

OEM Electronics for NMOS Arrays

Modular Components for UV-VIS Spectroscopy



Key Features

- high precision and high dynamic range
- fast readout with
15 or 16 bit A/D conversion
- various PC interfaces supported

Application Areas for NMOS Technology

- light source emission
- absorbance, color
- layer thickness
- concentration in fluids

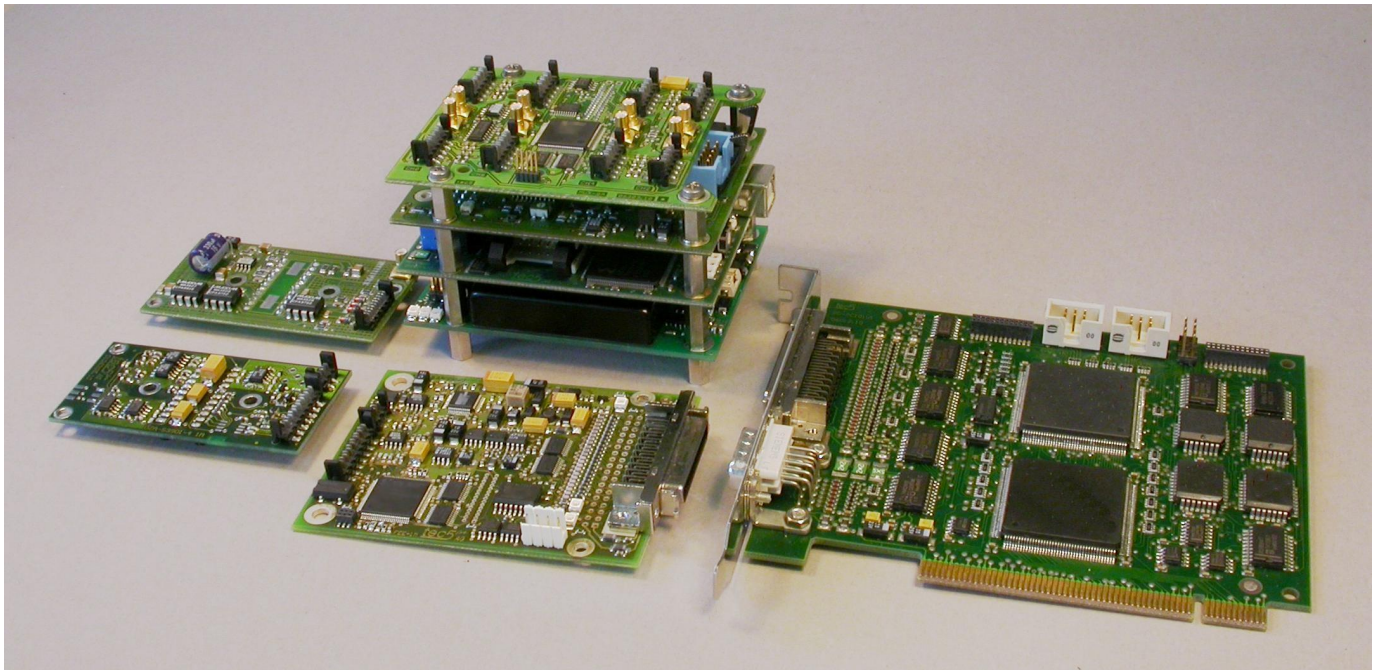


Figure 1: Electronics modules for NMOS arrays

General

Linear silicon photodiode arrays based on NMOS technology offer excellent dynamic performance for applications in UV-VIS spectroscopy. A range of electronics modules is available from tec5, supporting series S3901 – S3904 and S8380 – S8381 arrays manufactured by Hamamatsu and equivalent types.

In addition, the electronics modules can be used to operate Spectral Sensors types MMS and MCS manufactured by Carl Zeiss, based on the NMOS arrays supported.

Data are passed to follow-on processing by various interfaces, e.g. PCI, USB or Ethernet for a standard PC or by a parallel interface to a customer microcomputer's digital I/O.

Characteristics

- 128, 256, 512 and 1024 pixel arrays supported
- Carl Zeiss MMS and MCS sensors supported
- 15 or 16 bit A/D conversion
- Fast readout operation allowing acquisition rates of up to 1000 spectra per second
- High dynamic range version for lowest noise available
- Available PC interfaces:
 - USB
 - PCI
 - Ethernet
 - other (contact tec5)
- Customization available

Electronics Block Diagrams

Several electronics modules are used with the arrays or spectral sensors according to the block diagrams shown in figures 2 and 3. The function of each of the blocks is described in detail below.

PCI-based Configuration

A dedicated interface electronics board is plugged into a PC with PCI slot. The other boards and the

sensor are designed for being included into a customer's housing, connected to the PC by a 40-pin interface cable available in standard lengths of 2 m or 5 m.

All signal electronics modules are supplied from the PC's internal power supply.

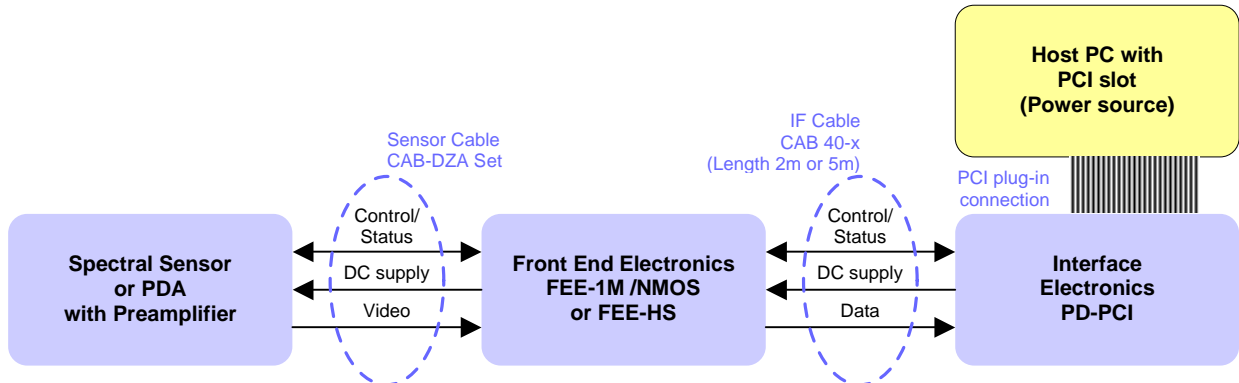


Figure 2: Block diagram of PCI-based electronics

USB- / Ethernet based Configuration

The USB- / Ethernet- based interface electronics with the Front End Electronics are supplied externally by an additional power supply (self-powered USB device). The electronics is connected to the PC by a standard USB or Ethernet interconnection cable according to the block diagram shown in figure 3. Although the electronics is

compatible to the older standards USB 1.1 or Ethernet 802.3 10Base-T, we recommend to use a Hi-Speed USB 2.0 port or an Ethernet 802.3 100Base-T interconnection for best performance. For high speed versions FEE-1M, Hi-Speed USB communication 100Base-T Ethernet is mandatory. All electronics boards are designed for integration into a customer's housing.

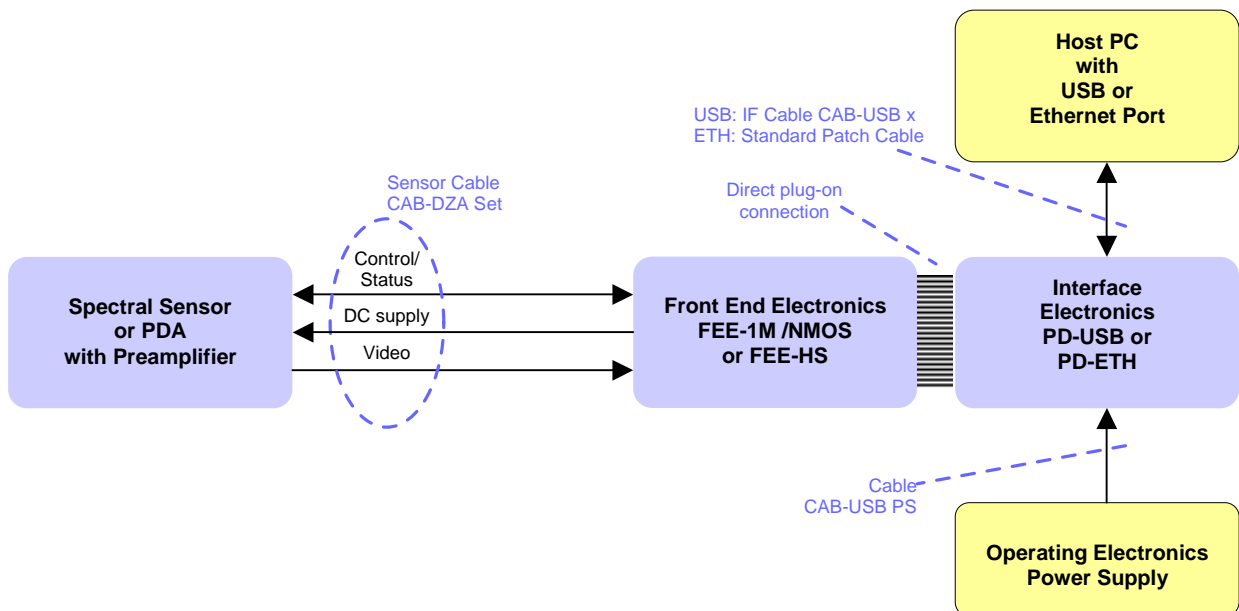


Figure 3: Block diagram of USB-based electronics

Sensor Preamplifier Modules

The photodiode array is plugged into the socket on the preamplifier printed circuit board, containing circuitry which should be located in close proximity to the detector array.

Available sensor preamplifier

- **DZA-S3901-4** for Hamamatsu S3901 to S3904 type photodiode arrays, for 187.5 kpixel per second readout rate, compatible to Carl Zeiss MCS spectral sensors, allows electronic multiplexing.
- **DZA-S3901-4 1M /0x** for Hamamatsu S3901 to S3904 type photodiode arrays, for 1 Mpixel per second readout rate (high-speed readout); compatible to Carl Zeiss MCS spectral sensors.
- **DZA-S3901-4 1M /D0x** for Hamamatsu S3901 to S3904 type photodiode arrays, for 100 kpixel per second readout rate (high-dynamic range readout), compatible to Carl Zeiss MCS spectral sensors.
- **DZA-MMS 1M** for Carl Zeiss MMS spectral sensors, for 1 Mpixel per second readout rate (high-speed readout).

Front End Electronics

Featuring 16 bit A/D conversion, the **FEE-1M** supports all tec5 sensor preamplifier modules for NMOS photodiode arrays. Sensor readout is performed at a rate of either 1000 or 100 kpixels per second. The high-speed configuration allows to read more than a thousand full spectra per second. The 100 kpixels per second readout in high dynamic range configuration results in lowest noise operation. Both FEE-1M configurations can be used with Carl Zeiss MCS-type spectral sensors.

The **FEE-HS** reads Carl Zeiss MMS-type spectral sensors at a readout rate of 187.5 kpixels per second, resulting in a total readout time of less than 1.5 ms for the spectral sensor. In MMS-based configurations, the internal preamplifier of the spectral sensor is used.

Interface Electronics

Depending on the preferred type of connection to the host PC, a PCI plug-in Interface Electronics, a USB- or Ethernet-type Interface Electronics may be used. Other alternatives for interfacing are available, please contact tec5 for additional details.

The interface electronics modules retrieve digitized data from the Front End Electronics and forward the data to a host PC. The electronics circuitry contains the readout scan cycle control logic with precise integration timing and hardware sequencing of all

functions with real-time requirements. A FIFO buffer memory is used to assure consistent data transfer to the computer's main memory.

The Interface Electronics modules offer peripheral control and synchronization with digital I/O lines, e.g. flash trigger output, external trigger input and general purpose digital I/O lines.

Electronic Multiplexer

Configurations based on the FEE-HS may be equipped with an electronic four- or eight channel multiplexer, allowing to operate several spectral sensors or photodiode arrays with preamplifiers with a single FEE and interface board. The multiplexers allow simultaneous or sequential readout, offering advantages in configurations requiring real-time referencing.

The Carl Zeiss MMS-type spectral sensors are supported directly by the multiplexers **MUX-4P** and **MUX-8A**, MCS spectral sensors can be multiplexed using the preamplifier types DZA-S3901-4 available from tec5.

Operating Carl Zeiss MMS and MCS Spectral Sensors

For operation of a standard Carl Zeiss MMS module, a FEE-HS and one of the tec5 interface boards are required. This standard configuration results in 15 bit A/D conversion and readout time below 1.5 ms.

For high speed applications, an MMS module without preamplifier can be used with DZA-MMS 1M and FEE-1M /NMOS-1 to achieve a readout time down to 0.2 ms (128 pixel).

For MCS-type spectral sensors manufactured by Carl Zeiss, either a high speed or high dynamic range configuration may be selected, both based on preamplifier DZA-S7030-4 1M and FEE 1M Front End Electronics with one of the tec5 interface boards.

Details for each standard configuration are contained in the dedicated section below. Other configurations may be available for special requirements, please contact us for more information if required.

Software Support

For configurations based on Interface Electronics manufactured by tec5, Windows 2000, XP and Vista drivers and the AdminTool program can be used for verifying hardware operation and simple data acquisition. In addition, various application programs and programming libraries are available from tec5. Please contact us for alternative operating systems or custom software development.

Configuration Details

For each sensor supported, the basic hardware configuration is shown in figure 4. The tables below contain detailed ordering information for the most popular sensors and interfaces.

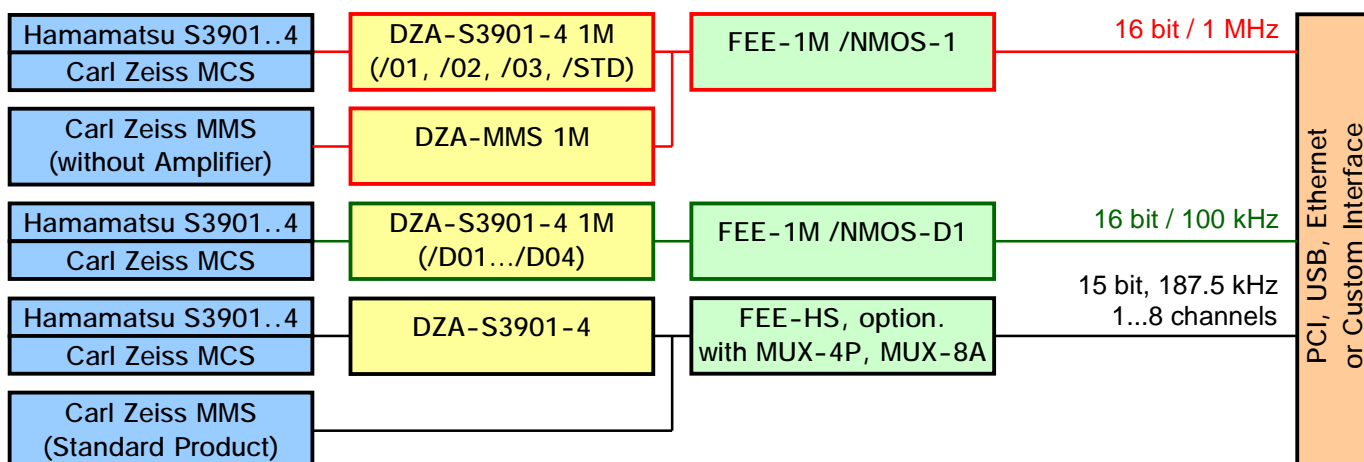


Figure 4: Configurations overview

USB / Ethernet Configurations

Sensor Type	Preamplifier	Front End	IF	Cable Assy	Remark	
S3901 Hamamatsu	DZA-S3901-4 1M /01 11-0106205-01	FEE-1M /NMOS-1 EMB 11-0106107-21	PD-USB01V2 /STD 11-0106015-00 or PD-ETH01V1 /STD 11-0106020-00	CAB-NMOS 1M Set 11-1501004-14	High Speed Configuration	
S3902 Hamamatsu	DZA-S3901-4 1M /02 11-0106205-02			Tbd.		
S3903 Hamamatsu	DZA-S3901-4 1M /03 11-0106205-03			FEE-1M /NMOS- D1 EMB 11-0106107-51	CAB-NMOS 1M Set 11-1501004-14	High Dynamic Range Configuration
S3904 Hamamatsu MCS Sensor Zeiss	DZA-S3901-4 1M /STD 11-0106205-00					
Carl Zeiss MMS (without amplifier)	DZA-MMS 1M					
S3901 Hamamatsu	DZA-S3901-4 1M /D01 11-0106205-11	FEE-1M /NMOS- D1 EMB 11-0106107-51	PD-USB01V2 /STD 11-0106015-00 or PD-ETH01V1 /STD 11-0106020-00	CAB-NMOS 1M Set 11-1501004-14	High Dynamic Range Configuration	
S3902 Hamamatsu	DZA-S3901-4 1M /D02 11-0106205-12					
S3903 Hamamatsu	DZA-S3901-4 1M /D03 11-0106205-13					
S3904 Hamamatsu MCS Sensor Zeiss	DZA-S3901-4 1M /D04 11-0106205-10					
Carl Zeiss MMS Sensor	Included in sensor	FEE-HS /EMB 11-0106101-12		CAB-DZA Set 11-1501004-00	Option: MUX 4P or MUX 8A	

Optional for USB configurations: USB cable CAB-USB 2, 11-1501007-00 or CAB-USB 5, 11-1501007-01.

DC power supply for signal chain NT-USB, 11-0302001-01.

PCI Configurations

Sensor Type	Preamplifier	Front End	IF	Cable Assy	Remark	
S3901 Hamamatsu	DZA-S3901-4 1M /01 11-0106205-01	FEE-1M /NMOS-1 STD 11-0106107-20	PD-PCI01V1 /52 11-0106012-30	CAB-NMOS 1M Set 11-1501004-14	High Speed Configuration	
S3902 Hamamatsu	DZA-S3901-4 1M /02 11-0106205-02			Tbd.		
S3903 Hamamatsu	DZA-S3901-4 1M /03 11-0106205-03			FEE-1M /NMOS-D1 STD 11-0106107-50	CAB-NMOS 1M Set 11-1501004-14	High Dynamic Range Configuration
S3904 Hamamatsu MCS Sensor Zeiss	DZA-S3901-4 1M /STD 11-0106205-00					
Carl Zeiss MMS (without amplifier)	DZA-MMS 1M 11-0106206.01					
S3901 Hamamatsu	DZA-S3901-4 1M /D01 11-0106205-11	FEE-1M /NMOS-D1 STD 11-0106107-50	PD-PCI01V1 /52 11-0106012-30	CAB-NMOS 1M Set 11-1501004-14	High Dynamic Range Configuration	
S3902 Hamamatsu	DZA-S3901-4 1M /D02 11-0106205-12					
S3903 Hamamatsu	DZA-S3901-4 1M /D03 11-0106205-13					
S3904 Hamamatsu MCS Sensor Zeiss	DZA-S3901-4 1M /D04 11-0106205-10					
Carl Zeiss MMS Sensor	Included in sensor	FEE-HS /STD 11-0106101-11		CAB-DZA Set 11-1501004-00	Option: MUX 4P or MUX 8A	

For all PCI configurations: PCI interconnection cable CAB40-2, 11-1501005-00 or CAB40-5, 11-1501005-01.