Operating Instructions

OEM Spectrometer

RU 60

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1. Features

The JETI broadband OEM spectrometer **RU60** is a new flat field spectrograph combined with a powerful processing electronics.

It is characterized by:

- a high quality image with very low aberrations over the whole spectral range
- a high dynamic range
- high sensitivity in VIS, UV and IR
- a compact design
- it can easily be integrated into customer systems

The OEM spectrometer RU 60 has several controller functions such as:

- internal storage of wavelength pixel relation
- preprocessing of data, dark signal correction, absolute calibration
- internal calculations like averaging, interpolation, transmission, reflexion, absorption, color coordinates
- dedicated control syntax (SCPI compliant)
- mechanical shutter

The communication interfaces are:

- USB 2.0 High Speed communication interface (USB CDC class)
- 10/100 Mbit/s TCP/IP, Ethernet MAC interface
- SPI master or slave communication interface with up to 50 Mbit/s, mode 0, 1, 2 or 3 (application specific OEM solution)
- LV-TTLUART communication interface
  8N1, up to 25Mbps (pre-defined 3 000 000, 921 600, 230 400, 115 200 or 38 400 bit/s)

- RS485 Interface with up to 2.5Mbps
- Digital trigger input LV-TTL
- Shutter/lamp control output LV-TTL
- 5V periphery supply output (from USB/USB-Charger with up to 300/1000 mA)
- 8 GPIO Pins, 3 Analog Inputs (12Bit, 18Msps)
- Output for JETI's high speed piezo-shutter
- JETI-Port connects to various detached imaging array boards

The **RU60** spectrometer electronics has the following advanced features:

- 80 MHz MIPS 4K core based RISC CPU with 512 KB Flash Program Memory and128 KB RAM.
- In field programmable by integrated bootloader via the communication interfaces, which allows easy updating of firmware.
- Firmware can utilizes general application or user specific OEM applications in spectroscopy.
- SCPI compliant control syntax for setting operation parameters, configuration, measurement, data format, endianes, etc.

2. Installation of Hardware

Unpack the **spectrometer RU60** carefully and check the delivered parts.
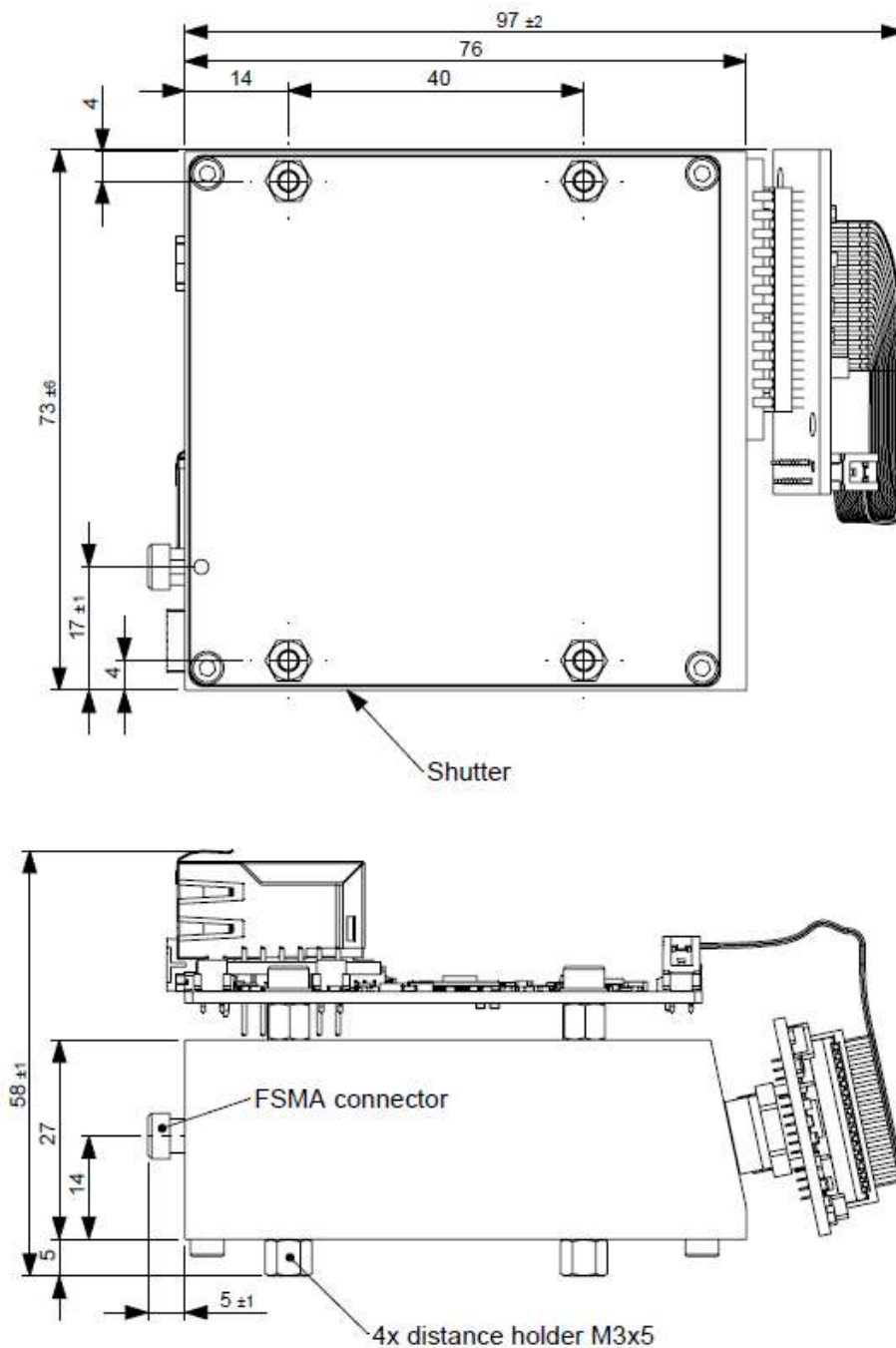
Connect the device via the populated interface. Please note the file install.txt on the USB stick.

USB version:

Install the driver from the USB stick.

2.1. Mechanical Dimensions

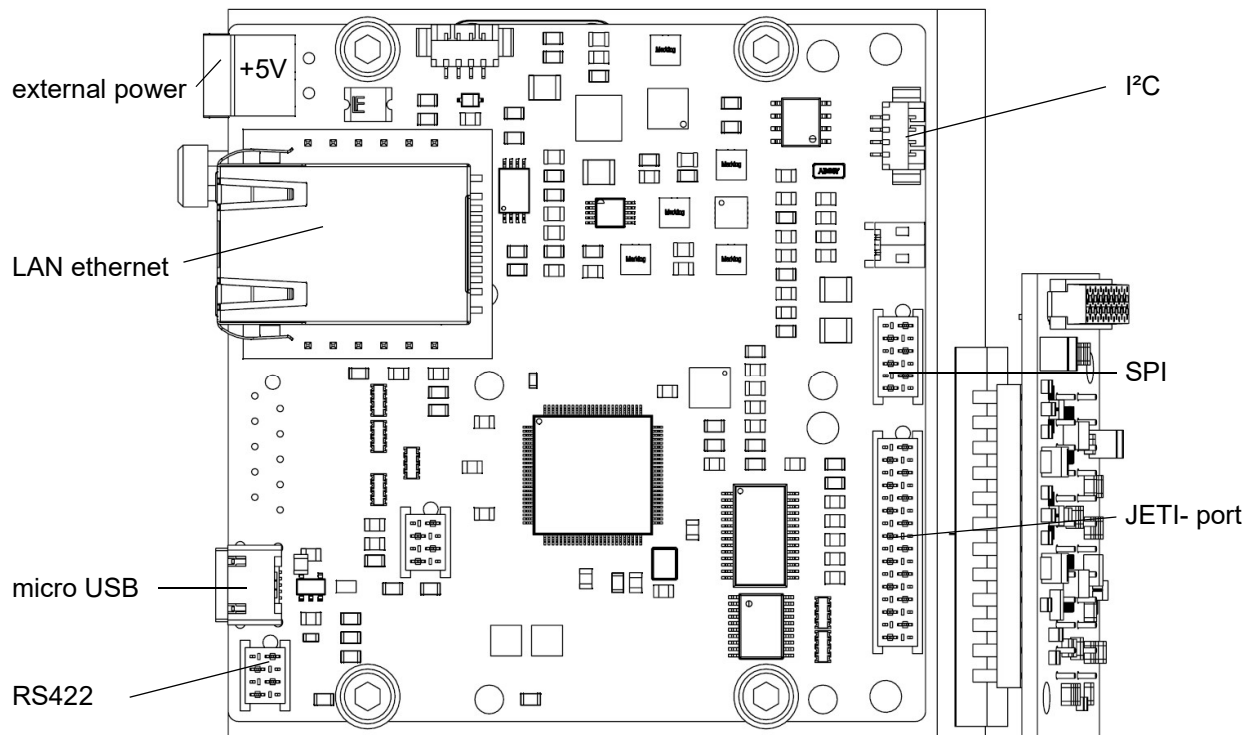Mounting: 4x screw M3

3. Connectors

3.1. Optical Connector

The spectrometer RU60 has a SMA 905 connector. It is recommended to use an optical fiber with 200 μm core diameter and a FSMA connector (other diameters are not recommended because of possible lost of optical resolution or light intensity).

3.2. Electric Connectors

See also operating instructions of PE60 on USB-stick.

4. JETI USB Driver Installation Guide

4.1. Installation of Driver Software under Windows 7 / 8 / 10

> Please note that you must have administrator privileges to install the device's driver!

USB drivers are already included in Windows 10 by default. Connect the device to a USB-port and it will work automatically.

For Windows 7 and 8/8.1 there is a driver on the delivered USB-stick. Navigate to the 'Driver' directory, run 'install.bat' with administrator privileges and follow the instructions. If a warning window appears that 'Windows can't verify the publisher of this software', click on Install Anyway.

5. Operating

After a RU 60 is connected to USB and the external power supply, it will be automatically recognized by Windows as a valid USB-device. The fiber should be connected (or directed using some additional optics) to the light source, which has to be measured.

Generally there are three ways to control the spectrometer:
- with Firmware commands
- with DLLs
- with JETI PC software

5.1. Firmware

One needs any terminal program, which allows a connection via virtual COM-port, to communicate using firmware commands. For the command syntax see the description Firmware OEM Spectrometer RU 60 on the CD or at www.jeti.com. Furthermore the application note 8 at http://www.jeti.com/cms/index.php/application-notes gives an overview about the different possibilities of the command syntax.

5.2. DLL

To communicate via DLLs the user must write a sort of a program in any programming language, allowing to embed external libraries, which include at least one of the following JETI-DLLs: jeti_core.dll, jeti_spectro.dll or jeti_spectro_ex.dll. A description of the different DLL functions, their handling and parameters, can be found in the individual DLL descriptions included in the SDK documentation.

5.3. JETI software

However, the easiest way to use a RU 60 spectrometer is to do it with JETI software like **VersaSpec**. It contains all basic features to make measurements and also some additional mathematics. For a description see the Versaspec operating instructions on the USB stick or at www.jeti.com.

5.4. Operation of RU 60 with Shutter or flash lamp

5.4.1. Shutter

The recommended operation of RU 60 is to combine a light measurement with an related dark scan of the same integration time. This procedure will avoid base line drift caused e.g. by temperature changes. If a continuous illumination is used then a mechanical shutter will be necessary.

The PE 60 electronics generates an additional driving signal for an external shutter. It is a TTL signal and it is available at pin 6 and 4 (ground) of the SPI interface. Alternatively it is possible to use the signal to switch off/ on a lamp if appropriate. (See also operating instructions of PE60 on USB-stick.)

RU 60 is equipped with an internal shutter, which is driven piezoelectrically.

The darkmode (*conf:darkmode) has to be set to 1 to proceed individual dark measurements.

It is possible to proceed a set of dark measurements with different integration times before a series of light measurements and to use the data for the baseline correction.

This mode will reduce the time of measurements, but nevertheless the dark measurement should be repeated from time to time. Set the darkmode to 0 to use this mode.

It takes some time to open/ close a mechanical shutter and it has to be ensured that the shutter is always fully opened/ closed for correct readings. Therefore exist a shutter delay time, which can be set with the commend *para:sdel.

5.4.2. Flash lamp

A flash lamp can be used for measurements with the RU 60 in the following way:

- 00Connect the trigger input of the lamp with pin 6 (signal) and pin 4 (ground) of the SPI interface of RU 60 (firmware version must be 2.6.1 or higher)

- Switch on the flashmode using the following firmware commands:

    *para:flmod 1<CR>

    *para:lampe 1<CR>

  Configure the flashlamp parameters:

    *para:flash *interval pulselength* (pulselength in µs and interval between flashes in ms)

  Number of flashes: It will be controlled by the used integration time. If it is shorter than the selected interval time, then only one flash will be released. If the integration time is longer than the interval time then as much flashes will be released as much multiples of intervals are contained in the integration time (e.g. an integration time of 100 ms and an interval of 20 ms gives 5 flashes whereas an integration time of 90 ms gives 4 flashes with the same interval time).

6. Specifications

Optical parameters

Spectral range	200 nm ... 1000 nm
Optical bandwidth	≤ 4.0 nm FWHM (100 µm slit)
	≤ 2.5 nm FWHM (50 µm slit)
	≤ 2.0 nm FWHM (30 µm slit)
Asymmetry factor	≥ 0.7
Optical input	F-SMA connector for a 200 µm fiber
Wavelength accuracy	≤ 0.2 nm (HgAr linesource)
Wavelength reproducibility	≤ 0.02 nm (HgAr linesource)
Stray light	< 0.2 % (ASTM E387, GG495, λ = 420 nm/ 600 nm)
Spectrometer	holographic grating, flat field
Detector	Hamamatsu S11155

Electronic parameters

Digital resolution	16 bit
Dynamics	≥ 3000
Typical sensitivity	for 50 x 200 µm slit:
	$4*10^{15}$ counts/ Ws at 250 nm
	$7*10^{15}$ counts/ Ws at 500 nm
	$4*10^{15}$ counts/ Ws at 750 nm
	$1*10^{15}$ counts/ Ws at 1000 nm
Sampling speed	up to 4 MS/ s
Integration time	0.01 ... 65535 ms
Power supply	5 V DC, < 500 mA or USB powered
Interfaces	USB (high speed)
	SPI (up to 15Mb/ s)
	TTL UART (up to 25Mb/ s)
	RS485/ RS422
	I²C

Scope of delivery

- Basic unit
- USB cable
- Power cable
- Software *VersaSpec* with operation manual (optional) on USB stick
- SDK on USB stick

7. Safety instructions

- Leave the component inside the static-proof packaging that it ships with until you are ready to use the component for the installation (Let the component in the antistatic packaging in which it is sent, until you want to install the component)

- Do not touch the PCB to avoid damaging by static discharging

- Plug in connectors only when the PCB is not power supplied

- Avoid mechanical damages of the connectors by careful handling

- Avoid contamination of the optical input to avoid damaging the slit

8. Service

Please contact in case of any question or technical problem:

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