1.3 Module description

This module is used to control stepper motors with a nominal voltage of 24 to 48 VDC (±25%) at a motor current up to 5 A (10 A peak).

Functions:

- Integrated motor detection
- Currents independently configurable
- Load-dependent current control
- Stall detection
- Homing
- Limitations
- Motion generator
- Counters
- ABR interface and digital inputs
- Automatic shutdown
- NetTime Technology

Integrated motor detection

Due to the integrated motor detection, the connected motors can be identified by their coil characteristics and feedback in the form of an analog value can be generated. This makes it possible to detect not only wiring errors, but also incorrect motor types being used.

Currents independently configurable

With individual adjustment of the coil currents, the motor is only operated with the current it actually needs. This prevents unnecessary heating of the motor. This lower heating has a positive effect on the energy consumption, thermal load and thus on the service life of the complete system.

Load-dependent current control

The module contains a sensorless, load-dependent current control. Depending on the operating situation and load, the module controls the current downwards. This results in energy savings of up to 75%.

Stall detection

Stall detection is integrated to analyze the motor load. Motor stall detection is defined by a configurable threshold. This allows an overload or motor stall to be detected sufficiently accurately in many applications.

Homing

A large selection of homing procedures allows a wide range of applications for the module. In addition to procedures triggered by limit switches, stop-controlled and immediate homing procedures can also be defined.

For end stop-controlled homing, a delay time can also be defined for stall detection. Homing is only performed after the delay time has elapsed. This prevents unwanted homing due to accidental, brief stoppage of the motor.

Limitations

Software limitations and/or hardware limit switches allow precise control of the maximum range of movement. This prevents limit transgressions that could result in damage to the machine.

Motion generator

Movements can be generated directly by the module. Homing or exact positioning procedures can be implemented with minimal application effort using a specified target position and acceleration as well as several other parameters.

Counter functions

The exact position of the motor can be determined either by an AB(R) encoder or by internal calculations in the module. This allows a large number of motors to be used that are precisely adapted to the machine requirements.

Inputs/Outputs

The module is equipped with digital inputs that can additionally be used as homing inputs, limit switches or AB(R) encoder inputs.

Automatic shutdown

The voltage of the module power supply and the module temperature are monitored. If a value overshoots the predefined limit value, the module is automatically shut down. The outputs are automatically started up again as soon as the value is within the limit value again.

In addition, SDC life sign monitoring can be used to monitor the communication between the controller and module. An interruption of the communication triggers an automatic shutdown of the motor by the module.

NetTime timestamp of the position and trigger time

It is not just the position value that is important for highly dynamic positioning tasks, but also the exact time the position is measured. The module is equipped with a NetTime function for this that supplies a timestamp for the recorded position and trigger time with microsecond accuracy.

2 Technical description

2.1 Technical data

Order number	X20SM1446-1
Short description	
I/O module	1 full bridge for controlling stepper motors
General information	
B&R ID code	0xF3B0
Status indicators	I/O function per channel, operating state, module status
Diagnostics	
Module run/error	Yes, using LED status indicator and software
Output	Yes, using LED status indicator and software
I/O power supply	Yes, using software
Power consumption	
Bus	0.01 W
Internal I/O	-
External I/O	
24 VDC	2.4 W
48 VDC	3.5 W
Additional power dissipation caused by actuators (resistive) [W]	-
Input current limiting	Max. 12.5 A
Certifications	
CE	Yes
UKCA	Yes
UL	cURus E225616 Power conversion equipment
Motor bridge - Power unit	
Quantity	1
Type	2-phase bipolar stepper motor (full bridge)
Nominal voltage	24 to 48 VDC ±25% [1]
Nominal current	5 A
Maximum current	10 A for 1 s [2]
DC bus capacitance	100 µF
Step resolution	Max. 256 microsteps per step
Module power supply	
Supply	External
Fuse	Required line fuse: Max. 10 A, slow-blow
Output protection	Reverse polarity protection on supply voltage
Digital inputs	
Quantity	4
Nominal voltage	24 VDC
Input circuit	Sink
Input filter	
Hardware	<5 µs
Software	-
Connection type	1-wire connections
Input resistance	Typ. 10 kΩ
Additional functions	1x ABR incremental encoder, open-circuit detection
Switching threshold	
Low	<5 VDC
High	>10 VDC
ABR incremental encoder	
Quantity	1
Encoder inputs	24 V, asymmetrical
Counter size	16-bit
Input frequency	Max. 50 kHz
Evaluation	4x
Electrical properties	
Electrical isolation	Channel isolated from bus Channel not isolated from I/O power supply
Operating conditions	
Mounting orientation	
Horizontal	Yes
Vertical	Yes

Table 2: X20SM1446-1 - Technical data

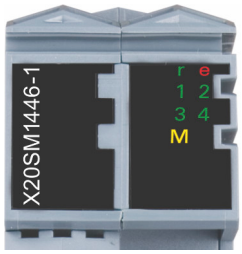
Order number	X20SM1446-1
Installation elevation above sea level	
0 to 2000 m	No limitation
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m
Degree of protection per EN 60529	IP20
Ambient conditions	
Temperature	
Operation	
Horizontal mounting orientation	-25 to 50°C
Vertical mounting orientation	-25 to 40°C
Derating	See section "Derating".
Storage	-25 to 70°C
Transport	-25 to 70°C
Relative humidity	
Operation	5 to 95%, non-condensing
Storage	5 to 95%, non-condensing
Transport	5 to 95%, non-condensing
Mechanical properties	
Note	Order 1x terminal block X20TB12 separately. Order 1x bus module X20BM31 separately.
Pitch	$25^{+0.2}$ mm

Table 2: X20SM1446-1 - Technical data

1) The tolerance value is composed of the voltage tolerances and permissible total AC voltage component with a peak value of 5% of the rated voltage.
2) See section "Let-through energy I2T".

2.2 LED status indicators

For a description of the various operating modes, see section "Additional information - Diagnostic LEDs" in the X20 system user's manual.

Figure	LED	Color	Status	Description
	r	Green	Off	No power to module
			Single flash	Mode RESET
			Double flash	Mode BOOT (during firmware update)[1]
			Blinking	Mode PREOPERATIONAL
			On	Mode RUN
	e	Red	Off	Module not supplied with power or everything OK
			On	Error or reset status
	e + r	Solid red / Single green flash		Invalid firmware
	1 - 4	Green	On/Off	Input state of the corresponding digital input
			Blinking	Open circuit or not connected
	M	Orange	On	The motor is active.

1) Depending on the configuration, a firmware update can take up to several minutes.

2.3 Pinout

To guarantee full motor power, voltage drops that could result from the cable length and the electrical connections must also be taken into account when selecting the attachment cable.

Warning!

The terminal block is not permitted to be disconnected or connected during operation.

Mise en garde !

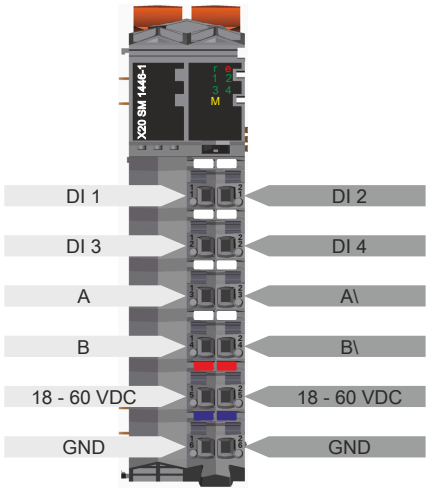
Il est interdit de déconnecter le connecteur pendant le fonctionnement.

Information:

Shielded motor cables must be used in order to meet the limit values per standard EN 55011 (emissions).

Information:

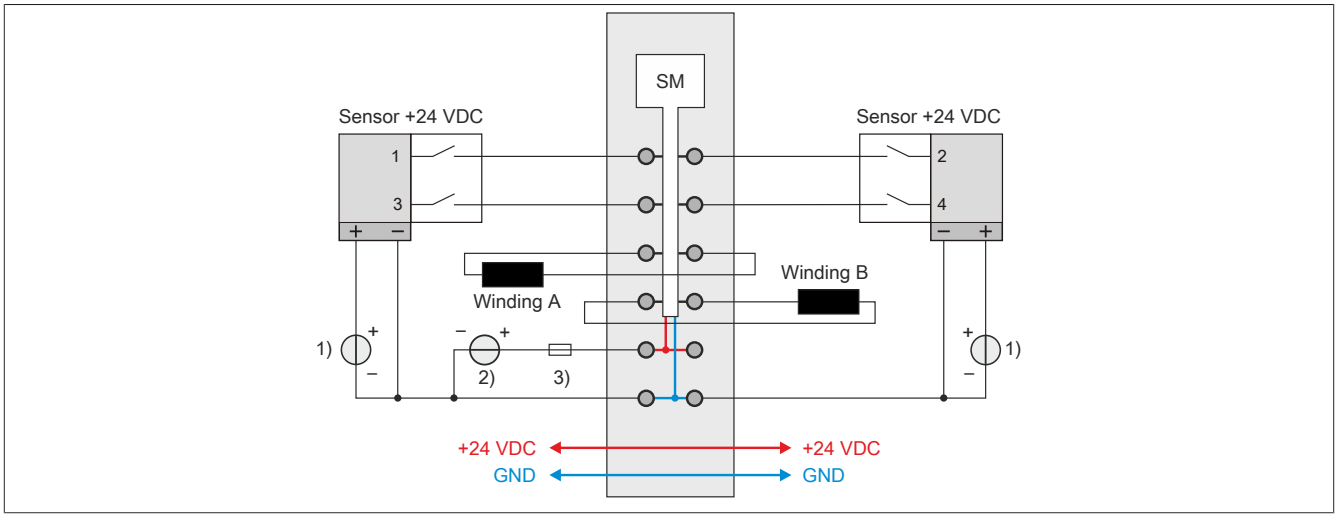
If a boost current of 10 A is required, the motor cables are not permitted to be longer than 2 meters.



2.4 Connection example

Information:

This module can only be operated if supplied with power via the terminal block.



1) 24 VDC supply
2) 18 to 60 VDC supply
3) Fuse, 10 A slow-blow

For the wiring of sensors 1 to 4 see "Push-pull input circuits" on page 9

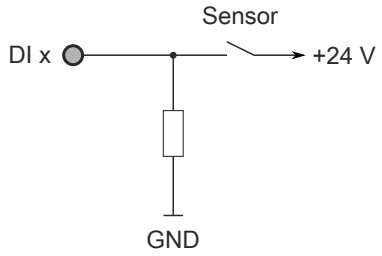
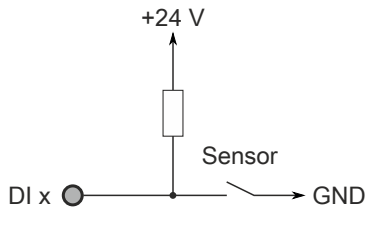
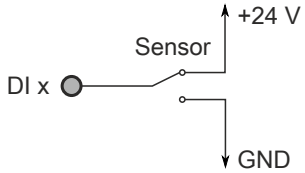
2.4.1 Push-pull input circuits

The digital inputs of the module are equipped with open-circuit detection and therefore designed for a push-pull circuit.

Information:

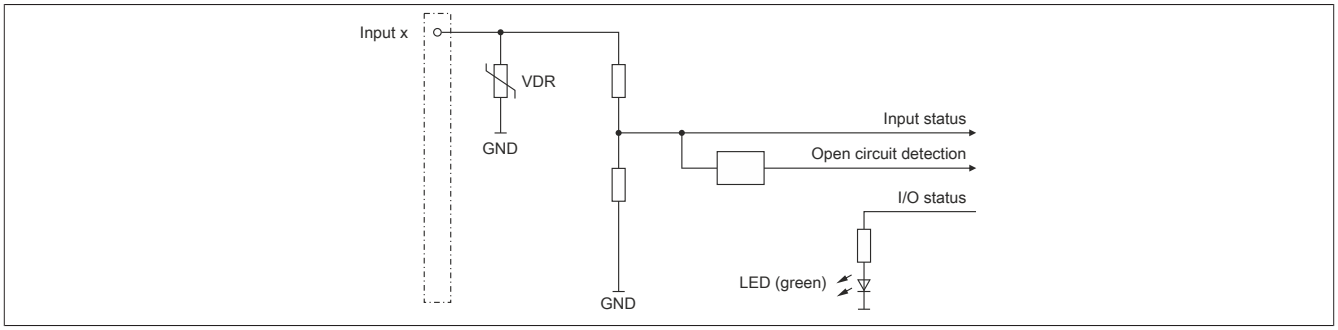
If no push-pull circuit is used, an open sensor contact is interpreted by the module as an open circuit.

Circuit variants

Push circuit	Pull circuit	Push-pull circuit with toggle switch
		

The size of the resistor depends on the sensor used and must therefore be calculated in each individual case.

2.5 Input circuit diagram



2.6 Output circuit diagram

