Surge protection for closed-circuit television systems (CCTV)

Guide for support in planning and installation

Building Connections
Application

Camera systems are used to monitor rooms, buildings and outdoor spaces, in order to record unauthorised access or criminal activities. Thus, the high availability of these systems must be guaranteed. CCTV (closed-circuit television) describes such camera monitoring systems. The difference to general camera systems is that the recorded images are only determined for a limited number of receivers (closed circuit), in contrast to transmissions for public television, for example.

CCTV camera systems are frequently installed outside buildings or on objects. During a thunderstorm, the devices

• can be completely destroyed by a direct lightning strike,
• or, if there is a remote lightning strike, can be damaged by surge voltages inducing in transmission cables during the release of electromagnetic waves.
Technical structure

Camera system structures have various differences. For video transmission, a coaxial cable with a BNC plug connection is frequently used as a cable medium, or a two-core/twisted pair cable is used. If the camera possesses a control unit to swivel and tilt the camera head, this transmission is usually controlled via a serial RS485 interface via a two-core/twisted pair cable. A two-pole cable is used as the power supply.

Depending on the version, the data and video interfaces are frequently run together, for example through an RJ45 network connection. Modern IP cameras possess a single RJ45 connection, which transmits both the data and video signal and also the power supply via Power over Ethernet (PoE).

To prevent a failure of cameras and display systems, the components must be protected against atmospheric discharges and surge voltages.

OBO Bettermann offers tailor-made surge protection solutions for these applications, in order to guarantee safe system operation.
To fulfil a surge protection concept, all the parts of a terminal or equipment that are able to carry current must be included in the equipotential bonding. In the case of camera systems, these would be, amongst other things, the different interfaces which the camera possesses. Depending on the version, the number varies from one to three.
## Variants

The surge protective devices are available in the following variants:

<table>
<thead>
<tr>
<th>Variant</th>
<th>Description</th>
<th>Protection class</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>PND-3in1-C-RS</td>
<td>To protect the power, data and video cable in one device in the case of surge voltages and lightning currents.</td>
<td>Type 1+2 / D1+C2</td>
<td>Power: 2-pole (screw terminal)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Data: 4-pole (screw terminal)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Video: Coaxial BNC socket</td>
</tr>
<tr>
<td>PND-2in1-C-RS</td>
<td>To protect the power, data and video cable in one device in the case of surge voltages and lightning currents.</td>
<td>Type 1+2 / D1+C2</td>
<td>Power: 2-pole (screw terminal)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Data + Video: RJ45 socket</td>
</tr>
<tr>
<td>ND-CAT6/E-B</td>
<td>To protect the RJ45 Power-over-Ethernet interface in the case of surge voltages and lightning currents.</td>
<td>Type 1 / D1</td>
<td>Power + Data + Video: RJ45 socket</td>
</tr>
<tr>
<td>ND-CAT6/E-F</td>
<td>To protect the RJ45 Power-over-Ethernet interface in the case of surge voltages.</td>
<td>Type 2+3 / C2+C1</td>
<td>Power + Data + Video: RJ45 socket</td>
</tr>
</tbody>
</table>

In addition, OBO can offer the matching housing for every variant for installation in outdoor areas.
Application examples

The following application examples offer a schematic diagram of the structure and protection of the most common camera monitoring systems for surge voltages and lightning currents. A connection box can be used to house the surge protective devices, for example on the camera pole. The surge protective devices should be installed as close as possible to the device to be protected, allowing the protection level and the risk of coupling on the protected side to be kept low. In addition, the length of the connection from the surge protective device to the local equipotential bonding should be kept as short as possible.
Scenario 1:

Three-cable camera system with/without external lightning protection

The camera is integrated into the system via three separate cables (power, data, video). Each of the three cables must be separately equipped with surge protection, in order to protect all the interfaces. As the PND-3in1-C-RS is a combination arrestor (type 1+2), it can be used with camera systems with and without lightning protection and protects all the named interfaces with a single device. For function monitoring, the device also possesses a visual indication and remote signalling.

The data and video transmission and the power supply are each carried out separately.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PND-3in1-C-RS (item no.: 5081066)</td>
</tr>
<tr>
<td>2</td>
<td>230 V</td>
</tr>
<tr>
<td>3</td>
<td>Video cable (Coax/BNC)</td>
</tr>
<tr>
<td>4</td>
<td>Data cable (RS485)</td>
</tr>
<tr>
<td>5</td>
<td>Monitor</td>
</tr>
<tr>
<td>6</td>
<td>Camera control unit</td>
</tr>
<tr>
<td>7</td>
<td>Camera</td>
</tr>
<tr>
<td>8</td>
<td>Swivel and tilt head</td>
</tr>
<tr>
<td>9</td>
<td>External lightning protection with protection angle</td>
</tr>
</tbody>
</table>
Scenario 2:

Two-cable camera system with/without external lightning protection

The video and data signal is transmitted jointly via a network connection (RJ45). The PND-2in1-C-RS (type 1+2) surge protection device offers the matching interfaces for this. Here too, the property of a combination arrester is given, meaning that it can also be used for camera systems with external lightning protective and all the cables can be protected against surge voltages with just one device. For function monitoring, this device also possesses a visual indication and remote signalling.

1. PND-2in1-C-RS (item no.: 5081064)
2. 230 V
3. Data and video cable (RJ45)
4. Monitor
5. Camera control unit
6. Camera
7. Swivel and tilt head
8. External lightning protection with protection angle
Scenario 3:

IP camera system

IP cameras only require one cable between the command centre and the camera. This cable transmits both the data and video signal and also the power supply via Power over Ethernet. The high amount of cabling work is not necessarily, transmission via IP is versatile and can easily be integrated in existing systems. The ND-CAT6/E-B (type 1) can be used in lightning protection zones from 0 to 1. For lightning protection zones 1 to 3, ND-CAT6/E-F must be used.

1. ND-CAT6/E-B (item no.: 5081804) or ND-CAT6/E-F (item no.: 5081802)
2. PC as command centre
3. LAN/PoE cable
4. Camera
5. External lightning protection with protection angle
Combination protection device 2in1 for CCTV camera systems

Data cable protection devices for coaxial and IP-based TV / camera systems

- Protection of power and data interface in a single device
- In aluminium housing
- Simple mounting with adapter plug
- Two-stage protection circuit
- Two-pole power connection for the power interface
- RJ45 connection for the data interface
- With remote signalling (RS) and LED operation display
- Incl. hat rail fastening set

Application: Protection of CCTV, video signals; (IP) cameras and/or TV systems

**PND-2in1-C-RS**

Max. continuous voltage (L-N) $U_c$ 230 V
Max. discharge current (8/20 µs) $I_{lim}$ 10 kA
Idle voltage $U_{idle}$ 10 kV
Nominal discharge current (8/20 µs) $I_{lim}$ 5 kA
Maximum discharge current (8/20 µs) $I_{lim}$ 10 kA
Impulse discharge current (10/350) $I_{lim}$ 1.5 kA
Network
Max. continuous voltage AC $U_c$ 5.6 V
Max. continuous voltage DC $U_c$ 8 V
Category Type 1+2 / D1+C2
Impulse durability wire-wire C1: 1 kV / 0.5 kA (8/20µs)
Impulse durability wire-earth C2: 4 kV / 2 kA (8/20µs)
Protection level wire-wire <40 V
Protection level wire-earth <600 V
Frequency range 0 - 100 MHz
Shielding connection available Yes
Shield connection Direct
Testing standard IEC 61643-21

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**Dimensions**

**Connection options**

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### Combined protection device 3in1 for CCTV camera systems

#### Data cable protection devices for coaxial and IP-based TV / camera systems

- Protection of power and data interfaces in a single device
- In aluminum housing
- Simple mounting with adapter plug
- Two-stage protection circuit
- Two-pole power connection for the power interface
- Screwless terminal and BNC connection for the data and video interface
- With remote signalling (RS) and LED operation display
- Incl. hat rail fastening set

**Application:** Protection of CCTV, video signals; (IP) cameras and/or TV systems

#### PND-3in1-C-RS

<table>
<thead>
<tr>
<th>Type No.</th>
<th>Maximum continuous voltage (L-N)</th>
<th>Maximum discharge current (8/20 μs)</th>
<th>Pack.</th>
<th>Weight kg/100 pcs.</th>
<th>Item No.</th>
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<tr>
<td>PND-3in1-C-RS</td>
<td>230 V</td>
<td>10 kA</td>
<td>1</td>
<td>29.900</td>
<td>5081066</td>
</tr>
</tbody>
</table>

#### Dimensions

- Length: 125.5 mm
- Width: 83 mm
- Height: 37.1 mm

#### Connection options

- L, N, PE

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**Lightning protection zone LPZ:** 0–2

**Earthing via:** Connection cable / hat rail

**Protection rating:** IP20

**Power:**
- SPD to IEC 61643-11: Class I+II
- SPD to EN 61643-11: Type 1+2

**Maximum continuous voltage (L-N):** 230 V

**Rated current:** 10 A

**Voltage protection level:** \(U_{\text{c}}\) < 1.2 kV

**Nominal discharge current (8/20 μs):** \(I_{\text{nom}}\) 5 kA

**Maximum discharge current (8/20 μs):** \(I_{\text{imp}}\) 10 kA

**Impulse discharge current (10/350):** \(I_{\text{imp}}\) 1.5 kA

**Data:**
- Maximum continuous voltage AC: 5.65 V
- Maximum continuous voltage DC: 8 V
- SPD to IEC 61643-21: Class I+II / D1+C2
- Category: Type 1+2 / D1+C2

**Impulse durability wire - wire:**
- Type C2: 10 kV / 5 kA (8/20 μs)
- Type C2: 10 kV / 5 kA (8/20 μs)

**Impulse durability wire - earth:**
- Type C2: 10 kV / 5 kA (8/20 μs)
- Type C2: 10 kV / 5 kA (8/20 μs)

**Lightning impulse current (10/350):** \(I_{\text{imp}}\) 1 kA

**Protection level wire-earth:** <450 V

**Protection level wire-wire:** <65 V

**Frequency range:** 0-100 MHz

**Video:**
- Maximum continuous voltage AC: 5.65 V
- Maximum continuous voltage DC: 8 V
- SPD to IEC 61643-21: Class I+II / D1+C2
- Category: Type 1+2 / D1+C2

**Impulse durability wire - earth:**
- Type C2: 10 kV / 5 kA (8/20 μs)
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- Type C2: 10 kV / 5 kA (8/20 μs)
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**Lightning impulse current (10/350):** \(I_{\text{imp}}\) 1 kA

**Protection level wire-wire:** <90 V

**Protection level wire-earth:** <150 V

**Frequency range:** 0-100 MHz

**Screen connection:** Yes

**Screening:** Direct

**Temperature range:** 0 °C to +80 °C
Surge protection for high-speed networks up to 1 GBit (Class E/CAT6)

- Protection class: Fine protection
- High-quality RJ45 sockets
- Low protection level at high current load
- Earthing via DIN rail or connection cable
- Support of Power over Ethernet (+ to 1 A)
- Tested transmission quality in networks up to 1 GBit/s (Class E) or CAT6
- Rapid installation through plug-in version
- Incl. DIN rail fastening set and earthing cable

Application example: 1 GBit Ethernet, 10/100 MBit Ethernet, PoE applications, IP camera systems, ISDN S0 interfaces

<table>
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<tr>
<th>Type</th>
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<th>Weight kg/100 pcs.</th>
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<td>ND-CAT6/E-F</td>
<td>Fine protection, 8 wires + shield RJ45 8(8)</td>
<td>RJ45 8(8)</td>
<td>1</td>
<td>16.380</td>
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Aluminium

Data cable protection device for high-speed networks

- Protection class: Fine protection
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- Support of Power over Ethernet (+ to 1 A)
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- Rapid installation through plug-in version
- Incl. DIN rail fastening set and earthing cable

Application example: 1 GBit Ethernet, 10/100 MBit Ethernet, PoE applications, IP camera systems, ISDN S0 interfaces

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<td>RJ45 8(8)</td>
<td>1</td>
<td>16.380</td>
<td>5081802</td>
</tr>
</tbody>
</table>
### Surge protection for high-speed networks up to 1 GBit (Class E/CAT6)

**Data cable protection device for high-speed networks**
- Protection class: Basic protection
- High-quality RJ45 sockets
- Low protection level at high current load
- Earthing via DIN rail or connection cable
- Support of Power over Ethernet + to 1 A
- Tested transmission quality in networks up to 1 GBit/s (Class E) or CAT6
- Rapid installation through plug-in version
- Incl. DIN rail fastening set and earthing cable

### Application example:
1 GBit Ethernet, 10/100 MBit Ethernet, PoE applications, IP camera systems, ISDN S0 interfaces

### ND-CAT6/E-B

<table>
<thead>
<tr>
<th>Type</th>
<th>Version</th>
<th>Connection system</th>
<th>Pack.</th>
<th>Weight kg/100 pcs.</th>
<th>Item No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ND-CAT6/E-B</td>
<td>Basic protection, 8 wires + shield</td>
<td>RJ45 8(8)</td>
<td>1</td>
<td>16.220</td>
<td>5081804</td>
</tr>
</tbody>
</table>

**Specifications**

- **Aluminium**
- **Connection options**
  - Dimensions: 48.7 x 93.6 x 25.5 mm
  - **Connection options**
    - 1/4
    - 2/5
    - 3/7
    - 5/6
    - PE

### Technical Details:

- **Maximum continuous voltage AC:** 46 V
- **Maximum continuous voltage DC:** 65 V
- **Category:** Type 1 / D1
- **Lightning protection zone LPZ:** 0-1
- **Channel performance ISO/IEC:** Class E
- **Channel performance ANSI/EA:** CAT 6
- **Number of poles:** 8
- **Rated current:** 1 A
- **Impulse durability wire-wire:** C2: 3 kV / 1.5 kA (8/20µs)
- **Impulse durability wire-earth:** C2: 3 kV / 1.5 kA (8/20µs)
- **Total discharge current (8/20):** 10 kA
- **Protection level wire-wire:** <1100 V
- **Protection level wire-earth:** <900 V
- **Frequency range:** >250 MHz
- **Temperature range:** -40 - +80 °C
- **Installation type:** Connector/cable adapter
- **Connection system:** RJ45 8(8)
- **Protection rating:** IP20
- **Shielding connection available:** Yes
- **Shield connection:** Direct
- **Earthing via:** Connection cable / hat rail
- **Testing standard:** IEC 61643-21
Surge protection for high-speed networks up to 10 GBit (Class EA/CAT6A)

Data cable protection device for high-speed networks
- High-quality RJ45 sockets
- Low protection level at high current load
- Earthing via DIN rail or connection cable
- Support of Power over Ethernet + to 1 A
- Tested transmission quality in networks up to 10 GBit (Class EA) or CAT6A
- Rapid installation through plug-in version
- Incl. DIN rail fastening set and earthing cable

Application example: 10 GBit Ethernet, 10/100 MBit Ethernet, PoE applications, IP camera systems, ISDN S0 interfaces

Dimensions

ND-CAT6A/EA

Maximum continuous voltage AC, \( U_{\text{AC}} \): 41 V
Maximum continuous voltage DC, \( U_{\text{DC}} \): 58 V
Category: Type 2+3 / C2+C1
Lightning protection zone LPZ: 1-2
Channel performance ISO/IEC: Class EA
Channel performance ANSI/EA: CAT 6A
Number of poles: 8
Rated current, \( I \): 1 A
Impulse durability wire-wire: C1: 0.3 kV / 0.15 kA (8/20µs)
Impulse durability wire-earth: C2: 2 kV / 1 kA (8/20µs)
Total discharge current (8/20): 7 kA
Protection level wire-wire: <120 V
Protection level wire-earth: <700 V
Frequency range: >500 MHz
Temperature range: \(-40^\circ\text{C} \rightarrow +80^\circ\text{C}\)
Installation type: Connector/cable adapter
Connection system: RJ45 8(8)
Protection rating: IP20
Shielding connection available: Yes
Shield connection: Direct
Earthing via: Connection cable / hat rail
Testing standard: IEC 61643-21