

# acA2500-14uc

The acA2500-14uc [Basler ace USB 3.0 camera](#) is equipped with an onsemi MT9P031 sensor.



## Specifications

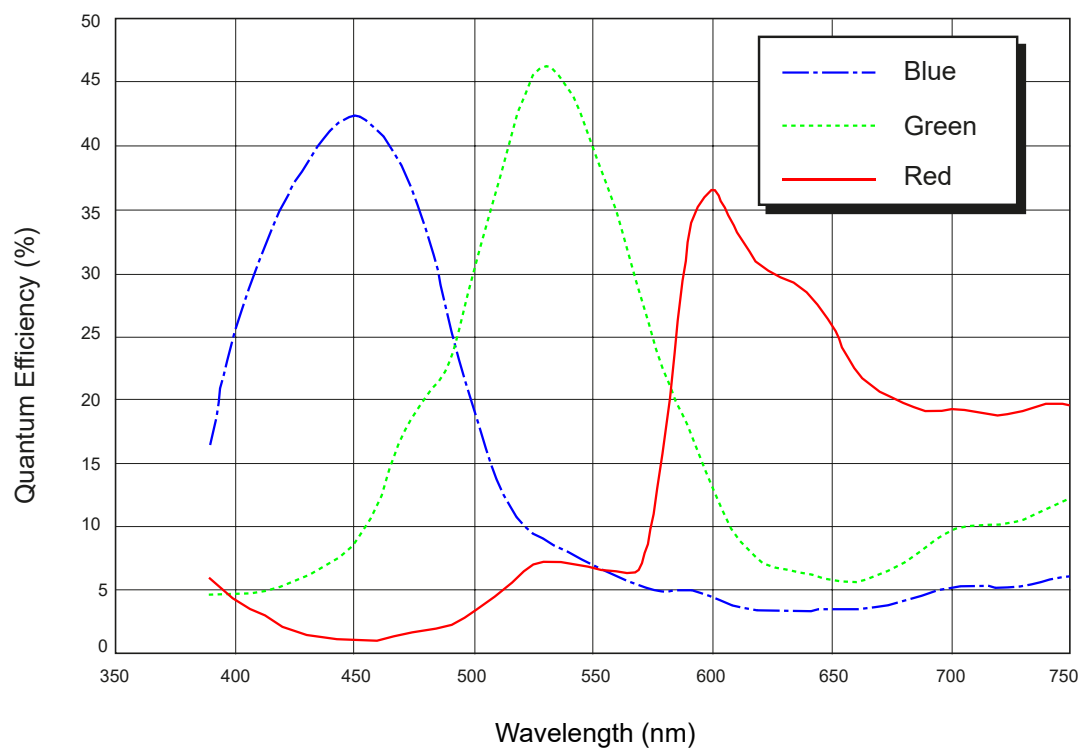
### General Specifications

|                           | acA2500-14uc                                                               |
|---------------------------|----------------------------------------------------------------------------|
| Resolution (H x V Pixels) | 2590 × 1942                                                                |
| Resolution                | 5 MP                                                                       |
| Sensor Type               | onsemi MT9P031<br>Progressive scan CMOS<br><a href="#">Rolling shutter</a> |
| Sensor Format             | 1/2.5"                                                                     |
| Effective Sensor Diagonal | 7.2 mm                                                                     |
| Pixel Size (H x V)        | 2.2 × 2.2 μm                                                               |

|                                  | acA2500-14uc                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Frame Rate (at Default Settings) | 14 fps                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Product Family                   | <a href="#">ace Classic</a>                                                                                                                                                                                                                                                                                                                                            |
| Mono / Color                     | Color                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Image Data Interface             | USB 3.0, nominal max. 5 Gbit/s (SuperSpeed)                                                                                                                                                                                                                                                                                                                                                                                                             |
| Pixel Formats                    | See <a href="#">Pixel Format</a> .                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Synchronization                  | Via hardware trigger<br>Via software trigger<br>Via free run                                                                                                                                                                                                                                                                                                                                                                                            |
| Exposure Time Control            | Via hardware trigger<br>Programmable via the camera API                                                                                                                                                                                                                                                                                                                                                                                                 |
| Camera Power Requirements        | ≈2.2 W (typical and max.) @ 5 VDC                                                                                                                                                                                                                                                                                                                                                                                                                       |
| I/O Lines                        | 1 <a href="#">opto-coupled input line</a><br>1 <a href="#">opto-coupled output line</a><br>2 <a href="#">general purpose I/O (GPIO) lines</a>                                                                                                                                                                                                                                                                                                           |
| Lens Mount                       | C-mount, CS-mount                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Size (L x W x H)                 | 29.3 × 29 × 29 mm (without lens mount or connectors)<br>48.2 × 29 × 29 mm (with lens mount and connectors)                                                                                                                                                                                                                                                                                                                                              |
| Weight                           | <80 g                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Conformity                       | CE (includes RoHS), EAC, UKCA, UL Listed, FCC, GenICam 2.x (including PFNC 2.x and SFNC 2.x), IP30, USB3 Vision, REACH, KC<br><a href="#">Certificates for your camera model</a> <br>For more information, see the <a href="#">Compliance</a>  section of the Basler website. |

|                          | acA2500-14uc                                                                                                                                             |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Software                 | <a href="#">Basler pylon Software Suite</a> <a href="#">↗</a> (version 4.0 or higher)<br>Available for Windows, Linux x86, Linux ARM, macOS, and Android |
| Accessories              | <a href="#">Accessories for your camera model</a> <a href="#">↗</a>                                                                                      |
| Availability and Pricing | See the <a href="#">product page</a> <a href="#">↗</a> on the Basler website.                                                                            |

## Spectral Response



The spectral response curves exclude lens characteristics, light source characteristics, and IR cut filter characteristics.

## IR Cut Filter

Color cameras are equipped with an IR cut filter. The filter is mounted in a filter holder inside the lens mount.

The IR cut filter has the following spectral characteristics:

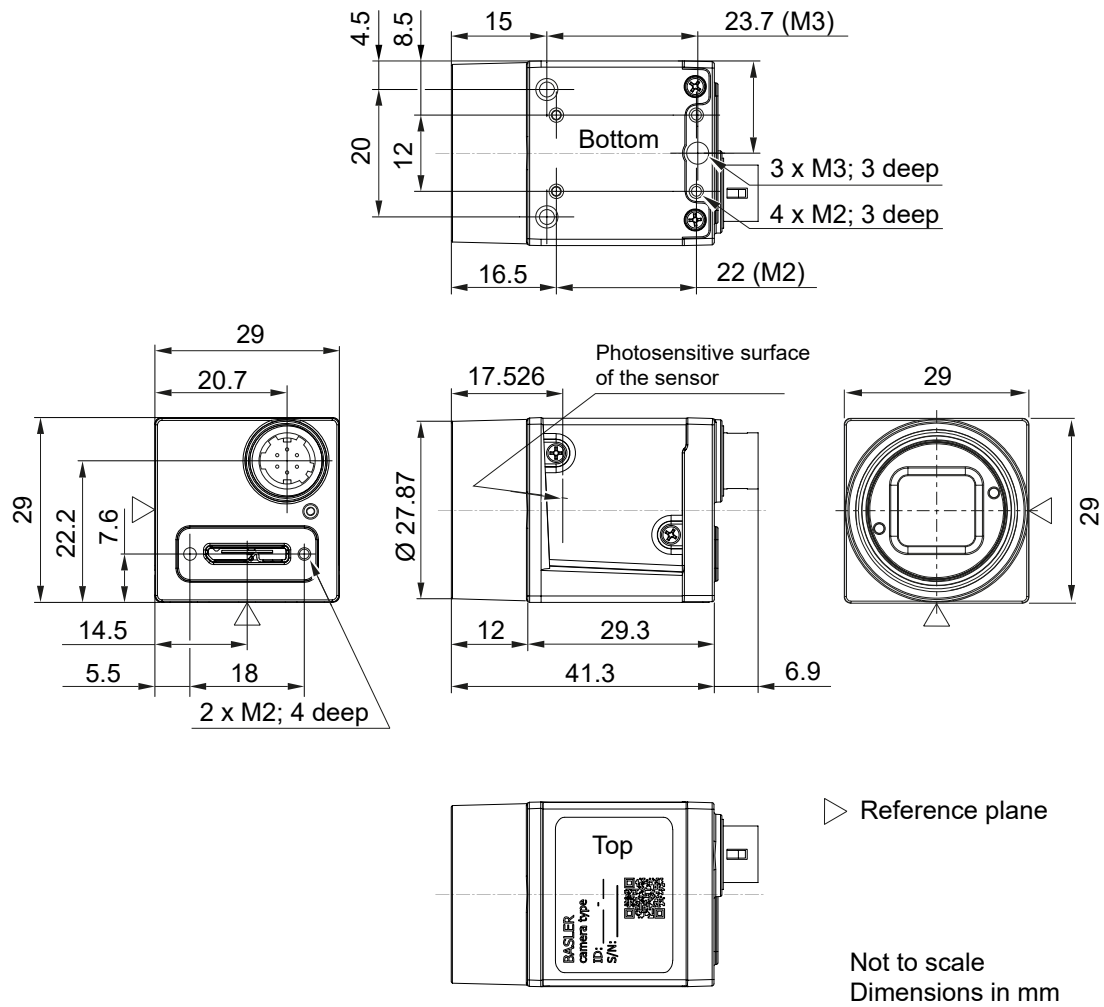
| Wavelength [nm] | Transmittance            |
|-----------------|--------------------------|
| 450–610         | $T_{\min} > 90 \%$       |
| 450–620         | $T_{\text{avg}} > 93 \%$ |
| $645 \pm 10$    | $T = 50 \%$              |
| 700–1070        | $T_{\max} < 4 \%$        |
| 690–1070        | $T_{\text{avg}} < 1 \%$  |

The filter holder can be removed. For more information, see the [ace IR Cut Filter Holder Removal Procedure](#)  application note.

## Mechanical Specifications

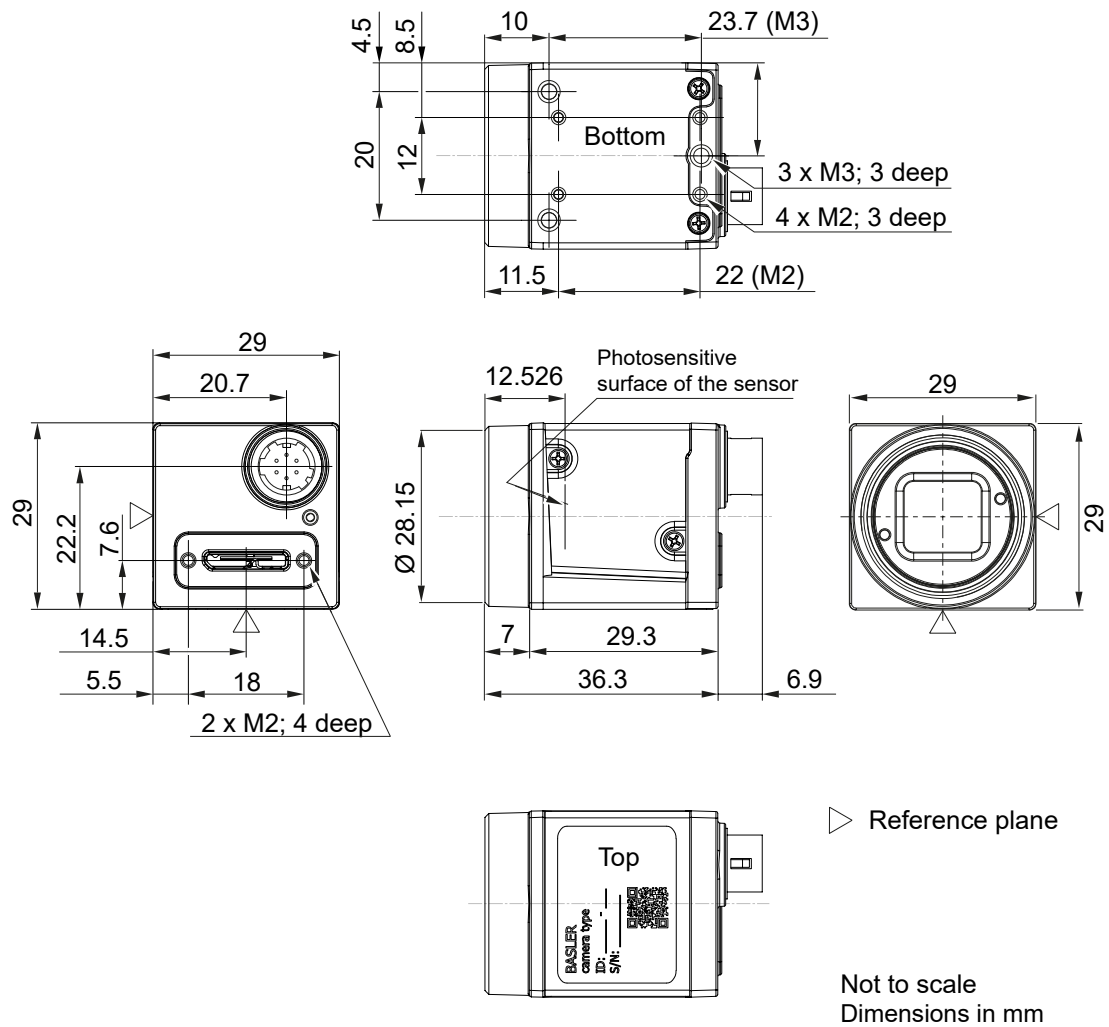
### Camera Dimensions and Mounting Points

#### C-Mount Camera Models



→ Download the [CAD/technical drawing for your Basler camera](#)

## CS-Mount Camera Models



→ Download the [CAD/technical drawing for your Basler camera](#).

## Maximum Allowed Lens Intrusion

→ See [Maximum Allowed Lens Intrusion](#).

## Mounting Instructions

→ See [Mounting Instructions](#).

## Stress Test Results

→ See [Stress Test Results](#).

# Requirements

## Environmental Requirements

### Temperature and Humidity

| Housing temperature during operation        | 0–50 °C (32–122 °F)               |
|---------------------------------------------|-----------------------------------|
| Humidity during operation                   | 20–80 %, relative, non-condensing |
| Storage temperature                         | –20–80 °C (–4–176 °F)             |
| Storage humidity                            | 20–80 %, relative, non-condensing |
| Housing temperature according to UL 60950-1 | max. 70 °C (158 °F)               |
| Ambient temperature according to UL 60950-1 | max. 30 °C (86 °F)                |

### Heat Dissipation

→ See [Providing Heat Dissipation](#).

## Electrical Requirements



### WARNING – Electric Shock Hazard



Unapproved power supplies may cause electric shock. Serious injury or death may occur.

- You must use power supplies that meet the Safety Extra Low Voltage (SELV) and Limited Power Source (LPS) requirements.
- If you use a powered hub or powered switch, they must meet the SELV and LPS requirements.



#### **WARNING – Fire Hazard**



Unapproved power supplies may cause fire and burns.

- You must use power supplies that meet the Limited Power Source (LPS) requirements.
- If you use a powered hub or powered switch, they must meet the LPS requirements.



#### **NOTICE – Incorrect voltage can damage the camera.**



You must supply camera and I/O power within the safe operating voltage ranges specified below.

Do not use negative voltage for an I/O line.

## **Camera Power**

You must supply camera power that complies with the Universal Serial Bus 3.0 specification.

The camera's nominal operating voltage is 5 VDC, effective on the camera's connector.

## **Opto-Coupled I/O Input Line**

| Voltage          | Description                                                                                                   |
|------------------|---------------------------------------------------------------------------------------------------------------|
| 30 VDC           | Absolute maximum. This voltage must never be exceeded. Doing so may damage the camera and voids the warranty. |
| 0–24 VDC         | Safe operating range.                                                                                         |
| 0–1.4 VDC        | Indicates a logical 0 (with inverter disabled).                                                               |
| >1.4–<br>2.2 VDC | Region where the logic level transition occurs; the logical state is not defined in this region.              |
| >2.2 VDC         | Indicates a logical 1 (with inverter disabled).                                                               |



- **Minimum current:** 5 mA
- **Current draw:** 5–15 mA
- If the camera is connected to a PLC device, Basler recommends using a cable that adjusts the voltage level of the PLC to that of the camera.

## Opto-Coupled I/O Output Line

| Voltage    | Description                                                                                                   |
|------------|---------------------------------------------------------------------------------------------------------------|
| 30 VDC     | Absolute maximum. This voltage must never be exceeded. Doing so may damage the camera and voids the warranty. |
| 3.3–24 VDC | Safe operating range.                                                                                         |
| <3.3 VDC   | Unreliable I/O output.                                                                                        |

- **Leakage current:** <60  $\mu$ A. Actual leakage depends on operating temperature and production spread of electronic components.
- **Maximum load current:** 50 mA
- **Minimum load current:** Not specified. Consider the following:
  - Leakage current will have a stronger effect when load currents are low.
  - Propagation delay of the output increases as load currents decrease.
  - Higher-impedance circuits tend to be more susceptible to EMI.
  - Higher currents cause higher voltage drops in long cables.

## General Purpose I/O Lines

 **NOTICE:** Applying incorrect electrical signals to the camera's GPIO line can severely damage the camera. 

Before you connect any external circuitry to the GPIO line, use the [Line Mode](#) feature to configure the line for input or output.

Make sure to apply appropriate input or output signal voltages as specified below.

### Operation as Input

| Voltage          | Description                                                                                                   |
|------------------|---------------------------------------------------------------------------------------------------------------|
| 30 VDC           | Absolute maximum. This voltage must never be exceeded. Doing so may damage the camera and voids the warranty. |
| 0–24 VDC         | Safe operating range. The minimum external pull-up voltage is 3.3 VDC.                                        |
| 0–0.8 VDC        | Indicates a logical 0 (with inverter disabled).                                                               |
| >0.8–<br>2.0 VDC | Region where the logic level transition occurs; the logical state is not defined in this region.              |
| >2.0 VDC         | Indicates a logical 1 (with inverter disabled).                                                               |

- **Current draw (high-level):** <100  $\mu$ A
- **Sink current:** Your application must be able to accept 2 mA sink current from the GPIO input line without exceeding 0.8 VDC.

### Operation as Output

| Voltage        | Description                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------------------|
| 30 VDC         | Absolute maximum. This voltage must never be exceeded. Doing so may damage the camera and voids the warranty. |
| 3.3–<br>24 VDC | Safe operating range.                                                                                         |
| <3.3 VDC       | Unreliable I/O output.                                                                                        |

- **Internal pull-up resistor:**  $\approx$ 2 k $\Omega$ , with open collector. Many applications will have to provide an additional pull-up resistor.
- **Residual voltage ("on" state):**  $\approx$ 0.4 VDC at 50 mA and 25  $^{\circ}$ C (77  $^{\circ}$ F) housing temperature. Actual residual voltage depends on operating temperature, load current, and production spread of electronic components.

- **Leakage current:** <60 µA. Actual leakage depends on operating temperature and production spread of electronic components.
- **Maximum load current:** 50 mA
- **Minimum load current:** Not specified. Consider the following:
  - Leakage current will have a stronger effect when load currents are low.
  - Propagation delay of the output increases as load currents decrease.
  - Higher-impedance circuits tend to be more susceptible to EMI.
  - Higher currents cause higher voltage drops in long cables.

For more information about the I/O lines, see the [I/O Control](#) section.

## Circuit Diagrams

→ See [Circuit Diagrams](#).

## Cable Requirements

### USB 3.0 Cable

- Use a high-quality USB 3.0 cable with a Micro-B plug.
- To [avoid EMI](#), cables must be shielded, as specified in the USB 3.0 standard.
- Basler recommends using USB 3.0 cables from the [Basler cable portfolio](#) [↗](#).

For more information about recommended USB 3.0 cables, see the [Recommended Accessories for Basler USB 3.0 Cameras](#) [↗](#) document.

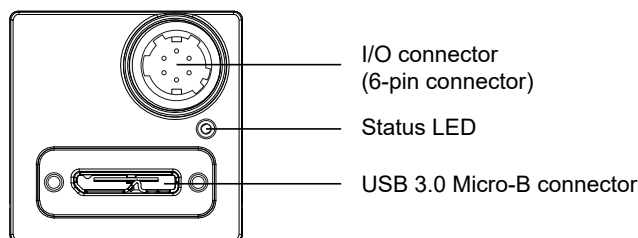
### I/O Cable

- The I/O cable must be shielded.
- The I/O cable must have a cross-section of at least 0.14 mm<sup>2</sup> (close to AWG26).
- Use twisted pair wire cables.
- Maximum recommended cable length: 10 m
- Camera-side connector: Hirose micro plug (part number HR10A-7P-6S) or equivalent
- Proximity to strong magnetic fields should be avoided.
- Basler recommends using I/O cables from the [Basler cable portfolio](#) [↗](#):

- [GPIO cable, 10 m](#)  (yellow cable): For use with the [GPIO lines](#) of your camera. Also provides camera power. To avoid interferences due to crosstalk, the opto-coupled I/O lines are not connected.
- [Opto-I/O cable, 10 m](#)  (blue cable): For use with the [opto-coupled I/O lines](#) of your camera. To avoid interferences due to crosstalk, the GPIO lines are not connected. Does not provide camera power. Therefore, when using this cable, you must provide power via Power over Ethernet (PoE).
- [Opto-GPIO Y-cable, 2 × 10 m](#)  (yellow-blue cable): Allows you to use the [GPIO lines](#) and the [opto-coupled I/O lines](#) simultaneously without interferences due to crosstalk. There are two separate wires to split both I/O types. Also provides camera power.
- [Power-I/O cable, 10 m](#)  (gray cable): For use with the [opto-coupled I/O lines](#) of your camera. Unlike the opto-I/O cable (blue cable, see above), this cable allows you to provide camera power. However, because all lines are connected, crosstalk between the GPIO lines and the opto-coupled I/O lines may occur.
- [Power-I/O PLC+ cable, 10 m](#)  (gray cable): For use with the [opto-coupled I/O lines](#) of Basler cameras connected to a programmable logic controller ([PLC](#) ). It adapts the signal level for zero voltage from PLC level ( $\backslash < 8.4$  VDC) to TTL level ( $\backslash < 1.4$  VDC).

## Physical Interface

### Camera Connectors and Status LED



### I/O Connector

- Hirose micro receptacle (part number HR10A-7R-6PB)

- Recommended mating connector: Hirose micro plug (part number HR10A-7P-6S)

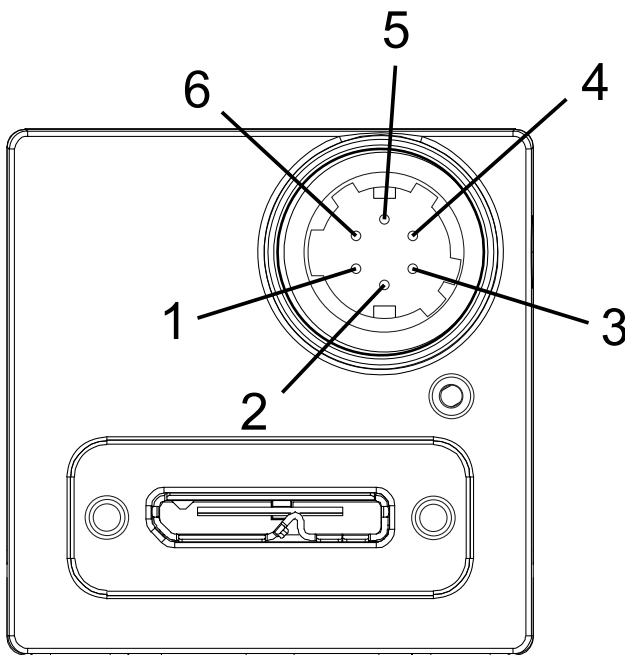
## USB 3.0 Micro-B Connector

- Standard USB 3.0 Micro-B connector with screw lock
- Recommended mating connector: Standard USB 3.0 Micro-B connector with screws

## Status LED

Indicates camera operation (LED lit = camera operating).

## Connector Pinout



| Pin | Line   | Function                        |
|-----|--------|---------------------------------|
| 1   | Line 3 | General purpose I/O (GPIO) line |
| 2   | Line 1 | Opto-coupled I/O input line     |
| 3   | Line 4 | General purpose I/O (GPIO) line |

| Pin | Line   | Function                                    |
|-----|--------|---------------------------------------------|
| 4   | Line 2 | Opto-coupled I/O output line                |
| 5   | -      | Ground for opto-coupled I/O lines           |
| 6   | -      | Ground for General Purpose I/O (GPIO) lines |

## Precautions

→ See [Safety Instructions \(ace, ace 2, racer 2 S\)](#).

## Installation

→ See [Camera Installation](#).

## Features

→ See [Features](#).