OXFORD INSTRUMENTS

ANDOR
an Oxford Instruments company

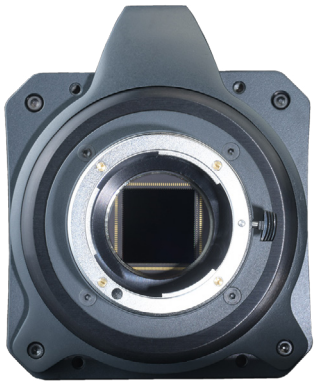
Sona

sCMOS

5 Easy Steps to Configure Sona with NIS-Elements

andor.com

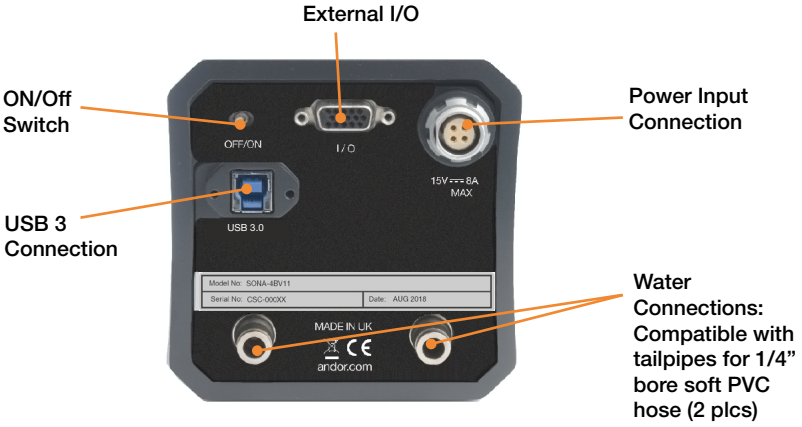
Sona with NIS-Elements



This document describes integration of a single **Sona 4.2B-11 or Sona 2.0B-11 within NIS-Elements** (page 3). This document also describes integration of two Sona cameras running simultaneously within NIS known as a Dual Sona driver (page 5).

Sona driver is available since NIS Elements (NIS) version 5.2

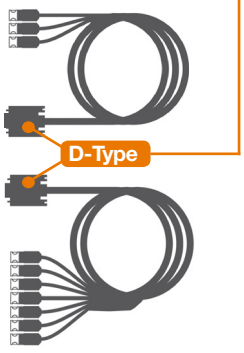
Sona Connectivity



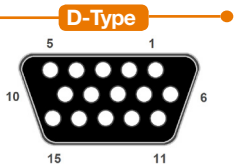
USB 3 Connection
USB 3 connection (USB 3.1) provides a robust high speed connection to the control PC.

USB3 Cable

External I/O: TTL / Logic
The TTL/Logic connection permits connection to other devices for synchronisation and control of fire, trigger and shutter operations. Option of 3-way or 7-way cable type.
Connector type: D-type to BNC cable Fire (Output), External Trigger (Input), ARM.



I/O Cable
(3 or 7-way)



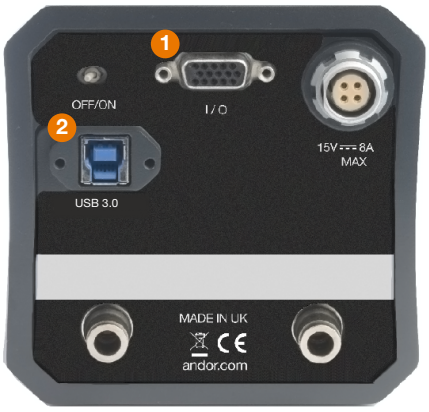
Pinouts for the 15-way D-type connector

Pin	3-way cable	7-way cable
1	ARM	ARM
2	AUX_OUT_1	AUX_OUT_1
3	Reserved	FIRE n
4	Reserved	FIRE
5	Reserved	AUX_OUT_2
6	Ground	Ground
7	External Trigger	External Trigger
8	Reserved	Spare
9	Reserved	Reserved
10	Reserved	Reserved
11	Reserved	Reserved
12	Reserved	Reserved
13	Reserved	Reserved
14	Reserved	Reserved
15	Reserved	Reserved

Please see your Sona Hardware Guide for more information on connectivity

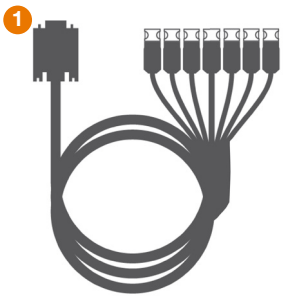
Single Sona with NIS-Elements

Setup



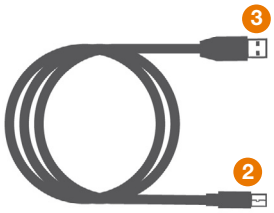
Sona back panel

+



I/O Cable
(3 or 7-way)

+



USB3 Cable

+

StarTech PEXUSB3S25
USB3 card in hp Z440.

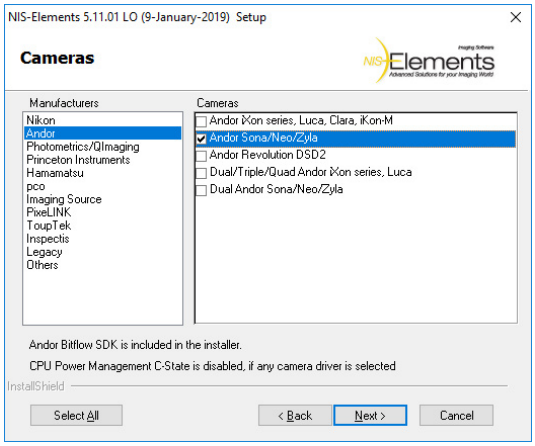
Step 1

Install the **USB3 interface card** into the host computer (StarTech Product ID: PEXUSB3S25)

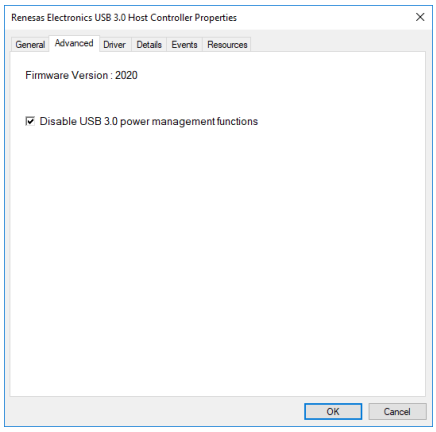
Optional - TTL PFI (NIDAQ card) ↔ Aux_Out_1 (Camera) The exposure signal (All rows) is programmed by Elements to be on the Aux_Out_1 I/O signal. It is required for TTL based acquisitions. Note: standard 3-way I/O cable includes AUX_OUT_1 signal.

Step 2

To **install NIS driver for Sona**, select in Cameras section in NIS installer manufacturer Andor and on the right pane Andor Sona/ Neo/Zyla. If Andor Sona/Neo/Zyla camera driver is selected, Andor SDK files and Windows USB3 drivers are installed.



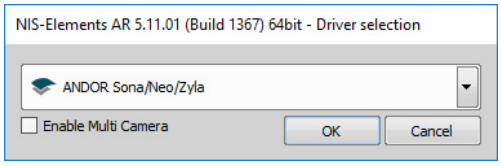
Step 3



Go to your device manager. Go to the Sona driver in the device manager. **Turn off the Power Management** on your platform. It includes BIOS and Windows Power Management Settings. In Windows Device Manager disable USB 3.0 power management functions on Renesas Electronics USB 3.0 Host Controller

Step 4

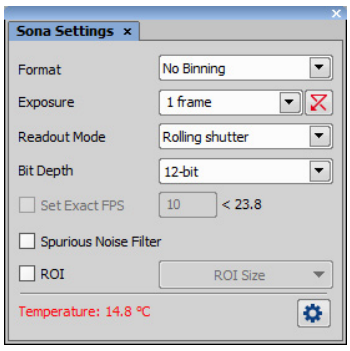
Sona driver selection Once your NIS session starts and a grabber selection dialog appears, choose Andor Sona/Neo/ Zyla from the drop-down menu. Press OK.



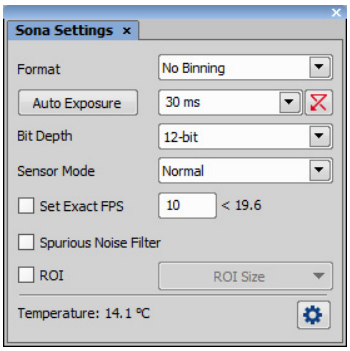
Single Sona with NIS-Elements

Step 5

Sona Pad: Control pad for the camera is now accessible from menu View → Acquisition Controls → Sona Settings or by key combination CTRL+ALT+C.



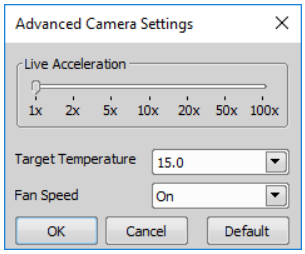
Sona pad



Sona pad
(Advanced GUI)

Advanced Options

Advanced settings for the camera are accessible via Sona pad → Settings…



Predefined ROIs

NIS-Elements provides several predefined centered ROI for different portsizes:

32 mm (2048x2048)
25 mm (1608×1608)
22 mm (1416×1416)
18 mm (1160×1160)

and typical resolutions:

2048x2048
1024×1024
512×512
256×256

Predefined ROIs can be accessed via:
Sona pad → ROI → ROI Size

TLL Based Acquisition

Triggered acquisition, JOBS → Triggered Task and Illumination Sequence are supported

Frame Rate

To reach maximum frame rate these parameters have to be considered:

1. **Exposure.** Press a button [1 frame] next to the exposure drop-down menu in the pad. This value corresponds to the longest exposure that will run the camera in the highest possible frame rate for the current settings
2. **ROI size and position** (Commands → ROI), the speed depends on the height of the ROI; faster speed is achieved if the ROI is defined in the center of the chip

Measured values (Fast Time lapse to Memory and Disk) are in the brackets and were measured with the following camera settings: Exposure: 1 frame / Bit Depth: 12bit / Predefined ROI (in the center)

Array Size		
1024 × 1024	512 × 512	256 × 256
95 (95)	190 (189.6)	378 (377.8)

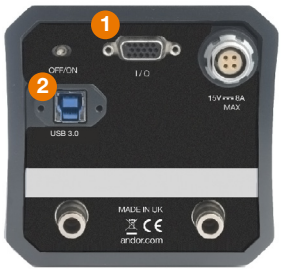
HW Timestamp

NIS uses Andor SDK functions to get timestamps. Timestamps are available e.g. in nd2 data set in Image → Properties → Recorded data. The source of the timestamps is the camera clock.

Dual Sona with NIS-Elements

Setup

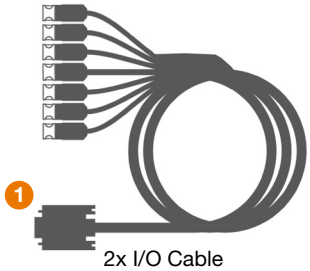
Master and Slave Sona to PC Wiring



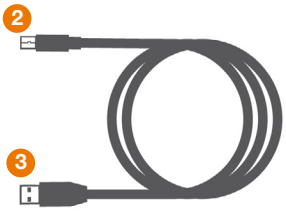
Master Sona

Slave Sona

+

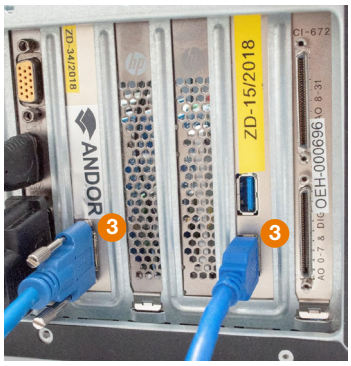


2x I/O Cable
(3 or 7-way)



2x USB3

+

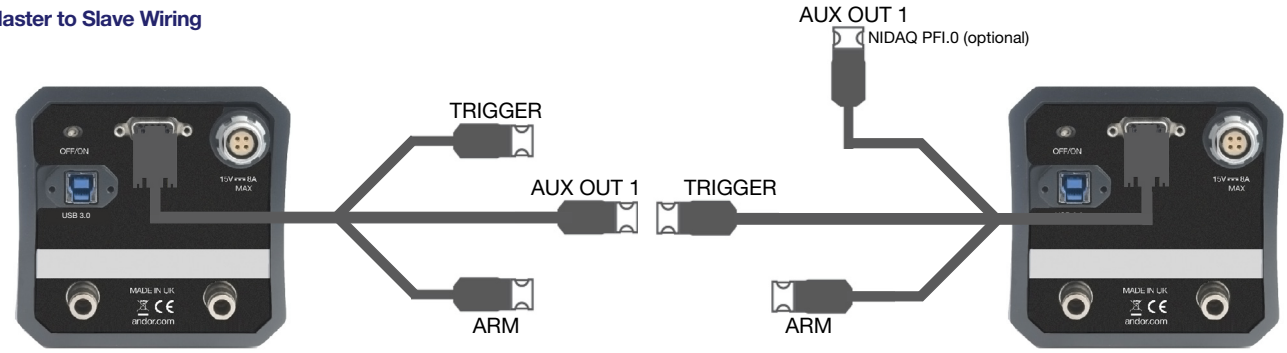


2x StarTech PEXUSB3S25 USB3 cards in hp Z440

Master: PC card #1/camera interface – USB

Slave: PC card #2/camera interface – USB

Sona Master to Slave Wiring



Master Sona

Slave Sona

TTL Wiring

1. BNC cable connection between Master Aux Out 1 and Slave Trigger
2. Optional BNC cable connection between Slave Aux Out 1 with PFI NI-DAQ connector

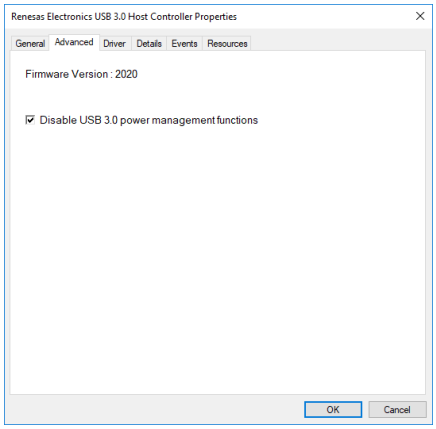
Step 1 Basic – USB3.1 Gen1- Both master and slave cameras are connected to a separate StarTech PEXUSB3S25 USB3 card.

Optional - TTL PFI (NIDAQ card) ↔ Aux_Out_1 (Camera) The exposure signal (All rows) is programmed by Elements to be on the Aux_Out_1 I/O signal. It is required for TTL based acquisitions. Note: standard 3-way I/O cable includes AUX_OUT_1 signal.

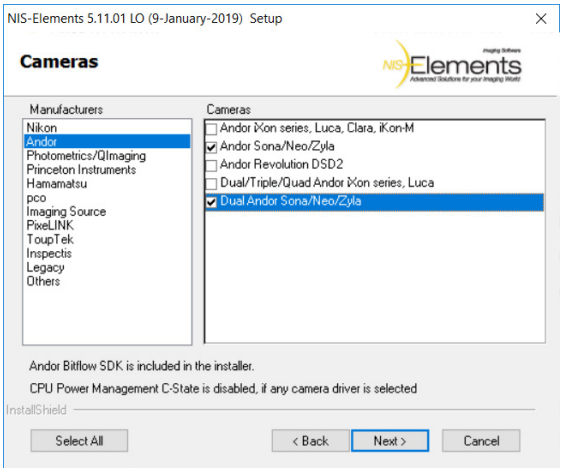
Dual Sona with NIS-Elements

Step 2

Go to your device manager. Go to the Sona drivers in the device manager. **Turn off the Power Management** on your platform. It includes BIOS and Windows Power Management Settings. In Windows Device Manager disable USB 3.0 power management functions on Renesas Electronics USB 3.0 Host Controller



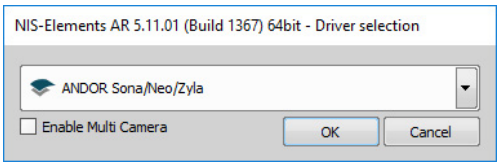
Step 3



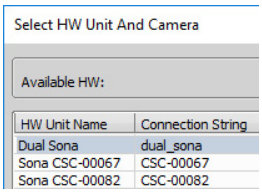
Installation: In NIS installer, section Cameras select manufacturer Andor and on the right pane Dual Andor Sona/Neo/Zyla. If Dual Andor Sona/Neo/Zyla camera driver is selected, Andor SDK files and Windows drivers are installed.

Step 4

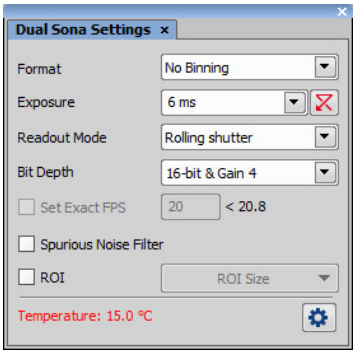
Start Up Sona Driver Selection Once your NIS session starts and a grabber selection dialog appears, choose Andor Sona/Neo/Zyla from the drop-down menu. Press OK.



After loading the Andor driver you have to select [Dual Andor Sona] in Acquire → Andor driver → HW Unit



Step 5



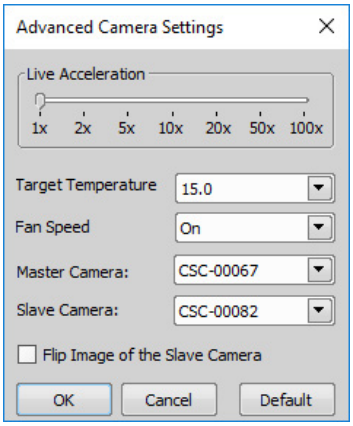
Dual Sona pad: Control pad for the camera is accessible from the menu View → Acquisition Controls → Dual Sona Settings or by shortcut key CTRL+ALT+C.

Dual Sona with NIS-Elements: Advanced Settings

Dual Sona configuration: Advanced settings for the camera are located at Sona Settings → Configure

Master/Slave Assignment: In Advanced Setup dialog, master and slave cameras are identified using serial number (SN).

Flip, Rotate: Typically, dual Sona setups uses two-camera adaptor like Andor TuCam or Cairn DualCam, it means that one camera (the one that collects the reflected light of the mirror in the adaptor) has flipped image. Select Flip Image of the Slave camera (Do not use Flip in camera Light Path)



Predefined ROIs

NIS-Elements provides several predefined centered ROI for different portsizes:

32 mm (2048x2048)
25 mm (1608×1608)
22 mm (1416×1416)
18 mm (1160×1160)

and typical resolutions:

2048x2048
1024×1024
512×512
256×256

Predefined ROIs can be accessed via:
Sona pad → ROI → ROI Size

TLL Based Acquisition

All fast acquisition, based on TTL signal: Triggered Acquisition (View → Acquisition Controls → Triggered Acquisition), Triggered experiment in JOBs and Illumination Sequence (View → Acquisition → Controls → Illumination Sequence) are supported.

HW Timestamp

NIS uses Andor SDK functions to get timestamps. Timestamps are available e.g. in nd2 data set in Image → Properties → Recorded data. The source of the timestamps is the camera clock.

Frame Rate

To reach maximum frame rate these parameters have to be considered:

1. **Exposure.** Press a button [1 frame] next to the exposure drop-down menu in the pad. This value corresponds to the longest exposure that will run the camera in the highest possible frame rate for the current settings
2. **Bit Depth** Select 12 bit for fastest scan
3. **ROI size and position** (Commands → ROI), the speed depends on the height of the ROI; faster speed is achieved if the ROI is defined in the center of the chip

Measured values (Fast Time lapse to Memory and Disk) are in the brackets and were measured with the following camera settings: Exposure: 1 frame / Bit Depth: 12bit / Predefined ROI (in the center)

Array Size		
1024 × 1024	512 × 512	256 × 256
95 (94.4)	190 (189)	378 (375)

Synchronisation

The exposure of the first row of a master camera (Aux_Out_1) is used to trigger the slave camera. Slave camera runs in Bulb mode. Exposure of the master camera has to be longer than 1 frame

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Basic Features

Feature	Single Sona	Dual Sona
Binning 1×1, 2×2, 3x3, 4x4, 8x8	Yes	Yes
Bit Depth	12, 16	12, 16
Spurious Noise Filter	Yes	Yes
1 frame calculation the longest exposure & the highest possible frame rate	Yes	Yes
Pre-calculated pixel calibration 11 µm × 11 µm	Yes	Yes
Predefined ROI 25 mm (1608x1608), 22 mm (1400x1400), 18 mm (1160x1160) 1024x1024, 512x512, 256x256	Yes	Yes
A user defined FPS (Advanced GUI)	Yes	Yes
Sensor Mode (Advanced GUI)	Yes	Yes
Triggered Mode **internal HW trigger** **Strobe (Advanced GUI)**	 Yes Yes	 Yes Yes
Selectable Fan Speed (Off, Low, Medium, On)	Yes	Yes
Set Target Temperature	Yes	Yes
Fast Flip, Rotate 180	No	-
Support Master/Slave Alignment	-	No
FPGA timestamps	Yes	Yes
Default Camera Settings **Trigger (Live, Fast TimeLapse)** **Trigger (ND Acquisition-NoDelay)** **Sensor Mode**	 Internal SW trigger Overlapped	 Internal SW trigger Overlapped
Exposure-end SW event (ND Acquisition → Close Active Shutter when idle)	Yes	Yes
Triggering support in NIS **Triggered Acquisition/JOB task Triggered Acquisition** **Illumination Sequence**	 Yes Yes	 Yes Yes
Multi Camera support e.g. single Sona and Zyla	Yes	-
Multi Camera support e.g. dual Sona and Zyla	-	Yes
Support for Triple/Quad Sona driver	No	No

Compatibility Summary

Feature	Single and Dual Sona
Supported OS	Win 10 (64bit)
NIS version	v5.2
USB3.1 Gen1 card **StarTech PEXUSB3S25 USB3 card**	
Renesas Electronics USB 3.0 Host Controller driver **Device Manager →** **Universal Serial Bus controllers →** **Renesas Electronics USB 3.0 Host Controller →**	v3.0.23.0 (download available on StarTech web site)
Renesas Host Controller firmware	v2020 (download available on StarTech web site)
Andor sCMOS cameras driver **Device Manager →** **Universal Serial Bus devices →** **Sona**	v1.0.0.0
Andor SDK	v3.14.3.30009 or later
Sona firmware	v18.10
NIS Installer **Local Options required** **Andor SDK embedded** **Andor USB3 Windows driver embedded** **Disable CState embedded**	 No Yes Yes Yes

Software Licenses

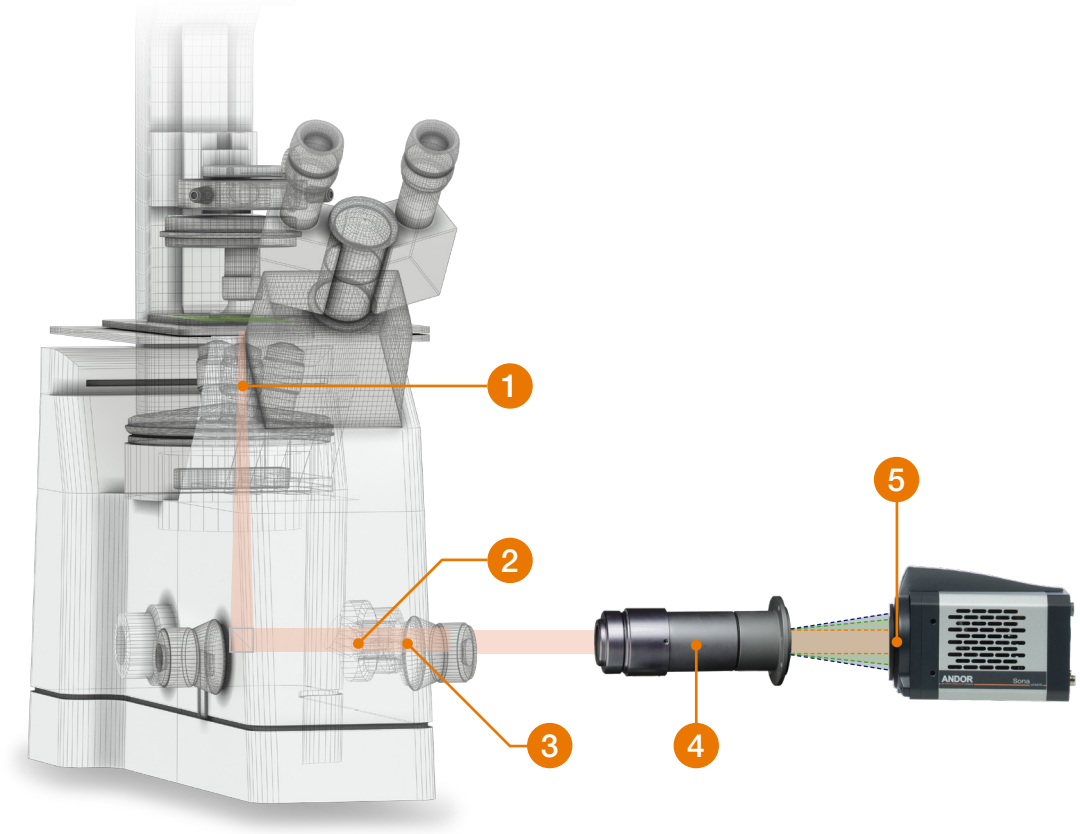
Single Sona	Interface	Licenses	Product Code	Package
Basic Integration	Win 10 (64bit)			AR/BR/D
		Single Sona Pad 1-D Acquisition		
Triggered Aquisition	USB + TTL	RT Acquisition	MQS42780	AR
Illumination Sequence	USB + TTL	6D + RT Acquisition + Illumination Sequence	MQS42560 + MQS42780 + MQS42930	AR
Triggered Experiment in JOBs	USB + TTL	6D + RT Acquisition + JOBs Editor	MQS42560 + MQS42780 + MQS43130	AR

Dual Sona	Interface	Licenses	Product Code	Package
Basic Integration	USB + TTL	Dual Camera	MQS41450	AR
		Dual Sona pad 1-D Acquisition		
Triggered Aquisition	USB + TTL	Dual Camera RT Acquisition	MQS42780	AR
Illumination Sequence	USB + TTL	Dual Camera + 6D + RT Acquisition + Illumination Sequence	MQS41450 + MQS42560 + MQS42780 + MQS42930	AR
Triggered Experiment in JOBs	USB + TTL	Dual Camera + 6D + RT Acquisition + JOBs Editor	MQS41450 + MQS42560 + MQS42780 + MQS43130	AR

Selecting a Magnifying Coupler Unit

There are many possible combinations of various manufacturers' tube lenses, their native microscopes' couplers and the Andor Magnifying Coupler Unit (MCU).

These should be selected so that the image overfills the sensor area, but also that Nyquist oversampling is still maintained. This ensures both maximum field of view and resolution.



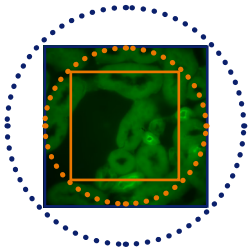
1. **Objective lens**
   Use lower magnification objectives e.g. x40 and x60 to maximize on-sample field of view while preserving resolving capability when combined with additional coupler magnification such as the MCU.

2. **Microscope output port**
   Wider aperture ports are readily available up to Ø25 mm and up to Ø32 mm aperture (FN32) is also now available.

3. **Tube Lens**
   Tube lenses of different focal lengths and magnifications are available to match the output of the microscope with various accessories.

4. **MCU**
   The MCU provides additional magnification so that the output from the microscope port can be matched to sensor area of the Sona.

5. **Sensor**
   The Sona 4.2B-11 sensor is Ø32 mm (2048 x 2048, 11 x 11 µm pixels). Due to this size additional magnification such as from the MCU is required to fill the sensor area.
   Sona 2.0B-11 has a smaller Ø22 mm area and is perfectly matched to 22 mm C-mount without additional magnification.



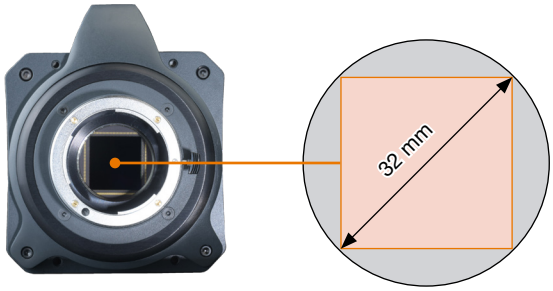
Relative sensor and aperture sizes
(shown actual size)

- Ø22 mm
- Ø32 mm

Magnifying Coupler Unit

Sona 4.2B-11

The following table presents sets of commonly used magnifications and components as shown in the lightpath diagram on page 11. These combinations make full use of the Sona 4.2B-11 sensor providing different effective pixel sizes and oversampling.



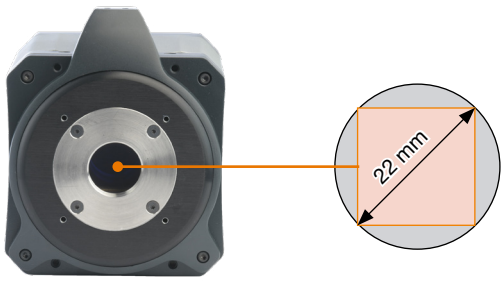
Microscope Configuration			④ Magnifying Coupler (MCU)	⑤ Effective Pixel Size	⑤ Oversampling (Nyquist)
① Objective Magnification	NA	③ Microscope Tube lens (or native coupler)			
x100	1.49	not present	x1 (not present)	11	2.23
x60	1.4	x1.5	not present	7.3	2.14
x60	1.4	not present	x2.0	5.5	2.85
x40	0.95	x1.5	not present	7.3	2.10
x40	0.95	not present	x2.0	5.5	2.8

* Calculations performed assuming emission wavelength of 600 nm.

Description	Order Code
MCU with x2 magnification for matching Sona to Nikon Ti Series (TiE and Ti2) Microscopes	**MCU-SONA-NIK-TI**

Sona 2.0B-11

The Sona 2.0B-11, with its smaller 2.0 megapixel sensor is a perfect match for modern microscopes that have a standard 22 mm C-mount port. When coupled with a x100 objective there is no need for an additional coupler. A magnifying coupler can be used if required for e.g. smaller port apertures, or for lower objective magnifications.



Help and Support

For more detailed information on specific combinations please refer to the tech note Optimizing Field of View and Resolution in Microscopy: Matching sCMOS Camera to Objective Lenses. For further help or assistance please contact customer support: https://andor.oxinst.com/support/