Remote-I/O-System u-remote UR20

Stepper motor module UR20-1SM-50W-6DI2DO-P

Manual

Let's connect.

Weidmüller

Content

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1 About this documentation

1.1 Symbols and notes

The safety notices in this documentation are designed according to the severity of the danger.

DANGER

Imminent danger to life!
Notes with the signal word “Danger” warn you of situations that will result in serious injury or death if you do not follow the instructions given in this manual.

WARNING

Possible danger to life!
Notes with the signal word “Warning” warn you of situations that may result in serious injury or death if you do not follow the instructions given in this manual..

CAUTION

Risk of injury!
Notes with the signal word “Caution” warn you of situations that may result in injury if you do not follow the instructions given in this manual.

ATTENTION

Material damage!
Notes with the signal word “Attention” warn you of hazards that may result in material damage.

Text next to this arrow are notes that are not relevant to safety, but provide important information about proper and effective work procedures.

The situation-dependent safety notices may contain the following warning symbols:

Symbol	Meaning
	Warning against dangerous electrical voltage
	Warning against explosive atmospheres
	Warning against electrostatically charged components
	Warning against automatic startups
	Observe the documentation

- ► All instructions can be identified by the black triangles next to the text.
- – Lists are marked with a tick.

1.2 Complete documentation

The documentation is intended for trained electricians who are familiar with national and international laws, provisions and standards.

This manual contains product-specific information and notes about the Stepper motor module UR20-1SM-50W-6DI2DO-P. It supplements but does not replace the **u-remote IP20 manual** (document No. 1432790000).

The **u-remote Web Server Manual** (document No. 2112220000) describes how to use the web server application.

All documents are available to download on the Weidmüller Website.

1.3 Standard data structure

All given details of data structure (e.g. process data, parameters) refer to the u-remote internal mapping, when the standard data format is set in the coupler parameters (see table below).
The way these data are represented by other fieldbus participants (e.g. the PLC), depends additionally on the fieldbus specification and the data format of the communicating device. Therefore it might happen, that bytes are changed within a word or words are changed within a double word.

Standard data formats

Fieldbus coupler	Standard data format
UR20-FBC-PB-DP, UR20-FBC-PB-DP-V2	Motorola
UR20-FBC-PN-IRT, UR20-FBC-PN-IRT-V2, UR20-FBC-PN-ECO	
UR20-FBC-MOD-TCP, UR20-FBC-MOD-TCP-V2, UR20-FBC-MOD-TCP-ECO	
UR20-FBC-CAN	Intel
UR20-FBC-EC, UR20-FBC-EC-ECO	
UR20-FBC-EIP	
UR20-FBC-DN	
UR20-FBC-PL	
UR20-FBC-IEC61162-450	

1.4 Software releases described

The present manual describes the following firmware releases of the couplers:

Firmware releases

Order No.	Fieldbus coupler	Release
1334870000	UR20-FBC-PB-DP	01.09.00
2614380000	UR20-FBC-PB-DP-V2	01.09.00
1334880000	UR20-FBC-PN-IRT	01.08.00
2566380000	UR20-FBC-PN-IRT-V2	01.10.01
2659680000	UR20-FBC-PN-ECO	01.00.00
1334910000	UR20-FBC-EC, HW 01.xx.xx	01.11.00
1334910000	UR20-FBC-EC, HW 02.xx.xx	01.12.00
2659690000	UR20-FBC-EC-ECO	01.00.00
1334930000	UR20-FBC-MOD-TCP	02.07.00
2476450000	UR20-FBC-MOD-TCP-V2	02.08.00
2659700000	UR20-FBC-MOD-TCP-ECO	01.00.00

Firmware releases

Order No.	Fieldbus coupler	Release
1334920000	UR20-FBC-EIP, HW 01.xx.xx	01.08.00
1334920000	UR20-FBC-EIP, HW 02.xx.xx	02.09.00
1334900000	UR20-FBC-DN	01.08.00
1334890000	UR20-FBC-CAN	01.08.00
1334940000	UR20-FBC-PL	01.08.00
2661310000	UR20-FBC-IEC61162-450	01.01.00

Device description files

Fieldbus protocol	Release	
PROFIBUS	UR20-FBC-PB-DP	2.93
	UR20-FBC-PB-DP-V2	2.93
	UR20-FBC-PN-ECO	20200227
PROFINET	UR20-FBC-PN-IRT	20200105
	UR20-FBC-PN-IRT-V2	20200207
EtherCAT	UR20-FBC-EC	00011200
	UR20-FBC-EC-ECO	00010000
Ethernet/IP	1.6	
DeviceNet	1.3	
CANopen	1.19	
POWERLINK	1.0	

Web server language files

Language	Release	Availablity
German	01.05.00	On delivery
English	01.05.00	On delivery
Chinese	01.05.00	On delivery
French	01.05.00	Available online
Italian	01.05.00	Available online
Spanish	01.05.00	Available online
Portuguese	01.05.00	Available online
Korean	01.05.00	Available online
Japanese	01.05.00	Available online

2 Safety

This chapter includes general safety instructions for handling the Stepper motor module UR20-1SM-50W-6DI2DO-P. Specific warning notices for specific tasks and situations are given at the appropriate places in the documentation. Failure to observe the safety and warning notices can result in damage to persons and material.

This manual contains product-specific information and notes about the Stepper motor module UR20-1SM-50W-6DI2DO-P. It supplements but does not replace the **u-remote IP20 manual** (document No. 1432790000). The manual is available to download from the Weidmüller website.

2.1 General safety notice

Work on the u-remote products may only be performed by qualified electricians with the support of trained persons. As a result of their professional training and experience, an electrician is qualified to perform the necessary work and identify any potential risks.

Before any work is carried out on the products (installation, maintenance, retrofitting), the power supply must be switched off and secured against being switched on again. Work may be carried out with safety extra-low voltage (SELV/PELV). When working during continued operations, the emergency stop mechanisms must not be made ineffective.

The u-remote products do not comprehend any components or parts that can be maintained by the operator. If a malfunction on a u-remote product cannot be fixed after following the recommended measures (see Chapter 7), the product in question must be sent back to Weidmüller. Weidmüller does not assume any liability if the product has been tampered with!

Electrostatic discharge

u-remote products can be damaged or destroyed by electrostatic discharge. When handling the products, the necessary safety measures against electrostatic discharge (ESD) according to IEC 61340-5-1 and IEC 61340-5-2 must be observed.

All devices are supplied in ESD-protected packaging. The packing and unpacking as well as the installation and disassembly of a device may only be carried out by qualified personnel and in accordance with the ESD information.

Open equipment

u-remote products are open equipment that may only be installed and operated in lockable housings, cabinets or electrical operations rooms. Only trained and authorised personnel may access the equipment.

For applications requiring functional safety, the surrounding housing must meet at least IP54. The standards and guidelines applicable for the assembly of switch cabinets and the arrangement of data and supply lines must be complied with.

Fuse protection

The operator must set up the equipment so that it is protected against overloading. The 24 V DC power supply units used must fulfill the SELV category, no matter whether they supply the system or feed-in modules. The output voltage of the feed-in power supply has to fulfill overvoltage category 1 according to IEC 61010. When connecting to outer current circuits the respective overload category has to be regarded for each single module of the u-remote station (see technical data).

The main switch, the switches of the subsequent circuits, the cable cross-sections and the fuse protection have to be configured according to IEC 61010. The current demand must be caluclated separately for each single u-remote station as described in the u-remote IP20 manual.

In the case of modules without fused sensor/actuator power supplies, all lines to the connected sensors/actuators must be fused corresponding to their conductor cross-section (as per DIN VDE 0298 Part 4).

To meet UL-specifications in accordance with UL 248-14, a UL-certified automatic fuse (e.g. ABB Type S201-B16) or a 10 A fuse with a medium time-lag (e.g. ESKA Part No. 522.227) must be used.

All connections of the u-remote components are protected against voltage pulses and overcurrent in accordance with IEC 61131-2, Zone B. The operator has to decide whether additional overvoltage protection according to IEC 62305 is required. Voltages that exceed +/-30 V may cause the destruction of couplers and modules.

Earthing

Via an FE spring on its underside each coupler and each module is electrically connected to the DIN rail. This connection is only established certainly if the assembly is carried out carefully and in accordance with the instructions (u-remote IP20 manual). In order to ensure the earthing of the station the DIN rail must be connected to the protective earth via the earth terminals (PE).

Shielding

Shielded lines are to be connected with shielded plugs and fixed on a shield bus in compliance with the relevant standard (see u-remote IP20 manual, Chapter 8).

2.2 Intended use

The stepper motor module UR20-1SM-50W-6DI2DO-P is an I/O module from the u-remote series that is designed for use in a u-remote station. The module can be used to connect a two-phase stepper motor with the u-remote station. The connected motor must have a nominal current of at least 200 mA.

The motor and module electronics are supplied by an external power supply (12–50 V DC). If the stepper motor module is used with a safe power-feed module (UR20-PF-O-X-SIL), note that only the digital outputs on the stepper motor module are safely switched off. The system operator must ensure that the external power supply is disconnected in the event of a fault.

The products of the u-remote series are intended for use in industrial automation. A u-remote station with bus coupler and connected modules is intended for the decentralised control of systems or sub-systems. Via the fieldbus coupler every module of a station is integrated into a fieldbus structure and connected to the superordinate control unit. The u-remote products conform to protection class IP20 (in accordance with IEC 60529).

The observance of the documentation is part of the intended use. The products described in this manual may only be used for the intended applications and only in connection with certified third-party devices or components. The product-specific protective measures can become ineffective in the event of deviating use.

2.3 Use in a potentially explosive atmosphere

Unless otherwise noted, the u-remote products can be used in potentially explosive atmospheres rated as Zone 2 (as per Directive 2014/34/EU). The u-remote products are suitable for use in Class I, Division 2, Groups A to D according to NFPA publication 70.

If u-remote products are used in potentially explosive atmospheres, the following notes are also applicable:

- Staff involved in assembly, installation and operation must be qualified to perform safe work on electrical systems protected against potentially explosive atmospheres.
- The requirements according to IEC 60079-14 must be observed.
- The substitution of any components may impair suitability for Class I, Divsion 2.
- The equipment shall be installed in an enclosure that provides a degree of protection not less than IP54 in accordance with IEC 60079-15, accessible only by the use of a tool.
- The housing enclosing must meet the requirements of explosion protection type Ex n or Ex e.
- The u-remote station may only be installed in horizontal orientation.
- Sensors and actuators that are located in Zone 2 or in a safe zone can be connected to the u-remote station.
- If the ambient temperature under rated conditions exeeds 55 °C, the cables used for feed-in (on the fieldbus coupler and on power-feed modules) must be specified for at least 90 °C.
- If the temperature under rated conditions exceeds 70 °C at the cable or conduit entry point, or 80 °C at the branching point of the conductors, the temperature specification of the selected cable shall be in compliance with the actual measured temperature values.
- The equipment shall only be used in an area of not more than pollution degree 2, as defined in IEC 60664-1.
- A stabilised power supply with double or reinforced insulation must be used (24 V DC current for supplying the u-remote station, 12–50 V DC current for the separate power supply).
- A visual inspection of the u-remote station is to be performed once per year.
- While explosive atmosphere is present:
  - No electrical connection shall be separated in energized condition.
  - The USB interface shall not be used.
  - Dip-switches, binary-switches and potentiometers shall not be actuated.

2.4 Legal notice

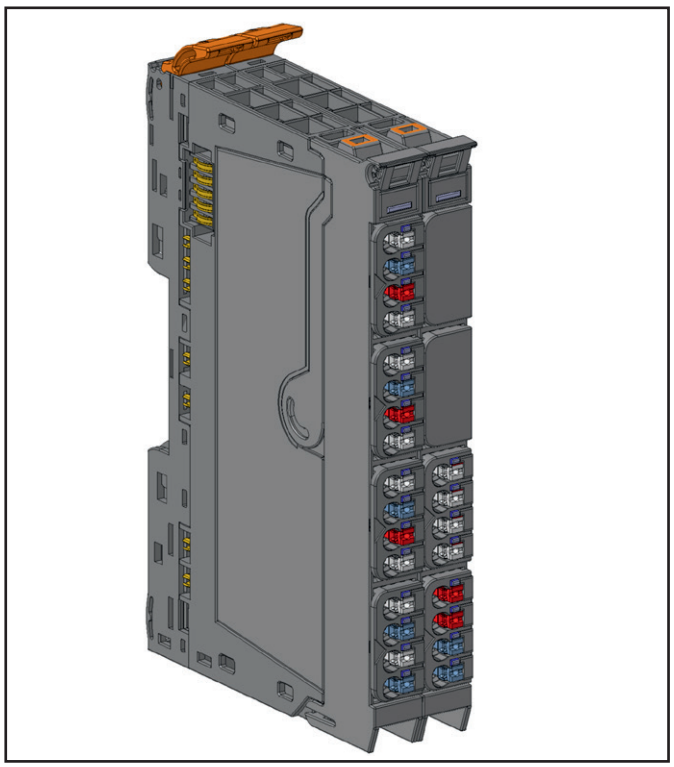
The stepper motor module UR20-1SM-50W-6DI2DO-P is CE-compliant in accordance with Directive 2014/30/EU (EMC Directive). It also meets the requirements of the ATEX Directive 2014/34/EU.

The results of the measurements according to CISPR 16-2-3 should also be suitable to demonstrate the compliance of the u-remote devices to the limits for radiated emissions as defined by CFR 47 Part 15, Subpart B, §15.109, Class A (2010) and ICES-003, Issue 5, Class A (2012).

Components of the following free software products are integrated into the u-remote products:

Component	Licence	Link
eCos	modified GPL	http://ecos.sourceware.org/license-overview.html
mongoose WebServer	MIT	http://web.archive.org/web/20111015092802/http://code.google.com/p/mongoose/source/browse/LICENSE
jQuery	MIT	https://github.com/jquery/jquery/blob/master/LICENSE.txt
jQuery-customSelect	MIT	https://github.com/jquery/jquery/blob/master/LICENSE.txt
jQuery-i18n	MIT	https://github.com/jquery/jquery/blob/master/LICENSE.txt
jQuery-overscroll	MIT	https://github.com/jquery/jquery/blob/master/LICENSE.txt
jQuery-ui	MIT	https://github.com/jquery/jquery/blob/master/LICENSE.txt
JSZip	MIT	https://github.com/Stuk/jszip/blob/master/LICENSE.markdown
md5 (as part of CryptoJS)	modified BSD	https://code.google.com/archive/p/crypto-js/wikis/License.wiki
snap-svg	Apache license 2.0	https://github.com/adobe-webplatform/Snap.svg/blob/master/LICENSE
underscore	MIT	https://github.com/jashkenas/underscore/blob/master/LICENSE
mustache	MIT	https://github.com/janl/mustache.js/blob/master/LICENSE

3 Module description

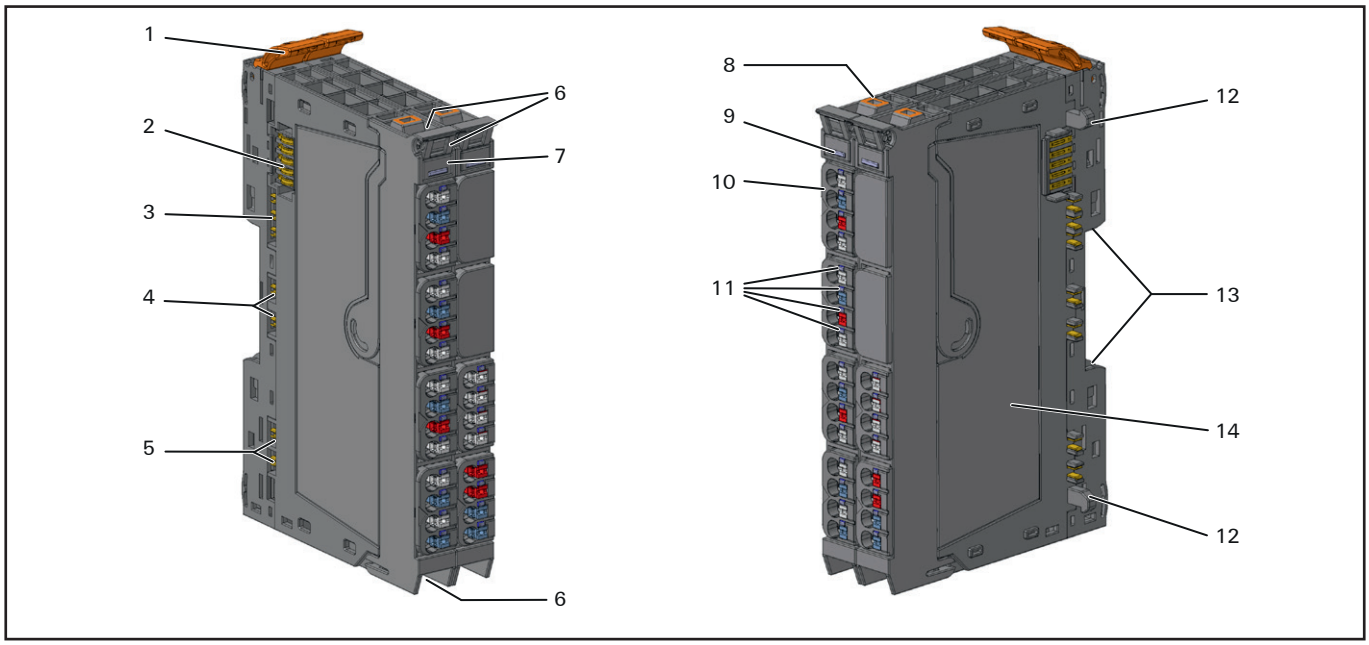


UR20-1SM-50W-6DI2DO-P stepper motor module (order no. 2489830000)

The UR20-1SM-50W-6DI2DO-P stepper motor module with integrated power amplifier can directly control a two-phase stepper motor. In addition, the module can record up to six binary control signals and control up to two actuators each with maximum 0.5 A. Inputs DI 4 and DI 5 can process rotary encoder signals (AB mode).
At each of the connectors 1 to 3, two sensors can be connected in two-wire or three-wire systems. Two actuators can be connected to connector 4 in two-wire systems. The stepper motor is connected to connector 7. An external power supply is connected to connector 8. A status LED is assigned to each channel.
A configuration application on the web server can be used to configure the drive system and to programme motion sequences.
The module electronics supply power to the sensors from the input current path (I_{IN}) and the actuators from the output current path (I_{OUT}). The module electronics and connected motor are supplied by the external power supply (12 ... 50 V). The external power supply must be fused against overcurrent separately.

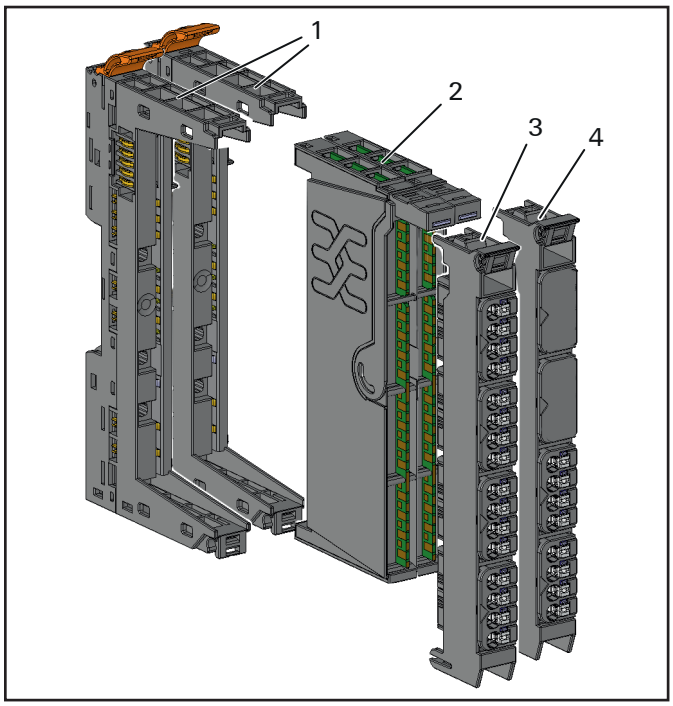
An interruption to the power supply of less than 1 ms has no impact. In the case of a longer interruption, the bus communication is switched off.

3.1 Device description



Stepper motor module UR20-1SM-50W-6DI2DO-P

1 Release lever for DIN rail fixing
2 System bus
3 System current path
4 Input current path
5 Output current path
6 Seats for module markers
7 Type designation
8 Connector frame unlocking device
9 Module status LED (collective message)
10 Connector
11 Channel status LED
12 Latching hook for latching onto module sides
13 DIN rail foot
14 Type plate

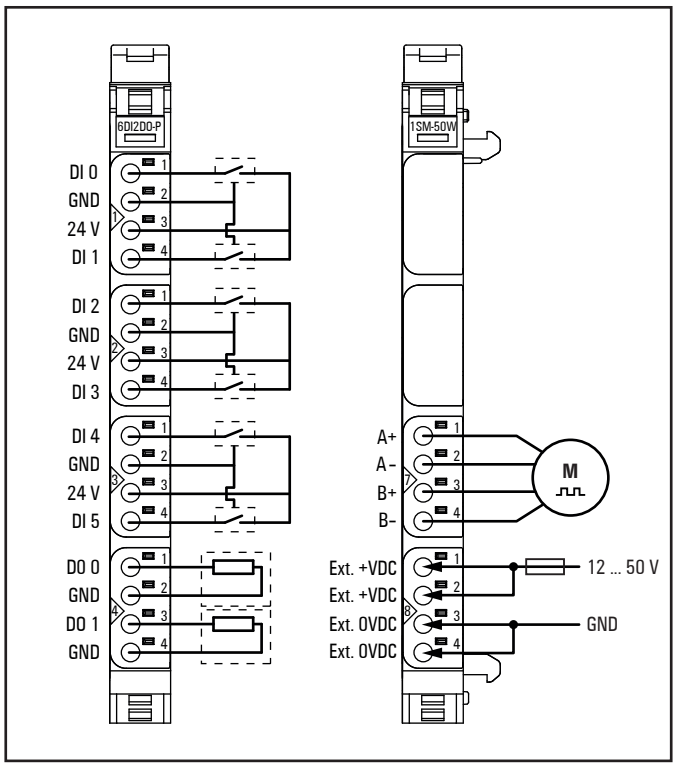


Stepper motor modules UR20-1SM-50W-6DI2DO-P components

1 Base modules
2 Elektronic unit
3 Plug-in unit PK1 for digital inputs and outputs
4 Plug-in unit PK2 for stepper motor and power supply

3.2 Connections

A detailed description of how devices can be connected to the module is available in chapter 4.

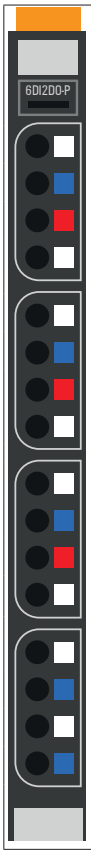


Connection diagram UR20-1SM-50W-6DI2DO-P

	Assignment	Function/connection
1.1	DI 0	Digital input
1.2	GND	0 V (U_{IN})
1.3	24 V	24 V (U_{IN})
1.4	DI 1	Digital input
2.1	DI 2	Digital input
2.2	GND	0 V (U_{IN})
2.3	24 V	24 V (U_{IN})
2.4	DI 3	Digital input
3.1	DI 4	Digital input
3.2	GND	0 V (U_{IN})
3.3	24 V	24 V (U_{IN})
3.4	DI 5	Digital input
4.1	DO 0	Digital output
4.2	GND	0 V (U_{OUT})
4.3	DO 1	Digital output
4.4	GND	0 V (U_{OUT})

	Assignment	Function/connection
7.1	A+	Motor, phase A, plus
7.2	A -	Motor, phase A, minus
7.3	B+	Motor, phase B, plus
7.4	B -	Motor, phase B, minus
8.1	Ext. +VDC	12 V ... 50 V (external)
8.2	Ext. +VDC	12 V ... 50 V (external)
8.3	Ext. 0VDC	0 V (external)
8.4	Ext. 0VDC	0 V (external)

3.3 LED indicators



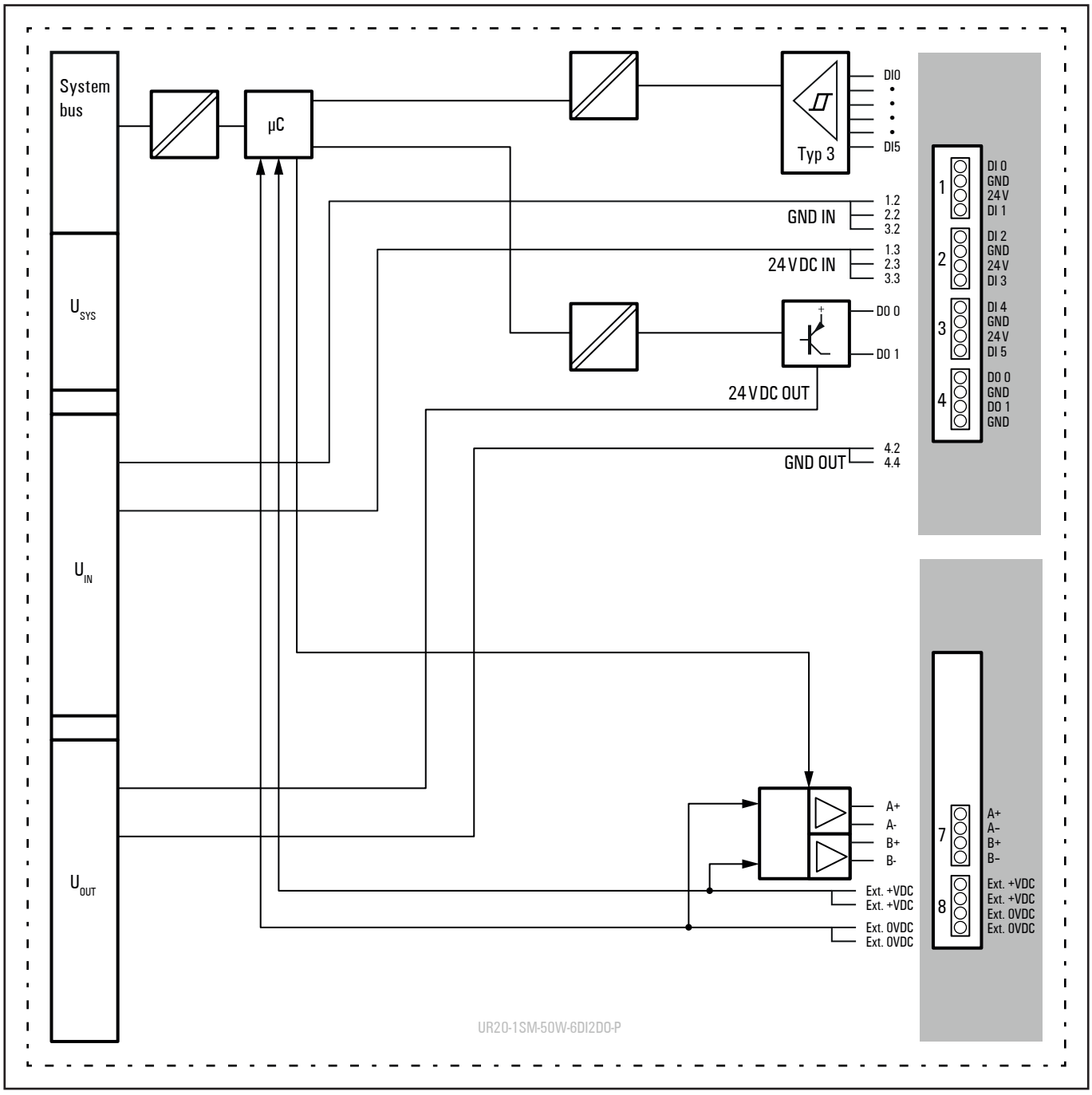
	Module status LED Green: Communication on system bus Red: Collective error diagnostics
1.1	Yellow: Input 0 active
1.4	Yellow: Input 1 active
2.1	Yellow: Input 2 active
2.4	Yellow: Input 3 active
3.1	Yellow: Input 4 active
3.4	Yellow: Input 5 active
4.1	Yellow: Output 0 active
4.4	Yellow: Output 1 active

LED indicators UR20-1SM-50W-6DI2DO-P, left, error messages see chapter 7

7.1	Yellow: Phase A active
7.2	Red: Phase A error
7.3	Yellow: Phase B active
7.4	Red: Phase B error
8.1	Green: external power supply OK
8.2	Red: external power supply error

LED indicators UR20-1SM-50W-6DI2DO-P, right, error messages see chapter 7

3.4 Block diagram



Block diagram UR20-1SM-50W-6DI2DO-P

3.5 Technical data

Technical data UR20-1SM-50W-6DI2DO-P

System data	
Data	Process, parameter and diagnosticdata depend on the coupler used, see table in section 6.3
Interface	u-remote system bus
System bus transfer rate	48 MBit/s
Modul diagnosis	yes
Galvanic isolation	500 V DC between current paths
Stepper motor connections A+, A-, B+, B-	
Number	1 channel, 2 phases
Supply, amplifier	external power supply entry, external protection necessary
Power	max. 50W
max. current load	see derating curve (see section 3.6)
Over load protection	yes
Short-circuit-proof	yes
Individual channel diagnosis	yes
Connection	4-wire
Cable length	< 30 m, shielded
Inputs DI 0 ... DI 3	
Number	4
Input type	P-switching, for type 1 and 3 type 3 sensors as per IEC 61131-2
Input filter	Input delay adjustable to 0 or 5 ms
Low input voltage	-30 V ... +5 V referred to GND
High input voltage	+11 V ... +30 V referred to GND
Low input current	≤ 1.5 mA
High input current	≥ 2.5 mA (2-wire sensor)
Sensor supply	max. 1 A per plug
Sensor connection	2-wire, 3-wire
Reverse polarity protection	yes
Cable length	< 30 m, shielded
Individual channel diagnosis	no
Inputs DI 4 ... DI 5	
Number	2
Input type	Input characteristics for sensor types 1 and 3 are in accordance with EN 61131-2, suitable incremental encoders, P-switching
Input filter	Filter time adjustable to 0 or 5 ms

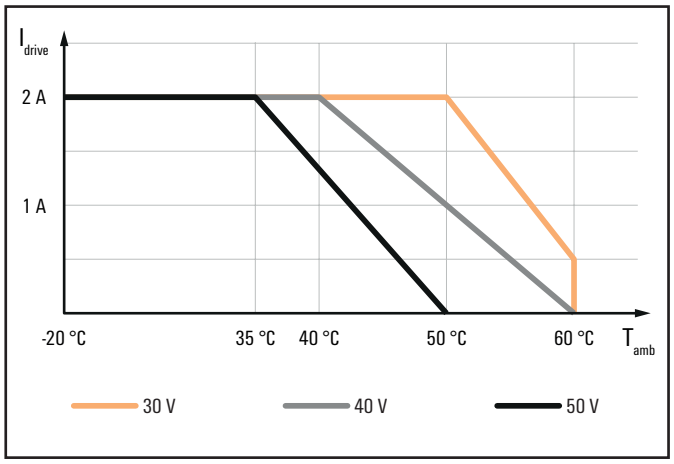
Technical data UR20-1SM-50W-6DI2DO-P

Maximum input frequency	100 kHz	
Mode of operation	AB mode with 4-times sampling	
Low input voltage	-30 V ... +5 V referred to GND	
High input voltage	+ 11 V ... +30 V referred to GND	
Low input current	≤ 1.5 mA	
High input current	≥ 2.5 mA (2-wire sensor)	
Sensor supply	max. 1 A per plug	
Sensor connection	2-wire, 3-wire	
Reverse polarity protection	yes	
Cable length	< 30 m, shielded	
Individual channel diagnosis	no	
Outputs DO 0... DO 1		
Number	2	
Output Type	P-switching, as per IEC 61131-2	
Type of load	ohmic, inductive, lamp load	
Response time	low » high max. 100 µs; high » low max. 250 µs	
Max output current	per channel	0.5 A
	per module	1 A
Breaking energy (inductiv)	150 mJ per channel	
Switching frequency	Ohmic load (min. 47 Ω)	1 kHz
	Inductive load (DC 13)	0.2 Hz without free-wheeling diode 1kHz with suitable free-wheeling diode
	Lamp load (12 W)	1kHz
Actuator connection	2-wire	
High input voltage	min. Uout - 1 V	
Low output current	≤ 0,5 mA	
High output current	nominal 500 mA	
Short-circuit-proof	yes	
Protective circuit	Constant current with thermal switch-off and automatic restart	
Response time of the current limiting circuit	< 100 µs	
Individual channel diagnosis	no	
Reactionless	yes	
Can be used with PF-O-xDI-SIL	yes	
MTTF	53.74 years	

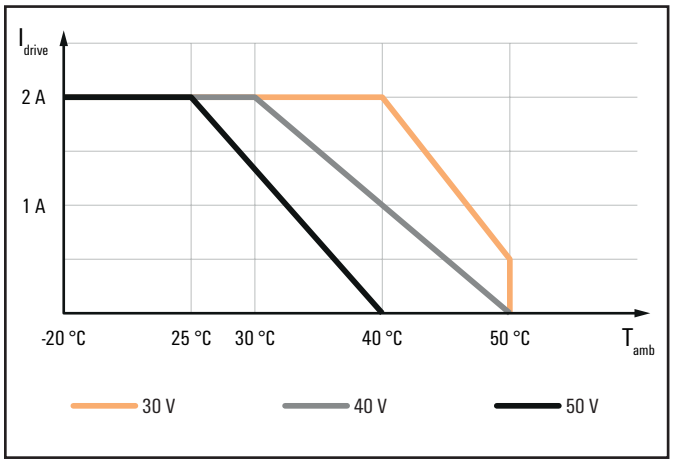
Technical data UR20-1SM-50W-6DI2DO-P

Supply		
Supply voltage U_{SYS}	3.6 V DC ... 6.5 V DC	
Supply voltage U_{IN}	24 V DC +20 %/-15 %	
Supply voltage U_{OUT}	24 V DC +20 %/-15 %	
External supply voltage	12 V DC ... 50 V DC	
Current consumption from system current path I_{SYS}	8 mA	
Current consumption from input current path I_{IN}	27 mA + sensor supply current	
Current consumption from output current path I_{OUT}	10mA + load	
Current consumption from external power supply	35 mA + load (at 24 V DC)	
General data		
Type of connection	"PUSH IN"	Single-wired, fine-wired
		Conductor cross-section 0.14 – 1.5 mm² (AWG 16 – 26)
Dimensions	Height	120.0 mm / 4.72″ (with release lever 128.0 mm / 5.04″)
	Width	23.0 mm / 0.9″
	Depth	76.0 mm / 2.99″
Weight (operational status)	173 g	
Protection class (IEC 60529)	IP 20	
Flammability rating UL 94	V-0	
Temperature data	Operation	-20 °C ... +60 °C / -4 ... +140 °F
	Storage, transport	-40 °C ... +85 °C / -40 ... +185 °F
Humidity	Operation, storage, transport	5 % to 95 %, non-condensing as per IEC 61131-2
Air pressure	Operation[2)]	≥ 795 hPa (altitude ≤ 2000 m) as per IEC 61131-2
	Storage, transport	≥ 700 hPa (altitude ≤ 3000 m) as per IEC 61131-2
Potential isolation	Test voltage	500 V DC field/system (as per EN 60079-15:2010)
	Pollution severity level	2 (as per DIN EN 60664-1:2008)
	Overvoltage category	II (as per DIN EN 50178)
Vibration resistance	5 Hz ≤ f ≤ 8.4 Hz: 3.5-mm amplitude as per IEC 60068-2-6	
	8.4 Hz ≤ f ≤ 150 Hz: 1-g acceleration as per IEC 60068-2-6	
Shock resistance	15 g over 11 ms, half sinewave, as per IEC 60068-2-27	
Approvals and standards	cULus	UL 61010
	Potentially explosive atmosphere Zone 2	ATEX Directive 2014/34/EU
	EMC	IEC 61000
	Explosion protection	IEC 60079-0:2012, IEC 60079-15:2010, EN 60079-0:2012, EN 60079-15:2010
	PLC	IEC 61131-2

3.6 Derating curves



UR20-1SM-50W-6DI2DO-P derating curve with horizontal installation



UR20-1SM-50W-6DI2DO-P derating curve with vertical installation

3.7 Adjustable parameters

A detailed description for how to parameterise the module is included in Section 5.4.

Overview of the editable parameters UR20-1SM-50W-6DI2DO-P

Channel	Description	Options[1)]	Default	Remark
8	Start/Stopp frequency f_{ss}	5 (0) / 10 (1) / 20 (2) / 50 (3) / 100 (4) / 200 (5) / 500 (6) / 750 (7) / 1000 (8) / 1250 (9) / 1500 (10) / 1750 (11) / 2000 (12)/ 2500 (13)	1000	in Hz
8	Factor f_{max}	1 ... 255	1	$f_{max} = f_{ss} \times$ Factor
8	Max. acceleration	0 ... 100	50	in %
8	Micro steps	1 (0) / 2 (1) / 4 (2) / 8 (3) / 16 (4) / 32 (5) / 64 (6) / 128 (7)/ 256 (8)	4	in increments
8	Traversing range	-2147483648 ... 2147483647	1000	in increments
8	Drive current	0 ... 228	127	in 10 mA, max. 2.28 A
8	Soft start factor[2)]	1 ... 100	0	in %
8	Factor break current	×1 (0) / ×1,25 (1) / ×1,5 (2) / ×1,75 (3) / ×2 (4) / ×2,25 (5) / ×2,5 (6)	1	
8	Factor boost current	×1 (0) / ×1,25 (1) / ×1,5 (2) / ×1,75 (3) / ×2 (4) / ×2,25 (5) / ×2,5 (6)	1	
8	Max. overcurrent duration	0 (0) / 5 (1) / 10 (2) / 20 (3) / 50 (4) / 100 (5) / 200 (6) / 500 (7) / 750 (8) / 1000 (9) / 1250 (10) / 1500 (11)/ 1750 (12) / 2000 (13)/ 2500 (14)	0	in ms
8	Axis mode	Linear (0) / Modulo[2)] (1)	Linear	
-	Diagnostic alarm	disabled (0) / enabled (1)	disabled	
0	Function DI	Ref.switch left/ccw (0) / Ref.switch right/cw (1) / Digital input (2)	Digital input	
0	Inversion	disabled (0) / enabled (1)	disabled	
0	Filter time	no (0) / 5 ms (1)	no	
1	Function DI	Zero track (0) / Digital input (1)	Digital input	
1	Inversion	disabled (0) / enabled (1)	disabled	
1	Filter time	no (0) / 5 ms (1)	no	
2	Function DI	Jog right/cw (0) / Tip right/cw (1) / Digital input (2)	Digital input	
2	Filter time	no (0) / 5 ms (1)	no	
3	Function DI	Jog left/ccw (0) / Tip left/ccw (1) / Digital input (2)	Digital input	
3	Filter time	no (0) / 5 ms (1)	no	
4	Function DI	Encoder Sig. A (0) / Digital input (1) / Limit switch right/cw (2)	Digital input	
4	Filter time	no (0) / 5 ms (1)	no	
5	Function DI	Encoder Sig. B (0) / Digital input (1) / Limit switch left/ccw (2)	Digital input	
5	Filter time	no (0) / 5 ms (1)	no	
6	Function DO	Digital output (0) / Position reached (1) / Position not reached (2)	Digital output	
7	Function DO	Digital output (0) / Position reached (1) / Position not reached (2)	Digital output	

1) Values in brackets for Modbus-TCP (firmware version 02.00.00 and higher), CANopen, EtherCAT and EtherNet/IP via module parameter class
2) Reserved for future firmware versions

Overview of the editable parameters UR20-1SM-50W-6DI2DO-P

Channel	Description	Options[1)]	Default	Remark
8	Encoder function	Enc.Pos. in process data (0) / Contouring error monitoring (1) / disabled (2)	disabled	
8	Homing	Stop on Ref.switch 0→1 (0) / Stop on Ref.switch 1→0 (1) / Stop on homing bit 1→0 (2)	Stop on Ref. switch 0→1t	
8	Encoder resolution	0 ... 65535	1000	steps/revolution
8	Full steps stepper motor/rev.	0 ... 65535	200	
8	Contouring error	0 ... 100	1	in % of the step resolution.of the motor

1) Values in brackets for Modbus-TCP (firmware version 02.00.00 and higher), CANopen, EtherCAT and EtherNet/IP via module parameter class
2) Reserved for future firmware versions

"Start/stop frequency F_{SS}" parameter

The "start/stop frequency F_{SS}" parameter is used to adjust the start/stop frequency F_{SS} of the stepper motor incl. coupled external inertia.

5 ... 2,500 (default: 1,000)
The start/stop frequency F_{SS} is 5 ... 2,500 increments.

"Factor F_{max}" parameter

The "factor F_{max}" parameter is used to adjust the maximum frequency F_{max} of the stepper motor as a multiple of the start/stop frequency F_{SS}.

1 ... 255 (default: 1)
The maximum frequency is F_{max} = 1 ... 255 × F_{SS}.

"Max. acceleration" parameter

The "max. acceleration" parameter defines the maximum acceleration as a percentage of the highest possible acceleration (65,535 incr./s²).

1 ... 100 (default: 50)
The maximum acceleration is a_{max} = 1% ... 100% (0.01 ... 1) × 65,535 incr./s².

"Micro steps" parameter

The "micro steps" parameter defines the step increments per full step in the power of two.

1 ... 256 (default: 4)

The step increments per full step equate to 1 ... 256.

"Traversing range" parameter

The "traversing range" parameter is used to set the length of the traversing range in increments. The traversing range always begins with -2147483648.

-2147483648 ... 2147483647 (default: 1,000)
The traversing ranges extends to -2147483648 ... 2147483647 increments.

The traversing range is specified in increments. If you double the value of the "micro steps" parameter, you halve the actual traversing range.

"Drive current" parameter

The "drive current" parameter defines the motor current per phase as a multiple of 10 mA.

0 ... 228 (default: 127)
The current per phase is i_{drive} = 0 ... 228 × 10 mA.

If you set a very low current, the actual current may differ considerably from the set value. The connected motor must have a nominal current of at least 200 mA.

"Soft start factor" parameter

Reserved for future firmware versions.

"Factor brake current" parameter

The "factor brake current" parameter defines the factor by which the traversing current is increased during braking operations.

1 ... 2.5 (default: 1)
The braking current is $i_{brake} = 1 ... 2.5 \times i_{drive}$.

The brake current must not exceed 2.28 A.

"Factor boost current" parameter

The "factor boost current" parameter defines the factor by which the traversing current is increased during accelerating operations.

1 ... 2.5 (default: 1)
The accelerating current is $i_{acc} = 1 ... 2.5 \times i_{drive}$.

The accelerating current must not exceed 2.28 A.

"Max. overcurrent duration" parameter

The "max. overcurrent duration" parameter defines how long the traversing current is increased for during braking and accelerating operations.

0 ... 2,500 (default: 0)
The traversing current is increased for a maximum of 0 ... 2,500 ms during braking and accelerating operations.

"Axis mode" parameter

The "axis mode" parameter defines the specification of the traversing range.

linear (default)
The traversing range is limited on both sides. Absolute positioning is only possible within the traversing range. The traversing range can be exited through relative positioning.

modulo
The traversing range is repeated. On passing the traversing range limit, the internal position counting is continued from the other traversing range limit.

"Diagnostic alarm" parameter

The "diagnostic alarm" parameter activates diagnostic alarms.

Disabled (default)
Diagnostic alarms are deactivated.

Enabled
Diagnostic alarms are activated.

"Function DI" parameter

The "function DI" parameter defines the function of the associated digital input.

Digital input
The input works as a general digital input.

Encoder sig. A
The input records the signal of a rotary encoder (channel A).

Encoder sig. B
The input records the signal of a rotary encoder (channel B).

Limit switch left/ccw
The input records the signal of a limit switch. The limit switch is started up by the stepper motor in a counter-clockwise direction.

Limit switch right/cw
The input records the signal of a limit switch. The limit switch is started up by the stepper motor in a clockwise direction.

Jog left/ccw
The input records the signal for triggering jog mode in a counter-clockwise direction.

Jog right/ccw
The input records the signal for triggering jog mode in a clockwise direction.

Zero track
The input records the zero track signal of a rotary encoder.

Ref. switch left/ccw
The input records the signal of a reference switch. The reference point is started up by the stepper motor in a counter-clockwise direction.

Ref switch right/cw
The input records the signal of a reference switch. The reference point is started up by the stepper motor in a clockwise direction.

Tip left/ccw
The input records the signal for triggering tip mode in a counter-clockwise direction.

Tip right/ccw
The input records the signal for triggering tip mode in a clockwise direction.

"Inversion" parameter
The "inversion" parameter defines the logic of the input.

Disabled
A low level at the input generates a 0 in the process image. A high level at the input generates a 1 in the process image. This adjustment is ideal for sensors with NO contact switch output.

Enabled
A low level at the input generates a 1 in the process image. A high level at the input generates a 0 in the process image. This adjustment is ideal for sensors with NC contact switch output.

"Filter time" parameter
The "filter time" parameter defines the filter behaviour of an input.

no (default)
Signals are not filtered.

5 ms
Signals with a duration of less than 5 ms are filtered.

"Function DO" parameter
The "function DO" parameter defines the function of the associated digital output.

Digital output
The output works as a general digital output.

Position reached
The output signal is low if the current position of the stepper motor deviates from the target position. The output signal switches to high once the motor has reached the target position.

Position not reached
The output signal is high if the current position of the stepper motor deviates from the target position. The output signal switches to low once the motor has reached the target position.

"Encoder function" parameter
The "encoder function" parameter defines the function of the connected rotary encoder.

Enc.Pos. in process data
The rotary encoder position is illustrated in the process input data.

Contouring error monitoring
The module calculates the contouring error as the difference between the current motor position and the rotary encoder position, and generates an error message if the contouring error is larger than the permitted contouring error. The permissible contouring error is adjusted using the "contouring error" parameter.

Disabled
The rotary encoder function is disabled.

"Homing" parameter
The "homing" parameter defines the type of reference run.

Stop on ref.switch 0→1
The motor travels in the specified direction with start/stop frequency. The reference run ends once the reference switch has been triggered.

Stop on ref.switch 1→0
The motor travels in the specified direction with start/stop frequency. The reference run ends once the reference switch has been triggered and the motor has been moved in the opposite direction with ¼ of the start/stop frequency.

Stop on homing bit 1→0
The reference run ends when the "homing" bit changes from 1 to 0 in the output data.

"Encoder resolution" parameter
The "encoder resolution" parameter is used to adjust the resolution of the connected rotary encoder in increments.

0 ... 65,535 (default: 1,000)
The connected rotary encoder has a resolution of 0 ... 65,535 increments.

The stepper motor module always evaluates all four flanks of the rotary encoder signal.

“Full steps stepper motor/rev.” parameter

The “full steps stepper motor/rev.” parameter is used to adjust the step number of the motor in full steps per revolution for the calculation of the permissible contouring error.

0 ... 65,535 (default: 200)

The stepper motor has a step number of 0 ... 65,535 full steps per revolution.

“Contouring error” parameter

The “contouring error” parameter defines the permissible contouring error as a percentage of the rotary encoder resolution. The contouring error is the difference between the current motor position and the rotary encoder position.

0 ... 100 (default: 1)

The permissible contouring error is 0 ... 100% of the rotary encoder resolution.

4 Assembly and installation

WARNING

Explosion risk!
During installation work, sparks can form and surfaces may become excessively hot
► Before starting any work, make sure that there is not an explosive atmosphere!
► For applications in explosive risk zones, observe the installation and construction requirements of EN 60079-15 and country-specific regulations.

WARNING

Dangerous contact voltage!
► All installation and wiring work must be carried out with the power supply disconnected.
► Make sure that the place of installation has been disconnected from the power supply!

ATTENTION

The product can be destroyed by electrostatic discharge!
u-remote products can be destroyed by electrostatic discharge.
► Make sure that persons and work equipment are sufficiently earthed!

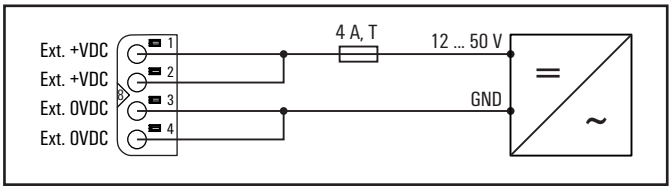
The stepper motor module has no fused sensor/actuator supply. Therefore, all cables to the connected sensors/actuators must be fused corresponding to their conductor cross-sections (as per DIN EN 60204-1, Section 12).

► In addition, always refer to the complete documentation in the **u-remote IP20 manual**.

► Carry out all work during the installation/removal and replacement of components as described in the u-remote manual.

4.1 Connecting the external power supply

► Connect the external power supply to connector 8.



Connecting the external power supply

If the stepper motor module is used with a safe power-feed module (UR20-PF-O-X-SIL):
► Note that only the digital outputs on the stepper motor module are safely switched off. Make sure that the external power supply is disconnected in the event of a fault.

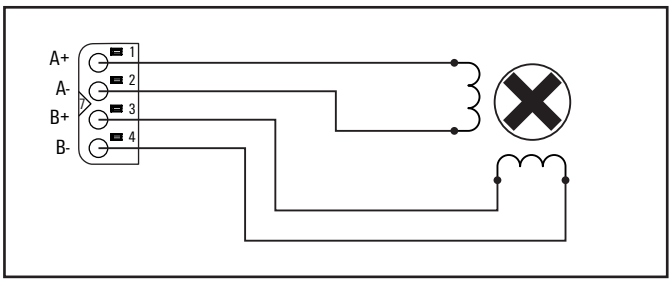
4.2 Connecting the stepper motor

Use shielded cables to connect the stepper motor.

If the actual rotation direction of the stepper motor does not correspond to the dircection indicated in the process data, reverse the polarity of one phase.

Connecting the bi-polar four-wire stepper motor

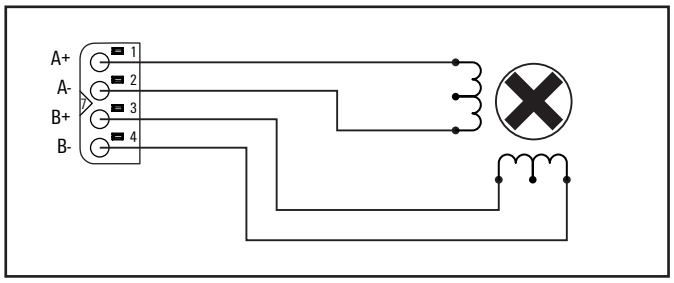
► Connect the stepper motor to connector 7.



Connecting the bi-polar four-wire stepper motor

Connecting the uni-polar six-wire stepper motor

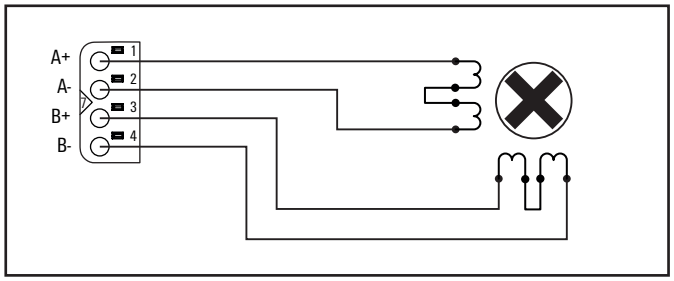
► Connect the stepper motor to connector 7.



Connecting the uni-polar six-wire stepper motor

Connecting the bi-polar eight-wire stepper motor (serial)

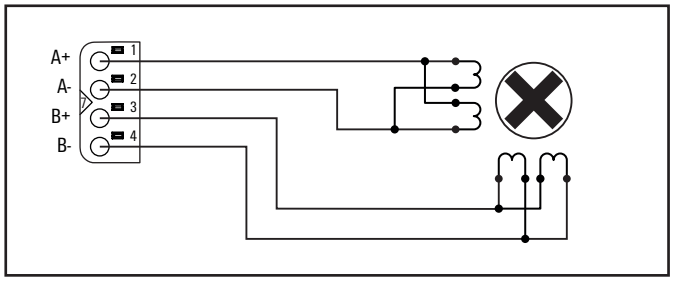
► Connect the stepper motor to connector 7.



Connecting the bi-polar eight-wire stepper motor (series operation)

Connecting the bi-polar eight-wire stepper motor (parallel)

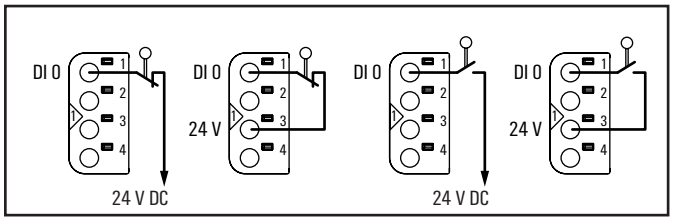
► Connect the stepper motor to connector 7.



Connecting the bi-polar eight-wire stepper motor (parallel operation)

4.3 Connecting the reference switch

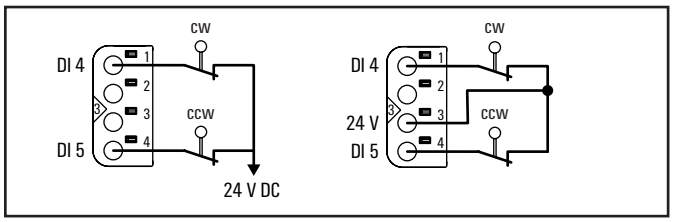
► Connect the reference switch to connector 1.



Connecting sensors

4.4 Connecting the limit switch

► Connect the limit switch, which is approached in a clockwise direction, to connection DI 4.
► Connect the limit switch, which is approached in a counter-clockwise direction, to connection DI 5.



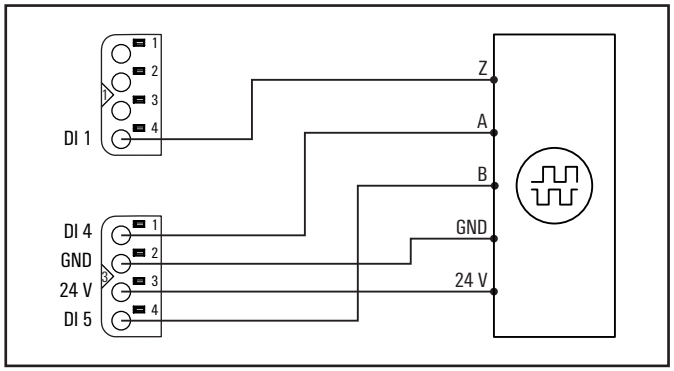
Connecting the limit switch

Limit switches are always evaluated by the stepper motor module as an NC contact.

4.5 Connecting the incremental rotary encoder

Use shielded cables to connect the rotary encoder.

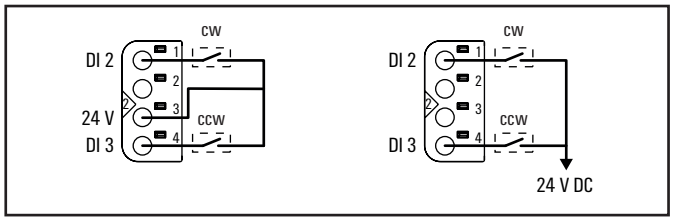
- ► Connect channel A of the rotary encoder to connection DI 4.
- ► Connect channel B of the rotary encoder to connection DI 5.
- ► If available, connect the zero track (channel Z) of the rotary encoder to connection DI 1.
- ► Connect the supply voltage as shown in the figure.



Connecting the incremental rotary encoder

4.6 Connecting signalers for jog mode and tip mode

- ► Connect the switches to connector 2.

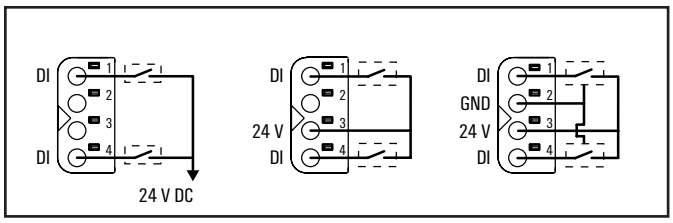


Connecting switches for jog/tip mode

4.7 Connecting standard field devices

Connecting sensors

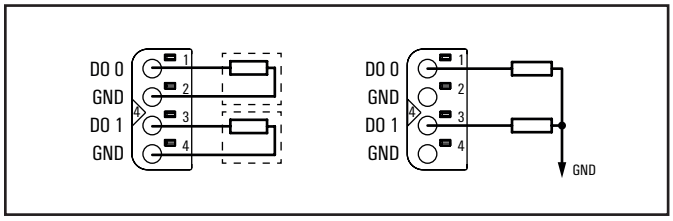
- ► Connect the sensors to connectors 1–3.



Connecting sensors

Connecting the load

- ► Connect the load to connector 4.



Connecting the load

5 Commissioning and operation

WARNING

Explosion risk!

► Before starting any work, make sure that there is not an explosive atmosphere!

WARNING!

Manipulation of the control unit!

During commissioning, the system may be manipulated to such an extent that can result in risks to life and material damage.

► Make sure that system components cannot start up unintentionally!

ATTENTION

The product can be destroyed!

► Perform an insulation test every time before commissioning the station (see section 7.6 in the u-remote IP20 manual).

► In addition, always refer to the complete documentation in the **u-remote IP20 manual** (document no. 1432780000).

5.1 Requirements

Before you start the commissioning work, the following requirements must be fulfilled.

- The control unit must be in operation.
- The u-remote station must be completely assembled and wired.
- The control unit and u-remote station must be connected to each other, and a PC/laptop must also be connected.
- The power supply must be turned on.

5.2 Device description files

If bitmap files for visualising the couplers are also supplied, store them in the same folder as the device description files.

► Download the current device description files from the Weidmüller website.

5.3 Integrating the module in the configuration

► Check whether the firmware of the fieldbus coupler and the module are up to date and update them if required.
► Check whether you have installed the current device description files and update them if necessary.
► Start the engineering tool.
► Configure the network and the controller as usual.
► Configure the u-remote station consisting of a fieldbus coupler, the stepper motor module and additional I/O-modules as usual.

► In addition, always refer to the complete documentation in the **u-remote IP20 manual** (document no. 1432780000).

5.4 Parameterising the module for the drive system

The entire drive system is configured by setting the appropriate parameters for the stepper motor module.

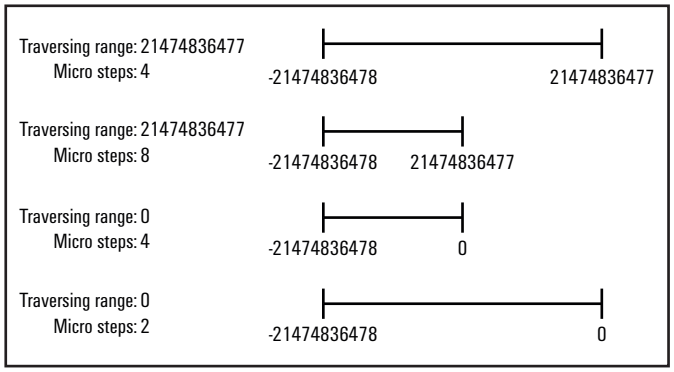
Parameterising the module for the stepper motor

The stepper motor with connected mechanical system is integrated by setting the appropriate parameters for the stepper motor module. For a detailed description of the adjustable parameters, see Section 3.7.

The stepper motor must be connected correctly to the module (see Section 4.2).

- ► Set the “axis mode” parameter to the desired mode.
- ► Set the “micro steps” parameter to the desired number of steps.
- ► Set the length of the traversing range using the “traversing range” parameter.

The traversing range is specified in increments. If, for example,you double the value of the “micro steps” parameter, you halve the actual traversing range.



“Traversing range” parameter, “micro steps” parameter and actual traversing range

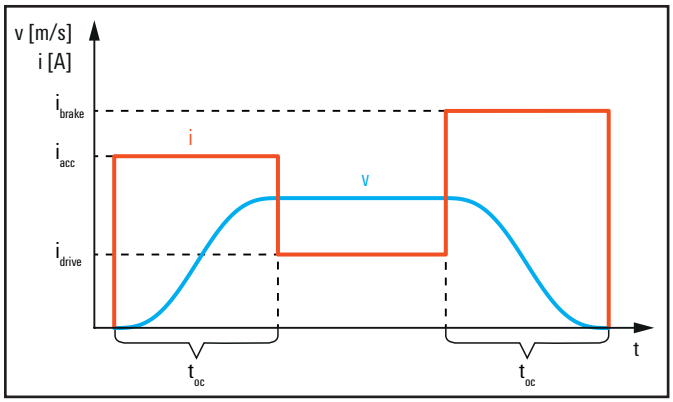
- ► Set the “max. acceleration” parameter to maximum acceleration.
- ► Set the “start/stop frequency F_{ss}” parameter to the start/stop frequency of the stepper motor incl. connected external inertia.

The stepper motor module references with start/stop frequency. Make sure that you select a start/stop frequency that is low enough to prevent the lever of the reference switch from being driven over.

- ► Set the maximum frequency of the stepper motor incl. connected external inertia using the “factor F_{max}” parameter.

The maximum frequency must not exceed 40 kHz.

The characteristic curve of a stepper motor changes with the number of micro steps. The start/stop frequency, the maximum frequency and the number of micro steps must be coordinated with each other.



Parameterising the drive, brake and boost current

- ► Set the “drive current” parameter to the motor current per phase i_{drive} of the stepper motor.

If you set a very low current, the actual current may differ considerably from the set value. The connected motor must have a nominal current of at least 200 mA.

- ► Set the “factor brake current” parameter to the desired brake current i_{brake}.
- ► Set the “factor boost current” parameter to the desired boost current i_{acc}.
- ► Set the “max. overcurrent duration” parameter to the desired maximum overcurrent duration t_{oc}.

The brake current and the boost current must not exceed 2.28 A.

Parameterising the module for the reference switch

A reference switch is integrated by setting the appropriate parameters for the stepper motor module. For a detailed description of the adjustable parameters, see Section 3.7.

The reference switch must be connected correctly to the module (see Section 4.3).

If you want to approach the reference switch in a counter-clockwise direction:
► Set the “function DI” parameter for channel 0 to “ref. switch left/ccw”.

If you want to approach the reference switch in a clockwise direction:
► Set the “function DI” parameter for channel 0 to “ref. switch right/cw”.

If you want to evaluate the reference switch as an NC contact:
► Set the “inversion” parameter for channel 0 to “enabled”.

If the reference run is to end once the reference switch has been actuated:
► Set the “homing” parameter to “stop on ref.switch 0→1”.

If the reference run is to end once the reference switch has been triggered and has been released again:
► Set the “homing” parameter to “stop on ref.switch 1→0”.

If the reference run is to end once the “homing” bit is reset again in the process output data:
► Set the “homing” parameter to “stop on bit homing 1→0”.
This setting is especially suitable if you are using a reference switch that is not connected to the stepper motor module.

We advise that you debounce switches, especially mechanical switches. To do this, set the “filter time” parameter for the channel to “5 ms”.

Parameterising the module for limit switches

Limit switches are integrated by setting the appropriate parameters for the stepper motor module. For a detailed description of the adjustable parameters, see Section 3.7.

The limit switches must be connected correctly to the module (see Section 4.4).

► Set the “function DI” parameter for channel 4 to “limit. switch right/cw”.
► Set the “function DI” parameter for channel 5 to “limit switch left/ccw”.

Limit switches are always evaluated by the stepper motor module as an NC contact.

We advise that you debounce switches, especially mechanical switches. To do this, set the “filter time” parameter for the channel to “5 ms”.

Parameterising the module for the incremental rotary encoder

An incremental rotary encoder is integrated by setting the appropriate parameters for the stepper motor module. For a detailed description of the adjustable parameters, see Section 3.7.

The rotary encoder must be connected correctly to the module (see Section 4.5).

► Set the “function DI” parameter for channel 4 to “encoder sig. A”.
► Set the “function DI” parameter for channel 5 to “encoder sig. B”.
► Set the “encoder resolution” parameter to the resolution of the rotary encoder.

If you want to use the zero track signal of the rotary encoder:
► Set the “function DI” parameter for channel 1 to “zero track”.

If you want to illustrate the position of the rotary encoder in the process input data:
► Set the “encoder function” parameter to “enc.pos. in process data”.

If you want to monitor the contouring error and generate an error message if the contouring error is too big:
► Set the “encoder function” parameter to “contouring error monitoring”.
► Set the “full steps stepper motor/rev.” parameter to the number of steps for the stepper motor.
► Set the “contouring error” parameter to the maximum permissible contouring error.

Parameterising the module for jog or tip mode

In jog mode, the system travels a specified distance in the specified direction with start/stop frequency, once a suitable input signal is emitted. The motion is stopped once the system has travelled the specified distance or has reached an end position.

In tip mode, the system travels in the specified direction with start/stop frequency, if a suitable input signal is emitted. The motion is stopped once the input signal stops or an end position has been reached. End positions can only be released in tip mode.

Jog and tip mode are set by setting the appropriate parameters for the stepper motor module. For a detailed description of the adjustable parameters, see Section 3.7.

You can also trigger jog mode without external signalers only via the process data. In this case, you do not have to parameterise the inputs for jog mode.

The signalers for jog and tip mode must be connected correctly to the module (see Section 4.6).

- ► Set the “function DI” parameter for channel 2 to “jog right/cw” for jog mode or to “tip right/cw” for tip mode.
- ► Set the “function DI” parameter for channel 3 to “jog left/ccw” for jog mode or to “tip left/ccw” for tip mode.

We advise that you debounce switches, especially mechanical switches. To do this, set the “filter time” parameter for the channel to “5 ms”.

5.5 Controlling the drive system

Once you have parameterised the stepper motor module for the drive system, you can control it via the process output data.

WARNING!

Manipulation of the control unit!
During commissioning, the system may be manipulated to such an extent that can result in risks to life and material damage.
- ► Make sure that system components cannot start up unintentionally!

WARNING!

Unintentional start-up when resuming fieldbus communication!
If the controller release is set, the connected motor can start up unintentionally if the fieldbus communication resumes after an interruption.
- ► In the process output data, set the “enable motor driver” bit to 0 if the fieldbus communication fails.

Triggering referencing

The reference point of the drive system is determined through referencing. The reference point is determined by activating a reference switch.

If you are using a reference switch and have parameterised the module for a reference switch, you can trigger a reference run via the process output data.

- ► Set “enable motor driver” to 1 in order to release the motor driver.
- ► Generate a rising edge for “homing”.

The drive system executes a reference run in the parameterised direction. After a successful reference run, “state homing” in the process input data changes to 1. You can then set the current position of the stepper motor or the rotary encoder.

If no reference switch is found during referencing, the run ends at an end stop.

Setting the current position of the stepper motor

You can set the current position of the stepper motor via the process output data.

► Set “target position” to the desired value.
► Generate a rising edge for “set current position”.

The module applies the new value as the current position of the stepper motor.

Setting the current position of the rotary encoder

You can set the current position of the rotary encoder via the process output data.

► Set the “target position” to the desired value.
► Generate a rising edge for “set encoder value”.

The module applies the new value as the current position of the rotary encoder.

Absolute positioning

Absolute positioning is only possible if the reference point of the drive system has previously been determined by a reference run (“state homing” is 1 in the process input data).

During absolute positioning the drive system moves at a specified speed from the current position to a absolute position within the traversing range.

► Set “target position” to the absolute target position (increments).
► Set “target velocity” to the target velocity (increments/s).
► Set “target acceleration” to the target acceleration in (increments/s²).
► Set “acceleration” to the desired acceleration type (see section 5.8).
► Set “moving mode” to 0 for absolute positioning.
► Set “enable motor driver” to 1 in order to release the motor driver.
► Set “moving” to 1.

The drive system travels as long as “moving” is set to 1. The motion is cancelled, if “moving” is set to 0 during an active action.

The drive system travels to the target position. “State moving” in the process input data changes to 1. “State direction” indicates the direction. After a successful run, “state target position” changes to 1 in the process input data.

Relative positioning

During relative positioning the drive system moves at a specified speed from the current position by a specified distance. The drive system can exit the parameterised traversing range.

► Set “target position” to the relative distance (increments).
► Set “target velocity” to the target velocity (increments/s).
► Set “target acceleration” to the target acceleration (increments/s²).
► Set “acceleration” to the desired acceleration type (see section 5.8)
► Set “moving mode” to 1 for relative positioning.
► Set “enable motor driver” to 1 in order to release the motor driver.
► Set “moving” to 1.

The drive system travels as long as “moving” is set to 1. The motion is cancelled, if “moving” is set to 0 during an active action.

The drive system travels to the target position. “State moving” in the process input data changes to 1. “State direction” indicates the direction. After a successful run, “status target position” changes to 1 in the process input data.

Running motion profiles

First create the motion profiles using the configuration application. Alternatively, write the motion profiles to the module via the process data.

You can run motion profiles. A motion profile is a predefined motion starting from the current position. Several motion profiles can be combined to complex motion sequences.

► Set “Moving mode“ to 2 for motion profile.
► Set “Selection register page number“ to the number of the register page with the first motion profile.
► Set “Selection data set number“ to the number of the data set with the first motion profile.
► Set “Enable motor driver“ to 1, to release the motor driver.
► Set “moving“ to 1.

The drive system travels as long as “moving“ is set to 1. The motion is cancelled, if “moving“ is set to 0 during an active action.

The motion profiles are processed in the specified sequence as long as “moving“ is set to 1. “Feedback register page number“ shows the number of the current register page. “Feedback data set number“ shows the number of the current data set.

Triggering jog mode via process data

In jog mode, the system travels the specified distance in the specified direction with start/stop frequency. The motion is stopped once the system has travelled the specified distance or has reached an end position.

- ► Set “enable motor driver” to 1 in order to release the motor driver.
- ► Set the “target position” to the relative distance (increments).

If you want to move in a clockwise direction:

- ► Set “jog right/cw” to 1.

The drive system travels the specified distance in a clockwise direction with start/stop frequency.

If you want to move in a counter-clockwise direction:

- ► Set “jog left/ccw” to 1.

The drive system travels the specified distance in a counter-clockwise direction.

Triggering jog or tip mode via an external signaler

The module must first be parameterised for jog or tip mode.

- ► Set the “enable motor driver” to 1 in order to release the motor driver.
- ► Activate the signaler at DI 3 in order to travel in a clockwise direction in jog or tip mode.
- ► Activate the signaler at DI 4 in order to travel in a counter-clockwise direction in jog or tip mode.

Releasing the end position

The signalers for tip mode must be connected correctly to the module (see Section 4.6).

The module must first be parameterised for tip mode.

- ► Set “position change” to 1.
- ► Set “enable motor driver” to 0.
- ► Activate the signaler for tip mode in the corresponding direction until the drive system is moved from the limit switch.

The release operation is interrupted if the signaler for tip mode is deactivated. If you deactivate the signaler while the limit switch is still activated, you must repeat the process.

After you have released the end position, you must perform a reference run.

5.6 Register communication via process data

Motion register

You can define motion profiles and safe them in the motion register of the stepper module.

All motion register data are stored power failure proof in the EEPROM of the module. On starting the module, the data sets are copied from the EEPROM to the working memory of the module.

Register page 0 is reserved. The register pages 1 to 15 contain 16 data sets each.

Register pages

Register page 0	Register page 1	...	Register page 15
res.	Data set 0	...	Data set 0
	...		...
	Data set 15		Data set 15

A data set contains 10 registers. A data set contains exactly one motion profile.

Data set

Register	Byte	Bit	Description	Comment
0	0	0 ... 7	Data set number	0 ... 15
1	1	0 ... 7	Start condition	0 = Move, immediately 1 = Move, if DI 0 = TRUE 2 = Move, if DI 1 = TRUE 3 = Move, if DI 2 = TRUE 4 = Move, if DI 3 = TRUE
2	2	0 ... 7	Target position	-2147483648 ... 2147483647
	3	0 ... 7		
	4	0 ... 7		
	5	0 ... 7		
3	6	0 ... 7	Target velocity	0 ... 65535
	7	0 ... 7		
4	8	0 ... 7	Target acceleration	0 ... 65535
	9	0 ... 7		
5	10	0 ... 7	Soft start factor[1)]	0 ... 100 %
6	11	0	Set DO 0	0 = Low after reaching the target position 1 = High after reaching the target position
		1	Set DO 1	0 = Low after reaching the target position 1 = High after reaching the target position
		2	reserved	
		3	reserved	
		4	reserved	
7		5	Moving mode	0 = absolute, 1 = relative
8		6	Acceleration	0 = constant, 1 = linear, 2 = optimal, 3 = reserved
		7		
9	12 ...	0 ... 7	Idle time	0 ... 65535 ms
	13	0 ... 7		
10	14	0 ... 3	Following set: Data set number	0 ... 15 = Data set 0 ... 15
		4 ... 7	Following set: Register page	0 = no following set 1 ... 15 = Register page 1 ... 15
11	15	0 ... 7	reserved	

1) Reserved for subsequent firmware releases

Reading the register from the working memory

- ► Set "Selection register page number" to the number of the register page.
- ► Set "Selection data set number" to the number of the data set.
- ► Set "Selection register number" to the number of the register.
- ► Set "Read or write register" to 0 for read only.
- ► Set "Read or write EEPROM" to 0.
- ► To initiate the register access, set "Register access request" to 1.

"Acknowlegde register access" changes to 1. "Register read data" contains the data read. "Feedback register number", "Feedback data set number" and "Feedback register page number" display the address of the register read. The return values are displayed as long as "Acknowlegde register access" is set to 1.

Reading a data set from the working memory

A data set contains 10 registers.

- ► Read all 10 registers of the data set one by one.

Reading a data set from the EEPROM

- ► Set "Selection register page number" to the number of the register page.
- ► Set "Selection data set number" to the number of the data set.
- ► Set "Read or write register" to 0 for read only.
- ► Set "Read or write EEPROM" to 1.
- ► To initiate the register access, set "Register access request" to 1.

The selected data set is copied from the EEPROM into the working memory of the module.

Writing a register into the working memory

- ► Set "Selection register page number" to the number of the register page.
- ► Set "Selection data set number" to the number of the data set.
- ► Set "Selection register number" to the number of the register.
- ► Set "Data register write access" to the value you want to write into the register.
- ► Set "Read or write register"to 1 for writing access.
- ► Set "Read or write EEPROM" to 0.
- ► To initiate the register access, set "Register access request" to 1.

"Feedback register number", "Feedback data set number" and "Feedback register page number" get the address of the register read. The return values are displayed as long as "Acknowlegde register access" is set to 1

Writing a data set into the working memory

A data set contains 10 registers.

► Write all 10 registers of the data set one by one.

Writing a data set into the EEPROM

► Set "Selection register page number" to the number of the register page.
► Set "Selection data set number" to the number of the data set.
► Set "Read or write register"to 1 for writing access.
► Set "Read or write EEPROM" to 1.
► To initiate the register access, set "Register access request" to 1.

The selected data set is copied from the working memory into the EEPROM of the module.

5.7 Creating motion profiles with the configuration application

The descriptions of this section are only valid for the following firmware versions:

Fieldbus coupler	Version
UR20-FBC-PB-DP-V2	01.07.00
UR20-FBC-PB-DP	01.06.00
UR20-FBC-PN-IRT-V2	01.08.00
UR20-FBC-PN-IRT	01.06.00
UR20-FBC-EC, HW 02.xx.xx	01.08.00
UR20-FBC-EC, HW 01.xx.xx	01.08.00
UR20-FBC-MOD-TCP-V2	02.06.00
UR20-FBC-MOD-TCP	02.06.00
UR20-FBC-EIP, HW 02.xx.xx	02.07.00
UR20-FBC-EIP, HW 01.xx.xx	01.07.00
UR20-FBC-DN	01.06.00
UR20-FBC-CAN	01.06.00
UR20-FBC-PL	01.06.00

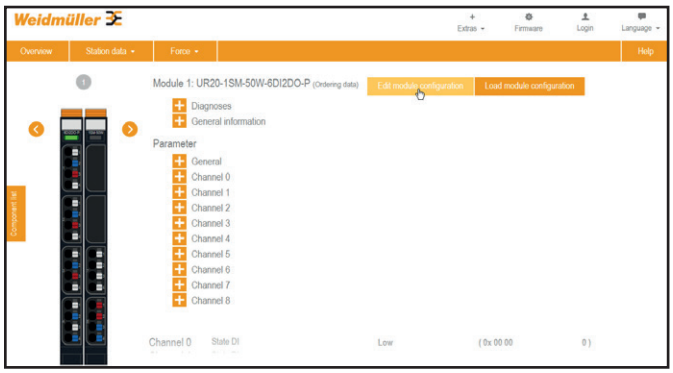
The configuration application of the stepper motor module is integrated in the u-remote web server. With the configuration application, you can:

- create motion profiles more easily
- export motion profiles as a file
- write motion profiles to the module.

► Always observe the complete documentation in the **u-remote web server manual** (document no. 2112210000).

Starting the configuration application

► Start the web server.
► Open the component view of the stepper motor module by clicking on the station view on the stepper motor module.
► Click on "edit module configuration" in the component view in order to start the configuration application.



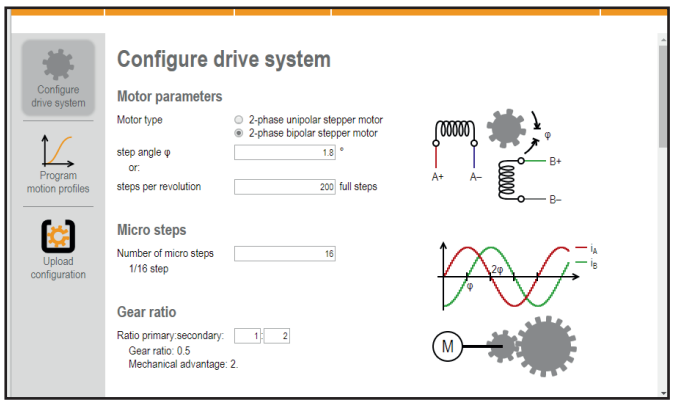
Start configuration application

The configuration application of the stepper motor module is started.

Configuring the drive system

In order to program motion profiles with concrete dimensions, you must first configure the drive system under "configure drive system".

► Click on "configure drive system".



Configure drive system

All values that you enter under “configure drive system” are only used to calculate the motion profiles and are not stored in the module.
For general operation, configure the drive system by parameterising the module for the drive system (see Section 5.4).

- ► Enter the step angle of the stepper motor in the “step angle φ” field or enter the number of full steps per revolution in the “steps per revolution” field.
- ► Enter the number of micro steps per full step in the “number of micro steps” field.
- ► Enter the gear ratio of the pre-switched gears in the “ratio primary:secondary” field.

If you do not use gears, use gear ratio 1:1.

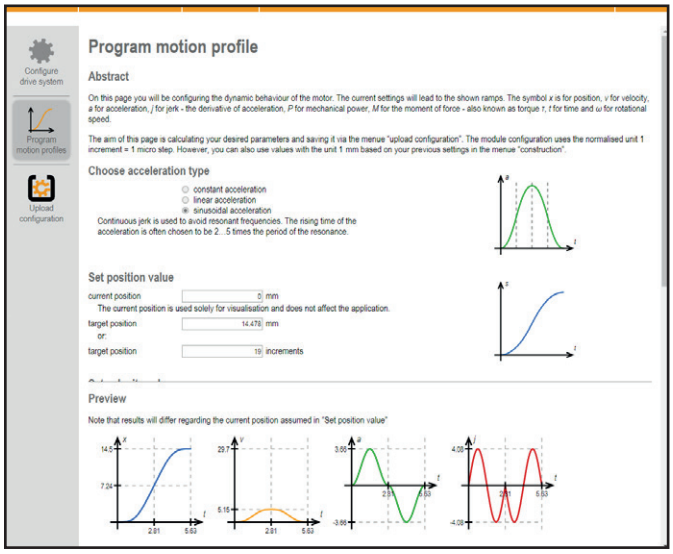
- ► Select the actuator type under “linear actuator”.
- ► Enter the length unit that you want to use in the configurator in the “unit” field.
- ► Complete the other fields in order to specify the actuator.

Actuator type	Specification	Description
Threaded rod	Lead length	Threaded feed per revolution
	Threads per unit	Number of threads per length unit
Ball screw	Lead length	Threaded feed per revolution
Timing belt	Tooth pitch	Spacing of the centre lines of two adjacent teeth on the pitch circle
	Number of teeth (pulley)	Number of teeth on drive wheel
	Pitch circle circumference	Diameter of the pitch circle
Rotary table	Positions per revolution	Number of discrete positions per revolution in the selected unit

- ► Check the automatically calculated values under “summary” and adjust your entries if necessary.

Programming a motion profile

- ► Click on “program motion profiles”.



Program motion profiles

- ► Select an acceleration type under “choose acceleration type” (see section 5.8).
- ► Program the motion profile by completing the fields under “set position value”, “set velocity value”, “set acceleration value” and “set jerk”.

Under “preview” you can view the current programmed motion profile. The preview is updated after each entry.

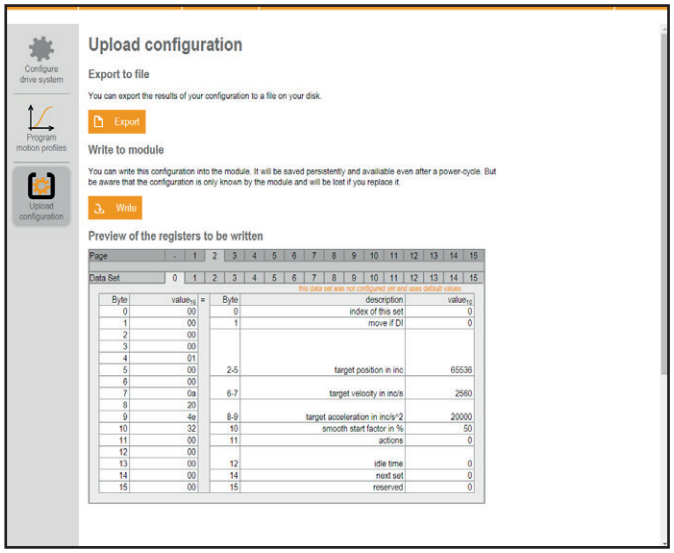
- ► Check again under “preview” whether the motion profile corresponds with your specifications.
- ► Under “save ramp to a register”, enter the page and the data set of the motion register where the motion profile is to be saved.
- ► Click on “save” to save the motion profile in the motion register setup.

All settings first take effect after they have been written to the module.

Checking the motion profiles

Motion profiles are stored in a motion register. You can check the current motion register setup before you export them or write them to the module.

► Click on “upload configuration”.



Upload configuration

Under “preview of the registers to be written”, there is a table with the current stored motion register setup.

► In order to display a page of the motion register, click on the respective number under “page”.
► In order to display a data set on the selected page, click on the respective numbers under “data set”.

Exporting motion profiles as a file

Motion profiles are stored in a motion register. You can export the current motion register setup as a file.

► Click on “upload configuration”.
► Under “preview of the registers to be written”, check the motion register setup.
► Click on “export” to export the current register setup.

The current motion register setup is saved on your computer as “configuration_UR20-1SM-50W-6DI-2DO.json”.

Writing motion profiles to the module

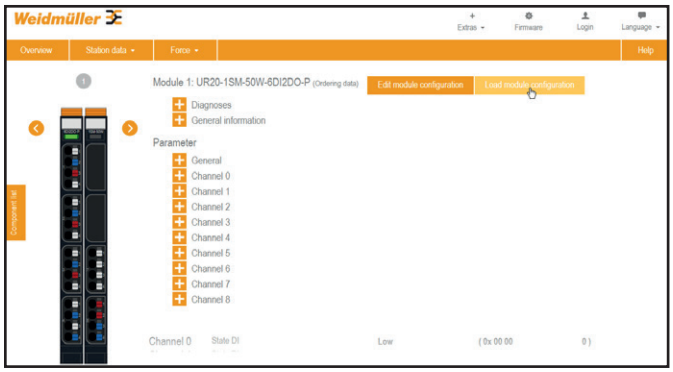
Motion profiles are stored in a motion register. You can write the motion register setup persistently to the stepper motor module.

► Click on “upload configuration”.
► Under “preview of the registers to be written”, check the motion register setup.
► Click on “write” to write the current register setup to the module.

The current motion register setup is persistently saved on the stepper motor module.

Uploading motion profiles from a file

► Start the web server.
► Open the component view of the stepper motor module by clicking on the station view on the stepper motor module.
► Click on “load module configuration” in the component view.



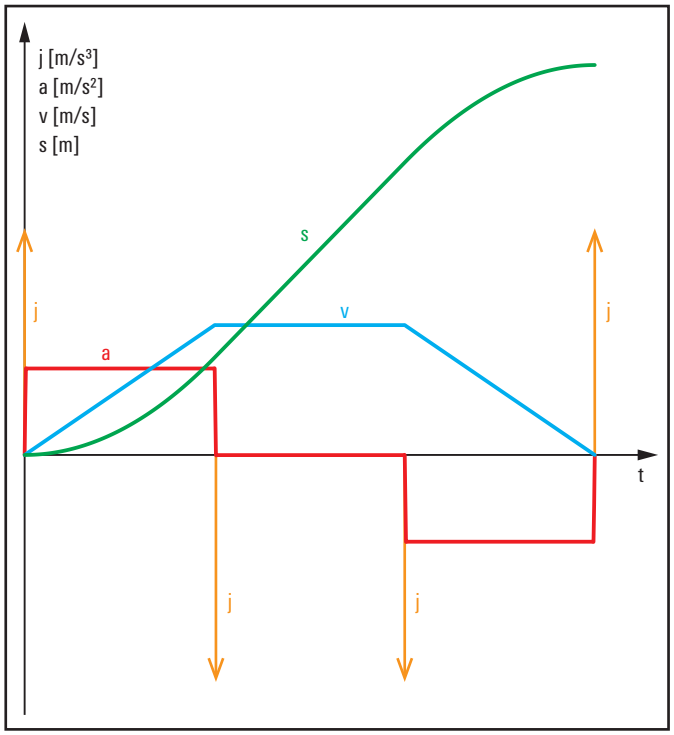
Uploading the motion register setup from the file

► Select the required file from your computer (.json).
► Check whether the details in the dialogue window correspond with the connected drive system.
► Click on “upload”.

The motion register setup is written to the module.

5.8 Acceleration types

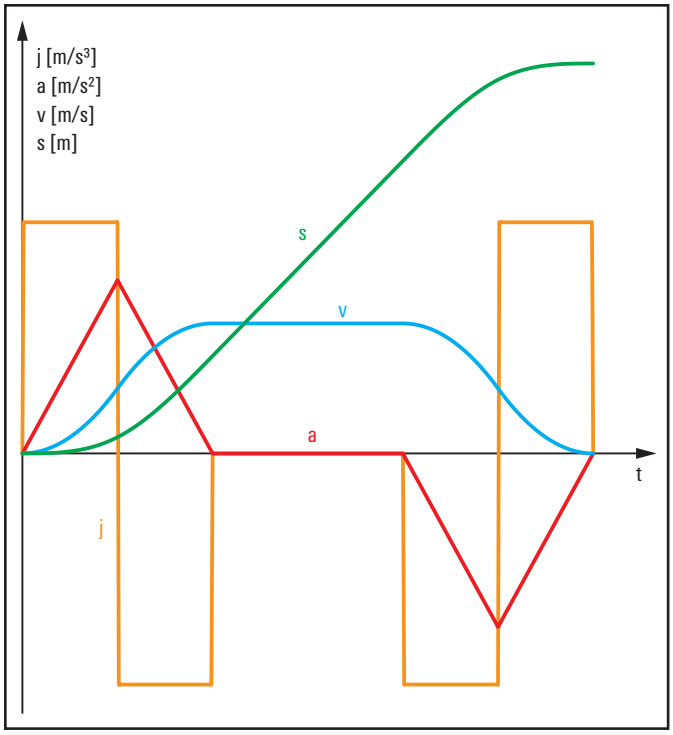
Constant acceleration



Jerk (j), velocity (v) and stroke (s) on contant acceleration (a)

During acceleration and braking procedures, the acceleration is constant.

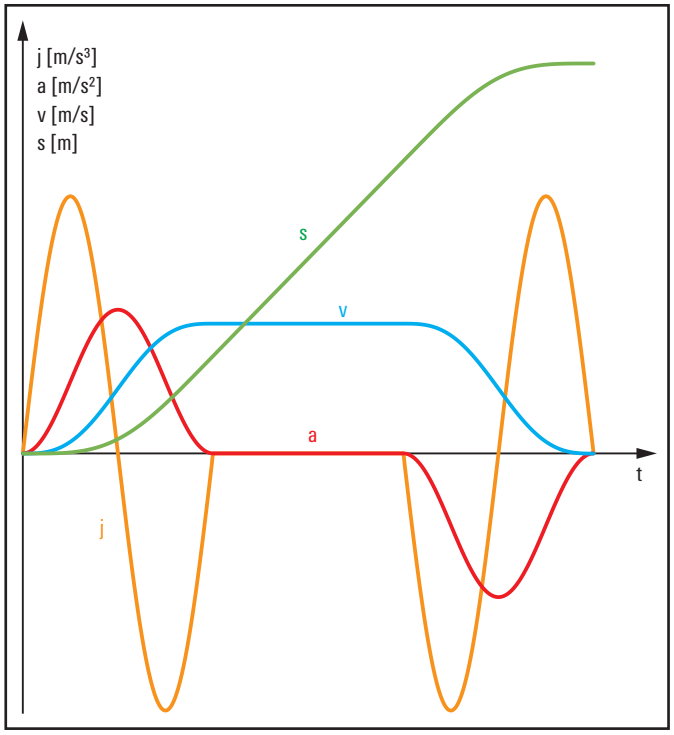
Linear acceleration



Jerk (j), velocity (v) and stroke (s) on linear acceleration (a)

During acceleration and braking procedures, the acceleration increases and decreases linear. The jerk is reduced compared to constant acceleration. With the same maximum acceleration, the travel time is increased compared to constant acceleration.

Optimal acceleration

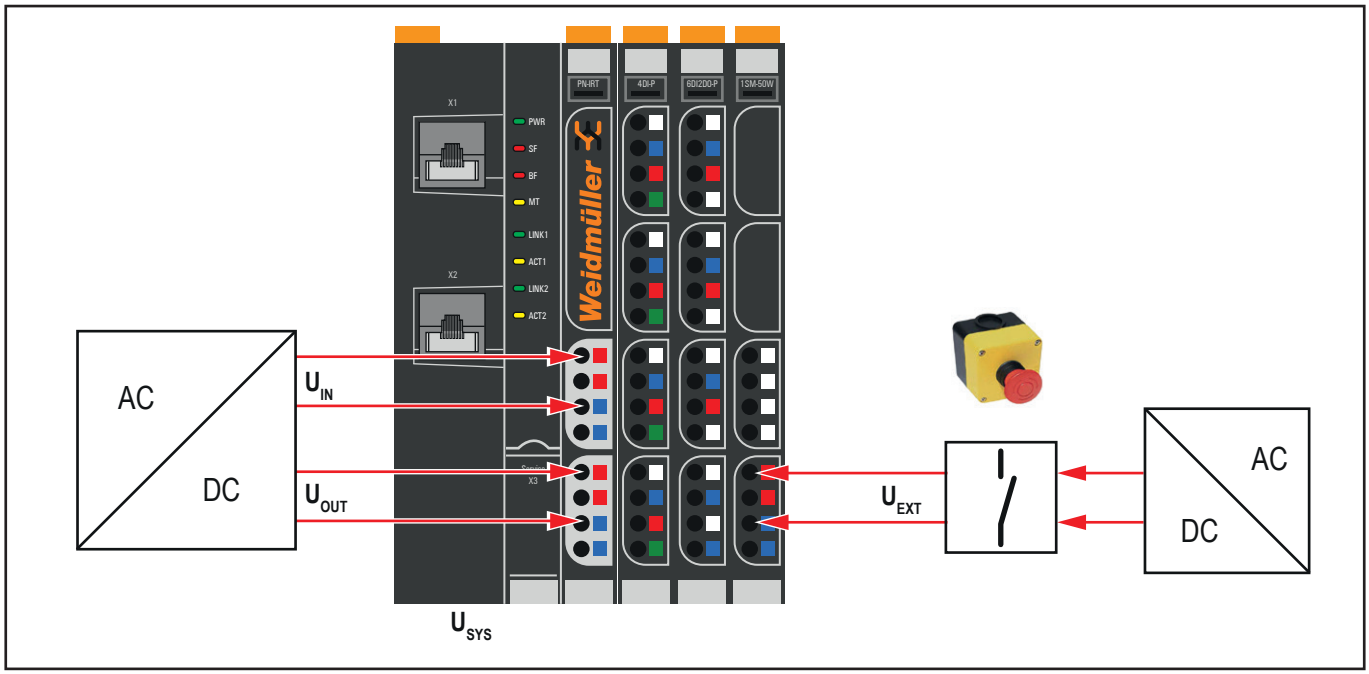


Jerk (j), velocity (v) and stroke (s) on optimal acceleration (a)

During acceleration and braking procedures, the acceleration describes a eine sin² curve. The jerk's harmonics are reduced compared to linear acceleration. The travel time on optimal acceleration corresponds to the travel time on linear acceleration.

5.9 Behaviour on interruption of power supply

There are different scenarios for the event that the power supply is interrupted.



Interruption of the power supply

U_{SYS} Internal system voltage
U_{IN} Power supply for input modules
U_{OUT} Power supply for output modules
U_{EXT} External power supply for the motor driver

Case1: Power supply U_{OUT} is interrupted

Requirement: U_{OUT} = OFF, U_{SYS} = U_{IN} = U_{EXT} = ON
Reaction: DO0 and DO1 = OFF
The internal release for the motor driver is logically "zero".
The module reports an error. The active motion is cancelled.

Case 2: Power supply of the u-remote station is interrupted

Requirement: U_{SYS} = U_{IN} = OFF, U_{OUT} = ON, U_{EXT} = ON.
Reaction: DO0 and DO1 = OFF
The internal release for the motor driver is logically "zero".
The module reports an error. The active motion is cancelled.

Case 3: Return of the power supply

Requirement: U_{OUT} = U_{SYS} = U_{IN} = ON, U_{EXT} = ON
Reaction: DO0 and DO1 = ON, if Bits are set.
The internal release for the motor driver is logically "zero".
The module reports an error. Travel commands are rejected until the switch-on sequence is performed.

Switch-on sequence after power supply interruption, return and restart

Requirement: The internal release for the motor driver is logically "zero".

Switch-on sequence:
1. The module reports an error with Bit SM_ERR_CUR (PDE 9.6) "Stepper motor driver".
2. Set the release bit SM_AMP (PDA 9.7) "Enable motor driver" to 0.
3. Set the Bit SM_MOV "moving" (PDA 9.1) to 0.
4. Acknowledge the error status with Bit SM_QUITT (PDA 9.6) "Acknowledge error motor driver".

Travel commands are now possible again.

6 Process data

6.1 Process input data

Process data inputs UR20-1SM-50W-6DI2DO-P

Byte	Format	Bit	Description	Comment
IB0 ... IB3	Double Word	IX0.0 ... IX3.7	Current position	Current position in increments
IB4 ... IB5	Word	IX4.0 ... IX5.7	Current velocity	Current velocity in increments/s
IB6	Byte	IX6.0 ... IX6.7	-	-
IB7	Byte	IX7.0 ... IX7.7	-	-
IB8	Byte	IX8.0	State DI 0	0 = low, 1 = high
		IX8.1	State DI 1	0 = low, 1 = high
		IX8.2	State DI 2	0 = low, 1 = high
		IX8.3	State DI 3	0 = low, 1 = high
		IX8.4	State DI 4	0 = low, 1 = high
		IX8.5	State DI 5	0 = low, 1 = high
		IX8.6	State DO 0	0 = low, 1 = high
		IX8.7	State DO 1	0 = low, 1 = high
IB9	Byte	IX9.0	State homing	0 = homing not made, 1 = homing made
		IX9.1	State moving	0 = stopped, 1 = running
		IX9.2	State direction	0 = right/cw, 1 = left/ccw
		IX9.3	State target position	0 = not reached, 1 = reached
		IX9.4	Max traversing exceeded	0 = no, 1 = yes
		IX9.5	Max acceleration exceeded	0 = no, 1 = yes
		IX9.6	Stepper motor driver	0 = OK, 1 = Error
		IX9.7	State power supply	0 = undervoltage, 1 = OK
IB10	Byte	IX10.0	Register address[1)]	
		IX10.1		
		IX10.2		
		IX10.3		
		IX10.4	Moving sets taken over[1)]	
		IX10.5	Register write acknowledge[1)]	
		IX10.6	Register write accepted[1)]	
		IX10.7	Register read abort[1)]	
IB11	Byte	IX11.0 ... IX11.7	Register read adress[1)]	
IB12 ... IB15	Double Word	IX12.0 ... IX15.7	Register read data[1)]	

1) Reserved for future firmware versions

6.2 Process output data

Process data outputs UR20-1SM-50W-6DI2DO-P

Byte	Format	Bit	Description	Comment
QB0 ... QB3	Double Word	QX0.0 ... QX3.7	Target position	Target position in increments or set current position in increments or load value encoder in increments
QB4 ... QB5	Word	QX4.0 ... QX5.7	Target velocity	Target velocity in increments/s
QB6 ... QB7	Word	QX6.0 ... QX7.7	Target acceleration	Target acceleration in increments/s^2
QB8	Byte	QX8.0	Acceleration	0 = constant, 1 = linear[1], 2 = optimal[1], 3 = reserved
		QX8.1		
		QX8.2	Moving mode	0 = absolute, 1 = relative, 2 = motion profile[1], 3 = reserved
		QX8.3		
		QX8.4	Moving time-optimized[1]	0 = disabled, 1 = enabled
		QX8.5	Position change	0 = off, 1 = on
		QX8.6	Set DO 0	0 = low, 1 = high
		QX8.7	Set DO 1	0 = low, 1 = high
QB9	Byte	QX9.0	Homing	0 = disabled, Edge 0-1 = start homing
		QX9.1	Moving	0 = disabled, Edge 0-1 = start moving
		QX9.2	Set encoder value	Edge 0-1 = start load value encoder
		QX9.3	Set current position	Edge 0-1 = start load current position
		QX9.4	Jog right/cw	0 = disabled, 1 = Jog right/cw
		QX9.5	Jog left/ccw	0 = disabled, 1 = Jog left/ccw
		QX9.6	Acknowledge error motor driver	0 = disabled, 1 = acknowledge
		QX9.7	Enable motor driver	0 = off, 1 = on
QB10	Byte	QX10.0	Register address[1]	
		QX10.1		
		QX10.2		
		QX10.3		
		QX10.4	Control bit write more moving sets[1]	
		QX10.5	-	
		QX10.6	Register read or write[1]	
		QX10.7	Register access request[1]	
QB11	Byte	QX11.0 ... QX11.7	Register write adress[1]	
QB12 ... QB15	Double Word	QX12.0 ... QX15.7	Register write data[1]	

1) Reserved for future firmware versions

6.3 Data width, dependent on the coupler used

Data width of UR20-1SM-50W-6DI2DO-P, dependent on the coupler used

Order no.	Coupler	Configuration	Parameters	Diagnostics	Process data	
					Input	Output
		Byte	Byte	Byte	Byte	Byte
1334870000	UR20-FBC-PB-DP	3	24	47	16	16
1334880000	UR20-FBC-PN-IRT	4	25	47	17	17
1334930000	UR20-FBC-MOD-TCP	–[1]	–[1]	–[1]	16	16
2476450000	UR20-FBC-MOD-TCP-V2	–[1]	–[1]	–[1]	16	16
1334910000	UR20-FBC-EC	4	–[2]	47	17	16
1334920000	UR20-FBC-EIP	4	21	47	16	16
1334900000	UR20-FBC-DN	4	21	47	16	16
1334890000	UR20-FBC-CAN	2	–[2]	47	16	16
1334940000	UR20-FBC-PL	2	–[2]	47	16	16

1) Observe the notes in the detailed description of the Modbus TCP fieldbus coupler (see section 5.4 of the u-remote IP20 manual).

2) Each parameter is transferred individually by a SDO transfer (service data objects). For that reason there is no size limit, nevertheless every transfered parameter prolongs starting up the station..

7 Diagnostics and troubleshooting

7.1 Diagnostic data

Diagnostic alarms can be activated with the „Diagnostic alarm" parameter.

Diagnostic data UR20-1SM-50W-6DI2DO-P

Name	Bytes	Bit	Description	Default
Error indicator	0	0	Module error	0
		1	Internal error	0
		2	External error	0
		3	Channel error	0
		4	Error	0
		5	Power supply fault	0
		6	Reserved	0
		7	Parameter error	0
Module type	1	0	Module Type 0x08	1
		1		1
		2		1
		3		0
		4	Reserved	1
		5	Reserved	0
		6	Reserved	0
		7	Reserved	0
Error byte 2	2	0 ... 7	Reserved	0
Error byte 3	3	0 ... 2	Reserved	0
		3	Reserved	0
		4	Communication fault	0
		5	Reserved	0
		5	Vin error	0
		7	Vout error	0
Channel type	4	0	Channel type 0x7D	1
		1		0
		2		1
		3		1
		4		1
		5		1
		6		1
		7	Reserved	0
Diagnostic bits per channel	5		Number of diagnostic bit per channel	8
Number of channels	6			10
Channel error	7	0 ... 7	Reserved	0
	8	0	Error at channel 8	
		1	Error at channel 9	
		2 ... 7	Reserved	0
	9 ... 10		Reserved	0
Channel 0 error to Channel 7 error	11 ... 18	0 ... 7	Reserved	0

Diagnostic data UR20-1SM-50W-6DI2DO-P

Name	Bytes	Bit	Description	Default
Channel 8 error	19	0	Overtemp shutdown	0
		1	Overcurrent Ch A	0
		2	Overcurrent Ch B	0
		3	Undervoltage Lockout	0
		4	Acceleration exceeded	0
		5	Velocity exceeded	0
		6	Contouring error exceeded	0
		7	Traversing range exceeded	0
Channel 9 error	20	0	Vext error	0
		1 ... 7	Reserved	0
Channel 10 error to Channel 31 error	21 ... 42	0 ... 7	Reserved	0
Time stamp	43-46		time stamp [µs] (32bit)	

7.2 LED indicators and troubleshooting

LED		Status	Empfohlene Maßnahme
Status LED		Green: communication on system bus	-
		Red: fault indication – Fault in the input current path supply voltage – Communication fault on system bus – Diagnosemeldung: parameterised limits exceeded (velocity, acceleration, traversing range)	– Check that the module has been snapped into place properly – Check supply voltage – Check parameters and traversing range and adjust them as necessary
Channel LED	1.1	Yellow: Input 0 active	-
	1.4	Yellow: Input 1 active	-
	2.1	Yellow: Input 2 active	-
	2.4	Yellow: Input 3 active	-
	3.1	Yellow: Input 4 active	-
	3.4	Yellow: Input 5 active	-
	4.1	Yellow: Output 0 active	-
	4.4	Yellow: Output 1 active	-
	7.1	Yellow: Phase A active	-
	7.2	Red: error phase A – Short circuit at the motor driver – Thermal overload at the motor driver	– Eliminate short circuit – Observe derating curves in the technical data
	7.3	Yellow: Phase B active	-
	7.4	Red: error phase B – Short circuit at the motor driver – Thermal overload at the motor driver	– Eliminate short circuit – Observe derating curves in the technical datan
	8.1	Green: external power supply OK	-
	8.2	Red: external power supply error – Voltage levels exceed allowed limits	– Check external supply voltage

8 Disassembly and disposal

8.1 Disassembling a u-remote-Modul

WARNING

Explosion risk!

► Prior to starting work, make sure that there is not a potentially explosive atmosphere!

WARNING

Dangerous contact voltage!

► Carry out all disassembly work on the u-remote station only when the power supply is disconnected.
► Make sure that the place of installation has been disconnected from the power supply!

Before you can disassemble a specific module, you must disassemble every module right of that module as well.

► Remove all cables and lines.
► Remove the end bracket marker (if present).
► Unfasten the mounting screw on the right-hand end bracket.
► Slide the end bracket with the end plate to the right and remove both from the DIN rail.

You can now disassemble the modules and the fieldbus coupler either individually or in groups of three to four modules.

► Press all the release levers of a module group towards the mounting plate so that they click into place.
► Slide the module group to the right and remove it from the DIN rail.
► Repeat the above procedure for all remaining modules/ module groups.
► Please observe the instructions for proper disposal.

8.2 Disposing of a u-remote-Modul

ATTENTION

Products in the u-remote series are subject to WEEE (EU Directive 2012/19/EU), which regulates the collection and recycling of electrical and electronic equipment.

► Make sure that disassembled products are properly disposed of!

When all u-remote products reach the end of their life cycle, you can return them to Weidmüller, and we will arrange for their proper disposal. This also applies to countries outside the European Union.

► Please pack the products properly and send them to your responsible distributor.

You can find the address of your respective country representative in the annex and at the Weidmüller website.

Weidmüller – Your Partner in Industrial Connectivity

As experienced experts we support our customers and partners around the world with products, solutions and services in the industrial environment of power, signal and data. We are at home in their industries and markets and know the technological challenges of tomorrow. We are therefore continuously developing innovative, sustainable and useful solutions for their individual needs. Together we set standards in Industrial Connectivity.

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