



# MORAVIAN CAMERAS

## PRODUCT PORTFOLIO

*M16 "Eagle" nebula, Wolfgang Promper*

**THE MORAVIAN CAMERAS** are developed, designed and manufactured in Czechia with the focus on performance and quality. All circuit boards used in our cameras are designed and manufactured by us and the components are selected to take the full advantage of available performance a wide variety of modern CMOS image sensors offer.

The CNC-machined and anodized aluminum casing provides an excellent protection for the sensitive components inside. The cameras are built to last, whether it's the usual outside weather conditions of the day-to-day usage or an unlucky accident.

Camera driver support for a wide variety of software and operating systems means you will not need to switch off your favorite program. But if you come to feel your choice is lacking some features, you can always try our advanced *Scientific Image Processing System*, free of charge, bundled and tested with our cameras.

All our products—from cameras to software—are designed by astronomers, for astronomers. We would never try to sell you something we would not use ourselves.

*All deep-sky object images in this booklet were taken using Moravian CMOS cameras.*



M27 "Dumbbell" nebula, Wolfgang Promper



NGC2264 "Cone" nebula, CielAustral Group

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## C0 AND C1 CMOS CAMERAS

The C0 and C1 cameras are the smallest in our line-up. The small form factor and power delivery over USB make these cameras ideal for auto-guider applications where they will not clutter up your telescope with unnecessary bulk or cables.

Featuring **sensors with global shutter**, these cameras are also a viable for Moon and planetary photography. With proper calibration, they can also serve for entry-level deep-sky astrophotography.

The CMOS response to light of the chips used in this model is linear, so it can be used for entry-level scientific applications, like variable star research.

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C1-3000

# CO TECHNICAL DETAILS

- CMOS sensors with 1.5- to 12-megapixel resolution
- Sensor diagonals from 6.3 mm to 17.6 mm
- Up to 12-bit digitization
- Electronic global shutter
- USB3 interface
- USB powered only
- C/CS and T-thread lens and telescope adapters

- Camera head size of 50 × 50 × 40.4 mm
- Weight of 115 grams



## VARIANTS WITH 8- AND 12-BIT DIGITIZATION

Common pixel size shared across all variants:  $3.45 \times 3.45 \mu\text{m}$ .

Model	CMOS sensor	Resolution	Image area
CO-1500	IMX273	1456 × 1088 pixels	5.02 × 3.75 mm
CO-3000	IMX252	2064 × 1544 pixels	7.12 × 5.33 mm
CO-5000	IMX250	2464 × 2056 pixels	8.50 × 7.09 mm
CO-12000	IMX253	4112 × 3008 pixels	14.19 × 10.38 mm

## VARIANTS WITH 12-BIT DIGITIZATION ONLY

Model	CMOS sensor	Resolution	Image area
CO-3000A	IMX265	2064 × 1544 pixels	7.12 × 5.33 mm
CO-5000A	IMX264	2464 × 2056 pixels	8.50 × 7.09 mm
CO-12000A	IMX304	4112 × 3008 pixels	14.19 × 10.38 mm



# CI TECHNICAL DETAILS

- CMOS sensors with 1.5- to 12-megapixel resolution
- Sensor diagonals from 6.3 mm to 17.6 mm
- Up to 12-bit digitization
- Electronic global shutter
- USB3 interface
- Passive sensor cooling
- USB powered only
- C/CS and T-thread lens and telescope adapters
- Camera head size of 57 × 57 × 47.4 mm
- Weight of 170 grams



## VARIANTS WITH 8- AND 12-BIT DIGITIZATION

Common pixel size shared across all variants:  $3.45 \times 3.45 \mu\text{m}$ .

Model	CMOS sensor	Resolution	Image area
C1-1500	IMX273	1456 × 1088 pixels	5.02 × 3.75 mm
C1-3000	IMX252	2064 × 1544 pixels	7.12 × 5.33 mm
C1-5000	IMX250	2464 × 2056 pixels	8.50 × 7.09 mm
C1-12000	IMX253	4112 × 3008 pixels	14.19 × 10.38 mm

## VARIANTS WITH 12-BIT DIGITIZATION ONLY

Model	CMOS sensor	Resolution	Image area
C1-3000A	IMX265	2064 × 1544 pixels	7.12 × 5.33 mm
C1-5000A	IMX264	2464 × 2056 pixels	8.50 × 7.09 mm
C1-12000A	IMX304	4112 × 3008 pixels	14.19 × 10.38 mm





NGC3576, CielAustral Group

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## C1+ CMOS CAMERA

The C1+ cameras are designed to fill the gap between the lightweight C1 cameras and the fully featured C2 cameras. Using the same CMOS sensor as the other two, these cameras feature **sensors with global shutter**.

When running on USB power alone, the C1+ cameras performs nearly the same as the lightweight C1.

Plugging in a 12V power input allows these cameras to make use of the **active thermoelectric cooling** and optionally **attach a filter wheel**, much like the C2 cameras.



C1+12000A



# CI+ TECHNICAL DETAILS

- CMOS sensors with 3- to 12-megapixel resolution
- Sensor diagonals from 8.9 mm to 17.6 mm
- Up to 12-bit digitization
- Electronic global shutter
- USB3 interface
- Ability to work from USB powered only
- Optional 12 V DC power supply
- Passive sensor cooling when powered from USB
- Active and regulated sensor cooling with 12 V DC power
- Ability to integrate with external filter wheel



## VARIANTS WITH 8- AND 12-BIT DIGITIZATION

Variants with the  $3.45 \times 3.45 \mu\text{m}$  pixel size.

Model	CMOS sensor	Resolution	Image area
C1+3000	IMX252	2064 × 1544 pixels	7.12 × 5.33 mm
C1+4000	IMX250	2464 × 2056 pixels	8.50 × 7.09 mm
C1+12000	IMX253	4112 × 3008 pixels	14.19 × 10.38 mm

## VARIANTS WITH 12-BIT DIGITIZATION ONLY

Variants with the  $3.45 \times 3.45 \mu\text{m}$  pixel size.

Model	CMOS sensor	Resolution	Image area
C1+3000A	IMX265	2064 × 1544 pixels	7.12 × 5.33 mm
C1+5000A	IMX264	2464 × 2056 pixels	8.50 × 7.09 mm
C1+12000A	IMX304	4112 × 3008 pixels	14.19 × 10.38 mm

Variants with the  $4.50 \times 4.50 \mu\text{m}$  pixel size.

Model	CMOS sensor	Resolution	Image area
C1+7000A	IMX428	3216 × 2208 pixels	14.47 × 9.94 mm





NGC2170, Wolfgang Promper

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## C2 CMOS CAMERA

The C2 cameras are the largest of our small camera trio. Using the same CMOS sensor as the C1 and C1+, these cameras features **sensors with global shutter**.

The C2 model is designed as the main telescope camera and can only operate with a 12V power input. The larger body holds a larger heat sink; yielding it a **better cooling performance** than the C1+ and allows integration of a **mechanical shutter** for easy dark frame acquisition.

The mechanical design inheriting from the earlier CCD G2 Mark II cameras makes this model compatible with a wide variety of telescope adapters and external filter wheels.

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C2-12000



# C2 WITH GLOBAL SHUTTER

- CMOS sensors with 3- to 12-megapixel resolution
- Sensor diagonals from 8.9 mm to 17.6 mm
- Up to 12-bit digitization
- Mechanical shutter for automatic dark frame acquisition
- USB3 interface
- 12 V DC power supply
- Active and regulated sensor cooling
- Optional internal filter wheel
- Ability to integrate with external filter wheel



## VARIANTS WITH 8- AND 12-BIT DIGITIZATION

Variants with the  $3.45 \times 3.45 \mu\text{m}$  pixel size.

Model	CMOS sensor	Resolution	Image area
C2-3000	IMX252	2064 × 1544 pixels	7.12 × 5.33 mm
C2-5000	IMX250	2464 × 2056 pixels	8.50 × 7.09 mm
C2-12000	IMX253	4112 × 3008 pixels	14.19 × 10.38 mm

## VARIANTS WITH 12-BIT DIGITIZATION ONLY

Variants with the  $3.45 \times 3.45 \mu\text{m}$  pixel size.

Model	CMOS sensor	Resolution	Image area
C2-3000A	IMX265	2064 × 1544 pixels	7.12 × 5.33 mm
C2-5000A	IMX264	2464 × 2056 pixels	8.50 × 7.09 mm
C2-12000A	IMX304	4112 × 3008 pixels	14.19 × 10.38 mm

Variants with the  $4.50 \times 4.50 \mu\text{m}$  pixel size.

Model	CMOS sensor	Resolution	Image area
C2-7000A	IMX428	3216 × 2208 pixels	14.47 × 9.94 mm



## C2 WITH ROLLING SHUTTER

- Proven design of C2 lineup—mechanical shutter, optional internal or external filter wheel, efficient regulated sensor cooling and USB3 interface
- Smaller sensor from the same family as the one used in the C1x, C3 and the C5 series
- 14-bit digitization
- No amplifier glow
- An affordable camera, still perfectly suitable for state-of-the-art research and astro-imaging applications
- The imaging area of  $11.3 \times 11.3$  mm can be easily covered even by mid-tier optics

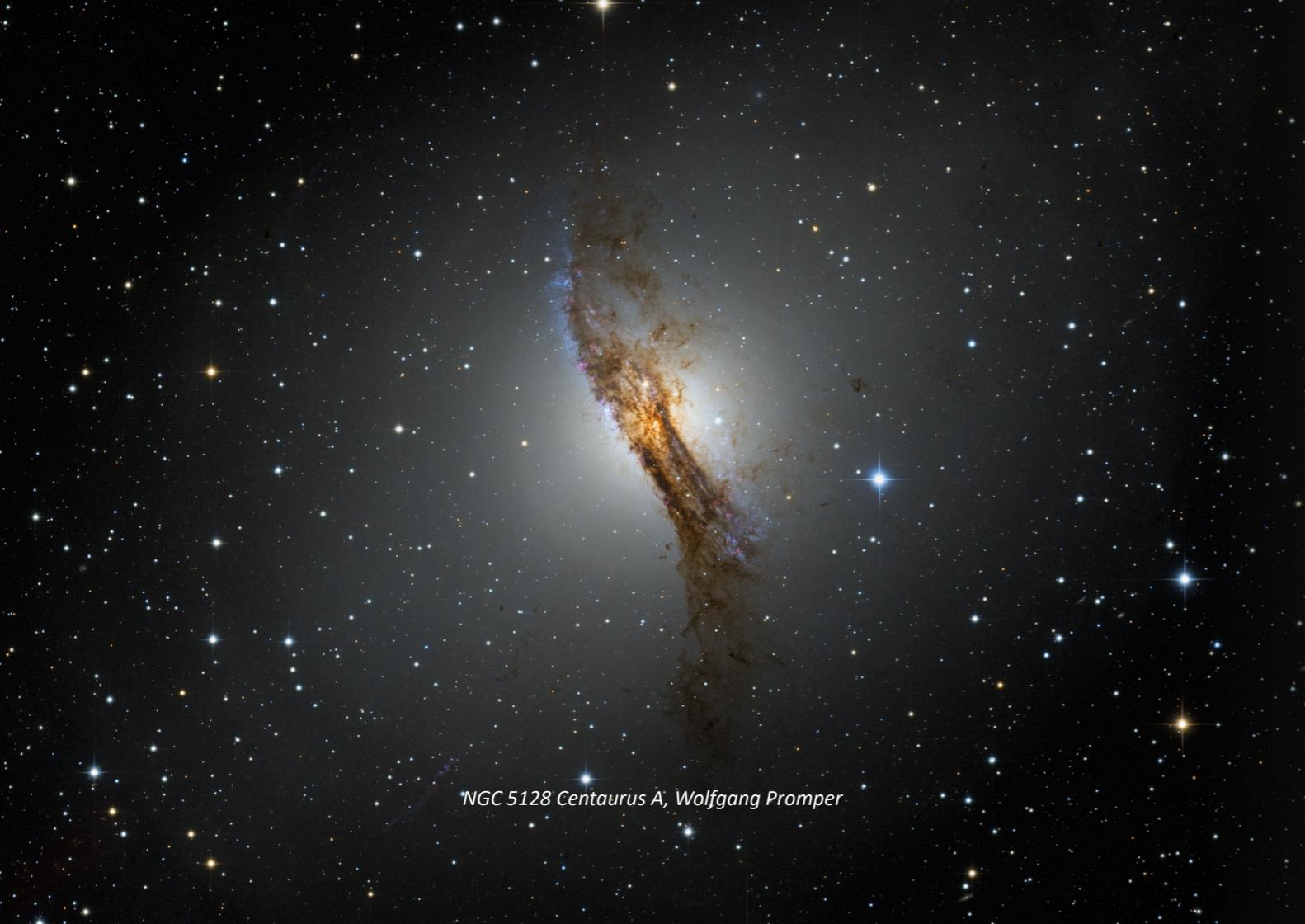
### VARIANTS

Variants with the  $3.76 \times 3.76 \mu\text{m}$  pixel size.

Model	CMOS sensor	Resolution	Image area
C2-9000	IMX533	3008 × 3008 pixels	11.31 × 11.31 mm



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*NGC 5128 Centaurus A, Wolfgang Promper*

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## C3 CMOS CAMERAS

The C3 cameras feature the latest generation of the Sony IMX CMOS sensors, coming with **exceptionally low dark current** and thanks to the sensor's **back-illuminated design**, exceptional quantum efficiency.

Despite the relatively small pixel size, this chip's full-well capacity is **exceeding 50 ke-**.

The 16-bit digitization and **linear response to light** make this model ideal for both aesthetic astrophotography and scientific research applications.



C3-61000

# C3 TECHNICAL DETAILS

- CMOS sensors with 26- and 61-megapixel resolution
- Sensor diagonals from 28.3 mm (APS format) and 43.3 mm (“full-frame” format)
- 16-bit digitization
- Electronic rolling shutter
- Mechanical shutter for automatic dark frame acquisition
- USB3 interface
- 12 V DC power supply
- Active and regulated sensor cooling
- Optional internal filter wheel
- Ability to integrate with external filter wheel



## CONSUMER GRADE VARIANTS

Common pixel size shared across all variants:  $3.76 \times 3.76 \mu\text{m}$ .

Model	Sensor	Resolution	Color mask	Image area
C3-26000	IMX571	6252 × 4176 pixels	None	23.51 × 15.70 mm
C3-61000	IMX455	9576 × 6388 pixels	None	36.01 × 24.02 mm
C3-26000C	IMX571	6252 × 4176 pixels	Bayer RGBG	23.51 × 15.70 mm
C3-61000C	IMX455	9576 × 6388 pixels	Bayer RGBG	36.01 × 24.02 mm

## INDUSTRIAL GRADE VARIANTS

Model	Sensor	Resolution	Color mask	Image area
C3-26000 PRO	IMX571	6252 × 4176 pixels	None	23.51 × 15.70 mm
C3-61000 PRO	IMX455	9576 × 6388 pixels	None	36.01 × 24.02 mm
C3-26000C PRO	IMX571	6252 × 4176 pixels	Bayer RGBG	23.51 × 15.70 mm
C3-61000C PRO	IMX455	9576 × 6388 pixels	Bayer RGBG	36.01 × 24.02 mm





NGC5139 globular cluster, Wolfgang Promper

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## C1× CMOS CAMERA

The C1× cameras employ the same sensor as the C3 model—the latest generation of the Sony IMX CMOS sensors—with the same benefits: **very low dark current**, high sensitivity thanks to the **back-illuminated design**, **full-well capacity of over 50 ke-**, **16-bit digitization** and **linear response to light**, making this model ideal for both astrophotography and scientific research applications.

Very similar to the C3 series, this model trades a little bit of its cooling efficiency for a lot less bulk and a symmetrical design useful in telescope configurations where space is limited, such as installation into the primary telescope focus.



C1x61000



# CI× TECHNICAL DETAILS

- CMOS sensors with 26- and 61-megapixel resolution
- Sensor diagonal from 28.3 mm (APS format) and 43.3 mm (“full-frame” format)
- 16-bit digitization
- Electronic rolling shutter
- USB3 interface
- 12 V DC power supply
- Active and regulated sensor cooling
- Ability to integrate with external filter wheel
- Optional GPS module and hardware trigger input for each variant



## CONSUMER GRADE VARIANTS

Common pixel size shared across all variants: **3.76 × 3.76 μm.**

Model	Sensor	Resolution	Color mask	Image area
C1×26000	IMX571	6252 × 4176 pixels	None	23.51 × 15.70 mm
C1×61000	IMX455	9576 × 6388 pixels	None	36.01 × 24.02 mm
C1×26000C	IMX571	6252 × 4176 pixels	Bayer RGBG	23.51 × 15.70 mm
C1×61000C	IMX455	9576 × 6388 pixels	Bayer RGBG	v

## INDUSTRIAL GRADE VARIANTS

Model	Sensor	Resolution	Color mask	Image area
C1×26000 PRO	IMX571	6252 × 4176 pixels	None	23.51 × 15.70 mm
C1×61000 PRO	IMX455	9576 × 6388 pixels	None	36.01 × 24.02 mm
C1×26000C PRO	IMX571	6252 × 4176 pixels	Bayer RGBG	23.51 × 15.70 mm
C1×61000C PRO	IMX455	9576 × 6388 pixels	Bayer RGBG	36.01 × 24.02 mm





NGC7293 "Helix" nebula, CielAustral Group

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## C4 CMOS CAMERA

The C4 cameras are designed for the most demanding scientific applications. For this purpose, they feature a large CMOS sensor with the size of  $37 \times 37$  mm,  $9 \mu\text{m}$  pixels and 16-megapixel (4k  $\times$  4k) resolution.

Inheriting the mechanical design from its predecessor, the G4 Mark II, this model is fully compatible with a vast range of telescope adapters, off-axis guider adapters, filter wheels, Camera Ethernet adapters, guiding cameras and more.



C4-16000EC

# C4 TECHNICAL DETAILS

- CMOS sensors with 16-megapixel resolution
- Sensor diagonal of 52.1 mm (37 × 37 mm)
- 9 μm pixel size
- 12-bit and 16-bit HDR digitization
- Electronic rolling shutter
- Mechanical shutter for automatic dark frame acquisition
- USB3 interface
- 12 V DC power supply
- Active and regulated sensor cooling
- Ability to integrate with external filter wheel



## VARIANTS

The pixel size for the C4 camera is  $9 \times 9 \mu\text{m}$ .

Model	CMOS sensor	Resolution	Image area
C4-16000	GSENSE4040	4096 × 4096 pixels	36.86 × 36.86 mm
C4-16000BSI	GSENSE4040BSI	4096 × 4096 pixels	36.86 × 36.86 mm

## ENHANCED COOLING VARIANT

The C4 cameras are also available in the **Enhanced Cooling** variant with larger back heat sink that provides improved cooling performance at the cost of slightly larger body.



M20 "Trifid" nebula, CielAustral Group

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## C5 CMOS CAMERA

The C5 cameras feature the largest sizes available of the latest Sony IMX CMOS sensor generation.

The **exceptionally low dark current** of this **back-illuminated sensor**, large full-well capacity of **exceeding 50 ke-**, the **16 bit digitization** and **linear response to light** make this model the ultimate choice for both aesthetic astrophotography and scientific research applications aimed at our most demanding customers.



C5A-100M

# C5A TECHNICAL DETAILS

- Asymmetrical, which allows for the inclusion of a mechanical shutter
- CMOS sensors with 100- and 150-megapixel resolution
- Sensor diagonals from 54.97 mm to 66.92 mm
- 16-bit digitization
- Electronic rolling shutter
- Mechanical shutter for automatic dark frame acquisition
- USB3 interface
- 12 V DC power supply
- Active and regulated sensor cooling
- Ability to integrate with external filter wheel
- Optional GPS receiver for precise exposure timing



## VARIANTS

Common pixel size shared across all variants: **3.76 × 3.76 μm**

Model	Sensor	Resolution	Color mask	Image area
C5A-100M	IMX461	11712 × 8750 pixels	None	44.04 × 32.90 mm
C5A-150M	IMX411	14256 × 10656 pixels	None	53.60 × 40.07 mm



# C5S TECHNICAL DETAILS

- Symmetrical design, intended for usage in primary focus or reflecting telescopes, but lacking the mechanical shutter
- CMOS sensors with 100- and 150-megapixel resolution
- Sensor diagonals from 54.97 mm to 66.92 mm
- 16-bit digitization
- Electronic rolling shutter
- USB3 interface
- 12 V DC power supply
- Active and regulated sensor cooling
- Ability to integrate with external filter wheel
- Optional GPS receiver for precise exposure timing
- Hardware trigger input



## VARIANTS

Common pixel size shared across all variants: **3.76 × 3.76 μm**

Model	Sensor	Resolution	Color mask	Image area
C5S-100M	IMX461	11712 × 8750 pixels	None	44.04 × 32.90 mm
C5S-150M	IMX411	14256 × 10656 pixels	None	53.60 × 40.07 mm

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CAMERAS**

# MORAVIAN CAMERA FILTER WHEELS

All Moravian cameras, except the smallest C1 model, can be equipped with an external filter wheel. For details on filter wheel variants, see table on the next page.

All filter wheels are designed to not interfere with any Moravian camera adapters.



In addition to external filter wheels the C2 and C3 cameras are available in a variant with an internal filter wheel.

This increases the bulk of the camera slightly, but doesn't otherwise interfere with any additional adapters and/or external filter wheels.



## FULL LIST OF EXTERNAL FILTER WHEEL VARIANTS

Model	Camera model	Filter slots	Unmounted Filters	Threaded Cells
EFW-2XS-8	C1+, C2	8	D31 mm	1.25"
EFW-2XS-7	C1+, C2	7	D36 mm	—
EFW-2S-12	C1+, C2	12	D31 mm	1.25"
EFW-2S-10	C1+, C2	10	D36 mm	—
EFW-2S-7	C1+, C2	7	D50 mm	2"
EFW-3S-7	C1×, C3	7	D50 mm	2"
EFW-3L-9	C1×, C3	9	D50 mm	2"
EFW-3L-7	C1×, C3	7	50 × 50 mm	—
EFW-4M-7	C4	7	D50 mm	2"
EFW-4M-5	C4	5	50 × 50 mm	—
EFW-4L-9	C4	9	D50 mm	2"
EFW-4L-7	C4	7	50 × 50 mm	—
EFW-5L-7	C5	7	50 × 50 mm	—
EFW-5XL-5	C5	5	65 × 65 mm	—

Internal filter wheel availability is described separately. Please refer to individual camera pages for details on internal filter wheel versions.



# ACCESSORIES

All Moravian cameras can be connected via USB to an optional Ethernet adapter. This adapter can then be communicated with over the standard TCP/IP stack, allowing remote control of the cameras over virtually unlimited distances.



The Moravian cameras are compatible with a wide variety of variable adapters. This ranges from ocular mount adapters for standard telescope ocular sizes, to off-axis guider adapters.



## ETHERNET ADAPTER VARIANTS

Model	ETH interface	USB 2.0	USB 3.0	Dimensions
CxETHA	1 Gbps, 10/100 Mbps	0	4	188 × 184 × 40 mm
CxETHA Micro	10/100 Mbps	4	0	95 × 83 × 39 mm

## ADAPTER AND OFF-AXIS ADAPTER VARIANTS

Model	Cameras	Filter wheels	Back focal distance	Front thread	Guider camera port
OAG-2-TT	C2	Internal, EFW-2S	55 mm	M42 × 0.75	1.25"
OAG-2-M48	C2 + C3	Internal, EFW-2S	55 mm	M48 × 0.75	1.25"
OAG-3-M68	C3	Internal, EFW-3S	61.5 mm	M68 × 1	1.25"
OAG-4-M68	C4	EFW-4M, EFW-4L	61.5 mm	M68 × 1	1.25"

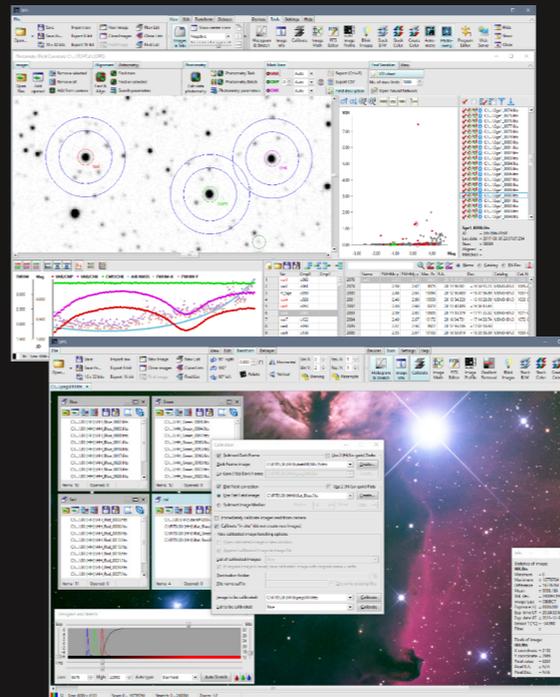
The full list of accessories and their variants is available at the Moravian cameras online product pages.

# RICH SOFTWARE SUPPORT

Rich software and driver support allows using all our cameras without the necessity to invest into any 3rd party software thanks to the free included software SIPS. However, the standardized ASCOM (for Windows) and INDI (for Linux) drivers, as well as Windows and Linux driver libraries are provided for all cameras, which allows them to be easily integrated with a broad variety of camera control programs.



The SIPS software features a camera and other observatory equipment control, including the telescope mount, guider telescope and dome.



Acquiring and applying dark and flat images used in image calibration, image stacking.

Powerful astrometry and photometry processing tools useful for both professionals and amateur astronomers alike.



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