SmartWire-Darwin
The System

User Manual

03/09 AWB2723-1617en

MOELLER

An Eaton Brand

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Danger!
Dangerous electrical voltage!

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the engineering instructions (AWA) of the device concerned.
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalisation. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference does not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60364-4-41 (VDE 0100 Part 410) or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.

- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).

Contents

About this Manual

System overview, SmartWire-Darwin

This manual describes the scope of functions, installation, commissioning and diagnosis of the SmartWire-Darwin intelligent connection system.

Specialist electrical training is needed for commissioning and creating circuit diagrams. The user must also be aware of and adhere to all valid occupational safety and accident prevention guidelines, standards and regulations.

Danger!
If active components are controlled, such as motors or pressurized cylinders, plant parts may become damaged or persons endangered, provided SmartWire-Darwin components are connected up incorrectly, or configured and programmed incorrectly.

Exclusion of liability

We have provided all the information in this manual to the best of our knowledge and belief and in accordance with the latest state of the art. However, this does not exclude the possibility of inaccuracies so that we cannot accept any liability for the accuracy and completeness of the information. In particular, this information does not guarantee any particular properties.

The SmartWire-Darwin components specified in this manual may be set up and operated only in connection with the corresponding manual and AWA installation instructions enclosed with the device. Installation, commissioning, operation, maintenance and retrofitting of the SmartWire-Darwin components may be performed only by qualified personnel. The SmartWire-Darwin components may be used only in the areas recommended by us and only in conjunction with third-party devices and components that have been approved by us. Their use is allowed fundamentally only in technically faultless condition. Fault-free and safe operation of the system requires proper transport, storage, installation

and commissioning as well as careful operation and maintenance. If the aforementioned safety-related instructions are not observed, in particular if the commissioning or maintenance of the devices is performed by insufficiently qualified personnel and/or the devices are used improperly, it cannot be excluded that the SmartWire-Darwin components will present sources of danger. We assume no liability for any injury or damages incurred.

Additional documentation

At various points in this manual reference is made to more detailed descriptions in other documentations. These are available in the form of PDF files for download from our FTP server.

ftp://ftp.moeller.net/DOCUMENTATION/AWB_MANUALS/.

The latest edition of this manual can be obtained from the Internet.

Reading conventions

Symbols used in this manual have the following meanings:

▶ Indicates instructions to be followed.

Caution!
Warns of a hazardous situation that could result in damage to the product or components.

Warning!
Warns of the possibility of serious damage and slight injury.

Danger!
Warns of the possibility of a hazardous situation that could result in major damage and serious or fatal injury or even death.

Draws your attention to interesting tips and supplementary information.

For greater clarity, the name of the current chapter is shown in the headline of the left-hand page and the name of the current section in the header of the right-hand page. This does not apply to pages at the start of a chapter and empty pages at the end of a chapter.

1 System description SmartWire-Darwin

Target group

This manual is aimed particularly at planners, developers and operators in the fields of electrical, control and mechanical engineering who want to use the connection system SmartWire-Darwin, with its reduced project planning and wiring costs, for operation in the switch cabinet, in the periphery, directly on the machine or in service buildings.

The SmartWire-Darwin components must only be installed and connected up by trained electricians or other persons who are familiar with the installation of electrical equipment.

Danger!
A specialist knowledge of electrical engineering is needed for configuration and commissioning. Plant sections and persons are at risk if a SmartWire-Darwin element is incorrectly connected or configured and active components such as motors or pressure cylinders are controlled.

Proper use

Several components of the SmartWire-Darwin connection system, referred to in the following as SWD, comply with the protection type IP20 and therefore have to be installed in an enclosure, switch cabinet or wiring distribution board. This does not apply to the SWD round cable with a connected round plug-in connector with screw-type locking, which complies with protection type IP67.

Power supply and signal terminals must be protected against accidental contact and covered.

An SWD topology may only be operated, if it has been properly fitted and connected by a qualified skilled electrician. The installation must comply with regulations for electromagnetic compatibility (EMC) (→ "Electromagnetic compatibility (EMC)", page 100).

Danger!
The power up of the SWD topology must not cause any hazards arising from activated devices, such as unexpected motor startups or power ups.

Improper use

The connection system SWD must not be used as a replacement for safety-related controllers such as burner controllers, crane controllers or two-hand safety controllers.

To find out how the SWD contactor modules can be used for safety-related switching-off in spite of this, please read the manual "SmartWire-Darwin Slaves" (AWB2723-1613en).

The SWD system

This manual describes the intelligent SmartWire-Darwin connection system, referred to below as SWD. The backbone of the SWD system is the self-configuring SWD network in which data are exchanged with the SWD slaves via an 8-conductor SWD network cable (→ section "The SWD network", page 19). The SWD slaves are provided with a voltage via the SWD network cable at the same time.

You can connect up to 99 SWD slaves, e.g. switching devices, control circuit devices and I/O modules to the SWD network cable.

As the SWD slaves are located on-site in the installation the SWD system reduces your wiring costs.

You create your SWD topology with the system components available (→ section "Components of the SWD system", page 13) according to the motto "plug & work".

At the beginning of the SWD network you always connect an SWD gateway via the SWD ribbon cable.

The SWD gateway controls the data interchange via the SWD network as a master function. At the same time, as a slave function, it exchanges data with the overriding controller via a field bus system. At present you can choose between the field bus systems PROFIBUS DP and CANopen.

SWD-Assist

The planning and ordering help system SWD-Assist provides valuable assistance with the project planning of your SWD topology. SWD-Assist is software that runs on Windows 2000 (SP 4), XP or Vista (32-bit) and relieves you of the planning work required for an SWD topology. The software is available free of charge at:

http://downloadcenter.moeller.net

- On this Moeller web site you have to first of all select the language and then the software package "SWD-Assist" in the field "Select your".
- Load SWD-Assist as an update or full version.

Components of the SWD system

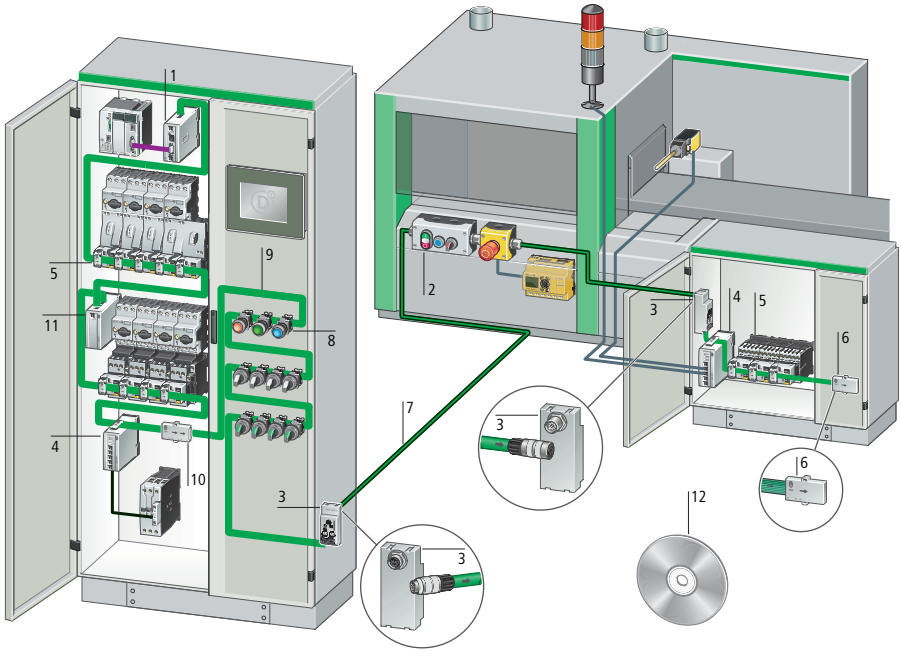


Figure 1: The SWD-networked switch cabinet

① SWD gateway
② M22-SWD... function element for control circuit devices in surface mounting enclosure
③ Switch cabinet bushing
④ SWD input/output module
⑤ SWD contactor module
⑥ Network terminator
⑦ SWD round cable
⑧ M22-SWD... function element for control circuit devices
⑨ SWD flat band conductor
⑩ Coupling for blade terminal
⑪ Power feeder module
⑫ Planning and ordering help, SWD-Assist

With the SWD components a differentiation is made between SWD slaves and SWD elements.

SWD slaves are all SWD components that respond to a request from the SWD gateway, i.e. can exchange data. They are given an SWD slave address.

SWD elements are passive SWD components that do not exchange any data, but are necessary for operation of the SWD network. SWD elements are, for example, the power feeder modules, SWD cables, adapters etc. SWD elements are not given an SWD slave address.

SWD station

The most important SWD slave in the SWD network is the PROFIBUS DP or CANopen gateway with its coordinator function.

SWD gateways for PROFIBUS-DP or CANopen
For a short description of how you install and plan your SWD gateway please refer to chapter "Engineering", page 27 and chapter "Installation", page 47.

For a detailed description of the SWD gateway please refer to the manual AWB2723-1612en.

Below you will find a short report of the SWD slaves that are currently available:

SWD contactor modules
The SWD modules DIL-SWD-32-001 (automatic) and DIL-SWD-32-002 (automatic/manual) can be combined with the contactors DILM7 to DILM38. Thus motor starters, consisting of a protective motor switch PKZ and a contactor DILM, can also be combined with the SWD system. Besides the device supply voltage, a 24 V DC control voltage is supplied to the DIL-SWD-32… modules for the contactors.

For a detailed description of the SWD modules DIL-SWD-32-… please refer to the manual "SmartWire-Darwin Slaves" (AWB2723-1613en).

SWD I/O modules

The SWD I/O modules are digital inputs and outputs for the connection of sensors and actuators that can be accessed via the SWD network. These can be, for example, auxiliary switches of additional switching devices that do not have integrated SWD technology. The modules are placed in the immediate vicinity of the sensors/actuators, due to which the remaining wiring is markedly reduced. Diverse modules with digital inputs and outputs in the form of transistors and relays are available.

For a short description of how you install your SWD I/O modules please refer to section "Connecting the SWD I/O module", page 57.

For a detailed description of the SWD I/O modules please refer to the manual AWB2723-1613, section "Input/output modules EU5E-SWD-…".

SWD function elements M22-SWD…

The M22-SWD... function elements are treated in the same way as RMQ Titan control circuit devices, but can be connected easily to the SWD network without any further wiring. The SWD function elements are combined as usual with the front elements of the RMQ Titan system.

SWD function elements are available for front fastening or for base fastening.

For a short description of how you install your M22-SWD… function elements please refer to section "Connecting M22-SWD… function elements", page 61.

For a detailed description of the SWD function elements M22-SWD… please refer to the manual AWB2723-1613, section "Control circuit devices M22-SWD".

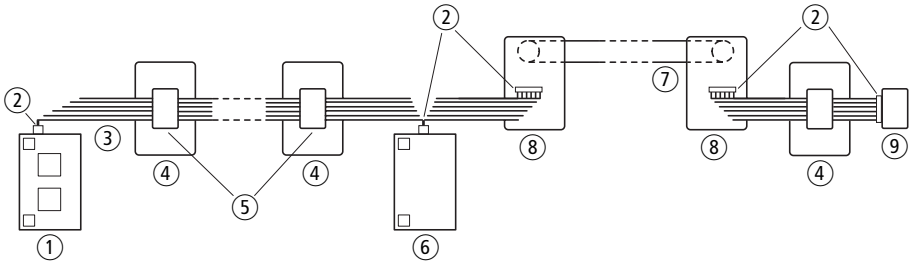


Figure 2: The SWD topology

① SWD gateway
② SWD blade terminal
③ SWD flat band conductor
④ SWD station
⑤ SWD external device plug
⑥ Power feeder module
⑦ SWD round cable
⑧ SWD switch cabinet bushing
⑨ Network terminator

SWD elements

The SWD elements complete the SWD system:

- Power feeder modules
- SWD flat band conductors and round cables
- Network terminator for flat band conductor
- Adapter for blade terminal/round cable
- PCB for surface mounting enclosure for plugging in M22-SWD… function elements
- Switch cabinet bushing socket/plug, POW
- Enclosure bushing socket/plug
- Jumper for device plug, Bottom and Front
- Coupling for blade terminal
- SWD accessories

A short functional description of the passive SWD components follows.

Power feeder modules
Power feeder modules are power supply units that are connected additionally to the SWD network when there is an increased current consumption or increased voltage drop. Being a passive SWD element, a power feeder module does not have a slave address.

The power feeder module EU5C-SWD-PF1 feeds the 24 V DC control voltage for contactors back onto the SWD ribbon cable.

The power feeder module EU5C-SWD-PF2 feeds both the 24 V DC control voltage for contactors and the supply voltage of approx. 15 V DC for the devices back onto the SWD ribbon cable (→ "Connecting power feeder module", page 53).

For a short description of how you install power feeder modules please refer to section "Connecting power feeder module", page 53.

For a detailed description of the power feeder modules please refer to the manual AWB2723-1613en.

SWD flat band conductors and round cables
You connect SWD elements via 8-conductor SWD ribbon cable or round cable, via which both the data and the supply voltages are transmitted (→ "Connecting the SWD connection cable", page 83).

Network terminator for flat band conductor
The SWD network requires termination at the beginning and end of the network (→ "Using network termination", page 98).

Adapter for blade terminal/round cable
This adapter (type SWD4-8FRF-10) is for the purpose of adapting from ribbon cable to round cable and vice versa (→ "Using the ribbon/round cable adapter", page 97).

PCB for surface mounting enclosure M22-I…
The M22-I… surface mounting enclosures (protection type IP67) are for the purpose of accommodating up to 6 M22 SWD base function elements. The M22 SWD base function elements are plugged onto an M22-SWD-I1…6-LP01

printed circuit board, which is inserted into the surface mounting enclosure. The connection with the SWD network is created via this printed circuit board.

The standard RMQ Titan surface mounting enclosure M22-I1…6 in conjunction with standard M22 front elements are used (→ "M22-SWD base fixing", page 66).

Socket/plug switch cabinet bushings
You use switch cabinet bushings with an M18 x 0.75 mm screw fixing for external connection of the SWD network to a switch cabinet or enclosure.

You use the switch cabinet bushing, for example, to connect to a control console with M22 SWD... function elements or to connect to another switch cabinet and in the process to supply in addition the 24 V DC control voltage for contactors (→ "Connecting a switch cabinet bushing", page 73).

Enclosure bushing socket/plug
Use enclosure bushings with an M20 x 1.5 mm screw fixing of protection type IP67, for example, in the surface mounting enclosure or switch cabinet for pluggable connection of the 8-conductor SWD round cable (→ "Connecting the enclosure bushing", page 80).

Jumper for device plug, Bottom/Front
This link connects an interrupted select cable (SEL cable). The select cable must be functional for automatic addressing of the SWD slaves.

SWD accessories
Further accessories such as blade terminals, connectors, round plugs/round sockets with screw-type locking in straight or angled finish and pliers for fitting the plug are available.

The SWD network

The relevant SWD gateway operates on the SWD network as a coordinator that assumes the network management and controls the data transfer procedure. The special SWD protocol is used for this purpose.

Features of the SWD network

Table 1: Features of the SWD network

Physics of the data cable	RS485
Network length [m]	at present up to 100
Number of slaves (max.)	99 (automatic addressing)
Data transfer rate [Kbits/s]	automatic detection, at present 125
User data bytes per telegram	variable, up to a maximum of 1000
Cycle time of one complete polling cycle[1)] [ms]	2 + (number of user data bytes x 0.1)
Access type	central coordinator (polling)
Data transfer protocol	SWD, character-orientated, fixed frame length, variable data field
Data backup process	CRC32 verification polynom
Alarm acquisition	acyclic data traffic
SWD system dependability	error-tolerant system, (time monitoring[2)], slave replacement, telegram repetition etc.)
Applications	Coupling via field bus systems to PLC, production controller and process controller, energy management

1) The difference in the typical polling cycle time for one or 99 planned SWD slaves is only approx. 2 ms (→ figure , page 20).

2) Time monitoring for the SWD slave and for the coordinator, default watchdog timeout 300 ms. If an SWD slave receives no valid data from the coordinator after expiry of the timeout period, it sets its outputs to the safe status 0. The coordinator also sets the receive data of a missing SWD slave to "0" after expiry of the timeout period.

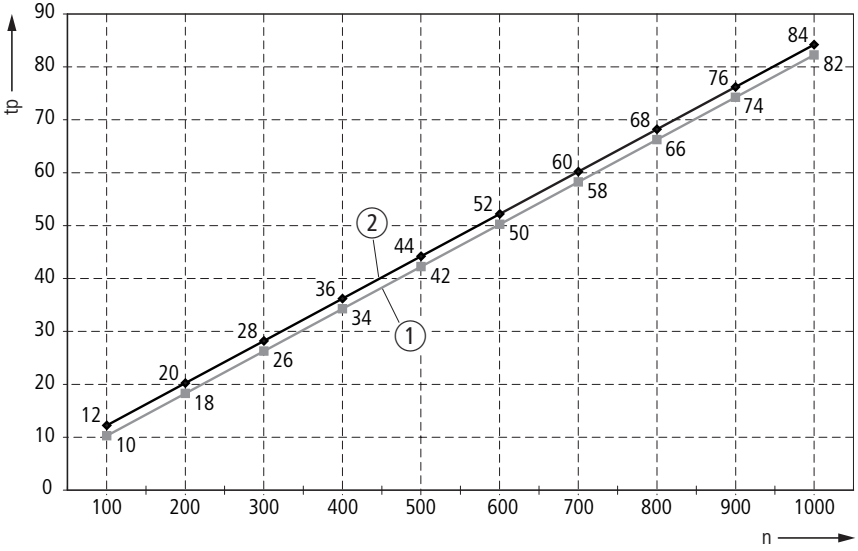


Figure 3: Polling cycle time, dependent on the SWD user data bytes transferred at 125 Kbit/s
n = number of user data bytes
t_P = polling cycle time [ms]

① 1 SWD slave with n user data bytes

② 99 SWD slaves with n user data bytes

Automatic addressing of the SWD slaves

Prerequisite: the SWD gateway is connected properly to the SWD network.

After initial switch-on of the supply voltage the SWD gateway determines the SWD slaves that are present on the SWD network. It commences communication with them and first of all sets all SWD slaves to the same data transfer rate. In this phase, in which SWD slaves can still be added or removed, the SWD gateway waits for the **"Config." button** to be pressed to start the automatic addressing. The SWD gateway reports the status with the following LED indication:

Table 2: LED indication of the SWD gateway after switching on with a new number of SWD slaves

LED	Status
SWD	Red flashing
Config.	Off (no planned configuration is available)

The SWD gateway creates the actual configuration from the configuration found by the **"Config." button** being pressed for at least 2 seconds. In the process it checks which and how many SWD slaves are connected to the SWD network. In accordance with their positioning in the SWD network it assigns slave addresses to these in uninterrupted ascending order. The SWD gateway starts with the SWD slave closest to it, assigning the slave address 1 up to a maximum of 99.

During this process the SWD LED flashes orange.

The SWD gateway stores the actual configuration as a valid **target configuration** and is now in the SWD mode "Failsafe". This stored target configuration serves as a reference for each switch-on after this.

The SWD gateway signals the end of this automatic configuration with address assignment with the following LED indication:

Table 3: LED indication of the SWD gateway after creation of a new target configuration

LED	Status
SWD	green continuous light
Config.	Off (no planned configuration is available)

The SWD gateway now waits for the parameters of the **project configuration** from the field bus master.

If the configuration for the overriding field bus master (the project configuration) in terms of the number and type of SWD slaves agrees with the target configuration in the SWD gateway and has been transferred to the SWD gateway, the data interchange can already commence.

This is valid for each field bus master.

The SWD gateway is now in the SWD mode "Normal".

Table 4: LED indication of the SWD gateway after changeover to the SWD mode "Normal"

LED	Status
SWD	green continuous light
Config.	green continuous light
CAN or DP	green continuous light when data is being exchanged on the field bus.
POW	yellow continuous light

For a brief description of how an SWD gateway is put into operation for the first time with a new actual configuration please refer to section "Initial switch-on of the SWD network", page 105.

In the manual SmartWire-Darwin Gateways (AWB 2723-1612en) you can find out how to configure an SWD gateway with its SWD slaves in the configuration software for the PLC.

Addressing when SWD slaves have been changed
After each subsequent switch-on of the supply voltage the SWD gateway first of all determines the **actual configuration** and compares it with the stored target configuration. In the process the SWD gateway checks which and how many SWD slaves are connected to the SWD network.

If the configuration has changed, it has to be differentiated whether the change has been effected in the SWD network, see "Switch-on in case of a changed actual configuration", page 109 or whether the change has been effected in the configuration software of the PLC, see "Switching on in the case of a changed project configuration", page 111.

Organization of the SWD slave data

The SWD network is organized in the same way as a binary data area in which the memory space required for the input/output bytes of a slave is reserved for each SWD slave detected. The data area comprises a maximum of 1000 bytes.

This reserved data area is transferred completely in the SWD network. Each SWD slave reads the receive data intended for it (input byte) and writes its send data (output bytes) to the memory location reserved for it.

The data are declared valid at the end of the transfer cycle, after error-free completion of the telegram verification.

Each SWD slave can now accept the new receive data at the same point in time and prepare its send data for the next transfer cycle.

Physical properties of the SWD network

An SWD network is designed for a line structure. It must be terminated at the beginning and at the end with a network termination. The network termination at the beginning is integrated into the SWD gateway so that only at the end of the line does a termination still have to be switched on or connected (→ "Using network termination", page 98).

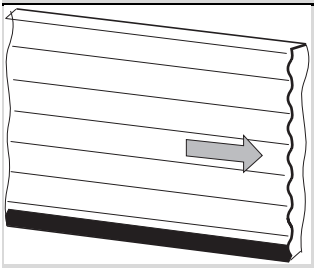
SWD network cables

Use SWD ribbon cable or SWD round cable as the SWD network cable. 2 conductors "Data A" and "Data B" are used for the data transfer.

Flat band conductor

Each ribbon cable conductor has a cross-section of 0.23 mm^2 (AWG 24). You will find the configuration of the ribbon cable conductors below.

Table 5: Configuration of the SWD flat band conductor

	Meaning	
	+24 V DC	Contactor control voltage
	Earth	Contactor control voltage
	GND	for device supply voltage and data
	Data B	
	Data A	
	GND	for device supply voltage and data
	SEL	Select cable
	+15 V DC	Device supply voltage

Round conductor

Round cables are suitable among other things for the bridging of large distances. The conductors for the supply of the device supply voltage and contactor control voltage have a cross-section of 0.5 mm^2, the other conductors 0.22 mm^2 each. See below for the configuration of the round cable conductors.

Table 6: Configuration of the SWD round cable

Core	Cross-section [mm^2]	Wire colour	Meaning	
1	0.5	brown	+15 V DC	Device supply voltage
2	0.22	grey	SEL	Select cable for automatic addressing of the SWD slaves
3	0.22	pink	GND	for device supply voltage and data
4	0.22	Red	Data A	
5	0.22	blue	Data B	
6	0.5	white	GND	for device supply voltage and data
7	0.5	yellow	Earth	Contactor control voltage
8	0.5	Green	+24 V DC	Contactor control voltage

2 Engineering

How do I plan a SWD topology?

This section will help you to plan the SWD topology of an installation. Before you plan the SWD topology, if possible:-

- The automation task should be clearly defined.
- The field bus system via which the SWD gateway communicates with the overriding controller should be defined.
- The number and the types of SWD slaves should be known.
- The positions of the SWD slaves in the installation should be determined so that the total length of the SWD ribbon cable and round cable is known.

You can also perform the entire project planning conveniently with SWD-Assist, which can be downloaded via the following link: http://downloadcenter.moeller.net.

The planning of the SWD topology extends to:

- Selection of the SWD gateway, depending on the field bus system used, which at present is PROFIBUS-DP or CANopen.
- Selection and positioning of the SWD slaves, e.g. SWD modules DIL-SWD-32-…, SWD I/O modules etc. The number and the types of SWD slaves determine the volume of data to be transferred and the electrical load (→ "Calculation of the electrical load in the device supply", page 32, → "Calculation of the electrical load in the contactor supply", page 35).
- Determination of the cable length from the gateway to the end of cable. On the basis of this length, the line resistance and the electrical load you then calculate the voltage drop on the line and check whether an additional power unit

(power feeder module) is required (→ "Voltage drop", page 36).

- Positioning of the SWD slaves with the drafting of a device mounting plan for the SWD cables (→ "How do I position my SWD slaves?", page 45).
- Definition of what type of network termination will be used at the end of the network (→ "Using network termination", page 98).

How do I configure my gateway?

The SWD gateway configures the SWD network automatically. So after installation and during commissioning of all the SWD slaves you only have to press the **"Config." button** to create a valid target configuration (→ "Automatic addressing of the SWD slaves", page 21).

In the process an SWD gateway determines how many and which SWD slaves are present on the SWD network and how many user data bytes have to be transferred. A maximum of 1000 user data bytes can be transferred on the SWD network.

Field bus

You configure the field bus side or the field bus master in the controller configuration of the overriding controller. The important thing is that the project configuration of the SWD slaves created there complies with the target configuration and is downloaded to the SWD gateway.

For a detailed description of how to configure your PROFIBUS DP or CANopen SWD gateway please refer to the manual AWB2723-1612en.

SWD PROFIBUS-DP Gateway EU5C-SWD-DP

The PROFIBUS DP gateway functions as a modular slave on the PROFIBUS DP in conjunction with the configured SWD slaves. Each SWD slave has to be considered as an independent module.

Table 7: Features of the SWD PROFIBUS DP gateway

PROFIBUS-DP transfer rate [Mbit/s] (max.)	12, automatic adaptation
Number of PROFIBUS DP slaves (max.)	124
Valid PROFIBUS DP slave addresses	1 - 125
PROFIBUS DP data volume per slave (max.)	488 I/O Byte (244 E/244 A Byte)
SWD data transfer rate [Kbit/s]	at present 125
Number of SWD slaves on the PROFIBUS DP gateway (max.), limitation on account of the data volume[1)]	58
Rated current I_G in the device supply [A]	0.7
Rated current I_S in the contactor supply [A]	3

1) Due to the internal memory structure of the PROFIBUS DP master a maximum of 58 SWD slaves can be served operated via an SWD PROFIBUS DP gateway.

SWD CANopen gateway EU5C-SWD-CAN

In connection with the SWD slaves the gateway functions on the CANopen bus as a modular slave in accordance with profile DS301.4, each SWD slave being an own module.

Table 8: Features of the SWD CANopen gateway

CANopen transfer rate [Mbit/s] (max.)	12, automatic adaptation
Number of CANopen slaves (max.)	124
Valid CANopen slave addresses (node addresses)	2 - 32
CANopen data volume per slave (max.)	256 I/O Byte (128 E/128 A Byte)
SWD data transfer rate [Kbit/s]	at present 125
Number of SWD slaves on the PROFIBUS DP gateway (max.)	99
Rated current I_G in the device supply [A]	0.7
Rated current I_S in the contactor supply [A]	3

How do I dimension the voltage supply of my SWD topology?

Besides its function as a coordinator the SWD gateway also assumes the power supply of the SWD topology.

In addition it has a built-in power supply unit which provides 2 separate supply voltages within the SWD network:

- The 15 V DC device supply voltage U_{VP} (**device supply**) for its own supply and for the electronics of the downstream SWD slaves.
  The SWD gateway (or an SWD power feeder module) generates this 15 V DC supply voltage from the 24 V DC supply voltage that you apply to the spring-loaded terminal connection POW.

- The 24 V DC control voltage U_{AUX} for the contactor coils (**contactor supply**) that are activated via an SWD module DIL-SWD -32- ....
  Only if the SWD topology comprises contactors or motor starters do you supply in addition to the SWD gateway (or SWD power feeder module) the control voltage via the spring-loaded terminal "AUX".

The calculations of the electrical load and the voltage drop have to be made separately for devices and contactor supply.

Connection of the SWD network to the SWD gateway and to the SWD power feeder module is always performed via the 8-conductor SWD ribbon cable. With a cross-sectional area of 0.23 mm² (AWG 24) per ribbon cable conductor the maximum current-carrying capacity is:

- 3 A, according to IEC/EN.
- 2 A, according to UL 508.

Not until you are in the subsequent SWD topology, e.g. in the case of a surface mounting enclosure, can you use the SWD round cable, which has a cross-section of 0.5 mm² for the conductors of the device supply voltage and contactor supply.

For the dimensioning of the power supply the following points have to be taken into account:

- In the device supply (15 V DC):
  - the total power consumption (→ "Device supply", page 32) and
  - the voltage drop (→ "Voltage drop", page 36).
- The following are optional in the contactor supply (24 V DC):
  - The total power consumption (→ "Contactor supply", page 34)
  - the voltage drop (→ "Voltage drop", page 36).

Please take the total current consumption of your SWD topology into account and, if necessary, plan for (an) additional supply unit(s), e.g. the SWD power feeder module(s) or SWD switch cabinet bushing(s).

Device supply

The SWD gateway supplies the 15 V DC device supply voltage (U_{VP}) via conductor 1 (+15 V) and the conductors 3 and 6 (each GND) (→ "Configuration of the SWD flat band conductor", page 24).

Calculation of the electrical load in the device supply
The total current consumption of all SWD slaves connected to the SWD gateway must not exceed 0.7 A in the device supply. Otherwise a power feeder module EU5C-SWD-PF2-1 has to be used before the SWD slave as of which the 0.7 A has been exceeded.

In the device supply the current consumption of the various SWD elements contains a constant proportion that is always consumed and a variable proportion, for example, caused by switching on an LED.

For the purpose of simplification calculate with the current consumption values of the following table "Maximum current consumption of the individual function elements in the device supply", which contains both proportions. For further simplification calculate with a simultaneity factor of 1, for example all LEDs are activated simultaneously.

▶ Add together the currents of all SWD slaves plus the current that flows through the network termination, making a total current I_G.

$$I_G = I_1 + I_2 + \ldots + I_n + I_{RB}$$

Table 9: Maximum current consumption of the individual function elements in the device supply

Function element	Maximum current consumption of SWD slaves
M22-SWD-K11	7
M22-SWD-K22	7
M22-SWD-LED-W	19
M22-SWD-LED-B	19
M22-SWD-LED-G	19
M22-SWD-LED-R	19
M22-SWD-K11LED-W	19
M22-SWD-K11LED-B	19
M22-SWD-K11LED-G	19
M22-SWD-K11LED-R	19
M22-SWD-K22LED-W	19
M22-SWD-K22LED-B	19
M22-SWD-K22LED-G	19
M22-SWD-K22LED-R	19
M22-SWD-KC11	7
M22-SWD-KC22	7
M22-SWD-LEDC-W	19

M22-SWD-LEDC-B	19
M22-SWD-LEDC-G	19
M22-SWD-LEDC-R	19
M22-SWD-K11LEDC-W	19
M22-SWD-K11LEDC-B	19
M22-SWD-K11LEDC-G	19
M22-SWD-K11LEDC-WR	19
M22-SWD-K22LEDC-W	19
M22-SWD-K22LEDC-B	19
M22-SWD-K22LEDC-G	19
M22-SWD-K22LEDC-R	19
DIL-SWD-32-001	40
DIL-SWD-32-002	40
EU5E-SWD-8DX	12
EU5E-SWD-4D4D	45
EU5E-SWD-4D2R	55
SWD4-RC8-10	17
M22-SWD-IL…LP (with the network termination switched on)	17

Contactor supply

A contactor receives the control voltage U_{AUX} via conductors 8 (+24 V) and 7 (earth) of the 8-conductor ribbon cable (→ "Configuration of the SWD flat band conductor", page 24) and further via the SWD module DIL-SWD-32-…. Each contactor is equipped with its own SWD module DIL-SWD -32- ....

Calculation of the electrical load in the contactor supply

If the SWD modules DIL-SWD-32-… are combined with contactors that on account of the type or quantity cause a total wattage/total current consumption > 72 W/3 A, a power feeder module EU5C-SWD-PF1-1, EU5C-SWD-PF2-1 or a switch cabinet bushing has to be inserted before the SWD slave as of which the 3 A have been exceeded.

Please refer to the following table for the current consumption of the various contactors.

Table 10: Wattage/current consumption of the contactor coils at a voltage of 24 V DC

Contactor	Pick-up power [W]	Pick-up current at 24 V DC [mA]	Sealing power [W]	Holding current with 24 V [mA]
DIL7 - DIL9	3	125	3	125
DIL12 - DIL15	4.5	188	4.5	188
DIL17 - DIL38	12	500	0.5	21

▶ Add the currents I_n of all SWD slaves to the total current I_G.

$$I_G = k \times (I_1 + I_2 + \ldots + I_n)$$

Take into account in the calculation the simultaneity factor "k" of the complete installation.

Example:

With a simultaneity factor k = 0.6, 10 contactors of the type DIL38 can be supplied by an SWD gateway or an SWD power feeder module.

Voltage drop

Extensive SWD networks with long line lengths (up to 100 m) and the line resistance resulting from these lead to a corresponding voltage drop on the device and contactor supply lines.

For the planned network position of an SWD slave it therefore has to be checked whether sufficient supply voltages are available there.

If the sum of all voltage drops is so large that the device electronics no longer function stably or a contactor no longer switches definitely, you must insert an additional supply unit before this network position.

Table 11: Line resistance of the SWD ribbon cable and round cable

R_L line resistance/ m, calculated from the supply and return line[1)]	[Ohms/m] for the 15 V DC device supply	[Ohms/m] for the 24 V DC contactor supply
Flat band conductor	0.131	0.174
Round conductor	0.06	0.07

1) The line resistance/m is valid for a line temperature of 70 °C.

On account of the different line resistances you must determine the the voltage drop for the SWD ribbon cable and SWD round cable separately.

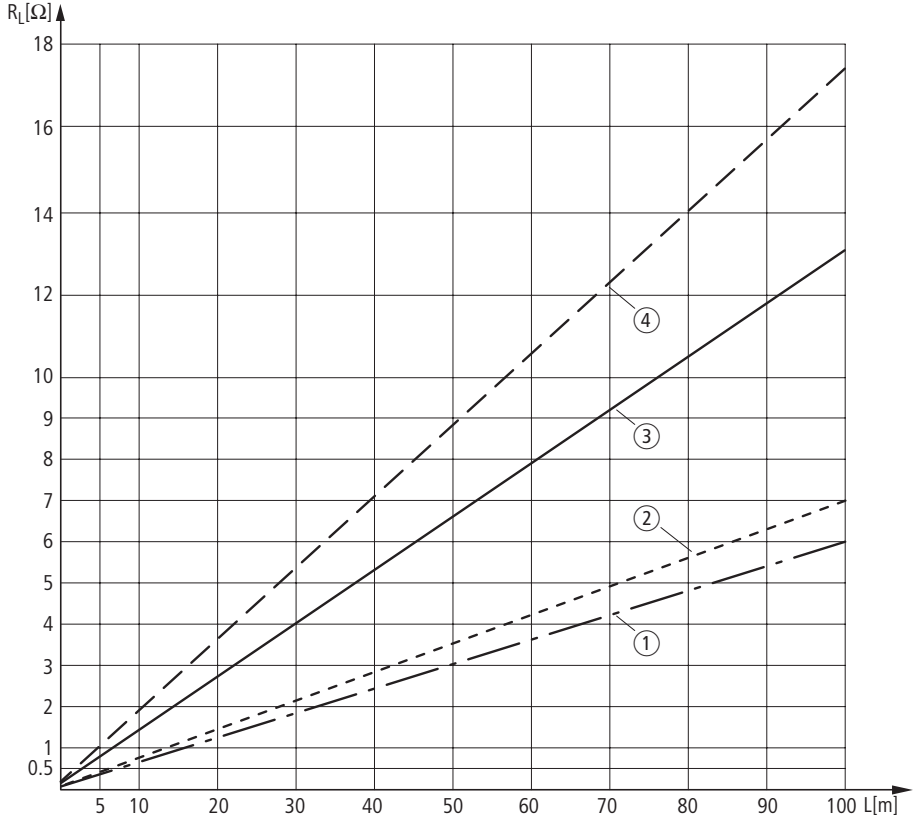


Figure 4: Line resistance of SWD ribbon cable and SWD round cable in the device and contactor supplies

① Round cable in the device supply
② Round cable in the contactor supply
③ Ribbon cable in the device supply
④ Ribbon cable in the contactor supply

Calculation of the voltage drop in the device supply
The operability of an SWD slave is guaranteed at a supply voltage for the devices U_{VP} in the range of +15 V DC (tolerance range -30 %/+20 %), i.e. +10.50 - +18.0 V DC.

The following is valid: U_{VPmin} = 10.5 V DC

Warning!
If the voltage drops below the minimum voltage, the safe operation of an SWD slave is no longer guaranteed.

For safety reasons assume a supply voltage U_{VP} = 14.5 V DC on the supply unit for the calculation of the voltage drop.

Maximum value for the voltage drop U_{Lmax}:

$$U_{Lmax} = U_{VP} - U_{VPmin} = 14.5\ V - 10.5\ V = 4.0\ V\ DC$$

In the following calculation of the supply voltage a maximum electrical load with a simultaneity factor of 1 is assumed.

Rule-of-thumb value: if you use only ribbon cables and the maximum current of 0.7 A is consumed, the maximum voltage drop in the device supply is achieved at a line length of approx. 43 m, even with an unfavourable layout. An unfavourable layout exists, if the first SWD slave is switched on after 43 m of ribbon cable.

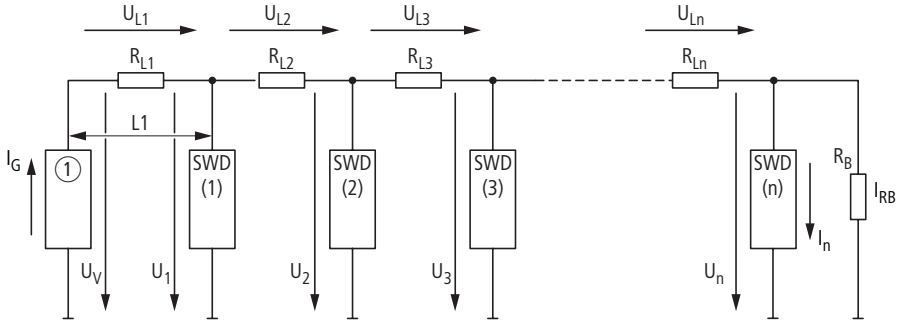


Figure 5: Voltage supply in the SWD network

① Supply unit: SWD gateway or SWD power feeder module

The following is valid in accordance with the illustration:

$U_V = U_{VP} = 14.5\ V\ DC$

$U_1 = U_V - R_{L1} \times (I_1 + I_2 + I_3 + \ldots + I_n + I_{RB})$

$U_2 = U_1 - R_{L2} \times (I_2 + I_3 + \ldots + I_n + I_{RB})$

$U_n = U_{n-1} - R_{Ln} \times (I_n + I_{RB})$

Caution!

In the case of this simplified formula the current limitation due to the line resistance remains unconsidered and the nominal current of the individual SWD slaves is assumed at all times. The result is valid at a supply voltage $U_n \geqq$ of 10.5 V DC.

- ▶ First of all determine the total current by adding together the current consumption of all SWD slaves in accordance with the table "Maximum current consumption of the individual function elements in the device supply", page 33, including the current consumption of the network termination (17 mA).
- ▶ Refer to the illustration "Line resistance of SWD ribbon cable and SWD round cable in the device and contactor supplies", page 37 or the table "Line resistance of the SWD ribbon cable and round cable" page 36 for the total line resistance subject to consideration of the length of the various SWD line types.

▶ Calculate the supply voltage at the SWD slave "Slave n" using the formula:

$$U_n = U_{n-1} - R_{Ln} \times (I_n + I_{RB})$$

→ Only if this rough calculation yields an excessively low supply voltage at an SWD slave "n" does it have to be calculated as of what network position the minimum supply voltage U_{VPmin} = 10.5 V DC is achieved. An additional power feeder module EU5C-SWD-PF2-1 has to be inserted into the SWD network before this position.

If your calculation has yielded an excessively low supply voltage at "Slave n" using the above formula:

▶ Calculate the supply voltage step by step to the individual SWD slaves with the aid of the table "Step-by-step calculation of the supply voltage", page 40.

Table 12: Step-by-step calculation of the supply voltage

SWD slave (slave address)	Step 1: Determining the current in the line segment	Step 2: Determining the resistance of the line segment as of the previous slave	Step 3: Determining the voltage drop in the line segment	Step 4: Determining the voltage of the current slave
SWD (1)	$I_G=I_1+I_2+\ldots I_n+I_{RB}$	$R_{L1}=R_L \times L_1$	$U_{L1}=I_G \times R_{L1}$	$U_1=U_V - U_{L1}$
SWD (2)	$I_2=I_G-I_1$	$R_{L2}=R_L \times (L_2-L_1)$	$U_{L2}=I_2 \times R_{L2}$	$U_2=U_1 - U_{L2}$
SWD (3)	$I_3=I_G-I_2$	$R_{L3}=R_L \times (L_3-L_2)$	$U_{L3}=I_3 \times R_{L3}$	$U_3=U_2 - U_{L3}$
…	…	…	…	…
SWD (n)	$I_n=I_G-(I_1+I_2+\ldots I_n+I_{RB})$	$R_{Ln}=R_L \times (L_n-L_{n-1})$	$U_{Ln}=I_n \times R_{Ln}$	$U_n=U_{n-1} - U_{Ln}$

- I_G = Total current in the SWD network that is supplied by a supply unit.
- I_{RB} = The current that flows through the network termination can be assumed as being 17 mA.

- U_V = 14.5 V = Supply voltage in the device supply.
- U_n = Supply voltage for the SWD slave "(n)"
- U_{Ln} = Voltage drop in the line segment "n".
- R_L = Line resistance per metre, calculated from the supply and return line.
- L_n = Length of the line segment "n" as of the preceding SWD slave. The preceding slave is the supply unit for SWD slave 1.

Example for calculation of the voltage drop in the device supply

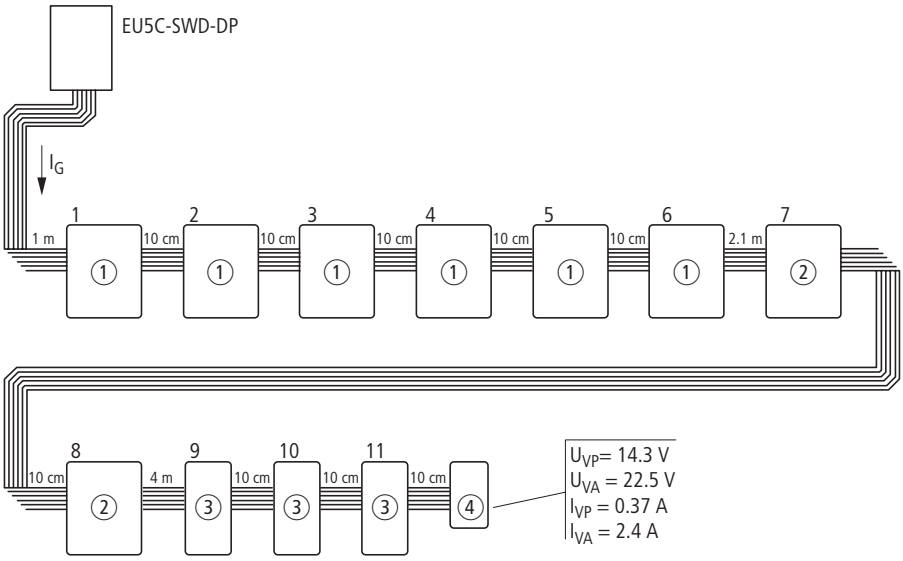


Figure 6: Example for calculation of the voltage drop in the device supply

① 6 contactors DILM38 (with DIL-SWD-032-002), simultaneity factor k = 0.8

② 2 SWD I/O modules (EU5E-SWD-4D4D)

③ 3 function elements M22-SWD-K11LEDC-W

④ Network termination (SWD4-RC8-10)

Total length of the ribbon cable 8 m

Example of calculation using the formula:

$$U_n = U_{n-1} - R_{Ln} \times (I_n + I_{RB})$$

Result of calculation	
Total current in the device supply I_{VP}	0.364 A
Total current in the contactor supply I_{AUX}	2.4 A
Voltage drop in the device supply U_{VP}	0.38 V
Voltage drop in the contactor supply U_{AUX}	2.52 V

The SWD gateway is supplying the SWD topology sufficiently.

Calculation of the voltage drop in the contactor supply

DC actuated contactors with the control voltage U_{AUX} +24 V DC switch dependably in the range +24 V DC (-20 %/ +10 %), i.e. from +19.2 to +26.4 V DC.

For safety reasons assume that the supply voltage U_{AUX} = 23.5 V DC on the supply unit for calculation of the voltage drop.

The following is valid: U_{AUXmin} = 19.2 V DC

Warning!
If the voltage drops below the minimum voltage, dependable operation of a contactor is no longer guaranteed.

Maximum value for the voltage drop U_{Lmax}:

$$U_{Lmax} = U_{AUX} - U_{AUXmin} = 23.5\ V - 19.2\ V = 4.3\ V\ DC$$

Rule of thumb value: if you are only using ribbon cables and the maximum current of 3.0 A is consumed, the maximum voltage drop in the contactor supply is achieved at a line length of approx. 8.4 m.

Calculation of the voltage drop in the contactor supply is the same as that for the device supply, with the exception that no current flow due to a network termination has to be taken into consideration. A higher electricity consumption has to be assumed, so the simultaneity factor also has to be taken into account more intensely in the calculation.

The following is valid in accordance with the illustration " ", page 39:

$$U_V = U_{AUX} = 23.5\ V\ DC$$

$$U_1 = U_V - R_{L1} \times k \times (I_1 + I_2 + I_3 + \ldots + I_n)$$

$$U_2 = U_1 - R_{L2} \times (I_2 + I_3 + \ldots + I_n)$$

$$U_n = U_{n-1} - R_{Ln} \times (I_n)$$

Please refer to the table "Wattage/current consumption of the contactor coils at a voltage of 24 V DC", page 35 for the current consumption of the contactor coils (I1…In).

Example of the calculation of the voltage drop in the contactor supply

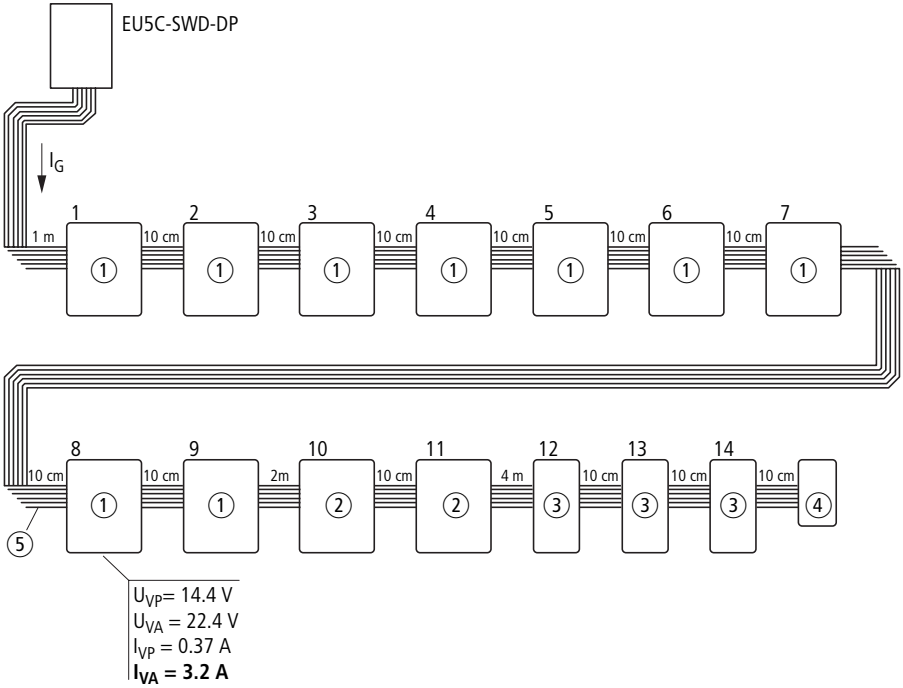


Figure 7: Example of the calculation of the voltage drop in the contactor supply

SWD topology:

This is based on the example of the calculation of the voltage drop in the device supply and should be expanded by another 3 contactors DILM38 (DIL-SWD-032-002) where the simultaneity factor k = 0.8.

① 9 contactors DILM38 (with DIL-SWD-032-002), simultaneity factor k = 0.8

② 2 SWD I/O modules (EU5E-SWD-4D4D)

③ 3 function elements M22-SWD-K11LEDC-W
④ Network termination (SWD4-RC8-10)
⑤ Position for an additional power feeder module (EU5C-SWD-PF1-1)

Total length of the ribbon cable 8.2 m

Example of calculation using the formula:

$$U_n = U_{n-1} - R_{Ln} \times (I_n + I_{RB})$$

Result of calculation	
Total current in the device supply I_{VP}	0.469 A
Total current in the contactor supply I_{AUX}	3.6 A
Voltage drop in the device supply U_{VP}	0.49 V
Voltage drop in the contactor supply U_{AUX}	3.77 V

The SWD gateway does not supply the contactor coils with sufficient current. An additional power feeder module EU5C-SWD-PF1-1 must be inserted after the contactor with the SWD slave address 7.

The voltage drop in the device supply is non-critical.

How do I position my SWD slaves?

There are no restrictions to the positioning. However, the following recommendations gained from everyday practice should be heeded:

▶ Arrange the SWD slaves of a device group as far as possible in groups on the SWD network.

If, for example, the functional elements M22-SWD... or SWD I/O modules are arranged next to each other, installation of the device plugs or later replacement of the SWD slaves will be easier.

→ A minimum distance of approx. 30 cm has to be maintained between SWD network lines and energy cables.

3 Installation

The SmartWire-Darwin (SWD) components must only be installed and connected up by trained electricians or other persons who are familiar with the mounting of electrical equipment.

Danger of electric shock!
Never carry out electrical work on the device while the power supply is switched on.

Always follow the safety rules:

- Switch off and isolate.
- Verify isolation from the supply.
- Secure against restart.
- Short-circuit and ground.
- Cover adjacent live parts.

The SWD components are installed in the following order:

- Mechanical installation of the SWD elements.
- Mechanical installation of the SWD cables and field bus cable (PROFIBUS-DP or CANopen).
- Electrical installation of the supply voltages.
- Electrical installation of the sensors and actuators on the SWD I/O module.

If contactors are used:

- Electrical installation of the control voltage for the contactors.

Mechanical Mounting

SWD gateways, SWD I/O modules and SWD power feeder modules are suitable for installation on a top hat rail in accordance with IEC/EN 60715, 35 mm.

- ▶ First of all set the field bus slave address. This is set on the SWD gateway by means of the DIP switches (switches 2 - 8) on the right-hand side of the SWD gateway.
- ▶ Install the above mentioned SWD components in a vertical position on a top hat rail or on a plate with the device feet ZB4-101-GF1 that are available as additional equipment.

Electrical Installation

Potential Relationship between the Components

The entire SWD topology operates with a common device supply voltage. The field bus and the SWD topology are electrically isolated from one another.

SWD gateway connection

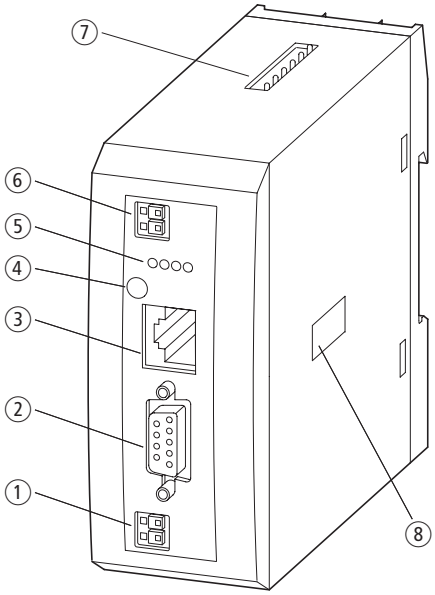


Figure 8: SWD gateway

① POW: Supply voltage 24 V DC
② Field bus interface
③ Diagnosis interface, only for diagnostic purposes in case of service
④ Config. button
⑤ Status LEDs
⑥ AUX: control voltage for contactors 24 V DC
⑦ SWD network output (SWD OUT)
⑧ DIP switch for setting the field bus address

Caution!
EMERGENCY STOP switching is performed by switching off the 24 V DC control voltage of the contactor coils. See manual AWB2723-1613en.

Connecting the POW power supply
The device supply voltage for the electronics of all SWD slaves (15 V DC) is generated from the 24 V DC supply voltage that you apply to the spring-loaded terminal connection POW.

Connecting the supply voltage AUX
If there are any contactors or motor starters in the SWD topology, a 24 V DC voltage AUX must be additionally supplied as a control voltage for the contactor coils.

Conductor sizes of the cables for the POW and AUX supply voltages

- solid: 0.2 - 1.5 mm^2 (AWG 24-16).
- fine wire 0.25 - 1.5 mm^2 with appropriate isolated wire-end sleeves with plastic collars in accordance with DIN 46228, Part 4, minimum length 8 mm.

Line protection for the POW and AUX supply voltages

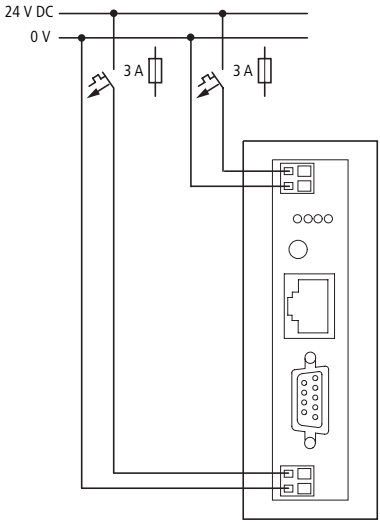


Figure 9: Line protection for the POW and AUX supply voltages

▶ On the SWD gateway connect the POW and AUX supply voltages via separate miniature circuit-breakers:

- Miniature circuit-breaker 24 V DC for POW
  - Line protection in accordance with **DIN VDE 0641** Part 11, IEC/EN 60898:
  - Miniature circuit-breaker 24 V DC rated current 3 A; tripping characteristic **C** or
  - Fuse 3 A, utilisation class gL/gG

  - Line protection for cable AWG 24 in accordance with **UL 508** and CSA-22.2 no. 14:
  - Miniature circuit-breaker 24 V DC rated current 2 A; tripping characteristic **C** or
  - Fuse 2 A.

- Miniature circuit-breaker 24 V DC for AUX
  - Line protection in accordance with **DIN VDE 0641 Part 11**, IEC/EN 60898:
  - Miniature circuit-breaker 24 V DC rated current 3 A; tripping characteristic **Z** or
  - Fuse 3 A, utilisation class gL/gG
  - Line protection for cable AWG 24 in accordance with **UL 508** and CSA-22.2 no. 14:
  - Miniature circuit-breaker 24 V DC rated current 2 A; tripping characteristic **Z** or
  - Fuse 2 A.

Caution!
The POW power supply behaves capacitively when first switched on, an increased starting current (12.5 A/6 ms) flows in comparison with the rated input current. The switching device and the power supply unit for switching on the supply voltage must be suitable for this briefly increased starting current.

Connecting the SWD network
Connection of the SWD gateway is performed via the SWD ribbon cable with a fitted blade terminal (beginning of the cable).

Caution!
Make SWD network connections only in voltage-free condition!

Connect PROFIBUS-DP bus
Connect the PROFIBUS DP cable by means of the PROFIBUS DP plug to the field bus interface of the SWD gateway.

Connecting the CANopen network
For connection to the CANopen cable you require a 9-pole D-SUB socket. (e.g. PS416-ZBS-411)

▶ Connect the CANopen cable by means of the CANopen plug to the field bus interface of the gateway.

For a detailed description of the field bus connection, refer to the manual AWB2723-1612en.

Connecting power feeder module

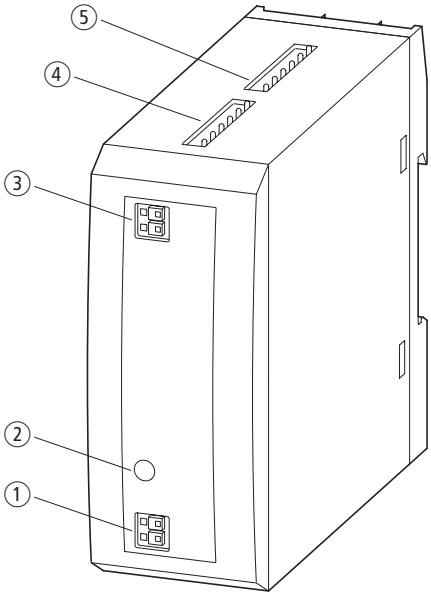


Figure 10: Connections of the power feeder module, shown here by way of the example of the EU5C-SWD-PF2

① POW: supply voltage 24 V DC
② Status LED
③ AUX: control voltage for contactors 24 V DC
④ SWD network input (SWD IN)
⑤ SWD network output (SWD OUT)

Caution!
EMERGENCY STOP switching is performed by switching off the 24 V DC control voltage of the contactor coils. See manual AWB2723-1613en.

Connecting the supply voltage AUX
If there are any contactors or motor starters in the SWD topology, a 24 V DC voltage AUX has to be supplied as a control voltage for the contactor coils.

You will find a description of the conductor sizes and line protection in the following section.

Connecting the POW power supply
EU5C-SWD-PF2: the device supply voltage for the electronics of all SWD slaves (15 V DC) is generated from the 24 V DC supply voltage that you apply to the spring-loaded terminal connection POW.

Conductor sizes of the cables for the POW and AUX supply voltages

- single wire: 0.2 - 1.5 mm^2 (AWG 24-16).
- fine wire 0.25 - 1.5 mm^2 with appropriate isolated wire-end sleeves with plastic collars in accordance with DIN 46228, Part 4, minimum length 8 mm.

Line protection for the POW and AUX supply voltages

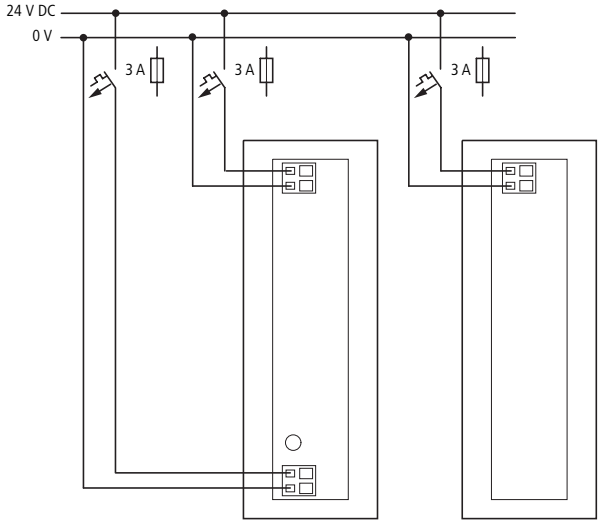


Figure 11: Line protection for the POW and AUX supply voltages

▶ On the SWD gateway connect the POW and AUX supply voltages via separate miniature circuit-breakers or fuses:

- Miniature circuit-breaker 24 V DC for POW
  - Line protection in accordance with **DIN VDE 0641** Part 11, IEC/EN 60898:
  - Miniature circuit-breaker 24 V DC rated current 3 A; tripping characteristic **C** or
  - Fuse 3 A, utilisation class gL/gG

  - Line protection for cable AWG 24 in accordance with **UL 508** and CSA-22.2 no. 14:
  - Miniature circuit-breaker 24 V DC rated current 2 A; tripping characteristic **C** or
  - Fuse 2 A.

- Miniature circuit-breaker 24 V DC for AUX
  - Line protection in accordance with DIN VDE 0641 Part 11, IEC/EN 60898:
  - Miniature circuit-breaker 24 V DC rated current 3 A; tripping characteristic **Z** or
  - Fuse 3 A, utilisation class gL/gG

  - Line protection for cable AWG 24 in accordance with **UL 508** and CSA-22.2 no. 14:
  - Miniature circuit-breaker 24 V DC rated current 2 A; tripping characteristic **Z** or
  - Fuse 2 A.

Caution!
The POW power supply behaves capacitively when first switched on, an increased starting current (12.5 A/6 ms) flows in comparison with the rated input current. The switching device and the power supply unit for switching on the supply voltage must be suitable for this briefly increased starting current.

Connecting the SWD network
Connection of the SWD gateway is performed via the SWD ribbon cable with a fitted blade terminal.

▶ Insert the SWD ribbon cable (end of cable) coming from the SWD gateway face into the socket SWD IN.

▶ Insert the SWD ribbon cable (start of cable) leading to the next SWD slave line into the socket SWD OUT.

Caution!
Make SWD network connections only in voltage-free condition!

For a detailed description of the connection of the power feeder modules, refer to the manual AWB2723-1613en.

Connecting the SWD I/O module

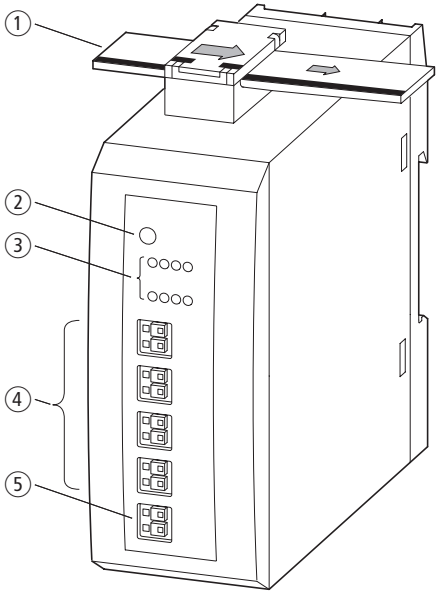


Figure 12: Connections of the SWD I/O module

① SWD ribbon cable with external device plug
② SWD status LED
③ Status LEDs of the inputs and/or outputs
④ Digital inputs and/or outputs
⑤ 0 V connection and/or 0 V/24 V connection with a combined input/output module EU5E-SWD-4D4D

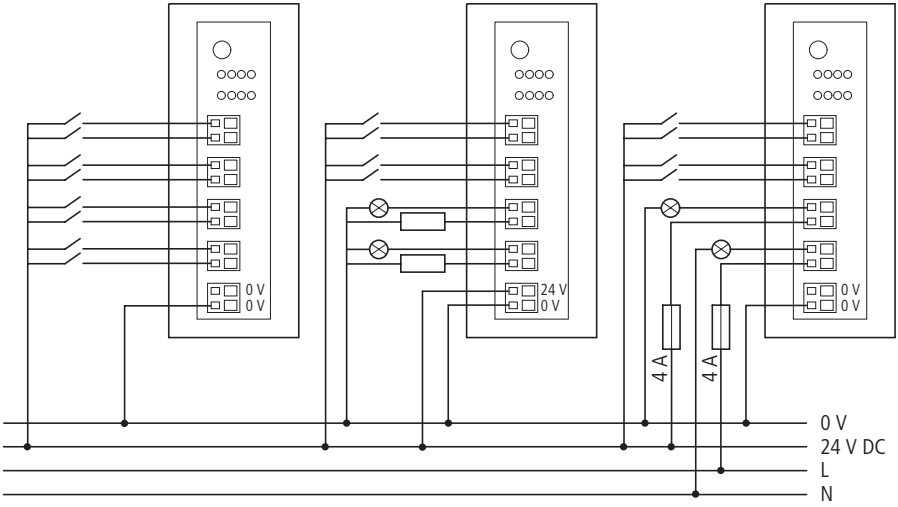


Figure 13: Wiring of the I/O modules

Protect the relay outputs of the I/O module EU5E-SWD-4D2R (example of value 4 A in the above illustration) in compliance with the usage category, → "Technical data", page 131.

Connecting digital inputs and/or outputs

SWD I/O module EU5E-SWD-8DX

- ▶ Connect the sensors to the corresponding input I0 to I7.
- ▶ Connect the reference potential 0 V DC of the inputs to the 0 V connection.

SWD I/O module EU5E-SWD-4D4D

- ▶ Connect the sensors to the corresponding input I0 to I3.
- ▶ Connect the joint reference potential 0 V DC of the inputs and of the supply voltage for the output to the 0 V connection.
- ▶ Connect the actuators to the corresponding output Q0 to Q3.
- ▶ Connect the 24 V DC supply voltage for the output voltage to the 24 V terminal.

SWD I/O module EU5E-SWD-4D2R

- ▶ Connect the sensors to the corresponding input I0 to I7.
- ▶ Connect the reference potential 0 V DC of the inputs to the 0 V connection.
- ▶ Wire the first relay output via Q0 and the second one via Q1.

For details on terminal capacity for the wiring of the digital inputs/outputs and of the output supply please refer to the Appendix (→ "Technical data", page 130).

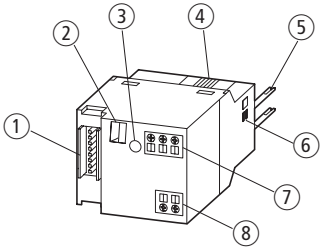
Connecting the SWD network

Connection of the SWD gateway is performed via the SWD ribbon cable with a fitted external device plug, which you insert into the SWD socket on the top side of the device.

For a detailed description of the connection of the SWD I/O module please refer to the manual AWB2723-1613en.

Connecting SWD contactor modules

DIL-SWD-32-001



DIL-SWD-32-002

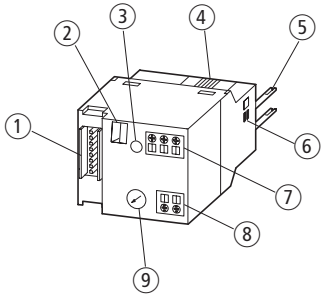


Figure 14: Structure of the SWD modules DIL-SWD-32-001 and DIL-SWD-32-002 for DILM

① Connection of SmartWire-Darwin external device plug
② Mechanical switching position indicator
③ Diagnostics LED
④ Catch slider
⑤ Connection pins
⑥ Adjusting slide for contactor size
⑦ Terminal X0-X1-X2
⑧ Terminal, electrical enable X3-X4
⑨ Selector switch 1-0-A

For a description of the "Contactor connection DIL-SWD-32-001/002" please refer to the manual AWB2723-1613en.

Connecting M22-SWD… function elements

For a detailed description of "Connecting M22-SWD… function elements" please refer to the manual AWB2723-1613en.

The M22-SWD... function elements are combined together with front elements of the RMQ Titan system to form control circuit devices that communicate via the SWD network. The M22-SWD… function elements are each available in 2 versions for front or base fixing.

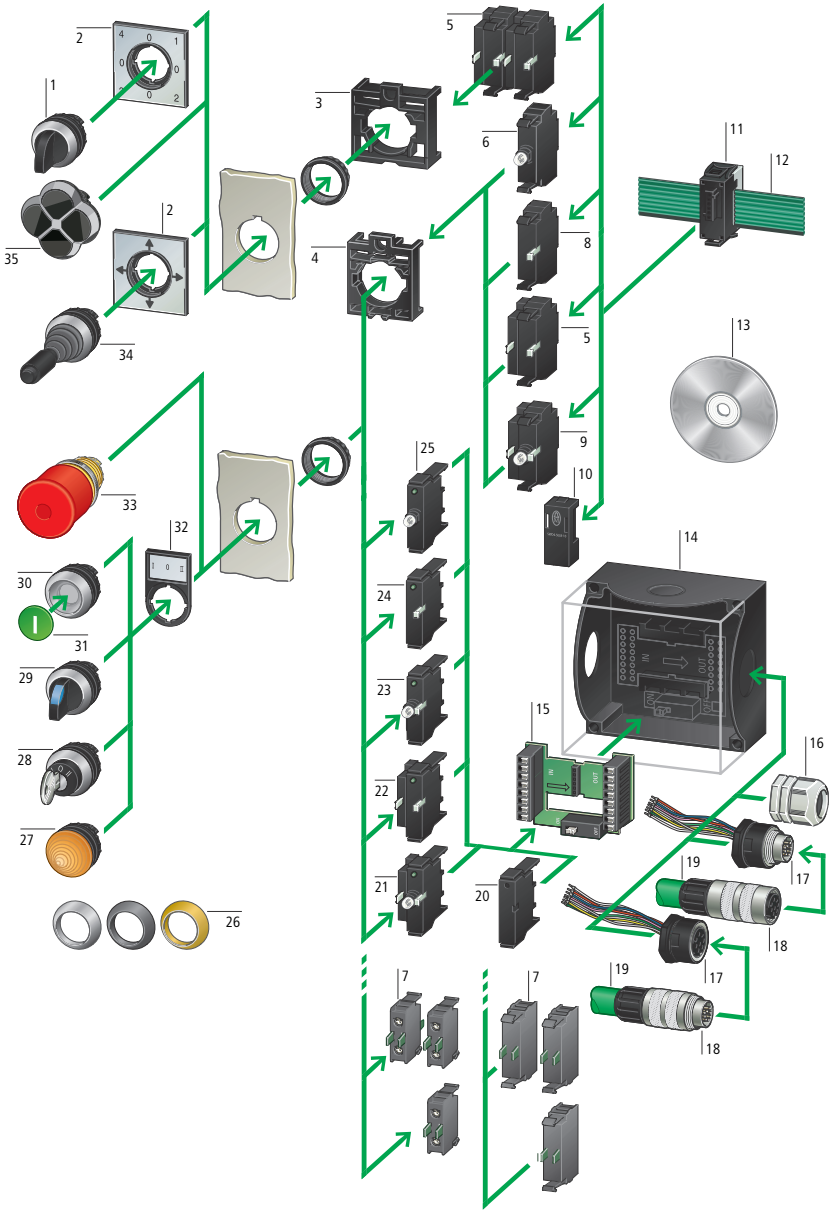


Figure 15: M22-SWD… function elements

Legend for figure 15:

1	4-way selector switch	18	Cable adapter plug/socket
2	Labels with label mounts	19	SWD round cable
3	4-way adapter	20	Link for base slots
4	Fixing adapters	21	Function element with 3 positions and LED for base fixing
5	Function element with 3 positions for front fixing	22	Function element with 3 positions for base fixing
6	LED element for front fixing	23	Function element with 2 positions and LED for base fixing
7	M22 contact elements	24	Function element with 2 positions for base fixing
8	Function element with 2 positions for front fixing	25	LED element for base fixing
9	Function element with 3 positions and LED for front fixing	26	Front rings
10	Link for device plug	27	Indicator lights
11	SWD external device plug	28	Key-operated buttons
12	SWD ribbon cable	29	Selector switch actuators
13	Planning and ordering help, SWD-Assist	30	Pushbutton actuators
14	M22 surface mounting enclosure	31	Button plates/Button lenses
15	Surface-mounting enclosure with PCB	32	Label mounts
16	Enclosure bushing for round cable	33	EMERGENCY STOP button
17	Enclosure bushing plug/socket	34	Joystick

M22-SWD front fixing

M22-SWD front function elements are used in connection with the M22-A adapter and M22 front elements for installation in consoles or switch cabinet doors. The M22 SWD front function elements are used just like the already known M22-K10-/K01 contact elements and M22 LED indicator elements. On the front panel the previous elements for the control circuit function are used.

Layout

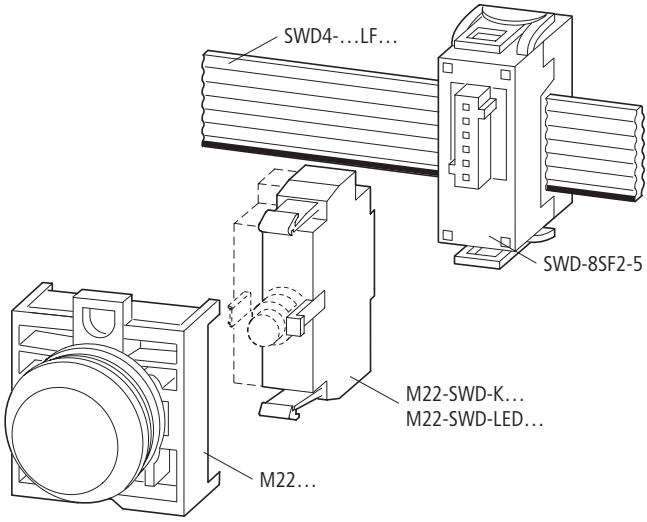


Figure 16: Layout of the M22 SWD front fixing

One M22 SWD front function element is used per M22-A adapter. Mounting is always performed in the middle position. Correspondingly more efficient function elements are used for the combined functions of a luminous command device or for the realization of a multi-step switch. A luminous pushbutton, which previously had to be realized as a combination of several elements, can now be realized simply by means of one combination element (LED indicator + contact element = M22-SWD-K11LED). The M22 SWD front function elements are snapped onto the M22-A adapter in the middle position.

Installation

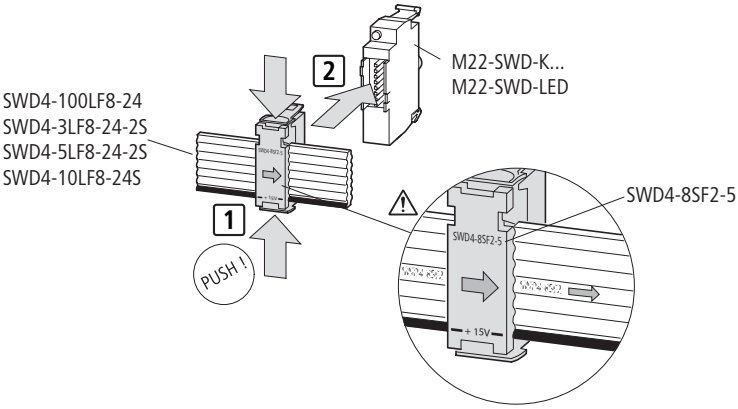


Figure 17: Connection of the function element to the SWD flat ribbon cable

- ▶ Fit the external device plug to the ribbon cable
- ▶ Plug the M22 SWD front function element onto the external device plug.
- ▶ Wire an SWD contact element.
- ▶ Fit the M22 front element.

M22-SWD base fixing

M22 SWD base function elements are inserted into the **M22-I… surface mounting enclosure** with a PCB and M22 front elements.

Layout

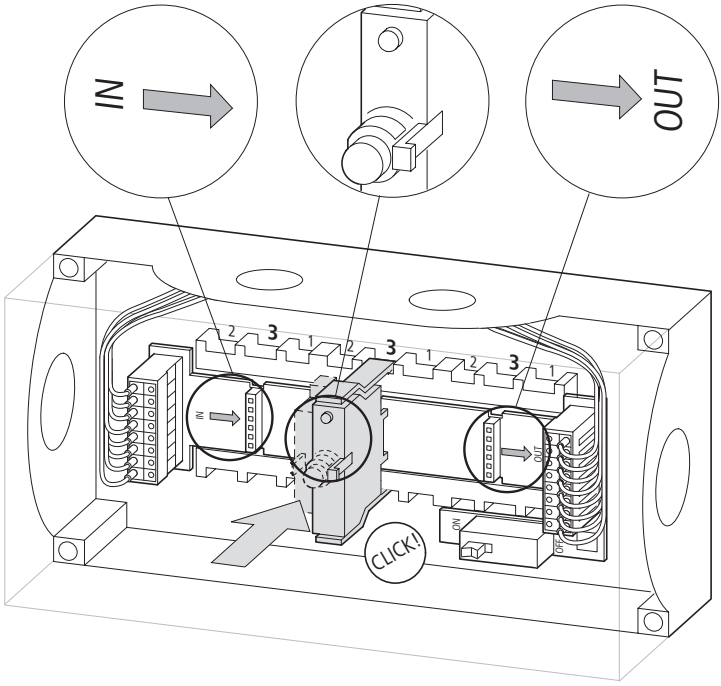


Figure 18: Surface-mounting enclosure with PCB and M22 SWD base function element

The M22 SWD base function elements are used just like the already known M22-K10-/K01 contact elements and M22 LED indicator elements. On the front panel the previous elements for the control circuit function are used. The connection with the SWD network is made via the printed circuit board. It has a switchable network termination.

Installation

The PCB in the surface mounting enclosure is connected via the SWD round cable to the SWD network.

The SWD round cable can be connected directly by means of V-M20 x 1.5 mm (metric cable gland with integrated cable relief) or plugged in (→ "Direct connection of the SWD round cable", page 67).

8-pole enclosure bushings with a screw fixing M20 x 1.5 mm as plug/socket versions are used for the plug-in version (→ "Pluggable connection of the SWD round cable", page 68).

Connection on the printed circuit board is performed via 8 numbered and colour-coded spring-loaded terminal clamps. This applies to the incoming SWD cable on the PCB side marked IN and to the outgoing SWD cable on the OUT side. The SWD round cable and SWD enclosure bushings have the same wire colours.

- **Direct connection of the SWD round cable**

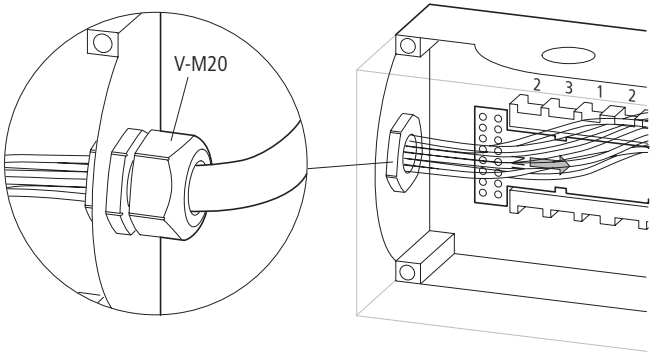


Figure 19: Direct connection with a cable gland

▶ Jacket and insulate the SWD round cable to a suitable length.

▶ Fit the individual wires with insulated wire-end sleeves with plastic collars in accordance with DIN 46228, Part 4, of suitable cross-section and a length of at least 8 mm.

▶ Introduce the SWD round cable that comes from the gateway face through the fitted cable gland and into the surface mounting enclosure.

▶ If further SWD slaves follow this surface mounting enclosure, introduce the second SWD round cable fitted with wire-end sleeves through another cable gland and into the surface mounting enclosure.

▶ Then connect the wires to the PCB (→ "Connection to the printed circuit board", page 70).

- **Pluggable connection of the SWD round cable**

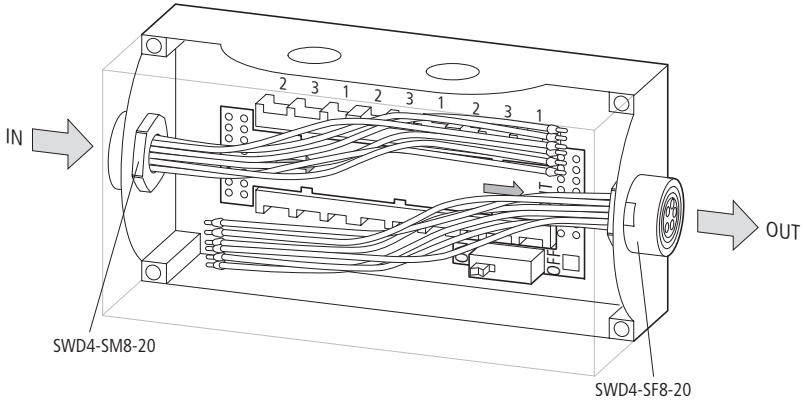


Figure 20: Pluggable connection with enclosure bushings

- **Incoming SWD round cable**

Fitted to the SWD round cable with the live conductors coming from the gateway is a cable socket (type SWD4-SF8-67 straight or type SWD4-SF8-67W angled at 90°) (→ "Housing bushing with plug", page 80).

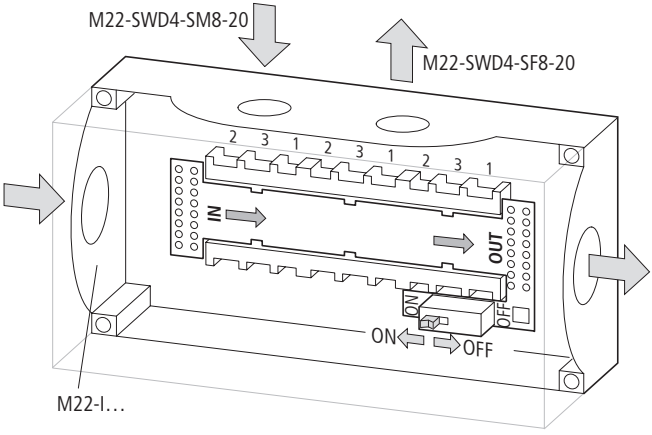
▶ So fasten the enclosure bushing plugs (type SWD4-SM8-20) in the surface mounting enclosure on the incoming side (IN).

- **Outgoing SWD round cable**

If further SWD slaves follow this surface mounting enclosure with SWD slaves, a cable plug (type SWD4-SM8-67 straight or type SWD4-SM8-67W angled at 90°) is fitted to the outgoing SWD round cable (→ "Housing bushing with socket", page 81).

▶ So fasten the enclosure bushing socket (type SWD4-SF8-20) in the surface mounting enclosure on the outgoing side (OUT).

Please refer to the following illustration for the incoming and outgoing SWD round cables (arrow direction) with different installation positions of the surface mounting enclosure.



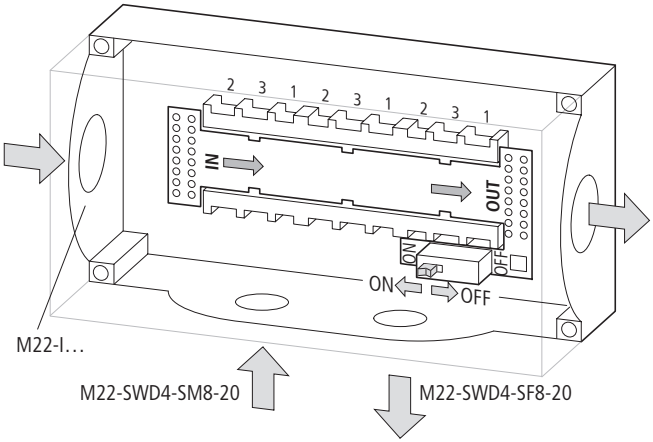


Figure 21: Incoming and outgoing SWD round cables with different installation positions

- **Connection to the printed circuit board**

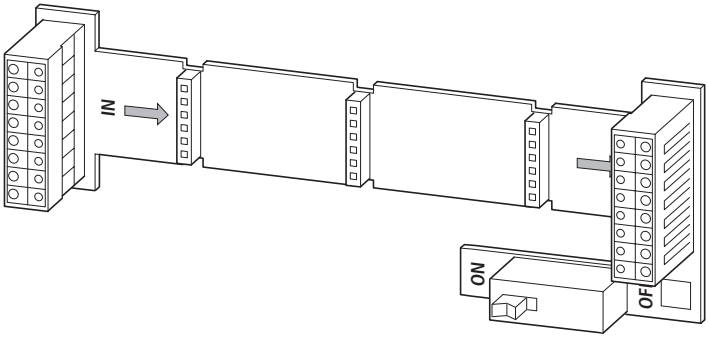


Figure 22: Printed circuit board

▶ Place the PCB in the mounting of the surface mounting enclosure so that the terminal strip is lying with the marking IN on the side of the incoming SWD round cable.

Ensure that the PCB is pointing in the correct direction. The direction of the arrow defines the arrangement of the SWD slaves. The SWD gateway is positioned to the left of the IN marking code.

▶ Clamp all incoming wires according to colour in the spring-loaded clamp terminals marked with the same colours on the IN side.

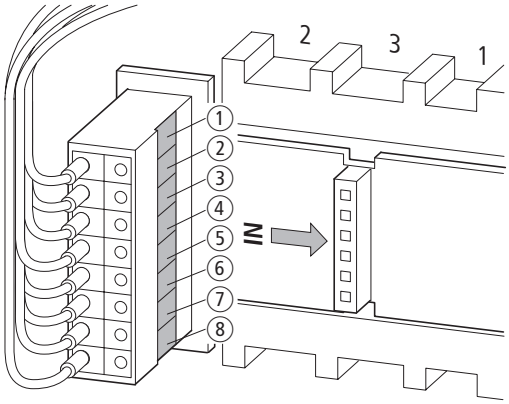


Figure 23: PCB with terminal strip for the incoming connection (IN)

① brown, +15 V DC: device supply voltage
② grey, SEL: select cable for automatic addressing of the SWD slaves
③ pink, GND: device supply voltage
④ red, data A
⑤ blue, data B
⑥ white, GND: device supply voltage
⑦ yellow, earth: contactor control voltage
⑧ green, +24 V DC: contactor control voltage

If further SWD slaves follow this surface mounting enclosure with SWD slaves:

▶ Clamp all outgoing wires according to colour in the spring-loaded clamp terminals marked with the same colours on the OUT side.

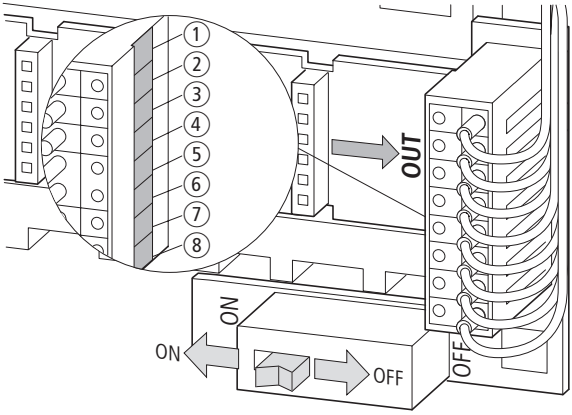


Figure 24: PCB with outgoing connection (OUT)

▶ Equip the PCB slots with the M22 SWD…C… function elements. Ensure that the installation position is correct. The status LED is at the top.

→ Each plugged-in M22 SWD base function element is given its own SWD slave address in the automatic addressing.

▽ **Caution!**
Equip unused slots with the link M22-SWD-SEL8-10.

▶ Switch the network termination to the position ON, if this surface mounting enclosure houses the last SWD slave.

▽ **Caution!**
The network termination must be switched without fail to the position OFF, if further SWD slaves follow the surface mounting enclosure with SWD slaves.

Connecting a switch cabinet bushing

Use the switch cabinet bushing for external connection of the SWD network to a switch cabinet or enclosure. This is not given a slave address. There is voltage reversal and EMC protection for an externally supplied 24 V DC control voltage. The device is screwed into a switch cabinet boring with an installation diameter of 18.5 mm.

Switch cabinet bushings provide the possibility of supplying the 24 V DC control voltage for contactors.

Use the SWD round cable for connection outside of the switch cabinet. So that the connection can be made easily made and disconnected, the switch cabinet bushing has a connection for round connectors with a screw fixing M18 x 0.75 mm, protection type IP67.

A switch cabinet bushing with a round socket (type SWD4-SFL8-20) and with a round plug (type SWD4-SML8-20) is available for supply.

Warning!
The protection type specified in the appendix is guaranteed only if it is correctly installed! Use connections only within the switch cabinet (the connection for round connectors with a screwing fastening is accessible outside of the switch cabinet).

Switch cabinet bushing with a round socket

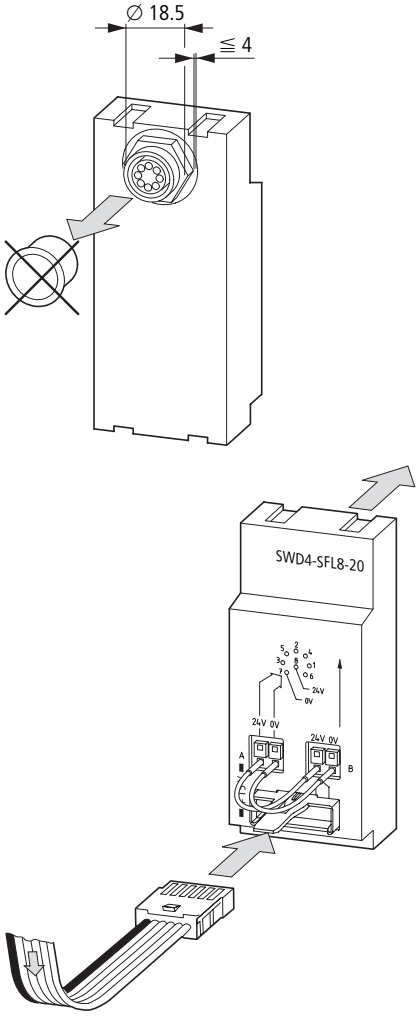


Figure 25: Switch cabinet bushing with a round socket

Use the switch cabinet bushing with an integrated round socket (type SWD4-SFL8-20), if you would like leave the switch cabinet in the direction of the SWD network end and the round socket is therefore carrying a live voltage. You

lead the SWD network further via the SWD round cable with a fitted round plug (type SWD4-SM8-67 straight or type SWD4-SM8-67W angled at 90°).

How you connect a round plug to the SWD round cable is described on page 85.

Switch cabinet bushing with round plug

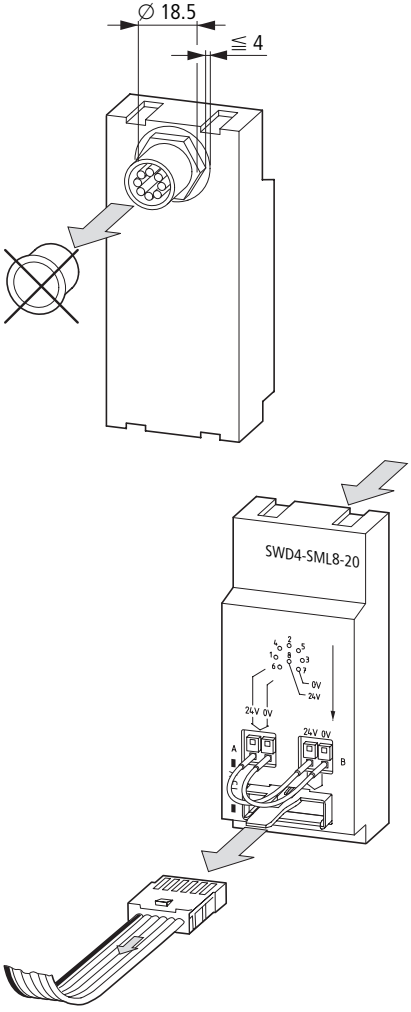


Figure 26: Switch cabinet bushing with round plug

Use the switch cabinet with an integrated round plug (type SWD4-SML8-20), if, coming from the gateway face, you are conducting the SWD network with the live conductors to the switch cabinet.

The supply is performed via the SWD round cable with a fitted round socket (type SWD4-SF8-67 straight or type SWD4-SF8-67W, angled at 90°).

How you connect a round socket to the SWD round cable is described on page 84.

The ribbon cable with an attached blade terminal used within the switch cabinet is plugged into the socket of the switch cabinet bushing.

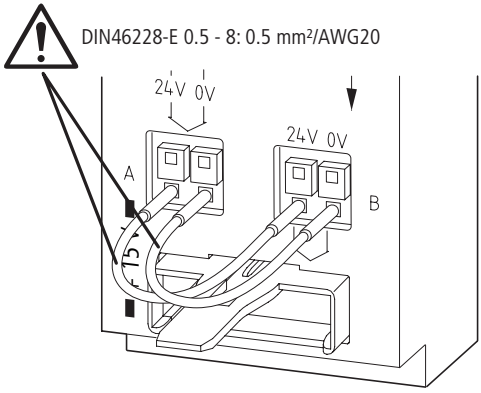


Figure 27: Connections of the switch cabinet bushing

Supply of the 24 V DC control voltage for contactor

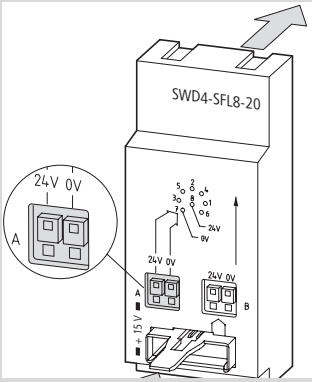
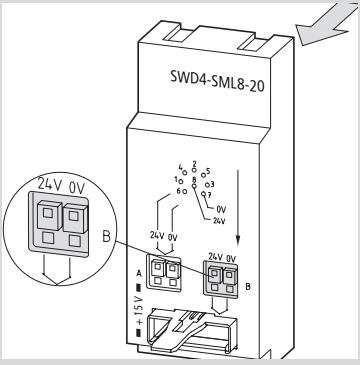
Warning!
The switch cabinet bushing interrupts the two conductors for the contactor control voltage (earth and 24 V DC) and conducts them to the spring-loaded terminals A and B. The remaining conductors between the SWD ribbon cable and round cable connection are connected throughout.

Within the switch cabinet routing the conductors (earth and 24 V DC) are connected from the ribbon cable connection to the spring-loaded terminals B and the corresponding wires of the round cable connection to the spring-loaded terminals A.

Table 13: Configuration of the spring-loaded terminals A and B

Ribbon cable conductor	Spring terminal
Earth	B: 0 V
24 V DC	B: 24 V
Round cable conductor	
Earth	A: 0 V
24 V DC	A: 24 V

The following 3 cases are possible for the feeding of the 24 V DC control voltage for contactors:

Possible cases	Type of switch cabinet bushing	Measures
The current requirement of the connected contactors is covered by the connected supply unit (SWD gateway or SWD power feeder module).	with a round socket (type SWD4-SFL8-20) or with a round plug (type SWD4-SML8-20).	Connect spring-loaded terminal A: 0 V to B: 0 V and A: 24 V to B: 24 V, as shown in the above illustration, "Connections of the switch cabinet bushing". The 24 V DC control voltage of the supply unit is conducted further.
An additional 24 V DC voltage supply in the switch cabinet supplies the contactors outside of the switch cabinet.	with a round socket (type SWD4-SFL8-20). The control voltage introduced via the ribbon cable to the spring-loaded terminals B is not transmitted any further.	Connect the 0 V connection of the additional 24 V DC power supply to the spring-loaded terminal A: 0 V and the 24 V connection to the spring-loaded terminal A: 24 V. 
An additional 24 V DC voltage supply in the switch cabinet supplies the contactors in the switch cabinet.	with a round plug (type SWD4-SML8-20). The control voltage introduced via the ribbon cable to the spring-loaded terminals A is not transmitted any further. The control voltage introduced via the ribbon cable to the spring-loaded terminals A is not transmitted any further.	Connect the 0 V connection of the additional 24 V DC power supply to the spring-loaded terminal B: 0 V and the 24 V connection to the spring-loaded terminal B: 24 V. 

Conductor sizes of the cables for the 24 V DC external power supply

- single wire: 0.2 - 1.5 mm^2 (AWG 24-16).
- fine wire 0.25 - 1.5 mm^2 with appropriate isolated wire-end sleeves with plastic collars in accordance with DIN 46228, Part 4, minimum length 8 mm.

Line protection for the cables of the 24 V DC external power supply

▶ Connect the 24 V DC external power supply via a miniature circuit-breaker or a fuse.

- Line protection in accordance with DIN VDE 0641 Part 11, IEC/EN 60898:
  - Miniature circuit-breaker 24 V DC rated current 3 A; tripping characteristic Z.
  - Fuse 3 A, utilisation class gL/gG

- Line protection for cable AWG 24 in accordance with UL 508 and CSA-22.2 no. 14:
  - Miniature circuit-breaker 24 V DC rated current 2 A; tripping characteristic Z.
  - Fuse: 2 A, utilisation class gL/gG)

Connecting the enclosure bushing

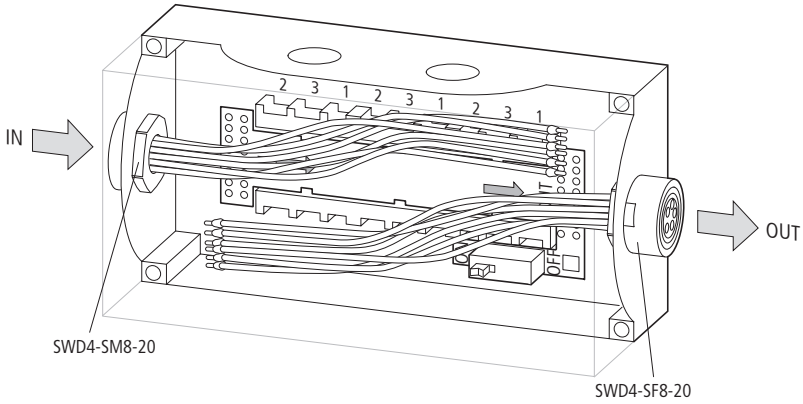


Figure 28: Enclosure bushings in a surface mounting enclosure

Use enclosure bushings with an M20 x 1.5 mm screw fixing of protection type IP67, for example, in the surface mounting enclosure, for the pluggable connection of the 8-conductor SWD round cable.

Enclosure bushings with an M20 x 1.5 mm screw fixing are available as plug and socket versions.

Housing bushing with plug
Use the enclosure bushing with an integrated plug (type SWD4-SML8-20), if, coming from the gateway face, you are leading the SWD network with the live conductors to the enclosure.

You lead the SWD network via the SWD round cable with a fitted round socket (type SWD4-SF8-67 straight or type SWD4-SF8-67W angled at 90°).

How you connect a round socket to the SWD round cable is described on page 84.

Housing bushing with socket
Use the enclosure bushing with an integrated socket (type SWD4-SFL8-20), if you would like leave the enclosure in the direction of the SWD network end and the round socket is therefore carrying a live voltage. You lead the SWD network further via the SWD round cable with a connected round plug (type SWD4-SM8-67 straight or type SWD4-SM8-67W angled at 90°).

How you connect a round plug to the SWD round cable is described on page 85.

Link for PCB base/device plug front
This link connects an interrupted select cable (SEL cable) that is required for automatic addressing of the SWD slaves.

The link (device plug front SWD4-SEL8-10) connects the interrupted SEL cable on an unused device plug (SWD4-8SF2-5).

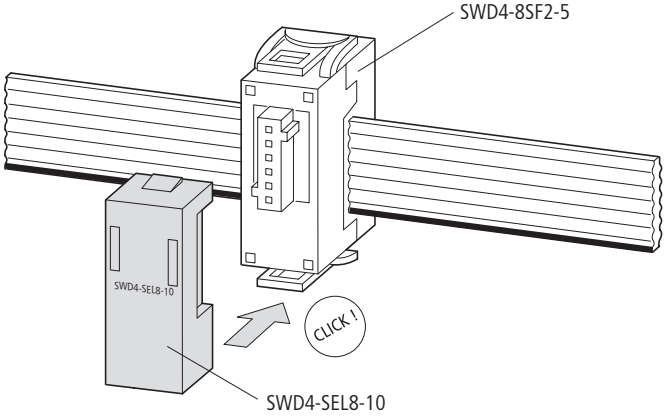


Figure 29: Link for device plug front

The link for the PCB base (M22-SWD-SEL8-10) for a PCB (M22-SWD-I1…6-LP01) in the surface mounting enclosure is plugged onto each unused socket strip.

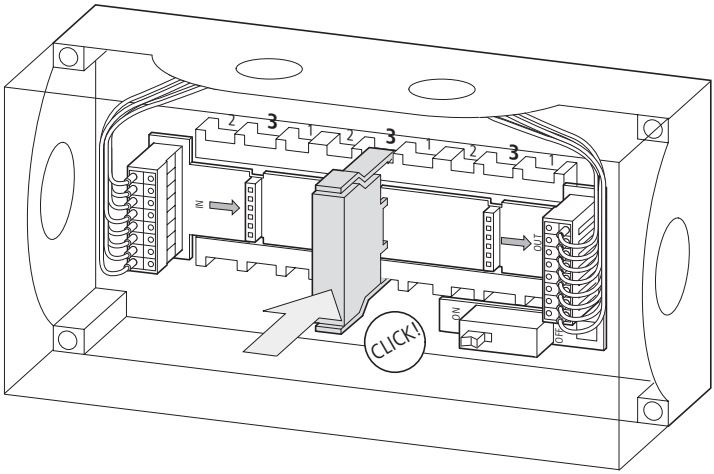


Figure 30: Link for PCB base

Caution!
Unused slots must be equipped with the link SWD4-SEL8-10 or M22-SWD-SEL8-10.

Connecting the SWD connection cable

SWD elements are connected via 8-conductor SWD ribbon cable or round cables. For DIY construction you can order SWD ribbon cables and round cables by the metre without plugs:

- Ribbon cable, length 100 m, type SWD4-100LF8-24
- Round cable, length 50 m, type SWD4-100LR8-24

Connecting the SWD ribbon cable

SWD slaves and some other SWD elements are connected via an SWD ribbon cable. At the beginning and end of the ribbon cable there is always a **blade terminal** (type SWD4-8MF2).

Several ready-made SWD ribbon cables are available to you, e.g. type SWD4-5LF8-24-2S, these already having been provided with blade terminals at the beginning and end. Alternatively you can make the SWD ribbon cable line by fitting the blade terminal yourself (→ "Fitting the blade terminal SWD4-8MF2", page 86).

You make the connection to the SWD slaves via **external device plugs** (type SWD4-8SF2-5). You fit the external device plug to the ribbon cable according to the position of the SWD slave (→ "Fitting external device plugs SWD4-8SF2-5", page 92).

Connecting SWD round cables

Some SWD elements, e.g. surface mounting enclosures with an inlaid PCB for RMQ Titan function elements or switch cabinet bushings are connected via an SWD round cable. You can introduce SWD round cables via a V-M20 cable gland and wire them directly or screw them on via fitted cable plugs and cable sockets. The configuration of the round socket and round plug is shown below.

Connect round socket to SWD round cable

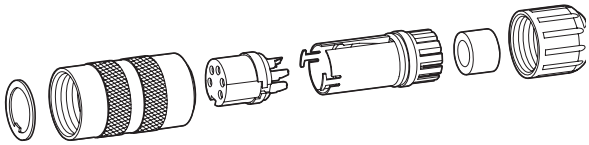


Figure 31: Straight round socket with screw locking for the SWD round cable

▶ Fit (solder) the round socket to the SWD round cable.

Warning!
Connection of the movable soldering lugs on the round socket may be performed only with the use of shrink sleeve insulation on the individual conductors.

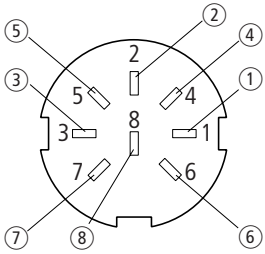


Figure 32: Configuration of the round socket, view onto the solder face

① brown, +15 V DC: device supply voltage
② grey, SEL: select cable for automatic addressing of the SWD slaves
③ pink, GND: device supply voltage
④ red, data A
⑤ blue, data B
⑥ white, GND: device supply voltage
⑦ yellow, earth: contactor control voltage
⑧ green, +24 V DC: contactor control voltage

Connect round plug to the SWD round cable

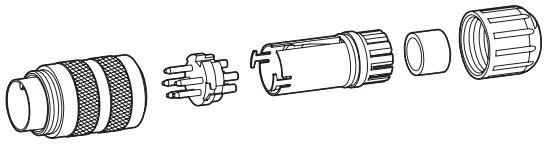


Figure 33: Straight round plug with screw locking for the SWD round cable

▶ Fit (solder) the round plug to the SWD round cable.

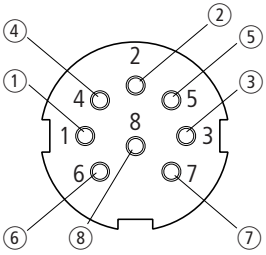


Figure 34: Solder view of the round plug

① brown, +15 V DC: device supply voltage
② grey, SEL: select cable for automatic addressing of the SWD slaves
③ pink, GND: device supply voltage
④ red, data A
⑤ blue, data B
⑥ white, GND: device supply voltage
⑦ yellow, earth: contactor control voltage
⑧ green, +24 V DC: contactor control voltage

Fitting SWD ribbon cable with plugs

Depending on the purpose fit a blade terminal or external device plug to the SWD ribbon cable. The plugs are connected firmly and permanently to the SWD ribbon cable by means of a suitable crimper.

Caution!
When fitting the plug make sure that the polarity of the ribbon cable is correct (→ "Fitting the blade terminal SWD4-8MF2", page 86).

Fitting the blade terminal SWD4-8MF2

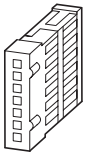


Figure 35: SWD blade terminal

A blade terminal (type SWD4-8MF2) must be fitted at the beginning and end of each SWD ribbon cable.

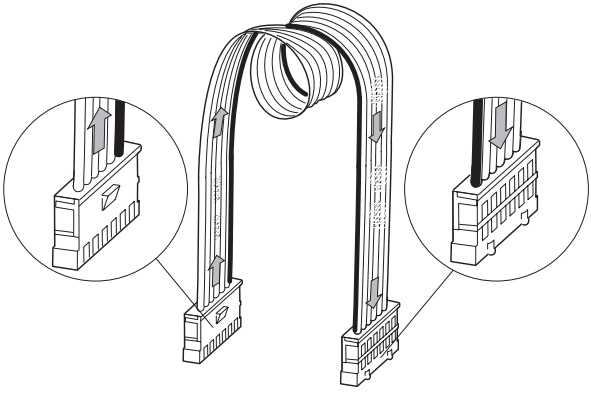


Figure 36: SWD ribbon cable with blade terminal at the beginning and end

- ▶ Make sure that the cut edge of the 8-pole SWD ribbon cable is straight and right-angled.
- ▶ Push the open blade terminal, with the transparent top part of the plug pointing upwards, into the crimper guide up to the stop pin (type SWD4-CRP-2).

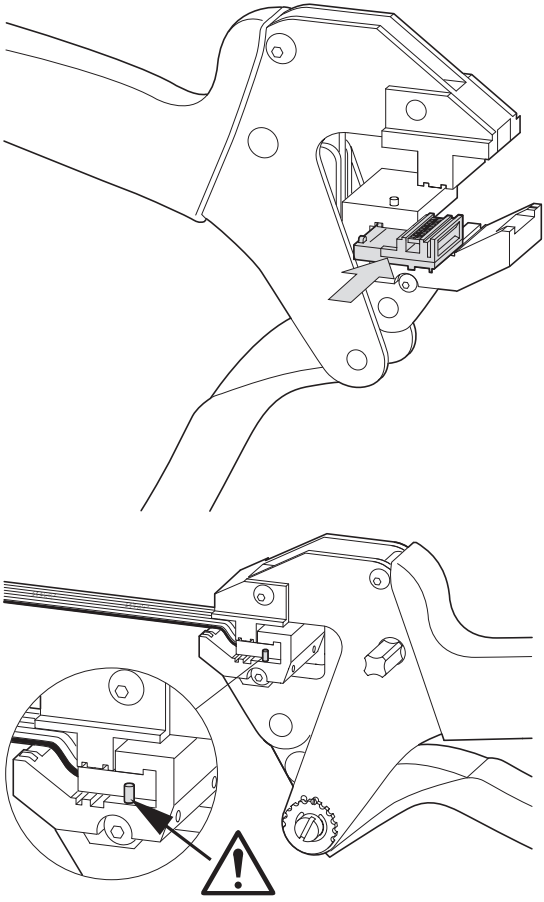


Figure 37: Push the blade terminal into the crimper up to the stop

The introduction hole on the blade terminal is then accessible from the front in the crimper.

▶ Push the ribbon cable up to the stop via the guide in the bottom part of the crimper between the blade contacts of the black bottom part of the plug and the transparent, movable top part of the plug.

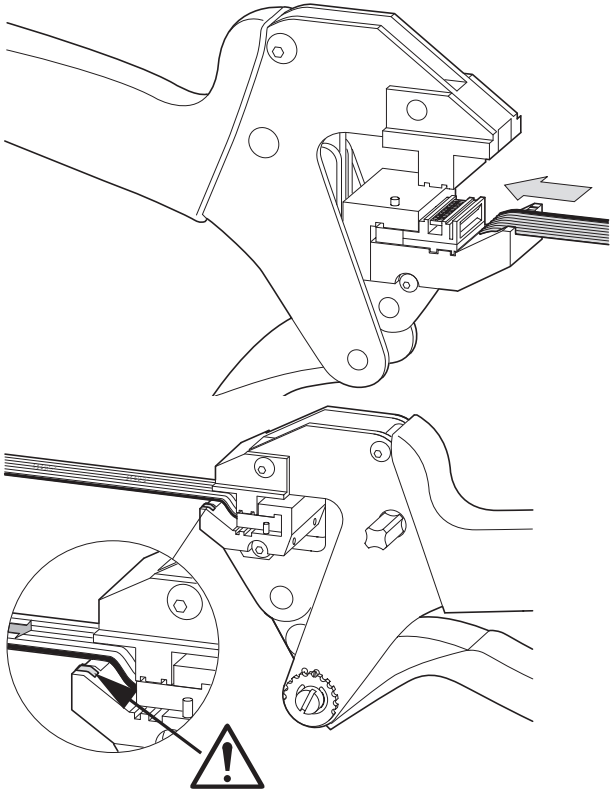


Figure 38: Push the SWD ribbon cable into the blade terminal

Warning!
For correct polarity the black conductor of the ribbon cable must be lying next to the white stripe on the bottom part of the crimper. This applies to plug fitting at the beginning and end of the ribbon cable.

Fitting the blade terminal to the beginning of the cable

→ When the ribbon cable is introduced into the plug for the beginning of the ribbon cable the ribbon cable imprint is located non-visibly on the underside.

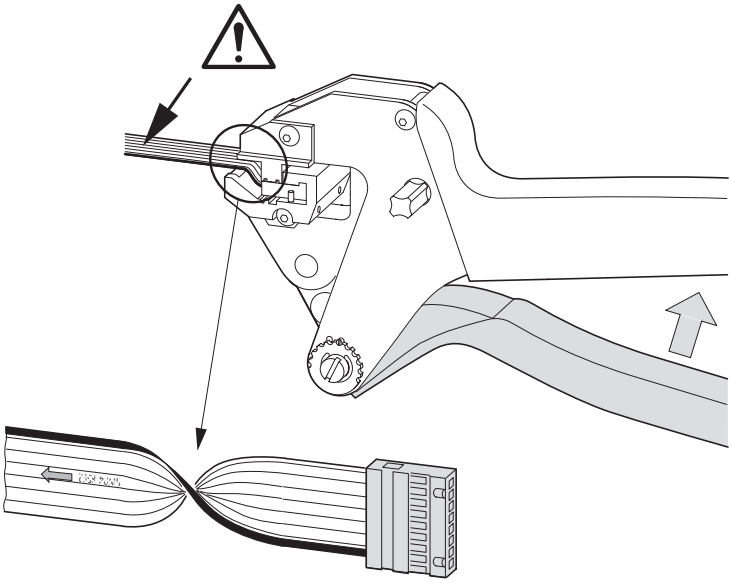


Figure 39: SWD ribbon cable with a blade terminal at the beginning of the cable

Fitting the blade terminal to the end of the cable

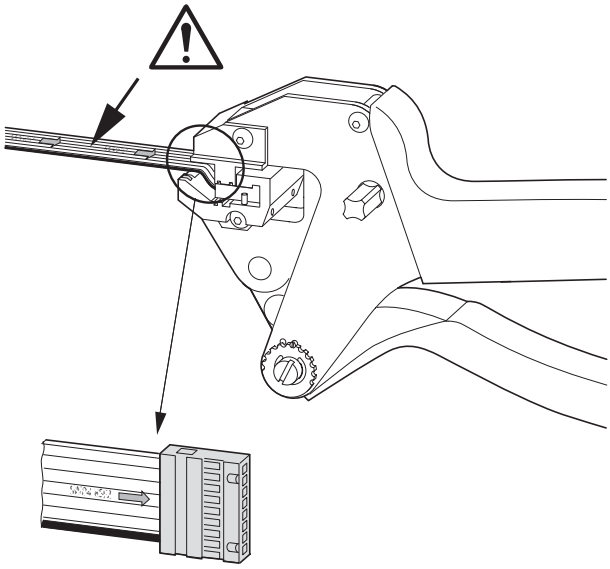


Figure 40: SWD ribbon cable with a blade terminal at the end of the cable

▶ Then crimp this blade terminal by pressing the crimper once until you feel a clear stopping point.

In delivery condition the distance between the top and bottom parts of the crimper is set optimally to 5 + 0.2 mm. The presence of undamaged locking compound on the knurled wheel indicates that the ex-factory setting is unchanged.

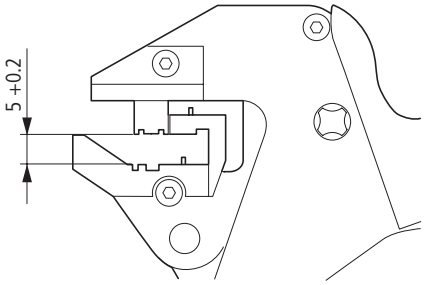


Figure 41: Crimper for SWD blade terminals

Corresponding inserts are available on request for the use of toggle lever presses.

Fitting external device plugs SWD4-8SF2-5

The device plugs for the SWD ribbon cables are for the purpose of connecting SWD slaves.

→ Unused slots must be fitted with the link for the device plug front (M22-SWD-SEL8-10), otherwise the SWD network will be interrupted.

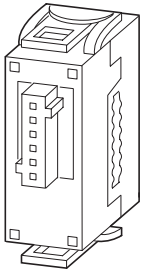


Figure 42: SWD external device plug

▶ On the basis of the position of the SWD slave determine where the first device plug has to be fastened to the ribbon cable.

→ Add at least 100 mm in length to the measured cable length before, between and after the device plugs. Due to the cable loop thus created the later dismantling of an SWD slave will be simplified and the cable will remain tension-free.

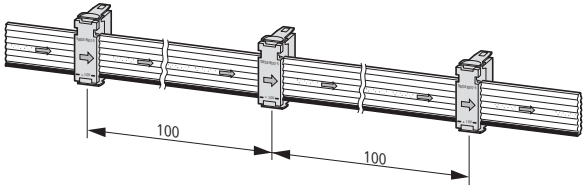


Figure 43: SWD device plug with sufficient cable length

Caution!
When fitting the plug make sure that the polarity of the ribbon cable is correct.

- ▶ Align the ribbon cable and the device plug so that the imprints on both parts are visible.
- ▶ Insert the ribbon cable in the device plug guide so that the black arrow on the ribbon cable is pointing in the same direction as the black arrow on the movable top part of the plug.

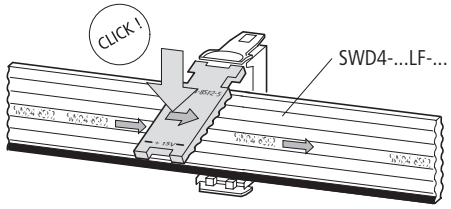


Figure 44: SWD device plug with correct polarity

Caution!
Correct polarity is ensured with this arrangement. The black conductor of the ribbon cable lies under the cable with the designation +15 V shown black on the top part of the plug.

- ▶ Fix the ribbon cable to the device plug by hingeing down and pressing in the centre of the top part of the plug until it audibly engages into the bottom part.

Corrections to the plug are now still possible by pushing it sideways.

If the catch has to be released again, introduce a screwdriver between the top part of the plug near to the black line and the catch of the bottom part of the plug and then lift up the top part.

When the plug position has been determined:

- ▶ Put the fixed device plug in the crimper (type SWD4-CRP-1) so that the actual socket is lying in the recess in the top part of the crimper.
- ▶ Then crimp this device plug by pressing the crimper once until you feel a clear stopping point.

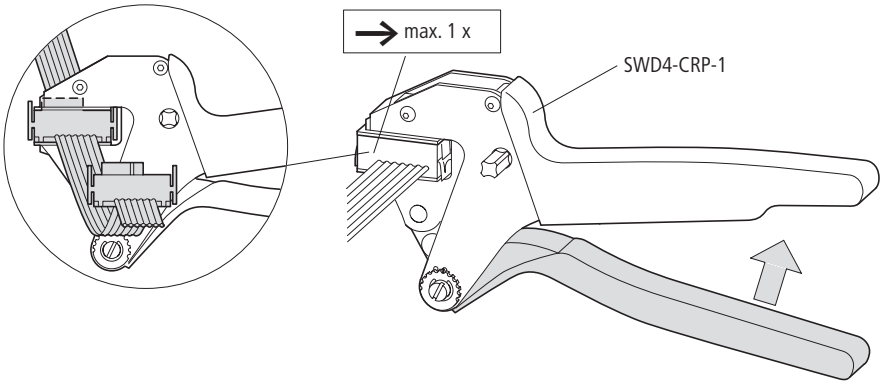


Figure 45: Crimping the SWD device plug in the crimper

→ The position of the crimped device plug can no longer be altered. Should the topology change and no more SWD slaves are to be connected here, this plug is replaced by an SWD link element (type SWD4-SEL8-10), → section "Link for PCB base/device plug front", page 81.

- ▶ Fit the other device plugs in each case with the additional cable length of 100 mm as described above.

In delivery condition the distance between the top and bottom parts of the crimper is set optimally to 12.5 + 0.3 mm. The presence of undamaged locking compound on the knurled wheel indicates that the ex-factory setting is unchanged.

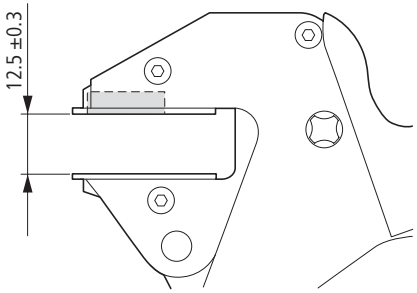


Figure 46: Crimper for SWD device plugs

Once all device plugs have been crimped the blade terminal still has to be attached to the end of the ribbon cable.

- ▶ Cut off the 8-pole SWD ribbon cable with the additional length mentioned of 100 mm straight and right-angled.
- ▶ Fit the blade terminal to the cable end as described above for the beginning of the ribbon cable, ensuring correct polarity.

→ When the ribbon cable is introduced into the plug for the end of the ribbon cable the ribbon cable imprint is located visibly on the upper side.

It may be necessary to fit further blade terminals, if:

- on account of an expansion of the SWD network a new cable segment is to be connected by means of an SWD coupling (→ "Coupling for an 8-pole blade terminal", page 96).
- due to an increased current consumption or a greater voltage drop an additional power supply unit (a power feeder module) is to be inserted into the SWD network (→ "Connecting power feeder module", page 53).

Coupling for an 8-pole blade terminal

Use the coupling for an 8-pole blade terminal (type SWD4-8SFF2-5) to connect two ribbon cables that are fitted with blade terminals at the beginning and end of the cable.

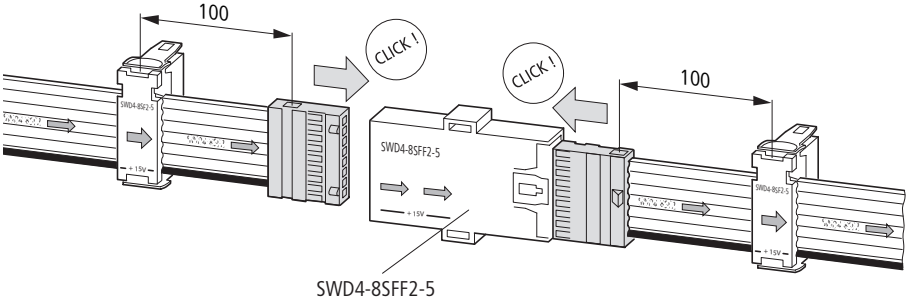


Figure 47: Connect SWD ribbon cables with a coupling for an 8-pole blade terminal

▶ Insert the ribbon cable into the coupling guide so that the black arrow on the ribbon cable is pointing in the same direction as the black arrow on the coupling.

Warning!
For correct polarity the black conductor of the ribbon cable must be inserted into the coupling so that it is lying next to the line shown in black with the designation +15 V.

Using the ribbon/round cable adapter

This adapter (type SWD4-8FRF-10) is for the purpose of changing from ribbon cable to round cable and vice versa. It is is fastened to a top hat rail or by means of the device feet ZB4-101-GF1 that are available as additional equipment to a plate.

For connection of the round cable the adapter has an 8-pole numbered and colour coded spring-loaded terminal connection. The ribbon cable with an attached blade terminal is plugged into the socket.

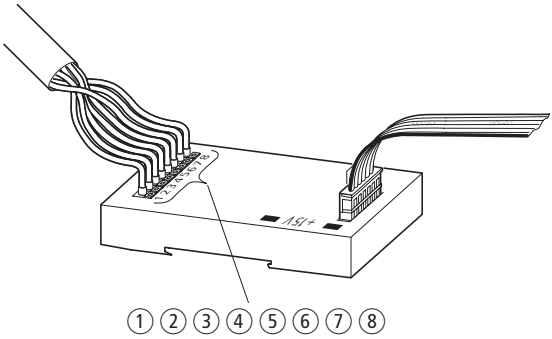


Figure 48: SWD blade terminal/round cable adapter with configuration of the spring-loaded terminal connection

① brown, +15 V DC: device supply voltage
② grey, SEL: select cable for automatic addressing of the SWD slaves
③ pink, GND: device supply voltage
④ red, data A
⑤ blue, data B
⑥ white, GND: device supply voltage
⑦ yellow, earth: contactor control voltage
⑧ green, +24 V DC: contactor control voltage

▶ Connect the 8 conductors of the round cable in accordance with their colour to the spring-loaded terminals of the same colour.
▶ Insert the ribbon cable into the adapter socket.

Warning!
For correct polarity the black conductor of the ribbon cable must be inserted into the adapter so that it is lying next to the line shown in black with the designation +15 V.

→ If you want to supply the 24 V DC contactor control voltage in addition when changing from ribbon cable to round cable, use the adapter for the switch cabinet bushing (→ "Connecting a switch cabinet bushing", page 73).

Using network termination

The SWD network must be terminated at the beginning and at the end with a network termination. The network termination at the network beginning is always integrated into the SWD gateway.

Network termination for an installed ribbon cable
If the SWD network ends with a ribbon cable, a ribbon cable plug must be connected there.

▶ Insert the ribbon cable into the SWD network termination (type SWD4-RC8-10).

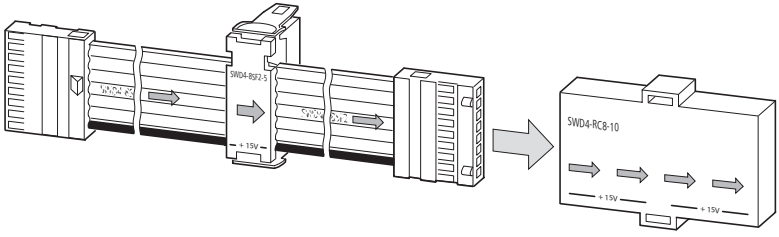


Figure 49: SWD network termination for ribbon cable

Network termination for an installed round cable

If you are using as the last SWD element on the SWD network a surface mounting enclosure with an inlaid PCB (M22-SWD-I…-LP01) that is connected via a round cable, use the integrated network termination.

▶ Switch the switch on the PCB to the position ON.

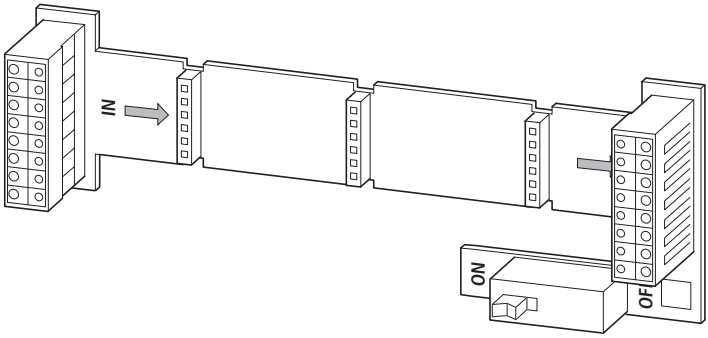


Figure 50: Network termination on the PCB in position ON.

Electromagnetic compatibility (EMC)

The SWD system conforms to the requirements of the EMC Directive. However, EMC planning is required prior to installation. All potential interference sources, such as galvanic, inductive and capacitive couplings as well as radiation couplings should be taken into consideration.

The EMC of the SWD system is protected, if the following rules are adhered to:

- Proper and extensive earthing of the inactive metal parts.
- Proper cable routing and wiring.
- The creation of a uniform reference potential and the earthing of all electrical resources.
- Special EMC measures for special applications.

Earthing of inactive parts

All inactive metal parts (e.g. switch cabinets, switch cabinet doors, support struts, mounting plates, top-hat rails etc.) must be extensively interconnected with a low impedance (earthing). This ensures a uniform reference potential for all control elements. The influence of coupled interference is decreased.

- With painted, anodised or insulated metal parts the insulating layer must be removed in the screw connection area. The connection point must be protected against corrosion.
- Any moving earthed parts (cabinet doors, separate mounting plates etc.) must be connected with short earth straps with a large surface area.
- The use of aluminium should be avoided where possible as aluminium oxidises and is then not suitable for earthing.

Danger!
The earth must never – not even in the case of a malfunction – have a dangerous touch voltage. The earth must therefore be connected to a protective earth conductor.

PE connection

The earth and the PE (protective earth) connection must be centrally connected to each other.

Earth-free Operation

With earth-free operation the relevant safety standards must be observed.

Mounting rails

All mounting rails must be fixed with low impedance to the mounting plate and correctly earthed. The use of corrosion protected mounting rails is recommended.

The extensive low-impedance fixing of the mounting rails in contact with the mounting system using screws or rivets is recommended. With painted, anodised or insulated metal parts the insulating layer must be removed in the connection area. The connection points must be protected against corrosion (e.g. by greasing).

Caution!
Use only grease that is specifically suited for this purpose.

SWD system for safety-related applications

For many applications of the SWD contactor modules (DIL-SWD-32-…), apart from normal operational switching, switching off in an emergency or switching off due to the opening of guard doors is required.

The SWD system is not designed for the transfer of safety-related signals.

To find out how the SWD contactor modules can be used for safety-related switching off despite this, please refer to the manual AWB2723-1613en.

4 Commissioning

The commissioning of an SWD network always takes place in connection with the SWD gateway and the overriding controller (PLC) with its field bus connection.

Commissioning of the various SWD gateways and controllers are described in separate manuals.

- AWB2723-1612…
  - PROFIBUS-DP: chapter "SWD-PROFIBUS-DP Gateway EU5C-SWD-DP" or
  - CANopen: chapter "SWD-CANopen Gateway EU5C-SWD-CAN"
- AWB2724-1491
  - Modular PLC XC-CPU201… (among other things with the connection for the CANopen field bus)
- AWB2725-1452
  - XI/OC signal modules (among other things with the connection for the PROFIBUS DP field bus).

The manuals are available for download on the Internet as PDF files. They can be quickly located at (http://www.moeller.net/en/support by entering the document number as the search term.

Danger!
Before the commissioning the SWD system must be completely mounted and wired.

Switch-on

▶ Before switching on check whether the following supply voltages are available:

- Supply voltage for PLC,
- the 24 V DC device supply voltage on the POW terminal of the SWD gateway and on an optionally used power feed module,
- the 24 V DC control voltage for contactors on the AUX terminal of the SWD gateway and on an optionally used power feed module,
- the external 24 V DC control voltage for contactors, in case you are using a switch cabinet bushing SWD4-SFL8-20/SWD4-SML8-20 with a 24 V DC external supply.

Caution!
Connect spring-loaded terminals "A" and "B" in accordance with the illustration "Connections of the switch cabinet bushing", page 76, if you would like to use the switch cabinet bushing without an external power supply. In this case you will work with the 24 V DC control voltage of the connected SWD gateway or power feed module.

Check whether:

- All plugs on the SWD cable are correct, i. e. are connected in accordance with the installation instructions in the subsection "Fitting SWD ribbon cable with plugs", page 86.
- The plugs for all SWD slaves are plugged in.
- The sensor/actuator connections for the SWD I/O modules are connected correctly.
- The field bus connection between the SWD gateway and the controller is plugged in.

Danger!
If you have already integrated an SWD slave into a system, secure the endangered working areas.

With the aid of the status LEDs described below you can recognize the respective operating statuses of the different SWD slaves.

Initial switch-on of the SWD network

After initial switch-on of the supply voltage the SWD gateway determines which and how many SWD slaves are connected to the SWD network. As yet no configuration exists in the SWD gateway.

Status messages of the SWD gateway after the initial switch-on

Prerequisite: the SWD network is connected properly to the SWD gateway.

Table 14: LED display of the SWD gateway for a new actual configuration

LED	Status
SWD	Red flashing
Config.	Off (no planned configuration is available)

Status messages of the SWD slaves after the initial switch-on

For the connected SWD slaves the status LED for diagnosis of the SWD network flashes in the colour green, frequency (1 Hz).

Creating a target configuration

Before the SWD gateway can exchange data with the PLC, it must store the found configuration of the SWD slaves internally as a **target configuration**.

▶ Press the **"Config." button** for at least 2 seconds.

→ The function of the "Config." button is disabled as long as communication with the field bus master is active. If necessary, interrupt communication by pulling out the field bus plug. While the SWD gateway is determining the configuration, the SWD LED flashes in the colour orange, frequency (1 Hz). For the connected SWD slaves the status LED for diagnosis of the SWD network flashes in the colour green, frequency (1 Hz).

The SWD gateway stores the found configuration internally as a target configuration and is in the SWD mode "Failsafe". It exchanges so-called zero data with the SWD slaves. All SWD slaves are operated in "safe status" i.e. their digital outputs are switched off.

With the aid of this target configuration the SWD gateway checks each time the voltage supply is switched back on whether the number and type of SWD slaves present on the SWD network are unchanged and whether the SWD topology is functional with these.

Status messages of the SWD gateway after creating the target configuration

Table 15: LED indication of the SWD gateway after creating the target configuration

LED	Status
SWD	green continuous light
Config.	Off (no planned configuration is available)

For the connected SWD slaves the status LED for diagnosis of the SWD network lights up continuously green.

Creating a project configuration of the SWD network

Create the project configuration in the PLC control configuration. Among other things define the number, type and sequence of SWD slaves and which SWD gateway is being operated (PROFIBUS DP slave or CAN device).

The following files are used for integration of the SWD gateway into the control configuration:

- **For CANopen**: an EDS description file (EDS = Electronic Data Sheet) that contains the standardized descriptions of the CANopen slaves. For the CANopen gateway EU5C-SWD-CAN this is the file EU5C-SWD-CAN.eds.
- **For PROFIBUS-DP**: a device master file (GSD file) which contains a standardized description of the WD gateway.

→ The SWD-Assist function generates and saves a project-specific GSD file that can be imported by PROFIBUS-DP configuration tools if these are provided with the necessary import function.

After the project configuration has been transferred to the SWD gateway and it agrees with the target configuration stored there, data interchange can already be commenced. The SWD gateway is now in the SWD mode "Normal", → table 18 on page 112.

In the manual AWB 2723-1612 ... you can find out how to configure an SWD gateway with its SWD slaves in the configuration software for the PLC.

Switching on when there are configuration changes

If an SWD configuration that is already in operation is switched on again, the SWD gateway checks first whether the actual and target configurations agree. If so, it is checked whether the project and target configurations agree. If the result of a check is negative, the SWD gateway changes over to the corresponding error mode, shows the error by means of the SWD and Config. LED and awaits operator actions.

The behaviour of the SWD network depends on the parameter settings of the SWD slaves in the PLC control configuration. If certain SWD slaves are mandatory for operation, you can define that the complete SWD network will not go into operation, if one of these essential slaves is missing.

Table 16: LED indication of the SWD gateway in the case of a changed actual configuration

LED	Status
SWD	Red flashing
Config.	Off (no planned configuration is available)

Switch-on in case of a changed actual configuration

If the SWD gateway ascertains after switching a deviation in the number or type of SWD slaves between the actual and target configuration, it reacts as follows:

- Change to error mode.
- For error reporting by means of LED indication please refer to the table "LED indication in the case of a new or changed actual configuration".

In the case of a changed actual configuration the continued behaviour of the operator is governed by whether the change has been created deliberately or by an unwanted influencing of the SWD topology. In any case the following is valid:

▶ Prior to reconfiguration interrupt the connection to the field bus master by pulling out the field bus plug.

Switching on in the case of a deliberately changed actual configuration

In this case the changed actual configuration must be saved as a new target configuration.

▶ Press the **"Config." button** for at least 2 seconds.

Please refer to the table "LED indication after creating a new target configuration".

▶ Change the project configuration for the field bus master in the configuration software for the PLC in accordance with the changed actual configuration.

▶ Reconnect to the field bus master.

The SWD gateway is then in the SWD mode "Normal" and is ready for data interchange (→ "LED indication of the SWD gateway after changeover to the SWD mode "Normal"", page 112).

Caution!
First of all check whether your actual configuration has been changed unintentionally, e.g. by detaching a device connector. In this case the changed actual configuration must not be saved as a new target configuration because an SWD slave that can no longer be found would thereby be removed permanently from the target configuration.

Remedy:

With the aid of the status LED ascertain which of the SWD slaves is no longer being found by the SWD gateway. Then check where there is a possible damage to the SWD cable or an SEL link is missing.

If an SWD slave is no longer connected, the SWD LED is switched off.

Switching on in the case of a changed project configuration

Requirements:

- Target configuration = Actual configuration,
- A connection to the field bus master is available.

If, after the switch-on and initialisation process, the SWD gateway ascertains a difference between the stored target configuration and the project configuration, it indicates this error with the following LED combination.

Table 17: LED indication of the SWD gateway in the case of a project configuration deviation

LED	Status
SWD	green continuous light
Config.	red continuous light

Remedy, if the project configuration has been changed:

▶ Retrace the change on the SWD network.

▶ Interrupt the connection to the field bus master by pulling out the field bus plug.

▶ Press the **"Config." button** for at least 2 seconds.

The SWD gateway stores the changed actual configuration as a new target configuration → table 16 on page 109.

→ The SWD LEDs of the SWD slaves light up continuously green after the creation of a new target configuration

▶ Reconnect to the field bus master.

▶ If necessary load the project configuration into the SWD gateway again .

Switching back on in the case of an unchanged configuration

Normally , if the actual, target and project configurations agree, the SWD gateway changes over to the SWD mode "Normal" and is ready for data interchange.

Table 18: LED indication of the SWD gateway after changeover to the SWD mode "Normal"

LED	Status
SWD	green continuous light
Config.	green continuous light
CAN or DP	green continuous light when data is being exchanged on the field bus.
POW	yellow continuous light

5 What Happens If …?

Check the condition of the SWD gateway and of the SWD slaves by means of the status LEDs and diagnostic bits. The diagnoses of the various SWD components and controllers are described in separate manuals.

Behaviour of the SWD gateway

The status of the SWD gateway is signalled optically via 4 front LEDs:

- POW,
- DP or CAN,
- Config.
- SWD.

POW-LED

Table 19: Diagnostics with the POW-LED

Event	Explanation	Remedy
LED off	No supply voltage POW available or SWD gateway is faulty.	Check the power supply POW or SWD gateway.
LED yellow continuous light	Fault-free operation, the SWD gateway is operational.	-
LED yellow flashing	The SWD gateway has ascertained an irregularity in the self-test.	Consult the Eaton Moeller branch office that is responsible for you or replace the device.

DP-LED

The DP LED reports to the PROFIBUS DP gateway EU5C-SWD-DP the status on the field bus face.

Table 20: Diagnostics with DP-LED

Event	Explanation	Remedy
LED off	No communication with PROFIBUS-DP master.	Check Profibus-DP master connection.
LED green continuous light	The project configuration of the controller agrees with the target configuration of the SWD gateway. Cyclical data exchange takes place via the PROFIBUS DP.	-
LED green flashing (1 Hz)	The PROFIBUS DP master has been recognized. No cyclical data exchange takes place yet via the field bus. The project configuration of the controller does not agree with the target configuration of the SWD gateway, but the deviation allows data exchange with the relevant SWD slaves.	Check your target configuration and, if necessary, update the project configuration.
LED orange continuous light	At least one SWD slave requests a diagnosis test, because, e.g. SWD slaves are invalid or essential slaves are missing or an SWD slave is missing that has been configured in the control configuration as mandatory.	Check your target configuration and, if necessary, update the project configuration.

CAN-LED

The CAN LED reports to the CANopen gateway EU5C-SWD-CAN the status on the field bus face.

Table 21: Diagnosis with the aid of the CAN LED

Event	Explanation	Remedy
LED off	No communication takes place on the CAN-Bus.	Check the connection to the CANopen master.
LED red strobe light	Baud rate detection on the CAN bus is active. No data interchange takes place with the CAN bus.	-
LED orange continuous light	CAN baud rate detected. Waiting for a valid target configuration. No data exchange takes place on the CAN bus.	-
LED flashing red (single flash)	Communication error on the CAN bus. (Error warning level reached.) Data exchange takes place with the CAN bus.	-
LED flashing red (double flash)	Monitoring error (node guarding/heartbeat). SDOs are transferred to the CAN Bus.	-
LED red continuous light	Communication error on the CAN bus. (Bus off.). No data exchange takes place with the CAN bus.	-
LED green flashing	Status Pre-operational initialisation mode , communication is only possible via SDOs.	
LED flashing green (single flash)	Status Stopped: no data exchange	
LED green continuous light	Status Operational: the project configuration of the controller agrees with the target configuration of the SWD gateway. Cyclical data exchange takes place via the CAN bus.	-

Config.-LED

Table 22: Diagnostics with the Config-LED

Event	Explanation	Remedy
LED off	No communication with the field bus master or the SWD gateway does not contain a project configuration, e.g. after switching back on.	Check the connection to the field bus master or transfer the project configuration into the SWD gateway.
LED green continuous light	The project configuration of the controller agrees with the target configuration of the SWD gateway.	Data exchange with the field bus OK.
LED green flashing (1 Hz)	The target configuration does not agree with the project configuration of the controller, but the parameter "Compatible devices allowed" has been activated. The deviation allows data exchange with the SWD slave in question. You can find a list of the types that are compatible with one another in the manual AWB2723-1612en.	The SWD gateway is ready for data exchange with the SWD slaves. Check your target configuration and, if necessary, update the project configuration.
LED red continuous light	The target configuration does not agree with the project configuration of the controller, the parameter "Compatible devices allowed" has not been activated.	The SWD gateway is **not** ready for data exchange with the SWD slaves. Correct your target or project configuration.

SWD-LED

Table 23: Diagnostics with the SWD-LED

Event	Explanation	Remedy
LED off	No power supply	Check the power supply.
LED red continuous light	No connection of SWD gateway with the SWD network or there is a short circuiting of the 15 V DC device voltage	Check the spade connection on the SWD gateway or the crimp connections of the plugs on the SWD ribbon cable.
LED red flashing (1 Hz)	After initial switch-on: the SWD gateway has detected SWD slaves on the SWD network, no actual or target configuration exists yet. After switching back on with the existence of a target configuration: at least one SWD slave too many or too few has been found in comparison with the target configuration.	No data exchange with the SWD gateway
LED orange flashing (1 Hz)	Transient state while the SWD gateway is determining the target configuration.	-
LED green flashing (1 Hz)	Transient state until the actual configuration found has been stored internally as a target configuration.	-
LED green continuous light	All SWD slaves stored in the target configuration are available.	The SWD gateway is in the SWD mode "Normal", data exchange with the SWD slaves is taking place on the SWD network.

Behaviour of the SWD power feeder modules

The status of an SWD power feed module EU5C-SWD-PF1-1 or EU5C-SWD-PF2-1 is signalled optically via the front panel LED **POW**.

Event	Explanation	Remedy
LED off	No 15 V DC device voltage available or the LED is defective.	Check the POW power supply or the SWD power feed module
LED yellow continuous light [1)]	15-V-DC device voltage OK.	-

Behaviour of the SWD inputs/outputs modules

The status of an SWD I/O module is signalled optically via the green front panel LED **SWD.**

Table 24: Diagnosis of an SWD I/O module with the aid of the green SWD LED

Event	Explanation	Remedy
LED off	No 15 V DC device voltage via the SWD network or the I/O module or the LED is defective.	Check the power supply or I/O module.
LED green continuous light [1)]	Fault-free operation, data exchange OK.	-
LED green flashing (1 Hz)	No data exchange with the SWD gateway.	The I/O module may not be in the target configuration or the SWD gateway is just creating a target configuration.
LED green fast flashing (3 Hz)	Error in the I/O module, e.g. overload.	Determine or evaluate the defect by means of a detailed slave diagnosis in the control program.

The I/O module indicates the statuses of its input and/or outputs with yellow LEDs.

Behaviour of the SWD module DIL-SWD-32-…

The status of an SWD module DIL-SWD-32-001/DIL-SWD-32-002 is signalled optically via the front panel LED **Ready**.

The Ready LED can assume the colours green or yellow. It indicates the statuses that are influenced via the SWD network, i.e. the communication status and the switching command from the controller. On the DIL-SWD-32-002 the communication status is indicated only when the 1-0-A selector switch has been switched to position A (Automatic).

If the DILM module DIL-SWD-32-002 is switched over to manual mode (position 0 or 1), a switching command from the controller remains without any effect. As the LED indicator indicates the switching command of the controller, on the DIL-SWD-32-002 in manual mode the actual switch position of the contactor can deviate from the LED indicator. The mechanical switch position indicator of a DIL-SWD-32-… shows unambiguously the actual switch position.

You can obtain feedback on the switch position of the DILM contactor combination by evaluating the input bit 0 (C = contactor) in the overriding controller.

Table 25: Diagnostics with the Ready-LED

Event	Explanation	Remedy
LED off	No 15 V DC device voltage via the SWD network or the DIL-SWD-32-… or LED is defective.	Check the power supply or DIL-SWD-32-….
LED green continuous light [1)]	Fault-free operation, data exchange OK.	The DIL-SWD-32-… has received the switching command **Off** for the contactor.
LED orange continuous light [1)]	Fault-free operation, data exchange OK.	The DIL-SWD-32-… has received the switching command **On** for the contactor.
LED green flashing (1 Hz)	No data exchange with the SWD gateway.	The DIL-SWD-32-… may not be in the target configuration or the SWD gateway is just creating a target configuration.

1) On the DILM module DIL-SWD-32-002 in manual mode (position 0 or 1) the actual switch position of the contactor can deviate from the indicated switching command of the controller. Only in position A and with a functioning SWD network does the status indicated by the Ready LED on the DIL-SWD-32-002 comply with the actual switch position of the contactor. In the case of the DILM module DIL-SWD-32-001 the switch position of the contactor also complies with the indicated switching command of the controller. An exception to this is the "Defect in the case of an insufficient contactor supply", see below.

Switching on Contactors with DIL-SWD-32-001
The DIL-SWD-32-001 has no selector switch, thus the status indicated by the Ready LED represents the actual switch position of the contactor.

Switching on Contactors with DIL-SWD-32-002
The 1-0-A selector switch of the DIL-SWD-32-002 makes it possible for the operator to electrically switch the contactor on (position 1, confirm ON) and off (position 0, confirm OFF) by hand. To activate the contactor via the SWD network the selector switch must be in position A (Automatic).

Defect in the case of an insufficient contactor supply.
In the contactor supply if the 24 V DC control voltage drops below the minimum voltage of 19.2 V DC or exceeds the maximum current of 3 A, the secure switching of a contactor is no longer guaranteed. The switching command from the

controller may remain without any effect. The mechanical switch position indicator of a DIL-SWD-32-… shows unambiguously the actual switch position.

Behaviour of the SWD function elements M22-SWD…

The status of an SWD function element M22-SWD... is signalled optically via the green SWD LED with a diameter of 3 mm on the rear panel.

Table 26: Diagnosis with the aid of the green SWD LED on the rear panel

Event	Explanation	Remedy
LED off	No 15 V DC device voltage via the SWD network or the M22-SWD… or LED is defective.	Check the power supply or M22-SWD….
LED green continuous light	Fault-free operation, data exchange OK.	-
LED green flashing (1 Hz)	No data exchange with the SWD gateway.	The M22-SWD… may not be in the target configuration or the SWD gateway is just creating a target configuration.
LED green fast flashing (3 Hz)	Defect in the M22-SWD…	Determine or evaluate the defect by means of a detailed slave diagnosis in the control program.

Appendix

Technical data — Current consumption 15-V-SWD supply voltage (device supply)

Type	Article no.	Current consumption [mA]	Notes
M22-SWD-K11	115964	7	–
M22-SWD-K22	115965	7	–
M22-SWD-LED-W	115966	19	–
M22-SWD-LED-B	115967	19	–
M22-SWD-LED-G	115968	19	–
M22-SWD-LED-R	115969	19	–
M22-SWD-K11LED-W	115972	19	–
M22-SWD-K11LED-B	115973	19	–
M22-SWD-K11LED-G	115974	19	–
M22-SWD-K11LED-R	115975	19	–
M22-SWD-K22LED-W	115978	19	–
M22-SWD-K22LED-B	115979	19	–
M22-SWD-K22LED-G	115980	19	–
M22-SWD-K22LED-R	115981	19	–
M22-SWD-KC11	115995	7	–
M22-SWD-KC22	115996	7	–
M22-SWD-LEDC-W	115997	19	–
M22-SWD-LEDC-B	115998	19	–
M22-SWD-LEDC-G	115999	19	–
M22-SWD-LEDC-R	116000	19	–
M22-SWD-K11LEDC-W	116003	19	–
M22-SWD-K11LEDC-B	116004	19	–
M22-SWD-K11LEDC-G	116005	19	–
M22-SWD-K11LEDC-R	116006	19	–
M22-SWD-K22LEDC-W	116009	19	–
M22-SWD-K22LEDC-B	116010	19	–
M22-SWD-K22LEDC-G	116011	19	–
M22-SWD-K22LEDC-R	116012	19	–
DIL-SWD-32-001	118560	40	–
DIL-SWD-32-002	118561	40	–
EU5E-SWD-8DX	116381	12	–
EU5E-SWD-4D4D	116382	45	–
EU5E-SWD-4D2R	116383	45	–
M22-SWD-I1-LP01	115990	17	with terminating resistor switched on
M22-SWD-I2-LP01	115991	17	
M22-SWD-I3-LP01	115992	17	
M22-SWD-I4-LP01	115993	17	
M22-SWD-I6-LP01	115994	17	
SWD4-RC8-10	116020	17	–

Power consumption/current consumption 24 V SWD control voltage U_{AUX}

		DIL-SWD-32-…
Pick-up power		
for DILM 7-9	W	3
for DILM 12-15	W	4.5
for DILM 17-38	W	12
Pick-up current		
for DILM 7-9	mA	125
for DILM 12-15	mA	188
for DILM 17-38	mA	500
Sealing power		
for DILM 7-9	W	3
for DILM 12-15	W	4.5
for DILM 17-3	W	0.5
Holding current		
for DILM 7-9	mA	125
for DILM 12-15	mA	188
for DILM 17-38	mA	21

SWD gateways, power feeder modules

			EU5C-SWD-DP	EU5C-SWD-CAN	EU5C-SWD-PF1-1	EU5C-SWD-PF2-1
General						
Standards			IEC/EN 61131-2, EN 50178		IEC/EN 61131-2, EN 50178	
Dimensions (W × H × D)		mm	35 × 90 × 127		35 × 90 × 124	
Weight		kg	0.16	0.16	0.11	0.17
Mounting			Top-hat rail IEC/EN 60715, 35 mm		Top-hat rail IEC/EN 60715, 35 mm	
Mounting position			vertical		vertical	
Ambient mechanical conditions						
Protection type (IEC/EN 60529)			IP20	IP20	IP20	IP20
Vibrations (IEC/EN 61131-2:2008)						
constant amplitude 3.5 mm		Hz	5 … 8.4	5 … 8.4	5 … 8.4	5 … 8.4
constant acceleration 1 g		Hz	8.4 … 150	8.4 … 150	8.4 … 150	8.4 … 150
Mechanical shock resistance (IEC/EN 60068-2-27) semi-sinusoidal 15 g/11 ms		Shocks	9	9	9	9
Drop to IEC/EN 60068-2-31	Drop height	mm	50	50	50	50
Free fall, packaged (IEC/EN 60068-2-32)		m	0.3	0.3	0.3	0.3
Electromagnetic compatibility (EMC)						
Overvoltage category			II	II	II	II
Pollution degree			2	2	2	2
Electrostatic discharge (IEC/EN 61131-2:2008)						
Air discharge (Level 3)		kV	8	8	8	8
Contact discharge (Level 2)		kV	4	4	4	4
Electromagnetic fields (IEC/EN 61131-2:2008)						
80-1000 MHz		V/m	10	10	10	10
1.4 - 2 GHz		V/m	3	3	3	3
2 - 2.7 GHz		V/m	1	1	1	1
Radio interference suppression (SWD)			EN 55011 Class A		EN 55011 Class A	

			EU5C-SWD-DP	EU5C-SWD-CAN	EU5C-SWD-PF1-1	EU5C-SWD-PF2-1
Burst (IEC/EN 61131-2:2008, Level 3)						
Supply cables		kV	2	2	2	2
CAN/DP field bus cable		kV	1	1	–	–
SWD cables		kV	1	1	1	1
Surge (IEC/EN 61131-2:2008, Level 1)						
Supply cables/CAN/DP bus cable			Supply cables 0.5 kV, CAN/DP bus cable 1 kV		Supply cables 0.5 kV, CAN/DP bus cable 1 kV	
Radiated RFI (IEC/EN 61131-2:2008, Level 3)		V	10	10	10	10
Ambient climatic conditions						
Operating ambient temperature (IEC 60068-2)		°C	–25 … +55	–25 … +55	–25 … +55	–25 … +55
Condensation			prevent with suitable measures		prevent with suitable measures	
Storage		°C	–40…70	–40…70	–40…70	–40…70
Relative humidity, non-condensing (IEC/EN 60068-2-30)		%	5 … 95	5 … 95	5 … 95	5 … 95
Supply voltage U_{AUX}						
Rated operational voltage		V	24 DC -15% +20%		24 DC -15% +20%	
Input voltage ripple		%	≦ 5	≦ 5	≦ 5	≦ 5
Protection against polarity reversal			Yes	Yes	Yes	Yes
max. current	I_{max}	A	3[1)]	3[1)]	3	3
Short-circuit rating			no, external fuse FAZ Z3		no, external fuse FAZ Z3	
Power loss		W	Normally 1	Normally 1	Normally 1	Normally 1
Potential isolation			No	No	No	No
Rated operating voltage of 24-V-DC slaves		V	typ. U_{Aux} - 0.2	typ. U_{Aux} - 0.2	typ. U_{Aux} - 0.2	typ. U_{Aux} - 0.2

			EU5C-SWD-DP	EU5C-SWD-CAN	EU5C-SWD-PF1-1	EU5C-SWD-PF2-1
Supply voltage U_{Pow}						
Supply voltage connection		V	24 DC -15 % + 20 %	24 DC -15 % + 20 %	–	24 DC -15 % + 20 %
Input voltage ripple		%	≦ 5	≦ 5	–	≦ 5
Protection against polarity reversal			Yes	Yes	–	Yes
Rated current	I	A	0.7	0.7	–	0.7
Overload proof			Yes	Yes	–	Yes
Inrush current and length		A	12.5 A/6 ms	12.5 A/6 ms	–	12.5 A/6 ms
Heat dissipation at 24 V DC		W	3.8	3.8	–	3.8
Potential isolation between U_{Pow} and U_{VP} 15 V SWD supply voltage (device supply)			No	No	–	Yes
Bridging voltage dips		ms	10	10	–	10
Repeat rate		s	1	1	–	1
Status indication		LED	Yes	Yes	–	Yes
SWD supply voltage (device supply)						
Rated operational voltage	U_e	V	14.5 ± 3 %	14.5 ± 3 %	14.5 ± 3 %	14.5 ± 3 %
max. current	I_{max}	A	0.7[2)]	0.7[2)]	0.7	0.7
Short-Circuit Rating			Yes	Yes	–	Yes
Connection supply voltages						
Connection type			Push in terminals		Push in terminals	
solid		mm^2	0.2 - 1.5 (AWG 24 - 16)		0.2 - 1.5 (AWG 24 - 16)	
flexible with ferrule		mm^2	0.25 - 1.5	0.25 - 1.5	0.25 - 1.5	0.25 - 1.5

		EU5C-SWD-DP	EU5C-SWD-CAN	EU5C-SWD-PF1-1	EU5C-SWD-PF2-1
SWD network					
Station type		SWD coordinator (master)		–	–
Number of SWD stations		58	99	–	–
Transfer rate	Kbit/s	at present 125	at present 125	–	–
Address allocation		automatic	automatic	–	–
Status indication		SWD-LED: green Config.-LED: red		–	–
Connections		Plug, 8-pole		2 × plug, 8-pole	
Plug connectors		Blade terminal SWD4-8MF2		2 blade terminals SWD4-8MF2	
Field bus interface					
Function		PROFIBUS DP slave	CANopen slave		
Bus protocol		PROFIBUS-DP	CANopen		
Transfer rate		up to 12 Mbit/s	up to 1 Mbit/s		
Setting data transfer rate		automatic	automatic		
Station address		2 … 125	2 … 32		
Address allocation		DIP switches	DIP switches		
Status display field bus interface	LED	Two-coloured red/ green	Two-coloured red/ green		
Terminating resistor field bus		switchable via plug	DIP switches		
Connection type field bus		1 × Sub-D, 9-pole, socket	1 × SUB-D plug, 9-pole		
Potential isolation		Yes	Yes		

Notes

1) If contactors with a total current consumption > 3 A are connected, a power feeder module EU5C-SWD-PF1/2 has to be used.
2) If contactors with a total current consumption > 0.7 A are connected, a power feeder module EU5C-SWD-PF2 has to be used.

I/O modules

			EU5E-SWD-8DX	EU5E-SWD-4D4D	EU5E-SWD-4D2R
General					
Standards			IEC/EN 61131-2, EN 50178		
Dimensions (W × H × D)		mm	35 × 90 × 101		
Weight		kg	0.1	0.1	0.11
Mounting			Top-hat rail IEC/EN 60715, 35 mm		
Mounting position			vertical		
Ambient mechanical conditions					
Protection type (IEC/EN 60529)			IP20	IP20	IP20
Vibrations (IEC/EN 61131-2:2008)					
constant amplitude 3.5 mm		Hz	5 … 8.4	5 … 8.4	5 … 8.4
constant acceleration 1 g		Hz	8.4 … 150	8.4 … 150	8.4 … 150
Mechanical shock resistance (IEC/EN 60068-2-27) semi-sinusoidal 15 g/11 ms		Shocks	9	9	9
Drop to IEC/EN 60068-2-31	Drop height	mm	50	50	50
Free fall, packaged (IEC/EN 60068-2-32)		m	0.3	0.3	0.3
Electromagnetic compatibility (EMC)					
Overvoltage category			II	II	II
Pollution degree			2	2	2
Electrostatic discharge (IEC/EN 61131-2:2008)					
Air discharge (Level 3)		kV	8	8	8
Contact discharge (Level 2)		kV	4	4	4
Electromagnetic fields (IEC/EN 61131-2:2008)					
80-1000 MHz		V/m	10	10	10
1.4 - 2 GHz		V/m	3	3	3
2 - 2.7 GHz		V/m	1	1	1
Radio interference suppression (SWD)			EN 55011 Class A		
Burst (IEC/EN 61131-2:2008, Level 3)					
Supply cables		kV	2	2	2
Signal cables		kV	1	1	1
SWD cables		kV	1	1	1
Surge (IEC/EN 61131-2:2008, Level 1)			–	Supply cables 0.5 kV	–
Radiated RFI (IEC/EN 61131-2:2008, Level 3)		V	10	10	10

		EU5E-SWD-8DX	EU5E-SWD-4D4D	EU5E-SWD-4D2R
Ambient climatic conditions				
Operating ambient temperature (IEC 60068-2)	°C	–25 … +55	–25 … +55	–25 … +55
Condensation		prevent with suitable measures		
Storage	°C	–40…70	–40…70	–40…70
Relative humidity, non-condensing (IEC/EN 60068-2-30)	%	5 … 95	5 … 95	5 … 95
SWD Interface				
Station type		SWD station (slave)		
Setting data transfer rate		automatic		
Status SWD	LED	Green		
Connection		Plug, 8-pole Connection plug: External device plug SWD4-8SF2-5		
Current consumption (15 V SWD supply)		→ page 123		
Connection supply and I/O				
Connection type		Push-In		
solid	mm^2	0.2 - 1.5 (AWG 24 - 16)		
Flexible with ferrule[1)]	mm^2	0.25 - 1.5	0.25 - 1.5	0.25 - 1.5
24 V DC supply for output supply				
Rated operational voltage U_e	V	–	24 DC -15 % / +20 %	–
Input voltage ripple	%	–	5	–
Protection against polarity reversal		–	Yes	–
Digital inputs				
Number		8	4	4
Input current	mA	typ. 4 at 24 V DC		
Voltage level to IEC/EN 61131-2				
Limit value type 1		Low < 5 V DC; High > 15 V DC		
Input delay		High → Low typ. < 0.2 ms Low → High typ. < 0.2 ms		
Status display inputs	LED	yellow		

			EU5E-SWD-8DX	EU5E-SWD-4D4D	EU5E-SWD-4D2R
Digital semiconductor outputs					
Number			–	4	–
Output current		A	–	typ. 0.5 at 24 V DC	–
Short-circuit detection threshold		A	–	max. 1.2 over 3 ms	–
Lamp load	R_{LL}	W	–	3	–
Overload proof			–	yes, with diagnostics	–
Switching capacity			–	EN 60947-5-1 utilization category DC-13	–
Relay outputs					
Number			–	–	2
Contact type			–	–	N/O contact
Operations					
Utilization category AC-1, 250 V, 6 A			–	–	$> 6 \times 10^4$
Utilization category AC-15, 250 V, 3 A			–	–	$> 5 \times 10^4$
Utilization category DC-13, 24 V, 1 A			–	–	$> 2 \times 10^5$
Safe isolation		V AC	–	–	230
minimum load current		mA	–	–	100 mA , 12 V DC
Response/reset time		ms	–	–	5/2.5
Bounce duration		ms	–	–	Normally 1.5
Short-circuit protective device			–	–	external 4 A gL/gG
Status display outputs		LED	–	yellow	yellow
Potential isolation					
Inputs for SWD network			Yes	Yes	Yes
Semi-conductor output for SWD network			–	Yes	–
Semi-conductor outputs for inputs			–	No	–
Relays for SWD network			–	–	Yes
Relays for inputs			–	–	Yes
Relays for relays			–	–	Yes

Notes 1) Minimum length 8 mm.

M22-SWD connections

		M22-SWD-K11/ M22-SWD-KC11	M22-SWD-LED-…/ M22-SWD-LEDC-…	M22-SWD-K11LED-…/ M22-SWD-K11LEDC-…	M22-SWD-K22/ M22-SWD-KC22	M22-SWD-K22LED-…/ M22-SWD-K22LEDC-…
General						
Standards		IEC/EN 61131-2, EN 50178				
Dimensions (W × H × D)	mm	12 × 42 × 39/ 12 × 45 × 37	10 × 42 × 45/ 10 × 45 × 42	12 × 42 × 45/ 12 × 45 × 42	17 × 42 × 39/ 17 × 45 × 37	17 × 42 × 45/ 17 × 45 × 42
Weight	g	10	10	10	14	14
Mounting position		any				
Ambient mechanical conditions						
Protection type (IEC/EN 60529)		IP20	IP20	IP20	IP20	IP20
Vibrations (IEC/EN 61131-2:2008)						
constant amplitude 3.5 mm	Hz	5 … 8.4	5 … 8.4	5 … 8.4	5 … 8.4	5 … 8.4
constant acceleration 1 g	Hz	8.4 … 150	8.4 … 150	8.4 … 150	8.4 … 150	8.4 … 150
Mechanical shock resistance (IEC/EN 60068-2-27) semi-sinusoidal 15 g/11 ms	Shocks	9	9	9	9	9
Drop (IEC/EN 60068-2-31); drop height	mm	50	50	50	50	50
Free fall, packaged (IEC/EN 60068-2-32)	m	0.3	0.3	0.3	0.3	0.3

		M22-SWD-K11/ M22-SWD-KC11	M22-SWD-LED-…/ M22-SWD-LEDC-…	M22-SWD-K11LED-…/ M22-SWD-K11LEDC-…	M22-SWD-K22/ M22-SWD-KC22	M22-SWD-K22LED-…/ M22-SWD-K22LEDC-…
Electromagnetic compatibility (EMC)						
Overvoltage category		Not applicable				
Pollution degree		2	2	2	2	2
Electrostatic discharge (IEC/EN 61131-2:2008)						
Air discharge (Level 3)	kV	8	8	8	8	8
Contact discharge (Level 2)	kV	4	4	4	4	4
Electromagnetic fields (IEC/EN 61131-2:2008)						
80-1000 MHz	V/m	10	10	10	10	10
1.4 - 2 GHz	V/m	3	3	3	3	3
2 - 2.7 GHz	V/m	1	1	1	1	1
Radio interference suppression (SWD)		EN 55011 Class A				
Burst (IEC/EN 61131-2:2008, Level 3)						
Supply cables	kV	2	2	2	2	2
SWD cables	kV	1	1	1	1	1
Radiated RFI (IEC/EN 61131-2:2008, Level 3)	V	10	10	10	10	10
Ambient climatic conditions						
Operating ambient temperature (IEC 60068-2)	°C	–30 … +55	–30 … +55	–30 … +55	–30 … +55	–30 … +55
Condensation		prevent with suitable measures				
Storage	°C	–40…80	–40…80	–40…80	–40…80	–40…80
Relative humidity, non-condensing (IEC/EN 60068-2-30)	%	9 … 95	9 … 95	9 … 95	5 … 95	5 … 95

	M22-SWD-K11/ M22-SWD-KC11	M22-SWD-LED-…/ M22-SWD-LEDC-…	M22-SWD-K11LED-…/ M22-SWD-K11LEDC-…	M22-SWD-K22/ M22-SWD-KC22	M22-SWD-K22LED-…/ M22-SWD-K22LEDC-…
SWD network					
Station type	SWD station (slave)				
Baud rate setting	automatic				
SWD-LED	Green				
Connections	Plug, 8-pole				
Plug connectors	SWD4-8SF2-5/ M22-SWD-I…LP	SWD4-8SF2-5/ M22-SWD-I…LP	SWD4-8SF2-5/ M22-SWD-I…LP	SWD4-8SF2-5/ M22-SWD-I…LP	SWD4-8SF2-5/ M22-SWD-I…LP
Number of insertion cycles	50	50	50	50	50
Current consumption (15 V SWD supply)	→ page 123				
Function element					
Contacts	1 changeover contact	–	1 changeover contact	2 changeover contact	2 changeover contact
Lifespan mechanical/electrical (operations)	1×10^6	–	1×10^6	1×10^6	1×10^6
LED display	No	Yes	Yes	No	Yes
Diagnostics	Yes	No	Yes	Yes	Yes
Fixing	front fixing/ base fixing	front fixing/ base fixing	front fixing/ base fixing	front fixing/ base fixing	front fixing/ base fixing

Network termination, switch cabinet bushings

			SWD4-RC8-10	SWD4-SFL8-20	SWD4-SML8-20
General					
Standards			IEC/EN 61131-2, EN 50178		
Dimensions (W × H × D)		mm	48.5 × 34.5 × 10	35 × 83 × 40	35 × 83 × 46
Weight		g	10	50	50
Mounting position			any	any	any
Ambient mechanical conditions					
Protection type (IEC/EN 60529)			IP20	IP67	IP67
Vibrations (IEC/EN 61131-2:2008)					
constant amplitude 3.5 mm		Hz	5 … 8.4	5 … 8.4	5 … 8.4
constant acceleration 1 g		Hz	8.4 … 150	8.4 … 150	8.4 … 150
Mechanical shock resistance (IEC/EN 60068-2-27) semi-sinusoidal 15 g/11 ms		Shocks	9	9	9
Drop to IEC/EN 60068-2-31	Drop height	mm	50	–	–
Free fall, packaged (IEC/EN 60068-2-32)		m	0.3	–	–
Electromagnetic compatibility (EMC)					
Overvoltage category			II	–	–
Pollution degree			2	–	–
Electrostatic discharge (IEC/EN 61131-2:2008)					
Air discharge (Level 3)		kV	8	8	8
Contact discharge (Level 2)		kV	4	4	4
Electromagnetic fields (IEC/EN 61131-2:2008)					
80-1000 MHz		V/m	10	10	10
1.4 - 2 GHz		V/m	3	3	3
2 - 2.7 GHz		V/m	1	1	1
Radio interference suppression (SWD)			EN 55011 Class A	–	–
Burst (IEC/EN 61131-2:2008, Level 3)				–	–
SWD cables		kV	1	–	–
Radiated RFI (IEC/EN 61131-2:2008, Level 3)		V	10	10	10

		SWD4-RC8-10	SWD4-SFL8-20	SWD4-SML8-20
Ambient climatic conditions				
Operating ambient temperature (IEC 60068-2)	°C	–25 … +55	–25 … +55	–25 … +55
Condensation		prevent with suitable measures		
Storage	°C	–40…70	–40…70	–40…70
Relative humidity, no condensation (IEC/EN 60068-2-30)	%	5 … 95	5 … 95	5 … 95
Connection options				
SWD-In		Socket, 8-pole	Plug, 8-pole	Plug, 8-pole
Number of insertion cycles		≥ 200	≥ 200	≥ 500
SWD-Out		–	Socket, 8-pole	Socket, 8-pole
Number of insertion cycles		–	≥ 500	≥ 200
Current consumption (15 V SWD supply)		→ page 123		

Enclosure bushings plug, socket

		SWD4-SF8-20	SWD4-SM8-20
General			
Standards		IEC/EN 61131-2 EN 50178	IEC/EN 61131-2 EN 50178
Dimensions (W × H × D)	mm	24 × 26 × 162	24 × 26 × 170
Weight	g	20	22.5
Mounting position		any	any
Ambient mechanical conditions			
Protection type (IEC/EN 60529)		IP67	IP67
Ambient climatic conditions			
Operating ambient temperature (IEC 60068-2)	°C	–25 … +55	–25 … +55
Condensation		prevent with suitable measures	
Storage	°C	–40…70	–40…70
Relative humidity, non-condensing (IEC/EN 60068-2-30)	%	5 … 95	5 … 95
Connection options			
SWD-In		–	Plug, 8-pole
Number of insertion cycles		–	≥ 500
SWD-Out		Socket, 8-pole	–
Number of insertion cycles		≥ 500	–
Current consumption (15 V SWD supply)			→ page 123

Coupling, plug

		SWD4-8SFF2-5	SWD4-8SF2-5	SWD4-8FRF-10
General				
Standards		IEC/EN 61131-2 EN 50178	IEC/EN 61131-2 EN 50178	IEC/EN 61131-2 EN 50178
Dimensions (W × H × D)	mm	48.5 × 34.5 × 10	15 × 36.5 × 17.5	35 × 90 × 35
Weight	g	4.5	5.5	42
Mounting position		any	any	any
Ambient mechanical conditions				
Protection type (IEC/EN 60529)		IP20	IP20	IP20
Vibrations (IEC/EN 61131-2:2008)				
constant amplitude 3.5 mm	Hz	5 … 8.4	5 … 8.4	5 … 8.4
constant acceleration 1 g	Hz	8.4 … 150	8.4 … 150	8.4 … 150
Mechanical shock resistance (IEC/EN 60068-2-27) semi-sinusoidal 15 g/11 ms	Shocks	9	9	9
Electromagnetic compatibility (EMC)				
Electrostatic discharge (IEC/EN 61131-2:2008)				
Air discharge (Level 3)	kV	8	–	–
Contact discharge (Level 2)	kV	4	–	–
Ambient climatic conditions				
Operating ambient temperature (IEC 60068-2)	°C	–25 … +55	–25 … +55	–25 … +55
Condensation		prevent with suitable measures		
Storage	°C	–40…70	–40…70	–40…70
Relative humidity, non-condensing (IEC/EN 60068-2-30)	%	5 … 95	5 … 95	5 … 95
Connection options				
SWD-In		Plug, 8-pole	Plug connector	Plug, 8-pole
Number of insertion cycles		≥ 200	1	≥ 200
SWD-Out		Plug, 8-pole	Socket, 8-pole	Push in terminals
Number of insertion cycles		≥ 200	≥ 200	–
Current consumption (15 V SWD supply)		→ page 123		

DIL contactor modules

			DIL-SWD-32-001	DIL-SWD-32-002
General				
Standards			IEC/EN 61131-2, EN 50178, IEC/EN 60947	
Dimensions (W × H × D)		mm	45 × 38 × 76	45 × 38 × 76
Weight		kg	0.04	0.04
Mounting			on DILM7 … DILM38	
Mounting position			as DILM7 … DILM38	
Ambient mechanical conditions				
Protection type (IEC/EN 60529)			IP20	IP20
Vibrations (IEC/EN 61131-2:2008)				
constant amplitude 3.5 mm		Hz	5 … 8.4	5 … 8.4
constant acceleration 1 g		Hz	8.4 … 150	8.4 … 150
Mechanical shock resistance (IEC/EN 60068-2-27) semi-sinusoidal 15 g/11 ms		Shocks	9	9
Drop to IEC/EN 60068-2-31	Drop height	mm	50	50
Free fall, packaged (IEC/EN 60068-2-32)		m	0.3	0.3
Electromagnetic compatibility (EMC)				
Overvoltage category			II	II
Pollution degree			2	2
Electrostatic discharge (IEC/EN 61131-2:2008)				
Air discharge (Level 3)		kV	8	8
Contact discharge (Level 2)		kV	4	4
Electromagnetic fields (IEC/EN 61131-2:2008)				
80-1000 MHz		V/m	10	10
1.4 - 2 GHz		V/m	3	3
2 - 2.7 GHz		V/m	1	1
Radio interference suppression (SWD)			EN 55011 Class A	EN 55011 Class A
Burst (IEC/EN 61131-2:2008, Level 3)				
CAN/DP bus cable		kV	1	1
SWD cables		kV	1	1
Radiated RFI (IEC/EN 61131-2:2008, Level 3)			10	10

			DIL-SWD-32-001	DIL-SWD-32-002
Ambient climatic conditions				
Operating ambient temperature (IEC 60068-2)		°C	–25 … +60	–25 … +60
Condensation			prevent with suitable measures	
Storage		°C	–30…70	–30…70
Relative humidity, non-condensing (IEC/EN 60068-2-30)		%	5 … 95	5 … 95
SWD network				
Station type			SWD station (slave)	
Setting data transfer rate			automatic	
SWD status (Ready-LED)		LED	green/orange	
Connections			Plug, 8-pole	
Plug connectors			External device plug SWD4-8SF2-5	
Current consumption (15 V SWD supply)			→ page 123	
Mode parameter				
Manual/automatic mode			No	Yes
Setting			–	Rotary switch
Connection auxiliary contact				
Number			2	2
Rated voltage[1]	U_e	V DC	15	15
Input current at 1 signal, typical		mA	3	3
Potential isolation			No	No
Cable length		m	≦2.8	≦2.8
Connection type			Push-In	Push-In
Terminal capacity				
solid		mm^2	0.2 - 1.5 (AWG 24 - 16)	
Flexible with ferrule[2]		mm^2	0.25 - 1.5	0.25 - 1.5

Notes

1) Own supply.

2) Minimum length 8 mm.

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