

# **DVS\_DC Cable Connection Guide**

Manual Version: V1.02

Thank you for purchasing our product. If there are any questions, or requests, please do not hesitate to contact the dealer.

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- Video and audio surveillance can be regulated by laws that vary from country to country. Check the law in your local region before using this product for surveillance purposes. We shall not be held responsible for any consequences resulting from illegal operations of the device.
- The illustrations in this manual are for reference only and may vary depending on the version or model. The screenshots in this manual may have been customized to meet specific requirements and user preferences. As a result, some of the examples and functions featured may differ from those displayed on your monitor.
- This manual is a guide for multiple product models and so it is not intended for any specific product.
- Due to uncertainties such as physical environment, discrepancy may exist between the actual values and reference values provided in this manual. The ultimate right to interpretation resides in our company.




# Safety and Compliance Information

## Safety Symbols

The symbols in the following table may be found on installation-related equipment. Be aware of the situations indicated and take necessary safety precautions during equipment installation and maintenance.

Symbol	Description
	Generic alarm symbol: To suggest a general safety concern.
	ESD protection symbol: To suggest electrostatic-sensitive equipment.
	Electric shock symbol: To suggest a danger of high voltage.

The symbols in the following table may be found in this manual. Carefully follow the instructions indicated by the symbols to avoid hazardous situations and use the product properly.

Symbol	Description
 <b>WARNING!</b>	Indicates a hazardous situation which, if not avoided, could result in bodily injury or death.
 <b>CAUTION!</b>	Indicates a situation which, if not avoided, could result in damage, data loss or malfunction to product.
 <b>NOTE!</b>	Indicates useful or supplemental information about the use of product.

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# 1 Overview

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This guide describes the guidelines and procedures for connecting a Digital Video Server (DVS) or DC (decoder) to other devices with cables, and instructions on how to protect an outdoor DVS or DC against lightning, how to ground it, and how to select a protection box for it.

Before installing a DVS or DC, read this guide carefully.

## 2 Connecting to Other Devices


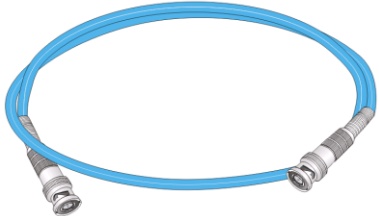
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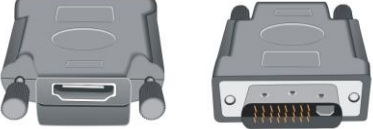


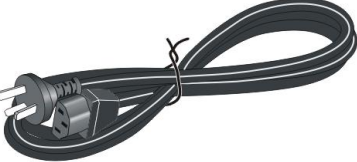

A DVS can be connected to PTZ cameras, third-party devices, audio/video devices, and alarm devices, and a DC can be connected to monitors, third-party devices, audio/video devices, and alarm devices.

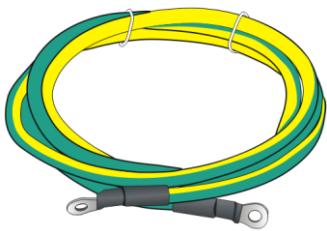
This chapter describes common cables, cable requirements, and cable connection procedures.

### Common Cables

**Table 2-1** Common cables and adapters

Cable/adaptor picture	Cable/adaptor name	Description
	Composite video cable	Used to connect to a camera or DVD player to transmit analog video signals.
	SDI cable	Used to connect to a high-definition (HD) camera to transmit SDI digital video signals.

Cable/adaptor picture	Cable/adaptor name	Description
	VGA cable	Used to connect to a VGA device, for example, PC or TV, to transmit VGA video signals.
	HDMI cable	Used to connect to an HDMI digital device, for example, PC or TV, to transmit HDMI digital audio/video signals.
	DVI cable	Used to connect to a high-definition DVI device, for example, PC or TV, to transmit DVI digital video signals.
	DVI to HDMI adaptor	Used to with an HDMI cable to transmit HD digital audio/video signals.
	DVI to VGA adaptor	Used with a VGA cable to transmit analog video signals.
	MIC cable	Used to connect to a microphone.
	Power cord	Used to connect to alternating the current (AC) power source.
	Network cable	Used to connect to a network access device.

Cable/adaptor picture	Cable/adaptor name	Description
	Grounding cable	Used to connect to a grounding bar or other grounding object to protect the device from interference caused by current.

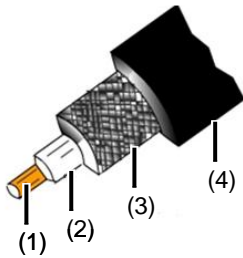
## Cable Requirements

### Video Cables

#### Composite video cables

The commonly used composite video cables are coaxial cables. A coaxial cable consists of four layers. This cable has a copper center conductor surrounded by a foam polyethylene dielectric. A bonded copper braid provides shield coverage and the outermost polyethylene cover provides protection for the whole cable. The cable structure is shown in [Figure 2-1](#).

**Figure 2-1** Coaxial cable



1: Center conductor	2: Polyethylene dielectric	3: Copper braid	4: Polyethylene cover
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A larger section surface of the conductor provides less signal loss during transmission and a longer transmission distance. The shield coverage prevents the transferred signals from being interfered by external electromagnetic waves and electrostatic fields.

Coaxial cables include SYV-75-3, SYV-75-5, SYV-75-7, and SYV-75-9. The transmission distance of a cable depends on the ambient environment where the cable is used. Generally, in an environment with little electromagnetic interference and if the signal transmission attenuation is no more than 3 dB, the transmission distance of SYV-75-5C is no more than 200 m (656.168 ft), and that of SYV-75-7C is no more than 300 m (984.252 ft). For more information about cable length that a DVS supports, see the actual specifications of the product.

The following lists the requirements on composite video cables:

- 75-ohm impedance
- Full copper center conductor
- 95% copper braid

- 5 mm or 7 mm or larger cable diameter.
- 128 braid

### SDI cables

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#### NOTE!

SDI cables and composite video cables are the same in appearance, but they are different in functionality. Do not use a composite video cable to replace an SDI cable.

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The following lists the requirements on SDI cables:

- The cable length is no more than 100 m (328.084 ft). Select a cable as required.
- The frequency attenuation per hundred meters is less than 20 dB.
- 75-ohm impedance
- Belden and Canare SDI cables are recommended.

### VGA cables

The following lists the requirements on VGA cables:

- A larger cable diameter indicates a better transmission quality. The inner shield braid can avoid signal interference, and an external magnet ring can shield external interference.
- The transmission distance depends on the cable materials. Generally, the maximum transmission distance of an engineering-level VGA cable is approximately 50 m (164.042 ft), and the maximum transmission distance of an ordinary VGA cable is approximately 15 m (49.2126 ft).
- To apply VGA cables for long-distance transmission, the following solutions can be used:
  - VGA cable plus VGA amplifier. This solution is not good because it also amplifies interference signals.
  - RGB cable plus RGB long-line driver. This solution is not good in synchronization and cannot eliminate interference signals completely though it can reduce them.
  - Twisted pair cable plus twisted pair transmission device. This solution is good because it is interference-free and can solve the synchronization problems through signal compensation.

### HDMI cables

The following lists the requirements on HDMI cables:

- A good-quality HDMI cable has a high-purity oxygen-free copper conductor surrounded by multiple layers of high-density aluminum and magnesium foil or tin-plated copper foil, featuring low interference and low impedance. The connectors are gold plated or silver plated with aluminum foil to prevent electromagnetic interference (EMI) and radio frequency interference (RFI).
- A larger cable diameter indicates a better transmission quality. HDMI cables include the following models: 26AWG, 28AWG, and 30AWG, where AWG is short for American Wire Gauge. A smaller value presents a larger cable diameter.
- The maximum transmission distance should be no more than 15 m (49.2126 ft).



- Do not overbend, fold, or twist HDMI cables because the cable core or shield braid might be damaged.
- HDMI adapters include standard adapter and mini adapter. Our products use standard HDMI adapter.
- HDMI cables include version 1.2 and version 1.3. Version 1.3 is better than version 1.2.
- HDMI certified cables are recommended.

### DVI cables

DVI cables can transmit various video signals, which require different cable materials. For more information, see [HD DVS/DC video cable connection](#). If a DVI cable is not connected to another adapter, the requirements on DVI cables are the same as HDMI cables.

## Audio Cables

Audio cables are usually made from 4-core shielded cable (PVVP) or unshielded digital communication cables. A larger section surface is required, for example, 0.5 mm<sup>2</sup>. It is recommended you to use shielded audio cables and the maximum cable length is 100 m (328.08 ft.). Commonly used audio cables include RCA general audio cables and ordinary coaxial cables.

## Alarm Cables

Twisted pair cables are recommended. The cable should range from 22 AWG to 28 AWG (24AWG and 26AWG are preferred). The direct current (DC) impedance must not be more than 100 ohm. The following table shows the maximum length for different cables, taking 100 ohm as the maximum impedance.

**Table 2-2** Maximum length for different alarm cables

Specification (AWG)	Maximum length
22	1453 m (4767.06 ft)
24	914 m (2998.69 ft)
26	570 m (1870.08 ft)
28	360 m (1181.10 ft)

## RS485 Serial Cables

It is recommended to use the following materials for RS485 serial cables:

- UL-certified twisted pair cables that meet the standards of UL2464 and UL20276.
- Category-3 and higher cables that meet the overall cabling standards. The cable core can range from 22 to 28 American Wire Gauge (AWG). 24 AWG and 26 AWG are recommended.

The impedance of the cable should be in the range from 90 ohm to 150 ohm. The RS485 port supports long distance communication; however, you must ensure that the overall cable attenuation is no more than 6 dB. For a DVS or DC, the total cable length should be no more than

900 m (2952.76 ft.), and the baud rate is recommended to be no more than 9600 bps. If a higher baud rate is required, choose the cable length according to the following table. If a too long cable is required, it is recommended to use repeaters to extend the transmission distance. A T-shape or Z-shape connection is preferred, or a star-shaped connection is adopted after an RS485 hub is deployed at the device side.

**Table 2-3** Maximum length of an RS485 cable at different baud rates

Baud rate (bps)	Maximum length
1200, 2400, 4800, 9600, 19200	900 m (2952.76 ft.)
38400	850 m (2788.71 ft.)
57600	550 m (1804.46 ft.)
76800	400 m (1312.34 ft.)
115200	250 m (820.21 ft.)



**CAUTION!**

It is not necessary to add a device matching resistance to an RS485 port of a DVS, and you must shut down the resistance of every connecting dome camera. For detailed instructions, see the user guide of the related dome camera.

## Network Cables

Network cables are mostly made from twisted pair cables, which are the most commonly used in cabling. Twisted pair cables includes unshielded twisted pair (UTP) cables and shielded twisted pair (STP) cables. An STP cable has a layer of bonded aluminum foil to reduce radiation. STP cables are more expensive than UTP cables, and STP cable installation is more difficult than UTP cable installation.

## Ground Wire

The ground wire should be no longer than 30 meters (98.43 ft.), and its impedance must be less than 5 ohm. For more information, see the YD5098 standard.

## Other Cables

### Adapter types

Commonly used adapters include the following:

- DVI series converters: including DVI to YPbPr converter, DVI to VGA converter, and DVI to HDMI converter.
- VGA series converters: including VGA to YPbPr converter, and VGA to DVI converter.

## HD DVS/DC video cable connection

The following tables list the requirements on the cables and converters when the DVS and DC connect to a camera, a PC, or a display device.

**Table 2-4** HD DVS video cable connection requirements

Video input card	Input interface and cable		Interface on camera or PC
SDI	BNC interface, standard SDI cable		BNC
DVI	DVI interface	VGA to DVI converter, VGA cable <b>Note:</b> The display settings only support the resolutions up to 1024×768 and a screen refresh rate of 60 Hz.	VGA
		YPbPr to DVI converter, YPbPr cable	YPbPr
		HDMI to DVI cable	HDMI
		DVI cable	DVI-D
HDMI	HDMI interface, HDMI cable		HDMI

**Table 2-5** HD DC video cable connection requirements

Video output card	Cable	Display interface
VGA	VGA to YPbPr cable	YPbPr
	VGA cable	VGA
HDMI	HDMI to DVI cable <b>Note:</b> The display must support HDTV.	DVI-D/I
	HDMI cable	HDMI

## Connecting Cables

### Cable Connection Guidelines

- Separate strong-electricity cables (for example, power cord) at least 30 cm (11.81 in) away from weak-electricity cables (for example, network cable and audio/video cables). Use cable ties to bind long cables and use labels on the cables for easy identification.
- When you install video cables, keep the cables away from interference sources, for example, high-frequency signal source and elevator motor. Do not overbend or overstretch the cables, or install them near heat sources.
- When you install audio cables or alarm cables, keep the cables away from interference sources.

- Use T-shape connection when you connect RS485 serial cables, that is, use one cable as a trunk, and distribute branches on the trunk. The cable on a trunk should be no more than 15 m (49.21 ft), and the terminating resistance is installed on the farthest camera. If multiple nodes are not in a straight line, use zigzag-shape connection. Do not use star shape or combination of T shape and zigzag shape.
- A network cable should be no more than 100 m (328.084 ft). The network cables that you make must comply with the T568B standard.
- Do not lay video cables or RS485 serial cables on stilts. Take lightning protection measures, for example, by using an external lightning protection device, when you lay video cables and RS485 cables outdoors. For more information, see [Installing a Lightning Protection Device](#).



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**NOTE!**

When connecting cables for a high-definition DVS, strictly follow the instructions of the product. For more information, see related engineering specifications of the DVS.

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For more information about connection of various cables, see the quick starts of the related device models. This chapter describes only cable connection on the RS485 port. The diagrams are for illustration only.

## Connecting to PTZ Cameras Through an RS485 Port in PTZ Control Mode

An RS485 port can be connected with an RJ45 connector or a phoenix connector. The following describes how to connect a DVS to one or multiple PTZ cameras through the RS485 port using different connectors.

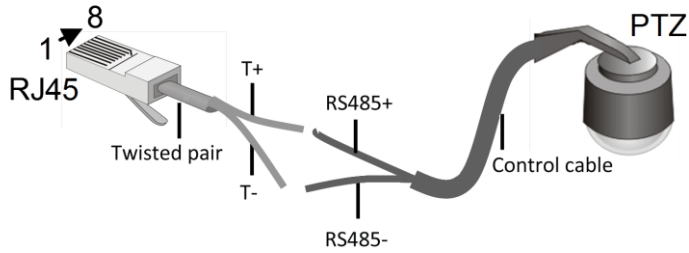
### Connecting a DVS to a PTZ camera using an RJ45 connector

- Connect using a four-wire RJ45 connector  
Connect T+ of the RJ45 connector to RS485+ of the PTZ control cable; and connect T- of the RJ45 connector to RS485- of the PTZ control cable, as shown in [Figure 2-2](#). If the PTZ camera uses a ground wire, connect the ground pin of the PTZ control cable to the ground pin (pin 7 or 8) of the RJ45 connector.

**Figure 2-2** Connect a four-wire RJ45 connector to a PTZ control cable

RJ45 pinouts

1:T+ 2:T- 3:N/A 4:R+ 5:R- 6:N/A 7:G 8:G



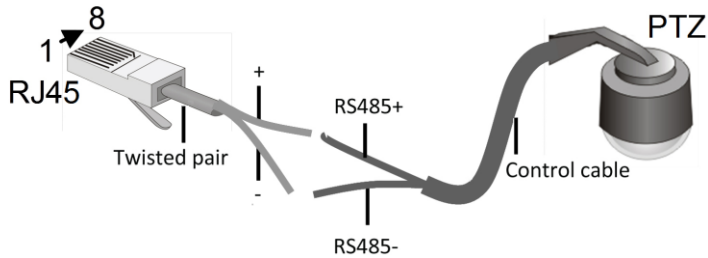
**Table 2-6** Four-wire RJ45 connector pinouts

Pin	Description
T+	Transmit (RS485, positive)
T-	Transmit (RS485, negative)
R+	Receive (RS485, positive)
R-	Receive (RS485, negative)
G	Ground
N/A	Reserved

- Connect using a two-wire RJ45 connector  
 Connect + of the RJ45 connector to RS485+ of the PTZ control cable; and connect - of the RJ45 connector to RS485- of the PTZ control cable, as shown in [Figure 2-3](#). If the PTZ camera uses a ground wire, connect the ground pin of the control cable to the ground pin (pin 4, 5, 7 or 8) of the RJ45 connector.

**Figure 2-3** Connect a two-wire RJ45 connector to a PTZ control cable

RJ45 pinouts  
 1:+ 2:- 3:N/A 4:G 5:G 6:N/A 7:G 8:G



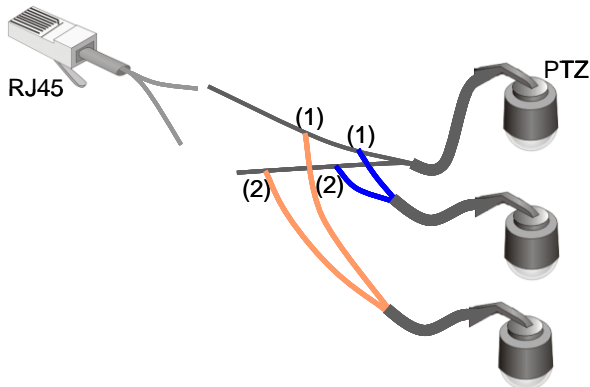
**Table 2-7** Two-wire RJ45 connector pinouts

Pin	Description
+	Transmit (RS485, positive)
-	Transmit (RS485, negative)
G	Ground
N/A	Reserved

**Connecting a DVS to multiple PTZ cameras using an RJ45 connector**

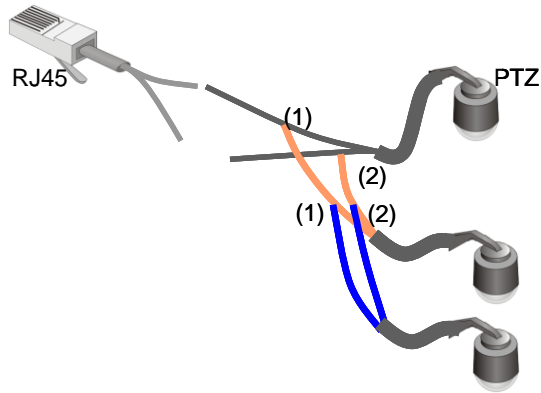
Connect the RJ45 connector to the PTZ control cables as shown in [Figure 2-4](#) and [Figure 2-5](#).

**Figure 2-4** Connect an RJ45 connector to multiple PTZ control cables (T-shape)



- 
- 1: Twist A (RS485+) of the PTZ control cables
  - 2: Twist B (RS485-) of the PTZ control cables
-

**Figure 2-5** Connect an RJ45 connector to multiple PTZ control cables (zigzag-shape)



1: Twist A (RS485+) of the PTZ control cables

2: Twist B (RS485-) of the PTZ control cables



**NOTE!**

When connecting cables in zigzag shape, ensure that the joints are at the connection terminals of the RS485 serial cables.

**Connecting multiple DVS to multiple PTZ cameras using RJ45 connectors**

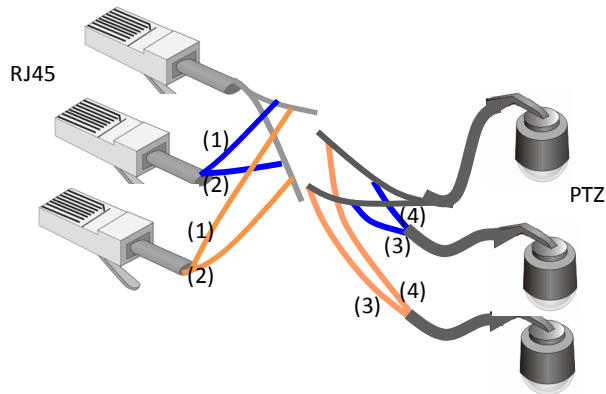


**NOTE!**

Before you start connection, access the device using a web browser (by visiting its IP address) and set the working mode of the serial port to half-duplex.

Connect the RJ45 connectors to the PTZ control cables as shown in the figures below.

**Figure 2-6** Connect multiple RJ45 connectors to multiple PTZ control cables (T-shape)



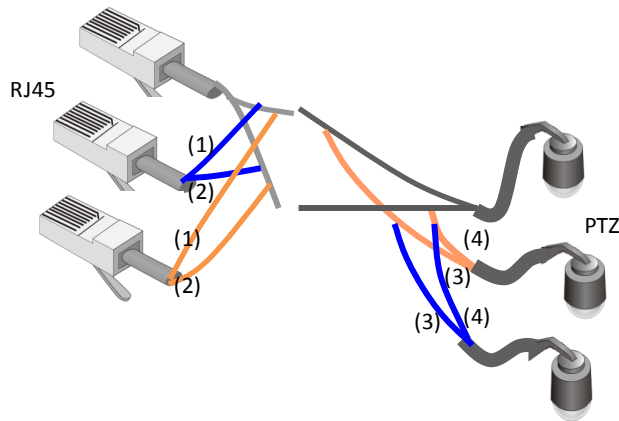
1: T+ or + of the RJ45 connectors

2: T- or - of the RJ45 connectors

3: Twist A (RS485+) of the PTZ control cables

4: Twist B (RS485-) of the PTZ control cables

**Figure 2-7** Connect multiple RJ45 connectors to multiple PTZ control cables (zigzag-shape)



1: T+ or + of the RJ45 connectors	2: T- or – of the RJ45 connectors
3: Twist A (RS485+) of the PTZ control cables	4: Twist B (RS485-) of the PTZ control cables



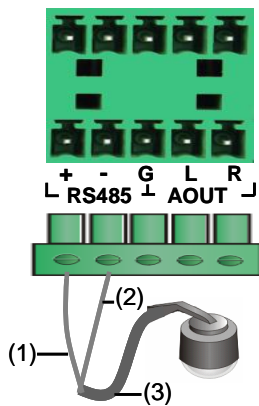
**NOTE!**

When connecting cables in zigzag shape, ensure that the joints are at the connection terminals of the RS485 serial cables.

**Connecting a DVS to a PTZ camera using a phoenix connector**

- Connect using a type A phoenix connector  
 Connect + of the phoenix connector to A (RS485+) of the PTZ control cable; and connect - of the phoenix connector to B (RS485-) of the PTZ control cable, as shown in [Figure 2-8](#). If the PTZ camera uses a ground wire, connect the ground pin of the control cable to the ground pin of the phoenix connector. The following takes a high-definition DVS as an example.

**Figure 2-8** Connect a type A phoenix connector to a PTZ control cable



1: A (RS485+)	2: B (RS485-)	3: PTZ control cable
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**Table 2-8** Phoenix connector pinouts

Pin	Description
+	Transmit (RS485, positive)
-	Transmit (RS485, negative)
G	Ground

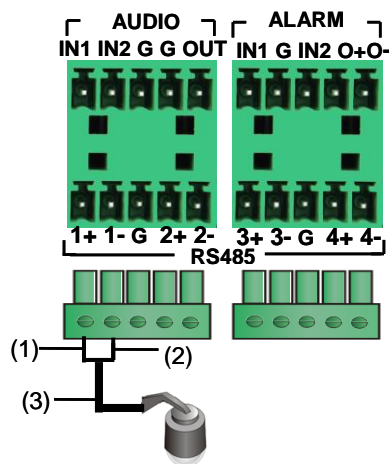


**NOTE!**

When a DC uses a phoenix connector to connect to a PTZ camera, connect A of the phoenix connector to A (RS485+) of the PTZ control cable, and connect B of the phoenix connector to B (RS485-) of the PTZ control cable.

- Connect using a type B phoenix connector  
 Connect any + pin of the phoenix connectors 1-4 to A (RS485+) of the PTZ control cable; and connect - of the phoenix connector to B (RS485-) of the PTZ control cable, as shown in [Figure 2-8](#). If the PTZ camera uses a ground wire, connect the ground pin of the control cable to the ground pin of the phoenix connector.

**Figure 2-9** Connect a type B phoenix connector to a PTZ control cable

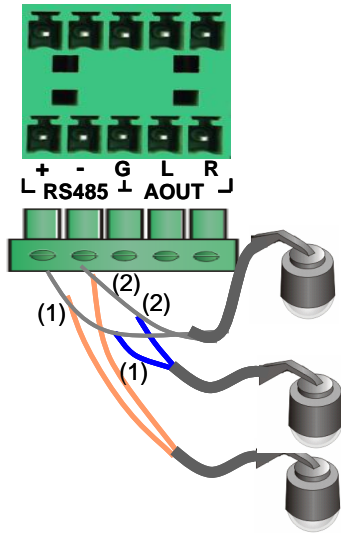


1: A (RS485+)	2: B (RS485-)	3: PTZ control cable
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**Connecting a DVS to multiple PTZ cameras using a phoenix connector**

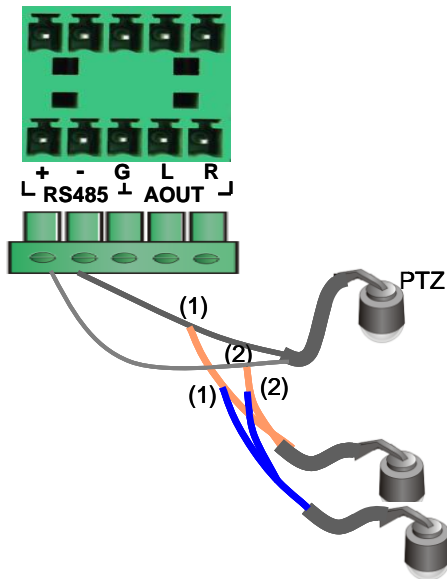
- Connect using a type A phoenix connector  
 Twist A (RS485+) of the PTZ control cables, twist B (RS485-) of the PTZ control cables, and connect the phoenix connector to the PTZ control cables as shown in the figures below.

**Figure 2-10** Connect a type A phoenix connector to multiple PTZ control cables (T-shape)



- 
- 1: Twist A (RS485+) of the PTZ control cables
  - 2: Twist B (RS485-) of the PTZ control cables
- 

**Figure 2-11** Connect a type A phoenix connector to multiple PTZ control cables (zigzag-shape)



- 
- 1: Twist A (RS485+) of the PTZ control cables
  - 2: Twist B (RS485-) of the PTZ control cables
- 



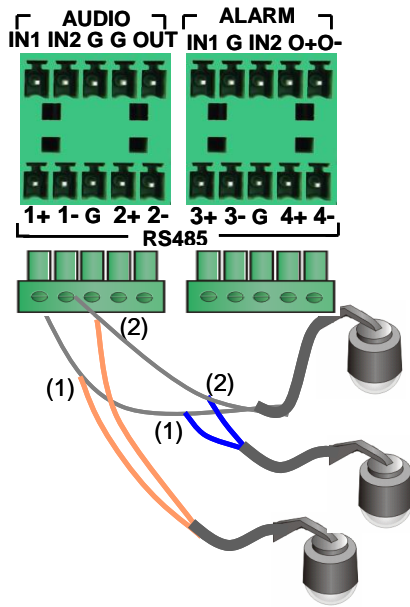
**NOTE!**

When connecting cables in zigzag shape, ensure that the joints are at the connection terminals of the RS485 serial cables.

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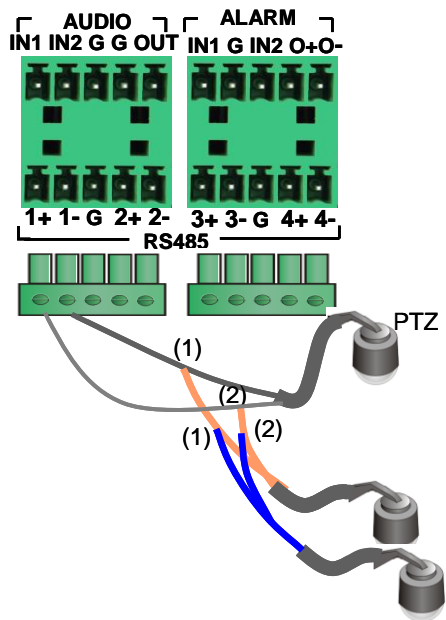
- Connect using a type B phoenix connector  
Twist A (RS485+) of the PTZ control cables, twist B (RS485-) of the PTZ control cables, and connect the phoenix connector to the PTZ control cables as shown in the figures below.

**Figure 2-12** Connect a type B phoenix connector to multiple PTZ control cables (T-shape)



- 
- 1: Twist A (RS485+) of the PTZ control cables
  - 2: Twist B (RS485-) of the PTZ control cables
- 

**Figure 2-13** Connect a type B phoenix connector to multiple PTZ control cables (zigzag-shape)



- 
- 1: Twist A (RS485+) of the PTZ control cables
  - 2: Twist B (RS485-) of the PTZ control cables
-

**NOTE!**

When connecting cables in zigzag shape, ensure that the joints are at the connection terminals of the RS485 serial cables.

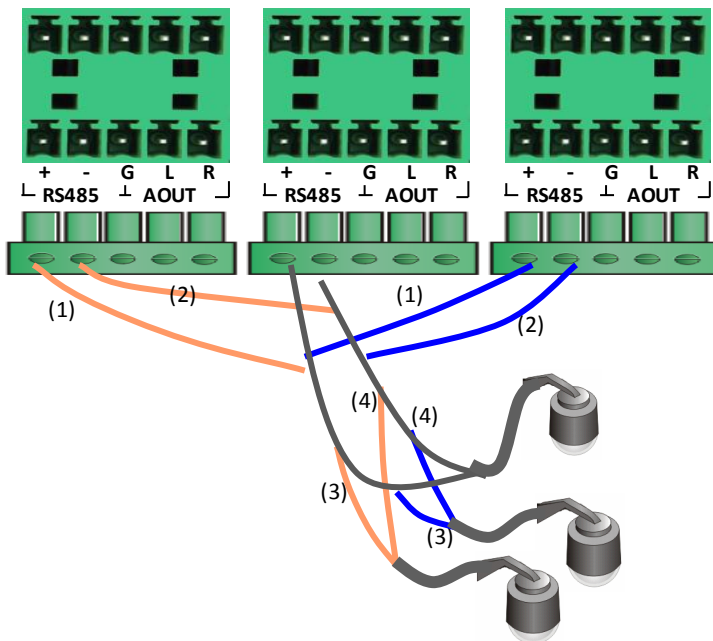
### Connecting multiple DVS to multiple PTZ cameras using phoenix connectors

**NOTE!**

Before you start connection, access the device using a web browser (by visiting its IP address) and set the working mode of the serial port to half-duplex.

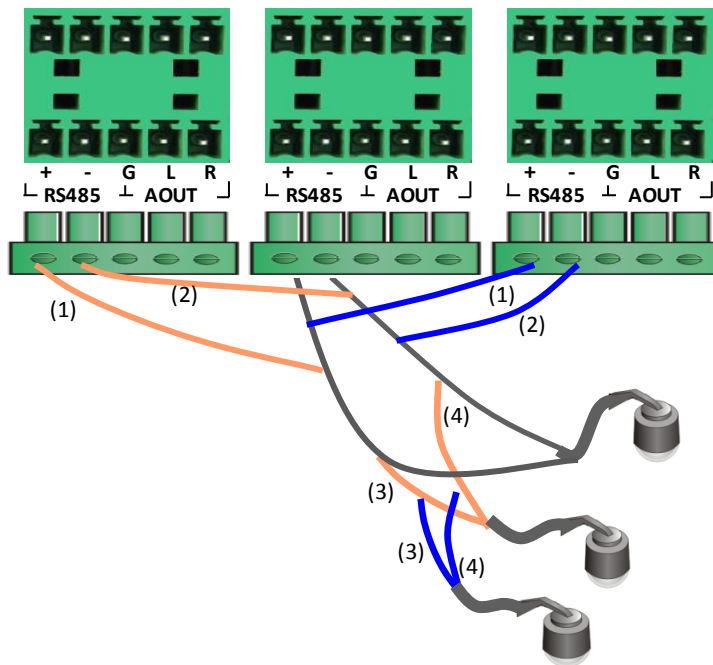
- Connect using type A phoenix connectors as shown in the figures below.

**Figure 2-14** Connect type A phoenix connectors to PTZ control cables (T-shape)



1: RS485+	2: RS485-
3: Twist A (RS485+) of the PTZ control cables	4: Twist B (RS485-) of the PTZ control cables

**Figure 2-15** Connect multiple phoenix connectors to multiple PTZ control cables (zigzag-shape)



1: RS485+	2: RS485-
3: Twist A (RS485+) of the PTZ control cables	4: Twist B (RS485-) of the PTZ control cables



**NOTE!**

When connecting cables in zigzag shape, ensure that the joints are at the connection terminals of the RS485 serial cables.

- Refer to [Figure 2-14](#) and [Figure 2-15](#) for connection using type B phoenix connectors.

### Connecting to a Third-Party Device Through an RS485 Port in Transparent Channel Mode

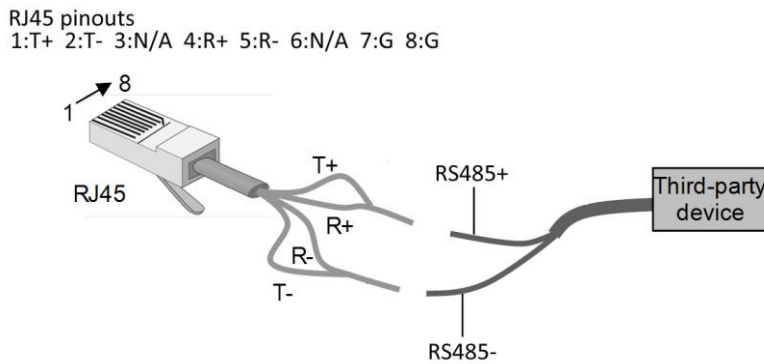
An RS485 port can be connected with an RJ45 connector or a phoenix connector. For some DVS and DC models, the RS485 port connected with an RJ45 connector is compatible with RS422. The following describes how to connect an RS485 port to a third-party device by using different connectors.

**Connecting through an RS422-compatible RS485 port**

Connect the RJ45 connector to the third-party device as follows:

- Twist T+ and R+ of the RJ45 connector and connect them to the RS485+ of the third party device cable. Twist T- and R- of the RJ45 connector and connect them to RS485- of the third party device cable, as shown in [Figure 2-16](#).
- If the third party device uses a ground wire, connect the ground pin of the third-party device to the ground pin (pin 7 or 8) of the RJ45 connector.

**Figure 2-16** Connect through an RS422-compatible RS485 port



**Connecting through an**

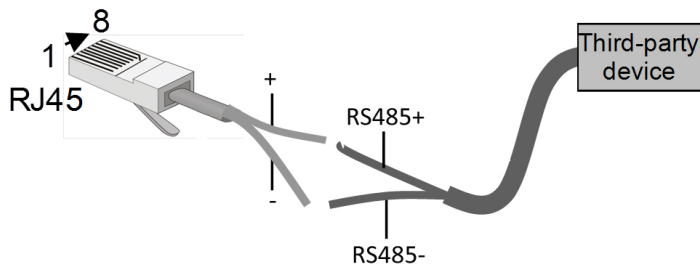
### **RS422-incompatible RS485 port**

Connect the RJ45 connector to the third-party device as follows:

- Connect + of the RJ45 connector to RS485+ of the third-party device, and connect - of the RJ45 connector to RS485- of the third-party device, as shown in [Figure 2-17](#).
- If the third party device uses a ground wire, connect the ground pin of the control cable of the third party device to the ground pin (pin 4, 5, 7 or 8) of the RJ45 connector.

**Figure 2-17** Connect through an RS422-incompatible RS485 port

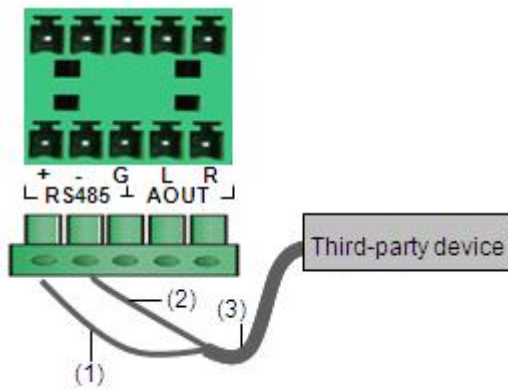
RJ45 pinouts  
1:+ 2:- 3:N/A 4:G 5:G 6:N/A 7:G 8:G



### **Connecting through phoenix connector**

- If the RS485 port is connected with a type A phoenix connector (see the figure below), connect the phoenix connector to the third-party device as follows:  
Connect + of the phoenix connector to RS485+ of the third-party device, and connect - of the phoenix connector to RS485- of the third-party device, as shown in [Figure 2-18](#). If the third-party device uses a ground wire, connect the ground pin of the control cable of the third party device to the ground pin of the phoenix connector.

**Figure 2-18** Connect a type A phoenix connector to a third-party device



1: RS485+	2: RS485-	3: Third-party device cable
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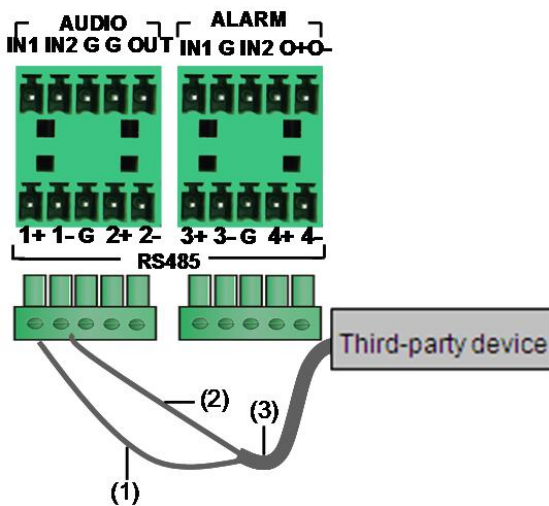


**NOTE!**

When a DC uses a phoenix connector to connect to a third-party device, connect A of the phoenix connector to RS485+ of the third-party device, and connect B of the phoenix connector to RS485- of the third-party device.

- If the RS485 port is connected with a type B phoenix connector (see the figure below), connect the phoenix connector to the third-party device as follows:  
Connect + of the phoenix connector to RS485+ of the third-party device, and connect - of the phoenix connector to RS485- of the third-party device, as shown in [Figure 2-18](#). If the third-party device uses a ground wire, connect the ground pin of the control cable of the third party device to the ground pin of the phoenix connector.

**Figure 2-19** Connect a type B phoenix connector to a third-party device

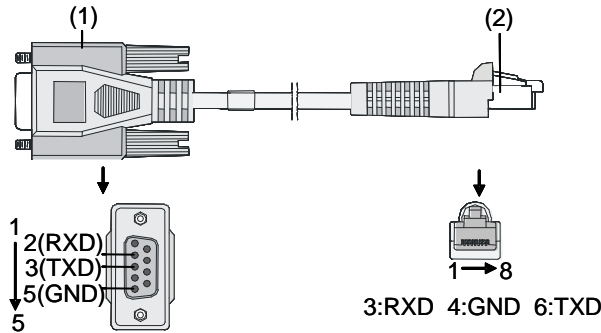


1: RS485+	2: RS485-	3: Third-party device cable
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## Connecting to a Serial Device Through an RS232 Cable

When connecting a serial device (e.g., PC) to a DVS or DC through an RS232 port for maintenance purpose, connect the cable as follows. The following takes a DB-9 connector as an example.

**Figure 2-20** RS232 serial cable



1: DB-9 connector	2: RJ45 connector
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**Table 2-9** RS232 serial cable pinouts and description

DB-9 pin	DB-9 terminal	RJ45 pin	RJ45 terminal	Description
2	RXD	3	RXD	Receive signal
3	TXD	6	TXD	Transmit signal
5	GND	4	GND	Ground

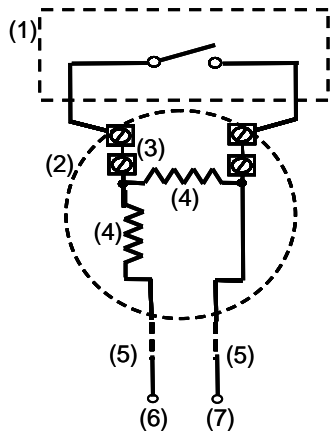
## Connecting to an Alarm Input Device with the Wire Detection Function

When the DVS connects to an external alarm input device, you can change hardware to implement the wire detection function at the alarm input. The hardware change is similar unless otherwise noted.

If the device has the wire detection function at the alarm input, it can generate short-circuit alarms and open-circuit alarms by detecting the impedance changes on the external alarm loop. To connect to the device, install the wire end resistors inside the alarm input device at the outlet terminal, as shown in [Figure 2-21](#).



**Figure 2-21** Install the wire end resistors



1: Unchanged part of the normally-open/closed Boolean alarm input device	
2: Changed part of the normally-open/closed Boolean alarm input device	
3: Outlet terminal of the alarm input device	4: Wire end resistors (2.2 kohm, shipped with the device)
5: Conducting wire that connects the device to the alarm input device (prepared by users)	
6: Terminal 1 or 2 of the alarm-in port on the device	
7: Ground terminal of alarm-in port of the device	



**NOTE!**

Ensure that the wire end resistor, outgoing line terminal, and conducting wire are connected securely.

### Connecting to an Alarm Output Device

When connecting a DVS or DC with multiple external alarm output devices in one circuit, you can connect them in serial or parallel connection mode as required.

## 3 Lightning Protection

Generally, DVS and DC devices are installed outdoors. To protect them from lightning, you can install outdoor protection boxes, ground them properly, and install lightning protection devices for them.



**NOTE!**

Some device models can be installed indoors only. For details, see the datasheet.

## Outdoor Protection Box

If you install a DVS or DC outdoors, place it in an outdoor protection box to guard against severe environments.

When you use an outdoor protection box, the following requirements should be met:

- Provide grade-1 preventative capability against mildew, moisture and corrosion, that is, 72-hour salt mist corrosion test; IP21 protection against the intrusion of dust, spherical objects (with a 12.5 mm diameter), and water (IPX1, vertical water drops).
- By using a heating component or a heat dissipation device, keep the internal temperature in the range of 0 °C to 60 °C (32 °F to 140 °F) when a DVS or DC is installed in the box.
- Provide a direct current (DC) power input, which meets the power supply requirements of the specific DVS or DC.
- If other devices need to be placed in the outdoor protection box, do not stack the devices. Keep at least a clearance of 5 cm (1.97 in.) around the air vents of the DVS or DC for heat dissipation.
- Provide a grounding bar, and connect it to the device ground wire, lightning protection device ground wire, main ground wire, and the box door ground wire to form an equipotential object.

## Grounding the Device

Proper grounding ensures safe and stable device operation against lightning, interference and static electricity. Before using the device, ground the device properly.



### **NOTE!**

The following sections illustrate how to ground the device through grounding screws or through the power source input. The connection positions in these diagrams are for illustration only.

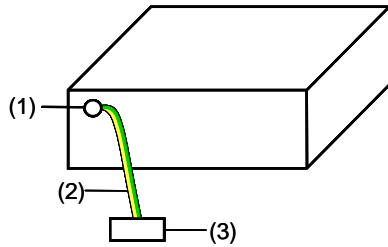
## Grounding a Device with DC Power Supply

The same grounding method is used for the DVS which adopts direct current (DC) power supplies.

### **Using a grounding bar for grounding**

When the equipment room has a grounding bar, you can connect one end of the ground wire of the device to the cable post of the grounding bar and fasten them with screws, as shown in the following figure.

**Figure 3-1** Ground the device through a grounding bar



1: Grounding screw	2: Ground wire	3: Grounding bar
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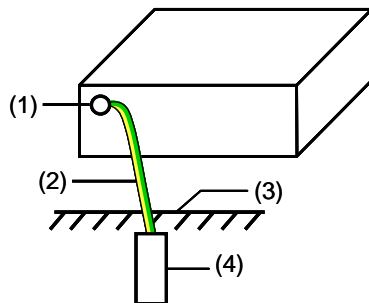
**CAUTION!**

Connect the ground wire of the device to the protection ground in the equipment room. Do not ground the chassis to a fire hydrant, radiator, or lightning arrester.

**Using a buried object for grounding**

If there is no grounding bar but an earth ground available for burying an object, you can bury an angle iron (or steel pipe) no less than 0.5 m (1.64 ft.) to the earth for grounding. Then, connect the ground wire of the device to the angle iron (or steel pipe) by welding, as shown in the following figure. The welding point should be treated against corrosion.

**Figure 3-2** Ground the device through a buried object



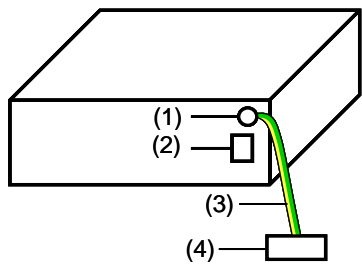
1: Grounding screw	2: Ground wire	3: Earth	4: Angle iron (or steel pipe)
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**Grounding a Device with AC Power Supply**

**Using a grounding bar for grounding**

When the equipment room has a grounding bar, you can connect one end of the ground wire of the device to the cable post of the grounding bar and fasten them with screws, as shown in the following figure.

**Figure 3-3** Ground the device through a grounding bar



1: Grounding screw	2: AC power input	3: Ground wire	4: Grounding bar
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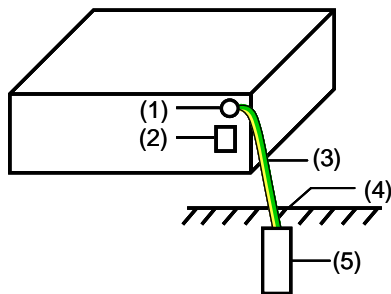
**CAUTION!**

Connect the ground wire of the chassis to the protection ground in the equipment room. Do not ground the chassis to a fire hydrant, radiator, or lightning arrestor.

**Using a buried object for grounding**

If there is no grounding bar but an earth ground available for burying an object, you can bury an angle iron (or steel pipe) no less than 0.5 m (1.64 ft.) to the earth for grounding. Then, connect the ground wire of the device to the angle iron (or steel pipe) by welding, as shown in [Figure 3-4](#). The welding point should be treated against corrosion.

**Figure 3-4** Ground the device by burying an object to the earth

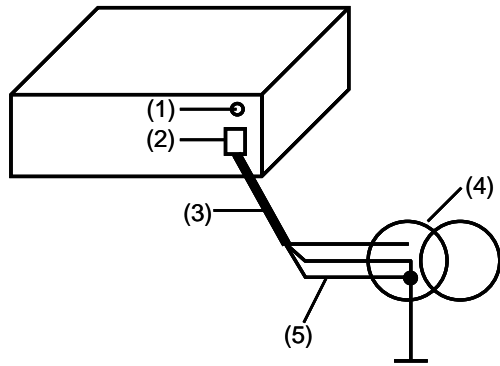


1: Grounding screw	2: AC power input	3: Ground wire	4: Earth
5: Angle iron (or steel pipe)			

**Using a protective earthing conductor of AC power cable for grounding**

If the device installation environment does not have a grounding bar, and does not allow burying a grounding object, you can ground the device by connecting it to the PE conductor of the Alternating Current (AC) power cable, as shown in [Figure 3-5](#). Meanwhile, make sure the PE conductor is properly grounded in the power distribution room or at the AC transformer side.

**Figure 3-5** Ground the device through a PE conductor



1: Grounding screw	2: AC power input	3: AC power cable
4: Power transformer	5: PE conductor	

## Installing a Lightning Protection Device

To ensure the safety and normal operation of a DVS/DC, use power supply lightning protection device or signal lightning protection device as required to provide lightning protection.

### Installation Tools

- Phillips screwdriver and flathead screwdriver
- Multimeter
- Diagonal cutting pliers

### Installation Procedure

1. Place the lightning protection device near the grounding terminal of the DVS or DC, and fix the lightning protection device.
2. Cut the ground wire of the lightning protection device to a proper length according to the distance between the lightning protection device and the DVS or DC, and fix the ground wire to the grounding terminal of the DVS or DC.
3. Use the multimeter to check whether the ground wire has good contact with the grounding terminal and the chassis of the DVS or DC.
4. Use the connection cables to connect the input terminal (IN) of the lightning protection device with the external signal cable, and connect the output terminal (OUT) of the lightning protection device with the DVS or DC to be protected. Check whether the LEDs of the DVS or DC work normally.
5. Bind the cables with nylon cable ties.

For more information, see the user guide of the related lightning protection device.