Specim FX17 - User Guide 1.0

Contents

Specim FX17

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For a period of **two years (24 months)** from the date of delivery to the customer there will be no labor and material charges for repairing or replacing (depending on the defect type) the defective Product. When the parts are sent to SPECIM for repair the customer will cover the delivery costs and after the repair the parts are sent back to the customer at SPECIM's cost.

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2. The aggregate liability of SPECIM is limited to the sum of money, actually paid by the Customer to SPECIM for the system delivered.

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Contacting Support

Further information and technical support are available from **Specim, Spectral Imaging Oy Ltd.** in Finland. Contact information:

- WWW: *www.specim.fi*
- Email: *support@specim.fi*
- Tel: +358 (0)10 4244 400

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Specim FX17 - Introduction

Overview

FX17 is a complete, multi-purpose, turn-key hyperspectral imaging instrument designed for industrial and laboratory use. It works in what is known as a push-broom mode, and collects hyperspectral data in the NIR (900 to 1700 nm) region through single fore optics. Each FX17 unit has been factory calibrated for optimum performance (including spectral wavelenght calibration and automatic image enhancement operations: smile and keystone with reduced distortion).

Figure 1: FX17 Spectral Camera

The main advantages of FX17 are:

- **High Speed**: FX17 outputs 670 FPS with the Full Image mode. With a MROI mode the speed can be up to several thousands frames per second depending on the number and positioning of the selected wavebands. For example with selection of 4 bands the speed can be more than 15000 FPS.
- **Fast Optics**: FX17 has high quality optics with a F-number 1.7, which enables good signal with short integration times. High Signal to Noise Ratio (1000:1) enables better detection accuracy on high speeds.
- **Flexibility**: Free wavelength selection from 230 bands within the camera coverage.
- **Plug 'n' Play**: Each FX17 unit has the same spectral wavelength calibration, which means that all the units gives identical results. Automatic image enhancement provides correction for smile, keystone and reduced distortion.
- **Size**: FX17 has much smaller footprint than traditional hyperspectral cameras and weights only 1.4 kg.
- **Integration**: FX17 has various options for controlling software, including Lumo ToolKit, Lumo SDK and a separate ASCII protocol. FX17 is controlled via CameraLink.

Technical Specifications

Optical Performance

This section describes the nominal optical performance characteristics of the camera.

The Specim FX17 spectral camera is optimized for the **NIR** spectral region, respectively, with the following optical specifications.

Table 1: Optical Characteristics

Optical Characteristics	NIR
Spectral range	900-1700 nm
Automatic Image Enhancement	Smile and keystone correction with decreased distortion. Also each unit has the same spectral wavelength calibration.
F number	1.7
FOV	40 degrees

Performance Characteristics

This section describes the performance characteristics of the camera.

The NIR camera is operated in a default mode of unbinned spectral and spatial pixels, which gives the effective pixel size on array of 15x15 um given the table.

Table 2: Camera Performance Characteristics

Characteristics	NIR		
Detector type	InGaAs		
Slit Width	Physical width 42µm. Projection on sensor 32µm (M=1.3)		
Pixel size	15x15 µm		
# Spatial pixels	640		
Spectral binning options	1x	2x	4x
# Spectral pixels covering the specified range	230	115	57
Spectral sampling/pixel	3.5 nm	7 nm	14 nm
Spectral Resolution FWHM	8 nm (mean)		
SNR @ max. signal	1000:1		
Frame rate (fps), full range (230 bands) max.	670 FPS		
Frame rate (fps), MROI examples	4 adjacent bands 15000 FPS 50 bands ~ 5000 FPS		
Integration time	Adjustable, within frame time		
Data interface	CL, 12 bits		

Characteristics	NIR
Sensor Cooling	TEC
Shutter	Electromechanical shutter for dark background registration, user-controllable by software

Mechanical Specifications

This section describes the mechanical specifications of the Specim FX17.

Table 3: Mechanical Specification

Characteristics	Value
Housing	Painted aluminium case
Size (L x W x H)	150 x 75 x 85 mm
Weight	1.4 kg

Electrical Specifications

This section describes the electrical specifications of the system.

Table 4: Electrical Specification

Characteristics	Value
Input supply voltage range	12 DC
Power consumptions	
Camera Sensor	Max. 24 W

Environmental Specifications

This section describes the environmental characteristics of the system.

Table 5: Environmental Specification

Characteristics	Value
Storage temperature	-20 ... +50°C
Operating temperature	+5 … +40°C, non-condensing
IP classification code	IP52

Dimensions

Dimensions, Field of View and Slit Orientation

This section describes the physical dimensions, FOV and Slit orientation of the camera. Please note that the mounting kit is also depicted in the pictures.

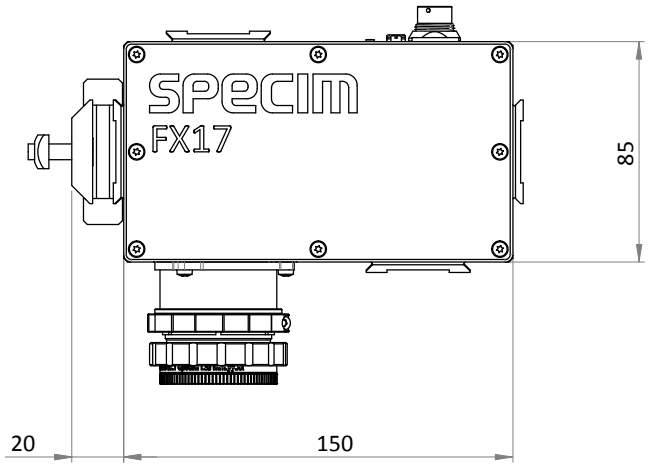

Figure 2: Dimensions - Top View

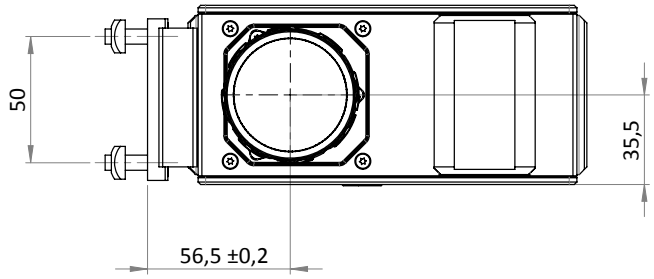

Figure 3: Dimensions - Front View

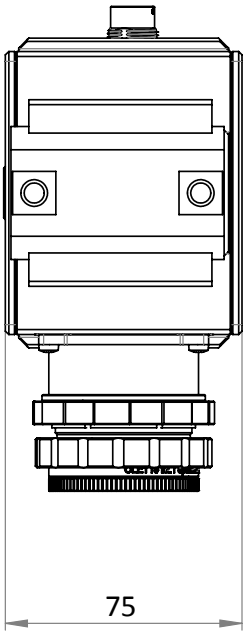

Figure 4: Dimensions - Side View

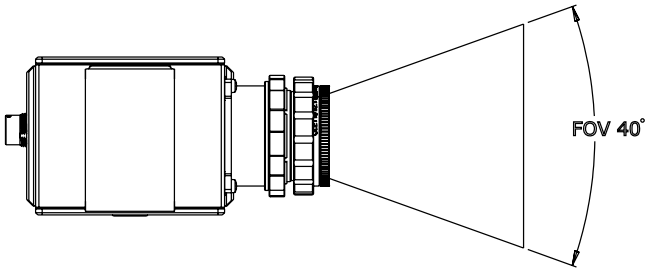

Figure 5: Field of View

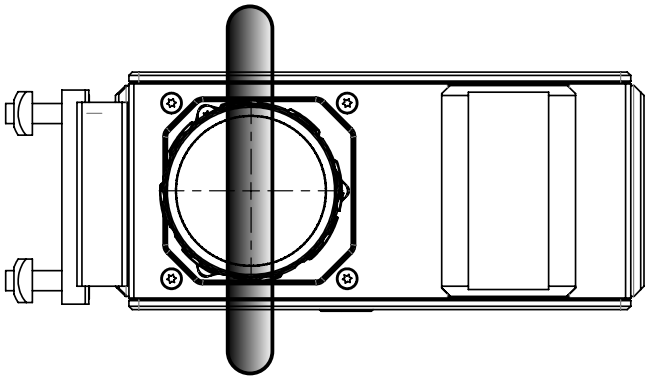

Figure 6: Slit Orientation

Installation

Mounting FX17

The following mounting options can be used in the Specim FX17:

- Standard Camera Thread (1/4-20 UNC) in the bottom of the FX17
- Dovetail joints located on four sides of the FX17 for the Mounting Kit

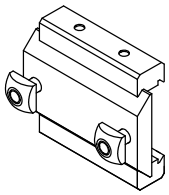

Figure 7: Mounting Kit

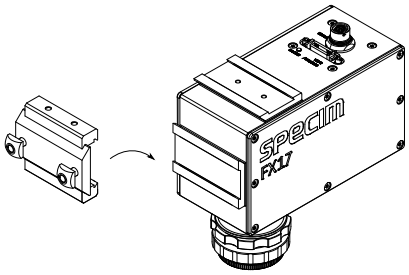

Figure 8: Mounting Kit assembly

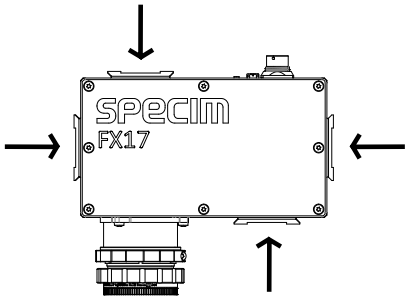

Figure 9: Dovetail joints for the Mounting Kit

Connecting FX17

Powering ON/OFF, Connectors and Pin Numbers

There are two connectors in the FX17 back panel:

- CameraLink Connector
- Power Connector for 12V DC

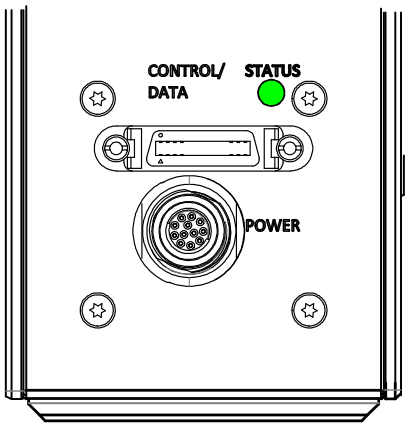

Figure 10: Connectors

Note: Before powering up the FX17, connect the CameraLink cable between the camera and the grabber. To power up the camera, do the following in this particular order:

1. Insert the power cable to the **camera**
2. Connect power cable to the **wall socket**
3. Camera is on when the **Status** Led is blinking

When powering off the camera, pull the power cable first from the wall socket. After removing the power cord, wait at least 30 seconds before connecting the power cord and starting camera again.

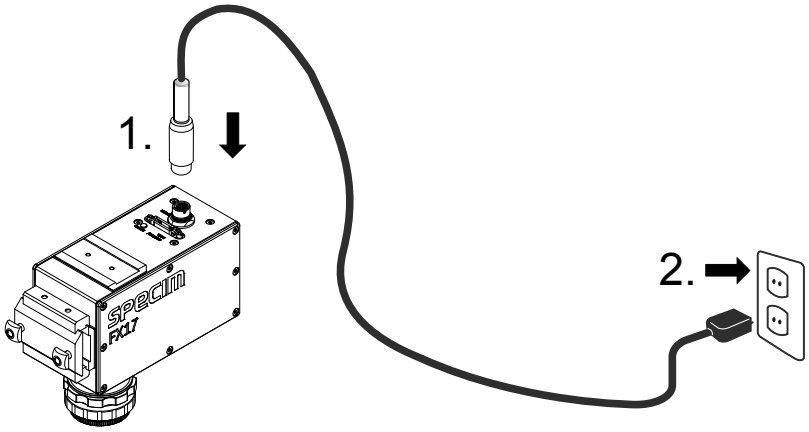

Figure 11: Powering Order

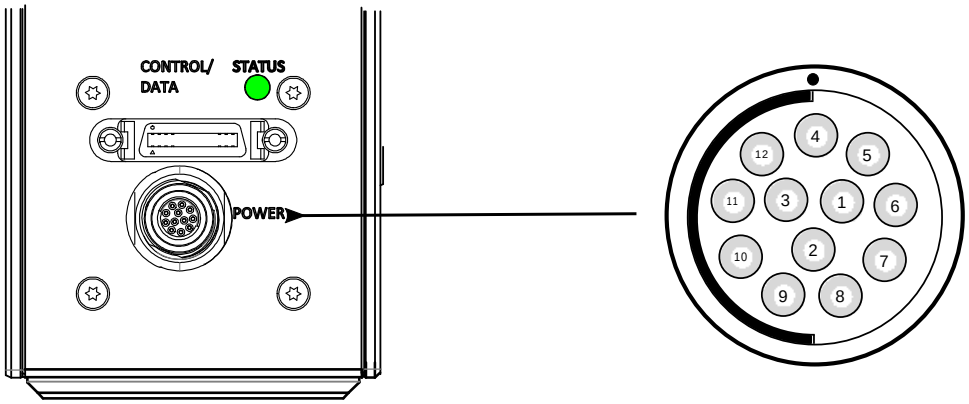

Figure 12: Power Connector Pin numbering

Table 6: Power Connector Pin-out

pin #	I/O Type	Name	Description
1	O	ISO_OUT0	General purpose Output 0, single-ended output
2	O	ISO_STROBE	Default Strobe out, single-ended output
3	O	RESERVED	Reserved, do not connect
4	PWR	CAMERA_GND	Camera GND, 0V
5	PWR	CAMERA_PWR	Camera Power 12V (+/- 10%)
6	PWR	ISO_GND	I/O GND, 0V
7	I	ISO_IN0	General purpose input 0
8	I	ISO_TRIGGER	Default Trigger in
9	O	RESERVED	Reserved, do not connect
10	O	RESERVED	Reserved, do not connect
11	O	RESERVED	Reserved, do not connect
12	O	RESERVED	Reserved, do not connect

Maintenance Guide

General Information

Warning: There are no parts inside the spectrograph or spectral camera that need annual adjustments or maintenance. Therefore, do not ever open the camera enclosure.

Each Specim FX17 -unit has the same spectral wavelenght calibration functionality, which means that and every each unit is providing identical measurement results in the same environment. The spectral wavelength calibration is done automatically for each pixel in the device itself.

Cleaning the Objective

The first surface of the fore optics or the slit window of the spectrograph is bound to get dirty during active use. Dust from environment, and accidental fingerprints will collect to the surface. When removing the fore optics from the spectrograph we advice to insert the protective caps both to the spectrograph front and the objective ends.

In normal measurements, any dirt in the surface will be cancelled out when making referencing to the white sample, and will not affect the final results. However, extreme dust will cause additional stray light (scattering) and could deteriorate the performance.

Important: We advice to only clean the optics when absolutely necessary.

The cleaning method depends on the nature of the contaminant. The main concern is that one should not make the problem worse by doing something wrong. Keep it in mind that one will only have to proceed as far as is necessary to achieve a satisfactory result.

Basic lens cleaning tools are:

- A hand rubber blower
- Canned air
- A fine optics brush
- Natural colon balls
- A microfiber or fine linen cloth
- Various lens cleaning fluids