

# Front End Electronics for NMOS Spectral Sensors and PDAs

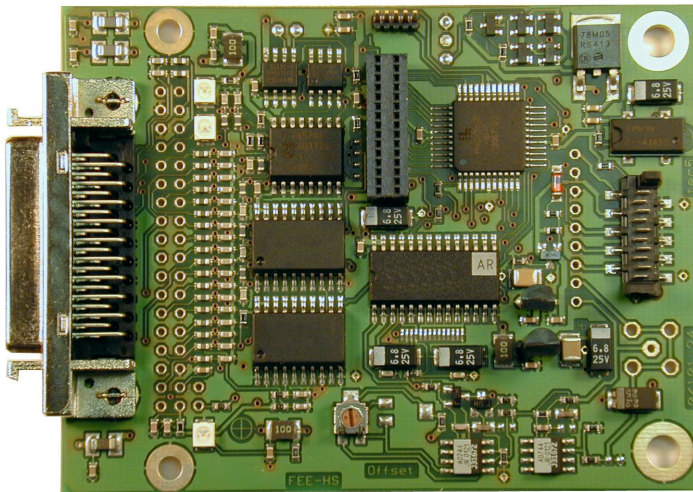


## FEE-HS

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## Sensors and Electronic Multiplexers

The following sensor modules are currently available:

- MMS - Spectral Sensors (not MMS NIR)
- MCS - Spectral Sensors (equipped with Preamplifier Electronics type DZA-S3901-4)
- Preamplifier Electronics DZA-S3901-4 for Hamamatsu photodiode arrays types S3901 to S3904 or compatible

The module is prepared for direct connection to tec5's Electronic Spectral Sensor Multiplexers (up to 8 channels). The multiplexers are plugged on top of the HS-Front End Electronics. Currently available are the multiplexers type MUX-4P and MUX-8A.

## Short Description

- § High speed readout control logic with ADC for digitization of the sensors's analog video signal
- § For NMOS photodiode arrays (PDAs)
- § Readout rate: 187.5 kpixel per second (1.4 ms readout time for 256 pixels)
- § Resolution: 15 bits A/D conversion
- § Dynamic range: approx. 1:23.000 with MMS Spectral Sensor, gain 1
- § Input from device: preamplifier with PDA or Spectral Sensor
- § Output to device: Ethernet-, USB- or PCI bus Interface Electronics
- § PCB dimensions 87 mm x 67 mm (FEE standard)

## General

The FEE-HS functions as a kind of adapter between the sensor module and the Interface Electronics. It generates the controlling signals for the photodiode array of the sensor module, preprocesses the analog video signal and performs analog / digital conversion. The digitized intensity values are provided as byte sequential data stream for the Interface Electronics.

The circuit board is connected either to the PCI bus Interface Electronics via a shielded 2 or 5m long multipin cable (PD-PCI01V1 version 'Standard', interface standard ,Interface\_40') or directly plugged on top of the Ethernet- or USB Interface Electronics (PD-ETH01V1 or PD-USB01V2, version ,Embedded', Interface standard 'Interface\_2\*18').

The sensor interface corresponds to specification ,Sensor\_1A'. The sensor module is connected to the FEE by a miniaturized coax line and a 10 pin flat ribbon cable.

## Features / Specifications

### Functional Properties

- Provision of all supply voltages for the PDA
- Autonomous single scan control:
  - generation of all control signals for the PDA
  - analog video signal preprocessing
  - 15 bit A/D conversion of the intensity values
  - provision of the digital intensity values for acquisition by the Interface Electronics
- Prepared for controlling tec5's Electronic Spectral Sensor Multiplexer units
- Local non-volatile memory, 256 Bytes capacity (e.g. for identification data of the sensor(s), calibration coefficients or customer specific information)

### Specifications

- ADC: 16 bits, type AD976A
- Resolution: 15 bits
- Conversion rate: approx. 187.5 kSps, crystal clock controlled
- Readout time: 1.4 ms for 256 pixels
- Spectra rate: approx. 700 spectra/s
- Input sensitivity: approx. 23.000 counts/V
- Offset adj. range: approx.  $\pm 900$  counts
- Standard deviation: typically 1.4 counts with MMS sensor, gain = 1 (20 dark spectra at 10 ms)
- Dynamic range: approx. 1 : 23.000 ( $2^{15} / 1.4$ )
- Non-linearity: typ.  $\pm 2$  counts, max.  $\pm 4$  counts
- Temperature drift:  $< \pm 1,5$  counts / °C

### Interfaces

- Interface type ,Sensor\_1A' to sensor unit
- Interface type ,Interface\_40' or 'Interface\_2\*18' to Interface Electronics
- Connector for Spectral Sensor Multiplexer

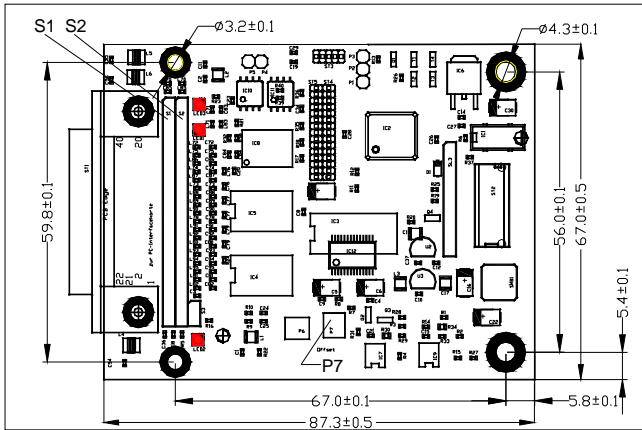
**Power consumption (from Interface Electronics)**

- 12V: approx. 30 mA
- +12V: approx. 120 mA
- with additional supply on +5V external supply input:
- + 5V ext.: approx. 70 mA
- +12V: approx. 50 mA
- 12V: approx. 30 mA

**Environmental conditions**

- Temperature range operating: 0 °C ... 60 °C
- Temperature range storage: -40 °C ... +70 °C
- Humidity (@25°C, non condensing): 10 % ... 90 %

**PCB Design**



**Assembly Versions**

**Assembly Version ‚Standard‘ (extension /STD)**

with 40 pin Mini-Delta connector for connection to the Interface Electronics via cable. The 36 pin connector array S1/S2 may be assembled with socket contacts (not used).

**Assembly Version ‚Embedded‘ (extension /EMB)**

is prepared to be directly plugged on top of the Interface Electronics (typically Ethernet or USB Interface Electronics). The 36 pin connector array S1/S2 is assembled with pins on the solder side, the 40 pin Mini-Delta connector is not assembled.

**Assembly Version for ‚Systems‘ (extension /SYS)**

is prepared for the module integration in systems. The 36 pin connector array S1/S2 is assembled with pin header contacts to link specific connector adapters (like the tec5 LKONV-40-37) via a flat-ribbon cable; the 40 pin Mini-Delta connector is not assembled.

**Interfaces**

**Interface Electronics connector type / specs / pinout**

ST1: 40 pin 3M Mini Delta Ribbon (socket type)

‘Interface\_40’ compatible

S1/S2: 2\*18 pin socket connector array

‘Interface\_2\*18’ compatible

ST1 Pin	S1/S2 Pin	Input / Output	Comment
A1	S1/17	Input	ADC Byte Select (MSB:High)
A2	S1/15	Input	StartScan from IE
A3	S1/13	Output	EndOfScan from FEE
A4	S1/11	Output	ADC Data Bit D7 or D15
A5	S1/12	Output	ADC Busy from FEE
A6	S1/10	Output	ADC Data Bit D6 or D14
A8	S1/9	Output	ADC Data Bit D5 or D13
A10	S1/8	Output	ADC Data Bit D4 or D12
A12	S1/7	Output	ADC Data Bit D3 or D11
A14	S1/6	Output	ADC Data Bit D2 or D10

A16	S1/5	Output	ADC Data Bit D1 or D9
A18	S1/4	Output	ADC Data Bit D0 or D8
A19	S2/3	Output	ScanRunning from FEE
B2	S1/18	Power	Power supply voltage +12V
B16	S2/2	Input	Power control from IE: Low if +5V supply voltage is available
B17	S2/5	Bidirect.	I2C Bus, Clock Signal
B18	S2/4	Bidirect.	I2C Bus, Data Signal
B19	S1/1	Power	Power supply voltage -12V
B20	S2/1	Power	Power supply voltage +5Vext

Pins A7, A9, A11, A13, A15, A17, A20, B1, S1/2, S1/3 and S2/16 are connected to ground; Pins S1/14, S1/16, S2/17 and S2/18 are reserved; Pins B3, B4, B5 are not connected; the remaining pins are routed and filtered between connectors ST1 and S1/S2 (Details see Technical Documentation). (IE = Interface Electronics)

**Sensor interface connector type / specs / pinout**

ST2: MICS 10 and SMB, ‘Sensor\_1A’ compatible

ST3: 9 pin socket connector array

ST2 Pin or SMB	SL3 Pin	Description
1	1	not connected
2	7	Sensor StartScan
3	3	Ground
4	6	Sensor Clock
5	3	Ground
6	5	Sensor EndOfScan
7	3	Ground
8	2	-5V Power supply for sensor module
9	3	Ground
10	1	+5V Power supply for sensor module
SMB	9	Ground
SMB	8	Sensor Video signal (center contact)
---	4	Mode for Sensor Multiplexer (MUX-4A)

**Trimming / Settings**

For offset compensation of the Front End Electronics, the optical sensor input has to be covered. Use a spectral data acquisition software to display raw pixel data in continuous acquisition / live display mode (e.g. tec5 AdminTool) with the following settings:

- Shortest integration time, without dark correction
- View-Option Y-scale: ADC – Counts
- View-Zoom Y-scale: approx. 0...50 [counts]
- Continuous acquisition

The offset is adjusted by trimming potentiometer P7 to result in a baseline between 15 and 20 counts.

**User Information**

**General**

The information in this data sheet has been checked carefully. However, no responsibility is assumed for inaccuracies. tec5 reserves the right to make changes to any portion of this document without notice.

Each product is tested carefully before being shipped. If, however, problems should occur while initial operation or during later operation, please first check your specific settings and correct installation (connectors).

**Warranty**

The warranty period for this product is 12 months. The warranty begins on the day of delivery. Within the warranty period, tec5 will repair free of charge any faulty functioning of the product resulting from faulty design or defective material. All other claims are excluded, in particular consequential damage.

**Handling**

The electronics is partly constructed in CMOS technology and is thus sensitive against electrostatic discharge. Take appropriate precautions whenever handling the component. Please switch off the power before connecting or disconnecting the product.