SmartWire-DT The System





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Original Operating Instructions

The German-language edition of this document is the original operating manual.

Translation of the original operating manual

All editions of this document other than those in German language are translations of the original German manual.

1st edition 2009, edition date 03/09 2nd edition 2010, edition date 06/09 3rd edition 2010, edition date 06/10 4th edition 2011, edition date 02/11 See revision protocol in the "About this manual" chapter

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Production: René Wiegand Translation: globaldocs GmbH

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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, emergencystop 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.).

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About This Manual

List of revisions		As of publication date 06/10 this manual AWB2723-1617en has been renamed to MN05006002Z-EN.		
		The following significant amendments have been introduced since previous issue:		
Publication date	Page(s)	Key word	New	Change
02/11	various	Notes about Eaton manuals		
11/10	all	Changed terminology, SmartWire-DT instead of SWD		\checkmark
	various	New numbers for manuals: "SmartWire-DT Gateways" MN05013002Z-EN (previously AWB2723-1612en) "SmartWire-DT Slaves" MN05006001Z-EN (previously AWB2723-1613en)		V
	21	New maximum network length 600 m, new maximum data transfer rate 250 Kbits/s		\checkmark
	17	SmartWire-DT universal module	\checkmark	
	117	UL/CSA approvals	\checkmark	

SmartWire-DT system overview	This manual describes the technical overview, installation, commissioning and diagnostics of the SmartWire-DT 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-DT components are connected up incorrectly, or configured and programmed incorrectly.

Exclusion of liability	All information in this manual was provided by us to the best of our knowledge and belief and in accordance with the current state-of-the-art. However, inaccuracies cannot be totally excluded, and we therefore do not assume any liability for the accuracy or completeness of this information. This information in particular does not contain any guar- antee for the provision of specific properties.
	The SmartWire-DT components specified in this manual may be set up and operated only in connection with the corre- sponding manual and instructional leaflet installation instructions enclosed with the device. Installation, commis- sioning, operation, maintenance and retrofitting of the SmartWire-DT components may be performed only by quali- fied personnel. The SmartWire-DT 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, mounting and commissioning as well as careful operation and mainte- nance. If the aforementioned safety-related instructions are not observed, in particular if the commissioning or mainte- nance of the devices is performed by insufficiently qualified personnel and/or the devices are used improperly, it cannot be excluded that the SmartWire-DT components will present sources of danger. We cannot accept any liability for any resulting injury or damage.

Additional documentation	At different points in this manual, references are made to more detailed descriptions in other documents. These are available as PDF files for download from the following address.
	ftp://ftp.moeller.net/DOCUMENTATION/AWB_MANUALS/
	The current edition of this manual in other languages can be obtained from the Internet.
Writing conventions	The symbols used in this manual have the following mean- ings:
	▶ indicates actions to be taken.
\bigtriangledown	Caution! Warns of a hazardous situation that could result in damage to the product or components.
Ń	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.
\rightarrow	Draws your attention to interesting tips and supplemen- tary 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.

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-DT, 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-DT 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-DT element is incorrectly connected or configured and active components such as motors or pressure cylinders are controlled.

Proper use

Several components of the SmartWire-DT connection system 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 SmartWire-DT 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.

A SmartWire-DT 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) (\rightarrow "Electromagnetic compatibility (EMC)", page 95).



Danger!

The power up of the SmartWire-DT topology must not cause any dangers arising from activated devices, such as unexpected motor startups or power ups.

Improper use

The connection system SmartWire-DT 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 despite this, please read the manual MN05006001Z-EN, "SmartWire-DT Slaves".

SmartWire-DT system	This manual describes the intelligent SmartWire-DT connec- tion system. The backbone of the SmartWire-DT system is the self-configuring SmartWire-DT network in which data are exchanged with the SmartWire-DT slaves via an 8- conductor SmartWire-DT network cable (-> section "SmartWire-DT network", page 21). The SmartWire-DT slaves are provided with a voltage via the SWD network cable at the same time.
	You can connect up to 99 SmartWire-DT slaves, e.g. switching devices, pilot devices and I/O modules to the SmartWire-DT network cable.
	As the SmartWire-DT slaves are located on-site in the instal- lation the SmartWire-DT system reduces your wiring costs.
	You create your SmartWire-DT topology with the system components available according to the motto "plug & work".
	At the beginning of the SmartWire-DT network you always connect an SmartWire-DT gateway via the SmartWire-DT ribbon cable.
	The SmartWire-DT gateway controls the data interchange via the SmartWire-DT 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.



- (2) SmartWire-DT blade terminal
- (3) SmartWire-DT flat band conductor
- ④ SmartWire-DT slave
- (5) SmartWire-DT external device plug
- 6 Power feeder module
- SmartWire-DT round cable
- (8) SmartWire-DT switch cabinet bushing
- (9) Network terminator

SWD-Assist

The SWD-Assist planning and ordering help system provides valuable support in the engineering and commissioning of your SmartWire-DT topology. SWD-Assist is software that runs on Windows 2000 (SP 4), Windoes XP, Vista (32 bit) or Windows 7.

The software is available free of charge at:

http://downloadcenter.moeller.net

- On this 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 SmartWire-DT system





- ① SmartWire-DT gateway
- (2) M22-SWD... function element for pilot devices in surface mounting enclosure
- ③ Switch cabinet bushing
- (4) SmartWire-DT input/output module
- (5) SmartWire-DT protective module
- 6 Network terminator
- SmartWire-DT round cable
- (8) M22-SWD... function element for pilot devices
- (9) SmartWire-DT flat band conductor
- (1) Coupling for blade terminal
- 1) Power feeder module
- (12) Planning and ordering help (SWD-Assist)

With the SmartWire-DT components a differentiation is made between SmartWire-DT slaves and SmartWire-DT elements.

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

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

SmartWire-DT slave

SmartWire-DT gateways for PROFIBUS-DP or CANopen

The most important SmartWire-DT slave in the SmartWire-DT network is the SmartWire-DT gateway with its coordinator function.

For a short description of how you install and plan your SmartWire-DT gateway please refer to Chapter "Engineering", page 29 and Chapter "Installation", page 47.

For a detailed description please refer to the manual MN05013002Z-EN "SmartWire-DT Gateways".

Below you will find a short report of the SmartWire-DT slaves that are currently available. For a detailed description of all SmartWire-DT slaves please refer to the manual MN05006001Z-EN, "SmartWire-DT Slaves".

SmartWire-DT I/O modules

The SmartWire-DT I/O modules connect conventional sensors and actuators to the SmartWire-DT network. These can include, auxiliary contacts of additional switch-gear without built-in SmartWire-DT technology. To reduce wiring, the modules are placed immediately next to the sensors/actuators.

Different I/O modules are available:

- With digital inputs and outputs in the form of transistors or relays
- With analog inputs and outputs
- For temperature measurement

SmartWire DT function elements M22-SWD...

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

SmartWire-DT function elements are available for front mounting or for base fixing.

For a short description of how you install your M22-SWD... function elements please refer to Section "M22-SWD... function elements", page 58.

SmartWire-DT protective modules

SmartWire-DT modules DIL-SWD-32-001 and DIL-SWD-32-002 (Automatic/Manual) can be combined with circuit breakers DILM7 to DILM38. This allows motor starters, consisting of a protective motor switch PKZ and a circuit breaker DILM to also be combined with the system. The DIL-SWD-32... modules are supplied with 24 V DC control voltage for the contactors as well as the device supply voltage through the 8 core SmartWire-DT ribbon cable.

Function element for PKE12/32

SmartWire-DT module PKE-SWD-32 connects a motor starter-contactor combination based on electronic motorprotective circuit-breaker PKE to the SmartWire-DT communication system. In addition to contactor actuation and position feedback, it also transmits analog values, such as current and "triggered" status.

SmartWire-DT module for NZM circuit-breakers

SmartWire-DT module NZM-XSWD-704 connects a circuitbreaker with electronic release(NZM 2, NZM 3, NZM 4) to the SmartWire-DT communication system. It can be used, for example, to detect the switch position (On/Off/Trip) and the actual currents. A remote operator that can optionally be fitted to the circuit-breaker can be actuated through the module.

SmartWire-DT universal module

The changes in hardware configuration and additional programming required to extend installations with additional functions are usually complex.

With a universal module M22-NOP or M22-NOPC you can replace all SmartWire-DT stations required for later expansion.

In the PLC's control configuration, program the SmartWire-DT slaves that will be required at a later date in addition to the ones that will be installed and used immediately.

You can then fit a universal module in place of this Smart-Wire-DT slave in the network.

In the user program scan whether the the configured Smart-Wire-DT station or a universal module is fitted. The data exchange with a SmartWire-DT station must be controlled according to this information.

If a universal module is later replaced with the originally configured SmartWire-DT slave, add this slave to the Smart-Wire-DT network by pressing the "Config." button on the gateway.

For a detailed description of the connection of a universal module please refer to the manual MN05006001Z-EN.

SmartWire-DT elements

The SmartWire-DT elements complete the SmartWire-DT system:

- Power feeder modules
- Flat band conductors and round cables
- PCB for surface mounting enclosure for plugging in M22-SWD... function elements
- Control panel and housing bushing socket
- SmartWire-DT accessories
 - Link for base or front mount
 - Coupling for blade terminal
 - Network terminator
 - Adapter for blade terminal/round cable
 - Crimping pliers

A short functional description of the passive SmartWire-DT components follows.

Power feeder modules

Power feeder modules are power supply units that are connected additionally to the SmartWire-DT network when there is an increased current consumption or increased voltage drop. Being a passive SmartWire-DT 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 Smart-Wire-DT 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 other SmartWire-DT devices back onto the SmartWire-DT ribbon cable.

SmartWire-DT flat band conductors and round cables

You connect SmartWire-DT elements via 8-conductor Smart-Wire-DT ribbon cable or round cable, via which both the data and the supply voltages are transmitted (\rightarrow "Connecting the SmartWire-DT connection cable", page 80).

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 SmartWire-DT network is created via this printed circuit board.

The standard RMQ-Titan surface mounting enclosure M22-I1 to M22-I6 in conjunction with standard M22 front elements are used (\rightarrow "M22-SWD base fixing", page 63).

Socket/plug switch cabinet bushings

You use switch cabinet bushings with an M18 x 0.75 mm screw fixing for external connection of the SmartWire-DT 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 (\rightarrow "Switch cabinet bushing", page 70).

Link for base or front mount

The link for base fixing is used for unused slots in the card for surface mounting enclosure M221...

The link for front mounting is used in combination with unused external device plug. The jumpers must be fitted in this case, since an address assignment to all SmartWire-DT stations is not, otherwise, possible.

Network terminator for flat band conductor

The SmartWire-DT network requires termination at the end of the network (\rightarrow "Using network termination", page 93).

Adapter for blade terminal/round cable

This adapter (part no. SWD4-8FRF-10) is for the purpose of adapting from ribbon cable to round cable and vice versa (\rightarrow "Using the ribbon/round cable adapter", page 92).

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 SmartWire-DT round cable (\rightarrow "Housing bushing socket", page 77).

SmartWire-DT 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.

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

Features of the SmartWire-DT network

Table 1:Features of the SmartWire-DT network		
Physics of the data cable	RS485+	
Network length	600 m	
Number of users	max. 99 (automatic addressing)	
Baud rate	125/250 Kbit/s	
User data bytes per telegram	variable, to max. 1024	
Cycle time at 125 Kbit/s	(2 + (number of user data bytes x 0.1)) ms	
Data transfer protocol	SmartWire-DT; cyclic, acyclic data transfer	
SmartWire-DT system reliability	error-tolerant system, time monitoring ¹⁾ , slave replacement, telegram repetition etc.	
Diagnostics	Station failure, device failure, replacement trough universal module	

1) Time monitoring for the SmartWire-DT slave and for the coordinator, default watchdog timeout 300 ms.

If a SmartWire-DT 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 SmartWire-DT slave to "0" after expiry of the timeout period.



(1) 1 SmartWire-DT slave with n user data bytes

(2) 99 SmartWire-DT slaves with n user data bytes

SmartWire-DT station address assignment

To operate a SmartWire-DT network, addresses must be assigned to the SmartWire-DT slaves. Addresses must be assigned during commissioning, on any changes in configuration and when replacing slaves. To assign addresses, press the Config. key on the SmartWire-DT gateway. After address assignment, all found stations are saved in the gateway's target configuration.

The configuration state is indicated by the SmartWire-DT LED:

SWD-LED	Status
Red flashing	No target configuration present (for initial startup)
Green	Target configuration present

Preconditions for address assignment:

The gateway has a connection to the SmartWire-DT network when its supply voltage is first switched on; the field bus plug is disconnected.

Pressing the Config. key when switching on the gateway will switch it to "Firmware update" mode.

Automatic address assignment to the SmartWire-DT slaves is not possible in this state.

An operating system update can be performed with design software SWD-Assist. For further information, see manual MN05013002Z-EN, "SmartWire-DT Gateway".

Pressing the Config. key for at least two seconds starts automatic address assignment.

The SmartWire-DT gateway reports this status with the following LED indication:

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

SWD-LED	Status
Orange flashing	Automatic address assignment started

During address assignment the SmartWire-DT gateway determines which and how many SmartWire-DT slaves are connected to the SmartWire-DT network (actual configuration). According to their positions in the SmartWire-DT network it assigns addresses to the stations in a continuous ascending sequence. It assigns address 1 to the SmartWire-DT slave closest to it and continues up to 99.

The SmartWire-DT gateway saves the actual configuration as a new target configuration. This saved target configuration then serves as a reference for each startup.

The SmartWire-DT gateway's LED signals the end of automatic address assignment as follows:

Table 3:	LED of the SmartWire-DT gateway after address
	assignment is completed

LED	Status
SWD	Green continuous light

The SmartWire-DT gateway now waits for 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 part no. of SmartWire-DT slaves agrees with the target configuration in the SmartWire-DT gateway and has been transferred to the SmartWire-DT gateway, the data interchange can already commence.

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	

Table 4: LED of the SmartWire-DT gateway after download of the PLC configuration

For a brief description of how an SmartWire-DT gateway is put into operation for the first time with a new actual configuration please refer to Section "Initial switch-on of the SmartWire-DT network", page 99.

In the manual MN05013002Z-EN, "SmartWire-DT Gateways", you can find out how to configure a SmartWire-DT gateway with its SmartWire-DT slaves in the configuration software for the PLC.

Organization of the SmartWire-DT slave data

All cyclic I/O data of existing SmartWire-DT stations are placed in a data storage area of the SmartWire-DT gateway. This data storage area comprises up to 1024 bytes. The cyclic data exchange between the coordinator and all Smart-Wire-DT stations takes place in a common message.

Each SmartWire-DT slave reads the receive data intended for it (input byte) and writes its send data (output bytes).

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

Each SmartWire-DT 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 SmartWire-DT network

SmartWire-DT networks are designed for a line topology. It must be terminated at each end with a network termination. The network termination at the gateway end is integrated into the SmartWire-DT gateway, so that a separate termination is required only at the other end of the line (\rightarrow "Using network termination", page 93).

SmartWire-DT network cables

Use SmartWire-DT ribbon cable or SmartWire-DT round cable as the SmartWire-DT network cable.

Flat band conductor

Each conductor of the 8 core ribbon cable has a cross-section of 0.23 mm² (AWG 24). The assignment of the ribbon cable's conductors are listed below.

Table 5:	Configuration of the SmartWire-DT flat band
	conductor

Meaning	
+24 V DC	Contactor control voltage
Common	Contactor control voltage
GND	for device supply voltage and data cable
Data B	Data cable B
Data A	Data cable A
GND	for device supply voltage and data
	(data A, data B)
SEL	Select cable for automatic addressing of the
	SmartWire-DT slaves
+15 V DC	Device supply voltage

Round conductor

Round conductors are used outside the control panel and are suitable for bridging larger distances (\rightarrow "Connecting the SmartWire-DT connection cable", page 80).

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 SmartWire-DT	round cable
----------	---------------	-----------------	-------------

Core	Cross- section [mm ²]	Conduct or colour	Meaning	
1	0.5	brown	+15 V DC	Device supply voltage
2	0.22	gray	SEL	Select cable for automatic addressing of the SmartWire-DT slaves
3	0.22	pink	GND	for device supply voltage and data cable
4	0.22	red	Data A	Data cable B
5	0.22	blue	Data B	Data cable A
6	0.5	white	GND	for device supply voltage and data
7	0.5	yellow	Common	Contactor control voltage
8	0.5	green	+24 V DC	Contactor control voltage

2 Engineering

How do I plan a SmartWire-DT topology?	This chapter will help you to plan the SmartWire-DT topology of an installation. Before planning the SmartWire-DT topology, the following should be ensured:		
	 The automation task should be clearly defined. The field bus system via which the SmartWire-DT gateway communicates with the overriding controller should be defined. The number and the types of SmartWire-DT slaves should be known. 		
	• The positions of the SmartWire-DT slaves in the installa- tion should be determined so that the total length of the SmartWire-DT ribbon cable and round cable is known.		
\rightarrow	Planning can be conveniently completed entirely with the design software SWD-Assist, which you can start with the following link:		
	http://downloadcenter.moeller.net		
	The planning of the SmartWire-DT topology extends to:		
	• Selection of the SmartWire-DT gateway, depending on the field bus system used.		
	 Selection and positioning of the SmartWire-DT slaves, e.g. SmartWire-DT modules DIL-SWD-32, SmartWire-DT I/O modules etc. The number and the types of SmartWire-DT slaves determine the volume of data to be transferred and the electrical load (→ "Calculation of the electrical load in the device supply", page 34, → "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 cable resis- tance and the electrical load you then calculate the voltage drop on the cable and check whether an addi-		

Engineering

	tional power supply unit (power feeder module) is required (—> "Voltage Drop", page 36).		
	 Positioning of the SmartWire-DT slaves with the drafting of a device mounting plan for the SmartWire-DT cables (→ "How do I position my SmartWire-DT slaves?", page 45). 		
	 Definition of what type of network termination will be used at the end of the network (" Using network termi- nation", page 93). 		
How do I configure my gateway?	The SmartWire-DT gateway configures the SmartWire-DT network automatically. So after installation and during commissioning of all the SmartWire-DT slaves you only have to press the "Config." pushbutton to create a valid target configuration (→ "SmartWire-DT station address assignment", page 23).		
	In the process an SmartWire-DT gateway determines how many and which SmartWire-DT slaves are present on the SmartWire-DT network and how many data have to be trans- ferred.		
	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 SmartWire-DT slaves created there complies with the target configuration and is downloaded to the SmartWire-DT gateway.		
	For detailed instructions for configuring your SmartWire-DT gateway, see manual MN05013002Z-EN, "SmartWire-DT Gateways".		

SmartWire-DT PROFIBUS-DP gateway EU5C-SWD-DP

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

	sinartwire bir nor bos bir gateway
PROFIBUS-DP Baud rate	max. 12 Mbit/s, automatic adaptation
Number of PROFIBUS DP slaves	max. 124
Valid PROFIBUS DP slave addresses	1 - 125
PROFIBUS DP data volume per slave	max. 480 I/O byte (240 I/240 O byte)
SmartWire-DT Baud rate	125/250 Kbit/s
Number of SmartWire-DT slaves on the PROFIBUS DP gateway	max. 58
Rated operational current I_G in the device supply	0.7 A
Rated operational current Is in the contactor supply	3 A

Table 7: Features of the SmartWire-DT PROFIBUS DP gateway

SmartWire-DT CANopen gateway EU5C-SWD-CAN

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

	Sindicitie D1 chillopen gateriaj
CANopen Baud rate	max. 1 MBit/s, 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 I/128 O byte)
SmartWire-DT Baud rate	125/250 Kbit/s
Number of SmartWire-DT slaves on the CANopen gateway	max. 99
Rated operational current I_G in the device supply	0.7 A
Rated operational current I_S in the contactor supply	3 A

Table 8: Features of the SmartWire-DT CANopen gateway
How do I dimension the power supply of my SmartWire-DT topology?	Each SmartWire-DT gateway has a built-in power supply unit, which provides two separate supply voltages in the SmartWire-DT network:
	• The 15 V DC device supply voltage U _{VP} (device supply) for the electronics of the downstream SmartWire-DT slaves. The SmartWire-DT gateway (or a SmartWire-DT power feeder module PF2) generates this 15 V DC supply voltage from the 24 V DC supply voltage applied to the spring-loaded terminal POW connection.
	• The 24 V DC control voltage U _{AUX} , if you energize contactor coils (contactor supply) through a Smart-Wire-DT module DIL-SWD-32/PKE-SWD32.
	The calculations of the electrical load and the voltage drop have to be made separately for devices and contactor supply.
	Connection of the SmartWire-DT network to the SmartWire- DT gateway and to the SmartWire-DT power feeder module is always performed via the 8-conductor SmartWire-DT ribbon cable. With a cross-sectional area of 0.23 mm ² (AWG 24) per ribbon cable conductor the maximum current carrying capacity is 3 A conform IEC/EN or 2 A conform UL 508.
	Not until you are in the subsequent SmartWire-DT topology, e.g. in the case of a surface mounting enclosure, can you use the SmartWire-DT round cable, which has a cross-section of 0.5 mm ² 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 (→ "Calculation of the electrical load in the device supply", page 35)
 - The voltage drop (\rightarrow "Voltage Drop", page 36).
- The following are optional in the contactor supply (24 V DC):
 - The total power consumption
 - (→ "Contactor supply UAUX", page 35)
 - The voltage drop (\rightarrow "Voltage Drop", page 36).

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

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

Add together the currents of all SmartWire-DT slaves and the current that flows through the network termination, making a total current I_G.

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



For information about the current consumption of SmartWire-DT slaves see the appendix of manual MN05006001Z-EN, "SmartWire-DT Slaves".

Contactor supply U_{AUX}

The 24 V DC supply voltage for contactor actuation is also supplied through the 8 core ribbon cable (\rightarrow "Configuration of the SmartWire-DT flat band conductor", page 26).

Calculation of the electrical load in the contactor supply

If the SmartWire-DT 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 SmartWire-DT slave as of which the 3 A have been exceeded.

The total current I_G is is the sum of the contactors' individual current consumption values weighted with utilization factor k.

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

Please refer to the manual MN05006001Z-EN, "SmartWire-DT Slaves" for the current consumption of the various contactors.



The current load is calculated automatically by the design software.

Example:

With an utilization factor k = 0.6, 10 contactors of the part no. DILM38 can be supplied by an SmartWire-DT gateway or an SmartWire-DT power feeder module.

Voltage Drop

Extensive SmartWire-DT networks with long line lengths (up to 600 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 SmartWire-DT 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, insert an additional supply unit before this network position.

The voltage drop of the devices and the current load in the contactor supply are calculated automatically by the design software SWD-Assist.

 Table 9:
 Line resistance of the SmartWire-DT ribbon cable and round cable

	Cable resistance R_L per m for 15 V DC device supply $[\Omega/m]$	Cable resistance R_L per m for 24 V DC device supply $[\Omega/m]$
Flat band conductor	0.131	0.174
Round conductor	0.06	0.07

The line resistance per meter (calculated from the supply and return line) applies at a cable temperature of 70 °C.

> Because of the differing cable resistance values, calculate the voltage drop for the SmartWire-DT ribbon cable and the round cable separately.





- Round cable in the device supply
 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 SmartWire-DT slave is guaranteed at a supply voltage U_{VP} for the devices 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 SmartWire-DT 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.

The maximum voltage drop U_{Lmax} is calculated as follows:

 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 an utilization 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 SmartWire-DT slave is switched on after 43 m of ribbon cable.



 Supply unit: SmartWire-DT gateway or SmartWire-DT power feeder module

The following is valid in accordance with figure 5:

 $\begin{array}{l} U_V \ = \ U_{VP} \ = \ 14.5 \ V \ DC \\ U_1 \ = \ U_V \ - \ R_{L1} \ x \ (I_1 \ + \ I_2 \ + \ I_3 \ + \ ... \ + \ I_n \ + \ I_{RB}) \\ U_2 \ = \ U_1 \ - \ R_{L2} \ x \ (I_2 \ + \ I_3 \ + \ ... \ + \ I_n \ + \ I_{RB}) \\ U_n \ = \ U_{n-1} \ - \ R_{Ln} \ x \ (I_n \ + \ I_{RB}) \end{array}$



Caution!

In the case of this simplified formula the current limitation due to the cable resistance remains unconsidered and the rated operational current of the individual SmartWire-DT slaves is assumed at all times. The result is valid at a supply voltage $U_n \ge$ of 10.5 V DC.

- First determine the total current by adding the current consumption of all SmartWire-DT slaves as listed in the tables in the appendix of manual MN05006001Z-EN, "SmartWire-DT Slaves", including the current consumption of the network connection (17 mA).
- Refer to the illustration "Line resistance of SmartWire-DT ribbon and round cable in the device and contactor supplies", page 37 or the table "Line resistance of the SmartWire-DT ribbon cable and round cable" page 36 for the total line resistance subject to consideration of the length of the various SmartWire-DT line types.

Calculate the supply voltage at the SmartWire-DT slave "Slave n" using the formula:

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

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

► If the calculation with the above formula has yielded too low a supply voltage at "TIn. n", calculate the supply voltage at the individual SmartWire-DT slaves using the table "Step-by-step calculation of the supply voltage", page 40.

Smart- Wire-DT 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 supply voltage of the current slave
SWD (1)	$\begin{split} I_G = & I_1 + I_2 + \dots \\ I_n + I_{RB} \end{split}$	$R_{L1} = R_L x L_1$	$U_{L1} = I_G \ x \ R_{L1}$	$U_1 = U_V - U_{L1}$
SWD (2)	$I_2 = I_G - I_1$	$R_{L2} = R_L x (L_2 - L_1)$	$U_{L2} = I_2 \ x \ R_{L2}$	$U_2 = U_1 - U_{L2}$
SWD (3)	I ₃ =I _G - I ₂	$R_{L3} = R_L x (L_3 - L_2)$	$U_{L3} = I_3 \times R_{L3}$	$U_3 = U_2 - U_{L3}$
SWD (n)	$ I_n = I_G - (I_1 + I_2 + \\ \dots \ I_n + I_{RB}) $	$ \begin{aligned} R_{Ln} &= \\ R_L \ x \ (L_n \ - \ L_{n-1}) \end{aligned} $	$U_{Ln} = I_n \ x \ R_{Ln}$	$U_n = U_{n-1} - U_{Ln}$

Table 10:	Step-by-step calculation of the supply voltage
-----------	--

- I_G = Total current in the SmartWire-DT 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 SmartWire-DT 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 SmartWire-DT slave. The preceding slave is the supply unit for SmartWire-DT 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 SmartWire-DT I/O modules (EU5E-SWD-4D4D)
- (3) 3 function elements M22-SWD-K11LED-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 SmartWire-DT gateway is supplying the SmartWire-DT topology sufficiently.

Calculation of the voltage drop in the contactor supply

DC operated 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: $U_{AUXmin} = 19.2 \text{ V DC}$



Warning!

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

The maximum voltage drop U_{Lmax} is calculated as follows:

 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 figure 5, page 39:

 $\begin{array}{l} U_V \ = \ U_{AUX} \ = \ 23.5 \ V \ DC \\ \\ U_1 \ = \ U_V \ - \ R_{L1} \ x \ k \ x \ (I_1 \ + \ I_2 \ + \ I_3 \ + \ ... \ + \ I_n) \\ \\ U_2 \ = \ U_1 \ - \ R_{L2} \ x \ (I_2 \ + \ I_3 \ + \ ... \ + \ I_n) \\ \\ U_n \ = \ U_{n-1} \ - \ R_{Ln} \ x \ I_n \end{array}$



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

SmartWire-DT topology:

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

- 9 contactors DILM38 (with DIL-SWD-032-002), simultaneity factor k = 0.8
- 2 SmartWire-DT I/O modules (EU5E-SWD-4D4D)
- (3) 3 function elements M22-SWD-K11LED-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 SmartWire-DT gateway does not supply th coils with sufficient current in this case. An add feeder module EU5C-SWD-PF1-1 must be inse contactor with SmartWire-DT slave address 7.	ne contactor litional power rted after the	
	The voltage drop in the device supply is non-c	ritical.	
How do I position my SmartWire-DT slaves?	There are no restrictions to the positioning. Ho following recommendations should be heeded	owever, the I:	
	Arrange the SmartWire-DT slaves of a device as possible in groups on the SmartWire-DT i	e group as far network.	
	 Fit the external device plug to the ribbon ca cient spacing. 	ble with suffi-	
	If, for example, the functional elements M22-5 SmartWire-DT I/O modules are arranged next t installation of the external device plugs or later of the SmartWire-DT slaves will be easier.	SWD or to each other, r replacement	
_	A minimum clearance of approx. 30 cm has tained between SmartWire-DT network lines cables running in parallel.	to be main- s and power	

3 Installation

The SmartWire-DT 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 retriggering.
- Short-circuit and ground.
- Cover adjacent live parts.

The SmartWire-DT components are installed in the following order:

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

When using contactors:

• Electrical installation of the control voltage for the contactors

Mechanical Mounting	SmartWire-DT gateways, SmartWire-DT I/O modules and SmartWire-DT power feeder modules are suitable for mounting on a top-hat rail in accordance with IEC/EN 60715, 35 mm.
	► When fitting the gateway, first set the field bus station address using the dip switches (switches 2 - 8) on the right side of the SmartWire-DT gateway.
	Install the above mentioned SmartWire-DT 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 accessories.

Electrical Installation Potential conditions between the components

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

SmartWire-DT gateway





- ① POW: Supply voltage 24 V DC
- (2) Field bus interface
- (3) Diagnostics interface
- ④ Config. pushbutton actuator
- \bigcirc Status LEDs
- 6 AUX: control voltage for contactors 24 V DC
- ⑦ SmartWire-DT network output (SWD OUT)
- (8) DIP switch for setting the field bus address



Caution!

EMERGENCY STOP switching by group is performed externally by switching off the 24 V DC control voltage of the contactor coils. See also manual MN05006001Z-EN, "SmartWire-DT Slaves"

Connecting the POW supply voltage

The device supply voltage for the electronics of all Smart-Wire-DT slaves (15 V DC) is generated from the 24 V DC supply voltage that you apply to the spring-cage terminal connection POW.



Caution!

The POW power supply behaves capacitively when first switched on, an increased inrush 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 inrush current.

Connecting the supply voltage AUX

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

Terminal capacities of the cables for the POW and AUX supply voltages

- solid: 0.25 1.5 mm² (AWG 24-16).
- flexible 0.25 1.5 mm² (AWG 24-16) with appropriate isolated ferrules with plastic collars in accordance with DIN 46228, Part 4, minimum length 8 mm.



Cable protection for the POW and AUX supply voltages



On the SmartWire-DT gateway connect the POW and AUX supply voltages via separate miniature circuit-breakers or fuses. For the applicable standards, see page 117.

Connecting the SmartWire-DT network

The SmartWire-DT gateway is connected using the Smart-Wire-DT ribbon cable with fitted blade terminal (at the cable's gateway end).



Caution!

Make the SmartWire-DT network connections only in a voltage-free state.

Connect PROFIBUS-DP bus

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

Connecting the CANopen network

For connection to the CANopen cable you require a 9-pole SUB-D 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 detailed instructions for connecting a SmartWire-DT gateway, see manual MN05013002Z-EN, "SmartWire-DT Gateways".

SmartWire-DT power module

The SmartWire-DT power modules EU5C-SWD-PF1-1 and EU5C-SWD-PF2-1 provide an additional power supply for stations in the SmartWire-DT network.



Figure 10: Connections of the SmartWire-DT power supply module (here the EU5C-SWD-PF2 is used for illustration)

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



Caution!

EMERGENCY STOP switching by group is performed by switching off the 24 V DC control voltage of the contactor coils. See manual 05006001Z-EN, "SmartWire-DT Slaves".

Connecting the supply voltage AUX

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

Connecting the POW supply voltage

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



Caution!

When first switched on, an increased inrush 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 inrush current.

Terminal capacities of the cables for the POW and AUX supply voltages

- solid: 0.2 1.5 mm² (AWG 24-16),
- flexible 0.25 1.5 mm² (AWG 24-16) with appropriate isolated ferrules with plastic collars in accordance with DIN 46228, Part 4, minimum length 8 mm.



For detailed instructions for connecting the SmartWire-DT power modules, see manual MN05006001Z-EN, "SmartWire-DT Slaves".

SmartWire-DT I/O modules

The SmartWire-DT I/O modules connect sensors and actuators to the SmartWire-DT network. A range of modules with various combinations of digital or analog inputs and outputs are available. The SmartWire-DT family of I/O modules is being continually expanded.

The following I/O modules are currently available:

- EU5E-SWD-8DX (eight digital inputs)
- EU5E-SWD-4DX (four digital inputs)
- EU5E-SWD-4D4D (four digital inputs and four digital outputs)
- EU5E-SWD-4D2R (four digital inputs and two digital relay outputs)
- EU5E-SWD-X8D (eight digital outputs)
- EU5E-SWD-4AX (four analog outputs)
- EU5E-SWD-2A2A (two analog inputs and two analog outputs, each 0 10 V or 0 20 mA)
- EU5E-SWD-4PT (four analog temperature inputs, Pt100, Pt1000 or Ni1000)

An example of I/O module connections is shown below.





- ① SmartWire-DT ribbon cable with external device plug
- (2) Status SmartWire-DT LED
- $(\ensuremath{\mathfrak{I}})$ 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



For detailed instructions for connecting an I/O module, see manual MN05006001Z-EN, "SmartWire-DT Slaves".

SmartWire-DT protective modules

The SmartWire-DT modules DIL-SWD-32-001 and DIL-SWD-32-002 for DILM are snapped directly onto either a contactor type DILM7 to DILM38, a DILA contactor relay or an MSC motor starter.

DIL-SWD-32-001

DIL-SWD-32-002



Figure 12: Surface mounting of the SmartWire-DT modules DIL-SWD-32-001 and DIL-SWD-32-002 for DILM

- ① Connection of SmartWire-DT external device plug
- (2) Mechanical switching position indicator
- ③ Diagnostics LED
- ④ Catch slider
- (5) Connection pins
- (6) Adjusting slide for contactor size
- Connection terminal X0-X1-X2
- (8) Connection terminal electrical enable X3-X4
- (9) Selector switch 1-0-A
- For a description of contactor connection DIL-SWD-32-001/DIL-SWD-32-002 see manual MN05006001Z-EN, "SmartWire-DT Slaves".

M22-SWD... function elements

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



For detailed instructions for connecting M22-SWD... function elements, see manual MN05006001Z-EN, "SmartWire-DT Slaves".



Figure 13: M22-SWD... function elements

Installation

Legend for Figure13:

- 1 4?way selector switch actuator
- 2 Labels with label mounts
- 3 4-way adapter
- 4 Fixing adapters
- 5 Function element with 3 positions for front mount
- 6 LED element for front mount
- 7 M22 contact elements
- 8 Function element with 2 positions for front mount
- 9 Function element with 3 positions and LED for front mount
- 10 Link for external device plug
- 11 SmartWire-DT external device plug
- 12 SmartWire-DT flat band conductor
- 13 Planning and ordering help (SWD?Assist)
- 14 M22 surface mounting enclosure
- 15 PCB for surface mounting enclosure
- 16 Enclosure bushing for round cable
- 17 Enclosure bushing plug/socket

- 18 Cable adapter plug/socket
- 19 SmartWire-DT round cable
- 20 Link for base slots
- 21 Function element with 3 positions and LED for base fixing
- 22 Function element with 3 positions for base fixing
- 23 Function element with 2 positions and LED for base fixing
- 24 Function element with 2 positions for base fixing
- 25 LED element for base fixing
- 26 Bezels
- 27 Indicator lights
- 28 Key-operated buttons
- 29 Selector switch actuators
- 30 Pushbutton actuators
- 31 Button plates/Button lenses
- 32 Label mounts
- 33 Emergency-stop button
- 34 Joystick

M22-SWD front mount

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. They replace the familiar M22-K10-/K01 contact elements and M22-LED... indication elements. On the front panel the previous elements for the control circuit function are used.

Surface mounting



Figure 14: Layout of the M22-SWD front mount

Only one M22-SWD front function element is used for each M22-A adapter. It is always mounted in the center 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. An illuminated 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).





- ► Fit the external device plug to the ribbon cable
- ► Plug the M22-SWD front function element onto the external device plug.
- ► Wire a SmartWire-DT 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.

Surface mounting



Figure 16: Surface mounting enclosure with PCB and M22-SWD base function element

The M22-SWD base function elements are used in the same way as the familiar contact elements M22-K10-/K01 and indicator elements M22 LED. On the front panel the existing elements are used for the control circuit function. The elements are connected to the SmartWire-DT network through this circuit-board, which features a switchable network termination.

Installation

Installation of the surface mounting enclosure

The circuit-board in the surface mounting enclosure is connected to the SmartWire-DT network with the Smart-Wire-DT round cable.

The SmartWire-DT round cable can be connected directly with V-M20 \times 1.5 mm (metric cable gland with integrated strain relief) or plugged in (\rightarrow "Direct connection of Smart-Wire-DT round cable", page 65).

8-pole enclosure bushings with a screw fixing M20 x 1.5 mm as plug/socket versions are used for the plugin version (\rightarrow "Plug-in connection of the SmartWire-DT round cable", page 66).

Connection on the PCB is performed via eight numbered and colour-coded spring-cage terminals. This applies to the incoming SmartWire-DT cable on the PCB side marked IN and to the outgoing SmartWire-DT cable on the OUT side. The SmartWire-DT round cable and SmartWire-DT enclosure bushings have the same wire colours.

Connection to the 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 SmartWire-DT round cable. Ensure that the PCB is pointing in the correct direction. The direction of the arrow defines the arrangement of the SmartWire-DT slaves. The SmartWire-DT gateway is to the left of the IN code.

Direct connection of SmartWire-DT round cable



Figure 18: Direct connection with a cable gland

- ► Jacket and insulate the SmartWire-DT round cable to a suitable length.
- ► Fit the individual wires with insulated ferrules with plastic collars in accordance with DIN 46228, Part 4, of suitable cross-section and a length of at least 8 mm.
- Introduce the SmartWire-DT round cable coming from the gateway side through the fitted cable gland and into the surface mounting enclosure.
- If further SmartWire-DT slaves follow this surface mounting enclosure, introduce the second SmartWire-DT round cable fitted with wire-end sleeves through another cable gland and into the surface mounting enclosure.
- ► Then connect the wires to the PCB.



Warning!

Ensure the secure seating of the cable and safe operation by using the integrated strain relief for the cable gland.



Plug-in connection of the SmartWire-DT round cable



- Incoming SmartWire-DT round cable

Fitted to the SmartWire-DT round cable with the live conductors coming from the gateway is a cable socket (type SWD4-SF8-67 straight or part no. SWD4-SF8-67W angled at 90°) (\rightarrow "Housing bushing with plug", page 77).

➤ So fasten the enclosure bushing plugs (part no. SWD4-SM8-20) in the surface mounting enclosure on the incoming side (IN).

- Outgoing SmartWire-DT round cable

If further SmartWire-DT slaves follow this surface mounting enclosure with SmartWire-DT slaves, a cable plug (part no. SWD4-SM8-67 straight or part no.SWD4-SM8-67W angled at 90°) is fitted to the outgoing SmartWire-DT round cable (\rightarrow "Housing bushing with socket", page 78).

➤ So fasten the enclosure bushing socket (part no. SWD4-SF8-20) in the surface mounting enclosure on the outgoing side (OUT).

For incoming and outgoing SmartWire-DT round cables (arrow direction) with different installation positions of the surface mounting enclosure, see the illustration below.



Figure 20: Incoming and outgoing SmartWire-DT round cables with different installation positions



Connection to the printed circuit board



- (1) brown, +15 V DC: device supply voltage
- ② gray, SEL: Select cable for automatic address assignment to the SmartWire-DT slaves
- (3) pink, GND: device supply voltage
- ④ red, data A
- (5) blue, data B
- (6) white, GND: device supply voltage
- yellow, earth: contactor control voltage
- (8) green, +24 V DC: contactor control voltage

If further SmartWire-DT slaves follow this surface mounting enclosure with SmartWire-DT slaves:

 Clamp all outgoing wires according to colour in the springcage terminals marked with the same colours on the OUT side.




► Equip the PCB slots with the M22-SWD...C... function elements. Ensure that the mounting position is correct. The status LED is at the top.



Caution!

Equip unused slots with link M22-SWD-SEL8-10.

Switch the network termination to the position ON, if this surface mounting enclosure houses the last SmartWire-DT slave.



Caution!

The network termination must be switched without fail to the position OFF, if further SmartWire-DT slaves follow the surface mounting enclosure with SmartWire-DT slaves.

Switch cabinet bushing

Use the switch cabinet bushing for external connection of the SmartWire-DT 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 mounting diameter of 18.5 mm.

 \rightarrow

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

Use the SmartWire-DT 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 (part no. SWD4-SML8-20) is available for supply.



Warning!

The protection type specified in the appendix is guaranteed only if it is correctly mounted! 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 23: Switch cabinet bushing with a round socket

To exit the switch cabinet in the direction of the SmartWire-DT network end and the round socket is therefore carrying a live voltage, use the switch cabinet bushing with a built-in round socket (part no. SWD4-SFL8-20). Route the SmartWire-DT network on using the SmartWire-DT round cable with a fitted round plug (part no. SWD4-SM8-67 straight or part no. SWD4-SM8-67W angled at 90°).

How to connect a round plug to the SmartWire-DT round cable is described on page 82.

Switch cabinet bushing with round plug





Use the switch cabinet with an integrated round plug (part no. SWD4-SML8-20), if, coming from the gateway face, you are conducting the SmartWire-DT network with the live conductors to the switch cabinet.

Power supply is through the SmartWire-DT round cable with a fitted round socket (part no. SWD4-SF8-67 flat or part no. SWD4-SF8-67W, angled at 90°).

How to connect a round socket to the SmartWire-DT round cable is described on page 81.

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



Figure 25: Connections of the switch cabinet bushing



Supply of the 24 V DC control voltage for contactors

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-cage terminals A and B. The remaining conductors between the SmartWire-DT 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 11: Configuration of the spring-loaded terminals A and B

Ribbon cable conductor	Spring-cage terminal
Common	B: 0 V
24 V DC	B: 24 V
Round cable conductor	
Common	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	Part no. of switch cabinet bushing	Measures
The current consumption of the connected contactors is covered by the connected supply unit (SmartWire-DT gateway or power feeder module).	with a round socket (part no. SWD4-SFL8-20) or with a round plug (part no. SWD4-SML8- 20).	Connect spring-cage 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 contac- tors outside of the switch cabinet.	with a round socket (part no. SWD4-SFL8- 20). The control voltage intro- duced via the ribbon	Connect the 0 V connection of the additional 24 V DC power supply to the spring-cage terminal A: 0 V and the 24 V connection to the spring-cage terminal A: 24 V.
	cable to the spring-cage terminals B is not trans- mitted any further.	SWD4-SFL8-20 SWD4-SFL8-20
An additional 24 V DC voltage supply in the switch cabinet supplies the contac- tors in the switch cabinet.	with a round plug (part no. SWD4-SML8- 20). The control voltage intro- duced via the ribbon	Connect the 0 V connection of the additional 24 V DC power supply to the spring-cage terminal B: 0 V and the 24 V connection to the spring-cage terminal B: 24 V.
	cable to the spring-cage terminals A is not trans- mitted any further.	SWD4-SML8-20

Terminal capacities of the cables for the 24 V DC external power supply

- solid: 0.2 1.5 mm² (AWG 24-16)
- flexible 0.25 1.5 mm² (AWG 24-16) with appropriate isolated ferrules with plastic collars in accordance with DIN 46228, Part 4, minimum length 8 mm.

Cable 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. For the applicable standards, see page 117.



Housing bushing socket



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 SmartWire-DT round cable.

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

Housing bushing with plug

Use the enclosure bushing with an integrated plug (part no. SWD4-SML8-20), if, coming from the gateway face, you are leading the SmartWire-DT network with the live conductors to the enclosure.

You lead the SmartWire-DT network via the SmartWire-DT round cable with a fitted round socket (part no. SWD4-SF8-67 straight or part no. SWD4-SF8-67W angled at 90°).

How to connect a round socket to the SmartWire-DT round cable is described on page 81.

Housing bushing with socket

Use the enclosure bushing with an integrated socket (part no. SWD4-SFL8-20), if you would like leave the enclosure in the direction of the SmartWire-DT network end and the round socket is therefore carrying a live voltage. You lead the SmartWire-DT network further via the SmartWire-DT round cable with a connected round plug (part no. SWD4-SM8-67 straight or part no. SWD4-SM8-67W angled at 90°).

How to connect a round plug to the SmartWire-DT round cable is described on page 82.



Link for PCB base/external device plug front

Figure 27: Link for external 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.







Caution!

External device plugs that are not fitted to a SmartWire-DT slave must be fitted with a link SWD4-SEL8-10.

This ensures a correct address assignment to subsequent SmartWire-DT slaves during the configuration process (when the Config. key is pressed).

Connecting the Smart- Wire-DT connection cable	SmartWire-DT slaves in the control panel are connected with 8 pole ribbon cable SWD4LF Outside the control panel they are connected with round cable SWD4LR8-24.
	Connecting the SmartWire-DT ribbon cable
	SmartWire-DT slaves and some other SmartWire-DT elements are connected through a SmartWire-DT ribbon cable. The ends of the ribbon cable are each fitted with a blade terminal (part no. SWD4-8MF2).
	Several ready-made SmartWire-DT ribbon cables are available, e.g. part no. SWD4-5LF8-24-2S, which are already fitted with blade terminals at both ends. Alternatively you can assemble SmartWire-DT ribbon cables of any length with blade terminals yourself (\rightarrow "Fitting the blade terminal SWD4-8MF2", page 83). Use ribbon cable SWD4-100LF8-24 (100 m) for this purpose.
	You make the connection to the SmartWire-DT slaves via external device plugs (part no. SWD4-8SF2-5). You fit the external device plug to the ribbon cable according to the position of the SmartWire-DT slave (\rightarrow "Fitting external device plugs SWD4-8SF2-5", page 88).
	Connecting SmartWire-DT round cables
	Some SmartWire-DT elements, e.g. surface mounting enclo- sures with an inlaid PCB for RMQ Titan function elements or switch cabinet bushings are connected via an SmartWire-DT

round cable. You can introduce SmartWire-DT 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 SmartWire-DT round cable



Figure 29:

Straight round socket with screw locking for the SmartWire-DT round cable

► Fit (solder) the round socket to the SmartWire-DT 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 30: Configuration of the round socket, view onto the solder face

- 1 brown, +15 V DC: device supply voltage
- ② gray, SEL: Select cable for automatic address assignment to the SmartWire-DT slaves
- (3) pink, GND: device supply voltage
- ④ red, data A
- (5) blue, data B
- (6) white, GND: device supply voltage
- yellow, earth: contactor control voltage
- (8) green, +24 V DC: contactor control voltage

Connect round plug to the SmartWire-DT round cable





► Fit (solder) the round plug to the SmartWire-DT round cable.





- 1) brown, +15 V DC: device supply voltage
- ② gray, SEL: Select cable for automatic address assignment to the SmartWire-DT slaves
- (3) pink, GND: device supply voltage
- ④ red, data A
- 5 blue, data B
- (6) white, GND: device supply voltage
- yellow, earth: contactor control voltage
- (8) green, +24 V DC: contactor control voltage



Warning!

Ensure secure seating of the cable and reliable operation by using the built-in strain relief for round sockets and plugs.

Fitting SmartWire-DT ribbon cable with plugs

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



Caution!

When fitting the plug make sure that the polarity of the ribbon cable is correct (\rightarrow "Fitting the blade terminal SWD4-8MF2").

Use only the original crimping pliers

(part no. SWD4-CRP-2) for fitting the blade terminals!

Fitting the blade terminal SWD4-8MF2



Figure 33: SmartWire-DT blade terminal

A blade terminal SWD4-8MF2 must be fitted at both ends of every SmartWire-DT ribbon cable.



Make sure that the cut edge of the 8-pole SmartWire-DT ribbon cable is flat and right-angled.

Blade terminals are fitted in three steps:

- Slide blade terminal into the crimping pliers' guide.
- Push the ribbon cable into the opened blade terminal.
- Press blade terminal with the crimping pliers.



- Figure 34: SmartWire-DT ribbon cable with blade terminal at the beginning and end
- ▶ Push the open blade terminal, with the transparent top part of the plug pointing upwards, into the crimper guide up to the stop pin (part no. SWD4-CRP-2).



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

When inserting the ribbon cable into the plug, check which cable end you are working on.

Make sure that the cut edge of the 8-pole SmartWire-DT ribbon cable is flat and right-angled.

Plug for gateway end of cable

When introducing the ribbon cable into the plug, the ribbon cable imprint is on its underside, i. e. is not visible. The arrow on the ribbon cable points away from the plug.





SmartWire-DT ribbon cable with a blade terminal at the gateway end of the cable

Plug for far end of cable

When introducing the ribbon cable into the plug, the ribbon cable imprint is on the top of the cable and therefore visible. The arrow on the ribbon cable points towards the plug.



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.





Slide the SmartWire-DT 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.

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

Using toggle presses

For using toggle presses, an insert SWD4-CRPAD-2 is available.

Fitting external device plugs SWD4-8SF2-5

The external device plugs for the SmartWire-DT ribbon cables are used to connect the SmartWire-DT slaves.



Unused external device plugs must be fitted with the link for the external device plug front (M22-SWD-SEL8-10).



Figure 37: SmartWire-DT external device plug

► On the basis of the position of the SmartWire-DT slave determine where the first external device plug has to be fastened to the ribbon cable.



Leave sufficient space between two external device plugs. The cable loop that this creates simplifies subsequent removal of a SmartWire-DT slave and ensures that no strain is applied to the cable.







Caution!

When fitting the plug make sure that the polarity of the ribbon cable is correct. Use only the original crimping pliers (part no. SWD4-CRP-1) for fitting the external device plugs!

- ► Align the ribbon cable and the external device plug so that the imprints on both parts are visible.
- Insert the ribbon cable in the external 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 39: SmartWire-DT 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 hanging 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.

Installation

When the plug position has been determined:

- Put the fixed external device plug in the crimper (part no. SWD4-CRP-1) so that the actual socket is lying in the recess in the top part of the crimper.
- ► Then crimp this external device plug by pressing the crimper once until you feel a clear stopping point.



Figure 40: Crimping the SmartWire-DT device plug with the crimping pliers



The position of the crimped external device plug cannot be altered, and an unused plug must also not be disconnected! Should the topology change and no more Smart-Wire-DT slaves are to be connected here, this plug is replaced by an SmartWire-DT link element (part no. SWD4-SEL8-10), \rightarrow section "Link for PCB base/external device plug front", page 78.

► Fit the remaining external device plugs as described above.

Using toggle presses

For using toggle presses, an insert SWD4-CRPAD-1 is available.

Coupling for an 8-pole blade terminal

To connect two ribbon cables that are fitted with blade terminals at both cable ends, use the coupling for an 8-pole blade terminal (part no. SWD4-8SFF2-5).



Figure 41:

Connect SmartWire-DT 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.



Caution!

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 (part no. SWD4-8FRF-10) is for changing from a ribbon cable to a round cable and vice versa. It is fitted to a top-hat rail or, using the optionally available fixing brackets ZB4-101-GF1, to a plate. For connecting the round cable, the adapter has an 8-pin numbered and color-coded spring-loaded terminal connection. The ribbon cable with an attached blade terminal is plugged into the socket.



- Figure 42: SmartWire-DT blade terminal/round cable adapter with configuration of the spring-cage terminal connection
- 1) brown, +15 V DC: device supply voltage
- ② gray, SEL: Select cable for automatic address assignment to the SmartWire-DT 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-cage terminals of the same colour.



Caution!

Ensure the secure seating of the round cable and safe operation by using cable binders for strain relief.

► 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.



To also supply the 24 V DC contactor control voltage when changing from ribbon cable to round cable, use the adapter for the switch cabinet bushing (\rightarrow "Switch cabinet bushing", page 70).

Using network termination

The SmartWire-DT network must be terminated at the beginning and at the end with a network termination.

Network termination for an installed ribbon cable

If the SmartWire-DT network ends with a ribbon cable, a ribbon cable plug must be connected there.

► Connect the ribbon cable to the SmartWire-DT network termination (part no. SWD4-RC8-10).





Network termination for an installed round cable

If you are using as the last SmartWire-DT element on the SmartWire-DT 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.





Electromagnetic compatibility (EMC)	The system SmartWire-DT conforms to requirements of the EMC guidelines. 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 system SmartWire-DT is ensured when the following rules are observed:
	 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 parts (control panels, panel doors, support rails, mounting plates, top-hat rails, etc.) must be connected to each other (earthing) with a large-area, low-impedance connection. This ensures a uniform reference potential for all control elements and decreases the influence of coupled interference.
	• With painted, anodized or insulated metal parts the insu- lating 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 oxidizes and is then not suitable for earthing.
Λ	Danger! Ground must never carry a dangerous touch voltage – not even in the case of a malfunction. The earth must there-

fore be connected to the protective conductor.

95

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, anodized 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 suitable special grease.

SmartWire-DT system for Safety Relevant Applica- tions	For many applications of the SmartWire-DT 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 SmartWire-DT system is not designed for transmitting safety-relevant signals.
\rightarrow	To find out how the SmartWire-DT system can be used for safety-related switching off, see manual MN05006001Z-EN. "SmartWire-DT Slaves".

4 Commissioning

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

Commissioning of the various SmartWire-DT gateways and controllers are described in separate manuals.

- MN05013002Z-EN, "SmartWire-DT Gateways" (previously AWB2723-1612en)
- MN05003001Z-EN (previously AWB2724-1491GB) Modular PLC XC-CPU201... (among other things with the connection for the CANopen field bus)
- MN050020002Z-EN (previously AWB2725-1452GB) 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 <u>http://www.moeller.net/en/support</u> by entering the document number as the search term.



Danger!

Before the commissioning the SmartWire-DT 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 SmartWire-DT gateway and on an optionally used power feeder module, the 24 V DC control voltage for contactors on the AUX terminal of the SmartWire-DT gateway and on an optionally used power feeder 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-cage terminals "A" and "B" in accordance with the Fig. 25, page 73, 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 SmartWire-DT gateway or power feeder module. Check whether: All plugs on the SmartWire-DT cable are correct, i.e. are connected in accordance with the installation instructions in the subsection "Fitting SmartWire-DT ribbon cable with plugs", page 83. • The plugs for all SmartWire-DT slaves are plugged in. • The sensor/actuator connections for the SmartWire-DT I/O modules are connected correctly. The field bus connection between the SmartWire-DT gateway and the controller is plugged in. Danger! If you have already integrated an SmartWire-DT slave into a system, secure the endangered operating ranges.

	With the aid recognize th SmartWire-I	d of the status LEDs described below you can ne respective operating statuses of the different DT slaves.
Initial switch-on of the SmartWire-DT network	After initial switch-on of the supply voltage the SmartWire- DT gateway determines which and how many SmartWire-DT slaves are connected to the SmartWire-DT network. As yet no configuration exists in the SmartWire-DT gateway. Status messages of the SmartWire-DT gateway after the initial switch-on Prerequisite: the SmartWire-DT network is connected prop- erly to the SmartWire-DT gateway.	
	Table 12:	LED display of the SmartWire-DT gateway for a new actual configuration
	LED	Status
	SWD	Red flashing
	Config.	Off (no planned configuration is available)

Status messages of the SmartWire-DT slaves after the initial switch-on

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

Creating a target configu- ration	Before the S the PLC, it n Wire-DT slav	martWire-DT gateway can exchange data with nust store the found configuration of the Smart- ves internally as a target configuration .
	 Press the seconds. 	"Config." pushbutton actuator for at least two
\rightarrow	The function of the "Config." pushbutton 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 SmartWire-DT coupling unit is determining the configuration, the SmartWire-DT LED flashes in the colour orange, frequency (1 Hz). For the connected SmartWire-DT slaves the status LED for diag- nosis of the SmartWire-DT network flashes in the colour green, frequency (1 Hz).	
	The SmartW internally as target config each time th number and SmartWire-I SmartWire-I	Vire-DT gateway stores the found configuration is a target configuration. With the aid of this guration the SmartWire-DT coupling unit checks he voltage supply is retriggered on whether the part no. of SmartWire-DT slaves present on the DT network are unchanged and whether the DT topology is functional with these.
	Status mes creating th	ssages of the SmartWire-DT gateway after ne target configuration
	Table 13: I	LED indication of the SmartWire-DT gateway after creating the target configuration
	LED	Status
	SWD	Green continuous light
	Config.	Off (no planned configuration is available)
	For the conr diagnosis of ously green.	nected SmartWire-DT slaves the status LED for f the SmartWire-DT network lights up continu-

Creating a project config- uration of the SmartWire- DT network	Create the project configuration in the PLC control configu- ration. Among other things define the number, part no. and sequence of SmartWire-DT slaves and which SmartWire-DT coupling unit is being operated (PROFIBUS-DP slave or CAN device).
	The following files are used for integration of the SmartWire- DT gateway into the control configuration:
	 For CANopen: an EDS description file (EDS = Electronic Data Sheet) that contains the standard- ized descriptions of the CANopen slaves. For PROFIBUS-DP: a device master file (GSD file) which contains a standardized description of the SmartWire-DT gateway.
\rightarrow	You can use the SWD-Assist design software to create a project-specific GSD file, which the programming system's field bus configurator can use if it has the required import function.
	When the PLC program is written to the PLC, the project configuration is also transmitted to the SmartWire-DT gateway and verified with the target configuration saved there. If the project and target configurations match, data exchange can begin.
	In the manual MN050130027-EN you can find out how to

In the manual MN05013002Z-EN you can find out how to configure a SmartWire-DT gateway with its SmartWire-DT slaves in the configuration software for the PLC.

Switching on when there are configuration changes	If the SmartWire-DT configuration that is already in opera- tion is switched on again, the SmartWire-DT coupling unit 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 SmartWire-DT gateway changes over to the corresponding error mode, shows the error by means of the SmartWire-DT and Config. LED and awaits operator actions. Table 14: LED indication of the SmartWire-DT gateway in the case of a changed actual configuration	
		case of a changed actual configuration
	LED	Status
	SWD	Red flashing

Confia.

The behavior of the SmartWire-DT network depends on the parameter settings of the SWD slaves in the PLC control configuration. If certain slaves are 'mandatory for operation, you can specify that the complete SmartWire-DT network will not go into operation, if one of these necessary slaves is missing.

Off (no planned configuration is available)

For configuration options see manual MN05013002Z-EN, "SmartWire-DT Gateways".

Switch-on in case of a changed actual configuration

If. after switching on, the SmartWire-DT coupling unit ascertains a deviation in the number or part no. of SmartWire-DT slaves between the actual and target configurations, it reacts as follows:

- Change to error mode,
- Error reporting by LED, see above Table 14.

In the case of a changed actual configuration the continued behavior of the operator is governed by whether the change has been created deliberately or by an unwanted influencing of the SmartWire-DT 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."** pushbutton actuator 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 SmartWire-DT gateway is then in the SmartWire-DT mode "Normal" and is ready for data interchange.



Caution!

First of all check whether your actual configuration has been changed unintentionally, e.g. by unclamping an external device plug.

In this case the changed actual configuration must not be saved as a new target configuration because an Smart-Wire-DT 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 Smart-Wire-DT slaves is no longer being found by the SmartWire-DT gateway. Then check where there is a possible damage to the SmartWire-DT cable or an SEL link is missing.

 \rightarrow

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

Switching on in the case of a changed project configuration

Basic requirements:

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

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

Table 15:LED indication of the SmartWire-DT gateway in the
case of a project configuration deviation

LED	Status
SWD	Green continuous light
Config.	Red continuous light

Remedy in case of a changed project configuration:

- ► Retrace the change on the SmartWire-DT network.
- Interrupt the connection to the field bus master by pulling out the field bus plug.
- ▶ Press the **"Config."** pushbutton actuator for at least 2 seconds.

The SmartWire-DT gateway stores the changed actual configuration as a new target configuration \rightarrow Table 14 on page 102.


The SmartWire-DT LEDs of the SmartWire-DT 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 Smart-Wire-DT gateway again.

Retriggering on in the case of an unchanged configuration

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

Table 16:	LED of SmartWire-DT gateway after change to
	SmartWire-DT modus "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

Commissioning

5 What Happens If ...?

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

Behavior of the	The status of the SmartWire-DT gateway is signalled opti-
SmartWire-DT gateway	cally via 4 front LEDs:
	 Status of power supply (POW) Status of field bus communication (e.g. DP, CAN) Status of configuration comparison (Config.) Status of SmartWire-DT network

POW LED (status of power supply)

Event	Explanation	I	Remedy
LED yellow continuous light	Fault-free operation, the Smart- Wire-DT gateway is operational.		
LED off	 No supply voltage POW available The SmartWire-DT gateway has a fault 	•	 Check the supply voltage POW Check the SmartWire-DT gateway
LED yellow flashing	The SmartWire-DT gateway has ascertained an irregularity in the self-test.	(i	Consult the Eaton branch office that is responsible for you or replace the device.

Table 17:	Diagnostics	with	the	POW-LED
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DP LED (status of PROFIBUS DP field bus)

Event	Explanation	Remedy
LED green continuous light	The project configuration of the controller agrees with the target configuration of the SmartWire-DT gateway. Cyclical data exchange takes place via the PROFIBUS DP.	-
LED off	No communication with PROFIBUS-DP master.	Check PROFIBUS-DP master connection.
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 SmartWire-DT gateway, but the deviation allows data exchange with the relevant SmartWire-DT slaves.	Check your target configura- tion and, if necessary, update the project configu- ration.
LED orange continuous light	At least one SmartWire-DT slave requests a diag- nosis test, because, e.g. SmartWire-DT slaves are invalid or essential slaves are missing or an Smart- Wire-DT slave is missing that has been configured in the control configuration as mandatory.	Check your target configura- tion and, if necessary, update the project configu- ration.

CAN LED (status of CANopen field bus)

Table 19:	Diagnosis with the aid of the CAN LED
-----------	---------------------------------------

Event	Explanation	Remedy
LED green contin- uous light	Operational status: Data exchange takes place through the CAN bus.	-
LED off	No communication takes place on the CAN-Bus.	Check the connec- tion to the CANopen master.
LED red strobe light	Baud rate detection on the CAN bus is active. No data exchange takes place on the CAN bus.	-
LED orange contin- uous light	CAN baud rate detected. Waiting for target configura- tion. No data exchange taking 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)	-
LED red continuous light	Communication error on the CAN bus. (Bus off) No data exchange takes place on the CAN bus.	-
LED green flashing	Status Pre-operational initialisation mode, communi- cation is only possible via SDOs.	Check field bus addresses Configuration error
LED flashing green (single flash)	Status Stopped: no data exchange	-

Config.-LED (status project vs. target configuration)

The Config. LED shows the result of the comparison of the gateway and saved target configurations, and the project configuration specified by the programming system.

If the configuration comparison function is disabled, the LED is off.

Event	Explanation	Remedy
LED green contin- uous light	The project configuration of the controller agrees with the target config- uration of the SmartWire-DT gateway.	-
LED off	No communication with the field bus master or the SmartWire-DT coupling unit does not contain a project configu- ration, e.g. after retriggering.	Check the connection to the field bus master or transfer the project configuration into the SmartWire- DT gateway.
LED red contin- uous light	The project configuration of the controller does not agree with the target configuration of the SmartWire-DT gateway.	The SmartWire-DT gateway is not ready for data exchange with the SmartWire-DT slaves. Correct your target or project configuration.

Table 20: Diagnostics with the Config-LED

SWD LED (status of SmartWire-DT network)

Event	Explanation	Remedy
LED green contin- uous light	All SmartWire-DT slaves stored in the target configuration are available.	-
LED green flashing (1 Hz)	When the power supply is switched on or after the target configuration is updated, the gateway checks whether all SmartWire-DT stations are present in the SmartWire-DT network.	-
LED red contin- uous light	No connection of SmartWire-DT gateway with the SmartWire-DT network or there is a short circuiting of the 15 V DC device voltage	Check the spade connection on the SmartWire-DT gateway or the crimp connections of the plugs on the SmartWire-DT ribbon cable.
LED red flashing (1 Hz)	After initial switch-on: the SmartWire-DT gateway has detected SmartWire-DT slaves on the SmartWire-DT network, no actual or target configuration exists yet.	Make sure that all required Smart- Wire-DT stations are present and correctly connected to the SmartWire- DT network. Then press the Config. key to reassign addresses.
	After retriggering with the existence of a target configuration: at least one SmartWire-DT slave too many or too few has been found in comparison with the target configuration.	Make sure that all required Smart- Wire-DT stations are present and correctly connected to the SmartWire- DT network. Then press the Config. key to reassign addresses.
LED orange flashing (1 Hz)	Transient state while the SmartWire- DT gateway is determining the target configuration.	-
LED off	No power supply	Check the power supply.

Table 21: Diagnostics with the SWD-LED

Table 22:	Combined indication of DP or CAN LED, Config. LED
	and SWD LED in firmware update mode

Event	Explanation	Remedy
All three LEDs are a continuous orange	The gateway is in firmware update mode.	-
All three LEDs are a continuous red	The gateway is in firmware update mode. An error has occurred.	-
All three LEDs are a continuous green	The gateway has successfully completed the firmware update.	-

Behavior of the	The status of an SmartWire-DT power feeder module EU5C-
SmartWire-DT powerfeed	SWD-PF1-1 or EU5C-SWD-PF2-1 is signalled optically via the
modules	front panel LED POW .

Event	Explanation	Remedy
LED yellow continuous light	15 V DC device voltage OK.	-
LED off	No 15 V DC device voltage available or the LED is defective.	Check the POW power supply or the SmartWire-DT power feeder module

Behavior of the SmartWire-DT input/output modules

The status of an SmartWire-DT input/output module is signalled optically via the green front panel LED **SWD**.

 Table 23:
 Diagnosis of an SmartWire-DT I/O module with the aid of the green SWD-LED

Event	Explanation	Remedy
LED green continuous light	Fault-free operation, data exchange OK.	-
LED off	No 15 V DC device voltage via the SmartWire-DT network or the I/O module or the LED is defective.	Check the power supply or I/O module.
LED green flashing (1 Hz)	No data exchange with the Smart- Wire-DT gateway	The I/O module may not be in the target configuration or the SmartWire-DT gateway is just creating a target configu- ration.
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 diagnostics in the control program.

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

Behaviour of SmartWire-DT modules DIL-SWD-32-...

The status of a SmartWire-DT 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 SmartWire-DT 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.

Event	Explanation	Remedy
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 off	No 15 V DC device voltage via the SmartWire-DT network or the DIL- SWD-32 or LED is defective.	Check the power supply or DIL-SWD-32
LED green flashing (1 Hz)	No data exchange with the Smart- Wire-DT gateway	The DIL-SWD-32 may not be in the target configuration or the SmartWire-DT gateway is just creating a target configuration.

Table 24:	Diagnostics	with the	Read	y-LED
-----------	-------------	----------	------	-------

 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 SmartWire-DT 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 SmartWire-DT 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-... module shows unambiguously the actual switch position.

-
vith a

Table 25:	Diagnostics with the aid of the green SWD LED on the
	rear panel

Event	Explanation	Remedy
LED green continuous light	Fault-free operation, data exchange OK.	-
LED off	No 15 V DC device voltage via the SmartWire-DT network or the M22-SWD or LED is defective.	Check the power supply or M22-SWD function element
LED green flashing (1 Hz)	No data exchange with the Smart- Wire-DT gateway	The M22-SWD may not be in the target configuration or the SmartWire-DT 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 diagnostics in the control program.

Appendix

Approval and Certification	SmartWire-DT components are approved for several coun- tries and regions. Approvals and national approvals for the SmartWire-DT system		
	Product standards	 CE Conformity; UL 508 (INDUSTRIAL CONTROL EQUIPMENT); CSA C22.2 No. 142-M1987 (Process Control Equipment); 	
	NA Certifi- cation	UL Listed, CSA certified	
Standards for cable protection	 The following standards for cable protection apply: When using miniature circuit-breakers DIN VDE 0641 Part 11, IEC/EN 60898 or UL 489 (and UL 1077) / CSA-22.2 No. 5-09 (and No. 235) 		
	 When using DIN VDE UL 248 (CSA-22.2 Fuses) 	g fuses 0641 Part 21, IEC 60269-1 to IEC 60269-4 and UL 248-14, Supplemental Fuses)/ 2 No. 248 (and No. 106, HRC-Miscellaneous	
Technical data	For technical current consu netic compati "SmartWire-I "SmartWire-I	data for SmartWire-DT components, such as mption, dimensions, weights and electromag- bility (EMC) see manuals MN05013002Z-EN, DT Gateways", and MN05006001Z-EN, DT Slaves".	

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