dimensions, see the manufacturer's specifications.

Figure 6. Extender dimensions



Revision Log

Below is a history of modifications to this guide.

Date	Rev	By	Pg(s)	Detail
20170215	0000	PH et al.	All	• Created new guide.