Systembeschreibung | System description | Description du système
Descrizione del sistema | Descripción de sistema | Systembeskrivning

R412018139-BAL-001-AG
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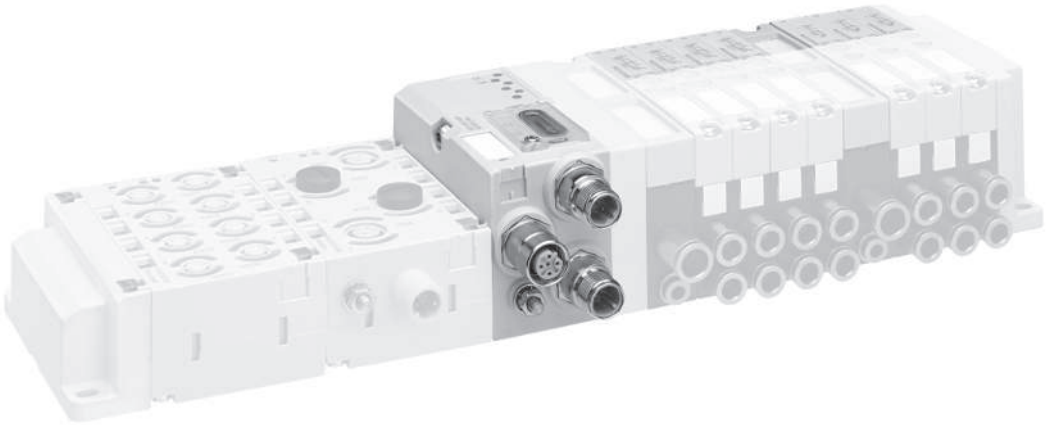
DE/EN/FR/IT/ES/SV

AVENTICS™ EtherNet/IP

Buskoppler AES/Ventiltreiber AV
Bus Coupler AES/Valve Driver AV
Coupleur de bus AES/Pilote de distributeurs AV
Accoppiatore bus AES/driver valvole AV
Acoplador de bus AES/controladores de válvula AV
Fältbussnod AES/Ventildrivenhet AV

EtherNet/IP™



EMERSON™

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1 About This Documentation

1.1 Documentation Validity

This documentation is valid for the AES series bus couplers for EtherNet/IP, with material numbers R412018222 and R412088222. The documentation is geared toward programmers, electrical engineers, service personnel, and system owners.

This documentation contains important information on the safe and proper commissioning and operation of the product and how to remedy simple malfunctions yourself. In addition to a description of the bus coupler, it also contains information on the PLC configuration of the bus coupler, valve drivers, and I/O modules.

1.2 Required and Supplementary Documentation

▶ Only commission the product once you have obtained the following documentation and understood and complied with its contents.

Table 1: Required and supplementary documentation

Documentation	Document type	Comment
System documentation	Operating instructions	To be created by system owner
Documentation of the PLC configuration program	Software manual	Included with software
Assembly instructions for all current components and the entire AV valve system	Assembly instructions	Printed documentation
System descriptions for connecting the I/O modules and bus couplers electrically	System description	PDF file on CD
Operating instructions for AV-EP pressure regulators	Operating instructions	Printed documentation

All assembly instructions and system descriptions for the AES and AV series, as well as the PLC configuration files, can be found on the CD R412018133.

1.3 Presentation of information

1.3.1 Warnings

In this documentation, there are warning notes before the steps whenever there is a risk of personal injury or damage to equipment. The measures described to avoid these hazards must be followed.

Structure of warnings

⚠ SIGNAL WORD

Hazard type and source

Consequences

▶ Precautions

Meaning of the signal words

⚠ DANGER

Immediate danger to the life and health of persons.

Failure to observe these notices will result in serious health consequences, including death.

⚠ WARNING

Possible danger to the life and health of persons.

Failure to observe these notices can result in serious health consequences, including death.

⚠ CAUTION

Possible dangerous situation.

Failure to observe these notices may result in minor injuries or damage to property.

NOTICE

Possibility of damage to property or malfunction.

Failure to observe these notices may result in damage to property or malfunctions, but not in personal injury.

1.3.2 Symbols

Recommendation for the optimum use of our products.

Observe this information to ensure the smoothest possible operation.

1.4 Designations

The following designations are used in this documentation:

Table 2: Designations

Designation	Meaning
Backplane	Internal electrical connection from the bus coupler to the valve drivers and the I/O modules
Left side	I/O zone, located to the left of the bus coupler when facing its electrical connectors
Module	Valve driver or I/O module
Right side	Valve zone, located to the right of the bus coupler when facing its electrical connectors
Stand-alone system	Bus coupler and I/O modules without valve zone
Valve driver	Electrical valve actuation component that converts the signal from the backplane into current for the solenoid coil

1.5 Abbreviations

This documentation uses the following abbreviations:

Table 3: Abbreviations

Abbreviation	Meaning
AES	**A**dvanced **E**lectronic **S**ystem
AV	**A**dvanced **V**alve
BOOTP	**B**ootstrap **P**rotocol Used to set the IP address and additional parameters for diskless computers that load their operating system from a boot server.
DHCP	**D**ynamic **H**ost **C**onfiguration **P**rotocol Used to automatically integrate a computer in an existing network; extension of the Bootstrap Protocol
DNS	**D**omain **N**ame **S**ystem
I/O module	**I**nput/**O**utput module
EtherNet/IP	**EtherNet** **I**ndustrial **P**rotocol
FE	Ground (**F**unctional **E**arth)
EDS	**E**lectronic **D**ata **S**heet
MAC address	**M**edia **A**ccess **C**ontrol address
nc	**n**ot **c**onnected
PLC	**P**rogrammable **L**ogic **C**ontroller or PC assuming control functions
UA	Actuator voltage (power supply for valves and outputs)
UA-ON	Voltage at which the AV valves can always be switched on
UA-OFF	Voltage at which the AV valves are always switched off
UL	Logic voltage (power supply for electronic components and sensors)

2 Notes on Safety

2.1 About This Chapter

The product has been manufactured according to the accepted rules of current technology. Even so, there is danger of injury and damage to equipment if the following chapter and safety instructions of this documentation are not followed.

1. Read these instructions completely before working with the product.
2. Keep this documentation in a location where it is accessible to all users at all times.
3. Always include the documentation when you pass the product on to third parties.

2.2 Intended Use

The AES series bus coupler and AV series valve drivers are electronic components developed for use in the area of industrial automation technology.

The bus coupler connects I/O modules and valves to the EtherNet/IP fieldbus system. The bus coupler may only be connected to valve drivers from AVENTICS and I/O modules from the AES series. The valve system may also be used without pneumatic components as a stand-alone system.

The bus coupler may only be actuated via a programmable logic controller (PLC), a numerical controller, an industrial PC, or comparable controllers in conjunction with a bus master interface with the fieldbus protocol EtherNet/IP.

AV series valve drivers are the connecting link between the bus coupler and the valves. The valve drivers receive electrical information from the bus coupler, which they forward to the valves in the form of actuation voltage.

Bus couplers and valve drivers are for professional applications and not intended for private use. Bus couplers and valve drivers may only be used in the industrial sector

(class A). An individual license must be obtained from the authorities or an inspection center for systems that are to be used in a residential area (residential, business, and commercial areas). In Germany, these individual licenses are issued by the Regulating Agency for Telecommunications and Post (Regulierungsbehörde für Telekommunikation und Post, Reg TP).

Bus couplers and valve drivers may be used in safety-related control chains if the entire system is geared toward this purpose.

▶ Observe the documentation R412018148 if you use the valve system in safety-related control chains.

2.2.1 Use in Explosive Atmospheres

Neither the bus coupler nor the valve drivers are ATEX-certified. ATEX certification can only be granted to complete valve systems. **Valve systems may only be operated in explosive atmospheres if the valve system has an ATEX identification!**

▶ Always observe the technical data and limits indicated on the rating plate for the complete unit, particularly the data from the ATEX identification.

Conversion of the valve system for use in explosive atmospheres is permissible within the scope described in the following documents:

- Assembly instructions for the bus couplers and I/O modules
- Assembly instructions for the AV valve system
- Assembly instructions for pneumatic components

2.3 Improper Use

Any use other than that described under intended use is improper and is not permitted.

Improper use of the bus coupler and the valve drivers includes:

- Use as a safety component
- Use in explosive areas in a valve system without ATEX certification

The installation or use of unsuitable products in safety-relevant applications can result in unanticipated operating states in the application that can lead to personal injury or damage to equipment. Therefore, only use a product in safety-relevant applications if such use is specifically stated and permitted in the product documentation. For example, in areas with explosion protection or in safety-related components of control systems (functional safety).

AVENTICS GmbH is not liable for any damages resulting from improper use. The user alone bears the risks of improper use of the product.

2.4 Personnel Qualifications

The work described in this documentation requires basic electrical and pneumatic knowledge, as well as knowledge of the appropriate technical terms. In order to ensure safe use, these activities may therefore only be carried out by qualified technical personnel or an instructed person under the direction and supervision of qualified personnel.

Qualified personnel are those who can recognize possible dangers and institute the appropriate safety measures, due to their professional training, knowledge, and experience, as well as their understanding of the relevant regulations pertaining to the work to be done. Qualified personnel must observe the rules relevant to the subject area.

2.5 General Safety Instructions

- Observe the regulations for accident prevention and environmental protection.
- Observe the national regulations for explosive areas.
- Observe the safety instructions and regulations of the country in which the product is used or operated.
- Only use AVENTICS products that are in perfect working order.
- Follow all the instructions on the product.
- Persons who assemble, operate, disassemble, or maintain AVENTICS products must not consume any alcohol, drugs, or pharmaceuticals that may affect their ability to respond.
- To avoid injuries due to unsuitable spare parts, only use accessories and spare parts approved by the manufacturer.
- Comply with the technical data and ambient conditions listed in the product documentation.
- You may only commission the product if you have determined that the end product (such as a machine or system) in which the AVENTICS products are installed meets the country-specific provisions, safety regulations, and standards for the specific application.

2.6 Safety Instructions Related to the Product and Technology

⚠ DANGER

Danger of explosion if incorrect devices are used!

There is a danger of explosion if valve systems without ATEX identification are used in an explosive atmosphere.

▶ When working in explosive atmospheres, only use valve systems with an ATEX identification on the rating plate.

⚠ DANGER

Danger of explosion due to disconnection of electrical connections in an explosive atmosphere!

Disconnecting the electrical connections under voltage leads to extreme differences in electrical potential.

1. Never disconnect electrical connections in an explosive atmosphere.
2. Only work on the valve system in non-explosive atmospheres.

⚠ DANGER

Danger of explosion caused by defective valve system in an explosive atmosphere!

Malfunctions may occur after the configuration or conversion of the valve system.

▶ After configuring or converting a system, always perform a function test in a non-explosive atmosphere before recommissioning.

⚠ CAUTION

Risk of uncontrolled movements when switching on the system!

There is a danger of personal injury if the system is in an undefined state.

1. Put the system in a safe state before switching it on.
2. Make sure that no personnel are within the hazardous zone when the valve system is switched on.

⚠ CAUTION

Danger of burns caused by hot surfaces!

Touching the surfaces of the unit and adjacent components during operation could cause burns.

1. Let the relevant system component cool down before working on the unit.
2. Do not touch the relevant system component during operation.

2.7 Responsibilities of the System Owner

As the owner of a system that will be equipped with an AV series valve system, you are responsible for

- ensuring intended use,
- ensuring that operating employees receive regular training,
- ensuring that the operating conditions are in line with the requirements for the safe use of the product,

- ensuring that cleaning intervals are determined and complied with according to environmental stress factors at the operating site,
- ensuring that, in the presence of an explosive atmosphere, ignition hazards that develop due to the installation of system equipment are observed,
- ensuring that no unauthorized repairs are attempted if there is a malfunction.

3 General Instructions on Equipment and Product Damage

NOTICE

Disconnecting connections while under voltage will destroy the electronic components of the valve system!

Large differences in potential occur when disconnecting connections under voltage, which can destroy the valve system.

▶ Make sure the relevant system component is not under voltage before assembling the valve system or when connecting and disconnecting it electrically.

NOTICE

An address change will not be effective during operation!

The bus coupler will continue to work with the previous address.

1. Never change the address during operation.
2. Disconnect the bus coupler from the power supply UL before changing the positions of switches **S1** and **S2**.

NOTICE

Malfunctions in the fieldbus communication due to incorrect or insufficient grounding!

Connected components receive incorrect or no signals. Make sure that the ground connections of all valve system components are electrically connected to each other and grounded.

▶ Verify proper contact between the valve system and ground.

NOTICE

Malfunctions in the fieldbus communication due improperly laid communication lines!

Connected components receive incorrect or no signals.

▶ Lay the communication lines within buildings. If you lay the communication lines outside of buildings, the lines laid outside must not exceed 42 m.

NOTICE

The valve system contains electronic components that are sensitive to electrostatic discharge (ESD)!

If the electrical components are touched by persons or objects, this may lead to an electrostatic discharge that could damage or destroy the components of the valve system.

1. Ground the components to prevent electrostatic charging of the valve system.
2. Use wrist and shoe grounding straps, if necessary, when working on the valve system.

4 About This Product

4.1 Bus Coupler

The AES series bus coupler for EtherNet/IP establishes communication between the superior controller and connected valves and I/O modules. It is designed only for use as a slave in an EtherNet/IP bus system in accordance with IEC 61158 and IEC 61784-1, CPF 2/2. Therefore, the bus coupler must be configured. The CD R412018133, included on delivery, contains an EDS file for the configuration → 5.2. Loading the Device Description File.

During cyclical data transfer, the bus coupler can send 512 bits of input data to the controller and receive 512 bits of output data from the controller. To communicate with the valves, an electronic interface for the valve driver connection is located on the right side of the bus coupler. The left side of the device contains an electronic interface which establishes communication with the I/O modules. The two interfaces function independently.

The bus coupler can actuate a maximum of 64 single or double solenoid valves (128 solenoid coils) and up to 10 I/O modules. It supports 100 Mbit full duplex data communication, as well as a minimum Ethernet/IP cycle time of 2 ms.

All electrical connections are located on the front side, and all status displays on the top.

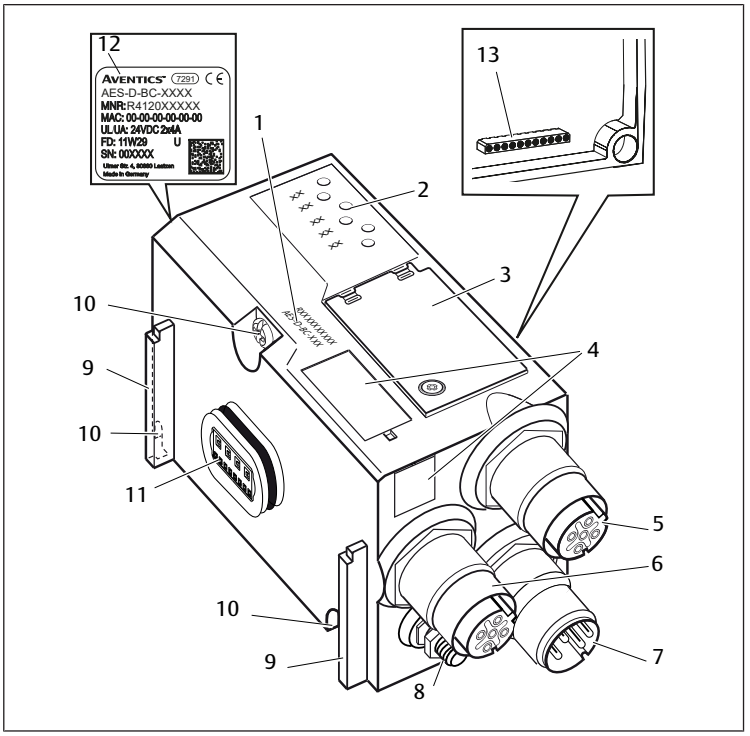


Fig. 1: EtherNet/IP bus coupler

1	Identification key	2	LEDs
3	Window	4	Field for equipment ID
5	X7E1 fieldbus connection	6	X7E2 fieldbus connection
7	X1S power supply connection	8	Ground
9	Base for spring clamp element mounting	10	Mounting screws for mounting on transition plate
11	Electrical connection for AES modules	12	Rating plate
13	Electrical connection for AV modules		

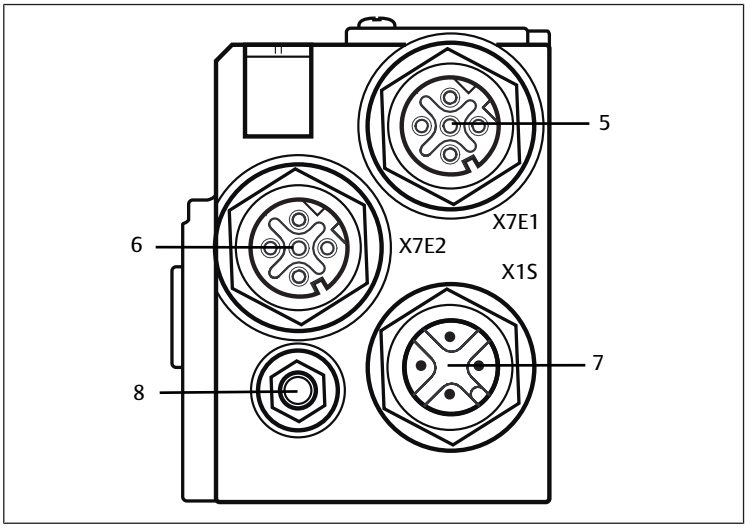
4.1.1 Electrical connections

NOTICE

Unconnected plugs do not comply with protection class IP65!

Water may enter the device.

▶ To maintain the protection class IP65, assemble blanking plugs on all unconnected plugs.



The bus coupler has the following electrical connections:

- **X7E1** socket (**5**): fieldbus connection
- **X7E2** socket (**6**): fieldbus connection
- **X1S** plug (**7**):
- 24 V DC power supply for bus coupler
- Ground screw (**8**): functional earth

The tightening torque for the connection plugs and sockets is 1.5 Nm +0.5.

The tightening torque for the M4x0.7 nut (SW7) on the ground screw is 1.25 Nm +0.25.

Fieldbus connection

The **X7E1** (**5**) and **X7E2** (**6**) fieldbus connections are designed as integrated M12 sockets, female, 4-pin, D-coded.

▶ See Table 6 for the pin assignments for the fieldbus connections. The view shown displays the device connections.

X7E1/X7E2

Table 4: Pin assignments of the fieldbus connections

Pin	X7E1 (5) and X7E2 (6) sockets
Pin 1	TD+
Pin 2	RD+
Pin 3	TD–
Pin 4	RD–
Housing	Ground

The AES series bus coupler for EtherNet/IP has a 100 Mbit full duplex 2-port switch, so that several EtherNet/IP devices can be connected in series. As a result, the controller can be connected to either fieldbus connection **X7E1** or **X7E2**. Both fieldbus connections are identical.

Fieldbus cable

NOTICE

Danger caused by incorrectly assembled or damaged cables!

The bus coupler may be damaged.

▶ Only use shielded and tested cables.

NOTICE

Faulty wiring!

Faulty wiring can lead to malfunctions as well as damage to the network.

1. Comply with the EtherNet//IP specifications.
2. Only a cable that meets the fieldbus specifications as well as the connection speed and length requirements should be used.
3. In order to assure both the protection class and the required strain relief, the cable and plug assembly must be done professionally and in accordance with the assembly instructions.
4. Never connect the two fieldbus connections **X7E1** and **X7E2** to the same switch/hub.
5. Make sure that you do not create a ring topology without a ring master.

Power supply

⚠ DANGER

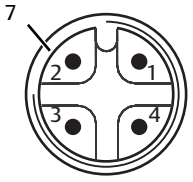
Electric shock due to incorrect power pack!

Danger of injury!

1. Only use the following power supply for the bus coupler:
   - 24 V DC SELV or PELV circuits, each with a DC fuse that can interrupt a current of 6.67 A within max. 120 s, or
   - 24 V DC circuits meeting the requirements for energy-limited circuits as described in section 9.4 of UL standard UL 61010-1, third edition, or
   - 24 V DC circuits meeting the requirements for power-limited power sources in accordance with section 2.5 of UL standard UL 60950-1, second edition, or
   - 24 V DC circuits meeting the requirements of NEC Class II in accordance with UL standard UL 1310.
2. Make sure that the power supply of the power pack is always less than 300 V AC (outer conductor – neutral wire).

The **X1S** power supply connection (**7**) is an M12 plug, male, 4-pin, A-coded.

▶ See Table 7 for the pin assignments for the power supply. The view shown displays the device connections.



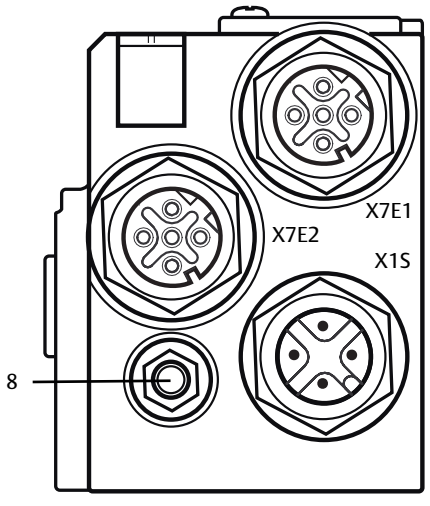
X1S

Table 5: Power supply pin assignments

Pin	X1S plug
Pin 1	24 V DC sensor/electronics power supply (UL)
Pin 2	24 V DC actuator voltage (UA)
Pin 3	0 V DC sensor/electronics power supply (UL)
Pin 4	0 V DC actuator voltage (UA)

- The voltage tolerance for the electronic components is 24 V DC ±25%.
- The voltage tolerance for the actuator voltage is 24 V DC ±10%.
- The maximum current for both power supplies is 4 A.
- The power supplies are equipped with internal electrical isolation.

Functional earth connection



▶ To discharge the EMC interferences, connect the FE connection (**8**) on the bus coupler via a low-impedance line to ground.
The cable cross section must be designed according to the application.

4.1.2 LED

The bus coupler has 6 LEDs.

The table below describes the functions of the LEDs. For a comprehensive description of the LEDs, see section → 11. LED Diagnosis on the Bus Coupler.

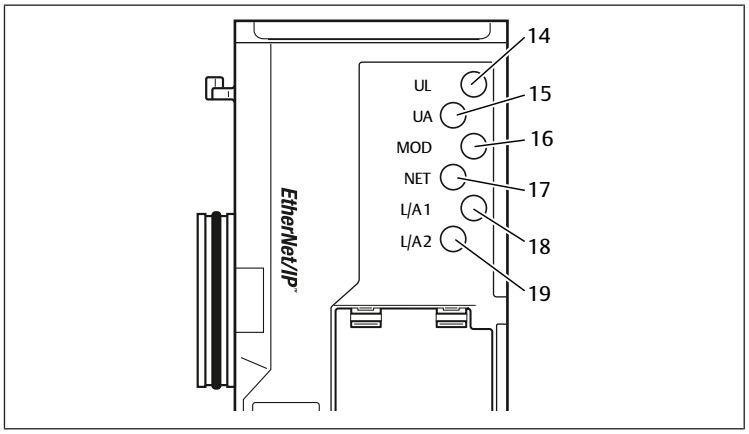


Table 6: Meaning of the LEDs in normal mode

Designation	Function	State in normal mode
UL (**14**)	Monitors electronics power supply	Illuminated green
UA (**15**)	Monitors the actuator voltage	Illuminated green
MOD (**16**)	Monitors diagnostic reporting from all modules	Illuminated green
NET (**17**)	Monitors data exchange	Illuminated green
L/A 1 (**18**)	Connection with Ethernet device on fieldbus connection **X7E1**	Illuminated in green and simultaneously flashes quickly in yellow
L/A 2 (**19**)	Connection with Ethernet device on fieldbus connection **X7E2**	Illuminated in green and simultaneously flashes quickly in yellow

4.1.3 Address switch

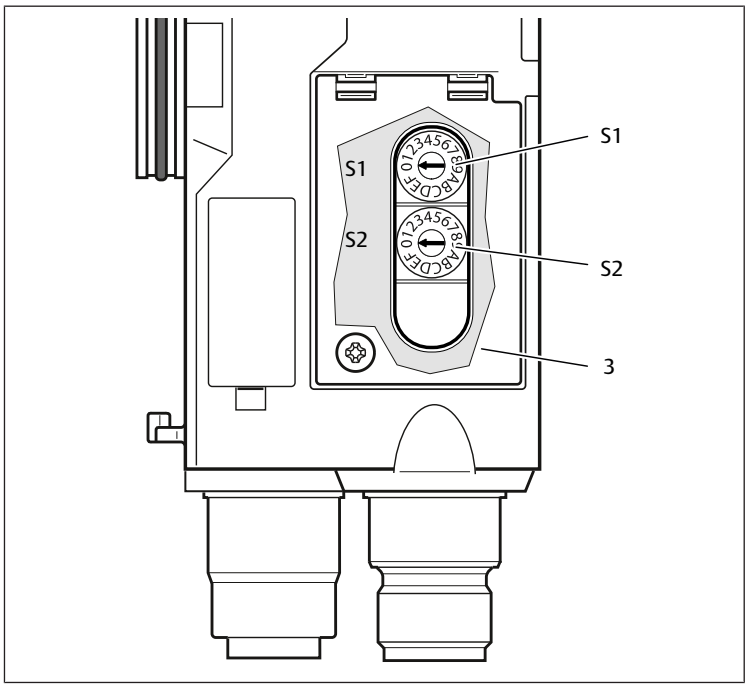
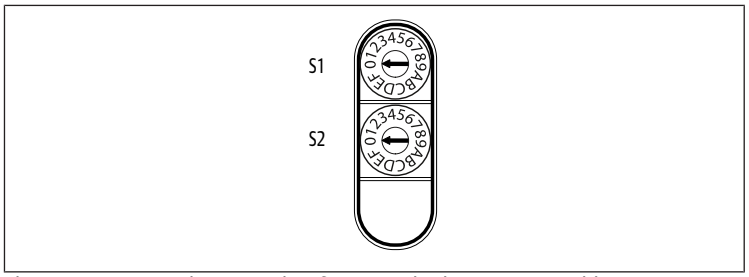


Fig. 2: Location of address switches S1 and S2



The two rotary switches **S1** and **S2** for manual valve system IP address assignment are located underneath the window (**3**).

- **Switch S1:** The higher nibble of the last block of the IP address is set at switch **S1**. Switch **S1** is labeled using the hexadecimal system from 0 to F.
- **Switch S2:** The lower nibble of the last block of the IP address is set on switch **S2**. Switch **S2** is labeled using the hexadecimal system from 0 to F.

A comprehensive description of addressing can be found in section → 9. Presettings on the Bus Coupler.

4.2 Valve Driver

The valve drivers are described in section → 12.1. Valve System.

5 PLC Configuration of the AV Valve System

For the bus coupler to exchange data from the modular valve system with the PLC, the PLC must be able to detect the input and output data lengths of the valve system. In order to represent the actual configuration of the valve system's electrical components in the PLC, you can use the configuration software of the PLC programming system. This process is known as PLC configuration.

You can use PLC configuration software from various manufacturers for the PLC configuration. The descriptions in the following sections therefore focus on the basic procedure for configuring the PLC.

NOTICE

Configuration error!

An incorrect valve system configuration can cause malfunctions in and damage to the overall system.

1. The configuration may only be carried out by qualified personnel → 2.4. Personnel Qualifications.
2. Observe the specifications of the system owner as well as any restrictions resulting from the overall system.
3. Observe the documentation of your configuration program.

You can determine the system data length on your computer and transfer it to the system on site without connecting the unit. The data can then be loaded on the system at a later time on site.

5.1 Readying the PLC configuration keys

Because the electrical components in the valve zone are situated in the base plate and cannot be identified directly, the PLC configuration keys for the valve zone and the I/O zone are required to carry out the configuration.

You also need the PLC configuration key when the configuration is carried out in a different location than that of the valve system.

▶ Note the PLC configuration key of the individual components in the following sequence:
- **Valve side:** The PLC configuration key is printed on the name plate on the right side of the valve system.
- **I/O modules:** The PLC configuration key is printed on the top of the modules.

A detailed description of the PLC configuration key can be found in section → 12.4. PLC Configuration Key.

5.2 Loading the Device Description File

The EDS file with texts in English for the AES series bus coupler for EtherNet/IP is located on the provided CD R412018133. The file can also be downloaded online from the Media Center.

Each valve system is equipped with a bus coupler; some contain valves and/or I/O modules, depending on your order. Basic settings for the module have been entered in the EDS file.

▶ Note that different EDS files have to be used, depending on the bus coupler used:

- For R412018222: EIP_Aventics-AES-20170206.eds
- For R412088222: EIP_Aventics-AES2-Gen2-XXXXXXXX.eds

1. To configure the valve system PLC, copy the EDS file on CD R412018133 to the computer containing the PLC configuration program.
2. Enter the IP address of the device and the absolute data lengths of the input and output data in the PLC configuration program.

The bus coupler's Ethernet/IP cycle time can be set in a range from 2 ms to 9999 ms.

▶ Set the cycle time to the desired value.

Operation without EDS file

You can also operate the system without an EDS file.

1. For this, calculate the incoming and outgoing data lengths as described in Table 9.
2. Enter the following values in the PLC configuration program for a class 1 connection:

Connection:

Master → slave: point-to-point

Slave → master: multicast

Connection points:

Master → slave: "101" and as data length "output data length"

Slave → master: "102" and as data length "input data length"

Configuration: "1" and as data length "0"

5.3 Configuring the Bus Coupler in the Fieldbus System

Before you can configure the individual components of the valve system, you need to assign an IP address to the bus coupler using your PLC configuration software. In most cases, a DHCP server assigns the address during commissioning and subsequently permanently assigns it to the device.

1. Assign a unique IP address to the bus coupler using the planning tool → 9.3. Assigning IP Address and Subnet Mask.
2. Configure the bus coupler as a slave module.

5.4 Configuring the Valve System

5.4.1 Module sequence

The input and output data used by the modules to communicate with the controller consist of a byte string. The lengths of the valve system input and output data are calculated from the number of modules and the data width of the individual module. The data is only counted in **bytes**. If a module has less than 1 byte of input or output data, the left-over bits are "stuffed" to the byte boundary using non-information bits.

Example: A valve driver board, 2x, with 4 bits of user data occupies 1 byte in the byte string, since the remaining 4 bits are stuffed with non-information bits. The data of the next module therefore starts after a byte boundary.

In the example (see Fig. 3), the modules are numbered to the right of the bus coupler (AES-D-BC-EIP) in the valve zone, starting with the first valve driver board (module 1) and continuing to the last valve driver board on the right end of the valve unit (module 9).

Bridge cards are not taken into account. Supply boards and UA-OFF monitoring boards occupy one module (see module 7 in Fig. 3). The supply boards and UA-OFF monitoring boards do not add any bytes to the input and output data. However, they are also counted, since they have diagnostic data, which is transferred at the corresponding module position. The data length for pressure regulators can be found in the operating instructions for AV-EP pressure regulators (R414007537).

The numbering is continued in the I/O zone (module 10 to module 12 in Fig. 3). There, numbering is continued starting from the bus coupler to the left end.

The bus coupler's parameter data is annexed to the output data in the byte chain. The bit assignments of the bus coupler are described in section → 5.5. Setting the Bus Coupler Parameters.

The diagnostic data of the valve system is 8 bytes in length and is appended to the input data. The structure of this diagnostic data is described in Table 14.

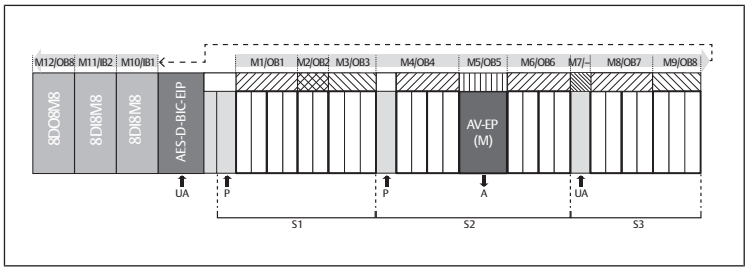


Fig. 3: Numbering of modules in a valve system with I/O modules

S1	Section 1	**S2**	Section 2
S3	Section 3	**P**	Pressure supply
UA	Power supply	**M**	Module
A	Single pressure control working connection	**AV-EP**	Pressure regulator with 16 bits of input and output data
IB	Input byte	**OB**	Output byte
-	Neither input nor output byte		

The symbols for the valve zone components are explained in section → 12.2. Valve Zone.

Example

Fig. 3 shows a valve system with the following characteristics:

- Bus coupler
- Section 1 (S1) with 9 valves
  - Valve driver board, 4x
  - Valve driver board, 2x
  - Valve driver board, 3x
- Section 2 (S2) with 8 valves
  - Valve driver board, 4x
  - Pressure regulator with 16 bits of input and output data
  - Valve driver board, 4x
- Section 3 (S3) with 7 valves
  - Supply board
  - Valve driver board, 4x
  - Valve driver board, 3x
- Input module
- Input module
- Output module

The PLC configuration key for the entire unit is thus:

423–4M4U43

8DI8M8

8DI8M8

8DO8M8

The data lengths of the bus coupler and the modules are shown in Table 9.

Table 7: Calculation of the valve system data lengths

Module number	Module	Output data	Input data
1	Valve driver board, 4x	1 byte of user data	–
2	Valve driver board, 2x	1 byte (4 bits of user data plus 4 filler bits)	–
3	Valve driver board, 3x	1 byte (6 bits of user data plus 2 filler bits)	–
4	Valve driver board, 4x	1 byte of user data	–
5	Pressure regulator	2 bytes of user data	2 bytes of user data
6	Valve driver board, 4x	1 byte of user data	–
7	Electrical supply	–	–
8	Valve driver board, 4x	1 byte of user data	–
9	Valve driver board, 3x	1 byte (6 bits of user data plus 2 filler bits)	–
10	Input module (1 byte of user data)	–	1 byte of user data
11	Input module (1 byte of user data)	–	1 byte of user data
12	Output module (1 byte of user data)	1 byte of user data	–
–	Bus coupler	1 byte of parameter data	8 bytes of diagnostic data
		Total length of output data: 11 bytes	**Total length of input data:** 12 bytes

The total length of the output data in the example configuration is 11 bytes. Of this, 10 bytes are the module output data and 1 byte is the bus coupler parameter byte.

The total length of the input data in the example configuration is 12 bytes. This consists of 4 bytes of module input data and 8 bytes of module diagnostic data.

The valve system always sends and receives the input and output data bytes in the same physical sequence. This cannot be changed. In most masters, however, alias names can be assigned to the data, making it possible for users to select any desired names for the data.

After the PLC configuration, the output bytes are assigned as shown in Table 10. The bus coupler parameter byte is appended to the output bytes of the modules.

Table 8: Example assignment of output bytes (OB)[1)]

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
OB1	Valve 4 Sol. 12	Valve 4 Sol. 14	Valve 3 Sol. 12	Valve 3 Sol. 14	Valve 2 Sol. 12	Valve 2 Sol. 14	Valve 1 Sol. 12	Valve 1 Sol. 14
OB2	–	–	–	–	Valve 6 Sol. 12	Valve 6 Sol. 14	Valve 5 Sol. 12	Valve 5 Sol. 14
OB3	–	–	Valve 9 Sol. 12	Valve 9 Sol. 14	Valve 8 Sol. 12	Valve 8 Sol. 14	Valve 7 Sol. 12	Valve 7 Sol. 14
OB4	Valve 13 Sol. 12	Valve 13 Sol. 14	Valve 12 Sol. 12	Valve 12 Sol. 14	Valve 11 Sol. 12	Valve 11 Sol. 14	Valve 10 Sol. 12	Valve 10 Sol. 14
OB5	First pressure regulator byte							
OB6	Second pressure regulator byte							
OB7	Valve 17 Sol. 12	Valve 17 Sol. 14	Valve 16 Sol. 12	Valve 16 Sol. 14	Valve 15 Sol. 12	Valve 15 Sol. 14	Valve 14 Sol. 12	Valve 14 Sol. 14
OB8	Valve 21 Sol. 12	Valve 21 Sol. 14	Valve 20 Sol. 12	Valve 20 Sol. 14	Valve 19 Sol. 12	Valve 19 Sol. 14	Valve 18 Sol. 12	Valve 18 Sol. 14
OB9	–	–	Valve 24 Sol. 12	Valve 24 Sol. 14	Valve 23 Sol. 12	Valve 23 Sol. 14	Valve 22 Sol. 12	Valve 22 Sol. 14
OB10	8DO8M8 (module 11) X2O8	8DO8M8 (module 11) X2O7	8DO8M8 (module 11) X2O6	8DO8M8 (module 11) X2O5	8DO8M8 (module 11) X2O4	8DO8M8 (module 11) X2O3	8DO8M8 (module 11) X2O2	8DO8M8 (module 11) X2O1
OB11	Bus coupler parameter byte							

[1)]Bits marked with "–" are filler bits. They may not be used and are assigned the value "0".

The input bytes are assigned as shown in Table 11. The diagnostic data are appended to the input data and are always 8 bytes in length.

Table 9: Example assignment of input bytes (IB)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
IB1	First pressure regulator byte							
IB2	Second pressure regulator byte							
IB3	8DI8M8 (module 9) X2I8	8DI8M8 (module 9) X2I7	8DI8M8 (module 9) X2I6	8DI8M8 (module 9) X2I5	8DI8M8 (module 9) X2I4	8DI8M8 (module 9) X2I3	8DI8M8 (module 9) X2I2	8DI8M8 (module 9) X2I1
IB4	8DI8M8 (module 10) X2I8	8DI8M8 (module 10) X2I7	8DI8M8 (module 10) X2I6	8DI8M8 (module 10) X2I5	8DI8M8 (module 10) X2I4	8DI8M8 (module 10) X2I3	8DI8M8 (module 10) X2I2	8DI8M8 (module 10) X2I1
IB5	Diagnostic byte (bus coupler)							
IB6	Diagnostic byte (bus coupler)							
IB7	Diagnostic byte (modules 1 to 8)							
IB8	Diagnostic byte (bits 0 to 3: modules 9 to 12, bits 4 to 7 not assigned)							
IB9	Diagnostic byte (not assigned)							
IB10	Diagnostic byte (not assigned)							
IB11	Diagnostic byte (not assigned)							
IB12	Diagnostic byte (not assigned)							

The length of the process data in the valve zone depends on the installed valve driver → 6. Structure of the Valve Driver Data. The length of the process data in the I/O zone depends on the selected I/O module (see the system description of the respective I/O modules).

5.5 Setting the Bus Coupler Parameters

The characteristics of the valve system are influenced by the different parameters that you set in the controller. You can use these parameters to determine the responses of the bus coupler and the I/O modules.

This section only describes the parameters for the bus coupler. The parameters of the I/O zone and the pressure regulators are explained in the system description of the individual I/O modules or in the operating instructions for the AV-EP pressure regulators. The system description of the bus coupler explains the parameters for the valve driver boards.

The following parameters can be set for the bus coupler:

- Response to an interruption in EtherNet/IP communication
- Response to an error (backplane failure)
- Sequence of the bytes

During cyclical operation, the parameters are set with the help of the parameter byte, which is appended to the output data.

Bit 0 is not assigned.

The response to an EtherNet/IP communication problem is defined in bit 1 of the parameter byte.

- Bit 1 = 0: If the connection is interrupted, the outputs are set to zero.
- Bit 1 = 1: If the connection is interrupted, the outputs are maintained in the current state.

The response to an error in the backplane is defined in bit 2 of the parameter byte.

- Bit 2 = 0: → 5.5.2. Error-response parametersSee error response option 1
- Bit 2 = 1: See error response option 2

The byte sequence of modules with 16-bit values is defined in bit 3 of the parameter byte (SWAP)

- Bit 3 = 0: 16-bit values are sent in big-endian format.
- Bit 3 = 1: 16-bit values are sent in little-endian format.

You can also write and read out the parameters during acyclic operation (unconnected messages). However, acyclic writing is only advisable when the module is not exchanging cyclical data, since the parameters in cyclical operation are immediately replaced by the cyclically transferred parameters.

You can write the bus coupler parameters acyclically with the following unconnected message.

▶ Enter the following values in the PLC configuration software in the corresponding input field.

Table 10: Writing bus coupler parameters

Field name in the software window	Value in input field to write parameter
Service code	0x10
Class	0xC7
Instance	0x01
Attribute	0x01

5.5.1 Setting parameters for the modules

You can write and read out the parameters of the modules using the settings in Table 13. The module parameters are not appended to the user data, they can only be written acyclically via unconnected messages.

▶ Note that the entire data length of a module parameter has to be transferred for the parameter to be taken over. The parameter data length for the module can be found in the documentation for the respective module.

The query "Parameter lesen" (read parameters) takes a few milliseconds since this process triggers the internal call "Parameter vom Modul neu einlesen" (read in parameters from module again). The most recently read-out data is transferred.

▶ Thus, execute the query "Parameter lesen" (read parameters) twice in 1 s intervals to read out the current parameter data from the module.

If you only execute the query "Parameter lesen" once, in the worst case, the parameters that were read in the last time the device was restarted will be returned.

Table 11: Writing and reading out module parameters

Field name in the software window	Value in input field to write parameter	Value in input field to read out parameter
Service code	0x10	0x0E
Class	0x64	0x64
Instance	Module number in hexadecimal coding (e.g. module no. 15 = 0x0F)	Module number in hexadecimal coding (e.g. module no. 18 = 0x12)
Attribute	0x01	0x02
Parameter data record	Volume of module parameter data to be written	Volume of module parameter data to be read

The parameters and configuration data are not saved locally by the bus coupler. They must be sent from the PLC to the bus coupler and the installed modules on startup.

5.5.2 Error-response parameters

Response to an interruption in EtherNet/IP communication

This parameter describes the response of the bus coupler in the absence of EtherNet/IP communication. You can set the following responses:

- Switch off all outputs (bit 1 of the parameter byte = 0)
- Maintain all outputs (bit 1 of the parameter byte = 1)

Response to a backplane malfunction

This parameter describes the response of the bus coupler in the event of a backplane malfunction. You can set the following responses:

Option 1 (bit 2 of the parameter byte = 0):

- If there is a temporary backplane malfunction (triggered, e.g., by a spike in the power supply), the **IO/DIAG** LED flashes red and the bus coupler sends a warning to the controller. As soon as the communication via the backplane is reinstated, the bus coupler returns to normal mode and the warnings are canceled.
- In the event of a sustained backplane malfunction (e.g. due to the removal of an end plate), the **IO/DIAG** LED flashes red and the bus coupler sends an error message to the controller. The bus coupler simultaneously resets all valves and outputs. **The bus coupler tries to re-initialize the system.** It sends the diagnostic message that the backplane is attempting re-initialization.
  - If the initialization is successful, the bus coupler resumes its normal operation. The error message is canceled and the **IO/DIAG** LED is illuminated in green.
  - If the initialization is not successful (e.g. due to the connection of new modules to the backplane or a defective backplane), the bus coupler continues to send the diagnostic message to the controller that the backplane is attempting re-initialization, and the initialization is restarted. LED **IO/DIAG** continues to flash red.

Option 2 (bit 2 of the parameter byte = 1)

- For temporary backplane malfunctions, the response is identical to option 1.
- In the event of a sustained backplane malfunction, the bus coupler sends an error message to the controller and the **IO/DIAG** LED flashes red. The bus coupler simultaneously resets all valves and outputs. **An initialization of the system is not started.** The bus coupler must be restarted manually (power reset) in order to return it to normal mode.

5.6 Bus Coupler Diagnostic Data

5.6.1 Structure of the diagnostic data

The bus coupler sends 8 bytes of diagnostic data which is appended to the module input data. A valve system consisting of a bus coupler and a module with 2 bytes of input data thus has a total of 10 bytes of input data. A valve system consisting of a bus coupler and a module without input data has a total of 8 bytes of input data.

The 8 bytes of diagnostic data contain

- 2 bytes of diagnostic data for the bus coupler and
- 6 bytes of group diagnostic data for the modules.

The diagnostic data is organized as shown in Table 14.

Table 12: Diagnostic data appended to input data

Byte no.	Bit no.	Meaning	Diagnostic type and device
Byte 0	Bit 0	Actuator voltage UA < 21.6 V	Bus coupler diagnosis
	Bit 1	Actuator voltage UA < UA-OFF	
	Bit 2	Electronics power supply UL < 18 V	
	Bit 3	Electronics power supply UL < 10 V	
	Bit 4	Hardware error	
	Bit 5	Reserved	
	Bit 6	Reserved	
	Bit 7	Reserved	
Byte 1	Bit 0	The backplane of the valve zone issues a warning.	Bus coupler diagnosis
	Bit 1	The backplane of the valve zone issues an error.	
	Bit 2	The backplane of the valve zone attempts a re-initialization.	
	Bit 3	Reserved	
	Bit 4	The backplane of the I/O zone issues a warning.	
	Bit 5	The backplane of the I/O zone issues an error.	
	Bit 6	The backplane of the I/O zone attempts a re-initialization.	
	Bit 7	Reserved	
Byte 2	Bit 0	Group diagnosis, module 1	Group diagnoses of modules
	Bit 1	Group diagnosis, module 2	
	Bit 2	Group diagnosis, module 3	
	Bit 3	Group diagnosis, module 4	
	Bit 4	Group diagnosis, module 5	
	Bit 5	Group diagnosis, module 6	
	Bit 6	Group diagnosis, module 7	
	Bit 7	Group diagnosis, module 8	
Byte 3	Bit 0	Group diagnosis, module 9	Group diagnoses of modules
	Bit 1	Group diagnosis, module 10	
	Bit 2	Group diagnosis, module 11	
	Bit 3	Group diagnosis, module 12	
	Bit 4	Group diagnosis, module 13	
	Bit 5	Group diagnosis, module 14	
	Bit 6	Group diagnosis, module 15	
	Bit 7	Group diagnosis, module 16	
Byte 4	Bit 0	Group diagnosis, module 17	Group diagnoses of modules
	Bit 1	Group diagnosis, module 18	
	Bit 2	Group diagnosis, module 19	
	Bit 3	Group diagnosis, module 20	
	Bit 4	Group diagnosis, module 21	
	Bit 5	Group diagnosis, module 22	
	Bit 6	Group diagnosis, module 23	
	Bit 7	Group diagnosis, module 24	
Byte 5	Bit 0	Group diagnosis, module 25	Group diagnoses of modules
	Bit 1	Group diagnosis, module 26	
	Bit 2	Group diagnosis, module 27	
	Bit 3	Group diagnosis, module 28	
	Bit 4	Group diagnosis, module 29	
	Bit 5	Group diagnosis, module 30	
	Bit 6	Group diagnosis, module 31	
	Bit 7	Group diagnosis, module 32	
Byte 6	Bit 0	Group diagnosis, module 33	Group diagnoses of modules
	Bit 1	Group diagnosis, module 34	
	Bit 2	Group diagnosis, module 35	
	Bit 3	Group diagnosis, module 36	
	Bit 4	Group diagnosis, module 37	
	Bit 5	Group diagnosis, module 38	
	Bit 6	Group diagnosis, module 39	
	Bit 7	Group diagnosis, module 40	
Byte 7	Bit 0	Group diagnosis, module 41	Group diagnoses of modules
	Bit 1	Group diagnosis, module 42	
	Bit 2	Reserved	
	Bit 3	Reserved	
	Bit 4	Reserved	
	Bit 5	Reserved	
	Bit 6	Reserved	
	Bit 7	Reserved	

The group diagnostic data of the modules can also be accessed acyclically.

5.6.2 Reading out the bus coupler diagnostic data

The diagnostic data of the bus coupler can be read out as follows:

▶ Enter the following values in the PLC configuration software in the corresponding input field.

Table 13: Reading out bus coupler diagnostic data

Field name in the software window	Value in input field
Service code	0x0E
Class	0xC7
Instance	0x03
Attribute	0x01

You can find a description of the diagnostic data for the valve zone in section → 6. Structure of the Valve Driver Data.
The diagnostic data for the I/O zone is described in the system descriptions of the individual I/O modules.

5.7 Extended Diagnostic Data of the I/O Modules

In addition to group diagnosis, some I/O modules can send extended diagnostic data with a length of up to 4 bytes to the controller. The total data length can thus be up to 5 bytes:

Byte 1 of the diagnostic data contains the group diagnosis information:

- Byte 1 = 0x00: No error has occurred.
- Byte 1 = 0x80: An error has occurred.

Bytes 2 to 5 contain the extended diagnostic data of the I/O modules. The extended diagnostic data can only be accessed acyclically.

Acyclic access to the diagnostic data is performed identically for all modules. You can find a description in section → 6.2.2. Acyclical diagnostic data of the valve drivers (explicit messages) using valve driver boards as an example.

5.8 Transferring the Configuration to the Controller

Data may be transferred to the controller once the system is completely and correctly configured.

1. Check whether the lengths for the input and output data that you have entered in the controller match those of the valve system.
2. Establish a connection to the controller.
3. Transfer the valve system data to the controller. The precise process depends on the PLC configuration program. Observe the respective documentation.

6 Structure of the Valve Driver Data

6.1 Process Data

⚠ WARNING

Incorrect data assignment!

Danger caused by uncontrolled movement of the system.

▶ Always set the unused bits to the value “0”.

The valve driver board receives output data from the controller with nominal values for the position of the valve solenoid coils. The valve driver translates this data into the voltage required to actuate the valves. The length of the output data is eight bits. Of these, 4 bits are used with a 2x valve driver board, 6 bits with a 3x valve driver board, and 8 bits with a 4x valve driver board.

Fig. 4 shows how valve positions are assigned on 2x, 3x, and 4x valve driver boards:

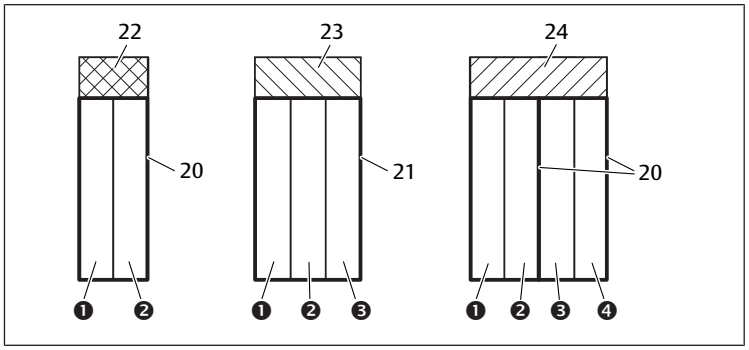


Fig. 4: Valve position assignment

(1) Valve position 1
(2) Valve position 2
(3) Valve position 3
(4) Valve position 4
20 Base plate, 2x
21 Base plate, 3x
22 Valve driver board, 2x
23 Valve driver board, 3x
24 Valve driver board, 4x

The symbols for the valve zone components are explained in section → 12.2. Valve Zone.

The assignment of valve solenoid coils to bits is as follows:

Table 14: Valve driver board, 2x[1)]

Output byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Valve designation	–	–	–	–	Valve 2	Valve 2	Valve 1	Valve 1
Solenoid designation	–	–	–	–	Sol. 12	Sol. 14	Sol. 12	Sol. 14

Table 15: Valve driver board, 3x[1)]

Output byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Valve designation	–	–	Valve 3	Valve 3	Valve 2	Valve 2	Valve 1	Valve 1
Solenoid designation	–	–	Sol. 12	Sol. 14	Sol. 12	Sol. 14	Sol. 12	Sol. 14

[1)]Bits that are marked with a “–” may not be used and are assigned the value “0”.

Table 16: Valve driver board, 4x

Output byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Valve designation	Valve 4	Valve 4	Valve 3	Valve 3	Valve 2	Valve 2	Valve 1	Valve 1
Solenoid designation	Sol. 12	Sol. 14	Sol. 12	Sol. 14	Sol. 12	Sol. 14	Sol. 12	Sol. 14

Tables 16-18 refer to double solenoid valves. With a single solenoid valve, only solenoid 14 is used (bits 0, 2, 4, and 6).

6.2 Diagnostic Data

6.2.1 Cyclical diagnostic data of the valve drivers

The valve driver sends the diagnostic message with the input data to the bus coupler (see Table 14). The diagnostic bit for the corresponding module (module number) indicates where the fault occurred. The diagnostic message consists of a diagnostic bit, which is set in the event of a short circuit of an output (group diagnostics).

The diagnostic bit can be read as follows:

- Bit = 1: An error has occurred.
- Bit = 0: No error has occurred.

6.2.2 Acyclical diagnostic data of the valve drivers (explicit messages)

The diagnostic data of the valve drivers can be read out as follows:

▶ Enter the following values in the PLC configuration software in the corresponding input field.

Table 17: Reading out the diagnostic data of the modules

Field name in the software window	Value in input field
Service code	0x0E
Class	0x64
Instance	Module number in hexadecimal coding (e.g. module no. 18 = 0x12)
Attribute	0x03

You will receive 1 data byte as a response. This byte contains the following information:

- Byte 1 = 0x00: No error has occurred.
- Byte 1 = 0x80: An error has occurred.

6.3 Parameter Data

The valve driver board does not contain any parameters.

7 Structure of the Electrical Supply Plate Data

The electrical supply plate interrupts the UA voltage coming from the left and transfers the voltage supplied by the additional M12 plug to the right. All other signals are directly passed on.

7.1 Process Data

The electrical supply plate does not have any process data.

7.2 Diagnostic Data

7.2.1 Cyclical diagnostic data of the electrical supply plate

The electrical supply plate sends the diagnostic message as a group diagnosis with the input data to the bus coupler (see Table 14). The diagnostic bit for the corresponding module (module number) indicates where the fault occurred. The diagnostic message consists of a diagnostic bit that is set when the actuator voltage falls below 21.6 V (24 V DC -10% = UA-ON).

The diagnostic bit can be read as follows:

- Bit = 1: An error has occurred (UA < UA-ON).
- Bit = 0: No error has occurred (UA > UA-ON).

7.2.2 Acyclic diagnostic data of the electrical supply plate

The electrical supply plate diagnostic data can be read out like the valve driver diagnostic data → 6.2.2. Acyclical diagnostic data of the valve drivers (explicit messages).

7.3 Parameter Data

The electrical supply plate does not have any parameters.

8 Structure of Pneumatic Supply Plate Data with UA-OFF Monitoring Board

The electrical UA-OFF monitoring board transfers all signals including the supply voltages. The UA-OFF monitoring board recognizes whether the UA voltage falls below the UA-OFF value.

8.1 Process Data

The electrical UA-OFF monitoring board does not have process data.

8.2 Diagnostic Data

8.2.1 Cyclic diagnostic data of the UA-OFF monitoring board

The UA-OFF monitoring board sends the diagnostic message as a group diagnosis with the input data to the bus coupler (see Table 14). The diagnostic bit for the corresponding module (module number) indicates where the fault occurred. The diagnostic message consists of a diagnostic bit that is set when the actuator voltage falls below UA-OFF.

The diagnostic bit can be read as follows:

- Bit = 1: An error has occurred (UA < UA-OFF).
- Bit = 0: No error has occurred (UA > UA-OFF).

8.2.2 Acyclic diagnostic data of the UA-OFF monitoring board (explicit messages)

The diagnostic data of the UA-OFF monitoring board can be read out like the valve driver diagnostic data → 6.2.2. Acyclical diagnostic data of the valve drivers (explicit messages).

8.3 Parameter Data

The electrical UA-OFF monitoring board does not have parameters.

9 Presettings on the Bus Coupler

NOTICE

Configuration error!

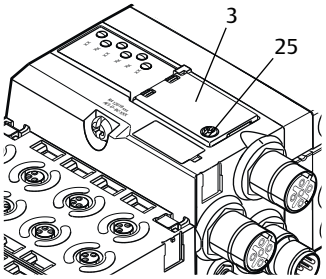
An incorrect valve system configuration can cause malfunctions in and damage to the overall system.

1. The configuration may only be carried out by qualified personnel → 2.4. Personnel Qualifications.
2. Observe the specifications of the system owner as well as any restrictions resulting from the overall system.
3. Observe the documentation of your PLC configuration program.

The following pre-settings must be made using the PLC configuration program:

- Assigning a unique IP address to the bus coupler and adjusting the subnet mask → 9.3. Assigning IP Address and Subnet Mask
- Setting the parameters for the bus coupler, i.e. writing the last output data byte with the parameter bits → 5.5. Setting the Bus Coupler Parameters
- Setting the module parameters via the controller → 5.5.1. Setting parameters for the modules

9.1 Opening and Closing the Window



NOTICE

Defective or improperly positioned seal!

Water may enter the device. The protection class IP65 is no longer guaranteed.

1. Make sure that the seal below the window (**3**) is intact and properly positioned.
2. Make sure that the screw (**25**) has been securely tightened with the correct torque (0.2 Nm).

1. Loosen the screw (**25**) on the window (**3**).
2. Lift up the window.
3. Carry out the settings as described in the next steps.
4. Close the window. Ensure that the seal is positioned correctly.
5. Tighten the screw.
   Tightening torque: 0.2 Nm

9.2 Changing the Address

NOTICE

An address change will not be effective during operation!

The bus coupler will continue to work with the previous address.

1. Never change the address during operation.
2. Disconnect the bus coupler from the power supply UL before changing the positions of switches **S1** and **S2**.

9.3 Assigning IP Address and Subnet Mask

The bus coupler requires a unique IP address in the EtherNet/IP network in order to be detected by the controller.

Address on delivery

On delivery, the switches are set to DHCP function (0x00). Switch S2 is set to 0 and switch S1 to 0.

9.3.1 Manual IP address assignment with address switch

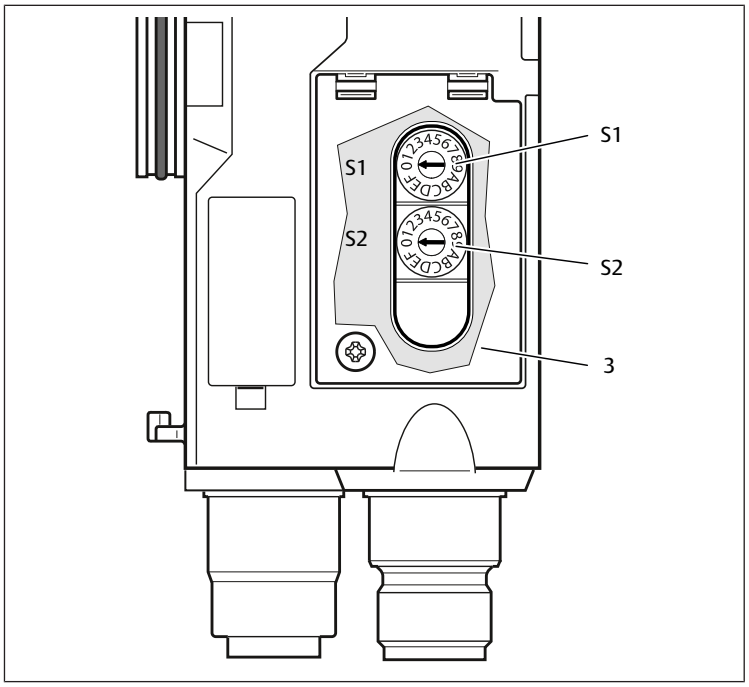
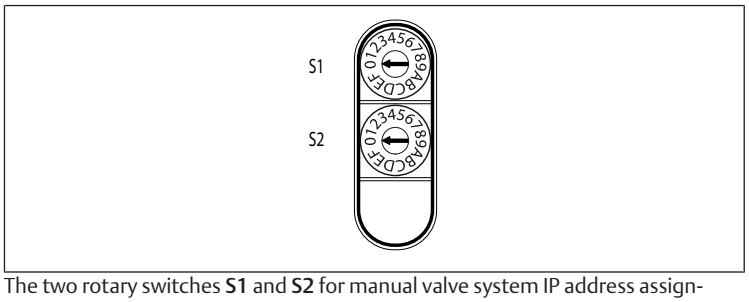


Fig. 5: Address switches S1 and S2 on the bus coupler



The two rotary switches **S1** and **S2** for manual valve system IP address assignment are located underneath the window (**3**).

- **Switch S1:** The higher nibble of the last block of the IP address is set at switch **S1**. Switch **S1** is labeled using the hexadecimal system from 0 to F.
- **Switch S2:** The lower nibble of the last block of the IP address is set on switch **S2**. Switch **S2** is labeled using the hexadecimal system from 0 to F.

The rotary switches are set to 0x00 by default. This activates address assignment via DHCP server.

Proceed as follows during addressing.

1. Ensure that each IP address exists only once on your network and note that the address 0xFF or 255 is reserved.
2. Disconnect the bus coupler from the power supply UL.
3. Set the station address at the switches **S1** and **S2** (see Fig. 5). For this, set the rotary switch to a position between 1 and 254 for decimal or 0x01 and 0xFE for hexadecimal:
   - **S1**: High nibble from 0 to F
   - **S2**: Low nibble from 0 to F
4. Reconnect the power supply UL.
   The system will be initialized using the address defined on the bus coupler. The IP address of the bus coupler is set to 192.168.1.xxx, where “xxx” corresponds to the setting of the rotary switch. The subnet mask is set to 255.255.255.0 and the gateway address to 0.0.0.0. Address assignment via DHCP is deactivated.

Table 20 contains a number of addressing examples.

Table 18: Addressing examples

S1 switch position High nibble (hexadecimal label)	S2 switch position Low nibble (hexadecimal label)	Station address
0	0	0 (address assignment via DHCP server)
0	1	1
0	2	2
...	...	...
0	F	15
1	0	16
1	1	17
...	...	...
9	F	159
A	0	160
...	...	...
F	E	254
F	F	255 (reserved)

9.3.2 IP address assignment with DHCP server

Setting the IP address to DHCP function

1. Disconnect the bus coupler from the power supply UL before changing the positions of switches **S1** and **S2**.
2. Only set the address to 0x00 afterwards.
   DHCP mode is active after the bus coupler has been restarted.

Assigning an IP address

After you have set the address 0x00 on the bus coupler, you can assign it an IP address.

The procedure to assign an IP address to the bus coupler depends on the PLC configuration program or your DHCP program. Please see the operating instructions for the program for more information.

The following example is based on the Rockwell software RSLogix 5000 with BOOTP/DHCP server. The PLC configuration and assignment of IP addresses can also be performed with a different PLC configuration program or DHCP program.

⚠ CAUTION

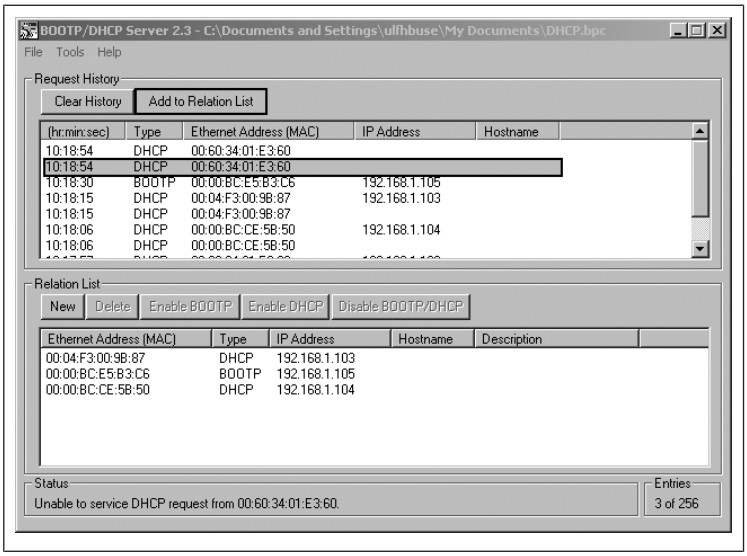
Danger of injury if changes are made to the settings during operation.

Uncontrolled movement of the actuators is possible!

▶ Never change the settings during operation.

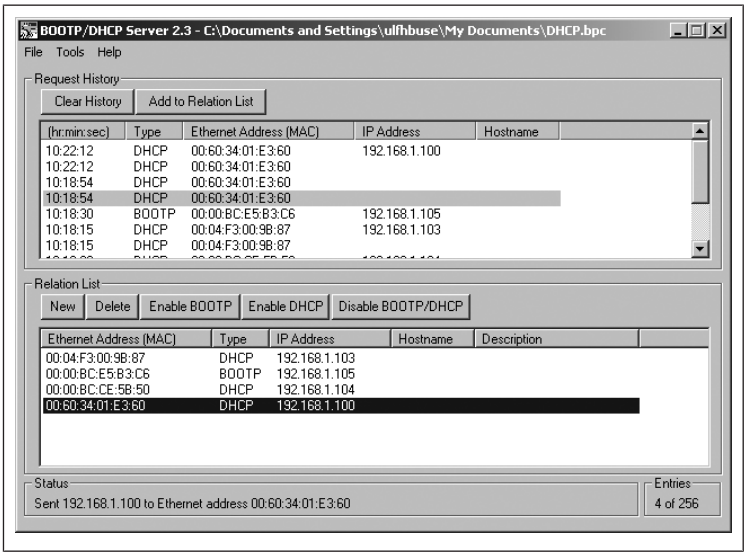
The bus coupler uses its MAC address to contact the DHCP server. You can use this address to identify the bus coupler. The MAC address of the bus coupler can be found on the rating plate.

▶ Select the bus coupler using its MAC address in the “Request History” pane.



When the device has responded, you can add it to the reference list and assign it an IP address.

1. Click the “Add to Relation List” button.
   The “New Entry” window opens.
2. Enter the required IP address in the “IP Address” field and press “OK” to confirm.
   As soon as the bus coupler has been added to the list and has sent the next DHCP request, the DHCP server will assign the specified address to the bus coupler.



In most cases, the IP address and subnet mask are not reassigned each time via the DHCP server, but permanently stored in the bus coupler. Once the DHCP server has assigned the desired address to the bus coupler, you must deactivate the bus coupler DHCP service for this to take effect.

1. Deactivate the DHCP service by clicking the “Disable BOOTP/DHCP” button.
2. Restart the system.
   The device will automatically start with the IP address that it had when the DHCP service was deactivated. In this example: 192.168.1.100.

10 Commissioning the Valve System with EtherNet/IP

Before commissioning the system, the following steps must have been carried out and completed:

- You have assembled the valve system with bus coupler (see the assembly instructions for the bus couplers and I/O modules, as well as the valve system).
- You have carried out the presettings and configuration → 9. Presettings on the Bus Coupler and → 5. PLC Configuration of the AV Valve System.
- You have connected the bus coupler to the controller (see AV valve system assembly instructions).
- You have configured the controller so that it actuates the valves and the I/O modules correctly.

Assembly and commissioning may only be carried out by qualified electrical or pneumatic personnel or an instructed person under the direction and supervision of qualified personnel → 2.4. Personnel Qualifications.

⚠ DANGER

Danger of explosion with no impact protection!

Mechanical damage, e.g. strain on the pneumatic or electrical connectors, will lead to non-compliance with the IP65 protection class.

▶ In explosive environments, make sure that the equipment is installed in a manner that protects it from all types of mechanical damage.

⚠ DANGER

Danger of explosion due to damaged housings!

Damaged housings can lead to an explosion in explosive areas.

▶ Make sure that the valve system components are only operated with completely assembled and intact housing.

⚠ DANGER

Danger of explosion due to missing seals and plugs!

Liquids and foreign objects could penetrate and destroy the device.

1. Make sure that the seals are integrated in the plug and not damaged.
2. Make sure that all plugs are mounted before starting the system.

⚠ CAUTION

Risk of uncontrolled movements when switching on the system!

There is a danger of personal injury if the system is in an undefined state.

1. Put the system in a safe state before switching it on.
2. Make sure that no personnel are within the hazardous zone when the compressed air supply is switched on.

1. Switch on the operating voltage.
   The controller sends configuration data to the bus coupler during startup.
2. After the initialization phase, check the LED statuses on all modules (→ 11. LED Diagnosis on the Bus Coupler and system description of the I/O modules).

Before applying the operating pressure, the diagnostic LEDs may only be illuminated in green, as described in Table 21:

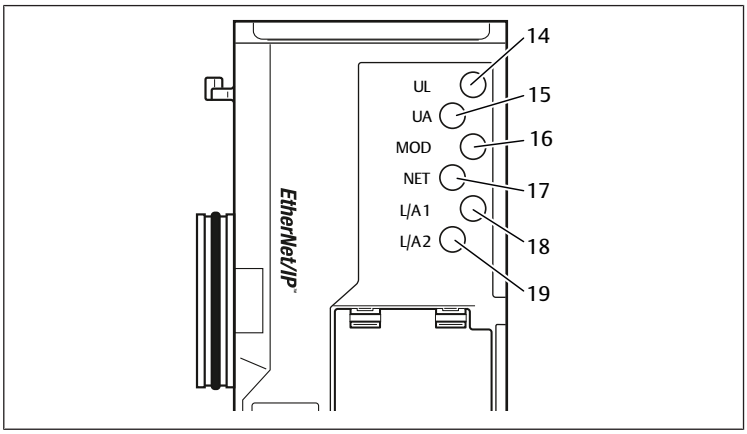


Table 19: Status of the LEDs on commissioning

Designation	Color	State	Meaning
UL (**14**)	Green	Illuminated	The electronics supply voltage is greater than the lower tolerance limit (18 V DC).
UA (**15**)	Green	Illuminated	Actuator voltage exceeds the lower tolerance limit (21.6 V DC).
MOD (**16**)	Green	Illuminated	The configuration is OK and the backplane is working perfectly.
NET (**17**)	Green	Illuminated	The bus coupler exchanges cyclical data with the controller.
L/A 1 (**18**)	Yellow	Flashes quickly[1)]	Connection with Ethernet device on fieldbus connection **X7E1**
L/A 2 (**19**)	Yellow	Flashes quickly[1)]	Connection with Ethernet device on fieldbus connection **X7E2**

[1)]At least one of the two LEDs L/A 1 and L/A 2 must be illuminated in green or be illuminated in green and flash quickly in yellow. Depending on the data exchange, the flashing may be so fast that it appears that the LED is illuminated. The color then appears to be light green.

If the diagnostic run is successful, you may commission the valve system. Otherwise, the errors must be remedied → 13. Troubleshooting.

▶ Switch on the compressed air supply.

11 LED Diagnosis on the Bus Coupler

The bus coupler monitors the power supplies for the electronic components and actuator control. If they exceed or fall below a set threshold, an error signal will be generated and reported to the controller. In addition, the status is displayed by the diagnostic LEDs.

Reading the diagnostic display on the bus coupler

The LEDs on the top of the bus coupler report the messages listed in Table 22.

▶ Before commissioning and during operation, regularly check the bus coupler functions by reading the LEDs.

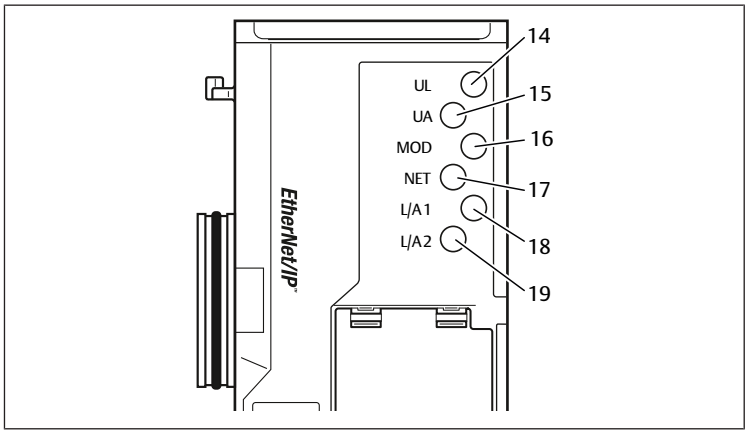


Fig. 6: Meaning of the diagnostic LEDs

Table 20: Meaning of the diagnostic LEDs

Designation	Color	State	Meaning
UL (**14**)	Green	Illuminated	The electronics supply voltage is greater than the lower tolerance limit (18 V DC).
	Red	Flashes	The electronics supply voltage is less than the lower tolerance limit (18 V DC) and greater than 10 V DC.
	Red	Illuminated	The electronics supply voltage is less than 10 V DC.
	Green/red	Off	The electronics supply voltage is significantly less than 10 V DC (limit not defined).
UA (**15**)	Green	Illuminated	Actuator voltage exceeds the lower tolerance limit (21.6 V DC).
	Red	Flashes	The actuator voltage is less than the lower tolerance limit (21.6 V DC) and greater than UA-OFF.
	Red	Illuminated	The actuator voltage is less than UA-OFF.
MOD (**16**)	Green	Illuminated	The configuration is OK and the backplane is working perfectly.
	Green	Flashes	The module has not yet been configured (there is no connection to a master).
	Red	Flashes	Diagnostic message from module present
	Red	Illuminated	Valve unit incorrectly configured or backplane function error
NET (**17**)	Green	Illuminated	The bus coupler exchanges cyclical data with the controller.
	Green	Flashes	Waiting to establish communication with the controller
	Red	Flashes	Communication was disrupted (no communication with the master)
	Red	Illuminated	Severe network problems, IP address assigned twice
	Green/red	Off	An IP address has not yet been assigned and the DHCP service is off.
L/A 1 (**18**)	Green	Illuminated	The physical connection between the bus coupler and network has been detected (link established).
	Yellow	Flashes quickly	Data packets received (flashes for each data packet received)
	Green/ yellow	Off	The bus coupler does not have a physical connection with the network.
L/A 2 (**19**)	Green	Illuminated	The physical connection between the bus coupler and network has been detected (link established).
	Yellow	Flashes quickly	Data packets received (flashes for each data packet received)
	Green/ yellow	Off	The bus coupler does not have a physical connection with the network.

12 Conversion of the Valve System

⚠ DANGER

Danger of explosion caused by defective valve system in an explosive atmosphere!

Malfunctions may occur after the configuration or conversion of the valve system.

▶ After configuring or converting a system, always perform a function test in a non-explosive atmosphere before recommissioning.

This chapter describes the structure of the complete valve system, the rules for converting the valve system, the documentation of the conversion, as well as the re-configuration of the valve system.

The assembly of the components and the complete unit is described in the respective assembly instructions. All necessary assembly instructions are included as printed documentation on delivery and can also be found on the CD R412018133.

12.1 Valve System

The AV series valve system consists of a central bus coupler that can be extended towards the right to up to 64 valves and up to 32 associated electrical components → 12.5.3. Impermissible configurations. Up to 10 input and output modules can be connected on the left side. The unit can also be operated without pneumatic components, i.e. with only a bus coupler and I/O modules, as a standalone system.

Fig. 6 shows an example configuration with valves and I/O modules. Depending on the configuration, your valve system may contain additional components, such as pneumatic supply plates, electrical supply plates, or pressure regulators → 12.2. Valve Zone.

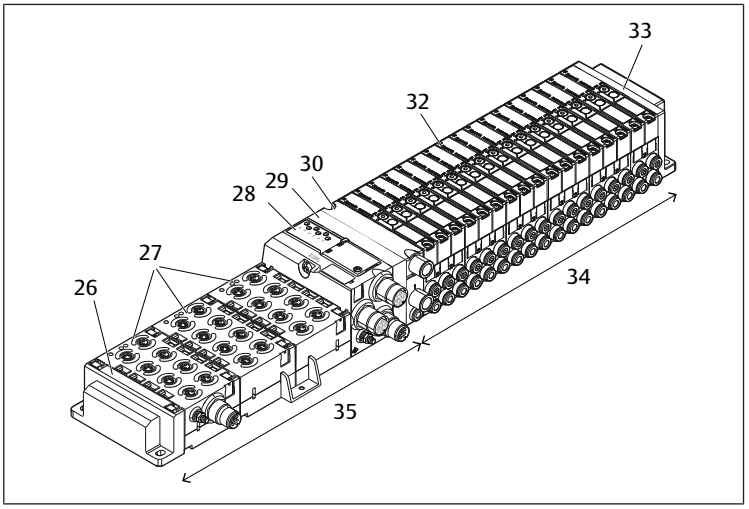


Fig. 7: Example configuration: unit consisting of AES series bus coupler and I/O modules, and AV series valves

26	Left end plate	**32**	I/O modules
27	Bus coupler	**33**	Transition plate
28	Pneumatic supply plate	**34**	Valve driver (concealed)
29	Right end plate	**35**	Pneumatic unit, AV series
30	Electrical unit, AES series		

12.2 Valve Zone

The following figures show the components as illustrations and symbols. The symbol representations are used in section → 12.5. Conversion of the Valve Zone.

12.2.1 Base plates

The valves from the AV series are always mounted on base plates that are assembled into blocks so that the supply pressure is applied to all valves.

The base plates are always 2x or 3x base plates for two or three single or double solenoid valves.

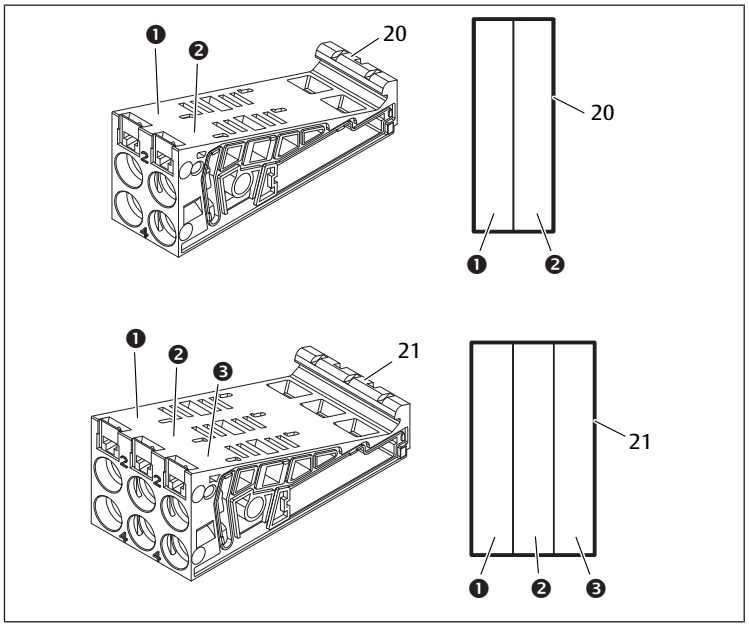


Fig. 8: Base plates, 2x and 3x

(1)	Valve position 1	**(2)**	Valve position 2
(3)	Valve position 3	**20**	20 Base plate, 2x
21	21 Base plate, 3x		

12.2.2 Transition plate

The transition plate (**29**) has the sole function of mechanically connecting the bus coupler to the valve zone. It is always located between the bus coupler and the first pneumatic supply plate.

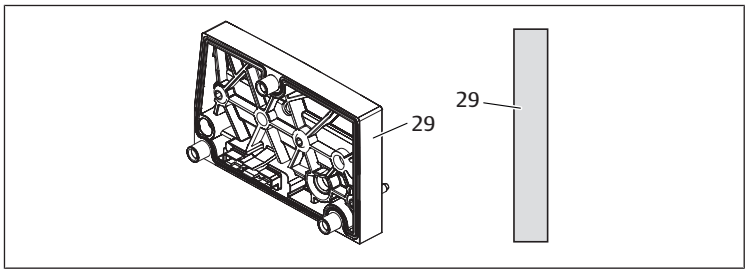


Fig. 9: Transition plate

12.2.3 Pneumatic supply plate

Pneumatic supply plates (**30**) can be used to divide the valve system into sections with different pressure zones → 12.5. Conversion of the Valve Zone.

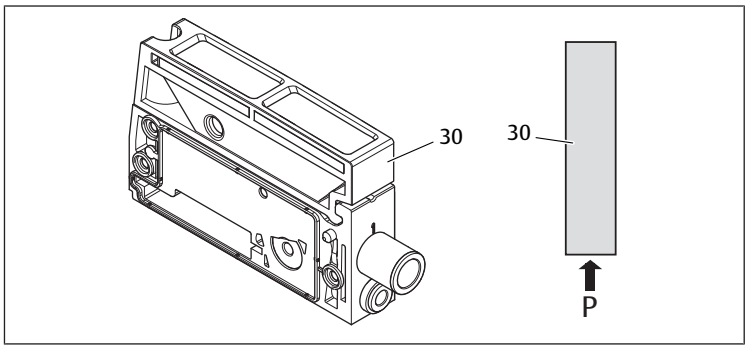


Fig. 10: Pneumatic supply plate

12.2.4 Electrical supply plate

The electrical supply plate (**35**) is connected to a supply board. It can feed in an extra 24 V power supply - 10 % for all valves located to the right of the electrical supply plate via an integrated 4-pin M12 connection. The electrical supply plate monitors the additional power supply (UA) for undervoltage.

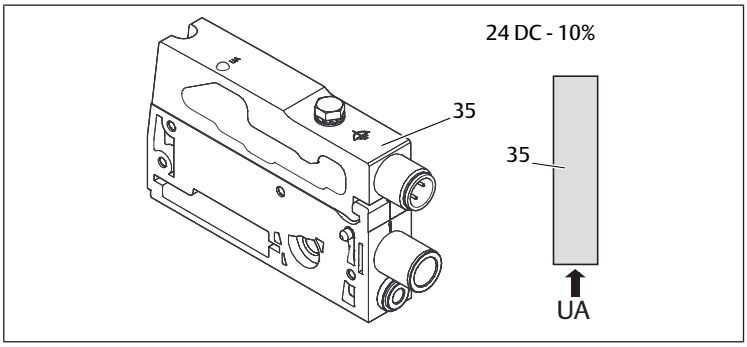


Fig. 11: Electrical supply plate

The tightening torque of the M4x0.7 ground screw (WS 7) is 1.25 Nm +0.25.

Pin assignments of the M12 plug

The connection for the actuator voltage is an M12 plug, male, 4-pin, A-coded.

▶ Please see Table 23 for the pin assignments of the M12 plug on the electrical supply plate.

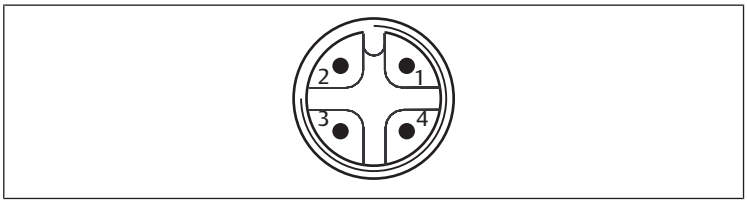


Table 21: Pin assignments of M12 plug on electrical supply plate

Pin	X1S plug
Pin 1	nc (not connected)
Pin 2	24 V DC actuator voltage (UA)
Pin 3	nc (not connected)
Pin 4	0 V DC actuator voltage (UA)

- The voltage tolerance for the actuator voltage is 24 V DC ±10%.
- The maximum current is 2 A.
- The voltage is internally isolated from UL.

12.2.5 Valve driver boards

Valve drivers, which establish an electrical connection between the valves and the bus coupler, are built into the bottom reverse side of the base plates.

The base plates' block assembly also ensures that the valve driver boards are connected via electrical plug connections. They come together to form the "backplane", which the bus coupler uses to control the valves.

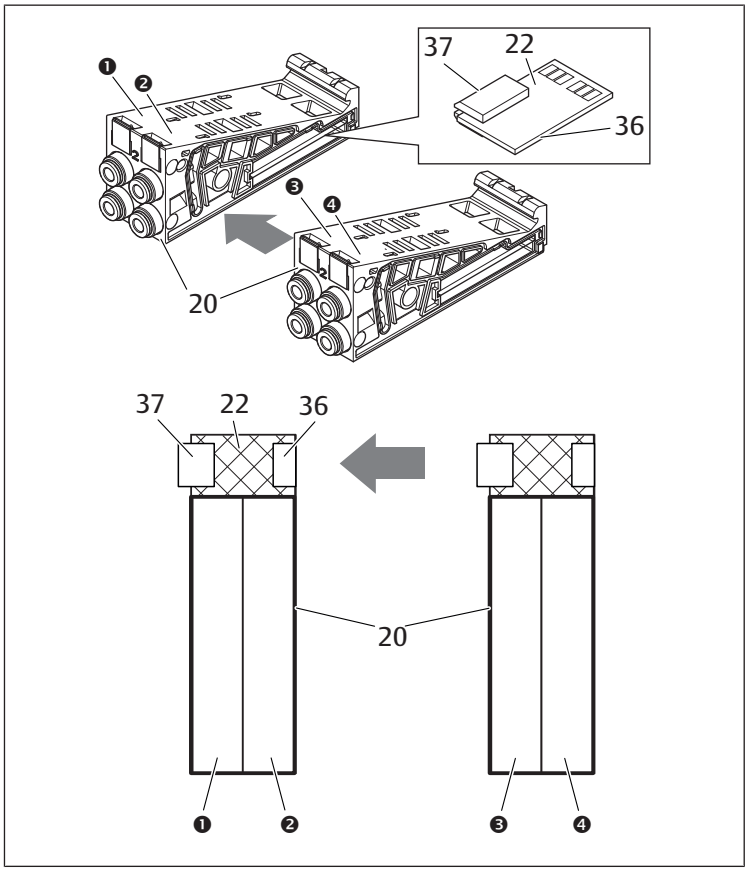


Fig. 12: Blocking of base plates and valve driver boards

(1)	Valve position 1	**(2)**	Valve position 2
(3)	Valve position 3	**(4)**	Valve position 4
20	Base plate, 2x	**22**	Valve driver board, 2x
36	Right plug	**37**	Left plug

The following valve driver and supply boards are present:

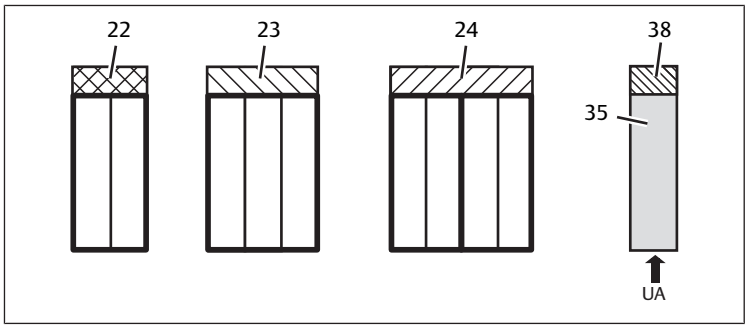


Fig. 13: Overview of the valve driver and supply boards

22	Valve driver board, 2x	**23**	Valve driver board, 3x
24	Valve driver board, 4x	**35**	Electrical supply plate
38	Supply board		

Electrical supply plates can be used to separate the valve system into sections with different voltage zones. For this purpose, the supply board interrupts the 24 V and the 0 V lines from UA voltage in the backplane. A maximum of ten voltage zones are permitted.

The power supply to the electrical supply plate must be taken into account during PLC configuration.

12.2.6 Pressure regulators

You can use electronically operated pressure regulators as a pressure zone control or single pressure control depending on the selected base plate.

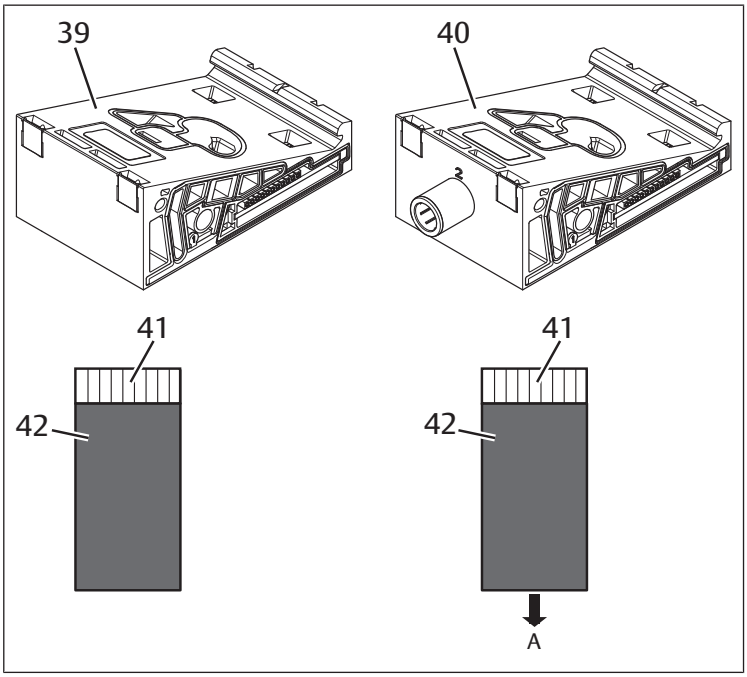


Fig. 14: Base plate for pressure regulators for pressure zone control (left) and single pressure control (right)

39	AV-EP base plate for pressure zone control	**40**	AV-EP base plate for single pressure control
41	Integrated AV-EP circuit board	**42**	Valve position for pressure regulator

Pressure regulators for pressure zone control and single pressure control do not differ in terms of the electronic control. This is why the differences between the two AV-EP pressure regulators are not discussed in further detail here. The pneumatic functions are described in the operating instructions for AV-EP pressure regulators, which can be found on CD R412018133.

12.2.7 Bridge cards

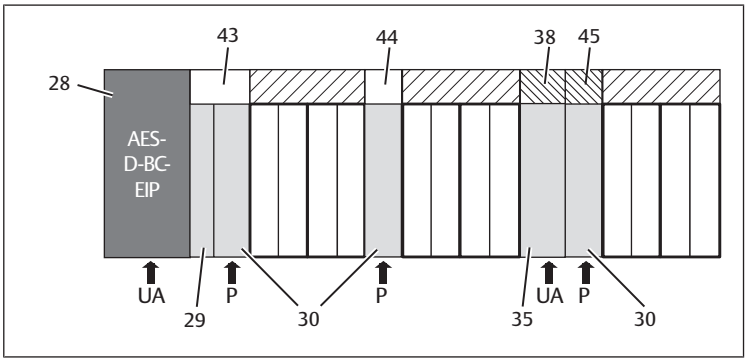


Fig. 15: Bridge cards and UA-OFF monitoring board

28	Bus coupler	**38**	Transition plate
29	Pneumatic supply plate	**43**	Electrical supply plate
30	Supply board	**44**	Long bridge card
35	Short bridge card	**45**	UA-OFF monitoring board

Bridge cards have the sole function of bridging the pressure supply areas. They are therefore not taken into account during PLC configuration.

Bridge cards are available in long and short versions:

The long bridge card is always located directly on the bus coupler. It bridges the transition plate and the first pneumatic supply plate.

The short bridge card is used to bridge additional pneumatic supply plates.

12.2.8 UA-OFF monitoring board

The UA-OFF monitoring board is an alternative to the short bridge card in the pneumatic supply plate (see Fig. 14).

The electrical UA-OFF monitoring board monitors the actuator voltage UA for status UA < UA-OFF. All voltages are passed through directly. The UA-OFF monitoring board must therefore always be installed after an electrical supply plate to be monitored.

In contrast to the bridge card, the UA-OFF monitoring board has to be taken into account when configuring the control.

12.2.9 Possible combinations of base plates and cards

Valve driver boards, 4x, are always combined with two 2x base plates.
Table 24 shows the possible combinations of base plates, pneumatic supply plates, electrical supply plates, and transition plates with various valve driver boards, bridge cards, and supply boards.

Table 22: Possible combinations of plates and cards

Base plate	Circuit boards
Base plate, 2x	Valve driver board, 2x
Base plate, 3x	Valve driver board, 3x
Two base plates, 2x	Valve driver board, 4x
Pneumatic supply plate	Short bridge card or UA-OFF monitoring board
Transition plate and pneumatic supply plate	Long bridge card
Electrical supply plate	Supply board

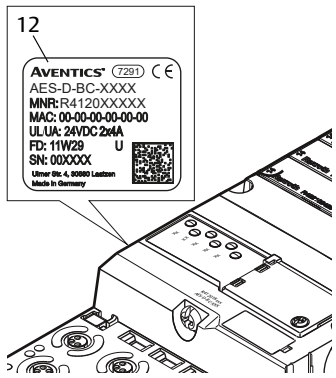
The boards in the AV-EP base plates are installed permanently and can therefore not be combined with other base plates.

12.3 Identifying the Modules

12.3.1 Material number for bus coupler

The bus coupler can be clearly identified using its material number. When exchanging the bus coupler, you can use the material number to reorder the same unit.

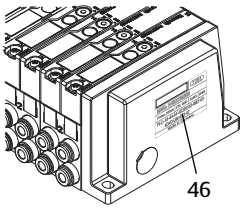
The material number is printed on the name plate (**12**) on the back of the device and on the top below the identification key.



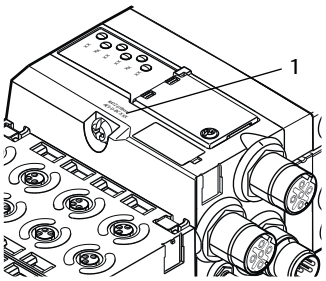
12.3.2 Material number for valve system

The material number for the complete valve system (**46**) is printed on the right end plate. You can use this material number to reorder an identically configured valve system.

▶ Note that, after a valve system conversion, the material number still refers to the original configuration → 12.5.5. Conversion documentation.



12.3.3 Identification key for bus coupler

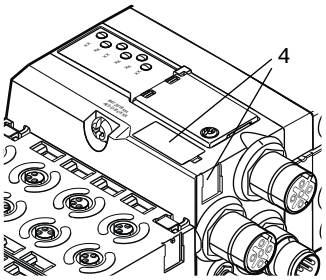


The identification key (1) on the top of the AES series bus coupler for EtherNet/IP is “AES-D-BC-EIP” and describes the unit’s main characteristics.

12.3.4 Equipment identification for bus coupler

The bus coupler requires a unique ID to enable the clear identification of the unit within the system. The two equipment identification fields (4) on the top and front of the bus coupler are available for this purpose.

▶ Label the two fields as shown in your system diagram.



12.3.5 Bus coupler rating plate

The rating plate is located on the back of the bus coupler. It contains the following information:

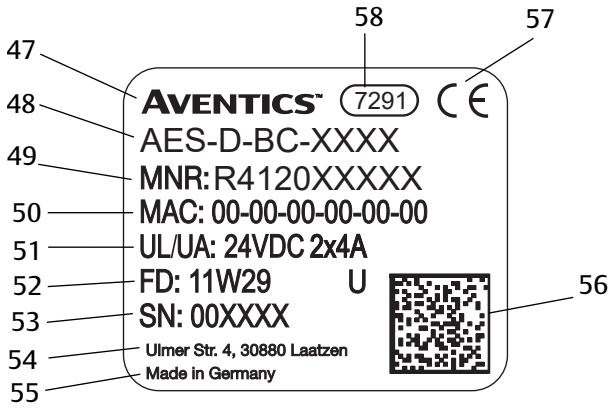
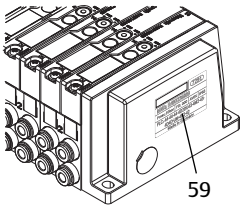


Fig. 16: Bus coupler rating plate

47	Logo	**48**	Series
49	Mat. no.	**50**	MAC address
51	Power supply	**52**	Manufacture date (FD) with format “FD: <YY>W<WW>”
53	Serial number	**55**	Country of manufacture
56	Data Matrix code	**57**	CE mark
58	Internal plant ID		

12.4 PLC Configuration Key

12.4.1 PLC configuration key for the valve zone



The PLC configuration key for the valve zone (**59**) is printed on the right end plate.

The PLC configuration key specifies the sequence and type of electrical components based on a numerical/alphabetical code. The PLC configuration key consists solely of numbers, letters, and dashes. There are no spaces between the values.

In general:

- Numbers and letters refer to the electrical components.
- Each digit corresponds to one valve driver board. The number's value refers to the number of valve positions for a valve driver board.
- Letters refer to special modules that are relevant to the PLC configuration.
- "–" visualizes a pneumatic supply plate without UA-OFF monitoring board; not relevant to the PLC configuration

The sequence begins on the right side of the bus coupler and ends at the right end of the valve system.

The elements that can be represented in a PLC configuration key are shown in Table 26.

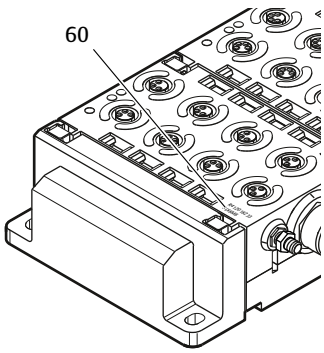
Table 23: Elements of the PLC configuration key for the valve zone

Abbreviation	Meaning	Length of output bytes	Length of input bytes
2	Valve driver board, 2x	1 byte	0 bytes
3	Valve driver board, 3x	1 byte	0 bytes
4	Valve driver board, 4x	1 byte	0 bytes
–	Pneumatic supply plate	0 bytes	0 bytes
K	Pressure regulator, 8 bit, configurable	1 byte	1 byte
L	Pressure regulator, 8 bit	1 byte	1 byte
M	Pressure regulator, 16 bit, configurable	2 bytes	2 bytes
N	Pressure regulator, 16 bit	2 bytes	2 bytes
U	Electrical supply plate	0 bytes	0 bytes
W	Pneumatic supply plate with UA-OFF monitoring	0 bytes	0 bytes

Example of a PLC configuration key: 423–4M4U43.

The transition plate and the pneumatic supply plate at the start of the valve system, as well as the right end plate, are not included in the PLC configuration key.

12.4.2 PLC configuration key for the I/O zone



The PLC configuration key for the I/O zone (**60**) is module-related. It is printed on the top of the device.

The sequence of I/O modules starts on the left side of the bus coupler and ends on the left end of the I/O zone.

The PLC configuration key encodes the following data:

- Number of channels
- Function
- Connector

Table 24: Abbreviations for the PLC configuration key in the I/O zone

Abbreviation	Meaning
8	Number of channels or number of plugs; the number always precedes the element
16	
24	
DI	Digital input channel
DO	Digital output channel
AI	Analog input channel
AO	Analog output channel
M8	M8 connection
M12	M12 connection
DSUB25	DSUB connection, 25-pin
SC	Spring clamp connection
A	Additional actuator voltage connection
L	Additional logic voltage connection
E	Enhanced functions
P	Pressure measurement
D4	Push-in D = 4 mm, 5/32 Inch

Example:

The I/O zone consists of three different modules with the following PLC configuration keys:

Table 25: Example of a PLC configuration key for the I/O zone

PLC configuration key for the I/O module	Characteristics of the I/O module	Data length
8DI8M8	• 8x digital input channels • 8x M8 connections	• 1 byte input • 0 bytes output
24DODSUB25	• 24x digital output channels • 1x D-SUB plug, 25-pin	• 0 bytes input • 3 bytes output
2AO2AI2M12A	• 2x analog output channels • 2x analog input channels • 2x M12 connections • Additional actuator voltage connection	• 4 bytes input • 4 bytes output (Bits are calculated from the resolution of the analog channels, rounded up to whole bytes, times the number of channels)

The left end plate is not reflected in the PLC configuration key.

▶ The length of the input or output bytes can be found in the system description of the individual I/O module.

If you do not have the system description of the module at hand, you can calculate the input and output data lengths by observing the following guidelines:

For digital modules:

▶ Divide the number of bits by 8, to find the length in bytes.
  – For input modules, the value is the input data length. There is no output data.
  – For output modules, the value is the output data length. There is no input data.
  – For I/O modules, the total output and input bytes are the lengths of the output and input data, respectively.

Example:

- The digital module 24DODSUB25 has 24 outputs.
- 24/8 = 3 bytes output data

For analog modules:

1. Divide the resolution of an input or output by 8.
2. Round the result up to a whole number.
3. Multiply this value by the number of inputs or outputs. This number is the length in bytes.

Example:

- The analog input module 2AI2M12 has 2 inputs with a resolution of 16 bits each.
- 16 bits/8 = 2 bytes
- 2 bytes x 2 inputs = 4 bytes input data

12.5 Conversion of the Valve Zone

The symbols for the valve zone components are explained in section → 12.2. Valve Zone.

NOTICE

Impermissible, non-compliant expansion!

Any expansions or reductions not described in these instructions interfere with the basic configuration settings. This will prevent a reliable system configuration.

1. Observe the rules for the expansion of the valve zone.
2. Observe the specifications of the system owner as well as any restrictions resulting from the overall system.

You may use the following components for the expansion or conversion of the system:

- Valve driver with base plates
- Pressure regulators with base plates
- Pneumatic supply plates with bridge card
- Electrical supply plates with supply board
- Pneumatic supply plates with UA-OFF monitoring board

With valve drivers, combinations of several of the following components are possible (see Fig. 16):

- Valve driver, 4x, with two base plates, 2x
- Valve driver, 3x, with one base plate, 3x
- Valve driver, 2x, with one base plate, 2x

If you would like to operate the valve system as a stand-alone system, a special right end plate is required (see).

12.5.1 Sections

The valve zone of a valve system can consist of multiple sections. A section always starts with a supply plate that marks the beginning of a new pressure or voltage zone.

An UA-OFF monitoring board should only be installed after an electrical supply plate, otherwise the actuator voltage UA is monitored before supply.

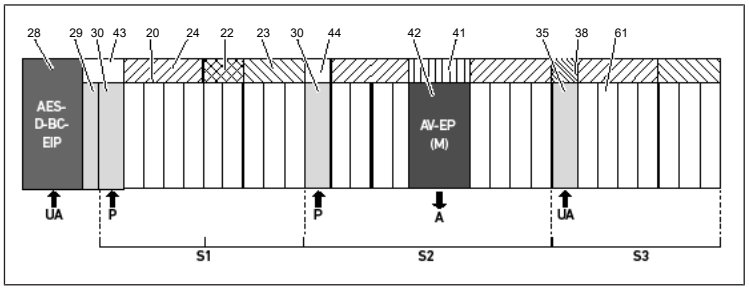


Fig. 17: Creating sections with two pneumatic supply plates and one electrical supply plate

28	Bus coupler	**29**	Transition plate
30	Pneumatic supply plate	**43**	Long bridge card
20	Base plate, 2x	**21**	Base plate, 3x
24	Valve driver board, 4x	**22**	Valve driver board, 2x
23	Valve driver board, 3x	**44**	Short bridge card
42	Valve position for pressure regulator	**41**	Integrated AV-EP circuit board
35	Electrical supply plate	**38**	Supply board
61	Valve	**S1**	Section 1
S2	Section 2	**S3**	Section 3
P	Pressure supply	**A**	Single pressure control working connection
UA	Power supply		

The valve system in Fig. 16 consists of three sections:

Table 26: Example valve system, consisting of three sections

Section	Components
Section 1	• Pneumatic supply plate (**30**) • Three base plates, 2x (**20**), and one base plate, 3x (**21**) • Valve driver boards, 4x (**24**), 2x (**22**), and 3x (**23**) • 9 valves (**61**)
Section 2	• Pneumatic supply plate (**30**) • Four base plates, 2x (**20**) • Two valve driver boards, 4x (**24**) • 8 valves (**61**) • AV-EP base plate, single pressure control • AV-EP pressure regulator
Section 3	• Electrical supply plate (**35**) • Two base plates, 2x (**20**), and one base plate, 3x (**21**) • Supply plate (**38**), valve driver board, 4x (**24**), and valve driver board, 3x (**23**) • 7 valves (**61**)

12.5.2 Permissible configurations

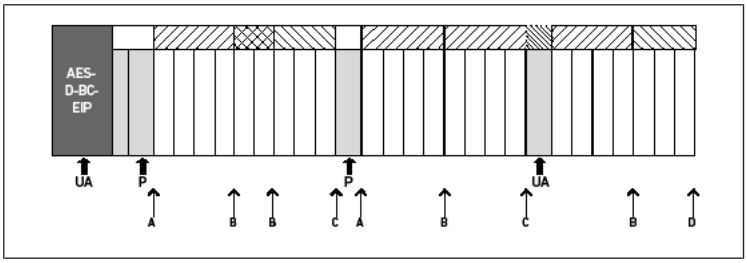


Fig. 18: Permissible configurations

You can expand the valve system at all points designated with an arrow:

- After a pneumatic supply plate (**A**)
- After a valve driver board (**B**)
- At the end of a section (**C**)
- At the end of the valve system (**D**)

To simplify your documentation and configuration, we recommend that you expand the valve system on the right end (**D**).

12.5.3 Impermissible configurations

Fig. 19 displays the configurations that are not permissible. You may not:

- Split a 4x or 3x valve driver board
- Mount more than 64 valves (128 solenoid coils)
- Integrate more than 8 AV-EPs
- Integrate more than 32 electrical components.

Some configured components have multiple functions and therefore count as multiple electrical components.

Table 27: Number of electrical components per component

Configured component	Number of electrical components
Valve driver boards, 2x	1
Valve driver boards, 3x	1
Valve driver boards, 4x	1
Pressure regulators	3
Electrical supply plate	1
UA-OFF monitoring board	1

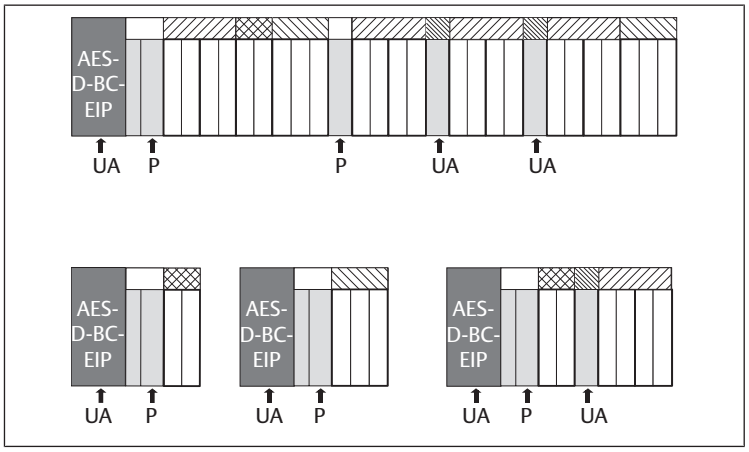


Fig. 19: Examples for impermissible configurations

12.5.4 Reviewing the valve zone conversion

▶ Following the conversion of the valve zone, use the following checklist to determine whether you have complied with all rules.

- Have you mounted at least 4 valve positions after the first pneumatic supply plate?
- Have you mounted a maximum of 64 valve positions?
- Have you integrated no more than 32 electrical components? Note that an AV-EP pressure regulator corresponds to three electrical components.
- Have you mounted at least two valves after every pneumatic or electrical supply plate that marks the start of a new section?
- Have you always installed the valve driver boards to be in line with the base plate limits, i.e.
  - One base plate, 2x, is installed with one valve driver board, 2x,
  - Two base plates, 2x, are installed with one valve driver board, 4x,
  - One base plate, 3x, is installed with one valve driver board, 3x,
- Have you integrated no more than 8 AV-EPs?

If you have answered "Yes" to all these questions, you may proceed with the documentation and configuration of the valve system.

12.5.5 Conversion documentation

PLC configuration key

After a conversion, the PLC configuration key printed on the right end plate is no longer valid.

1. Correct the PLC configuration key or cover it with a new label and write the new PLC configuration key on the end plate.
2. Always document all changes to your configuration.

Mat. no.

After a conversion, the material number (MNR) on the right end plate is no longer valid.

▶ Mark the material number so that it is clearly visible that the unit no longer corresponds to its original condition on delivery.

12.6 Conversion of the I/O Zone

12.6.1 Permissible configurations

No more than ten I/O modules may be connected to the bus coupler.

For further information on converting the I/O zone, see the system descriptions of the individual I/O modules.

We recommend an expansion of the I/O modules starting from the left end of the valve system.

12.6.2 Conversion documentation

The PLC configuration key is printed on the top of the I/O modules.

▶ Always document all changes to your configuration.

12.7 New PlC Configuration for the Valve System

NOTICE

Configuration error!

An incorrect valve system configuration can cause malfunctions in and damage to the overall system.

1. The configuration may therefore only be carried out by an electrical specialist!
2. Observe the specifications of the system owner as well as any restrictions resulting from the overall system.
3. Observe the documentation of your configuration program.

After converting the valve system, you need to configure the newly added components.

▶ In the PLC configuration software, adapt the lengths of the input and output data to the valve system.

Because the data is transferred as a byte string and divided up by the user, the position of the data in the byte string will shift if an additional module is used. However, if you add a module at the left end of the I/O modules, with an output module, only the parameter byte for the bus module will be shifted. With an input module, only the diagnostic data will be shifted.

▶ After converting the valve system, always make sure the input and output bytes are still correctly assigned.

If you have exchanged components without changing their order, you do not need to reconfigure the valve system. All components will be recognized by the controller.

▶ For the PLC configuration, proceed as described in section → 5. PLC Configuration of the AV Valve System.

13 Troubleshooting

13.1 Proceed as Follows for Troubleshooting

1. Even if you are in a rush, proceed systematically and in a targeted manner.
2. In the worst case, arbitrary, indiscriminate disassembly and modifications to the settings may mean that you are no longer able to determine the original cause of the error.
3. Get an overview of the function of the product as related to the overall system.
4. Try to clarify whether the product fulfilled the required function in the overall system before the error occurred.
5. Try to record any changes to the overall system where the product is installed:
   - Have changes been made to the operating conditions or area of application of the product?
   - Have changes (e.g. conversions) or repairs been made to the overall system (machine/system, electrical system, controller) or the product? If so: What are they?
   - Has the product or machine been operated as intended?
   - How does the malfunction manifest itself?
6. Try to get a clear picture of the cause of the error. If necessary, ask the immediate machine operator or foreman.

13.2 Table of Malfunctions

Table 31 contains an overview of malfunctions, possible causes, and remedies.

If you cannot remedy a malfunction, please contact AVENTICS GmbH. The address is printed on the back cover of these instructions.

Table 28: Table of malfunctions

Malfunction	Possible cause	Remedy
No outlet pressure at the valves	No power supply on the bus coupler or the electrical supply plate (see also the behavior of the individual LEDs at the end of the table)	Connect the power supply at plug **X1S** on the bus coupler and to the electrical supply plate.
		Check the polarization of the power supply on the bus coupler and the electrical supply plate.
		Switch on system component
	No set point stipulated	Stipulate a set point
	No supply pressure available	Connect the supply pressure

Malfunction	Possible cause	Remedy
Output pressure too low	Supply pressure too low	Increase the supply pressure
	Insufficient power supply for the device	Check LEDs **UA** and **UL** on the bus coupler and the electrical supply plate and supply the devices with the correct (adequate) voltage.
Air is audibly escaping	Leaks between the valve system and connected pressure line	Check the pressure line connections and tighten, if necessary.
	Pneumatic connections confused	Properly connect the pneumatics for the pressure lines
Addressing via DHCP server not possible	A save process was triggered on the bus coupler before the address 0x00 was set.	Perform the following four steps: 1. Disconnect the bus coupler from the voltage and set an address between 1 and 254 (0x01 and 0xFE). 2. Connect the bus coupler to the voltage and wait 5 seconds, then disconnect the voltage again. 3. Set the address switch to 0x00. 4. Re-connect the bus coupler to the voltage. Addressing via the DHCP server should now work.
	Wrong address set	Disconnect the bus coupler from the voltage UL and then set the correct address → 9.2. Changing the Address
UL LED flashes red	The electronics supply voltage is less than the lower tolerance limit (18 V DC) and greater than 10 V DC.	Check the power supply at plug **X1S**.
UL LED illuminated red	The electronics supply voltage is less than 10 V DC.	
UL LED is off	The electronics supply voltage is significantly less than 10 V DC.	
UA LED flashes red	The actuator voltage is less than the lower tolerance limit (21.6 V DC) and greater than UA-OFF.	
UA LED illuminated red	The actuator voltage is less than UA-OFF.	
MOD LED flashes green	No connection has been established with a master.	Configure the master so that it establishes a connection.
MOD LED flashes red	Diagnostic message from module present	Check modules.
MOD LED illuminated red	There is no module connected to the bus coupler.	Connect a module.
	There is no end plate present.	Connect an end plate.
	More than 32 electrical components are connected on the valve side. → 12.5.3. Impermissible configurations	Reduce the number of electrical components on the valve side to 32.
	Over ten modules are connected in the I/O zone.	Reduce the number of modules in the I/O zone to ten.
	The module circuit boards are not plugged together correctly.	Check the plug contacts of all modules (I/O modules, bus coupler, valve drivers, and end plates)
	A module circuit board is defective.	Exchange the defective module.
	The bus coupler is defective.	Exchange the bus coupler
	The new module is not recognized.	Contact AVENTICS GmbH (see back cover for address)
NET LED illuminated red	Severe network error present	Check network.
	IP address assigned twice	Change the IP address.
NET LED flashes red	Connection to master has been disrupted. EtherNet/IP communication can no longer take place.	Check the connection to the master.
	An error was discovered in the PLC configuration.	Check the PLC configuration.
NET LED is off	A physical connection to the network has not yet been established.	Establish physical connection to the network (connect and/or check EtherNet cable).
	Neither a static nor a dynamic IP address has been assigned.	Assign IP address.
	No DHCP service has been activated.	Re-activate DHCP service.
NET LED flashes green	The network connection is in place, but an EtherNet/IP connection has not been established.	Connect the module to an EtherNet/IP system.
		Switch on the EtherNet/IP controller.
L/A 1 or **L/A 2** LED illuminated in green (only flashes in yellow seldom)	No data exchange with the bus coupler, e.g. because the network section is not connected to a controller	Connect the network section with a controller.
	Bus coupler was not configured in the controller.	Configure bus coupler in the controller.
L/A 1 or **L/A 2** LED is off	There is no connection to a network participant.	Connect fieldbus connection **X7E1** or **X7E2** with a network participant (e.g. a switch).
	The bus cable is defective and no connection can be made with the next network participant.	Exchange the bus cable.
	Another network participant is defective.	Exchange network participant.
	Bus coupler is defective.	Exchange the bus coupler

14 Technical Data

Table 29: Technical data

General data	
Dimensions	37.5 mm x 52 mm x 102 mm
Weight	0.17 kg
Operating temperature range	-10°C to 60°C
Storage temperature range	-25°C to 80°C
Ambient operating conditions	Max. height above sea level: 2000 m
Vibration resistance	Wall mounting EN 60068-2-6: • ±0.35 mm displacement at 10 Hz to 60 Hz, • 5 g acceleration at 60 Hz to 150 Hz
Shock resistance	Wall mounting EN 60068-2-27: • 30 g with 18 ms duration, • 3 shocks each direction
Protection class according to EN60529/ IEC60529	IP65 with assembled connections
Relative humidity	95%, non condensing
Degree of contamination	2
Use	Only in closed rooms
Electronics	
Electronics power supply	24 V DC ±25%
Actuator voltage	24 V DC ±10%
Valve inrush current	50 mA
Rated current for both 24 V power supplies	4 A
Connections	Power supply for bus coupler **X1S**: • Plug, male, M12, 4-pin, A-coded Ground (FE, functional earth) • Connection according to DIN EN 60204-1/IEC60204-1
BUS	
Bus protocol	EtherNet/IP
Connections	Fieldbus connections **X7E1** and **X7E2**: • Socket, female, M12, 4-pin, D-coded
Output data quantity	Max. 512 bits
Input data quantity	Max. 512 bits
Standards and directives	
DIN EN 61000-6-2 “Electromagnetic compatibility” (Immunity for industrial environments)	
DIN EN 61000-6-4 “Electromagnetic compatibility” (Emission standard for industrial environments)	

Standards and directives
DIN EN 60204-1 “Safety of machinery – Electrical equipment of machines – Part 1: General requirements”