BALLUFF

BVS SC-_1280Z00-07-000
SMART*CAMERA* IO

User's manual



English

www.balluff.com

Original user's guide

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1 User instructions

1.1 Introduction

These operating instructions describe the **SMART***CAMERA* product from the Balluff Vision Solution BVS SC product family as well as the data interfaces and the startup for an immediate operation.

The web-based software interface integrated in the **SMART***CAMERA* is described in the separate software manual (BVS Cockpit manual).

Both manuals are available on the Balluff product website via www.balluff.com or via the help system of the BVS Cockpit interface.

The **SMART***CAMERA* was developed to identify objects in automated industrial environments via optical codings (barcode, 2D codes or plain text) and to recognize and verify characteristics of objects such as presence, contours, dimensions, colors and positions. The test results can be processed in a flexible way and forwarded to the higher-level controller. Some outstanding properties are:

– Complete camera control and evaluation integrated in the device
– Simple camera access from the network
– Simple and user-friendly settings, control of camera without additional software
– Simple, user-guided operation
– Support of Industry 4.0
– Integrated, flexible displays of process statistics

These characteristics make it possible to easily create test and identification tasks in automation, to flexibly check the status of the test process, to monitor long-term processes in a clearly arranged way.

Hence, the **SMART***CAMERA* perfectly supports logistics processes and quality assurance in different industries.

These operating instructions apply to the following variants of the **SMART***CAMERA*:

Ordering code	Product name	Description
BVS002C	BVS SC-M1280Z00-07-000	**SMART***CAMERA* Monochrome IO

Balluff GmbH completes the customer offering with a distinct service and accessories palette.

1.2 Typographical conventions

The following conventions are used in this manual:

Bulleted Lists

Enumerations are shown as a list with an en-dash.

– Entry 1
– Entry 2

Actions

Action instructions are indicated by a preceding triangle. The result of an action is indicated by an arrow.

► Action instruction 1
  ⇒ Action result
► Action instruction 2

1 User instructions

Numbers:

– Decimal numbers are shown without additional indicators (e.g. 123).
– Fixed-point numbers are shown with a period (e.g. 0.123).
– Hexadecimal numbers are shown with the additional indicator hex (e.g. 00_{hex}).

Parameters:

Parameters are shown in italics (e.g. CRC_*16*).

Directory paths:

Path information for saving data is shown with capital letters (e.g. PROJECT:\DATA TYPES\USER-DEFINED).

ASCII code:

Characters transmitted in ASCII code are set in apostrophes (e.g. 'L').

Symbols

Note, tip
This symbol indicates general notes.

NOTICE
The signal word NOTICE warns against possible property damage.
► Always observe the described measures for preventing this danger.

CAUTION
The pictogram used with the signal word CAUTION warns of a possible hazardous situation affecting the health of persons. Failure to observe these warning notes may result in injury.
► Always observe the described measures for preventing this danger.

1 User instructions

1.3 Abbreviations

BVS	Balluff Vision Solution
CMOS	Complementary metal-oxide-semiconductor
DCP	Discovery and basic Configuration Protocol
DHCP	Dynamic Host Configuration Protocol
DID	Device ID
I/O port	Digital input and output port
EEPROM	Electrical Erasable and Programmable ROM
EMC	Electromagnetic compatibility
FCC	Federal Communications Commission
FE	Function ground
GND	Ground
I/O port	Digital input / output port
ID	Identification
IO	Input / Output
IP	Internet Protocol
LAN	Local Area Network
LPS	Limited Power Source
MAC	Media Access Control
n.c.	not connected
PC	Personal Computer
RX	Receiver
SC	**SMART***CAMERA*
SIO	Standard Input/Output
PLC	Programmable Logic Controller
TX	Transmitter
UINT8	unsigned integer, 1 byte long
UINT16	unsigned integer, 2 bytes long
UINT32	unsigned integer, 4 bytes long

1 User instructions

1.4 Copyright

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All information and notes in these operating instructions, particularly the chapter Safety Instructions, must be observed.

1.5 Legal requirements

The General Terms and Conditions of Balluff GmbH in their respective current version and the conditions in these operating instructions exclusively apply to all deliveries of products and to all other services of Balluff GmbH (henceforth referred to as “GTC”). The provisioning of the software is exclusively subject to the respective current GTC, the conditions in these operating instructions as well as the regulations of the “Balluff Enduser Licensing Agreement”. You may use the software only in compliance with these provisions. If they should not yet be available, Balluff GmbH will gladly provide the current GTC upon request.

The **SMART***CAMERA* uses an embedded Linux/GNU as the operating system. Also used are a variety of freely available tools which were published under various open source licenses. Some licenses require that the source code and modifications be published. These sources are published on the Product homepage.

The license texts for all software products used can be downloaded from the Web interface along with the manuals. They are available as ZIP files.

1.6 Updates and upgrades

Balluff GmbH is authorized – but not obligated – to make updates or upgrades of the firmware available via the website of Balluff GmbH or in any other form. In such a case, Balluff GmbH is authorized – but not obligated – to inform you about the updates or upgrades. The use of such upgrades or updates assumes that you accepted the validity of the current GTC as well as the additional conditions in the operating instructions.

1.7 Trademarks

The product, trade, company and technology designations used (e.g. Microsoft®, Windows 7®, Internet Explorer®, Google Chrome®, Mozilla Firefox® and HALCON®) are trademarks of the respective owners.

2 Safety

2.1 Intended use

The **SMART***CAMERA* BVS SC is a camera with integrated image analysis for contactless acquisition and examination of objects in industrial environments.

The intended use also includes that you have read these operating instructions in their entirety and follow all the information – particularly the section “Safety”.

2.2 General safety notes

Installation and startup

Installation and startup may only be performed by trained technical personnel. Qualified personnel are people who are familiar with installation and operation of the product and have the necessary qualifications for these tasks.



Manufacturer's guarantee, warranty and liability are void for damage caused by unauthorized tampering or unapproved use, installation or handling in violation of the specifications of this user's guide.

The operator must ensure that appropriate safety and accident prevention regulations are observed.

► When connecting the **SMART***CAMERA* to an external controller, observe proper selection and polarity of the connection as well as the power supply (see “Connections and pin assignment” on page 14).

The **SMART***CAMERA* may only be used with an approved power supply (see “Product specification” on page 12).

Conformity

CE	This product was developed and manufactured in accordance with all applicable European Directives. CE conformity has been verified.
c UL us LISTED	This product is approved by UL PROCESS CONTROL EQUIPMENT File No. E227256.

All approvals and certifications are no longer valid in the following cases:

– Components are used that are not part of the **SMART***CAMERA* BVS SC.

– Components are used that have not been explicitly approved by Balluff. For a list of the approved components, see chapter “Accessories” on page 39.

Operation

► Before commissioning, carefully read the user's guide.

The system must not be used in applications in which the safety of persons is dependent upon proper functioning of the device.

The operator is responsible for ensuring that local safety regulations are observed.

Maintenance, inspection, repair

The working principle used in this **SMART***CAMERA* is maintenance- and wear-free. The operator must regularly inspect the SmartCamera for signs of damage or malfunctions in line with the operating conditions and environmental influences. If any damage or wear is found, the **SMART***CAMERA* must be immediately taken out of operation and secured against unauthorized use.

Only service technicians from BALLUFF GmbH may repair defective devices. Intervention in the product by the operator is not permitted due to safety reasons. The **SMART***CAMERA*'s housing may not be opened or loosened!



► Before maintenance, disconnect the device from the power supply.

Note

In the interests of product improvement, Balluff GmbH reserves the right to change the technical data of the product and the content of this manual at any time without notice.

2.3 Disposal

► Observe the national regulations for disposal.

3 Product description

The Balluff **SMART***CAMERA* BVS SC is a camera for the acquisition and analysis of black-and-white and color images. Application areas are optical identifications of codes and plain text, inspections for quality assurance and the measurement of objects. The camera can also be used in robot environments.

With the Gigabit LAN interface, the host industrial system can affect the processes in the camera and receive customer-specific processed result data.

The product is suitable for use in harsh industrial environments (IP67 with lens protection, standard M12 industry plug connections, standardized industry network connections).

Since the complete software is located on the **SMART***CAMERA* itself, no external software is required for the configuration and monitor display. Using standardized web browsers such as Google Chrome, Mozilla Firefox or Internet Explorer, the user can easily connect with the **SMART***CAMERA* and work in the Balluff BVS Cockpit interface developed specifically for camera systems.

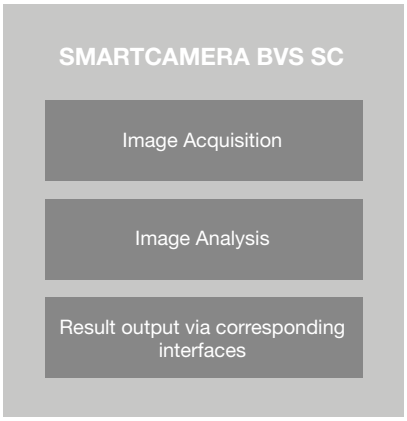


Figure 1: Function blocks of the **SMART***CAMERA*



Figure 2: **SMART***CAMERA* with lens

3.1 Product variants

The **SMART***CAMERA* has been designed in accordance with current, industrial standards:

- Image acquisition: C-mount lenses with corresponding matching filters; 1280 x 1024 pixel monochrome sensor
- LAN connection via Gigabit Ethernet M12
- Configuration/monitoring via Google Chrome, Mozilla Firefox or Microsoft Internet Explorer
- Digital input/output channels for NPN and PNP connections
- Integrated IO-Link 1.1 Master via M12 plug connector

The **SMART***CAMERA* product family is available in different designs.

Designation	Sensor	Image processing	LAN	Fieldbus	IO-Link	Digital I/Os
BVS002C BVS SC-M1280Z00-07-000	Mono-chrome	All tools	yes	no	no	8

3 Product description

3.2 Scope of delivery

Included in the scope of delivery:

- **SMART***CAMERA* BVS SC
- 2× cap M12
- Safety Precautions
- Quick Start Guide

A lens protection is available for specific environmental conditions which is screwed directly onto the camera housing, thereby meeting the requirements in accordance with IP67.

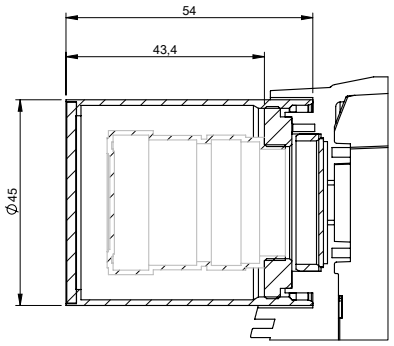


Figure 3: BAM PC-VS-023-1 (BAM02NA)

Please note that only C-mount lenses with a maximum diameter of 42 mm and a length of 40 mm can be used here. For longer lenses up to 69 mm the long tube BAM PC-VS-023-1-01 (BAM02W0) may be used.

The following accessory groups complete the Balluff product range:

- C-mount lenses (BAM LS-VS-004-C2/3-xx14-2)
- Screw-on filter (BAM OF-VS-002-xx-yy)
- Lights (BAE LX)
- Touchpanel PC (BAE-PD-VS-011-01)
- Mounting accessories
- Connection cable
- Power supply units

Note

Visit www.balluff.com for more information on available software and accessories.

3 Product description

3.3 Assembly

The camera features 12 internal threads for installation at the location of use. Four threads each at the rear, the left and the right. This ensures a secure and reliable mounting. The following drawings describe the exact position of all mounting holes.

Individual threads are also used for fastening optional accessories (see chapter “Accessories” on page 39).

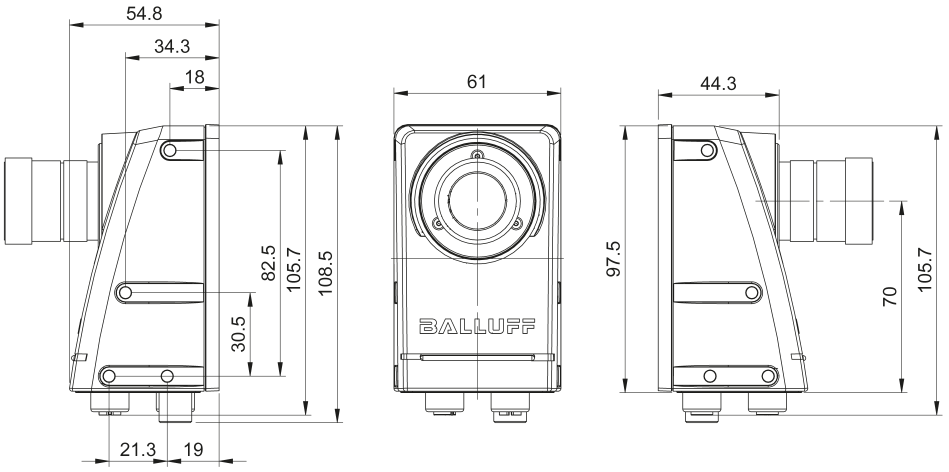


Figure 4: Mechanical connection (dimensions in mm)

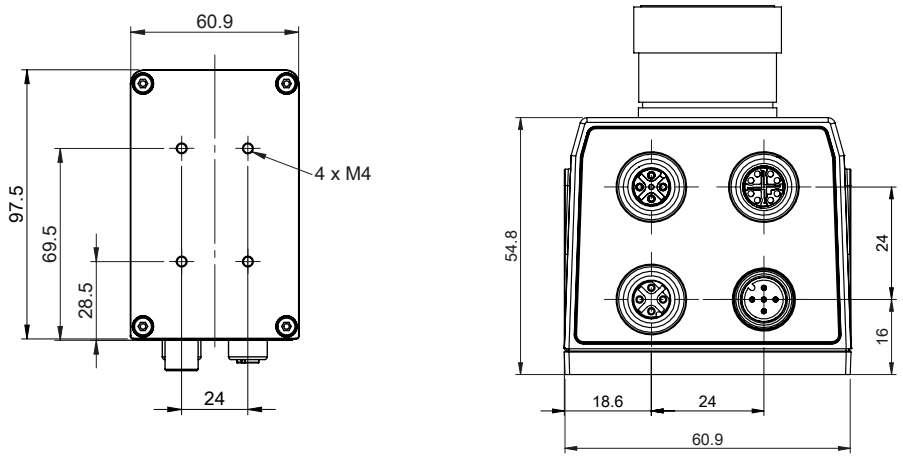


Figure 5: Mechanical connection at rear/bottom (dimensions in mm)

The screw connections at the rear plate have M4 threads. The maximum engagement length is 5 mm. The maximum tightening torque is 2 Nm.

The lateral screw connections have an M5 thread. The maximum engagement length is 5 mm. The maximum tightening torque is 2.6 Nm.

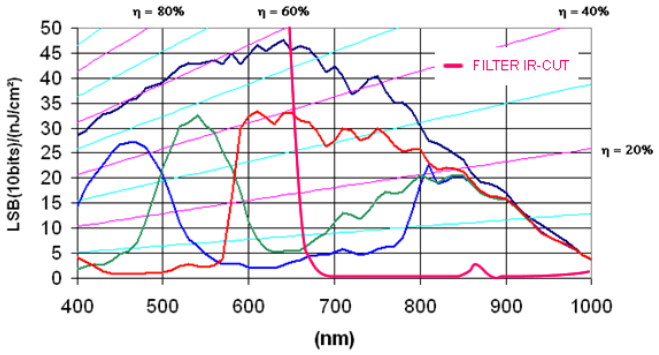


► The **SMART***CAMERA* and accessories must be firmly attached. Use only installation materials which are sufficiently dimensioned and ensure secure attachment.

3 Product description

3.4 Product specification

Image sensor

Model variant	Monochrome (CMOS)
Resolution	1280 × 1024
Max. frame rate [Hz]	60
Shutter type	Global shutter [1]
Sensor size	1/1.8"
Pixel size [µm]	5.3 × 5.3
Spectral sensitivity	

1) A global shutter sensor is not read line by line or column by column, but in one access. This rules out distortions with moving motifs (rolling shutter effect).

Mechanical data

Housing material	Painted aluminum die-cast box
Degree of protection	IP67 (with connectors and protection tube) [2]
Weight (without lens and accessories)	Approx. 360 g
Dimensions (L × B × H, without connector, without lens)	110 × 62 × 55 mm

2) The enclosure rating has not been UL certified.

Electrical data

Supply voltage	⎓ 24 V ± 20%
Residual ripple	≤ 5%
Rated current consumption without external load	300 mA
Max. current consumption	1,9 A / 0,63 A



► The **SMART***CAMERA* and accessories shall be supplied by limited energy in accordance to UL 61010-1 Third Edition, Sub. Clauses 9.4 or LPS in accordance to UL 60950-1 or Class 2 in accordance to UL 1310 or UL 1585.

3 Product description

Operating conditions

Ambient temperature	0 °C … +55 °C
Storage temperature	–25 °C…+70 °C
EMC	EN 61000-4-2/3/4/5/6 EN 61000-6-2 EN 61000-6-3 EN 55011
Vibration/shock for operation inside	EN 60068 Part 2-6/27
Operation	Internally
Height	up to 2000 m
Relative humidity	maximum 80 % for temperatures up to 31 °C, decreasing linearly to 50 % at 40 °C
Pollution degree	Pollution degree 2

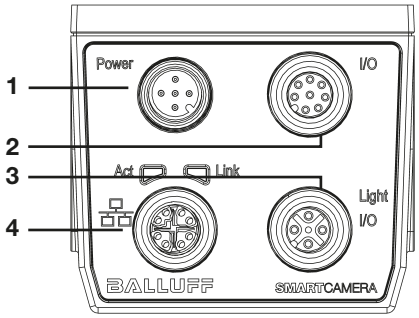
Vibration/shock was verified for the **SMART***CAMERA* – the C-mount lens used and its adjustment rings must be secured accordingly for operation.

3 Product description

3.5 Connections and pin assignment

The product variants differ by the existing interfaces.

I/O variant



1 Power
2 I/O
3 I/O Light
4 LAN

Figure 6: Connections and pin assignment of I/O variant

Connection	Function
Power	Voltage supply of **SMART***CAMERA*, two freely configurable I/O signals are also available.
LAN	Integrates the **SMART***CAMERA* in a local network.
I/O	To connect sensors/actuator, 6 galvanically isolated I/O signals are available.
I/O Light	2 I/O signals and supply voltage output, e.g. for an external lighting

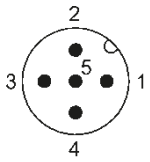
Notes

In order to ensure enclosure rating IP67, unused I/O ports must be closed with cover caps.

► The **SMART***CAMERA* and accessories shall be supplied by limited energy in accordance to UL 61010-1 Third Edition, Sub. Clauses 9.4 or LPS in accordance to UL 60950-1 or Class 2 in accordance to UL 1310 or UL 1585.

Power

5-pin M12 plug, A-coded



Pin	Description	Function
1	+24 V_{DC}	Supply voltage
2	I/O 0	Input/output
3	GND	Ground
4	I/O 1	Input/output
5	Not connected	None. Pin may not be used.

Notes

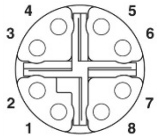
The digital sensor inputs correspond to the guideline concerning inputs, EN 61131-2,Type 3.

The maximum load on any output is 100 mA. The total current of the module must not exceed 4 A per pin. The load or supply must be limited accordingly.

3 Product description

LAN (Gigabit Ethernet)

8-pin M12 socket, X-coded



Pin	Description	Function
1	BI_DA+	Bidirectional data, Pair A +
2	BI_DA–	Bidirectional data, Pair A –
3	BI_DB+	Bidirectional data, Pair B +
4	BI_DB–	Bidirectional data, Pair B –
5	BI_DD+	Bidirectional data, Pair D +
6	BI_DD–	Bidirectional data, Pair D –
7	BI_DC–	Bidirectional data, Pair C –
8	BI_DC+	Bidirectional data, Pair C +

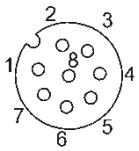
Notes

The cable must correspond at least to category 5e in accordance with EIA/TIA-568.

Transfer in accordance with 1000BASE-T/100BASE-TX/10BASE-T is being supported.

I/O

8-pin M12 socket, A-coded



Pin	Description	Function
1	I/O 0	Input/output
2	Common Out	e.g. +24 V (PNP) / GND (NPN)
3	I/O 1	Input/output
4	I/O 2	Input/output
5	I/O 3	Input/output
6	I/O 4	Input/output
7	Common In	e.g. GND (PNP) / +24 V (NPN)
8	I/O 5	Input/output

Notes

These inputs / outputs are galvanically decoupled from the supply voltage of the **SMART***CAMERA*. For this reason, *Common In* and *Common out* must always be connected, even if only one input or output function is required.

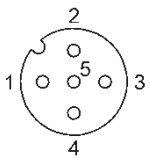
Every output may be loaded with a maximum current of 100 mA. The maximum current for Common In and Common Out is 630 mA each.

For a description of the interconnections, see the section “I/O” on page 19.

- The **SMART***CAMERA* and accessories shall be supplied by limited energy in accordance to UL 61010-1 Third Edition, Sub. Clauses 9.4 or LPS in accordance to UL 60950-1 or Class 2 in accordance to UL 1310 or UL 1585.

I/O light

5-pin M12 socket, A-coded



Pin	Description	Function
1	VP (+24 V_{DC})	Supply voltage
2	I/O 6	Input/output
3	GND	Ground
4	I/O 7	Input/output
5	Not used	None. Pin may not be used.

3 Product description

Notes

The maximum load on the supply voltage output is 1.2 A.

The digital sensor inputs correspond to the guideline concerning inputs, EN 61131-2, Type 3.

Every output may be loaded with a maximum current of 100 mA.

3.5.1 Power

The power plug connector supplies the **SMART***CAMERA* with the supply voltage and offers two I/O-24 V switching signals (I/O 0 & I/O 1) for the connection with sensors, actuators or PLC.

These two inputs and outputs feature a push-pull output stage. This allows using the output signal for PNP logic as well as NPN logic. The input stage always features PNP logic.

I/O 0 & I/O 1 (power plug connectors)			
Operation as input			
Voltage	Signal 0	0…5 V	< 2 mA
	Signal 1	11…30 V	2…5 mA
Delay		< 160 µs	

Operation as output			
Voltage	Signal 0	0 V (+V_D)	100 mA max.
	Signal 1	24 V (V_{DC} – V_D)	100 mA max.
Voltage drop V_D		< 2 V	
Delay		< 10 µs	

See also the guideline on digital inputs, EN 61131-2, Type 3.

Below are examples how inputs and outputs must be connected to obtain input and output function.

Notes

I/Os of the same name are logically connected with each other.

When operating the I/Os as output, then e.g. I/O 0 is connected at the power connection and I/O 0 at the IO connection.

If the I/Os are configured as input, their signals are ored. A 1 signal is recognized if a 1 signal is present either at I/O 0 of the power connection or I/O 0 of the I/O connection.

Input connection

If I/O 0 is configured as input, it is sinking and can be connected directly with the PNP output of a sensor, a PLC. A 1 signal is being detected if the input is connected with the supply voltage. A 0 signal is being detected if the input is set to ground or is not connected.

If an NPN device is to be connected to the input, then an external level converter must be connected upstream.

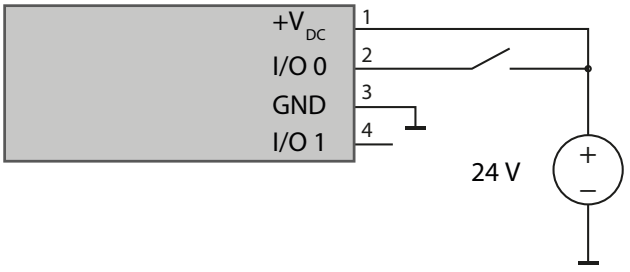


Figure 7: Input connection

3 Product description

Output connection

If I/O 0 is configured as output, the supply voltage is applied at the output and the actuator, PLC input is supplied with it if 1 is being output. The output is connected with GND if 0 is being output. The output current of an I/O may not exceed 100 mA.

If the output is being overloaded, e.g. by a short circuit, it is switched off and periodically checked whether the fault occurrence is still present. If the error was removed, the output is again in normal operating state without a reset.

PNP output connection

PNP logic is predominantly used in Europe. The output is sourcing, so that the load between I/O and GND must be switched accordingly. The load is connected with supply voltage if 1 is being output.

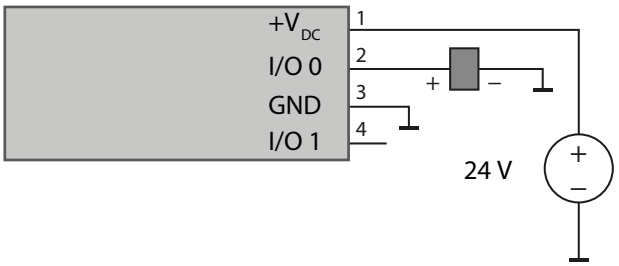


Figure 8: PNP output connection

NPN output connection

NPN logic is predominantly used in Asia. The output is sinking, so that the load between I/O and supply voltage must be switched accordingly. The load is set to GND if 0 is being output.

To obtain a normal switching behavior, the output can be inverted.

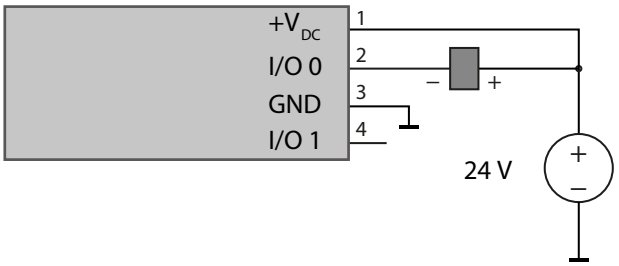


Figure 9: NPN output connection

3.5.2 LAN

The LAN interface meets the Ethernet standard in accordance with IEEE 802.3-2008 (up to 1 Gigabit). This network connection is used to call up the web interface BVS Cockpit for the configuration. In addition, a communication channel is available to control the image analysis and to call up the generated result values.

3 Product description

3.5.3 I/O light

The I/O light interface provides 24 volt and two I/O signals (I/O 6 & I/O 7). These I/Os, similar to the two I/Os at the power plug connectors (see “Power” on page 16), are equipped with a push-pull output stage and a PNP input.

I/O 6 & I/O 7 (I/O light plug connectors)			
Operation as input			
Voltage	Signal 0	0…5 V	< 2 mA
	Signal 1	11…30 V	2…5 mA
Delay	0 → 1	< 160 µs	
	1 → 0	< 160 µs	

Operation as output			
Voltage	Signal 0	0 V (+V_D)	100 mA max.
	Signal 1	24 V (V_{DC} – V_D)	100 mA max.
Voltage drop V_D		< 2 V	
Delay	0 → 1	< 10 µs	
	1 → 0	< 10 µs	

Supply voltage output			
Voltage	V_P	24 V (V_{DC} – V_D)	1.2 A max.
Voltage drop V_D		< 2 V	

Among other things, this makes it possible to easily connect lighting equipment to the **SMART***CAMERA*. Either the permanent voltage supply or the I/O signals can be used for this purpose.

The following example shows how the ring lighting BAE LX-VS-RR100 can be connected with trigger and boost.

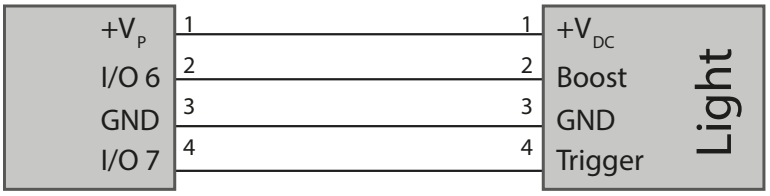


Figure 10: I/O light circuit

The ring lighting is equipped with a M12 plug, so that it can be connected directly with the **SMART***CAMERA*. A complex wiring is not necessary.

Naturally, other sensors/actuators can also be connected, the corresponding switching examples are located in the description of the power plug connector (see “Power” on page 16).

3 Product description

3.5.4 I/O

The IO interface furnishes six galvanically isolated I/O 24V switching signals for the connection with sensors, actuator or PLC.

All inputs and all outputs have a Common In or Common Out reference potential. This allows using the I/Os either for PNP logic or NPN logic. A mixed mode (PNP and NPN at the same time) is not possible.

These I/O signals can be used to control the camera or transfer individual information to the host system. As a result, the image acquisition can be triggered via these I/O signals. Outputting a binary analysis result is also possible. The assignment of the I/O signals is done via the BVS Cockpit interface (see “Digital I/O interface” on page 29).

I/O 0 & I/O 5 (I/O plug connectors)			
Operation as input			
Voltage	Signal 0	0…5 V (I/O to $V_{Common\ In}$)	< 2 mA
	Signal 1	11…30 V (I/O to $V_{Common\ In}$)	2…8 mA
Delay		0 → 1	< 70 µs
		1 → 0	< 150 µs

Operation as output				
		PNP	**NPN**	
Voltage	Signal 0	High-resistance	High-resistance	100 mA max.
	Signal 1	24 V ($V_{Common\ Out} - V_D$)	0 V ($V_{Common\ Out} + V_D$)	100 mA max.
Voltage drop VD		< 2 V		
Delay		0 → 1		< 20 µs
		1 → 0		< 60 µs

Supply voltage for I/O [1]			
Voltage	$V_{Common\ Out}$ [2]	24 V_{DC} (±20 % LPS Class 2)	0 V
	$V_{Common\ In}$ [2]	0 V	24 V_{DC} (±20 % LPS Class 2)

[1] The supply voltage for the I/O of the I/O interface is galvanically isolated from the operational voltage of the **SMART***CAMERA*.

[2] The maximum current for *Common In* and *Common Out* is 630 mA.

Below are examples how inputs and outputs must be connected to obtain input and output function.

Notes

I/Os of the same name are logically connected with each other.

When operating the I/Os as output, then e.g. I/O 0 is connected at the I/O connection and I/O 0 at the power connection.

If the I/Os are configured as input, their signals are logically combined with OR. A 1 signal is recognized if a 1 signal is present either at I/O 0 of the power connection or I/O 0 of the I/O connection.

3 Product description

PNP mode

PNP logic is predominantly used in Europe. The output is sourcing, the input is sinking.

To operate the I/O port in PNP mode, *Common Out* must be supplied with +24 V (19.2…30 V_{DC}) and *Common In* with 0 V.

If I/O 0 is configured as input, it can be connected directly with the PNP output of a sensor, a PLC or similar. A 1 signal is being detected if the input is connected with *Common Out*. A 0 signal is being detected if the input is set to *Common In* or is not connected.

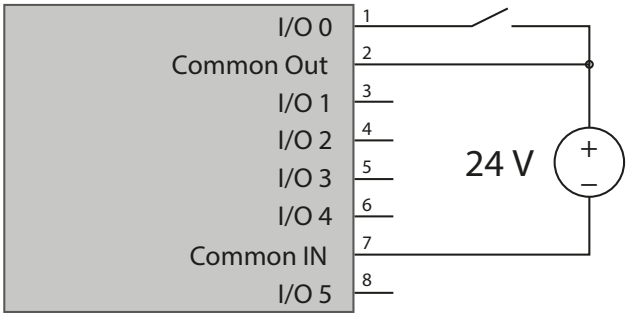


Figure 11: PNP mode, I/O 0 configured as input

If I/O 0 is configured as output, the output is connected with *Common Out* and the actuator, PLC input or similar is supplied with it if 1 is being output. The output is high-resistance if 0 is being output.

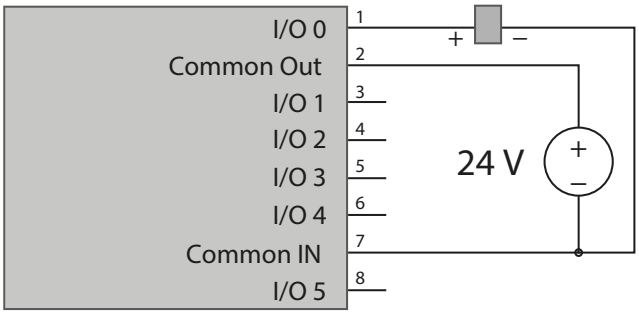


Figure 12: PNP mode, I/O 0 configured as output

The output current of an I/O may not exceed 100 mA. If the output is being overloaded, e.g. by a short circuit, it is switched off and periodically checked whether the fault occurrence is still present. If the error was removed, the output is again in normal operating state without a reset.

It is also possible to use input and output functions at the same time. In the following example, I/O 0 is configured as output and I/O 1 as input.

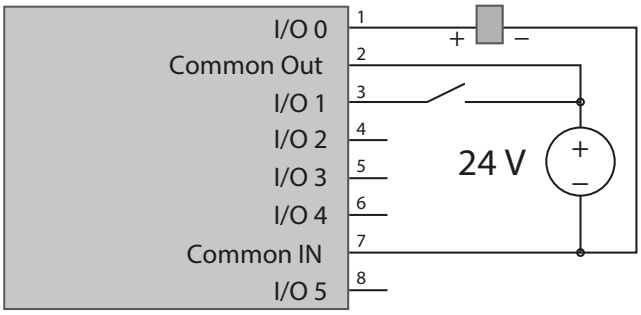


Figure 13: PNP mode, I/O 0 configured as output and I/O 1 as input

3 Product description

NPN mode

NPN logic is predominantly used in Asia. The output is sinking, the input is sourcing.

To operate the IO port in NPN mode, *Common Out* must be supplied with 0 V and *Common In* with +24 V (19.2…30 V_{DC}).

If I/O 0 is configured as input, it can be connected directly with the NPN output of a sensor, a PLC or similar. A 1 signal is being detected if the input is connected with *Common Out*. A 0 signal is being detected if the input is set to *Common In* or is not connected.

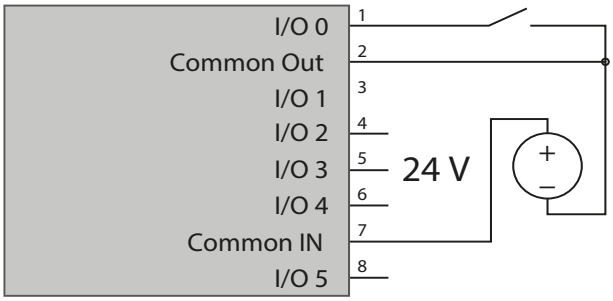


Figure 14: NPN mode, I/O 0 configured as input

If I/O 0 is configured as output, the output is connected with *Common Out* and the actuator, PLC input or similar is supplied with it if 1 is being output. The output is high-resistance if 0 is being output.

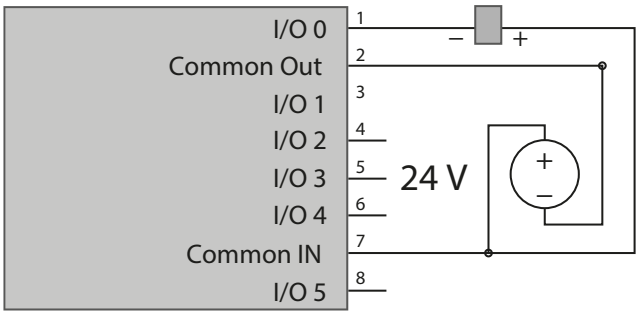


Figure 15: NPN mode, I/O 0 configured as output

The output current of an I/O may not exceed 100 mA. If the output is being overloaded, e.g. by a short circuit, it is switched off and periodically checked whether the fault occurrence is still present. If the error was removed, the output is again in normal operating state without a reset.

It is also possible to use input and output functions at the same time. In the following example, I/O 0 is configured as output and I/O 1 as input.

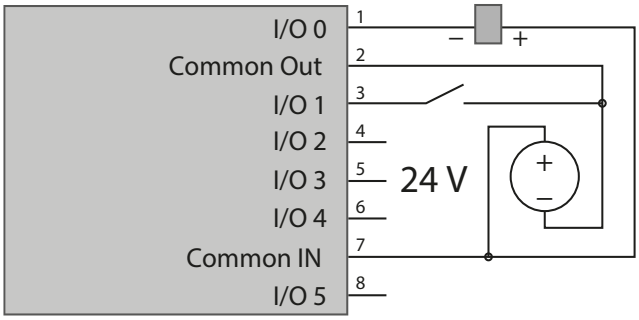


Figure 16: NPN mode, I/O 0 configured as output and I/O 1 as input

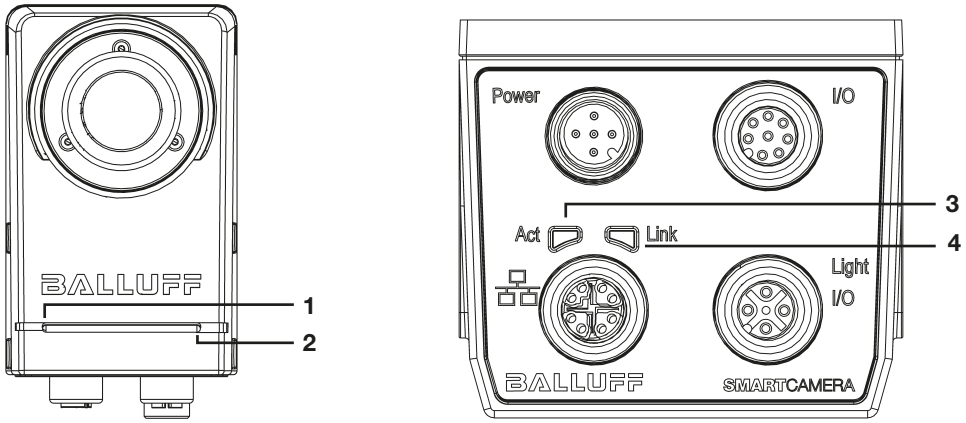
3 Product description

3.6 Display elements

The operating states of the vision system, the IO-Link master and the LAN and fieldbus interface are displayed using LEDs. The display elements are distributed across the front and the underside of the **SMART***CAMERA*.

Displays on the front

Displays at the plug connectors



1 Power LED
2 Signal LED
3 LAN Act
4 LAN Link

Figure 17: Display elements on the front and at the plug connectors

Displays on the front

LED	Indicator	Function
Power LED	Off	No supply voltage
	Green on	Inspection is running or waiting for a trigger
	Green, flashing	Inspection stopped or in configuration mode
	Red on	Fault
	Red, flashing	Firmware update active
Signal LED	Off	Signal = 0
	Yellow on	Signal = 1

The signal LED indicates the status of the I/O cable null.

Displays at the plug connectors

LAN

LED	Indicator	Function
LAN Link	Off	No LAN connection
	Green	LAN connection established
LAN Act	Off	No data transfer
	Yellow, flashing	Data transmission

3.7 Cleaning

The outside of the camera can be cleaned with a soft cloth. Persistent dirt can be removed with a cloth that is first moistened with a soap solution and wrung out.

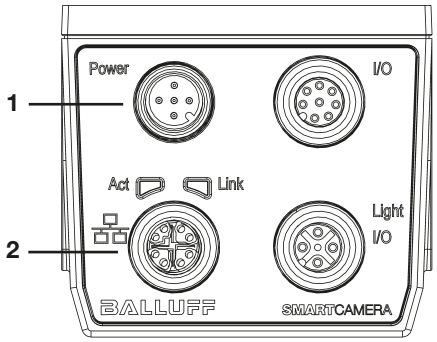
► After wiping off the dirt spots, wipe the camera with a dry cloth.

4 First steps

Three simple steps are required to initially start up and configure the **SMART***CAMERA*. Besides the **SMART***CAMERA*, the following is required:

– Power cable
– 24 V power supply
– LAN cable
– PC with web browser

4.1 Step 1: Establishing a network connection with the SMART*CAMERA*



1 Power
2 LAN

Figure 18: Establishing a network connection with the **SMART***CAMERA*

► Connect the **SMART***CAMERA* via the **LAN** port with the network.

Depending on the network topology between computer and **SMART***CAMERA*, different network settings must be made on the computer.

In general, the network configuration of your computer is set to *Obtain an IP address automatically*. For the firewall setting, Port 80 should be enabled.

The following network structures are possible:

Structure	Follow
SMART*CAMERA* and PC are connected directly via a LAN cable.	IP addresses are set automatically.
SMART*CAMERA* and PC are in the same subnet of a local network and a DHCP server is available for automatic IP assignment.	IP addresses are set automatically.
SMART*CAMERA* and PC are in the same subnet of a local network and no DHCP server is available for automatic IP assignment.	In this case, the IP addresses of PC and **SMART***CAMERA* must be matched and manually set. Pertinent useful notes are located in the section “Network settings / LAN interface” on page 28.
SMART*CAMERA* and PC are in different subnets of a local network.	Subnets are explicitly created to be able to subdivide computers in different networks and to structure it in this way. Since the different subnets, on the other hand, are connected via switches, the communication with the **SMART***CAMERA* is still possible. Pertinent useful notes are located in the section “Network settings / LAN interface” on page 28.

Step 2: Switching on the SMART*CAMERA*

► Now connect the power supply at the **Power** port with the power supply (24 V).

The **SMART***CAMERA* starts up and is operational after approx. 30 seconds.

At the start, the **SMART***CAMERA* opens the most recently opened inspection program and is in the same process state it occupied at switch-off.

4 First steps

4.2 Step 3: Opening the BVS Cockpit web interface

The camera is being configured via the BVS Cockpit. This web interface is being opened and operated via web browsers.

The following commercially available browser are being supported:

– Google Chrome version 24.0 and higher
– Mozilla Firefox version 15.0 and higher
– Microsoft Internet Explorer version 10 and higher

1. Record the serial number of the **SMART***CAMERA*.
   The serial number is located on the nameplate on the **SMART***CAMERA*.
   If the nameplate is not visible, you can also locate the **SMART***CAMERA* in the network via Windows Explorer (e.g. sc-150800015de).
2. To do so, select the network folder Netzwerk to display all the network devices.
   It also lists the connected **SMART***CAMERA* cameras.
3. To open the configuration screen of the **SMART***CAMERA*, perform the following steps:
   a. Open the web browser.
   b. Enter the following URL: http://sc-150800015de (150800015de" must be replaced with the serial number of the **SMART***CAMERA*).
   c. Confirm the entry.

Notes

More information about the configuration interface of the BVS Cockpit can be found in the software manual (BVS Cockpit manual) on the Balluff homepage and on the **SMART***CAMERA*.

If there is already another **SMART***CAMERA* in the network, you can also connect with this **SMART***CAMERA* and change to any other **SMART***CAMERA* in the local network using this interface.

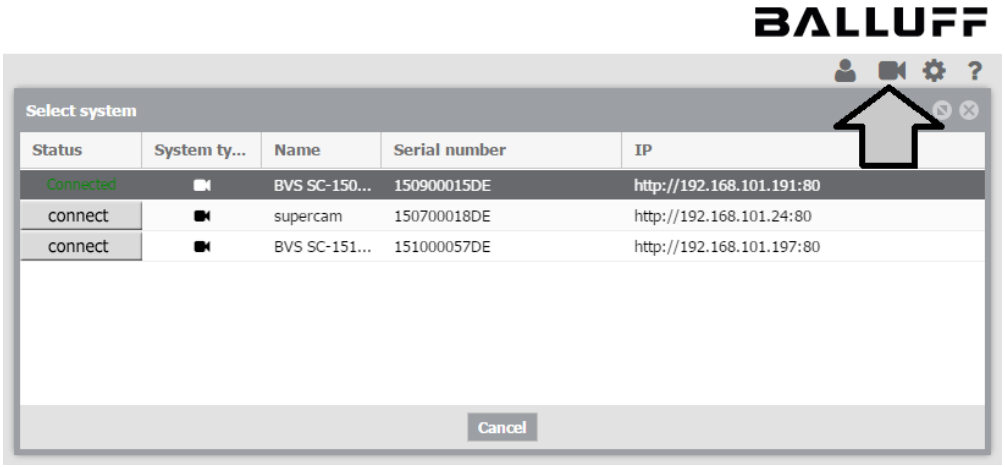


Figure 19: Display of all **SMART***CAMERAs* in the network

5 Startup

5.1 Updating software

The Balluff homepage regularly offers new software updates. These may include error fixes, speed optimizations or added functions.

Notes

To get the maximum benefit from the **SMART***CAMERA* it is recommended to regularly update the **SMART***CAMERA* with software updates.

Notes

This section describes the software update for the **SMART***CAMERA* with a Windows PC. The process will need to be adapted for other systems.

To update the camera perform the following steps:

1. Download the newest update file from the Balluff homepage (www.balluff.com) and save it on your computer.
2. Unzip the downloaded file. It contains:
   a. A PDF document that describes the new functions, fixed errors and the update procedure.
   b. The file BVS_Cockpit_X.X.X.sh. This contains the new software and must be loaded into the **SMART***CAMERA*. X.X.X indicates the software version.
3. Press the Windows + R keys and enter the address of the update directory of the **SMART***CAMERA* (e.g. \\sc-151000057de\updates[1]).Windows Explorer opens up in the update directory of the **SMART***CAMERA*.
4. Copy the update file (BVS_Cockpit_X.X.X.sh) to the updates folder. The **SMART***CAMERA* will now automatically start the update process. This may take up to 5 minutes. The Power LED on the front side will flash red during the update. The **SMART***CAMERA* is inaccessible in the network during the update.

► Never disconnect the camera from power during an update. This can result in irreparable damage to the **SMART***CAMERA*.

5. After a few minutes the update will be finished and the Power LED will change to green. The **SMART***CAMERA* is now ready for use.

1) The name comes from the Web address printed on the part label. In this example the address on the **SMART***CAMERA* is http://sc-151000057de/.
The name in the network is then: \\sc-151000057de\updates.

5 Startup

5.2 Network topologies

For the startup of the **SMART***CAMERA*, it is first integrated in the network environment. The different options are described in the following examples. This covers a large part of the application cases. To operate the **SMART***CAMERA* requires that the supply voltage is provided via the power connection in any case.

The IO1 topology shows a simply design with an operating panel for the configuration of the **SMART***CAMERA*. The interaction with the system is done exclusively via the digital I/Os in this example.

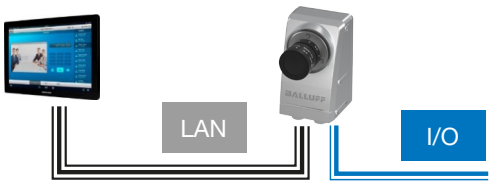


Figure 20: IO1 topology

In the IO2 example, the I/O signals of the **SMART***CAMERA* are being analyzed by a controller. In addition, the **SMART***CAMERA* is controlled via the LAN connection. This allows the controller, e.g. to initiate the trigger or query the status of the **SMART***CAMERA*.

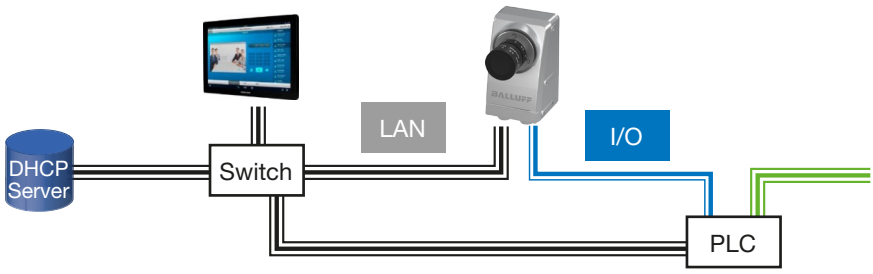


Figure 21: IO2 topology

5 Startup

The following sections describe the configuration of the individual interfaces in detail.

5.3 System settings

Below is a description of system settings. They can be reached via the System Settings selection in the system menu.



Figure 22: System menu

The system menu is located in the upper section of the user interface. It consists of the following menu items:

Menu item	Meaning
	User login
	Camera selection
	System setting
	Help system

5.4 Selecting the communication interface for the process data

The process data (results of the image analysis, control of the image acquisition,…) are exchanged via the LAN interface. The protocol is described in “Communication functions of the LAN Interface” on page 31.

The data are transferred as TCP or UDP packets via the LAN interface. The pertinent protocol is described under “General information” on page 31. Port 36701 is used.

5 Startup

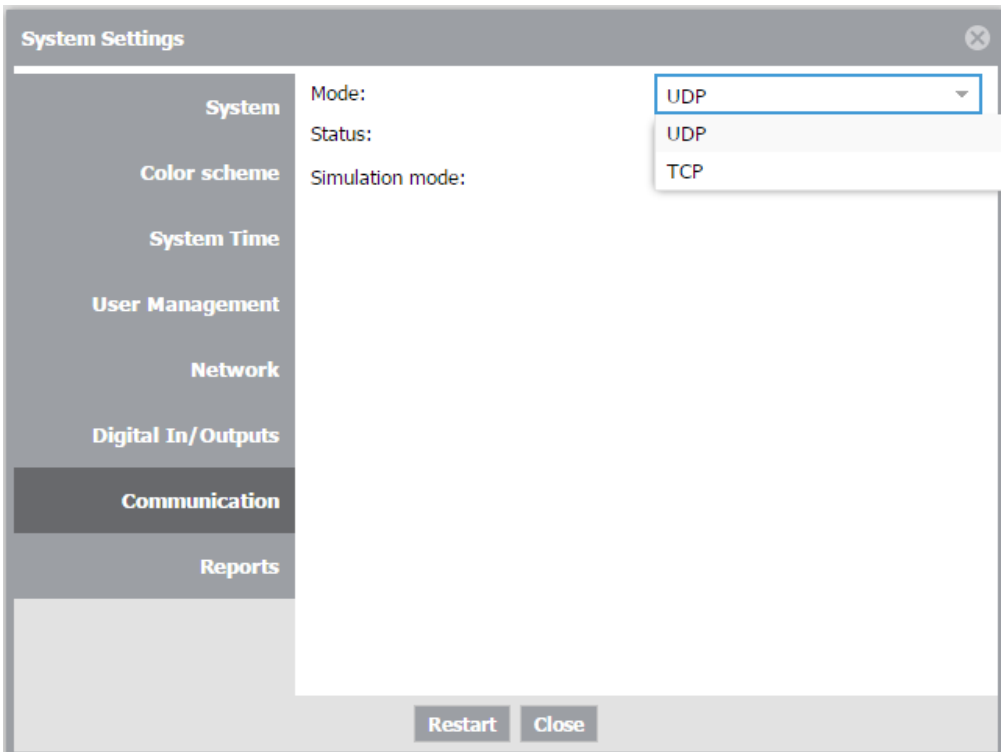


Figure 23: Communication tab in the System settings

5.5 Network settings / LAN interface

All variants of the **SMART***CAMERA* feature a 1 Gbit/s LAN interface for configuring and monitoring the image analysis. Chapter“First steps” on page 23 describes how this interface is used to establish the connection between computer and **SMART***CAMERA*. For some network topologies, this simple description is not sufficient. The required steps are described below.

5.6 Locating the camera in the network

SMART*CAMERA* **and PC are in different subnets of the network**

Subnets are explicitly created to be able to subdivide computers in different networks and to structure it in this way. Since the different subnets, on the other hand, are connected via switches, the communication with the **SMART***CAMERA* is still possible. In most networks, it is only necessary to enter the URL http://sc-150800015de with the matching serial number in the address field of the browser. The connection is established automatically. The **SMART***CAMERA* obtains the IP address from the DHCP server and the name service of the network ensures that the URL with the serial number is replaced with the correct IP address.

Without a name service, the URL cannot be resolved! In this case, the IP address must be entered directly. To do so, it is recommended to configure the DHCP server in such a way that the **SMART***CAMERA* is assigned the same address in every case. As an alternative, the IP address can also be assigned manually (see the next section).

Note

To prevent address conflicts, no IP may be used more than once in the network!

No DHCP server available in the network

In this case, the IP address of the LAN port must be set manually. To do so, you have to connect with the **SMART***CAMERA* using a PC that is configured for automatically assigned, private IP address (see "First steps" on page 23). The settings dialog for the IP address of the **SMART-***CAMERA* is located on the BVS Cockpit web interface under the icon ⚙ . This option also allows establishing a connection to the **SMART***CAMERA* if the manually set IP address is not known.

Note
After changing the IP address, the **SMART***CAMERA* may no longer be reachable. In this case, briefly disconnect the network at the PC and reconnect it.

5.6.1 Network configuration via BVS Cockpit

The network configuration is done in the System settings on the Network tab.

Setting and Displays	Description
Obtain an IP address automatically	It defines whether the IP address of the camera should be assigned dynamically or via DHCP or statically.
IP	If a static IP address is to be used, it can be entered here.
Gateway	If a static IP address is to be used, the gateway can be entered here. This entry is optional if the same subnet is used exclusively to access the camera.
Port	Which port the Web interface of the **SMART***CAMERA* can be accessed on. Default is Port 80.
Use Avahi/Bonjour	Determines whether the camera reports itself to other cameras via its name in the network (see Figure 19).

5.7 Digital I/O interface

The **SMART***CAMERA* 8 provides eight internal I/O signals.

Digital inputs and outputs are configured in the System settings on the Digital inputs/outputs tab.

Setting	Description
Name	A user-defined name that describes this input/output.
Direction	It defines whether it is an input or an output. Inputs can be read out with the *Read inputs* tool. Outputs are set with the *Set outputs* tool.
Inv.	If activated, the input/output is inverted. In the inverted state, the input/output is assumed to be active if no voltage is present.
Pulse length	Defines the pulse length of an output in milliseconds. The value default setting is 0. This means the output remains switched until the Set outputs tool is used to manually set a different value. For values greater than 0 the output is switches for this time length and then changed back to inactive mode. The system allows a maximum of two outputs to have a pulse length greater than zero assigned. In this case the remaining fields for entering pulse length are grayed out.

Note
If the pulse length exceeds the throughput time for an inspection this may result in undesired effects.

Note
After switching on and after switching to another inspection program the outputs are set as in the general settings:
- 0 V if Inv. is not active
- 24 V if Inv. is active

5 Startup

All logical signals are permanently linked with the physical signals of the plug connectors. I/O 0 and I/O 1 exists twice.

Signal	I/O 0	I/O 1	I/O 2	I/O 3	I/O 4	I/O 5	I/O 6	I/O 7
Power	Pin 2	Pin 4						
I/O	Pin 1	Pin 3	Pin 4	Pin 5	Pin 6	Pin 8		
I/O Light							Pin 2	Pin 4

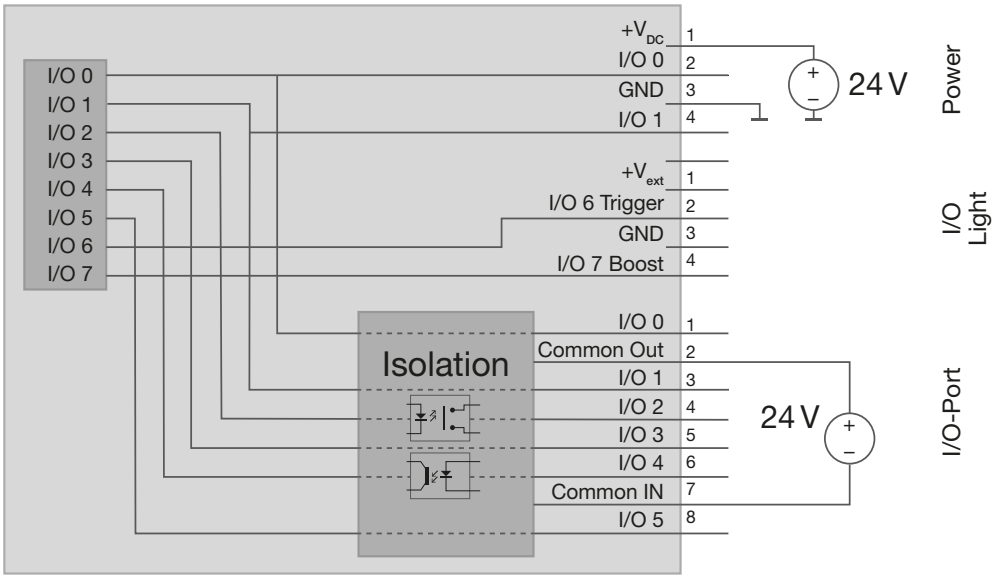


Figure 24: Control plan

If I/O 0 is operated as output, pin 1 at the I/O connection and pin 2 at the power connection are switched.

If the I/Os are configured as input, their signals are logically combined with OR. This means, a 1 signal is recognized if a 1 signal is present either at pin 2 of the power connection or pin 1 of the I/O connection. The same applies to I/O 1.

6 Communication functions of the LAN Interface

6.1 General information

The camera can be controlled using TCP or UDP sockets. The camera uses port 36701. The controlling system can use any available port.

TCP and UDP sockets are essentially different. With a TCP socket first a connection between camera and controlling system is opened. With a UDP socket this is not necessary, since individual packets are simply sent. In both cases the camera expects a Connect message, then it starts to send out status updates and result data. If the controlling system of a UDP socket does not want any more updates, it sends Disconnect. Likewise a Disconnect should be sent for a TCP socket before the socket is closed.

The camera responds to a Connect message with a Connect response; in addition, the camera then sends a status message to the client so that the client is informed about the current status of the camera.

The camera supports only one active client. In case of an existing TCP connection any further connection attempts are rejected. If on the other hand a UDP connection exists, it is closed as soon as a new request is placed by another client.

If transmission security is of great importance, use of TCP sockets is recommended.

Invalid messages are ignored by the camera.

6.2 Structure of the messages

The message elements consist of unsigned 32-bit numbers (UINT32) and byte strings. They are transferred using the little endian format. The lowest value byte is transferred first in this case.

There are three different categories of messages:

1. Messages from the camera to the client
   a. Status
   b. Result containers
2. Messages from the client to the camera without a response
   a. Disconnect
   b. Set time stamp
   c. Setting input data
   d. Set sequence number
   e. Trigger application
   f. Start application
   g. Stop application
   h. Trigger reset
3. Messages from the client to the camera, which then sends a response after the action is complete.
   a. Connect
   b. Switch application
   c. Query application
   d. Get the time stamp

All messages have the same structure.

Length in bytes	Structure	Designation
4	UINT32	Magic Number: 42565350_{hex}
4	UINT32	User data length in bytes
4	UINT32	Message ID
4	UINT8[]	User data

Messages that do not meet the specified format (wrong *Magic Number*, wrong length, unknown message ID), are ignored by the camera. The "*Magic Number*" is used to avoid inadvertent transfers. It is recommended to watch for a correct "*Magic Number*" at the receiving point when programming the client software.

6 Communication functions of the LAN Interface

Every message has a unique ID:

ID	Message
01_{hex}	Connect
02_{hex}	Disconnect
12_{hex}	Status
20_{hex}	Result containers
30_{hex}	Query application
31_{hex}	Switch application
32_{hex}	Get time stamp
33_{hex}	Set time stamp
34_{hex}	Setting input data
35_{hex}	Set sequence number
40_{hex}	Trigger application
41_{hex}	Start application
42_{hex}	Stop application
43_{hex}	Trigger reset

6.3 The individual messages

At the beginning of the connection of a client with the camera, the client has to send a Connect message.

6.3.1 Connect

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	00_{hex}	User data length in bytes
4	UINT32	01_{hex}	Message ID

The camera responds to it with its Connect message.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	04_{hex}	User data length in bytes
4	UINT32	01_{hex}	Message ID
4	UINT32	01_{hex}	Protocol version

If the LAN protocol should be expanded, the protocol version is counted up. This allows a client to see which protocol the camera is using.

After the Connect message, the camera sends a Status message to the client.

6.3.2 Disconnect

The client uses the Disconnect message to exit the connection. Afterwards, he no longer receives any result data and also no status messages.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	00_{hex}	User data length in bytes
4	UINT32	02_{hex}	Message ID

6.3.3 Status

After every status change, the camera sends the new status to the client.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350 $_{hex}$	Magic Number
4	UINT32	08$_{hex}$	User data length in bytes
4	UINT32	12$_{hex}$	Message ID
4	UINT32		Status word. A set bit indicates that the status is active (see the following table). In contrast to the fieldbus interface, the status bits do not have to be reset actively. If a status is no longer active, the camera simply sends out a new status message.

Value	Bit	Name	Function description
1	0	Overheat	The camera exceeded the permissible temperature. This could lead to a drop in quality of the inspections. – Check ambient temperature – Check installation conditions
2	1	System Error	Fatal system error. At least one reset is required, a part of the camera could be defective.
4	2	Input Container	It is set for input container overflow (more input containers than inspections, so that one input container was discarded) or underflow (more inspections than input containers, so that one input container was used multiple times).
16	4	Busy	This bit signals that the camera is currently busy. The bit is set while the application is switched over.
32	5	Report	This bit becomes active as soon as a report file could not be transferred and got lost.
128	7	Running	This bit signals that the camera is operating in Run mode.
256	8	Overtriggered	A trigger was rejected by the camera.
512	9	Waiting for Trigger	This bit signals that the camera is waiting for a trigger signal.

4	UINT32		It defines the endian format of the result container and the input data: 0: Little endian

6.3.4 Result containers

After the conclusion of an inspection, the result is send from the camera to the client with this message.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350 $_{hex}$	Magic Number
4	UINT32		User data length in bytes
4	UINT32	20$_{hex}$	Message ID
4	UINT32		Application ID. The BVS Cockpit can manage several applications, each of which has its own ID. This field shows the application that gene - rated the result container.
x	UINT8[]		Result data as defined in the BVS Cockpit.

6 Communication functions of the LAN Interface

6.3.5 Query application

The client can use this message to query the application ID of the active application.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	00_{hex}	User data length in bytes
4	UINT32	30_{hex}	Message ID

The camera is waiting for:

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	04_{hex}	User data length in bytes
4	UINT32	30_{hex}	Message ID
4	UINT32		Active application ID

6.3.6 Switch application

The client can use this message to switch over the active application on the camera.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	04_{hex}	User data length in bytes
4	UINT32	31_{hex}	Message ID
4	UINT32		ID of the desired application

An application ID allows only values under which an application is actually stored in the BVS Cockpit.

The Application ID Null is not allowed since multiple applications can be given this ID. The application can only be changed if it is stopped (see “6.3.13 Stop application” on page 36).

Following this message, the camera returns an acknowledgment to the client.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	08_{hex}	User data length in bytes
4	UINT32	31_{hex}	Message ID
4	UINT32		Status: 0: Application was successfully set 1: Application ID is invalid
4	UINT32		Active application ID

The message is not sent until after the application has been switched over, which may take several 100 milliseconds.

6.3.7 Get the time stamp

The client uses this message to query the real-time clock of the camera.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	00_{hex}	User data length in bytes
4	UINT32	32_{hex}	Message ID

The camera responds to it with the current values:

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	18_{hex}	User data length in bytes
4	UINT32	32_{hex}	Message ID
4	UINT32		Year (e.g. 2017)
4	UINT32		Month (1...12)
4	UINT32		Day (1...31)
4	UINT32		Hour (0…23)
4	UINT32		Minute (0…59)
4	UINT32		Second (0…59)

6.3.8 Set time stamp

The client uses this message to set the current time at the camera. After every voltage ramp-up, the time stamp must be set anew.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	18_{hex}	User data length in bytes
4	UINT32	33_{hex}	Message ID
4	UINT32		Year (e.g. 2017)
4	UINT32		Month (1...12)
4	UINT32		Day (1...31)
4	UINT32		Hour (0…23)
4	UINT32		Minute (0…59)
4	UINT32		Second (0…59)

The camera does not send a response to this message. Invalid values are rounded to the next valid value.

Note

If an NTP server is specified in the BVS Cockpit, the camera automatically obtains the time from the server. Use of the *Set time stamp* message is then not necessary. The manually set time is overwritten by that of the NTP server.

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6.3.9 Setting input data

Some applications require input data (e.g. comparison code or traceability data). This message transfers them from the client to the camera.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32		User data length in bytes
4	UINT32	34_{hex}	Message ID
x	UINT8[]		Input data for the application as defined in the BVS Cockpit.

6.3.10 Set sequence number

Every application pass generates a result that contains a unique sequence number. This sequence number is displayed in the BVS Cockpit. The result container can also be configured in such a way that it contains the sequence number. After the restart, the sequence number starts with zero. This message allows the client to set the sequence number to a defined value. The next application pass will then receive this sequence number. With every additional application pass, the sequence number is being incremented.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	04_{hex}	User data length in bytes
4	UINT32	35_{hex}	Message ID
	UINT32		New sequence number

6.3.11 Trigger application

It is sent from the client to the camera to start an application pass. The behavior of the camera depends on the setting in the BVS Cockpit. If an application is untriggered, this message is being ignored.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	00_{hex}	User data length in bytes
4	UINT32	40_{hex}	Message ID

6.3.12 Start application

It is sent from the client to the camera to set the camera to the Run mode. The behavior of the camera depends on the setting in the BVS Cockpit. An untriggered application starts immediately after this message and continuously furnishes results. A triggered application is ready after this message to receive a trigger.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	00_{hex}	User data length in bytes
4	UINT32	41_{hex}	Message ID

6.3.13 Stop application

It is sent from the client to the camera to exit the Run mode of the camera. An untriggered application stops after this message and furnishes no more results. A triggered application ignores additional triggers after this message.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	00_{hex}	User data length in bytes
4	UINT32	42_{hex}	Message ID

6.3.14 Trigger reset

Restarts the camera. After this message, the network connection is being lost and must be re-established after the restart. The restart takes approx. 30 seconds.

Length in bytes	Structure	Value	Designation
4	UINT32	42565350_{hex}	Magic Number
4	UINT32	00_{hex}	User data length in bytes
4	UINT32	43_{hex}	Message ID

6.4 Examples

Examples for Ethernet communication

The following examples show how the messages are structured and how they are sent.

Connect

Most message elements are of type UINT32 and consist of 4 bytes. But over Ethernet one byte after the other is sent. Be sure therefore that the data are sent in little-endian format. This means the lowest value byte is transferred first.

Each message begins with the Magic Number 42565350_{hex}.
Transmission begins with the lowest value byte: 50_{hex} 53_{hex} 56_{hex} 42_{hex}

Then the user data follow. The Connect message has no user data and so the length is Null. As UINT32 in little-endian: 00_{hex} 00_{hex} 00_{hex} 00_{hex}

The messages ID for Connect is 01_{hex}, as UINT32, little-endian: 01_{hex} 00_{hex} 00_{hex} 00_{hex}

There are no user data, the message is now complete.

The entire Connect command is thus:

50_{hex}	53_{hex}	56_{hex}	42_{hex}
00_{hex}	00_{hex}	00_{hex}	00_{hex}
01_{hex}	00_{hex}	00_{hex}	00_{hex}

The message is coded in C language:

```
unsigned char[] connect =
{
0x50, 0x53, 0x56, 0x42,
0x00, 0x00, 0x00, 0x00,
0x01, 0x00, 0x00, 0x00
};
```

Result containers

After each completed inspection the camera sends a results container to the controlling system. The structure of the user data depends on the configuration in the BVS Cockpit. In this example it is assumed that an inspection was configured which provides a string of 20 bytes (= 14_{hex}). The camera read the text “Hallo Welt!” and sends it to the controlling system.

The coding of the text is in ASCII format. The text that is read (11 bytes long) is shorter therefore than the area provided in the message (20 bytes). The camera therefore fills the remaining bytes with zeros. One byte chain is simply sent after the other. Little-endian has no meaning here since these are individual bytes.

The entire command is thus:

50_{hex}	53_{hex}	56_{hex}	42_{hex} (Magic number)
14_{hex}	00_{hex}	00_{hex}	00_{hex} (user data length)
20_{hex}	00_{hex}	00_{hex}	00_{hex} (Message ID)

6 Communication functions of the LAN Interface

Reply from **SMART***CAMERA*:

48_{hex} 61_{hex} $6C_{hex}$ $6C_{hex}$ $6F_{hex}$ 20_{hex} 57_{hex} 65_{hex} $6C_{hex}$ 74_{hex}
21_{hex} 00_{hex} 00_{hex} 00_{hex} 00_{hex} 00_{hex} 00_{hex} 00_{hex} 00_{hex} 00_{hex}
(ASCII: 'H', 'a', 'l', 'l' 'o', space, 'W', 'e', 'l', ‚t', '!', 9× fill-bytes)

Other examples (values always in hex):

- Start application: 50535642 00000000 41000000
- Trigger application: 50535642 00000000 40000000
- Stop application: 50535642 00000000 42000000
- Trigger reset: 50535642 00000000 43000000
- Disconnect: 50535642 00000000 02000000
- Set input data (10 x a, b, c, d, e, f, g, h, i, j – (= ASCII 41, … 50):
  50535642 0A000000 34000000 41424344454647484950
- Query application ID: 50535642 00000000 30000000
- Change application to xx($_{hex}$) ID-Number: 50535642 04000000 30000000 xx000000
- Get time stamp: 50535642 00000000 32000000

7 Appendix

7.1 Type code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
B	V	S		S	C	-		1	2	8	0	Z	0	0	-			-			

1–3	BVS	Balluff Vision Solutions
5–6	SC	**SMART***CAMERA*
8	Function type	M: Monochrome sensor
9–12	Resolution	1280: 1280 × 1024 pixel
13	Lights	Z: No integrated lighting
14–15	Optics	00: C-mount lenses
17–18	Interface	07: IO variant (no fieldbus) 30: PROFINET IO / Ethernet IP plus IO-Link
20–22	Variants	000: Full standard functionality

7.2 Accessories

(optional, not included in the scope of delivery)

Protection tube		
BAM02NA	BAM PC-VS-023-1	Protection tube for lenses up to a length of 40 mm.
BAM02W0	BAM PC-VS-023-1-01	Protection tube for lenses up to a length of 69 mm.
C-mount lenses		
BAM029R	BAM LS-VS-004-C2/3-0614-2	C-mount lens 6 mm focal length
BAM02FA	BAM LS-VS-004-C2/3-0814-2	C-mount lens 8 mm focal length
BAM02FC	BAM LS-VS-004-C2/3-1214-2	C-mount lens 12 mm focal length
BAM02FE	BAM LS-VS-004-C2/3-1614-2	C-mount lens 16 mm focal length
BAM02FF	BAM LS-VS-004-C2/3-2514-2	C-mount lens 25 mm focal length
BAM02FH	BAM LS-VS-004-C2/3-3514-2	C-mount lens 35 mm focal length
BAM02FJ	BAM LS-VS-004-C2/3-5014-2	C-mount lens 50 mm focal length
BAM02Y3	BAM LS-VS-004-C2/3-7532-2	C-mount lens 75 mm focal length
Filters		
BAM02FK	BAM OF-VS-002-PL-27	Lens filter 27 mm polarized
BAM02FL	BAM OF-VS-002-UV-27	Lens filter 27 mm UV
BAM02MN	BAM OF-VS-002-IR-27	Lens filter 27 mm IR
BAM02FM	BAM OF-VS-002-RD-27	Lens filter 27 mm red
BAM02FN	BAM OF-VS-002-YE-27	Lens filter 27 mm yellow
BAM02FP	BAM OF-VS-002-GN-27	Lens filter 27 mm green
BAM02FR	BAM OF-VS-002-BU-27	Lens filter 27 mm blue
Spacer rings		
BAM02MT	BAM SP-XO-002-0,5-40/31-A	C-Mount spacer rings (0.5/1/5/10/20/40 mm)
Touchpanel PC		
BAE00WC	BAE PD-VS-011-01	Touchpanel PC 12"

7 Appendix

Mounting accessories		
BAM00ZW	BAM MB-MS-038-B19-1	Mounting bracket **SMART***CAMERA*
BAM01YT	BMS CUJ-M-S25-D045-00	3D holder system
BAM01YP	BMS CS-M-S25-DX15-00	Removable disk for 3D fastener system
BAM02ZU	BMS CU-M-S25-D030-01	Attachment for interchangeable plate
BAM02P7	BAM MB-VS-026-B14-1	Ring light mounting bracket – **SMART***CAMERA*
Connection cable		
BCC0HZK	BCC M418-E818-8X0-723-PS58N9-020	GigE cable RJ45, M12, 2 m
BCC06K7	BCC M418-0000-2A-044-VX8825-020	IO interface, M12, open, 2 m
BCC032F	BCC M415-0000-1A-003-PX0434-020	Power, M12, open, 2 m

Note

Other accessories for the BVS SC-… such as lenses, filters, lights or cables can be found at www.balluff.com.

www.balluff.com

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