

SmartWire-DT® Gateway EU5C-SWD-EIP-MODTCP



EATON

Powering Business Worldwide

All proprietary names and product designations are brand names or trademarks registered to the relevant title holders.

Original operating manual

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 operating manual.

1. Edition 2009, publication date 02/09
2. Edition 2009, publication date 06/09
3. Edition 2010, publication date 03/10
4. Edition 2010, publication date 06/10
5. Edition 2011, publication date 03/11
6. Edition 2011, publication date 09/11
7. Edition 2013, publication date 01/13

See list of revisions in chapter "About this manual"

© 2009 by Eaton Industries GmbH, 53105 Bonn

Author: Heribert Einwag

Editor: Bettina Ewoti

All rights reserved, also for the translation.

No part of this manual may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, micro-filming, recording or otherwise, without the prior written permission of Eaton Industries GmbH, Bonn.

Subject to alteration.



Danger! **Dangerous electrical voltage!**

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally retriggered
- Verify isolation from the supply
- Earth and short-circuit
- Cover or enclose neighbouring units that are live.
- Follow the engineering instructions (AWA/IL) of the device concerned.
- Only suitably qualified personnel in accordance with EN 50 110-1/-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 equalizing. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional actuation.
- 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 device.
- Ensure a reliable electrical isolation of the low voltage for the 24 V supply. Only use power supply units complying with IEC 60 364-4-41 (VDE 0100 Part 410) or HD 384.4.41 S2.
- Deviations of the mains voltage from the nominal value must not exceed the tolerance limits given in the technical data, otherwise this may cause malfunction and dangerous operation.
- Emergency switching off devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency switching off devices must not cause restart.
- Built-in devices for enclosures or cabinets must only be run and operated in an installed state, desk-top devices or portable devices only when the housing is closed.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency switching off devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks, etc.).

Contents

0	About this Manual	5
0.1	List of revisions	5
0.2	Target group	5
0.3	Exclusion of liability	6
0.4	Reading conventions	7
1	SmartWire-DT Gateway® EU5C-SWD-EIP-MODTCP	9
1.1	Proper use	9
1.2	Overview of functions	9
1.3	Versions	10
1.4	Important data for engineering	11
1.4.1	Field bus connection	11
1.4.2	Baud rate	12
2	Installation	13
2.1	Setting the gateway's field bus address	13
2.1.1	Default settings Ethernet address	13
2.1.2	Obtaining an Ethernet address	13
2.1.3	Resetting the Ethernet address	17
2.2	Mounting Considerations	18
2.2.1	Mounting the EU5C-SWD-EIP-MODTCP gateway on a top-hat rail	18
2.2.2	Screwing the EU5C-SWD-EIP-MODTCP gateway into place	19
2.3	Potential Relationship between the Components	19
2.4	Connecting the power supply	20
2.5	Connect SmartWire-DT®	22
2.6	Connect field bus	23
2.7	Connecting the diagnostics interface	24
2.8	Wiring in accordance with EMC requirements	25
3	Commissioning	27
3.1	Putting the SmartWire-DT® into operation	27
3.1.1	Reading of target configuration	28
3.1.2	Switching on when the target configuration is stored	29
3.1.3	Switching the gateway on when a planned SWD configuration is already stored	29
3.2	Take the field bus into operation	29
3.2.1	Creating EthernetIP/Modbus-TCP field bus communication	30
3.2.2	MS-LED status display	31
3.2.3	POW status display	31
4	Creating a planned SmartWire-DT® configuration in SWD-Assist	33
4.1	Select gateway as field bus module	33
4.2	Select SWD module	35
4.3	Selecting a communications protocol	36
4.4	Ethernet parameters tab	37
4.5	Set device parameter of the gateway	38

4.6	Set the device parameters of the SWD modules	39
4.7	Setting specific device parameters for SmartWire-DT® modules	39
4.8	Storing the planned SmartWire-DT® configuration	40
4.9	Exporting the SmartWire-DT® modules' I/O data	41
5	Commissioning the PLC programming environment	43
5.1	For Ethernet/IP, using RSLogix 5000 as an example	43
5.1.1	Selecting the EU5C-SWD-EIP-MODTCP gateway	43
5.1.2	Configuring the gateway's communication parameters	45
5.1.3	What the SWD-Assist CSV file looks like	46
5.1.4	Importing the SmartWire-DT® modules' I/O data	47
5.2	For Modbus/TCP	49
5.2.1	What the SWD-Assist text file looks like	49
5.2.2	Using gateways with ELC/Modicon controllers	50
5.2.3	Using gateways with Eaton controllers	50
5.3	Web-Interface	51
5.4	Updating the operating system	52
6	Implemented EtherNet/IP objects	53
6.1	Standard CIP object classes	54
6.1.1	Identity object 0x01	55
6.1.2	Message Router Object 0x02	57
6.1.3	Assembly object 0x4	59
6.1.4	Example: I/O data mapping	61
6.2	Manufacturer-specific object classes	63
6.2.1	Gateway object 0x64	63
6.2.2	SWD modules object 0x65	69
7	Modbus/TCP – SmartWire-DT® implementation	72
7.1	Overview of Modbus registers	74
7.2	SmartWire-DT® input/output data	75
7.3	Device informations Gateway	76
7.4	Time monitoring and Modbus-TCP operating mode	76
7.5	Acyclic data communications	78
8	What you need to know about SmartWire-DT®	81
8.1	Configurations	84
8.2	Changing the planned SWD configuration in SWD assist	84
8.3	SWD cycle time	86
8.4	Cyclical input and output data of the SWD modules	88
8.5	SWD device parameters	91
8.5.1	Device parameters of the SWD gateway	92
8.5.2	Device parameters of SWD modules	93
8.5.3	Application cases for the effective use of the device parameters	94
8.6	Faults on the SWD line	95
8.7	LEDs on the device	97
8.8	SWD assist	98

9	Appendix.....	99
9.1	Dimensions	99
9.2	Technical data	100
9.2.1	Standards	100
9.2.2	General ambient conditions	100
9.2.3	Power supply	101
9.2.4	SmartWire-DT®	102
9.2.5	Field bus interface Ethernet/IP and Modbus-TCP	103
9.2.6	Diagnostics interface.....	103
9.3	Compatible SWD module types.....	104
	Index.....	107

0 About this Manual

This manual describes the installation, commissioning and programming of the following SmartWire-DT gateway

- EU5C-SWD-EIP-MODTCP

The SmartWire-DT (SWD) communication system provides electromechanical switchgear and pilot devices with communication capabilities.

Support Center

The latest version of this manual can be found in other languages on the Internet by visiting our Support Center at:

<http://www.moeller.net/en/support>

By entering the search keyword "Gateway" or "SWD" into the quick search or by entering the document designation, e.g. MN05002002Z-DE.

Basic information concerning the SmartWire-DT topic can be found in:

- "SmartWire-DT The System", MN05006002Z-EN
- "SmartWire-DT Modules", MN05006001Z-EN

You can find further information on the topics SmartWire-DT and the SmartWire-DT modules in the following documents:

- Instructional leaflet „EU5C-SWD...“, IL05006001Z-DE

Download Center

The XSoft-CoDeSys-2 software described in this manual, as well as the SWD-Assist engineering tool, can be downloaded by visiting the Eaton Download Center at:

<http://www.eaton-automation.com>

0.1 List of revisions

This is a fully revised version. and replaces version 09/11 of MN05013002Z. In contrast to previous versions, which described SmartWire-DT gateways for various field buses, this version only covers one single SmartWire-DT gateway. The following table show the most important changes that have been made in terms of content:

Publication date	Page(s)	Subject	New	Modified	Omitted
01/13	91	„Replacement during operation permissible" device parameter"	✓		

0.2 Target group

This manual is intended for automation technicians and engineers.

0 About this Manual

0.3 Exclusion of liability

Extensive knowledge of how to work with the field bus being used, as well as familiarity with the SmartWire-DT system, will make it easier to understand the contents of this manual.

A specialist knowledge of electrical engineering is needed for commissioning and programming.

0.3 Exclusion of liability

All information in this operator manual was provided by us to the best of our knowledge and belief and in accordance with the current state-of-the-art. However, this does not exclude the possibility of inaccuracies so that we cannot accept any liability for the accuracy and completeness of the information. In particular, this information does not guarantee any particular properties.

The devices described here must only be set up and operated as specified in this manual and in the installation instructions provided with the device. The devices must be installed, commissioned, operated, maintained, and retrofitted by qualified people only. The devices must only be used in the recommended areas and only in conjunction with third-party devices and components that have been approved by us. Only use is technically faultless condition is permitted. Fault-free and safe operation of the system requires proper transport, storage, installation and commissioning as well as careful operation and maintenance. If the following safety instructions are not observed, particularly with regard to commissioning and maintenance of the devices by insufficiently qualified personnel and/or in the event of improper use of the devices, any hazards caused by the devices cannot be excluded. We assume no liability for any injury or damages incurred.

0.4 Reading conventions

Symbols used in this manual have the following meanings:



DANGER

Warns of hazardous situations that result in serious injury or death.



CAUTION

Warns of the possibility of hazardous situations that could result in slight injury or even death.

NOTICE

Warns about the possibility of material damage.



Indicates useful tips.

- Indicates instructions to be followed.

For greater clarity, the name of the current chapter and the name of the current section are shown at the top of each page.

0 About this Manual

0.4 Reading conventions

1 SmartWire-DT Gateway® EU5C-SWD-EIP-MODTCP

1.1 Proper use

EU5C-SWD-EIP-MODTCP SmartWire-DT gateways are used to establish a connection between a SmartWire-DT line, together with its SmartWire-DT modules, and a higher-level controller.

SmartWire-DT is not designed for transmitting safety-relevant signals and must not be used as a replacement for controllers such as burner, crane, and two-hand safety controllers.

Despite the above, SmartWire-DT can be used in applications with safety categories of up to 3, PL d as per EN ISO 13849-1 and SIL Cl2 as per EN 62061 if specific add-ons are incorporated. For more information, please consult manual "SmartWire-DT Modules", MN05006001Z-EN.

1.2 Overview of functions

EU5C-SWD-EIP-MODTCP gateways are used to connect a SmartWire-DT line with line to Ethernet and make it possible to access the data of up to 99 SmartWire-DT modules via EtherNet/IP or Modbus/TCP. These gateways can be integrated as modular field bus modules into control systems that use this type of communications. This makes it possible to access the data of every individual module from the controller.

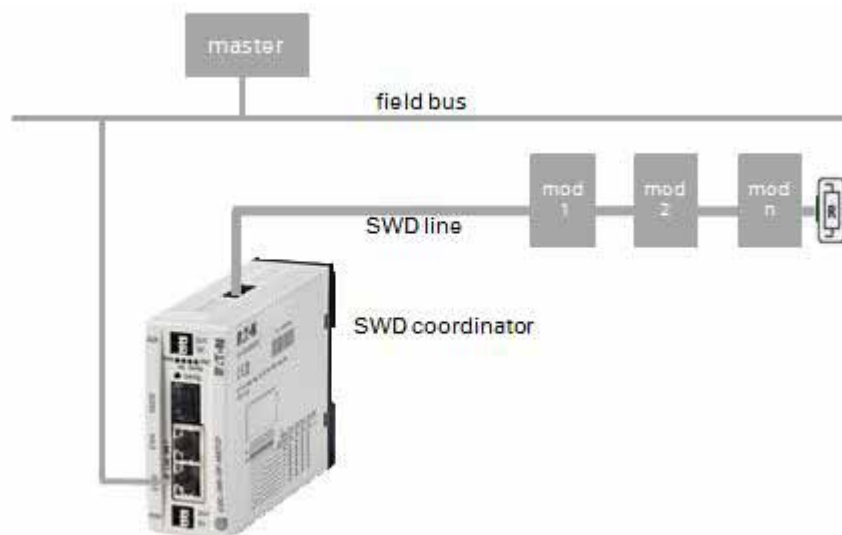


Figure 1: Connecting the field bus and SmartWire-DT with a gateway

The integrated Ethernet switch on the device is used to connect to the field bus. In addition, the internal Ethernet switch makes it possible to directly connect an additional module to the field bus.

1 SmartWire-DT Gateway® EU5C-SWD-EIP-MODTCP

1.3 Versions

The SmartWire-DT line, along with its modules, is connected to the gateway. The ribbon cable, with the SWD modules and all connection components - such as blade terminals and external device plugs - is referred to as the "SWD line."

Terminals for two 24-V power supplies are available: POW for the gateway and the SmartWire-DT modules and AUX for powering the contactor coils if these are also operated via SmartWire-DT modules.

The 8-pin ribbon cable is used to run data communications, as well as the power for the SmartWire-DT modules and the contactor coils, from the gateway to the modules.

The diagnostic port is used to connect to a computer in order to run the SWD assist planning and commissioning program.

1.3 Versions

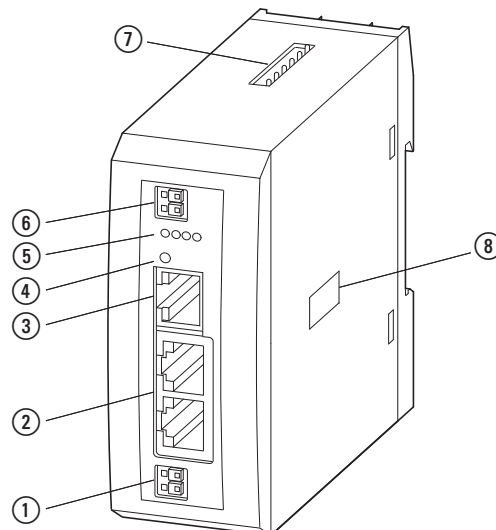


Figure 2: Front view
EU5C-SWD-EIP-MODTCP

- ① Power supply, 24 V DC POW
- ② Fieldbus interface
- ③ Diagnostics interface
- ④ Configuration buttons
- ⑤ LED indicators: POW, MS, Config, SWD
- ⑥ Power supply, 24 V DC AUX
- ⑦ SmartWire-DT connection
- ⑧ Dip switch for address setting

1.4 Important data for engineering

In connection with the SmartWire-DT modules, the gateway appears as a modular module on the relevant field bus. The following gateway can be run on the field buses specified below:

Gateway	Fieldbus
EU5C-SWD-EIP-MODTCP	EtherNet/IP (default setting) or Modbus TCP (selected via the web interface or with SWD-Assist)

Each SmartWire-DT module is presented as a separate module, with its data, to the field bus master.

The following number of SmartWire-DT modules is the maximum number that can be run on the gateway:

Gateway	Maximum number of modules at the SWD line
EU5C-SWD-EIP-MODTCP	99

Make sure to take the maximum volume of data that can be transmitted on the field bus into account. The corresponding limit will be defined by the field bus.

Field bus-slave	Max. input data [Byte]	Max. output data [Byte]
EtherNet/IP	500	496
Modbus-TCP	800	642



The sum of all input and output data must not exceed 1000 bytes.



Information about the volume of input and output data of an SWD module is provided in the Appendix of the manual "SmartWire-DT Modules", MN05006001Z-EN.

The SmartWire-DT line may be extended up to 600 m.

1.4.1 Field bus connection

The field bus connection on the gateway uses RJ45 sockets. These sockets are connected to each other by means of an integrated Ethernet switch. The ETH2 and ETH2 ports feature diagnostic LEDs used to indicate the corresponding link and data communications statuses. Finally, the unit will switch from 10 to 100 Mbit/s and vice versa automatically.

1 SmartWire-DT Gateway® EU5C-SWD-EIP-MODTCP

1.4 Important data for engineering

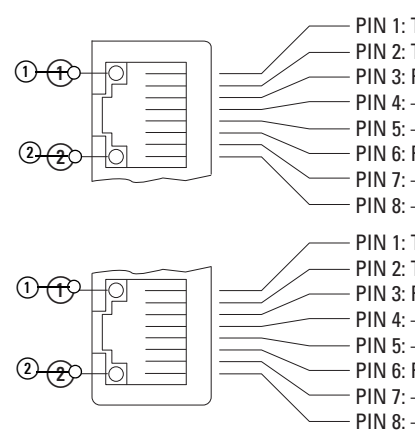


Figure 3: The configuration of the terminal sockets at the gateway

- ① LED yellow
- ② LED green

Table 1: What the various diagnostic LED combinations on Ethernet ports ETH1 and ETH2 mean

LED	Category	Status	Meaning
Yellow	Link/Activity	To	Link active
		Flashing	Ethernet data exchange
		off	Link not active
Green	Baud rate	To	100 MBit/s
		off	10 MBit/s



Even though the DLR protocol (DLR = Device-Level Ring) is not supported, the device can be used as a non-DLR device in Ethernet DLR topologies.. When used this way, the device will continuously check whether communication requests are being handled via both Ethernet connections. These checks may result in increased communications.

1.4.2 Baud rate

The gateway supports operation with the relevant field bus masters up to the following Baud rate:

Fieldbus	Maximum data baud rate in MBit/s
EtherNet/IP	10/100
Modbus-TCP	10/100

The unit will adapt to the field bus master's Baud rate automatically.

2 Installation

SWD gateways must only be installed and wired up by qualified electricians or other persons familiar with electrical engineering.

The SWD gateway is installed in the following order:

- Adjust the field bus adresse at the device.
- Mount the device.
- Connect the power supply.
- Connect the SmartWire-DT line.
- Connect the field bus.

2.1 Setting the gateway's field bus address

Before mounting the device, set the field bus address by using the DIP switches (DIP = Dual Inline Package) The DIP switches are located under a cover on the right side of the gateway.

NOTICE

Changes made to the dip switches' settings will take effect only after the power supply is turned off and back on again.

2.1.1 Default settings Ethernet address

The EU5C-SWD-EIP-MODTCP gateway comes with the following default settings:

IP address: 192.168.001.254

Subnet mask: 255.255.255.000

Standard Gateway:192.168.001.001

2.1.2 Obtaining an Ethernet address

There are various ways to adjust the Ethernet address:

- The address is set directly on the device
- From DHCP server on run-up
- From BOOTP server on run-up
- By setting the address with the SWD-Assist planning program
- By acquiring it once via the DHCP server, at which point it will be stored automatically

The method used is selected by means of integrated DIP switches.

The dip switches are located under the cover on the right-hand side of the gateway.

The following figure shows the various possible configurations.

2 Installation

2.1 Setting the gateway's field bus address

Table 2: Selecting the method that will be used to obtain an Ethernet address

DIP Switch										Description
1	2	3	4	5	6	7	8	9	0	
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	X	Reset to default settings
2 ⁰	2 ¹	2 ²	2 ³	2 ⁴	2 ⁵	2 ⁶	2 ⁷	OFF	X	The address is set directly on the device Setting of the last byte of the IP address (1 - 254)
ON	OFF	OFF	OFF	X	X	X	X	ON	X	DHCP: IP address set via DHCP server at run-up
OFF	ON	OFF	OFF	X	X	X	X	ON	X	BOOTP: IP address set via BOOTP server at run-up
OFF	OFF	ON	OFF	X	X	X	X	ON	X	PGM: IP address set via the serial interface with the use of the SWD assist planning program
OFF	OFF	OFF	ON	X	X	X	X	ON	X	PGM-DHCP: Address acquired once via DHCP server

1) X means that the position of the corresponding dip switch will be ignored.

Setting the address directly on the device

You can use dip switches 1 to 8 in order to set the last byte of the IP address. In order to do so, the dip switch 9 must be set to "OFF". The valid range of addresses that can be set is 1 to 254. Addresses 0 and 255 are used for broadcast messages in the subnetwork.

The first three bytes of the IP address will be passed when the planned SmartWire-DT configuration is transferred from the SWD-Assist planning program (see also: the notes concerning the → Section "Address setting PGM", page 15 operating mode). The subnet mask and the default gateway address will also be taken from the SWD-Assist project.

DHCP server address setting

An address is acquired from a DHCP server on the field bus when the gateway is put into operation. To activate the "DHCP" operating mode, the dip switches 1 and 9 are set to "ON". The dip switches 2, 3, 4 are set to OFF.

DIP Switch										Description
1	2	3	4	5	6	7	8	9	0	
2 ⁰	2 ¹	2 ²	2 ³	2 ⁴	2 ⁵	2 ⁶	2 ⁷	MODE		
ON	OFF	OFF	OFF	X	X	X	X	ON	X	Used to adjust the IP address via a DHCP server

1) X means that the position of the corresponding dip switch will be ignored.

The DHCP server will deliver the IP address, the subnet mask, and the default gateway address.

DHCP supports three IP address allocation mechanisms:

- Automatic address allocation: The DHCP server assigns a permanent IP address to the client.

2.1 Setting the gateway's field bus address

- Dynamic address allocation: The address assigned by the DHCP server is reserved only for a specific period of time. Once this time elapses, or if a client "explicitly" releases the address during this period, the address is re-assigned.
- Manual address allocation: A field bus administrator assigns the IP address. In this case, DHCP is only used to transmit the assigned address to the client.

Address setting BOOTP server

An address is acquired from a BOOTP server on the field bus when the gateway is put into operation. To activate the "BOOTP-Server" operating mode, set dip switches 2 and 9 to "ON".

The dip switches 1, 3 and 4 are set to OFF .

DIP Switch										Description
1	2	3	4	5	6	7	8	9	0	
2 ⁰	2 ¹	2 ²	2 ³	2 ⁴	2 ⁵	2 ⁶	2 ⁷	MODE		
OFF	ON	OFF	OFF	X	X	X	X	ON	X	Used to adjust the IP address via a BOOTP server

1) X means that the position of the corresponding dip switch will be ignored.

The BOOTP server will deliver the IP address, the subnet mask, and the default gateway address.

Address setting PGM

"PGM" refers to a method used to obtain addresses from the gateway's non-volatile memory.

The IP address, the subnet mask, and the default gateway address are entered under the "Ethernet parameters" tab when creating a project in the SWD-Assist planning program. After the project is downloaded using the SWD-Assist program, the values entered are transferred to the gateway, where they are stored in non-volatile memory. Once the project is downloaded, the corresponding addresses will take effect immediately.

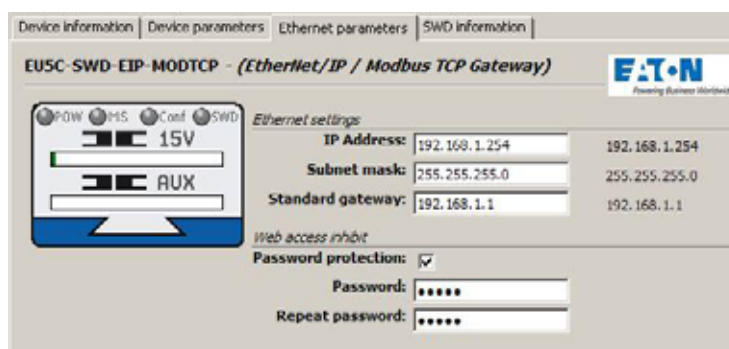


Figure 4: Adjusting Ethernet parameters with the SWD assist planning program

2 Installation

2.1 Setting the gateway's field bus address

To activate the PGM operating mode, set DIP switches 3 and 9 to "ON". Set DIP switches 1, 2, and 4 to OFF.

DIP Switch										Description
1	2	3	4	5	6	7	8	9	0	
2 ⁰	2 ¹	2 ²	2 ³	2 ⁴	2 ⁵	2 ⁶	2 ⁷	MODE		PGM: Setting of the IP address with SWD assist
OFF	OFF	ON	OFF	X	X	X	X	ON	X	

1) X means that the position of the corresponding dip switch will be ignored.

Address setting PGM-DHCP

In this case, an address is assigned once, via a DHCP server on the field bus, when the gateway is put into operation for the first time.

The addresses assigned by the DHCP server for the gateway's IP address, the subnet mask, and the default gateway address will be stored in the gateway's non-volatile memory. In addition, the gateway will use a flag bit to "remember" the fact that these addresses have already been assigned. Every time the gateway is turned on after this, it will first check the flag bit. If the flag bit is set, the gateway will obtain its addresses from its non-volatile memory. In other words, it will behave the same way as with the PGM operating mode.

SWD-Assist can be used to read and edit address information, as well as to store it in the gateway's non-volatile memory.

If you want to reset the gateway in the PGM-DHCP operating mode, you will have to reset the flag bit. To do this, select a different operating mode while the gateway is off and then start the gateway. If the gateway detects an operating mode other than DHCP-PGM when it is turned on, it will reset its flag bit. If you then select the DHCP-PGM operating mode, the gateway will request new addresses from the DHCP server just like when it is first put into operation.

To activate the DHCP-PGM operating mode, set dip switches 4 and 9 to "ON".

The dip switches 1, 2, 3 are set to „OFF“.

DIP Switch										Description
1	2	3	4	5	6	7	8	9	0	
2 ⁰	2 ¹	2 ²	2 ³	2 ⁴	2 ⁵	2 ⁶	2 ⁷	MODE		PGM-DHCP: IP address received once via DHCP
OFF	OFF	OFF	ON	X	X	X	X	ON	X	

1) X means that the position of the corresponding dip switch will be ignored.

2.1 Setting the gateway's field bus address

Example:

Follow the example below in order to configure an address directly on the gateway - 18 (decimal) is used as an example in this case:

$$18_{\text{dec}} = 16 + 2 = 1 \cdot 2^4 + 1 \cdot 2^1$$

The address is to be set at the dip switches.

for EU5C-SWD-EIP-MODTCP the following applies:

- First, use the DIP switches to select the source from which you want to acquire the Ethernet address. For the address setting example in which the address is set directly on the device, DIP switch 9 would be switched to OFF, for instance. The upper three bytes of the IP address are passed when the project is transferred from the SWD-Assist program.
- This way, the last byte of the field bus address can be set to an address of 18_{dec} directly on the gateway.

DIP Switch										Description
1	2	3	4	5	6	7	8	9	0	
2 ⁰	2 ¹	2 ²	2 ³	2 ⁴	2 ⁵	2 ⁶	2 ⁷	MODE		
OFF	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	X	Setting the last byte of the gateway's field bus address to a value of 18_{dec}

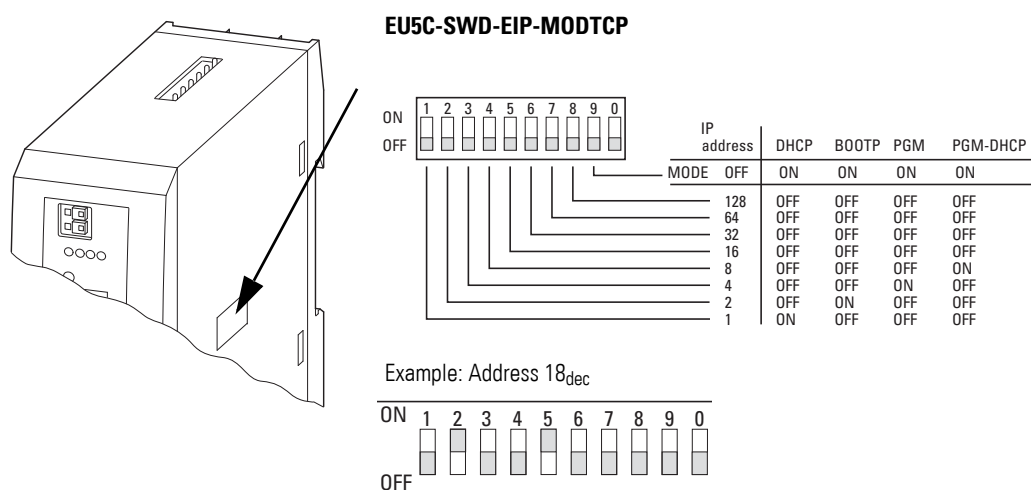


Figure 5: Setting the field bus address on an EU5C-SWD-EIP-MODTCP gateway

2.1.3 Resetting the Ethernet address

The gateway can be restored to its default settings at any time. To do this, set DIP switches 1 to 8, as well as the operating mode selector switch (DIP switch 9), to "OFF" and then power cycle the gateway (turn it off and then back on).

2 Installation

2.2 Mounting Considerations

2.2 Mounting Considerations

Install the EU5C-SWD-EIP-MODTCP gateway in a control cabinet, a panel-board, or an enclosure in such a way that the power supply and terminal connections cannot be touched accidentally during operation. Snap the device onto an IEC/EN 60715 top-hat rail or fix it in place using fixing brackets. EU5C-SWD-EIP-MODTCP gateways can be mounted either vertically or horizontally.

For ease of wiring, leave a clearance of at least 3 cm between the device terminals and the wall or adjacent devices.

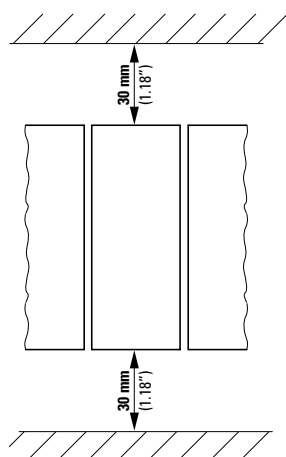


Figure 6: Vertical mounting

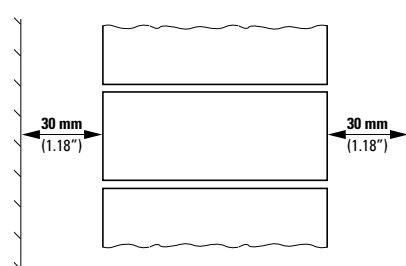


Figure 7: Horizontal mounting

2.2.1 Mounting the EU5C-SWD-EIP-MODTCP gateway on a top-hat rail

Before mounting the device, make sure that you have set the device's field bus address.

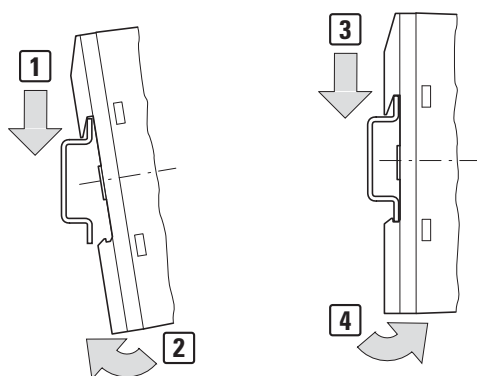


Figure 8: Mounting on top-hat rail

- Place the EU5C-SWD-EIP-MODTCP gateway on the top-hat rail's upper edge in an inclined position. Lightly push the device down and against the top-hat rail until it snaps into place over the top-hat rail's lower edge.

2.3 Potential Relationship between the Components

The spring mechanism will make the EU5C-SWD-EIP-MOD-TCP gateway automatically lock into place.

- Check that the gateway is seated firmly.

The device is mounted vertically on a top-hat rail in the same way.

2.2.2 Screwing the EU5C-SWD-EIP-MODTCP gateway into place

For screw fixing, you will need two fixing brackets that can be used on the back of the EU5C-SWD-EIP-MODTCP gateway. Fixing brackets ZB4-101-GF1 are available as accessories.

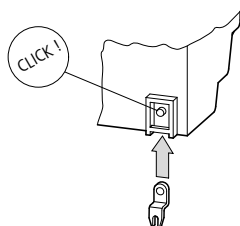


Figure 9: Inserting a fastening bracket



Figure 10: EU5C-SWD-EIP-MODTCP screw fixing

2.3 Potential Relationship between the Components

The entire SmartWire-DT system operates on a common supply voltage. Provide a common star point for the earth wiring. In this way the various modules in the SmartWire-DT system will not be electrically isolated from one another. The field bus and the SmartWire-DT system are electrically isolated from one another.

2 Installation

2.4 Connecting the power supply

2.4 Connecting the power supply



DANGER

In safety-relevant applications the power supply providing power to the SmartWire-DT system must feature a PELV power supply unit (protective extra low voltage).



DANGER

The gateway has protection against polarity reversal for the 24-V-DC-POW supply. If, however, the gateway is connected to a grounded device, e.g., a computer, via the diagnostic interface, the gateway may be destroyed if the polarity of the power supply is reversed!

The gateway and the SmartWire-DT modules are powered via the POW terminals. The Gateway uses the voltage at POW to generate the 15-V supply voltage for the SmartWire-DT modules with a maximum output current of 0.7 A.

If loads or contactor modules are also connected via the SWD line, the 24-VDC control voltage for the loads must be supplied in addition to the device supply voltage. The AUX terminals are used for this purpose.

Take into account the total power consumption and the voltage drop in your SWD line and, if necessary, include additional supply units, such as power feeder modules, in your design. The SWD assist software program will provide support when you are carrying out the corresponding calculations. In addition, it will automatically let you know if additional power supply modules are required for your design.

The manual "SmartWire-DT The System", MN05006002Z-EN, contains detailed calculation examples.

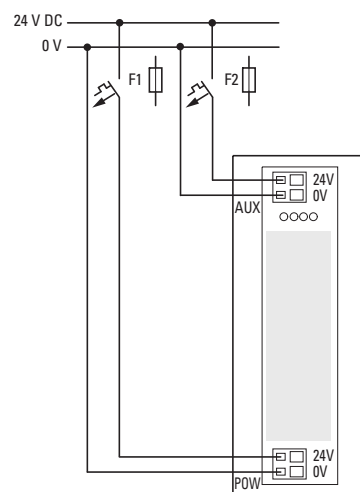


Figure 11: Connection of power supply

- ▶ Connect the 24 V DC voltage to the connection terminals POW on the front side of the gateway.
- ▶ If necessary, connect the 24 VDC voltage for the contactor coils to the AUX terminals.
- ▶ Connect the POW and AUX supply voltages via separate miniature circuit-breakers or fuses.

Miniature circuit-breaker F1 for POW

- Cable protection in accordance with DIN VDE 0641 Part 11, IEC/EN 60898:
 - Miniature circuit-breaker 24 V DC rated operational current 3 A; trip type C or
 - Fuse 3 A, utilization class gL/gG
- Cable protection for cable AWG 24 in accordance with UL 508 and CSA-22.2 no. 14:
 - Miniature circuit-breaker 24 V DC rated operational current 3 A; trip type C or
 - Fuse 3 A

Miniature circuit-breaker F2 for AUX

- Cable protection in accordance with DIN VDE 0641 Part 11, IEC/EN 60898:
 - Miniature circuit-breaker 24 V DC rated operational current 3 A; trip type Z or
 - Fuse 3 A, utilization class gL/gG
- Cable protection for cable AWG 24 in accordance with UL 508 and CSA-22.2 no. 14:
 - Miniature circuit-breaker 24 V DC rated operational current 2 A; trip type B or
 - Fuse 2 A

2 Installation

2.5 Connect SmartWire-DT®

2.5 Connect SmartWire-DT®

- ▶ Grab the end of the SWD line that has an arrow pointing away from the blade terminal.
- ▶ Plug this blade terminal into the gateway's SmartWire-DT connection.

To do so use the SmartWire-DT cable SWD-4-100LF8-24 and the SWD-4-8MF2 relevant blade terminal or prefabricated cables of type SWD-4-(3/5/10)F8-24-2S.



Detailed instructions explaining how to assemble a SmartWire-DT external device plug (SWD4-8SF2-5) onto an 8-pin SmartWire-DT cable can be found in "SmartWire-DT The System", MN05006002Z-EN, in the "Assembling external device plug SWD4-8SF2-5" section.

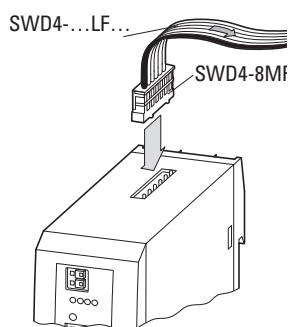


Figure 12: Connection SmartWire-DT

2.6 Connect field bus

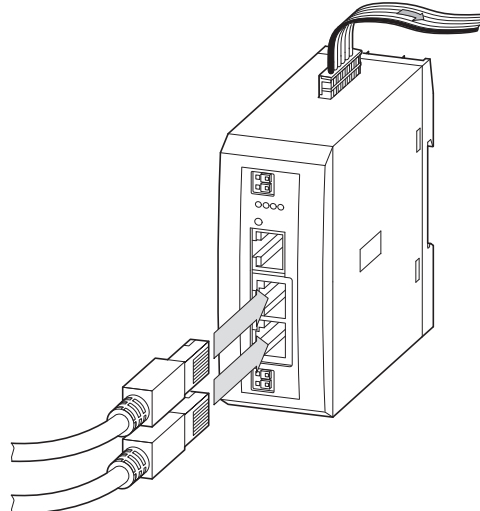


Figure 13: EtherNet/IP or Modbus-TCP connection

EtherNet/IP, Modbus-TCP

- Connect the EU5C-SWD-EIP-MODTCP gateway to the field bus. To do so use the integrated Ethernet switch, marked with ETH1, ETH2.

In the case of EU5C-SWD-EIP-MODTCP, the operating system is updated using the field bus interface. → Section "5.4 Updating the operating system", page 54.

2.7 Connecting the diagnostics interface

The EU5C-SWD-EIP-MODTCP SmartWire-DT gateway features a serial interface on the front. By using a programming cable, you can connect it to a computer and do the following with the corresponding software:

- Online SmartWire-DT line diagnostics using the SWD assist program
- Create a planned SWD configuration and load it into the gateway

You can use any of the following programming cables:

Table 3: Programming cable for the connection to a PC

Device	Programming cable	Baud rate
EU5C-SWD-EIP-MODTCP	EU4A-RJ45-CAB1	–
	EU4A-RJ45-USB-CAB1	Ethernet

	Pin	RS232
--	-----	-------

8	8	RxD
7	7	–
6	6	–
5	5	TxD
4	4	GND
3	3	–
2	2	–
1	1	–

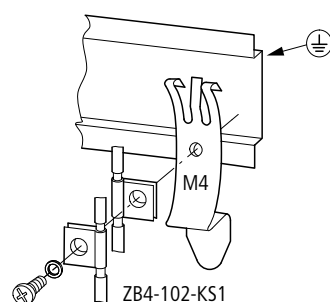
Figure 14: Configuration of the serial interface.

2.8 Wiring in accordance with EMC requirements

Undesired faults can occur on the field bus due to electromagnetic interference. This can be minimized beforehand by the implementation of suitable EMC measures. These include:

- EMC-conformant system configuration,
- EMC compliant cable routing,
- Measures designed to reduce potential differences
- the correct installation of the field bus system (cable, connection of the bus connectors, etc.),
- Using shielding

for top-hat rail



for mounting plate

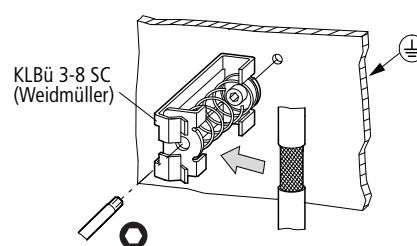
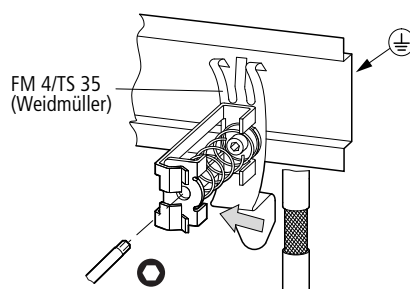
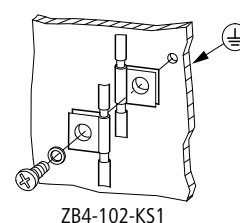


Figure 15: Field bus shielded by using a shield

2 Installation

2.8 Wiring in accordance with EMC requirements

3 Commissioning

Before switching on, check whether the power supply for the gateway is connected correctly. The configuration and installation of the SmartWire-DT line must also have been carried out correctly with all modules connected.



DANGER

If you already have integrated devices and equipment in a system, block off any parts of the system that are connected to the working area in order to prevent access. This will ensure that no one will be injured if the system behaves unexpectedly, e.g., motors start up unexpectedly.

Commissioning takes place in several steps:

- 1 Commissioning the SmartWire-DT line
- 2 Creating the project configuration and transferring it to the gateway.
- 3 Setting Ethernet communication parameters.
- 4 Create a connection to the field bus.
- 5 Load and start the PLC program.

Rules for successfully commissioning an EU5C-EIP-MODTCP

Make sure to follow the rules below in order to successfully commission the gateway:

In order to be able to run the device, the target configuration and the planned SWD configuration must be stored in it. Both must be identical. The device will only start properly if the actual configuration matches the target configuration when the device starts and the target configuration matches the planned SWD configuration.

3.1 Putting the SmartWire-DT® into operation

→ Chapter 8 "What you need to know about SmartWire-DT®", page 81 goes over the terms and basic knowledge related to SmartWire-DT.



DANGER

Switch off the power supply whenever you are reconnecting modules in the SmartWire-DT system. The SmartWire-DT modules may be permanently ruined otherwise!

Before the gateway can exchange data with the PLC, the target configuration needs to be imported and stored in the gateway. The target configuration will be compared with the current actual configuration every time the gateway is started. During this process, the gateway will determine whether there are any SWD modules that cannot be reached or whether a wrong type of module is plugged into the SWD line. SmartWire-DT's response to any detected

3 Commissioning

3.1 Putting the SmartWire-DT® into operation

discrepancies will depend on how the device parameters for the SWD coordinator and the SWD modules have been configured → Chapter 8 "What you need to know about SmartWire-DT®", page 81.

If a SmartWire-DT module drops out, it will be possible to continue running the SmartWire-DT line with the remaining modules. This applies even after the gateway is restarted or switched on again later. Please note that the application program can always be used to diagnose cases in which a SWD module has dropped out.



The target configuration should only be imported for SWD lines that have all the corresponding SmartWire-DT modules.

NOTICE

If you press the configuration button and a SWD module is missing or has dropped out from the SWD line, only the modules up to the device that dropped out will be assigned an address and stored. It will not be possible to use the remaining modules until the defective module is replaced and the configuration is imported again by pressing the configuration button.

Import the target configuration in the following cases:

- Initial Commissioning
- Replacement of a defective module
- Whenever the SWD module layout on the SWD line is changed

The online functions of the SWD assist software offer a wide range of options for the display and the diagnostics functions of the SmartWire-DT line even without the active PLC → Section "8.8 SWD assist", page 98.

3.1.1 Reading of target configuration

The target configuration needs to be imported the first time the device is commissioned, whenever a module is replaced, and whenever the SWD module layout on the SWD line is changed.

Requirements that must be met in order to import the target configuration:

- All SmartWire-DT modules are connected to the SmartWire-DT line.
 - The SmartWire-DT line is connected to the gateway.
 - Voltage POW is applied to the gateway and the POW LED lights up.
 - Configured power feeder module are connected.
 - The SmartWire-DT status LEDs of the SWD modules are on or are flashing.
- Press the configuration button on the gateway for at least two seconds. The SWD-LED on the gateway begins to flash orange. The SWD-LEDs on the SmartWire-DT modules also flash.

All modules are addressed in sequence, the complete configuration is stored retentively in the gateway as target configuration. After this the SWD-LED lights green, continuous light.



If the target configuration import process cannot be started and the SWD LED is showing an orange light, disconnect the SmartWire-DT gateway's field bus connection and try importing the target configuration again.



If the SWD LED shows a solid red light, no addresses have been assigned to any of the SWD modules. If this happens, check the SWD line - especially the SmartWire-DT connection.

3.1.2 Switching on when the target configuration is stored

If a target configuration is already stored in the gateway, the system will check, every time the gateway is switched on, whether the modules that are actually on the SWD line match the target configuration in the gateway. The SWD LED on the gateway will indicate the result of this check → Section "8.7 LEDs on the device", page 97.

3.1.3 Switching the gateway on when a planned SWD configuration is already stored

If a planned SWD configuration is stored in the gateway, the system will check whether the stored target configuration matches the planned SWD configuration in the gateway. The Config LED on the gateway will indicate the result of this check → Section "8.7 LEDs on the device", page 97.

If there is no planned SWD configuration stored in the gateway, or if the order of the modules on the SWD line has changed, follow the steps in the following description: → Chapter 4 "Creating a planned SmartWire-DT® configuration in SWD-Assist", page 33.

3.2 Take the field bus into operation

If you are putting the field bus into operation for the first time, you will first have to commission the corresponding PLC programming environment → Chapter 5 "Commissioning the PLC programming environment", page 43.

Generally speaking, the following basic initial commissioning steps need to be carried out:

- 1 Add function block libraries to the PLC programming environment.
- 2 Open or create the project in the PLC programming environment.
- 3 Search for the field bus master in the PLC programming environment (target system) and configure the corresponding network settings
- 4 Select the gateway as a field bus module.
- 5 Configure the gateway's and the SWD modules' parameters in the PLC programming environment

3 Commissioning

3.2 Take the field bus into operation

3.2.1 Creating EthernetIP/Modbus-TCP field bus communication

The green SWD LED on the gateway is used to indicate when the gateway and the SmartWire-DT line are successfully communicating. This is a prerequisite for communications between the gateway and the PLC via the field bus.

If the planned SWD configuration matches the target configuration stored on the gateway, the Config LED will show a solid green light

You will find the LEDs in → Section “Table 28: LED SWD coordinator”, page 97.

- ▶ Use the PLC programming environment to load the application program into the PLC.
- ▶ Start the PLC.



If a monitoring time has not been set in the Modbus-TCP operating mode and a Modbus connection was active beforehand, the MS LED on the gateway will continue to show a solid green light even after the Ethernet cables have been disconnected!



Changes to the project, to the modules, or to the parameters will make it necessary to store the planned SWD configuration in the gateway once again.

If the fieldbus protocol has been changed (EtherNet/IP or Modbus-TCP), the change will only take effect after the gateway is restarted.

3.2.2 MS-LED status display

Table 4: MS-LED at SWD coordinator

Description	MS LED	Data exchange Gateway - PLC
No power supply	off	No
The gateway has a valid planned SWD configuration and it is ready for the establishment of an Ethernet/IP- or Modbus-TCP connection	Green flashing	No
Cyclic data exchange via Ethernet/IP or Modbus-TCP active.	Green continuous light	yes
The gateway is signaling a communications error. For example, the original connection for cyclic data exchange has not been terminated correctly and a timeout has occurred.	Red continuous light	No
The gateway is waiting for a field bus address to be assigned via DHCP or BOOTP. As soon as the gateway is assigned an address, the LED will flash with a green light	Red flashing	No

If the SWD and Config LEDs show a solid green light and the MS LED is flashing with a green light, you have successfully completed the commissioning process.

3.2.3 POW status display

Description	POW
Device ready for operation	on
If the other three gateway LEDs are permanently red, the operating system or the hardware is faulty. If they show continuous orange light, the gateway is in Firmware Update mode. This mode can be deactivated by switching on the power supply again.	off

3 Commissioning

3.2 Take the field bus into operation

4 Creating a planned SmartWire-DT® configuration in SWD-Assist

SWD lines that use an EU5C-SWD-EIP-MOD-TCP gateway are created with SWD-Assist version 1.40 or higher. SWD-Assist is used to select both the gateway and all required SmartWire-DT modules. It is also used to configure all the settings for the field bus, as well as the parameter settings for the individual SmartWire-DT modules, which are then loaded onto the gateway as a planned SmartWire-DT configuration.

To create an SWD line for an EtherNet/IP field bus using the SWD-Assist planning program, you will need to follow the steps below:

- 1 Select the EU5C-SWD-EIP-MODTCP gateway and configure its parameters
- 2 Select the SmartWire-DT modules you want and configure their parameters
- 3 Select the EtherNet/IP or Modbus/TCP field bus communications protocol
- 4 Specify the device names for the gateway and the modules
- 5 Transfer the planned SmartWire-DT configuration to the gateway
- 6 Export the input/output data to a CSV or text file



If any changes are made to the modules, parameters, or in regard to the field bus protocol, the planned SmartWire-DT configuration will have to be transferred again.

4.1 Select gateway as field bus module

- ▶ Start SWD-Assist and create a new project. An EU5C-SWD-DP PROFIBUS gateway will be shown on the workspace by default.
- ▶ Select the EU5C-SWD-EIP-MODTCP gateway from the catalog of devices and drag it to the canvas.

The EU5C-SWD-DP gateway will be replaced with an EU5C-SWD-EIP-MODTCP gateway.

4 Creating a planned SmartWire-DT® configuration in SWD-Assist

4.1 Select gateway as field bus module

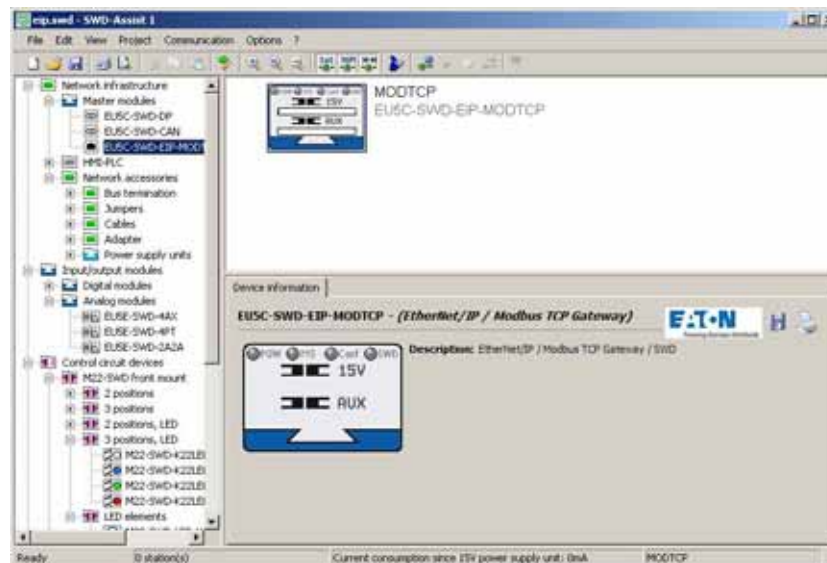


Figure 16: Selecting the EU5C-SWD-EIP-MODTCP gateway in SWD-Assist

Specifying the device name for the gateway

After this, it is important to enter a device name for the gateway and for the individual SmartWire-DT modules. The reason for this is that this information will be used to identify the gateway on the EtherNet/IP field bus and when naming the I/O data corresponding to the SmartWire-DT modules in the export file.

A device name is used for the gateway in SWD-Assist. "EIPSWD" will be the default name used by the program. The device name will be used later on when creating the EU5C-SWD-EIP-MOD-TCP EtherNet/IP gateway in the PLC programming environment's device configurator, as well as when creating the symbolic names used to identify I/O data.

The device name must be unique, i.e., it cannot be in use in the application program already. The maximum permitted length is 24 characters. The name can contain letters, numbers, and underscores (_). Umlauts are not permissible, e.g., "ä", "ö."

4 Creating a planned SmartWire-DT® configuration in SWD-Assist

4.2 Select SWD module

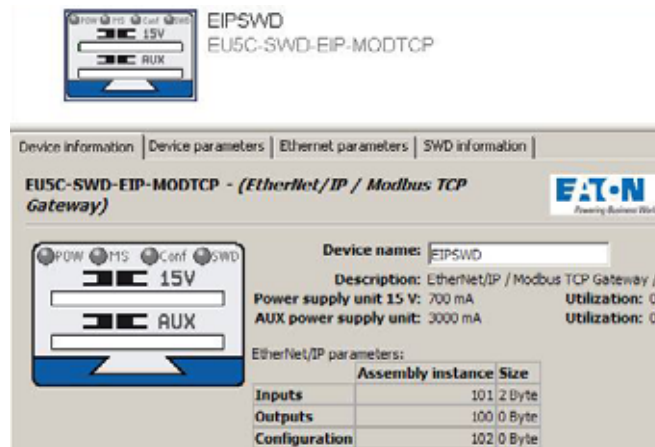


Figure 17: Specifying the device name for the gateway in SWD-Assist

4.2 Select SWD module

The device catalog will show its SmartWire-DT modules sorted according to various applications.

- Select the SmartWire-DT modules that you need for the SWD line and drag them to the workspace.

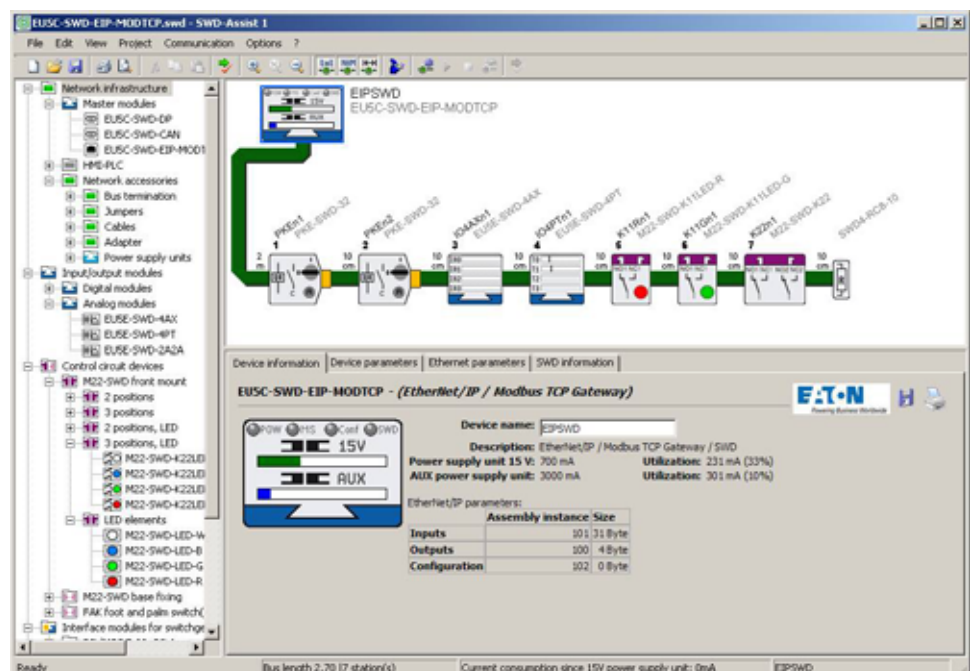


Figure 18: Selecting SmartWire-DT modules in SWD-Assist

- Finally, you can check the configuration you have entered. To do this, open the "Project" menu item and click on the "Plausibility check" option. Any errors—such as missing components—will be shown.

For more information regarding how to set up an SWD line, please consult the online Help for SWD-Assist.

4 Creating a planned SmartWire-DT® configuration in SWD-Assist

4.3 Selecting a communications protocol



To open the online Help function, press the F1 function key while working with SWD-Assist.

Specifying the device name for the SmartWire-DT modules

Just like with the gateway, device names are also used for SmartWire-DT modules in the SWD-Assist planning program. A device name based on the module's type and position in the SWD line will be suggested by default. These device names are used to identify the modules and must be unique. They are used when generating symbolic names for I/O data.

The device name must be unique, i.e., it cannot be used for any other SmartWire-DT modules. The maximum permitted length is 24 characters. The name can contain letters, numbers, and underscores (_). Vowels like "ä", "ö" are not permissible.

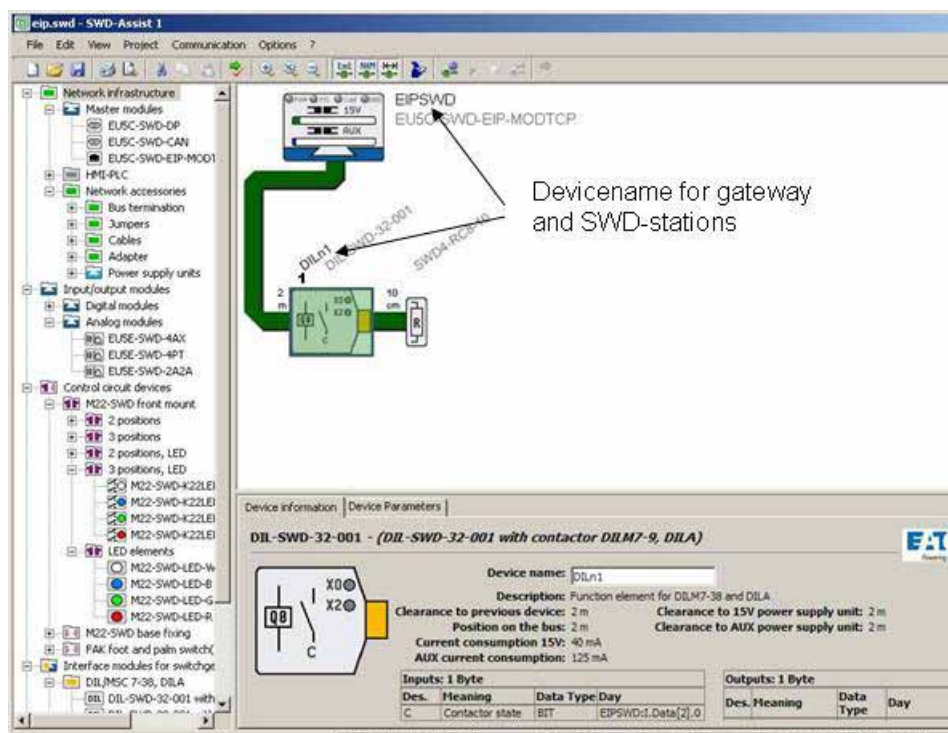


Figure 19: Specifying the device name for a SmartWire-DT module in SWD-Assist

4.3 Selecting a communications protocol

The gateway can work with either the EtherNet/IP or Modbus/TCP field bus protocol in order to exchange data with higher-level PLCs. The default field bus protocol is EtherNet/IP.

The protocol that should be used is selected either through the web interface or in the project with SWD-Assist.

- Open the "Device parameters" tab and select the field bus protocol you want using the "Mode" setting.

4 Creating a planned SmartWire-DT® configuration in SWD-Assist

4.4 Ethernet parameters tab



If you change the field bus protocol (EtherNet/IP or Modbus/TCP), you will have to load the planned SmartWire-DT configuration into the gateway once again. The change will only take effect after the gateway is restarted.

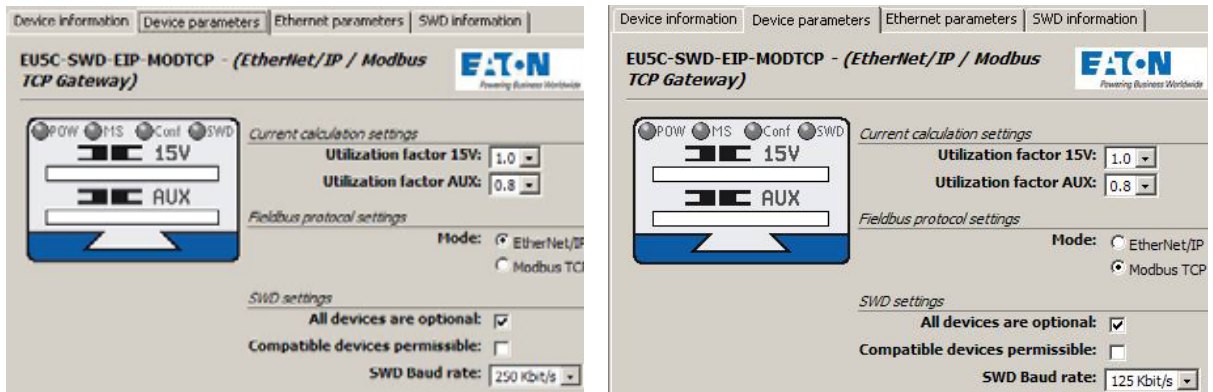


Figure 20: Selecting the field bus protocol in SWD-Assist:
left - EtherNet/IP; right - Modbus/TCP

The field bus protocol you select will affect the way I/O allocation lists are created for the PLC programming environment during the planning phase.

EtherNet/IP

If you select EtherNet/IP as the mode, the I/O addresses (tags) will be defined according to the agreements for EtherNet/IP. The format of the export file created in SWD-Assist is designed to enable you to import these I/O identifiers directly into the RSLogix 5000 PLC programming environment.

Modbus-TCP

If you select Modbus/TCP as the mode instead, the I/O data will be mapped to the relevant register data structure as per the specifications for Modbus/TCP. The address assignments will then be provided in an export file so that they can be worked with further.

4.4 Ethernet parameters tab

The EU5C-SWD-EIP-MODTCP gateway will communicate with the higher-level PLC via the Ethernet interface regardless of the field bus protocol you select. The gateway comes with the following default settings:

IP address: 192.168.1.254

Subnet screen: 255.255.255.0

Default gateway: 192.168.1.1

- ▶ Open the "Ethernet parameters" tab.
- ▶ Change the setpoint values for the field bus address as necessary.

4 Creating a planned SmartWire-DT® configuration in SWD-Assist

4.5 Set device parameter of the gateway

After the project is transferred to the gateway, the settings and the configuration data will be saved in a retentively and will be applied immediately.



The DIP switches can be used to restore the default settings at any time (→ Section "2.1.1 Default settings Ethernet address", page 15).

The way the network settings in the SWD-Assist "Ethernet parameters" tab will affect the system will depend on how the DIP switches on the device have been set.

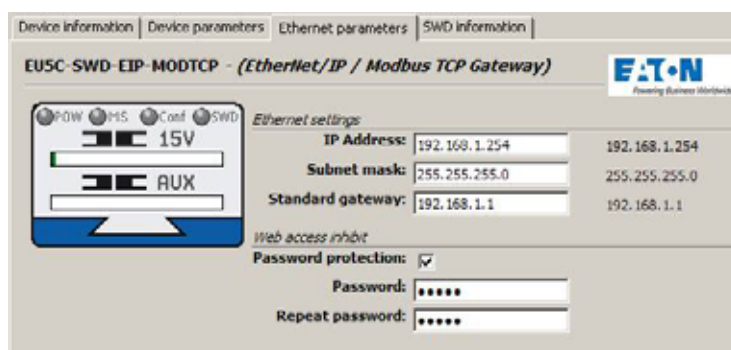


Figure 21: Network settings for field bus communications in SmartWire-DT



Please note that these settings will only take effect if the DIP switches have been used to set the "Address setting directly on the device," "PGM," or "PGM-DHCP" address-setting method.

The corresponding setting options can be found on → Section "Table 26: Device parameter SWD coordinator", page 92.

4.5 Set device parameter of the gateway

All "Device information," "Device parameters," etc. tabs refer to the gateway or to the SmartWire-DT modules. The specific device to which they refer will depend on the device you clicked on previously on the workspace.

- ▶ On the workspace, click on "EU5C-SWD-EIP-MODTCP."
- ▶ Open the "Device parameters" tab.

The program will show the SmartWire-DT coordinator's device parameters.

To configure the SmartWire-DT coordinator's device parameters, use the settings in the "SWD settings" section. These settings will define the coordinator's behavior when the SmartWire-DT modules on the SWD line do not match the planned SmartWire-DT configuration in the gateway.

4 Creating a planned SmartWire-DT® configuration in SWD-Assist

4.6 Set the device parameters of the SWD modules

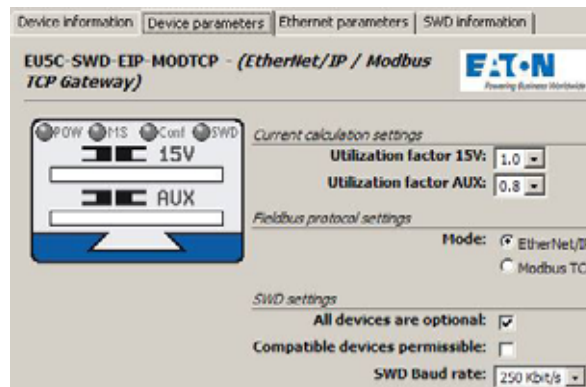


Figure 22: Configuring the device parameters for the gateway in SWD-Assist

The device parameters are described in → Section "Table 26: Device parameter SWD coordinator", page 92.

4.6 Set the device parameters of the SWD modules

All "Device information," "Device parameters," etc. tabs refer either to the gateway or to the SmartWire-DT modules. The specific device to which they refer will depend on the device you clicked on previously on the workspace.

- ▶ Select the SmartWire-DT module you want, e.g., "PKE2".
- ▶ Open the "Device parameters" tab.
- ▶ Adjust the settings, e.g., "Required module," as needed.

→ Section "Table 27: Device parameters of SWD modules", page 93

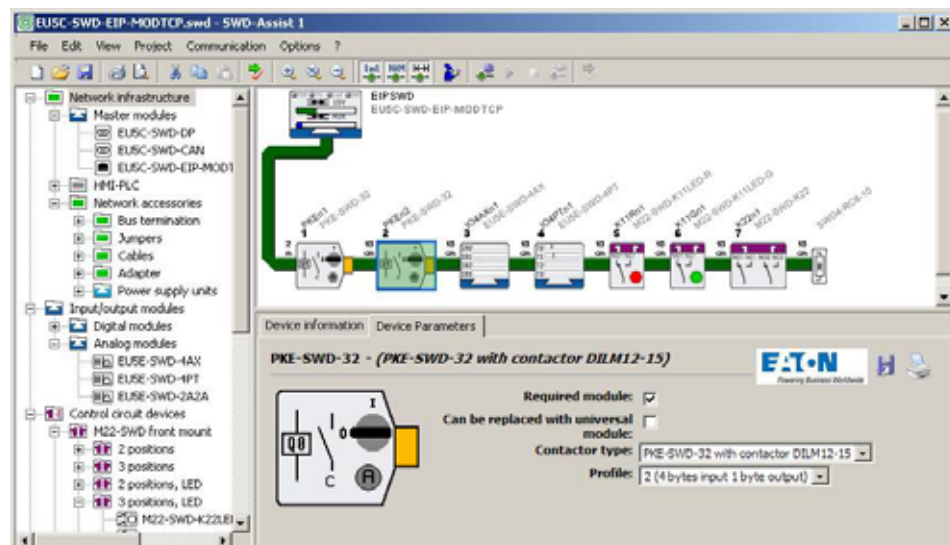


Figure 23: Configuring the SmartWire-DT parameters for "PKE2" in SWD-Assist

4.7 Setting specific device parameters for SmartWire-DT® modules

Certain SmartWire-DT modules make it possible to set additional device-specific parameters.

4 Creating a planned SmartWire-DT® configuration in SWD-Assist

4.8 Storing the planned SmartWire-DT® configuration

These include, for example, "Contactor model" and "Profile" for the PKE-SWD-32 device model; see example → Figure 23.

Likewise, various data profiles that define the scope of I/O data that is transmitted cyclically can also be defined.

Device-specific parameters for the EU5C-SWD-4PT analog module include, for example, selecting the analog sensor that must be connected, which can be selected using the "T0" and "T1" drop-down menus, and scanning time specifications, which can be selected using the "Refresh" drop-down menu. These settings are found in the "Device parameters" tab for the module.

For information regarding the parameter configuration options available for individual SmartWire-DT modules, please consult the "SmartWire-DT Modules", MN05006001Z-EN.

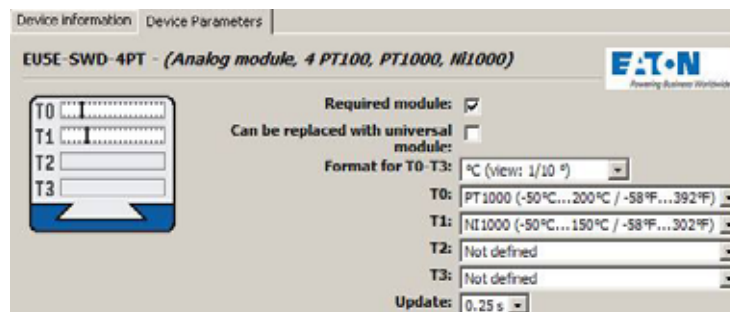


Figure 24: Device parameters of EU5E-SWD-4PT SmartWire-DT temperature module in SWD-Assist

4.8 Storing the planned SmartWire-DT® configuration

- ▶ In order to establish a connection to the device, first switch to the Communication view by clicking on the "View" > "Communication view" buttons.
- ▶ Click on the "Connection setup" button and then on the "Online" button.
- ▶ Click on the "Configurations in device" button
- ▶ Under "Planned configuration," click on "PC=>Device"

The planned SmartWire-DT configuration is now stored in the gateway. The Config LED will show a solid green light.

4 Creating a planned SmartWire-DT® configuration in SWD-Assist

4.9 Exporting the SmartWire-DT® modules' I/O data

4.9 Exporting the SmartWire-DT® modules' I/O data

The units' I/O addresses will be mapped to the corresponding field bus I/O objects based on the field bus protocol that has been selected, i.e., EtherNet/IP or Modbus/TCP. The SWD-Assist planning program performs this mapping, which is shown for every SmartWire-DT module.

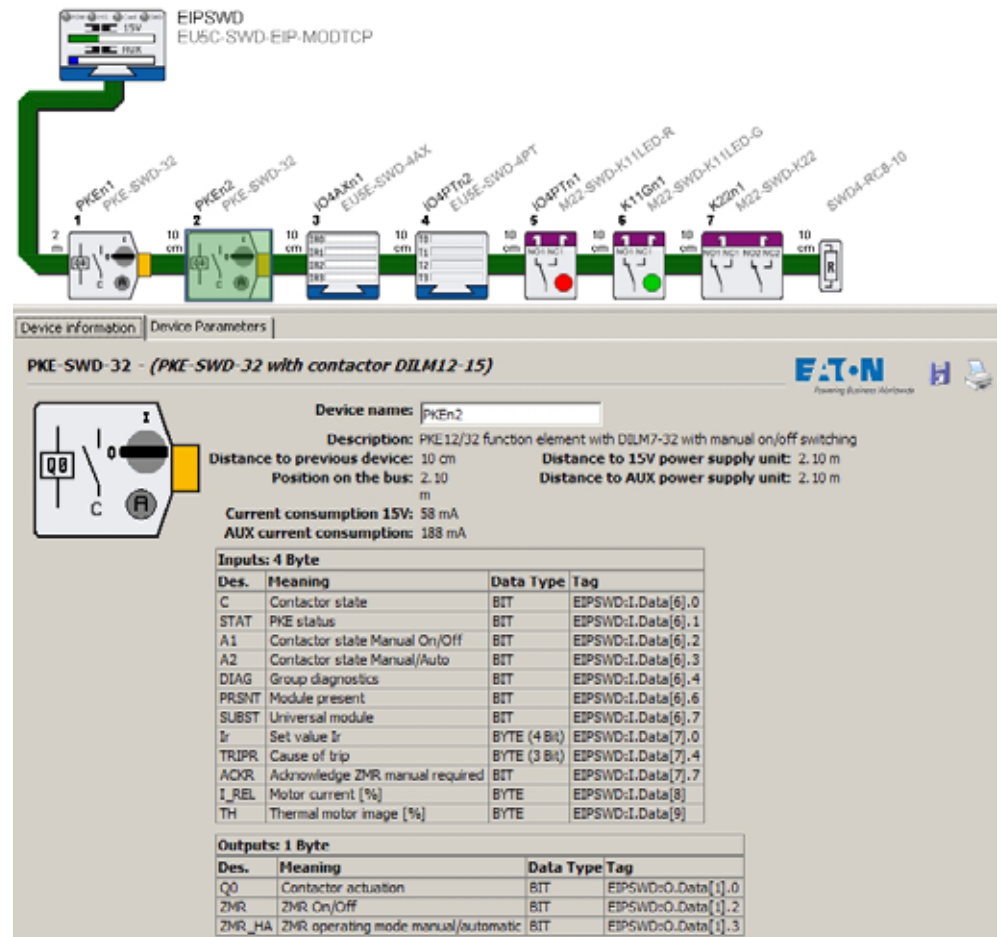


Figure 25: I/O addresses for the "PKE-n2" SmartWire-DT module; EtherNet/IP protocol in SWD-Assist

The process of providing access to the SmartWire-DT modules' I/O data in the PLC programming environment is made much easier by exporting this data in a file format that is compatible with the programming environment.

To export the SmartWire-DT modules' I/O data to a CSV or text file, proceed as follows:

- ▶ Start the SWD-Assist planning program.
- ▶ Make sure that the right field bus protocol is selected.
- ▶ Open the "Project" menu and click on the "Export configuration" option.

This will store all required information in a CSV or text file.

4 Creating a planned SmartWire-DT® configuration in SWD-Assist

4.9 Exporting the SmartWire-DT® modules' I/O data

EtherNet/IP

When using the EtherNet/IP operating mode, this data can be exported as a CSV file for the RSLogix 5000 PLC programming environment and can then be imported into RSLogix 5000 PLC programming environment V17.0 or higher.

Modbus-TCP

In the case of Modbus-TCP applications, the data can be exported in a text file format.

Chapter → Chapter 5 "Commissioning the PLC programming environment" describes how the CSV file for the EtherNet/IP communications protocol is used.

5 Commissioning the PLC programming environment

Two things are required in order to be able to create a PLC application:

- Creating the planned SmartWire-DT configuration with the SWD-Assist planning program, regardless of the protocol that you want to use.
- Creating the corresponding user program with the PLC programming environment for the PLC being used.
 - An example for EtherNet/IP would be the Allen-Bradley RSLogix 5000 PLC programming environment in conjunction with a Compact Logix PLC
 - An example for Modbus/TCP would be the XSoft-CoDeSys-2 PLC programming environment in conjunction with an Eaton XC20x or XV20x PLC.

5.1 For Ethernet/IP, using RSLogix 5000 as an example

In order to use the EU5C-SWD-EIP-MODTCP gateway in the RSLogix 5000 PLC programming environment, you will have to follow the steps below:

- 1 Configure and set the parameters for the EtherNet/IP EU5C-SWD-EIP-MODTCP module
- 2 Import the SmartWire-DT modules' I/O data (tag list) and use it in the application program

5.1.1 Selecting the EU5C-SWD-EIP-MODTCP gateway

In order to be able to use an EU5C-SWC-EIP-MODTCP gateway, you will need a controller with an EtherNet/IP interface. The PLC programming environment's "Controller Organizer" pane will show the Ethernet interfaces under "I/O Configuration."

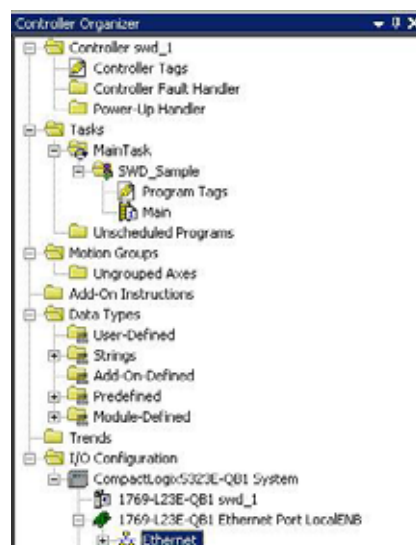


Figure 26: Ethernet interface in the RSLogix 5000 V19.01.00 controller I/O configuration

5 Commissioning the PLC programming environment

5.1 For Ethernet/IP, using RSLogix 5000 as an example

- ▶ Select the Ethernet interface to which you want to connect the SmartWire-DT gateway.
- ▶ Open the context menu and select the "New modules" option.

The "Select modules" dialog box for selecting available Ethernet module groups will appear.

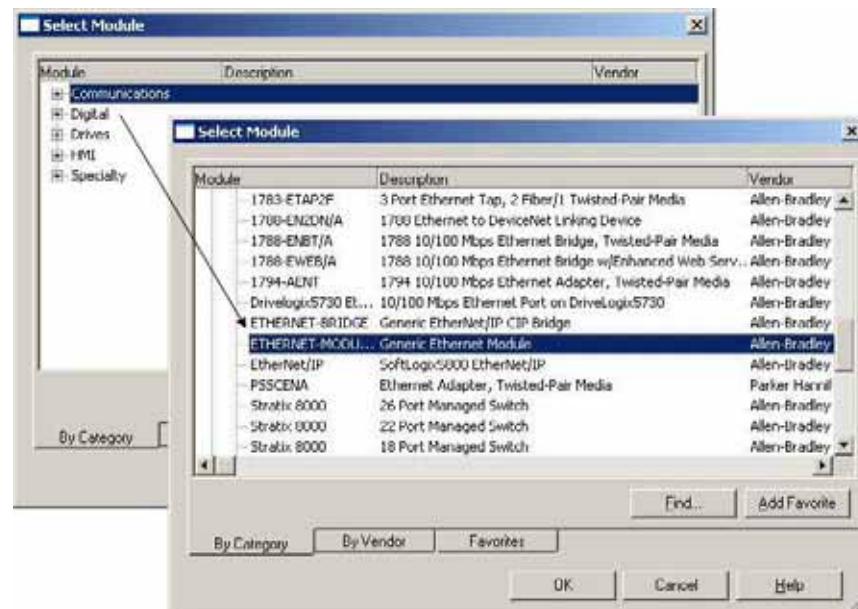


Figure 27: Selecting the gateway as a "Generic Ethernet module" in RSLogix 5000 V19.01.00

- ▶ In the "Select modules" dialog box, select the "Communications" group.
- ▶ Under "Communications," select the "Generic Ethernet module" device and confirm your selection by clicking on "OK."

5 Commissioning the PLC programming environment

5.1 For Ethernet/IP, using RSLogix 5000 as an example

5.1.2 Configuring the gateway's communication parameters

The dialog box that follows, "Module properties...", → Figure 28 is used to configure important properties that are required in order to ensure that the controller and the gateway will be able to communicate successfully. On one hand, these include information regarding the relevant Ethernet connection parameters, such as the IP address and information regarding the type and volume of I/O data.

I/O data is provided by the gateway in byte format.

- ▶ Accordingly, make sure to first select the "SINT" data type for the "Communication format" parameter.

You will need the project file that you created with the SWD-Assist planning program in order to enter the additional necessary information manually.

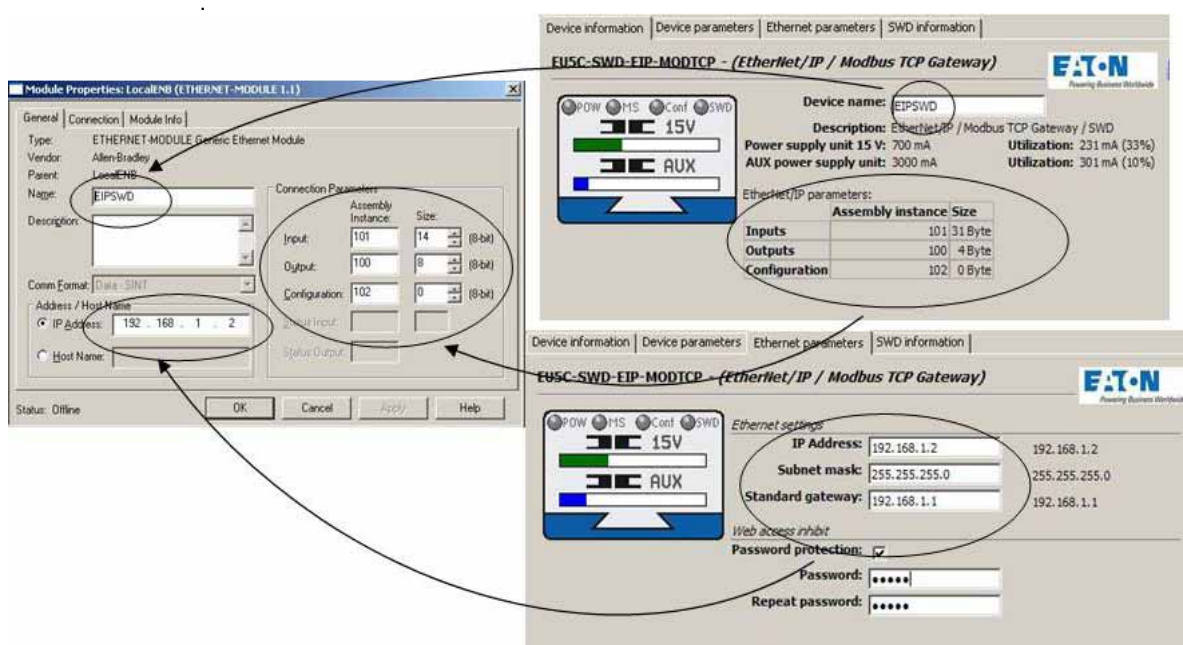


Figure 28: Entering the gateway parameters found in the SWD-Assist planning program into the RSLogix 5000 V19.01.00 PLC programming environment

- ▶ Use SWD-Assist to open your SmartWire-DT project file, e.g., "Example.swd".
- ▶ Select the EU5C-SWD-EIP-MODTCP gateway and open the "Device information" tab.
- ▶ Now copy the values for the inputs', outputs', and configuration data volumes found in SWD-Assist to the corresponding fields in the RSLogix 5000 parameter dialog box by hand → Figure 28.
- ▶ After doing so, open the "Ethernet parameters" tab in SWD-Assist.
- ▶ Now copy the Ethernet address values for the gateway to the RSLogix 5000 PLC programming environment's parameter dialog box.

This will ensure that the PLC programming environment will recognize and know the gateway, together with its important communication parameters, as well as the corresponding data and configuration volumes.

5 Commissioning the PLC programming environment

5.1 For Ethernet/IP, using RSLogix 5000 as an example



Modifying the SWD line may affect the aforementioned data volumes. Differences between the actual line and the specified volumes will be indicated with the red Config LED on the gateway if, for example, the gateway detects that there are errors after performing a configuration comparison. If this happens, transfer the modified SmartWire-DT project to the gateway again and update the values in the above dialog box if necessary.

5.1.3 What the SWD-Assist CSV file looks like

The table below shows how device names are used in I/O addresses and symbolic names in the CSV file (CSV = Comma-Separated Value).

The I/O address ("Specifier" column) is made up of:

- The device name of the EtherNet/IP fieldbus module (the EU5C-SWD-EIP-MODTCP gateway); "EIPSWD" in this particular case
- A code used to indicate whether the address is for an input (I) or an output (Q)
- The address information for the specific I/O data within the data space

The symbolic name ("Name" column) is made up of:

- The device name of the field bus module (the EU5C-SWD-EIP-MODTCP gateway); "EIPSWD" in this particular case
- The device name ("PKEnt1" in this particular case) of the module for connecting a contactor to SmartWire-DT
- A code used to indicate whether the address is for an input (I) or an output (Q)
- An individual name for the specific I/O data, e.g., "C" for the feedback signal for the contactor's position

TYPE	SCOPE	NAME	DESCRIPTION	DATATYPE	SPECIFIER	ATTRIB
TAG		EIPSWD.C		AB.ETHERNET_MODULE.C.0		
TAG		EIPSWD.I		AB.ETHERNET_MODULE.SINT_31Bytes.I.0		
TAG		EIPSWD.O		AB.ETHERNET_MODULE.SINT_4Bytes.O.0		
ALIAS		EIPSWD.PKEnt1.C	Contactor state		EIPSWD.I.Data[2]0	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.STAT	PKE status		EIPSWD.I.Data[2]1	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.A1	Contactor state Manual On/Off		EIPSWD.I.Data[2]2	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.A2	Contactor state Manual/Auto		EIPSWD.I.Data[2]3	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.DIAG	Group diagnostics		EIPSWD.I.Data[2]4	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.PRSNT	Module present		EIPSWD.I.Data[2]6	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.SUBST	Universal module		EIPSWD.I.Data[2]7	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.r_b0b3	Set value Ir Bit 3		EIPSWD.I.Data[3]0	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.r_0	Set value Ir Bit 0		EIPSWD.I.Data[3]1	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.r_1	Set value Ir Bit 1		EIPSWD.I.Data[3]2	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.r_2	Set value Ir Bit 2		EIPSWD.I.Data[3]3	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.r_3	Set value Ir Bit 3		EIPSWD.I.Data[3]4	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.TRIPR_b4b6	Cause of trip		EIPSWD.I.Data[3]5	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.TRIPR_4	Cause of trip Bit 0		EIPSWD.I.Data[3]6	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.TRIPR_5	Cause of trip Bit 1		EIPSWD.I.Data[3]7	[RADIX:16]
ALIAS		EIPSWD.PKEnt1.I.TRIPR_6	Cause of trip Bit 2		EIPSWD.I.Data[3]8	[RADIX:16]

Figure 29: Example: Extract from a CSV file with EtherNet/IP I/O data for RSLogix 5000 V19.01.00

5 Commissioning the PLC programming environment

5.1 For Ethernet/IP, using RSLogix 5000 as an example



You can change the device names for the gateway and the SmartWire-DT modules in SWD-Assist at any time. The corresponding I/O addresses (tags) and symbolic names will be updated immediately. You can also change these names in the PLC programming environment.

5.1.4 Importing the SmartWire-DT® modules' I/O data

The next step after entering the information for the EU5C-SWD-EIP-MODTCP gateway into the PLC programming environment is to transfer the SmartWire-DT modules' existing I/O data so that it can be used in the programming environment. To do so, the CSV file previously exported in SWD-Assist needs to be imported into the RSLogix 5000 programming system.

- ▶ Open the "Extras" menu item and select the "Import" option.
- ▶ Now select "Tags and logic comments."
- ▶ In the dialog box that appears, select the CSV file that you previously created with the SWD-Assist planning software and confirm your selection by clicking on "Import".

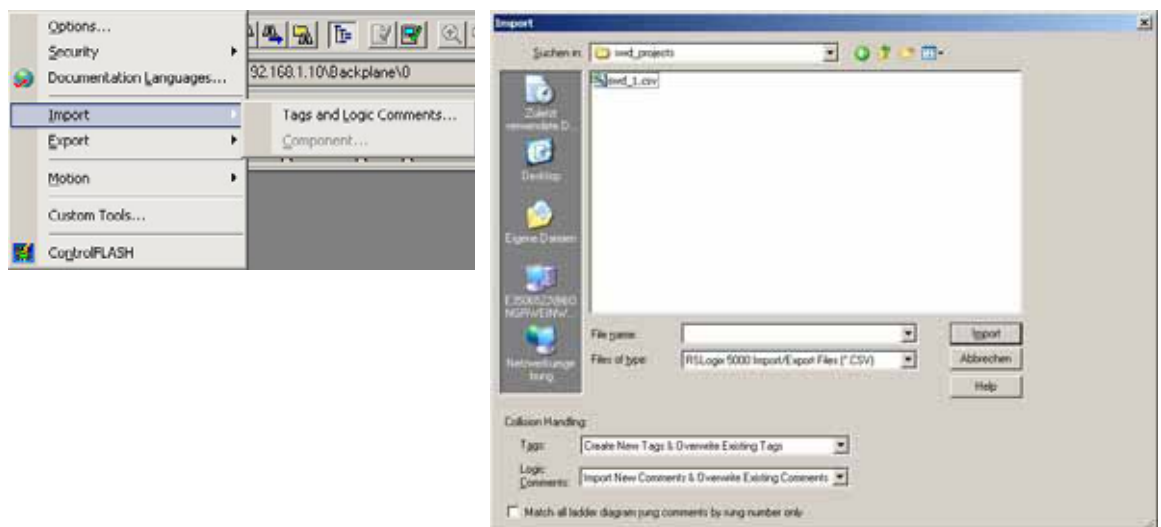


Figure 30: Importing the SmartWire-DT modules' I/O data into the RSLogix 5000 V19.01.00 PLC programming environment

Once you are done with these steps, the programming system will have the I/O data and you will be able to use this data for your user program as usual.

5 Commissioning the PLC programming environment

5.1 For Ethernet/IP, using RSLogix 5000 as an example

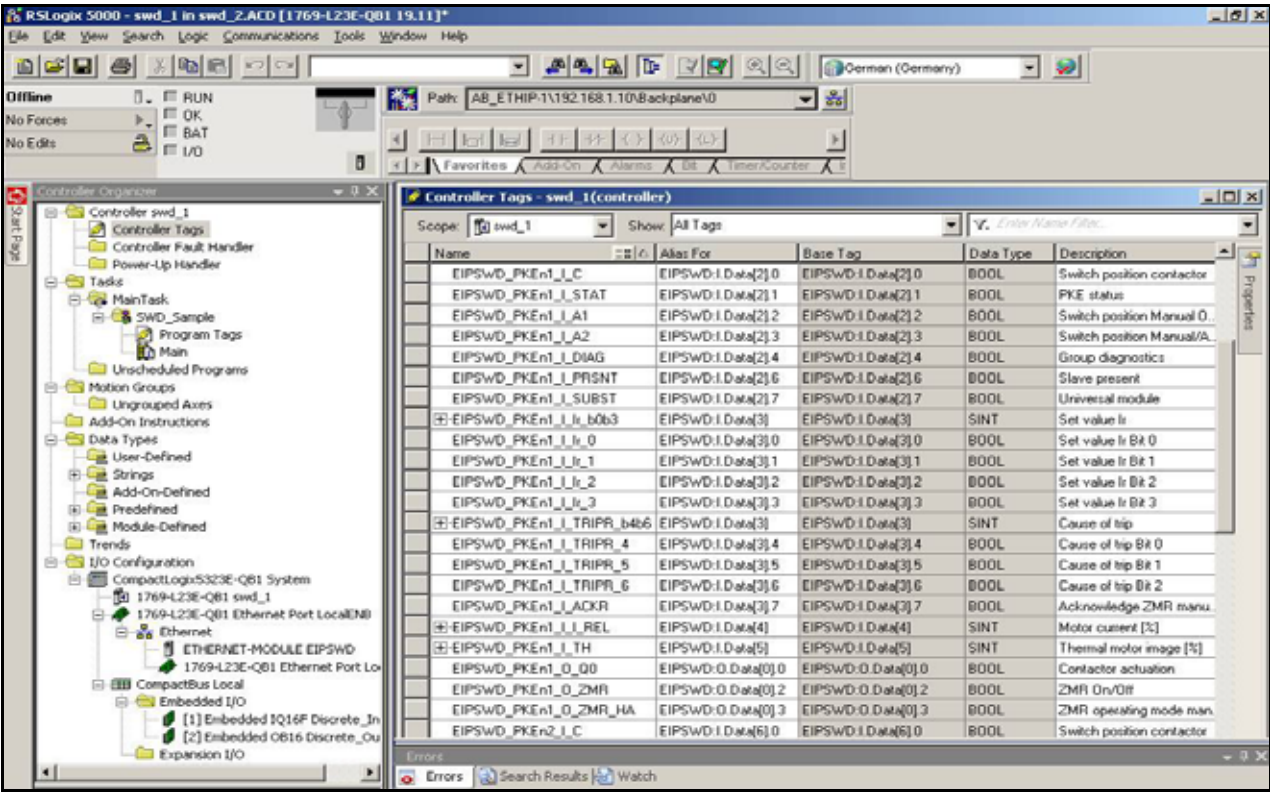


Figure 31: Tag list containing all of the SWD line's I/O data in the RSLogix 5000 V19.01.00 PLC programming environment

5.2 For Modbus/TCP

5.2.1 What the SWD-Assist text file looks like

The SmartWire-DT I/O data is mapped to 16-bit Modbus registers → Chapter 7 "Modbus/TCP – SmartWire-DT® implementation", page 72.

In order to make it easier to identify the I/O data in the PLC programming environment, SWD-Assist generates a TXT file with all I/O data for the corresponding Modbus/TCP information. This information is stored in the form of a table in a TXT file. It can be edited further directly in a PLC programming environment or in a spreadsheet program such as Microsoft Excel.

The table below shows how device names are used in I/O addresses and symbolic names in the TXT file.

Name	Register	Bit position	Bit number	Data type	Description
MODSWD_PKE1 I C	0	8	1 BIT		Contactor state
MODSWD_PKE1 I STAT	0	9	1 BIT		PKE status
MODSWD_PKE1 I A1	0	10	1 BIT		Contactor state Manual On/Off
MODSWD_PKE1 I A2	0	11	1 BIT		Contactor state Manual/Auto
MODSWD_PKE1 I DIAG	0	12	1 BIT		Group diagnostics
MODSWD_PKE1 I PRSNT	0	14	1 BIT		Module present
MODSWD_PKE1 I SUBST	0	15	1 BIT		Universal module
MODSWD_PKE1 I Ir	0	0	4 BYTE (4 Bit)		Set value Ir
MODSWD_PKE1 I TRIPR	0	4	3 BYTE (3 Bit)		Cause of trip
MODSWD_PKE1 I ACKR	0	7	1 BIT		Acknowledge ZMR manual required
MODSWD_PKE1 I I_REL	1	8	8 BYTE		Motor current [%]
MODSWD_PKE1 I TH	1	0	8 BYTE		Thermal motor image [%]
MODSWD_PKE1 O Q0	2048	8	1 BIT		Contactor actuation
MODSWD_PKE1 O ZMR	2048	10	1 BIT		ZMR On/Off

Figure 32: I/O data for Modbus/TCP; sample extract from a TXT file

The following information is included:

- The symbolic name -in the "Name" column, made up of:
 - The gateway's device name ("ModTCP" in this example)
 - The module's device name; "PKE1" for the SmartWire-DT-PKE connection in this example
 - A code used to indicate whether the address is for an input (I) or an output (Q)
 - An individual code for the specific I/O data, e.g., "C" for the feedback signal for the contactor position
 - The name of the input/output
- The address of the Modbus register
- The bit position within the word and the bit length of the specific input/output data
- The specific input/output data's data type
- A description of the specific input/output data

If this information is used in order to generate input/output variables, the various definition access methods of the PLC programming environment being used must be taken into account.

5 Commissioning the PLC programming environment

5.2 For Modbus/TCP

5.2.2 Using gateways with ELC/Modicon controllers

Depending on the controller system being used, it is possible that the system will not be able to process all the data with one single Modbus request. If this is the case, please use multiple read/write requests in order to make sure that all data is processed.

5.2.3 Using gateways with Eaton controllers

Eaton controllers (XC20x) and HMI displays with a PLC runtime functionality can be used as Modbus-TCP servers and clients. The library required for this purpose must be imported into the XSoft-CoDeSys-2 programming software's library manager. Please read application note AN2700K22, "Modbus/TCP Master/Slave for XControl Controllers." This application note contains not only the corresponding documentation, but also the required library.



The application note can be downloaded on the Internet at:

ftp://ftp.moeller.net/AUTOMATION/APPLICATION_NOTES/Index.html

5.3 Web-Interface

The web interface can be used to access the EU5C-SWD-EIP-MODTCP gateway.

The following functions are supported via the WEB interface:

- Showing the gateway's device parameters
- Showing the gateway's and SWD line's statuses
- Showing all connected SmartWire-DT modules with their serial numbers, statuses, etc.
- Showing and changing network settings
- Showing and changing password protection
- Updating the operating system

To establish a connection to the gateway using the web interface, follow the steps below:

- ▶ Open one of the following browsers:
Internet Explorer 6 or higher or Mozilla Firefox 3 or higher
- ▶ Enter the gateway's IP address as the URL.
The default address is: 192.168.1.254.

The homepage, showing the most important information concerning the gateway, will appear.

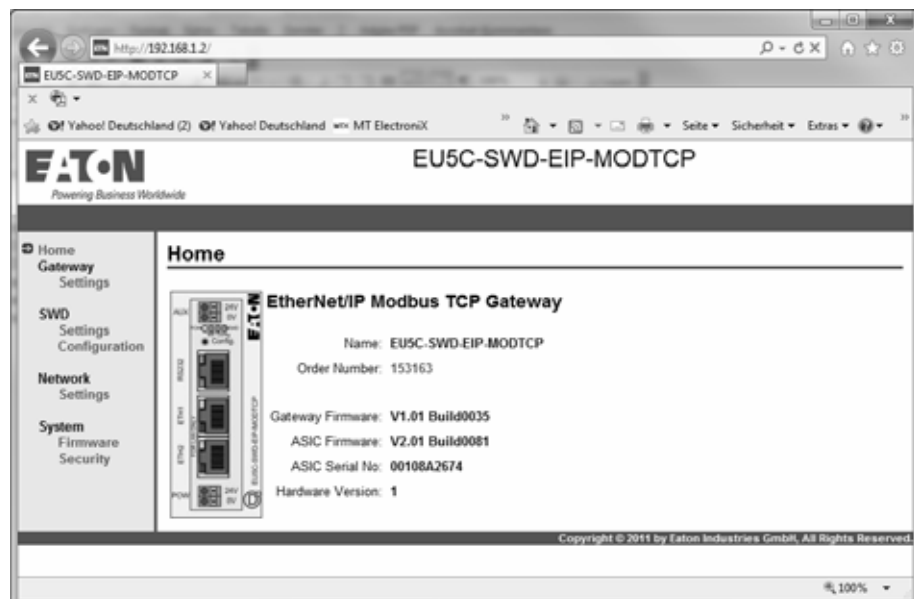


Figure 33: Web interface homepage

5 Commissioning the PLC programming environment

5.4 Updating the operating system

5.4 Updating the operating system

In order to be able to update the operating system, you must first have downloaded the latest version from our Support Center. To do so, follow the steps below:

- ▶ Go to the Support Center and enter "SWD" into the quick search field.
- ▶ Select the "Operating system for the EU5C-SWD-EIP-MODTCP Ethernet/IP-MOD-BUS-TCP-SmartWire-DT Gateway" software and click on "Download."
- ▶ Once on the FTP server, click on directory "V1.0."
- ▶ Then click on "EU5C-SWD-EIP-MODTCP_V1.03_Build0051.bin" to start downloading the file.
- ▶ Save the binary file in a folder of your choice.

To update the operating system on the gateway, follow the steps below:

- ▶ On the web interface, click on the "Browse..." button and select the "EU5C-SWD-EIP-MODTCP..." binary file from the folder where you saved it.
- ▶ Click on "Transfer to Device."

The binary file will be transferred to the gateway.

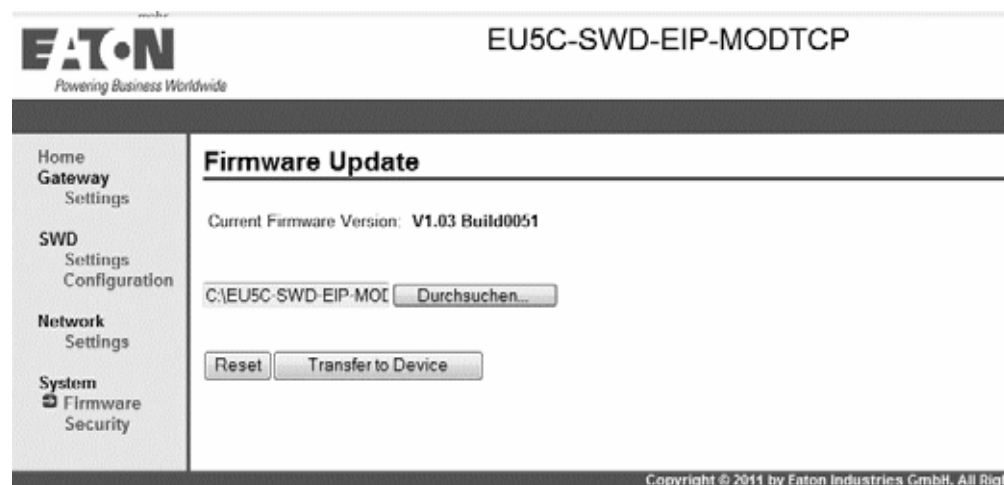


Figure 34: Updating the operating system with the web interface

- ▶ Power cycle the gateway by turning it off and then back on.

The operating system is now updated.

6 Implemented EtherNet/IP objects

This device has been developed and certified in accordance with the Open DeviceNet Vendors Association's (ODVA) specifications. The EtherNet/IP protocol relies on the Common Industrial Protocol (CIP) in order to transfer data.

CIP is a media-independent protocol that is implemented in the upper layers of the OSI layer model. It is based on the producer-consumer communications model and is strictly object-oriented. Every CIP object has attributes (data), services (commands), connections, and behaviors (relationships between attribute values and services). CIP features an extensive object library designed to support general network communications, network services, and typical automation functions.

It supports the following types of communication:

- Point-to-point or multicast implicit I/O messaging
- Unconnected explicit messaging (UCMM)
- Connected explicit messaging

The EtherNet/IP protocol provides access to the gateway's and SmartWire-DT modules' data via the following object classes:

- Standard object classes; all CIP object classes are implemented;
CIP = Common Industrial Protocol
- Vendor-specific object classes, VSC object classes;
VSC = Vendor Specific Class

The following pages provide a detailed description of the most important CIP object classes. This detailed description indicates which standard services → Table 6 have been specifically implemented.

VSC object classes contain information concerning specific properties of individual SmartWire-DT modules, including, for example, diagnostic and parameter information. Vendor-specific objects are described in → Section "6.2 Manufacturer-specific object classes", page 63.

6 Implemented EtherNet/IP objects

6.1 Standard CIP object classes

6.1 Standard CIP object classes

The values for the individual class and instance attributes found on the table are based on the current version of the operating system, version 1.02.

The following standard CIP object classes are supported:

Table 5: CIP object classes

Class	Property Name	Description
01 (0x01)	Identity Object	Information about the device, such as the manufacturer, device model, etc. (→ Page 55)
02 (0x02)	Message Router Object	Communication interface that can be used to generate requests for all of the device's classes and instances (→ Page 57)
04 (0x04)	Assembly Object	A package of multiple data corresponding to a data object in a data field. A typical application is using them to group all cyclic input or output data. (→ Page 59)
06 (0x06)	Connection Manager Object	Used to manage internal resources for I/O and explicit messaging connections
244 (0xF4)	Port Object	Device port description
245 (0xF5)	TCP/IP Interface Object	Information regarding the TCP/IP interface's settings
246 (0xF6)	Ethernet Link Object	Status information for an Ethernet 802.3 interface

The following chapters describe the most important CIP object classes in greater detail.

Service Codes

The following standard EtherNet/IP service codes are used in accordance with the CIP Specification:

Table 6: Standard service codes for CIP object classes

Service code	Service name	Description
1 (0x01)	Get_Attribute_All	Delivers the contents of the class or instance of the relevant object
2 (0x02)	Set_Attribute_All	Modifies the contents of the instance or of the class attributes of the relevant object
5 (0x05)	Reset	Resets the relevant object to its setpoint values
10 (0x0A)	Multiple_Service_Packet	Grouping of a self-defined number of attributes belonging to a class or instance
14 (0x0E)	Get_Attribute_Single	Delivers the contents of a single attribute
16 (0x10)	Set_Attribute_Single	Modifies a single attribute

6.1.1 Identity object 0x01

Identity object 0x01 delivers information via the EU5C-SWD-EIP-MODTCP SmartWire-DT gateway. This includes information regarding the device name, the device version, the serial number, and version information.

Overview of functions

Classes/ Instances	Attribute/Services	&Value
Classes		
	Attributes	0x01, 0x02, 0x03, 0x06, 0x07
	Services	0x01, 0x0E
Instances		
	Attributes	0x01, 0x02, 0x03, 0x04, 0x05, 0x06, 0x07
	Services	0x01, 0x05, 0x0E

Class Attributes

Attribute number	Attribute Name	Get/Set	Data type	Description	&Value
1 (0x01)	REVISION	G	UINT	Version	0x00 01
2 (0x02)	MAX OBJECT INSTANCE	G	UINT	Maximum number of object instances	0x00 01
3 (0x03)	NUMBER OF INSTANCES	G	UINT	maximum number of instances	0x00 01
6 (0x06)	MAX CLASS IDENTIFIER	G	UINT	Highest number of the implemented class attribute	0x00 07
7 (0x07)	MAX INSTANCE ATTRI-- BUTE	G	UINT	Highest number of the implemented instance attribute	0x00 07

Instance attributes

Attribute number	Attribute Name	Get/Set	Data type	Description
1 (0x01)	VENDOR	G	UINT	Manufacturer ID
2 (0x02)	DEVICE TYPE	G	UINT	Classifies the product as a communication adapter
3 (0x03)	PRODUCT CODE	G	UINT	Article No. (153163)
4 (0x04)	REVISION MAJOR MINOR	G	STRUCT of USINT USINT	Device version
5 (0x05)	DEVICE STATUS	G	WORD	Device status (see → Table 7)
6 (0x06)	SERIAL NUMBER	G	UINT	Device serial number
7 (0x07)	PRODUCT NAME	G	SHORT STRING	Length (first byte) and product name (EU5C-SWD-EIP-MODTCP)

6 Implemented EtherNet/IP objects

6.1 Standard CIP object classes

Gateway device status

Table 7: Gateway device status

BIT	Name	Value / Description
0 - 1	reserved	
2	Configured	1: Gateway has planned SmartWire-DT configuration 0: Gateway does not have a planned SmartWire-DT configuration
3	reserved	
4 - 7	Extended device status	0011: No input/output connection active 0110: At least one input/output connection in "RUN" operating mode 0111: At least one input/output connection; all in "IDLE" operating mode
8 - 15	reserved	

Common Services

Table 8: Common Services

Service code	Class	Instance	Service name
1 (0x01)	yes	yes	Get_Attribute_All Returns a pre-defined listing of this object's attributes
5 (0x05)	No	yes	Reset Starts the reset service for the device
14 (0x0E)	yes	yes	Get_Attribute_Single Returns the specific attribute's content

6.1.2 Message Router Object 0x02

This object establishes a connection to a class object or to an instance of the gateway

Overview of functions

Classes/Instances	Attribute/Services	&Value
Classes		
	Attributes	0x01, 0x02, 0x03, 0x04, 0x05, 0x06, 0x07
	Services	0x01, 0x0E
Instances		
	Attributes	0x01, 0x02
	Services	0x01, 0x0A, 0x0E

Class Attributes

Attribute number	Attribute Name	Get/Set	Data type	Description	&Value
1 (0x01)	REVISION	G	UINT	Version	0x00 01
2 (0x02)	MAX OBJECT INSTANCE	G	UINT	Maximum number of object instances	0x00 01
3 (0x03)	NUMBER OF INSTANCES	G	UINT	maximum number of instances	0x00 01
4 (0x04)	OPTIONAL ATTRIBUTE LIST NUMBER OF Attributs	G	STRUCT of UINT	Number of attributes	0x00 02
	OPTIONAL Attributs		ARRAY of UNIT	List of optional attributes	0x00 01 0x00 02
5 (0x05)	OPTIONAL SERVICE LIST NUMBER SERVICES	G	STRUCT of UINT	Number of services	0x00 01
	OPTIONAL SERVICES		ARRAY of UINT	List of optional services	0x00 0A
6 (0x06)	MAX CLASS IDENTIFIER	G	UINT	Highest number of the implemented class attribute	0x00 07
7 (0x07)	MAX INSTANCE ATTRIBUTE	G	UINT	Highest number of the implemented instance attribute	0x00 02

6 Implemented EtherNet/IP objects

6.1 Standard CIP object classes

Instance attributes

Attribute number	Attribute Name	Get/Set	Data type	Description	&Value
1 (0x01)	OBJECT LIST	G	STRUCT of	List of all the object class codes supported by the device	
	NUMBER		UINT	Number of classes	0x 00 0B
	CLASSES		ARRAY OF UINT	Classes supported by the gateway	0x00 01, 0x00 02, 0x00 04, 0x00 06, 0x00 F4, 0x00 F5, 0x00 F6, 0x00 64, 0x00 65, 0x00 00, 0x00 00
2 (0x02)	MAX NUMBER OF CONNECTIONS	G	UINT	maximum number of connections	0x00 20

Common Services

Table 9: Common Services

Service code	Class	Instance	Service name
1 (0x01)	yes	yes	Get_Attribute_All Returns a pre-defined listing of this object's attributes
10 (0x0A)	No	yes	Multiple_Service_Packet Performs a set of services as an autonomous sequence.
14 (0x0E)	yes	yes	Get_Attribute_Single Returns the specific attribute's content

6.1.3 Assembly object 0x4

The assembly object is used to group input or output data in order to be able to easily read and write large volumes of data using a single connection. The output data to all SmartWire-DT modules is grouped in instance 100. The inputs of all SmartWire-DT modules are grouped in instance 101. The object length varies and depends on the number of SmartWire-DT modules and their data volumes. The maximum object length is 496 bytes for each instance.

Overview of functions

Classes/ Instances	Attribute/Services	&Value
Classes		
	Attributes	0x01, 0x02, 0x03, 0x04, 0x06, 0x07
	Services	0x0E
Instances		
	Attributes	0x03, 0x04
	Services	0x10 (for instance 100 only), 0x0E

For explanations regarding the services, see Tabelle 6

Class Attributes

Attribute number	Attribute Name	Get/Set	Data type	Description	&Value
1 (0x01)	REVISION	G	UINT	Class version	0x00 02
2 (0x02)	MAX CLASS ID	G	UINT	Highest supported class number	0x00 65
3 (0x03)	NUMBER OF INSTANCES	G	UINT	Number of instances	0x00 02
4 (0x04)	OPTIONAL ATTRIBUTE LIST NUMBER OF Attributes	G	STRUCT of UNIT	Number of attributes	0x00 01
	OPTIONAL Attributes		ARRAY of UNIT	List of optional attributes	0x00 04
6 (0x06)	MAX CLASS IDENTIFIER	G	UINT	Highest number of the implemented class attribute	0x00 07
7 (0x07)	MAX INSTANCE ATTRIBUTE	G	UINT	Highest number of the implemented instance attribute	0x00 04

Common Services

Table 10: Common Services

Service code	Class	Instance 100	Instance 101	Service name
14 (0x0E)	yes	yes	yes	Get_Attribute_Single Returns the specific attribute's content
16 (0x10)	No	yes	No	Set_Attribute_Single Modifies a single attribute.

6 Implemented EtherNet/IP objects

6.1 Standard CIP object classes

Instance attributes of instance 100 and instance 101

Attribute number	Attribute Name	Instance	Get/Set	Data type	Description
3 (0x03)	DATA	100	G/S	ARRAY OF USINT	Output data
		101	G		Input data
4 (0x04)	SIZE	100/101	G	UINT	Number of Input/output data

How the data from instance 100 is mapped to the SmartWire-DT modules' outputs

All the output data of the PLC programming environment for the SmartWire-DT modules is stored in the data storage area for instance 100. The size of the data storage area depends on the number of configured SmartWire-DT modules and their type. When creating an SWD line with SWD-Assist, the total size of all output data is specified. This is equal to the size of the assembly object. The SmartWire-DT modules' output data is arranged continuously within the instance's data storage area. The beginning and the length of the individual output data for each module are also specified individually in SWD-Assist.

How the SmartWire-DT modules' input data is mapped to instance 101

The first two bytes of the data field contain the gateway's status → Table 7, page 56; the remaining bytes contain all of the SmartWire-DT modules' input data, including the corresponding status information. The size of the data storage area depends on the number of configured SmartWire-DT modules and their type. When creating an SWD line with SWD-Assist, the total size of all input data is specified. This is equal to the size of the assembly object. The SmartWire-DT modules' input data is arranged continuously within the instance's data storage area. The beginning and the length of the individual input data for each module are also specified individually in SWD-Assist.

6.1.4 Example: I/O data mapping

The following sample configuration will be used to show how data is mapped in instances 100 and 101 of the assembly object.

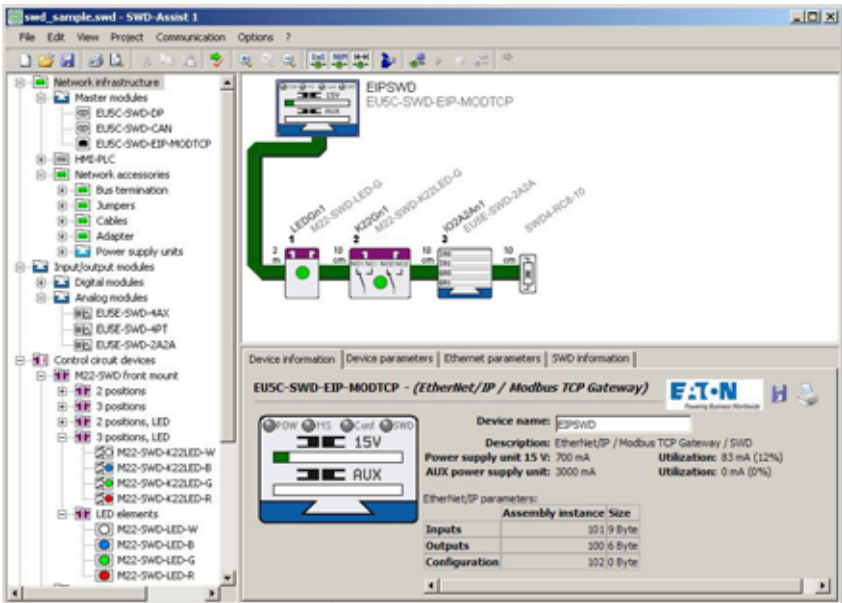


Figure 35: Sample configuration in SWD-Assist

Module 0:	Gateway EU5C-SWD-EIP-MODTCP
Module 1:	M22-SWD-LED-G, Indication element green
Module 2:	M22-SWD-K22LED-G, function element, 3 positions with green indication element
Module 3:	EU5E-SWD-2A2A, analog module, 2 analog inputs, 2 analog outputs

SWD-Assist shows the length of the instances of the assembly object for this configuration

	Assembly object instance	Length
Inputs	101	9 bytes
Outputs	100	6 bytes

6 Implemented EtherNet/IP objects

6.1 Standard CIP object classes

Tabelle 11 and Tabelle 12 show how the assembly object's instances are made up of the corresponding input/output data.

Table 11: Output data of SmartWire-DT modules in instance 100 of the assembly object

Byte 0:	1 Byte	Byte 2	bytes3	Byte 4	Byte 5
					High byte of analog output 2 EU5E-SWD-2A2A
				Low Byte of analog output 2 EU5E-SWD-2A2A	
			High Byte of analog output 1 EU5E-SWD-2A2A		
		Low Byte of analog output 1 EU5E-SWD-2A2A			
	Output M22-SWD-K22LED-G				
Output M22-SWD-LED-G					

Table 12: Gateway status and input data of SmartWire-DT modules in instance 101 of the assembly object

Byte 0:	1 Byte	Byte 2	bytes3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
								High Byte analog input 2 EU5E-SWD-2A2A
							Low Byte analog input 2 EU5E-SWD-2A2A	
						High Byte analog input 1 EU5E EU5E-SWD-2A2A		
					Low Byte analog input 1 EU5E-SWD-2A2A			
				Status EU5E-SWD-2A2A				
			Status M22-SWD-K22LED-G					
		Status M22-SWD-LED-G						
	High Byte Gateway status							
Low Byte Gateway status								



"Gateway status" is described in → Section "Table 7: Gateway device status", page 56.

The "SmartWire-DT Modules", MN05006001Z-EN describes the SmartWire-DT modules' input data.

6.2 Manufacturer-specific object classes

In addition to standard object classes, there are also vendor-specific classes (VSC = Vendor-Specific Class) that make it possible to access individual properties corresponding to the EtherNet/IP gateway and the SmartWire-DT modules. Object classes 0x64 and 0x65 are used for this purpose.

Class	Property Name	Description
100 (0x64)	Gateway	Data corresponding to gateway EU5C-SWD-EIP-MODTCP and the SmartWire-DT system, as well as acyclic access to the SmartWire-DT modules
101 (0x65)	SmartWire-DT	The SmartWire-DT modules' data and settings

6.2.1 Gateway object 0x64

Gateway object 0x64 makes it possible to access the data corresponding to the EU5C-SWD-EIP-MODTCP gateway and the SmartWire-DT system. In addition, acyclic access to the SmartWire-DT modules' data is also available.

Overview of functions

Classes/ Instances	Attribute/Services	&Value
Classes		
	Attributes	0x64, 0x65, 0x66, 0x67
	Services	0x0E
Instances		
	Attributes	0x64, 0x65, 0x66, 0x67, 0x68, 0x69, 0x6A, 0x6B, 0x6C, 0x6D, 0x6E, 0x6F, 0x70, 0x71, 0x72, 0x73, 0x74
	Services	0x10, 0x0E

For explanations regarding the services, see Tabelle 6

Class attributes of gateway object

Table 13: Class attributes of gateway object 0x64

Attribute number	Attribute Name	Get/Set	Data type	Description	&Value
100 (0x64)	CLASS REVISION	G	UINT	Version	0x00 01
101 (0x65)	MAX OBJECT INSTANCE	G	UINT	Maximum number of object instances	0x00 01
102 (0x66)	NUMBER OF INSTANCES	G	UINT	maximum number of instances	0x00 01
103 (0x67)	MAX CLASS IDENTIFIER	G	UINT	Highest number of the implemented class attribute	0x00 67

6 Implemented EtherNet/IP objects

6.2 Manufacturer-specific object classes

Instance attributes of gateway object

Table 14: Instance attributes of gateway object 0x64

Attribute number	Attribute Name	Get/Set	Data type	Description	&Value
100 (0x64)	MAX OBJECT ATTRIBUTE	G	USINT	Holds the number of the last object attribute	0x74
101 (0x65)	STATE	G	UINT	Current Gateway Status	see → Table 15, page 66
103 (0x67)	DEVICE ID	G	UINT	Manufacturer ID	
104 (0x68)	ORDER NAME	G	SHORT STRING	Length (first byte) and product name ("EU5C-SWD-EIP-MODTCP")	13 45 55 35 43 2D 53 57 44 2D 45 49 50 2D 4D 4F 44 54 43 50
105 (0x69)	SERIAL NO.		SHORT STRING	Device serial number	
106 (0x6A)	SW REVISION		SHORT STRING	Firmware Version of the Gateway	
107 (0x6B)	PROJECT PARAMETER		STRUCT of UINT USINT USINT UINT	Gateway Parameters SWD Baud rate (in kBit/s) Number of modules in the planned SmartWire-DT configuration CyclicExchangeDelay in ms SmartWire-DT project parameters	„SmartWire-DT device parameters; possible values of instance attribute 107, gateway object 0x64“ → Table 16, page 66
108 (0x6C)	PRODUCED DATA SIZE	G	UINT	Length of input data	
109 (0x6D)	CONSUMED DATA SIZE	G	UINT	Length of output data	
110 (0x6E)	FIRST CONFIGURATION ERROR (FIRST MISSING MANDATORY MODULE)	G	UINT	First module with an error (invalid part no., wrong serial number, etc.)	
111 (0x6F)	NODE COUNT	G	UINT	Number of modules in the target configuration	
112 (0x70)	NODE IDENTS	G VENDOR DEVICE	ARRAY of STRUCT USINT USINT	Manufacturer and device IDs for all the SmartWire-DT modules in the target configuration Manufacturer Device identification:	
113 (0x71)	INDEX	G/S	USINT	Object index for acyclic data	
114 (0x72)	DATA	G/S	ARRAY of USINT	Data for reading / writing acyclic data	

6 Implemented EtherNet/IP objects

6.2 Manufacturer-specific object classes

Attribute number	Attribute Name	Get/Set	Data type	Description	&Value
115 (0x73)	LENGTH	G/S	USINT	Length of acyclic read/write data	1 – 120
116 (0x74)	ERROR	G	UINT	Error Message	

6 Implemented EtherNet/IP objects

6.2 Manufacturer-specific object classes

Gateway status

Table 15: Gateway status; possible values of instance attribute 101, gateway object 0x64

&Value	Description
0x0000	no error
0x0001	FAILSAFE: no SmartWire-DT communication
0x0002	no project configuration present
0x0004	no target configuration present
0x0040	Renew Target Configuration
0x007F	SmartWire-DT initialization
0x0080	Wiring test active
0x0081	Error when comparing the target configuration and the actual configuration
0x0082	Error when comparing the project configuration and the target configuration

SmartWire-DT® project parameters

Table 16: SmartWire-DT device parameters; possible values of instance attribute 107, gateway object 0x64

BIT	Name	&Value	Value / Description
0	SWD Compatibility	0	Using the M22-NOP universal module is not permitted
		1	The M22-NOP universal module can be used as a substitute for a planned module
1	SWD Optional Modules	0	0=Default setting The device parameter on each SWD module is used to define whether the module is optional.
		1	All SWD modules are optional. The SWD line can be run with any number of failed SWD modules. Data will be transferred to the field bus master. The setting in the SWD modules → Section "Table 27: Device parameters of SWD modules", page 93, will have no effect.
3 - 15	reserved		

Acyclic data transfer

Gateway object 0x64 is also used to acyclically access the data of individual SmartWire-DT modules. Instance attributes 0x71 to 0x74 are used for this purpose.

Instance attributes

Table 17: Instance attributes of gateway object 0x64; extract from → Table 14

Attribute number	Attribute Name	Get/Set	Data type	Description	&Value
...					
113 (0x71)	INDEX	G/S	USINT	Object index for acyclic data	See note
114 (0x72)	DATA	G/S	ARRAY of USINT	Data for reading or writing acyclic data	
115 (0x73)	LENGTH	G/S	USINT	Length of the acyclic read/write data	
116 (0x74)	ERROR	G	UINT	Error Message	see → Table 18, page 67



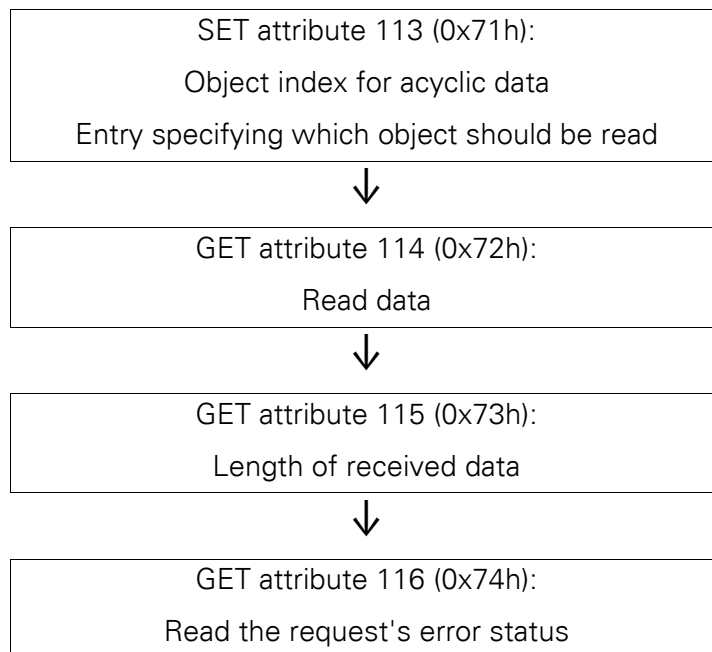
The number and meaning of the available object indexes are described in the "SmartWire-DT Modules", MN05006001Z-EN manual.

Error messages for acyclic data communications

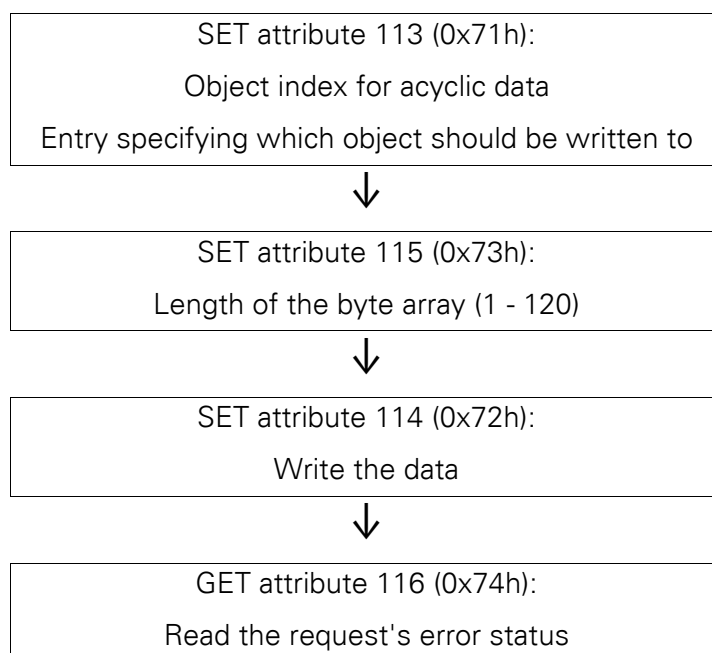
Table 18: Error messages; possible values of instance attribute 0x74, gateway object 0x64

&Value	Status	Description
0x0000	OK	no error
0x00BB	Pending	Acyclic data transfer running
0xFExx	Error	0xfe 3e : SmartWire-DT module address invalid 0xfe a0 : Read error 0xfe a1 : Write error 0xfe a2 : SmartWire-DT module error 0xfe b1 : invalid length 0xfe b2 : invalid index 0xfe b6 : Unallowed access 0xfe b7 : invalid area 0xfe b8 : invalid part no.
0xFFFF2	Busy	Acyclic channel is busy
0xFFFF3	TimedOut	Communications monitoring time has elapsed (timeout)
0xFFFF4	Com error	Communication fault
0xFFFF5	Not present	SmartWire-DT module not available
0xFFFF6	Permission denied	Access prohibited
0xFFFF7	Buffer size too small	Buffer size (attribute 0x73) is too small for data

Acyclic read request example



Acyclic write operation example



6.2.2 SWD modules object 0x65

Overview of functions

Classes/ Instances	Attribute/Services	&Value
Classes		
	Attributes	0x64, 0x65, 0x66, 0x67
	Services	0x0E
Instances		
	Attributes	0x64, 0x65, 0x66, 0x67, 0x68, 0x69, 0x6A, 0x6B, 0x6C, 0x6D, 0x6E, 0x6F, 0x70, 0x71, 0x72, 0x73, 0x74
	Services	0x10, 0x0E

For explanations regarding the services, see Tabelle 6

Class Attributes

A maximum of 0x0063_{hex}, i.e., 99_{dec}, instances can be created for the SmartWire-DT module object. This corresponds to the maximum number of 99 modules on a single SWD line.

Attribute number	Attribute Name	Get/Set	Data type	Description	&Value
100 (0x64)	CLASS REVISION	G	UINT	Version	0x00 01
101 (0x65)	MAX OBJECT INSTANCE	G	UINT	Maximum number of object instances	0x00 63
102 (0x66)	NUMBER OF INSTANCES	G	UINT	Maximum number of instances (= number of SmartWire-DT modules from the target configuration)	
103 (0x67)	MAX CLASS IDENTIFIER	G	UINT	Highest number of the implemented class attribute	0x00 67

Instance attributes for instances 1 to 99 (SmartWire-DT module address)

Attribute number	Attribute Name	Get/Set	Data type	Description
100 (0x64)	MAX OBJECT ATTRIBUTE	G	USINT	Number of the highest instance attribute (= 120)
101 (0x65)	STATE OF MODULE	G	UINT	SmartWire-DT module status → Table 19, page 70
102 (0x66)	VENDOR ID	G	USINT	Manufacturer ID
103 (0x67)	DEVICE ID	G	USINT	SmartWire-DT device classification
104 (0x68)	ORDER NAME	G	SHORT STRING	Length and name of the SmartWire-DT module
105 (0x69)	SERIAL NO.	G	SHORT STRING	Serial number

6 Implemented EtherNet/IP objects

6.2 Manufacturer-specific object classes

Attribute number	Attribute Name	Get/Set	Data type	Description
106 (0x6A)	SW REVISION	G	SHORT STRING	Firmware Version
107 (0x6B)	CURRENT PROFILE	G	UDWORD	Data profile
108 (0x6C)	CURRENT PARAMETER	G	USINT	Mode parameter
109 (0x6D)	EXTENDED DIAGNOSE	G	STRUCT of UDWORD UINT ARRAY of USINT	Extended SmartWire-DT module diagnostics Time point Extended diagnostic message → Table 20, page 71 List of currently pending diagnostic messages (maximum of 5) → Table 21, page 71
110 (0x6E)	EXTENDED PARAMETER SIZE	G	USINT	Size of extended parameter data
111 (0x6F)	EXTENDED PARAMETER	G	ARRAY of USINT	Extended parameter data (0 - 120 bytes)
112 (0x70)				
113 (0x71)	INDEX	G/S	USINT	Object index for cyclic data
114 (0x72)	DATA	G/S	ARRAY of USINT	Data buffer for acyclic read/write data
115 (0x73)	LENGTH	G/S	USINT	Length of read/write data
116 (0x74)	ERROR	G	UINT	Error Message
117 (75h)	PRODUCED DATA SIZE	G	UINT	Size of SmartWire-DT module input data
118 (76h)	PRODUCED DATA	G	ARRAY of USINT	Input data
119 (77h)	CONSUMED DATA SIZE	G	UINT	Size of SmartWire-DT module output data
120 (78h)	CONSUMED DATA	G	ARRAY of USINT	Output data

SmartWire-DT module device status

Table 19: Cyclic input data concerning the SmartWire-DT module's device status

BIT	Name	Value/Description
0	DIAG	0: no diagnostic alarm 1: SmartWire-DT module delivering diagnostics
1	RESERVED	reserved
2	PRSNT	0: SmartWire-DT module not present (input data has a value of 0) 1: module present
3	SUBST	0: Planned SmartWire-DT module present 1: Universal module present instead of planned SmartWire-DT module
4 - 15	RESERVED	reserved

Extended SmartWire-DT module diagnostics

Table 20: Extended SmartWire-DT module diagnostic data

BIT	Name	Description
0	MODUL MISSING	0: SmartWire-DT module not present 1: module present
1	MODUL DIAGNOSE	0: no diagnostic alarm 1: SmartWire-DT module delivering diagnostics
2	MODUL REPLACED	0: Planned module is present 1: Universal module present instead of planned module
3 - 15	RESERVED	reserved

The table below lists the error causes (in currently available SmartWire-DT modules) that can be queried if the diagnostics bit is set. The "SmartWire-DT Modules", MN05006001Z-EN, documents the various errors for each module (in the "Diagnostics" section).

Meaning of possible error values

If there is a diagnostic message for a SmartWire-DT module, instance attribute 0x6D of the corresponding SmartWire-DT module instance will contain a list of the diagnostic messages currently pending. A maximum of 5 error values will be stored in this list. The following table describes the possible error values.

Table 21: Meaning of error values in the list of currently pending diagnostic messages

Error value	Description
0x01	Overtemperature
0x02	Supply voltage too low
0x03	No connection to basic device
0x10	M22 contact position undefined
0x11	M22 Contact to short-circuit
0x13	(Overload or short-circuit)
0x14	Internal error
0x15	Manual/Auto switch position undefined
0x16	S0 interface error
0x17	Value exceeds measuring range
0x18	Value falls below measurement range

7 Modbus/TCP – SmartWire-DT® implementation

The Modbus-TCP communication system is based on the TCP/IP protocol being used. All data and parameters are entered into the TCP/IP frame's useful information data range. This data is integrated into a special MBAP frame that ensures that the data will be interpreted unambiguously. "MBAP" stands for ModBus Application Protocol. Special function codes are used to access the data (function codes 1 - 255).

Communications between Modbus modules are based on the client/server principle. The client, e.g., the PLC, uses function codes to transmit a request to the server, e.g., the EU5C-SWD-EIP-MODTCP gateway. The server responds to the request and returns the requested data to the client. If an error occurs during the communication request, e.g., because a request is not permitted, the client will receive an error message.

Data model and Modbus registers

In principle, Modbus differentiates between bit data and word data. Each of these is further subdivided into two available types:

Data Object	Data type	Access	maximum number
Input Status	BIT	Read	65536
Coil Status	BIT	Read / Write	65536
Input Register	Word	Read	65536
Holding register	Word	Read / Write	65536

These data structures are provided from the Modbus server side. The scope of the data access functions and the maximum number of data objects are both independent of the specific implementation being used.



The EU5C-SWD-EIP-MODTCP gateway only supports access to input and output registers.

In the case of Modbus, there are multiple addressing methods that can be used to access the data in the PLC. Their use depends on the selected PLC and the corresponding programming system. For example, when using the 5-digit addressing method, the PLC will work with an offset of 40001 and the entire data storage area will be offset by this number.

All references in this documentation are specified as hexadecimal values.

Tabelle 22 lists the various addressing methods, together with their corresponding limits, for the EU5C-SWD-EIP-MODTCP gateway.

Table 22: Addressing modes for Modbus

Description	hexadecimal	decimal	5 digit	6 digit
Input data	0x0000 - 0x03FF	0 - 1023	40001 - 41024	400001 - 401024
Output data	0x0800 - 0x0BFF	2048 - 3071	42048 - 43072	402048 - 403072
Name of the gateway	0x1000 - 0x1006	4096 - 4102	44097 - 44103	404097 - 404103
Status of the gateway	0x100C	4106	44107	404107
Bit-length of the digital outputs	0x1012	4114	44115	404115
Bit-length of the digital inputs	0x1013	4115	44116	404116
Version of register mapping	0x1017	4119	44120	404120
active monitoring time (in milliseconds)	0x1020	4128	44129	404129
Defined monitoring time (in milliseconds)	0x1120	4384	44385	404385
Modbus connection monitoring (in seconds)	0x1121	4385	44386	404386
"Modbus connection" operating mode	0x1130	4400	44401	404401
Used to save Modbus parameters	0x1131	4401	44402	404402
Used to restore the Modbus connection parameters	0x113C - 0x113D	4412 - 4413	44413 - 44414	404413 - 404414
Used to save the Modbus connection parameters	0x113E - 0x113F	4414 - 4415	44415 - 44416	404415 - 404416
Request space for acyclic service objects	0x0000 - 0x03FF	0 - 1023	40001 - 41024	400001 - 401024
Results space for acyclic service objects	0x0800 - 0x0BFF	2048 - 3071	42048 - 43072	402048 - 403072

More specifically, it supports the following functions:

Function code	Function	Explanation
3	Read Holding Registers	Used to read word output information
4	Read Input Registers	Used to read word input registers
6	Write Single Register	Used to write to a single word output register
16	Write Multiple Registers	Used to write to multiple word output registers
23	Read/Write Multiple Registers	Used to read from and write to multiple word registers

7.1 Overview of Modbus registers

The input and output register space makes it possible to access the gateway's data in a structured manner. Tabelle 23 below lists the available registers, together with their contents and address ranges. A detailed description of the registers is provided afterwards.

Table 23: Overview of Modbus registers

Modbus register, hexa-decimal	Read/Write	Data type	&Value	Description
SmartWire-DT input/output data				
0x0000 - 0x03FF	R	WORD	0 - FFFF	Input data (input register, input status)
0x0800 - 0x0BFF	R/W	WORD	0 - FFFF	Cyclic output data (holding register, coil status)
0x1012	R	WORD	0 - 5136	Bit-length of the digital outputs
0x1013	R	WORD	0 - 6400	Bit-length of the digital inputs
0x1017	R	WORD	1	Version of "mappings" register
Gateway device information				
0x1000 - 0x100B	R	STRING	EU5C-SWD-EIP-MODTCP	Name of the gateway
0x100C				Status of the gateway → Section "Register 0x100C: "Gateway-Status"", page 76
Time Tracker				
0x1020	R	WORD	0 - FFFF	Active time monitoring (in milliseconds)
0x1120	R/W	WORD	0 - FFFF Default setting: 3000 (= 3 seconds)	Defined time monitoring (in milliseconds)
0x1121	R/W	WORD	0 - FFFF	Time monitoring for the "Reset" register
0x1130	R/W	WORD		"Modbus connection" operating mode
0x1131	R/W	WORD	0 - FFFF Default setting: 0	Time monitoring for Modbus connection (in seconds) 0 = No time monitoring
0x113C - 0x113D	R/W	WORD		Used to restore the Modbus connection parameters
0x113E - 0x113F	R/W	WORD		Used to save the Modbus connection parameters
Acyclic SmartWire-DT data				
0x8000 - 0x807F				Request space for acyclic service objects → Section "7.5 Acyclic data communications", page 78
0x8080 - 0x80FF				Results space for acyclic service objects → Section "7.5 Acyclic data communications", page 78

7.2 SmartWire-DT® input/output data

Registers 0x1012 and 0x1013 on → Table 23, page 74 contain the length of the SmartWire-DT modules' input/output data. This length is defined in bits. Padding bytes are included.

The gateway mapping assignment version is provided via access to register 0x1017.

The SmartWire-DT modules' data is transferred to the Modbus registers for cyclic input/output data after the byte data. The volume and description of the input/output data depend on the specific characteristics of the SmartWire-DT modules being used. These characteristics are described in the "SmartWire-DT Modules", MN05006001Z-EN.

The input data consists of status information regarding the modules, as well as process data. Status information includes, for instance, information concerning the validity of data. Process data, meanwhile, can include data such as the contactor state of an M22 control device or analog values corresponding to a SmartWire-DT module. The SmartWire-DT modules' data (byte or word format) is allocated to Modbus registers in the SWD-Assist planning program.

Normally, the modules' data is allocated continuously to the word registers. When there are byte variables, the first byte is stored in the (word) Modbus register's high byte, while the second byte is stored in the low byte.

Rules for distributing SmartWire-DT module data across Modbus registers

If input data of data type "byte" is followed by additional input data of data type "WORD," an additional padding byte will be inserted before the last data type if the number of "byte" data types is odd. This is in order to make it possible to store word variables completely in a Modbus register.

Examples

3 input data instances of data type "byte" and 1 input data instance of data type "word"

MODBUS register	High byte	Low byte
n	1 Byte	Byte 2
n+1	Padding byte	bytes3
n+2	Input word	

2 input data instances of data type "byte" and 1 input data instance of data type "word"

MODBUS register	High byte	Low byte
n	1 Byte	Byte 2
n+1	Input word	

7 Modbus/TCP – SmartWire-DT® implementation

7.3 Device informations Gateway

A similar rule applies to output data. If a module's data storage area ends in a high byte (odd number of data bytes), a padding byte will be inserted in this case as well so that the word data of the following module will start in a new Modbus register.

Take the information in the SWD-Assist planning program into account. The information used to assign addresses to data is found in the export file.

7.3 Device informations Gateway

The gateway's device name can be found in register 0x100 - 0x100B → Table 23, page 74.

Register 0x100C: "Gateway-Status"

Register 0x100C holds information regarding the SmartWire-DT gateway's device status. This information is described in greater detail below:

Modbus register	R/W	Data type	&Value	Description
0x100C	R	WORD		Gateway status
			0x0000	no error
			0x0001	FAILSAFE: no SmartWire-DT communication
			0x0002	No planned SmartWire-DT configuration present
			0x0004	no target configuration present
			0x0040	Renew Target Configuration
			0x007F	SmartWire-DT initialization
			0x0080	Wiring test active
			0x0081	Error when comparing the target configuration and the actual configuration
			0x0082	Error when comparing the target configuration and the planned SmartWire-DT configuration

7.4 Time monitoring and Modbus-TCP operating mode

The following registers affect important Modbus-TCP communication behaviors, such as the response when a communications connection is lost, the operating mode of the Modbus connection, and saving these parameters as new default parameters for the gateway.

Registers 0x1020, 0x1120, 0x1121: "Time monitoring"

These registers are used to define the behavior of the SmartWire-DT modules' outputs when communications are lost on the Modbus connection. Register 0x1120 can be used to specify a time, in milliseconds, after which the outputs will be switched off if any of the following conditions are met:

- The controller switches from "Run" to "Stop"
- The Ethernet cable that is connected to the gateway is disconnected
- No Modbus-TCP communications between the PLC and the gateway

The setpoint value is 3000 (3000 milliseconds = 3 s). This means that the outputs will be switched off after 3 seconds in any of the above situations.

This needs to be taken into account when communications between the PLC and the gateway are based on an integrated firmware driver without cyclic access. If you are only using a user program to communicate, there may be extended pauses between communications operations. If, for example, you are working with the Master.Lib and ModbusSlave.Lib application libraries together with XControl PLCs, the following must be taken into account:

- Addressing between the PLC and the gateway is not cyclic, but sporadic instead (time > 3 s)
- Single-step operation during testing and commissioning

In these cases, change the value as required.



DANGER

Setting the timeout value in register 0x1120 to a value of "0" can result in dangerous situations, since set outputs will remain on even if there are no communications between the PLC and the gateway.

If time monitoring has been configured, the active time monitoring status can be read from register 0x1020. The time monitoring time is reset every time a Modbus/TCP frame is transmitted.

If there are no cyclic data transfers that will automatically reset the time monitoring time, the monitoring time can also be reset with write access to register 0x1121. This can also be done with any other Modbus/TCP frame.

**Registers 0x1113C, 0x1113D:
"Restore Modbus-TCP connection parameters"**

Registers 0x113C and 0x113D are used to restore the parameters in register 0x1120 to their setpoint values. To do this, a value of "0x6C6F" is first written to register 0x113C. In order to enable the reset, a value of "0x6164" ("LOAD") is then written to register 0x113D. This must be done within 30 seconds of writing to register 0x113C.

It is also possible to write to both registers with a single operation by using function codes FC16 and FC23. The parameters will be enabled, but will not be saved in a non-volatile manner yet. To save them in a non-volatile manner, it is necessary to use the "Save Modbus-TCP connection parameters" service.

**Registers 0x113E, 0x113F:
"Save Modbus-TCP connection parameters"**

Registers 0x113E and 0x113F are used to store the Modbus-TCP connection parameters held in register 0x1120 in a non-volatile manner. To do this, a value of "0x7361" is first written to register 0x113E. However, the data is not actually stored until command "0x7665" ("SAVE") is written to register

7 Modbus/TCP – SmartWire-DT® implementation

7.5 Acyclic data communications

0x113F. This must be done within 30 seconds of writing to register 0x113E. It is also possible to write to both registers with a single operation by using function codes FC16 and FC23

7.5 Acyclic data communications

In addition to cyclic data, acyclic information can also be exchanged between a Modbus-TCP master and a SmartWire-DT module. There are specific Modbus registers and services for assigning requests and for receiving the requested data for this purpose.

MODBUS register	Description
0x800C - 0x807F	Registers for request space
0x8080 - 0x80FF	Registers for response space

When acyclic services are used, the data is stored in these Modbus registers. The Modbus client will then wait until the request has been processed. This is indicated by means of a request acknowledgment. Once this acknowledgment is received, the response can be read. If acyclic communication requests for various modules are being processed at the same time, the PLC will manage them. The following table describes the detailed structure of these register spaces.

Registers 8000h - 807Fh: "Acyclic service objects, request space"

MODBUS register	Name	Data type	&Value	Description
0x8000	SERVICE NUMBER	UINT	0 - 0xFFFF	This register holds a user-specific value that is deleted after the service is run. The value is copied to the SERVICE NUMBER register in the response space after the service is run.
0x8001				
0x8002 (Low Byte)	INDEX	USINT	0 - 0xFF	The INDEX entry is used to specify the application object. Application objects are described in the "SmartWire-DT Modules", MN05006001Z-EN.
0x8002 (High Byte)	SERVICE CODE	USINT	0 - 255	The SERVICE CODE entry is used to specify the type of access: 0x00: NO FUNCTION 0x03: READ 0x10: WRITE
0x8003 (Low Byte)	DESTINATION ADDRESS	USINT	0 - 99	Address of the SmartWire-DT module
0x8003 (High Byte)	SLOT	USINT	0	0 (not a modular Modbus module)
0x8004	LENGTH	USINT	0 - 120	Length of data to be read or written
0x8005 - 0x807F	OPTIONAL DATA (Register 0 - 122)	UINT	0 - 0xFFFF	Object-specific data or error codes

Registers 0x8080 - 0x80FF:**"Acyclic service objects, response space"**

Once an acyclic communication request has been transmitted, the SERVICE NUMBER, INDEX, SERVICE CODE, DESTINATION ADDRESS, and SLOT information will be copied to the response space.

The SERVICE NUMBER parameter is used for a simple handshake in the PLC program. The request is in progress until the SERVICE NUMBER in the response space matches the SERVICE NUMBER in the request space.

MODBUS register	Name	Data type	&Value	Description
0x8080	SERVICE NUMBER	UINT	0 - 0xFFFF	This register holds a user-specific value that is deleted after the service is run. The value is copied to the SERVICE NUMBER register in the response space after the service is run.
0x8081	RESULT	UINT	0 - 0xFFFF	Result of request: 0x0000: ERROR FREE EXECUTION 0xFFFF: SERVICE PARAMETERS INCORRECT 0xFFFF: SERVICE CODE UNKNOWN
0x8082 (Low Byte)	INDEX	USINT	0 - 0xFF	Used to specify the application object.
0x8082 (High Byte)	SERVICE CODE	USINT	0 - 255	Used to specify the type of access: 0x00: NO FUNCTION 0x03: READ 0x10: WRITE
0x8083 (Low Byte)	DESTINATION ADDRESS	USINT	0 - 99	Address of the SmartWire-DT module
0x8083 (High Byte)	SLOT	USINT	0	0 (not a modular Modbus module)
0x8084	LENGTH	USINT	0 - 120	Length of the data provided
0x8085 - 0x80FF	OPTIONAL DATA (Register 0 - 122)	UINT	0 - 0xFFFF	Requested data

Registers 0x1300 - 0x137F**"Status of SmartWire-DT modules"**

MODBUS register	R/W	Data type	&Value	Description
0x1300 - 0x137F	R	USINT	0 - 0xF	The SmartWire-DT modules' status byte (0 - 99)

The status data provides information regarding the SmartWire-DT modules' status. It is found in bits 4 to 7 of the first input byte of the cyclic data of each SmartWire-DT module:

Table 24: SmartWire-DT module status

7	6	5	4	3	2	1	0
Diagnostic data							
SUBST	PRSNT	—	DIAG	—	—	—	—

7 Modbus/TCP – SmartWire-DT® implementation

7.5 Acyclic data communications

BIT	Name	Description
4	DIAG	0: There are currently no diagnostic messages from the module. 1: There is at least one diagnostic message. The exact cause of the diagnostic message can be read by using acyclic services. "SmartWire-DT Modules", MN05006001Z-EN, describes the various possible diagnostic alarms for each SmartWire-DT module.
6	PRSNT	0: Communications cannot be established between the gateway (SmartWire-DT coordinator) and the SmartWire-DT module. All input data has a value of 0. 1: The SmartWire-DT module is present and is exchanging data with the gateway (SmartWire-DT coordinator).
7	SUBST	0: The planned SmartWire-DT module is present 1: An M22-NOP(C) universal module is present instead of the planned SmartWire-DT module

8 What you need to know about SmartWire-DT®

This chapter provides a general overview of SmartWire-DT (SWD). For more detailed descriptions, please refer to the following manuals:

- "SmartWire-DT The System", MN05006002Z-EN
- "SmartWire-DT Modules", MN05006001Z-EN

With SmartWire-DT you can interconnect up to 99 modules very quickly in simple steps. Modules can consist of switchgears as well as I/O components.

The ribbon cable with the SWD modules and all components required for connecting them is called the SWD line. The SWD line starts at the blade terminal as a possible connection to the control relay and then ends at the bus termination.

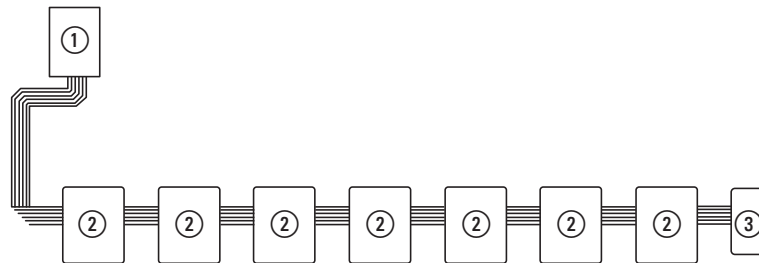


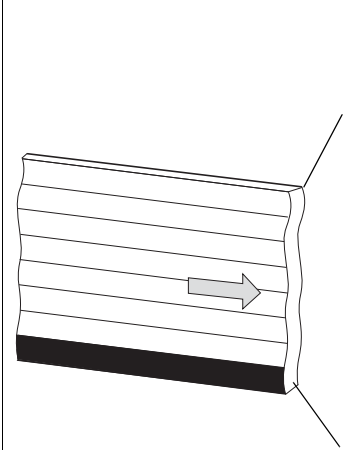
Figure 36: SWD coordinator with SWD line

- ① SWD coordinator
- ② SWD module
- ③ Bus termination

Wiring assignment

An 8-core connecting cable is used by SWD coordinator to feed the SWD modules with power and exchange data. SmartWire-DT is self-configuring and addresses its modules at the push of a button.

Table 25: Configuration of the SmartWire-DT ribbon cable

	Meaning	
	+24 V DC	U _{AUX} , Contactor control voltage
	Chassis ground	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 modules
	+15 V DC	U _{SWD} , Device supply voltage

The power supply for SWD coordinator and the SWD modules is connected via the POW terminals. The 15 V power supply of the SWD modules U_{SWD} is generated from POW.

If you wish to use contactors, circuit-breakers or motor starters in the installation with SmartWire-DT, a 24 V DC voltage U_{AUX} must be fed in at AUX.

Definition of terms: components - elements - modules

The SWD components consist of SWD modules and SWD elements.

SWD modules are all those SWD components that respond to a request from the SWD coordinator, i.e. can exchange data. They are assigned an SWD module address.

SWD elements are passive SWD components that do not exchange data but are required for operating the SmartWire-DT network. SWD elements are, for example, the power feeder modules, SWD cables, adapters etc. SWD elements are not given an SWD module address.

SWD universal module

If functions have to be retrofitted on an installation, modifications in the hardware configuration and program extension are normally very labor-intensive. The use of a universal module enables you to initially replace the SWD modules that are required at a later time. If the installation is then extended later, the planned modules are then installed instead of the universal modules. In this way, you will be able to retain all module addresses. A detailed description on connecting the universal modules is provided in the "SmartWire-DT Modules", MN05006001Z-EN.

Power feeder module

The number and the types of SWD modules determine the volume of data to be transferred and the current consumption.

You can use power feed modules if your application has a higher power consumption than the device provides, or if the cable length of the SWD line causes an increased voltage drop. Calculation examples are provided in the "SmartWire-DT The System", MN05006002Z-EN.

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

The EU5C-SWD-PF1 power feeder module feeds the 24 V DC supply voltage for contactors on the SWD line.

The EU5C-SWD-PF2 power feeder module feeds both the 24 V DC supply voltage for contactors as well as the 15 V DC supply voltage for other SWD modules on the SWD line.

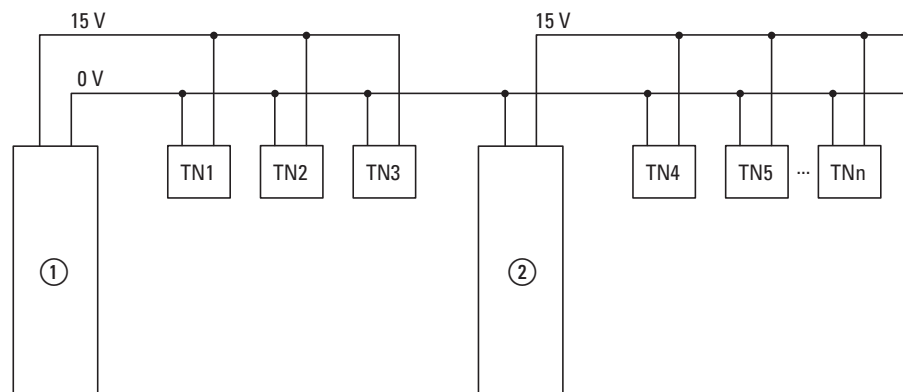


Figure 37: Schematic layout of an SWD line with the EU5C-SWD-PF2 power feeder module

- ① EU5C-SWD-EIP-MODTCP
- ② EU5C-SWD-PF2

8 What you need to know about SmartWire-DT®

8.1 Configurations

8.1 Configurations

The following different SWD configurations are possible:

1 Planned SWD configuration

Before the SWD coordinator can start running, the device must know which SWD modules are present and how their parameters have been configured. This collected information is found in the planned SWD configuration.

Depending on the field bus protocol that you will be using, you will be creating the planned SWD configuration in the PLC programming environment or in SWD assist.



Please note that the planned SWD configuration and the project configuration are not the same thing.

While the planned SWD configuration describes the parameters and the layout of the modules on the SWD line, the project configuration is the description for the controller as such.

2 Target configuration

Pressing the "Config" configuration button on the device will make the system determine the actual configuration and store it as a target configuration in the SWD coordinator.

3 Actual configuration

By this is meant the actual physical configuration present on the SWD line. Every time SWD coordinator is started, the actual configuration is determined and compared with the stored target configuration. time SWD coordinator is started, the actual configuration is determined and compared with the stored target configuration.

8.2 Changing the planned SWD configuration in SWD assist

To change the configuration of the SWD line, e.g., to add a new module or replace an existing one, you will have to change the planned SmartWire-DT configuration and import the target configuration again. Proceed as described in → Section "3.1.1 Reading of target configuration", page 30.

Example: Changing or replacing a module on the SWD line

Module M22-SWD-K11LED-W has one changeover contact and one white LED. This module is to be replaced with an M22-SWD-K22LED-W module, which features two changeover contacts and one white LED. In order to change the module, you would proceed as follows:

- ▶ Switch the power supply off at the device.
- ▶ Pull the M22-SWD-K11LED-W out of the external device plug.
- ▶ Plug the M22-SWD-K22LED-W into the external device plug.
- ▶ Switch on the power supply.

The SWD LED will show a red light, indicating that, as expected, the modules on the SWD line do not match the target configuration stored on the device.

8 What you need to know about SmartWire-DT®

8.2 Changing the planned SWD configuration in SWD assist

- ▶ Press the "Config" configuration button on the front of the device.

The device will detect all the modules currently on the SWD line and store them in the device as a target configuration.

The SWD LED will show a green light, as the modules on the SWD line will match the target configuration.

The Config LED will show a red light, as the modified target configuration will no longer match the planned SWD configuration. You will now have to make them match again by using SWD assist or the PLC programming environment.

In order to modify the planned SWD configuration in SWD assist, you would proceed as follows:

- ▶ Start SWD assist.
- ▶ Open the "*.swd" application file with File -> Open
- ▶ Switch to the Project view or turn off the Communication view by clicking on the "View" -> "Communication view" button.
- ▶ Replace the M22-SWD-K11LED-W module in the Project view. To do so, go to the device catalog and drag M22-SWD-K22LED-W to drop it where M22-SWD-K11LED-W is located on your workspace.

The SWD line will show the symbol for M22-SWD-K11LED-W instead of the original module.

- ▶ Save the changed project file „*.swd“ in the PC.
- ▶ In order to establish a connection to the device, first switch to the Communication view by clicking on the "View" > "Communication view" buttons.
- ▶ Click on the "Connection setup" button and then on the "Online" button.

The device information in SWD assist will show that the planned SWD configuration and the target configuration in the device still do not match.

Because of this, the planned SWD configuration in SWD assist will have to be transferred to the device.

- ▶ Store the modified planned SWD configuration on the device. To do this, click the "Configurations in the device" button and then the "PC=>device" button.

The device information will show the STOP device status.

The Config LED will show a green light. This indicates that the target configuration and the planned SmartWire-DT configuration match. The device can now run.

Device :

Project. ≠ Target config.

SWD status :

STOP

8 What you need to know about SmartWire-DT®

8.3 SWD cycle time

8.3 SWD cycle time

The SWD cycle time is the time required for the cyclic exchange of data between the coordinator and all modules using a common data frame on the SWD line.

The SWD gateway is the coordinator.

The SWD cycle time does not depend on the number of modules on the SWD line as much as it does on the amount of payload data that the summation frame needs to transmit. Within this context, "payload data bytes" refers to the number of input and output bytes of a module.

There are commonplace modules, such as switches, that transmit little payload data. However, there are also modules with multiple settings and read-out values, such as motor-protective circuit-breakers.

To calculate the SWD cycle time, each byte is counted as 10 bits, since a start bit and a stop bit are required for each byte for synchronization purposes. The SWD cycle time can be calculated using the following formula:

$$\text{SWD cycle time } t_p [\text{ms}] = \frac{1}{C} \left[n \cdot 10 \text{ bit} + 2 \text{ bit} \cdot n_{TN} + 30 \text{ bit} \cdot 10 \right]$$

n = Number of user data bytes.

C = Baud rate [kBit/s]

n_{TN} = number of modules

Example:

The following values are given:

Input bytes = 13 bytes

Output bytes = 8 bytes

Modules: 9

Baud rate = 125kBit/s

n = Number of user data bytes = 21

$$\text{SWD cycle time } t_p [\text{ms}] = \frac{1}{125 \text{ kBit/s}} \left[21 \cdot 10 \text{ bit} + 2 \text{ bit} \cdot 9 + 30 \text{ bit} \cdot 10 \right] = 4.224 \text{ ms}$$

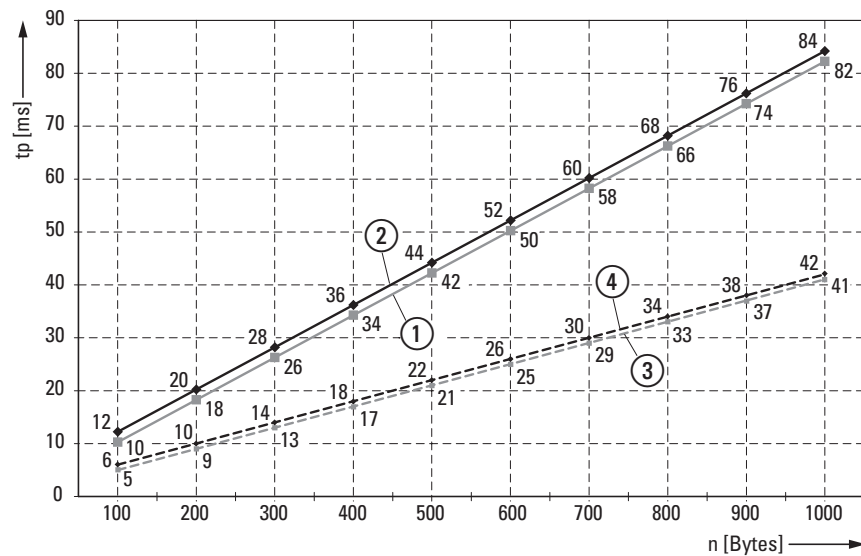


Figure 38: SWD cycle time based on the amount of transmitted payload data bytes

- ① 125 kBit/s: 1 SmartWire-DT module with n user data bytes
- ② 125 kBit/s: 99 SmartWire-DT module with n user data bytes
- ③ 250 kBit/s: 1 SmartWire-DT module with n user data bytes
- ④ 250 kBit/s: 99 SmartWire-DT module with n user data bytes

When the baud rate doubles, the SWD cycle time is cut in half. In the example above, the SWD cycle time goes from 4,224 ms at 125 kbit/s to 2.112 ms at 250 kbit/s.

8.4 Cyclical input and output data of the SWD modules

All the inputs and outputs of the SWD modules that are present are stored in a data storage area inside the SWD coordinator. This data storage area is referred to as the "process image." The input data can have a maximum size of 800 bytes, while the output data can have a maximum size of 642 bytes. In total, the data area must not exceed 1000 bytes. The cyclic exchange of data between the SWD coordinator and the SWD modules takes place in a common data frame. The input data can consist of several bytes, depending on the module. This input data contains information such as switch positions and diagnostic information.

The modules' input and output data is available to the PLC programming environment. To find out more about how it can be accessed, please refer to → Section "6.2 Manufacturer-specific object classes", page 63.

Diagnostics possibilities

The SWD coordinator can provide the following diagnostic information:

- Cyclic diagnostic information
- Extended diagnostics information

Cyclic diagnostics information

SmartWire-DT provides you with cyclical diagnostic information. This information can be evaluated in the program and used for further control tasks.

This basic diagnostic information is coded in the normal process image of each SWD module. The information about whether the SWD module is exchanging data normally or whether diagnostic alarms are currently present is provided on all SWD modules in the first input byte (byte 0) at bit positions 4 and 6.



DANGER

Persons, systems and machines may be put at risk if an N/C contact is misinterpreted. When using N/C contacts always evaluate the PRSNT and DIAG diagnostic bits of this module.

Example of input and diagnostic data

The M22-SWD-K11-LED-R function element has a red LED for illuminated pushbuttons and the two switch states 0 and 1. With cyclical input data of one byte, it contains information on switch position and diagnostic information.

Byte 0:

7	6	5	4	3	2	1	0
Diagnostic data				Input data			
SUBST	PRSNT	—	DIAG	—	—	NO1	NC1

8 What you need to know about SmartWire-DT®

8.4 Cyclical input and output data of the SWD modules

BIT	designation	Meaning
0	NC1 = Normally Closed	0: contact actuated 1: contact not actuated
1	NO1 = Normally Open	0: contact not actuated 1: contact actuated
2	Not used	-
3	Not used	-
4	DIAG	0: no diagnostic alarm 1: Diagnostic alarm present
5	Not used	-
6	PRSNT	0: module not present 1: module present
7	SUBST	0: planned module is present 1: M22-SWD-NOP(C) universal module present

The diagnostic bits of the individual SWD modules can be looked up in the "SmartWire-DT Modules", MN05006001Z-EN.

Example for output data:

The M22-SWD-K11-LED-R function element has a red LED for illuminated pushbuttons and the two switch states 0 and 1. With cyclical output data of one byte, it contains information on switch position and diagnostic information.

Byte 0:

7	6	5	4	3	2	1	0
–	–	–	–	–	–	–	Q0

BIT	designation	Meaning
0	Q0	Control section LED
1	Not used	–
2	Not used	–
3	Not used	–
4	Not used	–
5	Not used	–
6	Not used	–
7	Not used	–

Extended diagnostic services

If a SWD module is signaling "Diagnose," i.e., if bit 4 of input byte 0 is set to 1, the corresponding details can be obtained by evaluating the extended diagnostic services.

8 What you need to know about SmartWire-DT®

8.4 Cyclical input and output data of the SWD modules

If you were to determine the detailed states for an M22-SWD-K11-LED-R function element as an example of a SWD module, you would be able to get information on the following:

&Value	Meaning
0x10	The contact is longer than four seconds in the middle position.
0x11	There is a short-circuit in the contact.

If there is a diagnostic alarm present for an SWD module, this means that there is a fault on this module. Using the SWD assist software you can display the extended diagnostic alarms to identify the faults more closely.

Proceed as follows for SWD assist to display the extended diagnostic alarms:

- ▶ In SWD-Assist, switch to the Communication View by clicking on the "View" -> "Communication View" menu option.
- ▶ Connect to the SWD coordinator by clicking on the "Connection establishment" button -> "Online."
- ▶ In the workspace, click on the module that you want to diagnose.
- ▶ In the Properties field choose the "Diagnostics buffer" tab.

The table in the Properties field shows you the extended diagnostic alarms. The alarms are logged and displayed with a time stamp. The time stamp is based on the system time of your PC. The code is displayed in decimal notation. Diagnostic alarms can be categorized as follows:

- Code < 1000:
Alarm comes directly from the module; the code is the same as a fault on field bus systems. These fault messages are described in the "SmartWire-DT module" manual. The error codes stated there are in hexadecimal notation.
- Code $\geq$ 1000:
Alarm was generated by SWD coordinator as the SWD module can no longer send.

The extended diagnostic alarms are not retentive in the SWD assist. If SWD coordinator is switched off, the diagnostics buffer is cleared.

Further information on extended diagnostics is provided in the Online Help of SWD assist.

For more information on how to evaluate the extended diagnostic messages in the PLC programming environment, please refer to → Section "6.2 Manufacturer-specific object classes", page 63.

8.5 SWD device parameters

For EU5C-SWD-EIP-MODTCP all device parameters are adjustable via SWD assist.

A "required module" is a module for which the "Required module" device parameter = "1" so that it is enabled.

The "All devices are optional" and "Required module" device parameters define whether there is a SmartWire-DT error when the actual configuration is different from the target configuration.

The "Compatible devices permissible" and "Can be replaced with universal module" device parameters define whether there is a SmartWire-DT error when the target configuration is different from the planned configuration.

"Replacement during operation permissible" device parameter

The "Replacement during operation permissible" device parameter makes it possible to hot swap SWD modules block by block. In addition, the "All devices are optional" parameter must be set to "1". Otherwise, the entire line will be disabled if communications with one or more SmartWire-DT modules are lost.

NOTICE

Hot swapping modules on the SWD line is only allowed in conjunction with the SWD4-FFR-PF1-1 power supply module and SWD4-FFR-ST1-1 cable adapter SmartWire-DT components.

When "Replacement during operation permissible" is enabled, the SmartWire-DT coordinator will perform an automatic addressing routine if it detects any differences between the target configuration and the actual configuration when comparing them. The comparison between the planned SmartWire-DT configuration and the target configuration will continue to be performed.

Examples

Remember that if "All devices are optional" is set to "1" and is enabled, the SWD line will continue to run even if a module on the line drops out - regardless of whether "Replacement during operation permissible" is enabled or disabled.

When "Replacement during operation permissible" = "0", this means that the device parameter is not enabled. If the module is replaced with an identical module while the power is off, the target configuration will have to be imported again after the power is turned back on. The SWD line will not start running. In other words, the user is required to intervene.

When "Replacement during operation permissible" = "1", this means that the device parameter is enabled. If the module is replaced with an identical module while the power is off, a new target configuration will be automatically imported. If this imported target configuration matches the planned SmartWire-DT configuration, the SWD line will start running. The SWD line will also

8 What you need to know about SmartWire-DT®

8.5 SWD device parameters

start running if the new modules are compatible with the planned SmartWire-DT configuration and the "Compatible devices permissible" device parameter for these SmartWire-DT modules = "1", is enabled.

8.5.1 Device parameters of the SWD gateway

Table 26: Device parameter SWD coordinator

Device parameter adjustable on SWD coordinator	VALUE	Reaction SWD line
SWD Baud rate	125 Kbaud 250 Kbaud	125 Kbaud =setpoint value Baud rate on SWD line Setting options: • 125 Kbaud (setpoint value) • 250 kbaud (operating system V1.10 and higher)
All devices are optional	0	0=Default setting The device parameter on each SWD module is used to define whether the module is optional → Section "Required module", page 93.
	1	All SWD modules are optional. The SWD line can be run with any number of failed SWD modules. Data will be transferred to the field bus master. The → Section "Required module", page 93 setting in the SWD modules will have no effect.
Compatible devices permissible	0	0=Default setting The planned SWD modules in the SWD configuration must comply with the SWD modules of the stored gateway target configuration. If they do not, no data will be transferred to the field bus master.
	1	Data will be exchanged if the SmartWire-DT modules connected to the SWD line are identical to or compatible with the SmartWire-DT modules in the planned SmartWire-DT configuration. If they do not, no data will be transferred to the field bus master. This is displayed via the status LED on the device. You will find the list of devices that are compatible with one another in → Table 30, page 106.
Replacement during operation permissible	0	0=Default setting; New SWD modules on the SWD line must always be assigned an address by importing the target configuration.
	1	This setting enables block-by-block hot swapping for SWD modules without having to explicitly reconfigure them via the device by pressing the configuration button. In addition, the "All devices are optional" parameter must be set to "1". Otherwise, the entire line will be disabled if communications with one or more SmartWire-DT modules are lost.

8.5.2 Device parameters of SWD modules

Table 27: Device parameters of SWD modules

Device parameter adjustable on SWD module	Value	Reaction SmartWire-DT
Required module	1	Required SWD module 1=Setpoint value The SWD module must be present when the system starts and during operation. A missing SWD module causes following: • PRSNT diagnostic bit to be set to "0" • DIAG diagnostic bit to be set to "1" • The SWD line will not start running or will be stopped, as the case may be. Note: This device parameter will only take effect if the coordinator's "All devices are optional" device parameter is disabled, i.e., if it has a value of "0".
	0	The SWD line will keep running even if the SWD module is missing or defective.
Can be replaced with universal module	0	0=Setpoint value The SWD module can not be replaced by a universal module M22-SWD-NOP(C).
	1	The SWD module can be replaced by a universal module M22-SWD-NOP(C).

8.5.3 Application cases for the effective use of the device parameters

"Compatible devices permissible" is enabled

The system is already running and both the target configuration and the planned SWD configuration are stored on the SWD coordinator. The SWD coordinator is switched off in order to replace a defective module. As you don't have a replacement of the same type, you use a compatible type according to the table.

When you switch the SWD coordinator back on, the actual configuration will be determined. The automatic configuration comparison will detect the new module and signal this discrepancy by showing a solid red light on the Config LED. You will then have to press the "Config" configuration button. After this, the SWD coordinator will import the new target configuration. The SmartWire-DT coordinator will compare the target configuration with the planned SmartWire-DT configuration and detect a difference between both. The system will then check whether the "Compatible devices permissible" option has been enabled. If it has, the SWD coordinator will check whether the module in the target configuration is really compatible with the module in the planned SWD configuration. If it is, there is no SmartWire-DT error and the SWD line will start running.

"Can be replaced with universal module" is enabled

You've designed a system and you want to first use a universal module for a specific module, as the actual specific module will be installed as part of a later upgrade. To do this, you enable the "Can be replaced with universal module" device parameter.

This makes it possible for the module in the planned SmartWire-DT configuration to be replaced by a universal module in the target configuration. Once you install the universal module on the de-energized SWD line, you switch on the SWD coordinator and press the "Config" configuration button to import the target configuration. The check against the planned SWD configuration then shows that the configurations do not match. After this, the SWD coordinator checks whether the "Can be replaced with universal module" device parameter is enabled for this module. If it is, the SWD line will start running.

8.6 Faults on the SWD line

Different events can occur in conjunction with the SWD line, which require rectification.

Missing or faulty module

If the SWD coordinator determines that the actual configuration is missing a SWD module from the target configuration, the PRSNT diagnostic bit will be set to 0.

If the "All devices are optional" device parameter = "1", missing modules will not trigger a SmartWire-DT error. The "Required module" device parameter, which can be set individually for each SmartWire-DT module, will not be checked in this case. The Config LED and the SWD LED will show a solid green light.

If the "All devices are optional" device parameter on the SmartWire-DT coordinator = "0", the "Required module" device parameter on the individual SmartWire-DT module will be checked.

If the missing SmartWire-DT module is not a required SmartWire-DT module, the SWD line will keep running and will continue to work with the remaining SmartWire-DT modules. The Config LED and the SWD LED will show a solid green light.

If, however, the SWD module is a mandatory module, the SWD LED will show a flashing red light and the SWD line will not start running. The Config LED will show a solid green light, while the SWD LED will show a flashing red light.

If this error occurs during ongoing operation, e.g., because a module responds too late or is faulty, the SWD line will resume operation as soon as the error is fixed. A restart is not necessary.

8 What you need to know about SmartWire-DT®

8.6 Faults on the SWD line

"Wrong" or faulty module

An "incorrect" module is one that SWD coordinator finds which, when determining the actual configuration, is not expected in the target configuration.



Bear in mind that the serial number of the module is also examined for matching as well as the module type.

This means that if you replace a pushbutton actuator with one of the same type when the SWD line is switched off, it will be identified as an "incorrect" module by the SWD coordinator.

An "incorrect" SWD module on the SWD line can only be found on startup since the replacement of an SWD module is not permitted when the device is switched on. The following therefore distinguishes which cases an "incorrect" module can occur on an SWD line after startup.

If the SWD coordinator determines that an SWD module of the actual configuration does not match the target configuration, it defines it as an "wrong" module. The DIAG diagnostic bit stays at 0.

The same response also takes place if SWD coordinator finds more modules on the SWD line than is stored in the target configuration.

With a "wrong" module the SWD line does not go into operation. The Config LED is green, the continuous light; the SWD-LED is not flashing red.

You may wish to permit the "incorrect" module, because, for example, you wish to replace a faulty SWD module with a new one. Perhaps you wish to replace an SWD module with a compatible SWD module or with a universal module. In that case read further in → Section "Compatible devices permissible" is enabled", page 94 and → Section "Can be replaced with universal module" is enabled", page 94.

In any case, you will have to press the "Config" configuration button.

8.7 LEDs on the device

The SWD-LED indicates whether the actual configuration of the SWD line matches the target configuration.

The Config LED is used to indicate the result of the configuration comparison between the stored target configuration and the planned configuration. This comparison takes into account all relevant device and module parameters.

Table 28: LED SWD coordinator

LED		Status	Data exchange coupling unit PLC
SmartWire-DT	off	no supply voltage at POW no target configuration present	No
	Green continuous light	Actual configuration = Target configuration	yes
	green flashing	The SWD modules are being addressed and the actual configuration is being determined, e.g., after switching the system on or downloading a planned SWD configuration with s	No
	red flashing	actual configuration ≠ target configuration e.g., a required module is missing or one module too many	No
	Red continuous light	No SWD line present No 15 V DC device voltage present	No
	Changes from permanent orange to red	Firmware update mode The gateway is in firmware update mode when the POW LED is off. The firmware update mode can be left by switching on the supply voltage again.	No
Config	off	No planned SWD configuration is available, because e.g. • Initial Commissioning or • Program in SWD coordinator was deleted	No
	Green continuous light	target configuration = defined planned SWD configuration	yes
	Green flashing	A module from the planned SWD configuration has been replaced with a compatible module in the target and actual configurations	yes
	Red continuous light	Target configuration ≠ defined planned SWD configuration	No
	Changes from permanent orange to red	The gateway is in firmware update mode when the POW LED is off. The firmware update mode can be left by switching on the supply voltage again.	No

8 What you need to know about SmartWire-DT®

8.8 SWD assist

LEDs on the module

Table 29: LEDs on the relevant module

LED		Status
Module-LED	off	no 15 V supply voltage
	green flashing	Waiting for addressing
	green fast flashing	Error on module and diagnostic alarm is "1"
	Green continuous light	Module matches the target configuration.

Further information is provided in the manual "SmartWire-DT The System", MN05006002Z-EN.

8.8 SWD assist

The SWD assist planning, ordering and commissioning program can be used to perform the following functions, among others:

- Selecting modules, as well as a gateway
- Entering device parameters for the SWD gateway and the SWD modules
- Entering SWD network parameters
- Creating I/O allocation lists
- Transferring a planned SWD configuration to a gateway or, vice versa, from a gateway to the current SWD assist project
- Status indication of the inputs/outputs
- Wiring test
- Reading of the stored actual configuration
- Importing the planned SWD configuration stored on the gateway
- Comparison of the target and actual configuration
- Display of cyclical and acyclical diagnostics messages



A planned SWD configuration with the EU5C-SWD-EIP-MODTCP gateway can be created with SWD assist version 1.40 or higher.

The Online Help function provides a detailed description of how to use SWD-Assist. In order to open it, click on the "?" icon on the SWD-Assist menu bar or press the F1 key.

9 Appendix

9.1 Dimensions

EU5C-SWD-EIP-MODTCP		
Dimensions W × H × D	mm	35 × 90 × 124.5
	inch	1.38 × 3.54 × 4.9
Dimensions a	mm	120
	inch	4.7
Space units (SU) width		2
Weight	kg	0.16
	lb	0.35
Mounting Considerations		Top-hat rail IEC/EN 60715, 35 mm or screw fixing usingfixing brackets ZB4-101-GF1 (accessories).
Mounting position		Horizontal or vertical

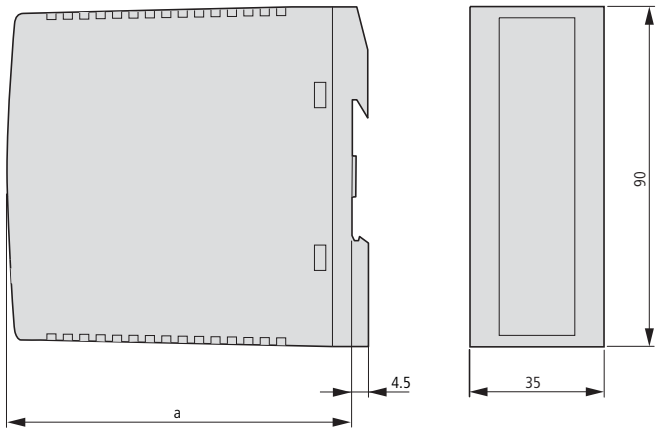


Figure 39: Dimensions EU5C-SWD-EIP-MODTCP

9.2 Technical data

9.2.1 Standards

	EU5C-SWD-EIP-MODTCP
Standards	EN 55011, EN 50178, EN 61131-2, IEC EN 61000-4, IEC60068-2-6, IEC60068-2-27

9.2.2 General ambient conditions

			EU5C-SWD-EIP-MODTCP
Ambient mechanical conditions			
Degree of protection (IEC/EN 60529, EN50178, VBG 4)			IP20
Vibrations (IEC/EN 61131-2:2008)			
constant amplitude 0.15 mm	Hz		5 – 8.4
constant acceleration 1 g	Hz		8.4 – 150
Mechanical shock resistance (IEC/EN 60068-2-27)	Impact		9
semi-sinusoidal 15 g/11 ms	resis- tances		
Drop to IEC/EN 60068-2-31	Drop height	mm	50
Free fall, packaged (IEC/EN 60068-2-32)		m	0.3
Ambient climatic conditions			
Operating ambient temperature (IEC 60068-2)		°C	-25 to +55
Condensation			prevent with suitable measures
Storage		°C	–40 to +70
Relative humidity, non-condensing (IEC/EN 60068-2-30)		%	5 – 95
Electromagnetic compatibility (EMC)			
Overvoltage category			II
Pollution degree			2
Electrostatic discharge (IEC/EN 61131-2:2008)			
Air discharge (Level 3)	kV		8
Contact discharge (Level 2)	kV		4
Electromagnetic fields (IEC/EN 61131-2:2008)			
80 - 1000 MHz	V/m		10
1.4 - 2 GHz	V/m		3
2 - 2.7 GHz	V/m		1
Radio interference suppression (SmartWire-DT)			EN 55011 Class A
Burst (IEC/EN 61131-2:2008, Level 3)			
Supply cables	kV		2
Fieldbus cable	kV		1
SmartWire-DT cables	kV		1
Surge (IEC/EN 61131-2:2008, Level 1)			
Supply cables/Fieldbus cable	kV		supply cable: 0.5, bus cable: 1
Radiated RFI (IEC/EN 61131-2:2008, Level 3)		V	10

9.2.3 Power supply

			EU5C-SWD-EIP-MODTCP
DC power supply AUX			
Rated operational voltage	V		24 DC -15 % +20 %
Residual ripple of input voltage	%		≤ 5
Protection against polarity reversal			Yes
Maximum current	I_{max}	A_x	CE:3 ¹⁾ UL: 2 ¹⁾
Short-circuit strength			no, external fuse CE: FAZ 3 UL: FAZ 2
Heat dissipation	W		Normally 1
Potential isolation			
from power supply POW			Yes
from serial interface			No
from SmartWire-DT			No
from fieldbus interface			Yes
Rated operating voltage of 24-V-DC modules	V		typical U_{AUX} - 0.2
DC power supply POW			
Supply voltage	V		24 DC -15 % + 20 %
	%		≤ 5
			Yes
Rated operational current	I_e	A_x	0.7
Overload proof			yes
Inrush current and length			12.5 A/6 ms
Heat dissipation at 24 V DC	W		3.8
Potential isolation between U_{POW} and 15 V SmartWire-DT supply voltage			No
Potential isolation			
from power supply POW			Yes
from serial interface			No
from SmartWire-DT			No
from fieldbus interface			Yes
Bridging voltage dips	ms		10
Repeat rate	s		1
Status display			POW-LED plain color: orange

1) When the total power consumption > I_{max} ,
an EU5C-SWD-PF1 or EU5C-SWD-PF2 power feeder module has to be used.

9.2.4 SmartWire-DT®

			EU5C-SWD-EIP-MODTCP
SmartWire-DT power supply U_{swd} (generated from the POW supply voltage)			
Rated operational voltage	U_e	V	$14.5 \pm 3 \%$
max. current	I_{max}	A	0,7 ¹⁾
Short-circuit strength			Yes
Potential isolation			
from power supply POW			No
from power supply AUX			Yes
from serial interface			No
from fieldbus interface			Yes
Connection supply voltages			
Connection type			Push in terminals
solid		mm ²	0.2 – 1.5 (AWG 24 – 16)
flexible with ferrule		mm ²	0.25 – 1.5
SmartWire-DT line			
Module type			SWD configurator
Max. number of SmartWire-DT modules			99
Baud rate		kBd	125/250
Interface standard of data cable			RS485
Address setting			automatically via configuration button
Status display			Multi-color SWD-LED: orange/ green/red Dual colored Config LED: green/red
Connections			Plug, 8-pole
Plug connectors			Blade terminal SWD4-8MF2
Bus termination resistor SWD line			integrated in the device: the end of the SWD line must be terminated with SWD-RC8-10

1) When the total power consumption $> I_{max}$,
an EU5C-SWD-PF2 power feeder module has to be used.

9.2.5 Field bus interface Ethernet/IP and Modbus-TCP

		EU5C-SWD-EIP-MODTCP
Fieldbus interface		
Function		Ethernet/IP module or Modbus-TCP module
Default port		MODBUS: 502 EIP: TCP 44818 UDP 2222
Protocol		Ethernet/IP or Modbus TCP
Input data, maximum	Byte:	Ethernet/IP: 500 Modbus TCP: 800
Output data, maximum	Byte:	Ethernet/IP: 496 Modbus TCP: 642
Baud rate	MBit	10 / 100
Baud rate detection		automatic
Address setting		automatic
Module address		
Address setting with		Dip switch/DHCP/BOOTP
Status display		MS-LED two-colored: red/green
Status display at the Ethernet interface		LEDs at the RJ45 sockets two-colored: yellow/green yellow: baud rate (10/100 MBit/s) green: link status (active/data exchange/not active)
Terminal types		2 × RJ45 plugs (2 channel switch)
Potential isolation		
from power supply POW / AUX		yes
from serial interface		yes
from SmartWire-DT		yes

9.2.6 Diagnostics interface

		EU5C-SWD-EIP-MODTCP
Diagnostics interface		
Part no.		RS232
Terminal types		RJ45
Potential isolation		
from power supply POW / AUX		No
from SmartWire-DT		No
from fieldbus interface		Yes

9 Appendix

9.3 Compatible SWD module types

9.3 Compatible SWD module types

You can find permissible SWD modules and their permissible replacement types:

Table 30: List of types that are compatible with one another

Part no.	Description	permissible replacement type 1	permissible replacement type 2
RMQ function elements (front mount)			
M22-SWD-K11	Function element, 2 pos. front	M22-SWD-K22	
M22-SWD-K22	Function element, 3 pos. front		
M22-SWD-LED-W	Function element, LED W front	M22-SWD-K11LED-W	M22-SWD-K22LED-W
M22-SWD-K11LED-W	Function element, 2 pos., LED W, front	M22-SWD-K22LED-W	
M22-SWD-K22LED-W	Function element, 3 pos., LED W, front		
M22-SWD-LED-R	Function element, LED R front	M22-SWD-K11LED-R	M22-SWD-K22LED-R
M22-SWD-K11LED-R	Function element, 2 pos., LED R, front	M22-SWD-K22LED-R	
M22-SWD-K22LED-R	Function element, 3 pos., LED R, front		
M22-SWD-LED-G	Function element, LED G front	M22-SWD-K11LED-G	M22-SWD-K22LED-G
M22-SWD-K11LED-G	Function element, 2 pos., LED G, front	M22-SWD-K22LED-G	
M22-SWD-K22LED-G	Function element, 3 pos., LED G, front		
M22-SWD-LED-B	Function element, LED B front	M22-SWD-K11LED-B	M22-SWD-K22LED-B
M22-SWD-K11LED-B	Function element, 2 pos., LED B, front	M22-SWD-K22LED-B	
M22-SWD-K22LED-B	Function element, 3 pos., LED B, front		

9 Appendix

9.3 Compatible SWD module types

Part no.	Description	permissible replacement type 1	permissible replacement type 2
RMQ function elements (base fixing)			
M22-SWD-KC11	Function element, 2 pos., base	M22-SWD-KC22	
M22-SWD-KC22	Function element, 3 pos., base		
M22-SWD-LEDC-W	Function element, LED-W, base	M22-SWD-K11LEDC-W	M22-SWD-K22LEDC-W
M22-SWD-K11LEDC-W	Function element, 2 pos., LED-W, base	M22-SWD-K22LEDC-W	
M22-SWD-K22LEDC-W	Function element, 3 pos., LED-W, base		
M22-SWD-LEDC-R	Function element, LED-R, base	M22-SWD-K11LEDC-R	M22-SWD-K22LEDC-R
M22-SWD-K11LEDC-R	Function element, 2 pos., LED-R, base	M22-SWD-K22LEDC-R	
M22-SWD-K22LEDC-R	Function element, 3 pos., LED-R, base		
M22-SWD-LEDC-G	Function element, LED-G, base	M22-SWD-K11LEDC-G	M22-SWD-K22LEDC-G
M22-SWD-K11LEDC-G	Function element, 2 pos., LED-G, base	M22-SWD-K22LEDC-G	
M22-SWD-K22LEDC-G	Function element, 3 pos., LED-G, base		
M22-SWD-LEDC-B	Function element, LED-B, base	M22-SWD-K11LEDC-B	M22-SWD-K22LEDC-B
M22-SWD-K11LEDC-B	Function element, 2 pos., LED-B, base	M22-SWD-K22LEDC-B	
M22-SWD-K22LEDC-B	Function element, 3 pos., LED-B, base		
DILM/MSD function elements			
DIL-SWD-32-001	DIL/MSD	DIL-SWD-32-002	
DIL-SWD-32-002	DIL/MSD, Manual/Auto		
PKE-SWD-32			
I/O function elements			
EU5E-SWD-4DX	Digital module, 4 inputs		
EU5E-SWD-8DX	Digital module, 8 inputs		
EU5E-SWD-4D4D	Digital module, 4 inputs, 4 outputs		
EU5E-SWD-4D2R	Digital module, 4 inputs, 2 outputs		
EU5E-SWD-X8D	Digital module, 8 outputs		
EU5E-SWD-4AX	Analog module, 4 inputs		
EU5E-SWD-2A2A	Analog module 2 inputs, 2 outputs		
EU5E-SWD-4PT	Analog module, 4 temperature inputs		
EU5E-SWD-4PT-2	Analog module, 4 temperature inputs		

9 Appendix

9.3 Compatible SWD module types

Index

A

Actual configuration	84
Acyclic data communications	
Ethernet/IP	63
Modbus/TCP	78
Add SWD module	84

B

Baud rate	12
Baud rate SmartWire-DT	92
Blade terminal SmartWire-DT -4-8MF2	22
BOOTP-Server	
Address setting	15
Bus termination resistor	
SmartWire-DT	81

C

Cable protection	21
CIP	53
CIP object classes	54
commissioning	27
Configuration buttons	10, 84
Configuration comparison	97
Connection terminals	21
CSV	46
Cycle time	
SWD	86
Cyclical SWD input and output data	88

D

Data communication	
acyclic	78
Device baud rate	12
Device connection	20
Device parameters	91
DHCP-Server	
Address setting	14
Diagnostics	
SmartWire-DT	88
Diagnostics interface	10, 24
DIP	13
DIP Switch	17
DLR	12
Download Center	5

E

Engineering	11
Error	
at SWD line	91
EU5C-SWD-EIP-MODTCP	
Default Ethernet settings	13
Exchange SWD module	84
Extended diagnostic alarms	89

F

Field bus protocol	
EtherNet/IP	36
Modbus-TCP	36
Fieldbus interface	10

I

IP address	
Default setting	13

L

LED	
Config	97
SWD	97
SWD module	98

M

Module	
required module	91
wrong module	96

O

ODVA	53
Online replacement	91

P

Parameter	
All devices are optional	92
Can be replaced with universal module	93
Compatible SWD modules permissible	92
Replacement during operation permissible	92
Required module	93
PGM	15
Address setting	15
Power feeder module	83
Programming cable	24
Project configuration	84
Putting the SmartWire-DT into operation	27

R

Remove SWD module	84
Replace SWD module	84
Required module	91

S

SmartWire-DT	81
Cable layout	82
Cyclical diagnostic information	88
Device Parameters	91
Diagnostics options	88
Error on SWD line	95
Extended diagnostic messages	89
LED displays SWD coordinator	97
LED displays SWD module	98
Module	11
Network	11
Power feeder module	83
Universal module	82
Support Center	5
SWD	
Components	82
Elements	82
Line	10, 81
SWD Baud rate	92
SWD cycle time	86
Switch	11

T

Target configuration	84
Technical Data	100
The address is set directly on the device	14

U

Universal module	82
CANopen	93
Updating the operating system	52

V

VSC	53
-----------	----

W

Web-Interface	51
Wiring in accordance with EMC requirements	25
Wrong module	96