SIEMENS

Industrial Controls

Load Feeders and Motor Starters

SIRIUS Motor Starter M200D AS-Interface Basic

Manual

Edition 08/2014

Answers for industry.

SIEMENS

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SIRIUS motor starters M200D AS-Interface Basic

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indicates that minor personal injury can result if proper precautions are not taken.

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Introduction / product description

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1.1 What are M200D distributed motor starters?

M200D motor starters are standalone devices with a high degree of protection (IP65) for distributed use near the motor.

Depending on the order variant, they are available as:

- Direct starters, electromechanical or electronic (DSte, sDSte)
- Reversing starters, electromechanical or electronic (RSte, sRSte)

They are suitable for the following tasks:

- Switching and protecting three-phase loads at 400 V AC up to 5.5 kW
- Control via AS-Interface

Depending on the order variant, they are equipped with:

- Brake output for 400 / 230 V AC or 180 V DC
- Integrated manual local control with a key-operated switch and keypad

Connecting the M200D motor starter to AS-Interface

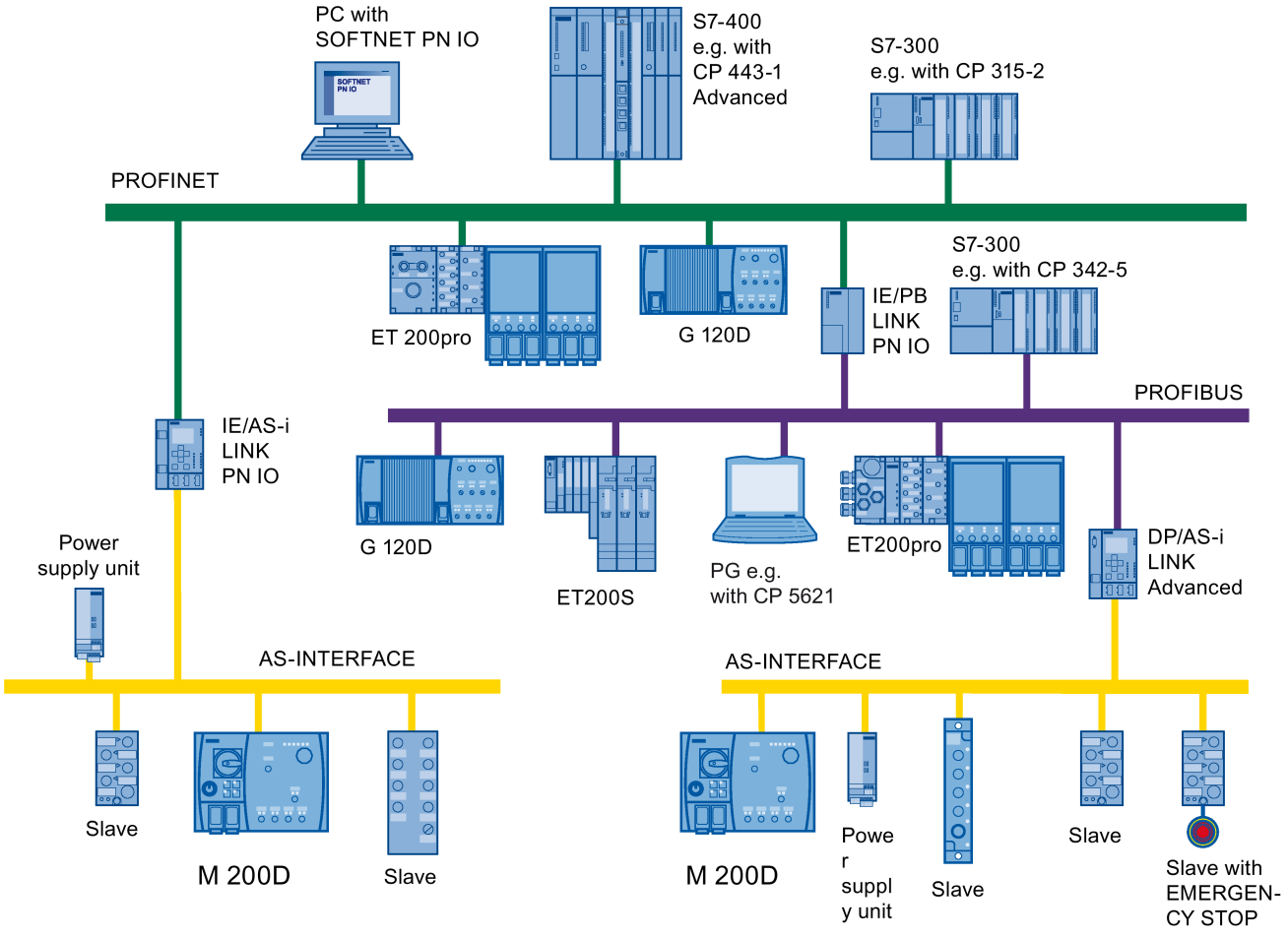


Figure 1-1 M200D: overview

1.2 Fieldbus interfaces

1.2.1 AS-Interface

Overview

The AS-Interface (actuator sensor interface, AS-i) is an open international standard for fieldbus communication between distributed actuators and sensors at the lowest control level.

AS-i complies with the IEC 61158 / EN 50295 standards and was specifically designed for connecting binary sensors and actuators that comply with these standards. AS-i makes it possible to replace point-to-point cabling of the sensors and actuators by a bus line.

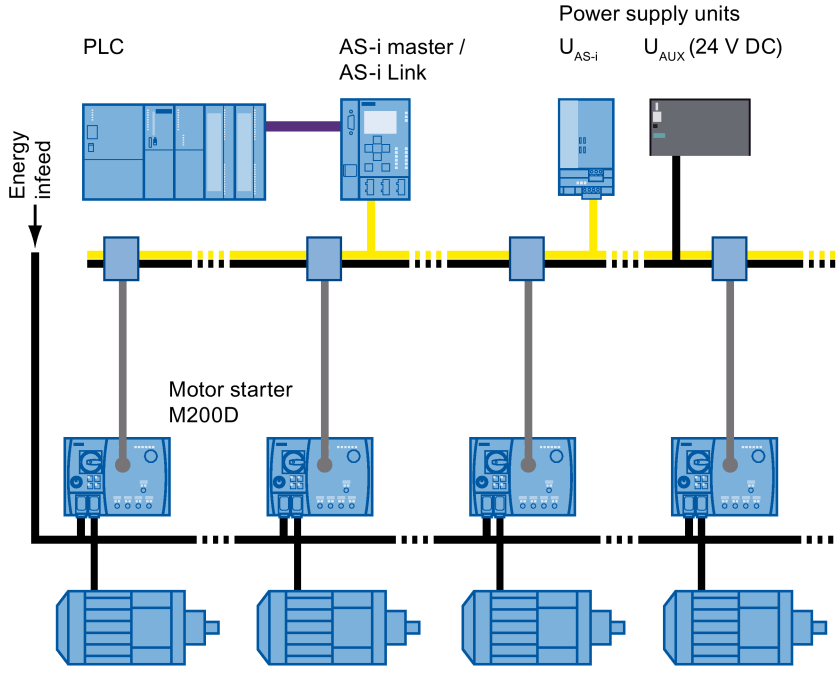


Figure 1-2 Example: M200D AS-i

The AS-Interface has the following advantages:

- Flexibility
- Cost effectiveness
- Simple and rapid installation with a minimum of errors
- A common line for transferring data and power

Product family

2

2.1 Motor starter M200D AS-Interface

The following motor starters with AS-Interface (AS-i) are available:

- M200D AS-i Basic
  motor starter with thermistor motor protection + thermal motor model:
  - Direct starter (electromechanical) (DSte) up to 5.5 kW,
    Current ranges: 0.15 – 2 A and 1.5 – 12 A
  - Reversing starter (electromechanical) (RSte) up to 5.5 kW,
    Current ranges: 0.15 – 2 A and 1.5 – 12 A
  - Direct starter (electronic) (sDSte) up to 4 kW,
    Current ranges: 0.15 – 2 A and 1.5 – 9 A
  - Reversing starter (electronic) (sRSte) up to 4 kW,
    Current ranges: 0.15 – 2 A and 1.5 – 9 A

Order variants:

- Brake output for:
  - 400/230 V AC
  - 180 V DC
- Integrated manual local control (key-operated switch and keypad)

Accessories:

- Connection components (e.g. cables, connectors, etc.)
- Hand-held device
- Safety bar for the plug connections

2.2 Overview of the device functions

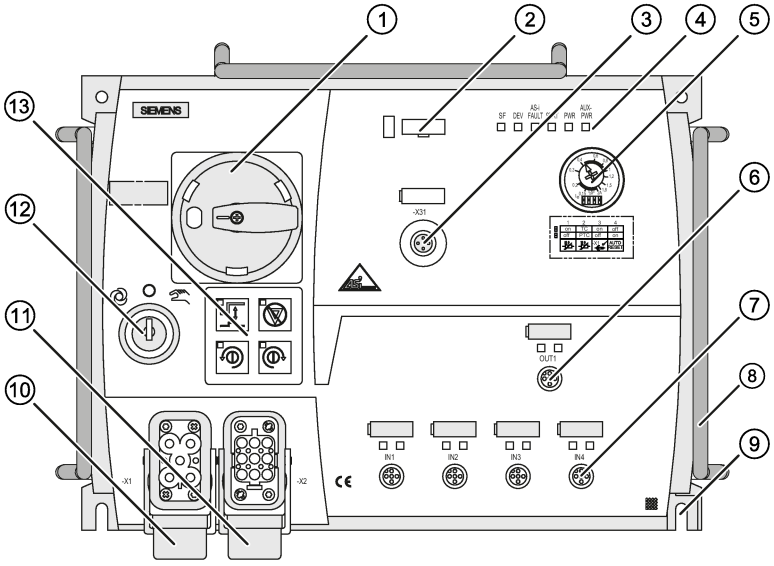
Device functions	Electromechanical (DSte, RSte)/ electronic (sDSte, sRSte)
Fieldbus interface	●
Control function: reversing starter	○
Control function: soft starter	—
Brake output 400 V / 230 V AC	○
Brake output 180 V DC	○
Thermal motor model	●
Temperature sensor (thermistor motor protection)	●
Asymmetry monitoring	●
Blocking current monitoring	●
Zero-current monitoring	●
M12 inputs (routed via AS-i)	4 (2)
M12 outputs (routed via AS-i)	1 (0)
Connector monitoring	●
Short-circuit protection	●
Communication	
Slave type	A/B slave (4I / 3O)
Communication profile	7.A.E
Diagnostics via parameter channel (parameter echo)	●
Support for AS-i S1 status bit	●
Transfer of data sets via AS-i	—
Extended cyclic process image	—
Access via "Motor Starter ES"	—
Additional functions	
Self-test	●
Local device interface	●
Disconnecting means	●
Integrated manual local control (key-operated switch, keypad with LEDs)	○
Setting elements parameterized on device	●

● Integrated

○ Order variant

2.3 Design concept

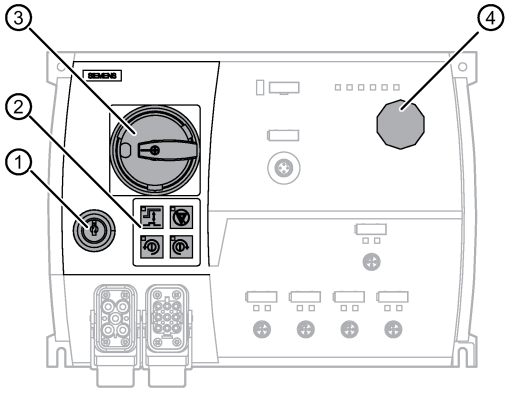
Connections and controls on the motor starter



① Disconnecting means (circuit breaker), can be locked
② Optical device interface
③ M12 AS-i connection
④ Diagnostic LEDs
⑤ Cover (setting elements)
⑥ M12 output
⑦ M12 inputs
⑧ Protection guard for cables and connections (accessories)
⑨ Fixing holes for installation
⑩ 400 V infeed
⑪ Motor connection
⑫ Key-operated switch (order variant)
⑬ Keypad for manual operation (order variant)

2.3.1 Operator controls

The motor starter is equipped with the following operator controls:



① Key-operated switch (order variant)
② Keypad (order variant)
③ Disconnecting means (circuit breaker)
④ Cover for parameter setting elements

Integrated manual local control (key-operated switch ① and keypad ②; order variant)

A key-operated switch and keypad are used for local operation.
The key can be inserted/removed in three positions.

Disconnecting means ③ (circuit breaker)

The disconnecting means is designed for the following individual functions:

- Disconnecting the series-connected consumers from the supply voltage
- Short-circuit protection of the series-connected consumer
- Switching on inhibited via padlock (max. three padlocks possible)

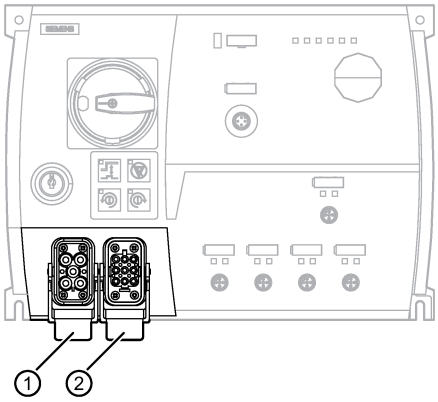
Parameter settings ④

The following setting elements can be found under the cover of the M200D AS-i Basic:

- Rotary coding switch for:
  - Setting the rated operating current
  - Deactivating the thermal motor model (class OFF)
- DIP switch for:
  - Autoreset (ON / OFF)
  - Connector monitoring (ON / OFF)
  - Temperature sensor (ON / OFF)
  - Temperature sensor (PTC / TC)

2.3.2 Connections

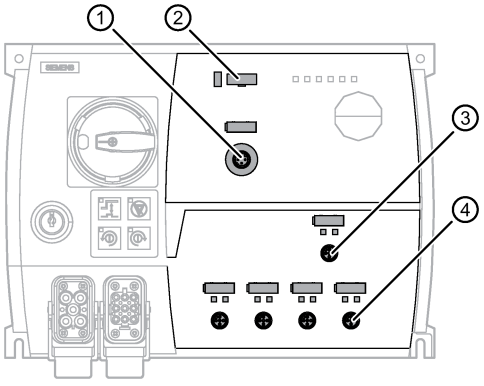
Power terminals



① Infeed for the three phases as well as the PE and N conductor via power connectors (HAN Q4/2 with ISO23570 assignment)

② Connection of the motor via power connectors (HAN Q8/0 with ISO23570 assignment)

Control circuit / bus



① AS-i bus connection with auxiliary voltage, M12 connector

② Optical device interface (under the labeling strip) for connecting the hand-held device

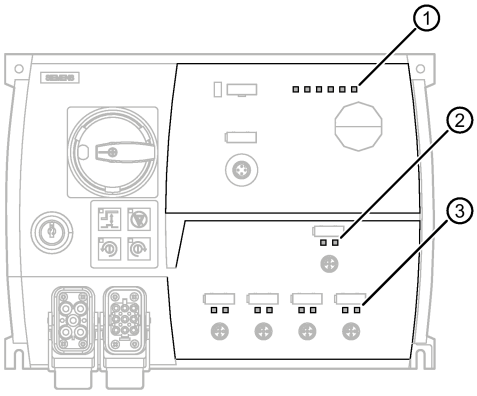
③ 1 x M12 output

④ 4 x M12 inputs

- 2 inputs can be read via AS-i
- 2 inputs with fixed input function

2.3.3 Status indicators

The following LEDs on the front of the starter indicate the device status:



① Indicators for the device status and communication
② Indicator for output OUT1
③ Indicators for inputs IN1 ... IN4

For a detailed description of the indicators, see "Diagnostics (Page 83)".

Functions

3

3.1 Overview of the device functions

Device functions	Electromechanical (DSte, RSte)/ electronic (sDSte, sRSte)
Fieldbus interface (Page 22)	●
Control function: reversing starter (Page 22)	○
Brake output 400 V / 230 V AC (Page 23)	○
Brake output 180 V DC (Page 23)	○
Thermal motor model (Page 25)	●
Temperature sensor (thermistor motor protection) (Page 27)	●
Blocking protection (Page 28)	●
Residual current monitoring (Page 28)	●
Asymmetry monitoring (Page 30)	●
M12 inputs (routed via AS-i) (Page 31)	4 (2)
M12 outputs (routed via AS-i) (Page 35)	1 (0)
Connector monitoring (Page 35)	●
Short-circuit protection (Page 37)	●
Communication	
Slave type	A/B slave (4I / 3O)
Communication profile (Page 70)	7.A.E
Diagnostics via parameter channel (parameter echo) (Page 88)	●
Support for AS-i S1 status bit (Page 88)	●
Transfer of data sets via AS-i	—
Extended cyclic process image	—
Access via "Motor Starter ES"	—
Additional functions	
Self-test (Page 40)	●
Local device interface (Page 42)	●
Disconnecting means (Page 37)	●
Integrated manual local control (Page 43) (key-operated switch, keypad with LEDs)	○
Setting elements for parameter assignment on device (Page 74)	●

● Integrated

○ Order variant

3.2 Introduction

Device functions

This section describes the device functions. All the device functions are assigned inputs (e.g. device parameters) and outputs (e.g. messages).
The following schematic diagram illustrates the functional principle of the device:

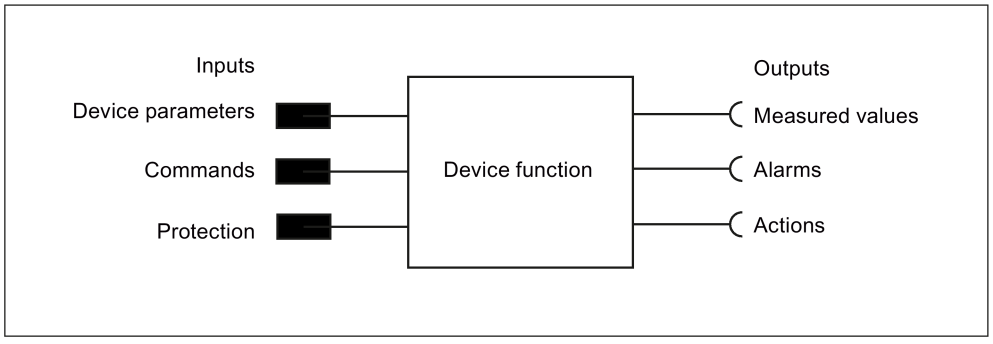


Figure 3-1 Functional principle of the device

Self-protection

The motor protects itself against fatal damage by means of the thermal motor model and temperature measurements for electronic switching elements.

Currents

Note

All current values (e.g. blocking current, current limits) are percentages of the rated operating current set on the device (e.g. I_e = 2 A = 100 %).

3.3 Basic functions / parameters

Definition

Basic parameters are "central" parameters required by a range of device functions.

3.3.1 Rated operating current

Here, you can enter the rated operating current that the branch (switchgear and motor) can carry without interruption. This is usually the rated motor current. The setting range depends on the output class of the M200D motor starter (0.15 ... 2 A or 1.5 ... 12 A).

Note

The rated operating current is one of the key parameters.

The rated operating current must **always** be set if motor protection is to be ensured via the electronic overload relay.

The overload relay can be deactivated.

In this case, motor protection must be ensured by means of a thermistor in the motor.

Notes

- On the motor starter, the default rated operating current is set to the **minimum** value.
- The rated operating current for the M200D AS-i Basic motor starter is set by means of the rotary coding switch. For more information, see Parameterization via local setting (Page 74).

3.3.2 Protection against voltage failure

If the supply voltage fails, the last overload message "Overload" is retained.

3.4 Fieldbus interface

Response to CPU / master STOP

If the fieldbus interface is interrupted, all control signals are set to 0.

Note

This is only relevant in "automatic" mode.

Group diagnosis

The controller is informed of whether or not a group fault message is present in the device when "I/O fault bits" on the SAP status tab (S1 = 1) is set. The AS-i master enters the S1 value in the list of I/O faults (LPF) that have been signaled. The controller can read this list via the "GET_LPF" command and then query a specific diagnostic value from the slave (see also Diagnostics via parameter channel (parameter echo) (Page 88)).

The motor starter issues a fault message if a fault is present. In this case, the SF LED lights up red.

Reference

For more information, refer to the documentation for your AS-i master.

3.5 Motor control

3.5.1 Control function: reversing starter

Description

This control function allows the motor starter to control the direction in which motors rotate. An internal logic prevents both directions of rotation from being activated simultaneously. The delayed switchover from one direction of rotation to another is implemented by means of the lock-out time, which is permanently set to 150 ms.

Note

To reverse the direction of rotation, a mechanically-switching reversing contactor is integrated in reversing starters with electronic switching. The preferred position of this contactor is "CW rotation".
When the direction is changed to "CCW rotation", the reversing contactor is activated first, followed by the electronic contacts after an 80 ms delay.

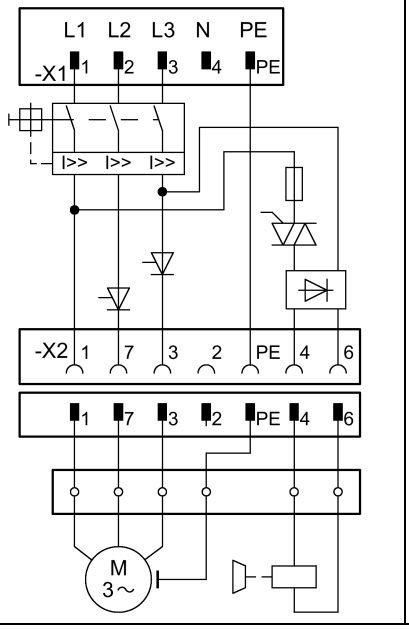
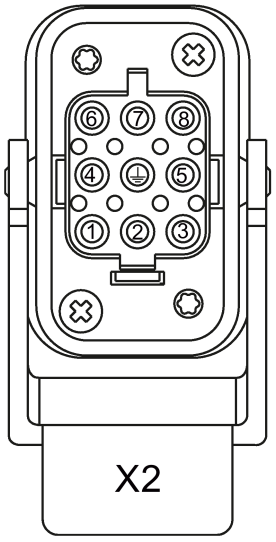
3.5.2 Brake output

Description

A motor-mounted mechanical disk or spring-loaded brake is used to brake the motor. The brake is controlled via the brake output.

Circuit diagram: example

The following circuit diagram illustrates the mechanical braking procedure with a 180 V DC brake output:

Circuit diagram	Motor connector	Pin	Name
		1	Phase L1
		2	—
		3	Phase L3
		4	Brake L1 (switched)
		5	Thermistor
		6	Brake L3 (direct)
		7	Phase L2
		8	Thermistor
		⏚	PE (yellow/green)

⚠ WARNING

Hazardous voltage
Danger of death or serious injury

The brake is only switched in a single phase. This means that voltage can be applied at pin 6 even when the system is switched off.

Brake output

Externally-supplied motor brakes are usually powered via a jumper on the motor terminal board.

Since switching the motor and brake simultaneously can increase wear and tear to the brake, all M200D motor starters can be fitted with an optional electronic brake controller.

Depending on the order variant, the following externally supplied brake coils can be controlled:

- 400 V AC / 230 V
  (The brake rectifier must be installed in the motor. The rectifier input is controlled via the motor starter).
- 180 V DC
  (A rectifier is not required for the brake in the motor because the motor starter provides the 180 V DC. In this way, brake coils for 180 V DC can be switched directly).

The brake voltage is fed to the motor together with the motor infeed via a joint cable (e.g. 6 x 1.5 mm^2). For more information about connecting the brake output, see section Brake output (Page 62).

Note

With both brake output versions, the electronic switching element is located on the AC side. Please refer to the technical data of the brake (e.g. Catalog D87.1 "SIEMENS MOTOX Geared Motors") for the resulting application time of the brake.

If faster brake application times are required (DC side tripping), a 400 V / 230 V AC brake output in conjunction with a function rectifier integrated into the motor is preferable.

Devices with an 180 V DC brake output from product version E10 onwards are suitable for attaining short brake application times. In comparison to the previous product versions, this means that the time until the motor comes to a standstill is shorter.

The integrated free-wheeling diode is deactivated when switching off the brake output and the energy of the brake coil dissipated through a varistor.

Brake release delay at startup

A fixed ON-delay time of 40 ms is set for the M200D AS-i Basic motor starter to prevent wear and tear to the brake (e.g. the motor output is activated 40 ms after the brake output).

In reversing mode, the release delay does not begin until the lock-out time has expired.

3.6 Motor protection

3.6.1 Thermal motor model

Description

The approximate temperature of the motor is calculated using the measured motor currents and device parameters "Rated operating current" and "Tripping class". This indicates whether the motor is overloaded or functioning in the normal operating range.

Motor protection shutdown response

You use this device parameter to specify how the motor starter is to respond in an overload situation:

- Shutdown without restart (AUTO RESET = off)

  Following an overload situation, the shutdown command cannot be reset until the motor model has fallen below the reset threshold and after a reset command has been issued (trip reset).

- Shutdown with restart (AUTO RESET = on)

⚠ WARNING

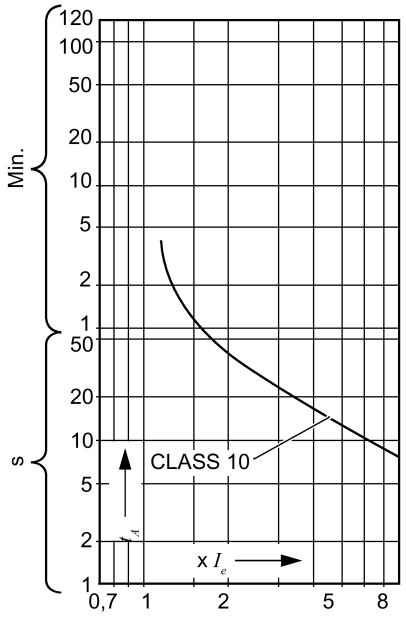
Motor restarts automatically if AUTO RESET is on.
Can Cause Death, Serious Injury, or Property Damage

The motor starter restarts automatically after the recovery time if a start command is present (autoreset). (autoreset).
Make sure that you take appropriate measures to exclude the risk of hazardous conditions.

Trip class

The trip class (CLASS) specifies the maximum time within which a protective device must trip from a cold state at 7.2 x the setting current (motor protection to IEC 60947). The M200D AS-i Basic trip class is set permanently to CLASS 10 and can be deactivated.

If the setting is changed to CLASS OFF, the "thermal motor model" function is deactivated along with the accompanying messages. With the M200D AS-i Basic, the thermal motor model is deactivated by means of the rotary coding switch for setting the operating current (CLASS OFF position).



3-pole symmetrical load

Note

Deactivation rule

To ensure motor protection, the motor cannot be switched on when the temperature sensor is deactivated and, at the same time, CLASS OFF is set. This is indicated on the M200D AS-i Basic with either a warning (if an ON command is not present) or a fault (if an ON command is present).

Recovery time

The recovery time is the time defined for cooling after which the system can be reset following an overload trip. The recovery time for the M200D AS-i Basic is set permanently to 90 s.

Trip reset signals present during the recovery time have no effect.

Voltage losses occurring before this time expires can prolong the recovery time.

Prewarning limit for motor heating

The motor starter also assumes a prewarning role, that is, it issues a warning if the motor temperature limit is exceeded. The prewarning limit for the M200D AS-i Basic is 90 % of the motor heating value. The motor is shut down at 100 %.

The warning can be read via Diagnostics via parameter channel (parameter echo) (Page 88) for the starter.

Settings

Device parameter	Default setting	Setting range
Motor protection shutdown response	Shutdown without restart	• Shutdown without restart • Shutdown with restart
Trip class	CLASS 10	• CLASS 10 • CLASS OFF

3.6.2 Temperature sensor

Description

Temperature sensors are used to directly monitor the motor winding temperature. This indicates whether the motor is overloaded or functioning normally. If temperature sensors are installed in the motor stator winding (order option for the motor), the M200D motor starter can use these to monitor the motor.

M200D motor starters can evaluate **one** temperature sensor circuit.

The temperature sensor evaluation electronics are galvanically isolated from the electronics and the auxiliary voltage.

This is beneficial if insulation damage is caused to the motor or the motor supply line, as this does not affect any further system components (see Technical Specifications).

Temperature sensor

You can activate or deactivate this parameter depending on whether or not a temperature sensor is installed in the motor. The setting is made by means of the DIP switch on the device.

Two types of temperature sensor are supported:

- Thermoclick.
  This is a switch that opens at a certain winding temperature.
- PTC type A.
  This is a PTC thermistor with a characteristic to IEC 60947-8.

When the PTC type A temperature sensor is active, temperature sensor monitoring is also activated (see below).

Motor protection shutdown response

You can use this parameter to determine how the motor starter is to respond to a temperature sensor or thermal motor model overload:

- Shutdown without restart (AUTO RESET = off)
- Shutdown with restart (AUTO RESET = on)

⚠ WARNING

Motor restarts automatically if AUTO RESET is on.
Can Cause Death, Serious Injury, or Property Damage

The motor starter restarts automatically after the recovery time if a start command is present (autoreset). (autoreset).
Make sure that you take appropriate measures to exclude the risk of hazardous conditions.

Temperature sensor monitoring

Temperature sensor monitoring is activated when a PTC type A temperature sensor is parameterized.

This device parameter monitors the temperature sensor cable for interruptions (wire breakage) and short-circuits. The motor is shut down if either of these scenarios occurs.

Settings

The possible settings for the M200D AS-i Basic motor starter can be found in section Parameterization via local setting (Page 74).

3.7 System monitoring

3.7.1 Current limit values

Description

The motor current and current limit values can be used to determine different system statuses:

System status	Current value	Protection by
Motor blocked	Very high current flowing	Blocking protection
Motor runs at no load (e.g. because system is damaged)	Very low current flowing (< 18.75 % of I_e)	Residual current detection

Response to residual current detection

Residual current detection responds when the motor current in all three phases falls below 18.75 % of the set rated operating current. In this case, the motor starter shuts down the motor.

Residual current detection is deactivated by setting the rotary coding switch to "CLASS OFF".

Note

When the motor is switched on, residual current detection is suppressed for around 1 second.

Blocking current monitoring

The blocking current specifies how much current is consumed by the motor (at rated voltage) when the axis blocked.

The blocking current monitoring function detects when a motor axis is blocked mechanically. The block causes the motor to consume more power. The "blocking current" is a defined monitoring threshold for the motor current consumption.

It is monitored as follows:
When the motor starts, the tripping limit for the blocking current is set permanently to 800 % of the rated operating current for a period of 10 s. During operation, the "blocking current" tripping limit is set permanently to 400 % of the rated operating current.

If the blocking current is exceeded, the motor starter detects blocking. Blocking time monitoring is activated as of the point at which the blocking current is exceeded. If the blocking current flows for longer than the blocking time, the motor starter automatically generates a shutdown command.

The blocking current monitoring function is deactivated by setting the rotary coding switch to "CLASS OFF".

Note

If the blocking time expires and the system is still blocked, the motor starter is shut down.

Blocking time

The blocking time is the time a block can be present before the motor shuts down. If the blocking time expires and the system is still blocked, the motor starter is shut down. The blocking time in the M200D AS-i Basic is set permanently to 1 s.

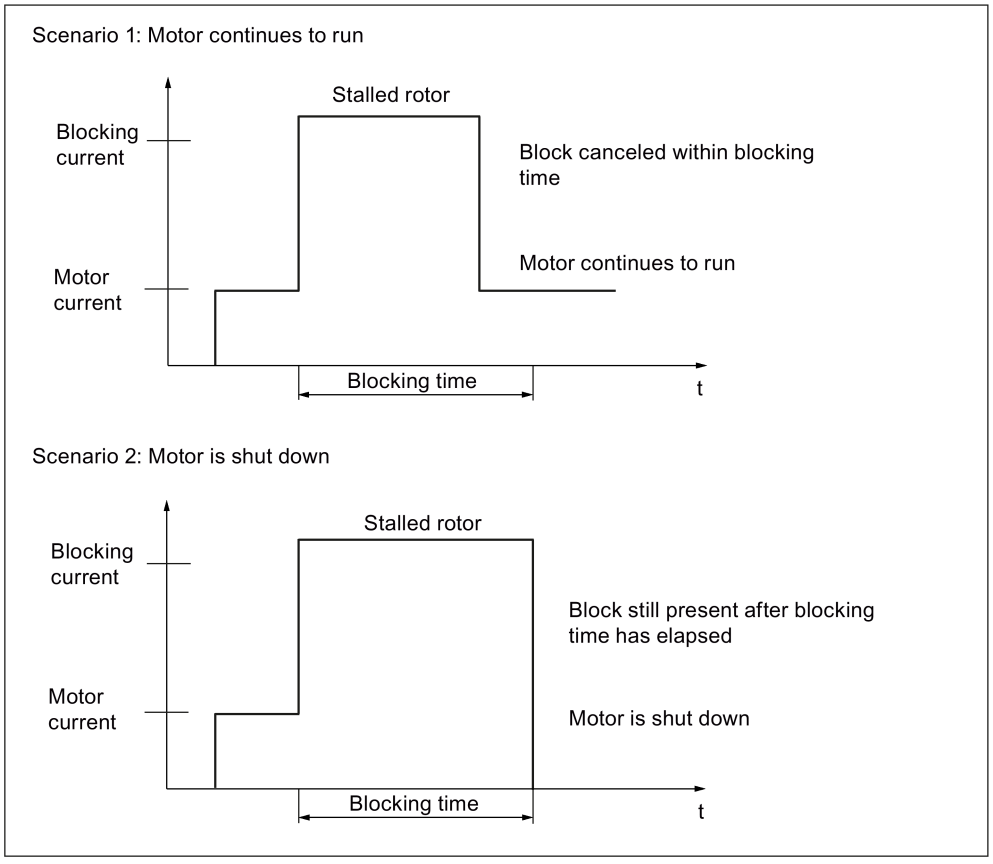


Figure 3-2 Block protection principle

3.7.2 Asymmetry monitoring

Description

Three-phase induction motors respond to slight asymmetries in the supply voltage with a higher asymmetric current consumption, which causes the temperature in the stator and rotor windings to increase. In this case, the M200D motor starter protects the motor against overload by shutting it down.

Note

When the motor is switched on, asymmetry evaluation is suppressed for approx. 0.5 s.

Asymmetry limit value

The asymmetry limit is a percentage value by which the motor current is allowed to deviate in each phase.
Asymmetry occurs when the difference between the lowest and highest phase current is greater than the asymmetry limit value. The asymmetry limit for the M200D AS-i Basic is set permanently to 30 %.

The reference value for the evaluation is the maximum phase current in one of the 3 phases.

Response to asymmetry

If the asymmetry limit value is exceeded, the motor starter is shut down.

3.7.3 Inputs

Description

The motor starter can use the "inputs" function to execute various actions, whereby the signals at the digital inputs are evaluated. You can connect the inputs directly to sensors (PNP) (2 and 3-wire system).

The input actions of the individual digital inputs affect the motor starter functions (=OR operation) independently of one another.

The signals of inputs IN1 and IN2 are transferred cyclically via the process image.

Note

Potential transfer

With AS-i, digital inputs must not be connected to digital outputs because this can establish an impermissible connection between the U_{AS-i} and U_{AUX} voltages.

Input function

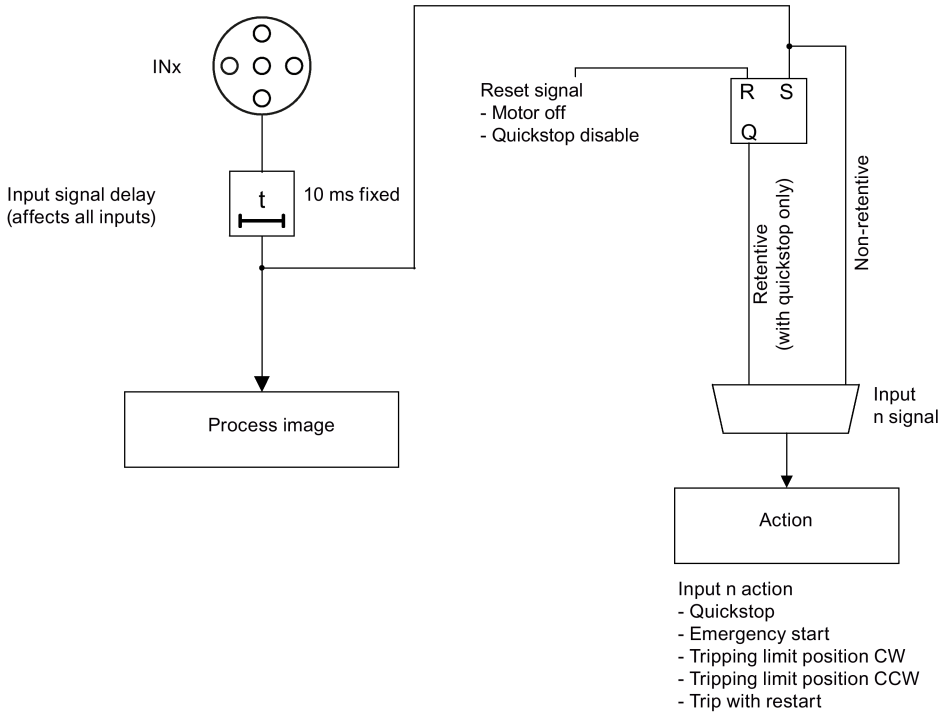


Figure 3-3 Overview of input parameters

Input n signal

The input level of the digital inputs is stored for inputs IN1 and IN2, that is, the active edge executes the input action assigned to the corresponding input. Regardless of the input signal present, the action can only be deactivated again by a further event.

The input level is not stored for inputs IN3 and IN4. This input action is active as long as the input is active.

Input n level

The input logic for the M200D AS-i Basic is set to "NO contact".

Device parameter	Setting	
	.DS...	.RS...
Input signal delay	10 ms	10 ms
Input 1 level	Normally open contact	Normally open contact
Input 2 level		
Input 3 level		
Input 4 level		
Input 1 action	Quickstop	Quickstop
Input 2 action	No action	No action
Input 3 action	Emergency start	Tripping limit position CW
Input 4 action	Trip with restart	Tripping limit position CCW
Input 1 signal	Retentive (edge evaluation)	Retentive (edge evaluation)
Input 2 signal	Non-retentive (level evaluation)	Non-retentive (level evaluation)
Input 3 signal		
Input 4 signal		

Description of the actions

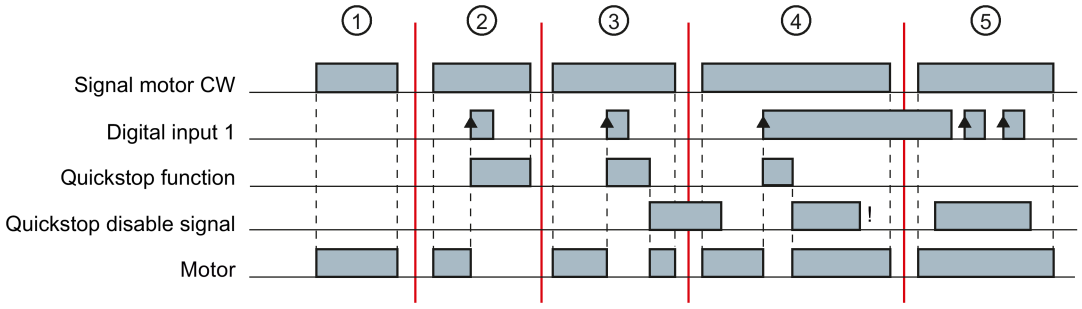
Quickstop

- The motor and the brake output are switched off without a group fault.
- "Quickstop" has priority over "Motor CW" and "Motor CCW".
- The input action responds with edge triggering to the input signal. This means deactivation is possible when the static input signal "Quickstop" is present.
- The (saved) input trigger is reset when the "Motor CW" and "Motor CCW" control commands are canceled or by means of "Quickstop disable" (in the process image).

Note

When bit DO2 (PIO) (Quickstop disable) is set, input 1 in the PII can be used as a free input because the input function "Quickstop" is deactivated.

Example:



① Motor is switched on by "Motor CW".

② Motor is switched on by "Motor CW", then switched off by the rising edge at digital input 1 (permanently assigned with input action1 = Quickstop). By revoking the "Motor CW" command, the Quickstop function is reset.

③ Motor is switched on by "Motor CW", then switched off by the rising edge at digital input 1. By setting Quickstop disable, the Quickstop function is reset and the motor runs "CW" again until the "Motor CW" is revoked.

④ Motor is switched on by "Motor CW", then switched off by the rising edge at digital input 1. By setting Quickstop disable, the Quickstop function is reset and the motor runs "CW" again. Although the static digital input signal 1 (DI2) is still present, the motor continues to run and is only reset by revoking the "Motor CW" command.
Reason: The input action is edge-triggered.

⑤ Motor is switched on by "Motor CW" and continues to run uninterrupted since Quickstop disable continuously overwrites the edges of the signal of digital input 1 (DI2).

Figure 3-4 Quickstop example

Emergency start

- Starts the motor when an ON command is issued despite the fact that an internal shutdown command is present.
- Switches on the brake output too if an ON switching command is present for this.
- The self-protection function of the motor starter remains active and prevents the device from being destroyed.

Tripping emergency limit position CW/CCW

- The motor and the brake output are tripped regardless of the direction of rotation.
- The brake output can be switched on again once the "Brake" and "Motor CW / CCW" control commands have been canceled.
- Tripping end position CW: The motor can only be switched on again with the opposite command /"motor CCW").
- Tripping end position CCW: The motor can only be switched on again with the opposite command ("Motor CW").

Trip with restart

- Results in tripping of the motor and brake.
- Acknowledged automatically after the cause of the trip has been rectified (initial status).

3.7.4 Outputs

Description

The motor starter can use the "outputs" function to control various actuators (e.g. indicator lights, signal transmitters, or contactor relays).

With the M200D AS-i Basic, the output is active in the event of...

- Group fault (permanently assigned function, not parameterizable)

...and outputs a continuous signal.

The digital output is overload/short-circuit proof and is supplied from U_{AUX}.

Note

Potential transfer

With AS-i, digital inputs must not be connected to digital outputs because this can establish an impermissible connection between the U_{AS-i} and U_{AUX} voltages.

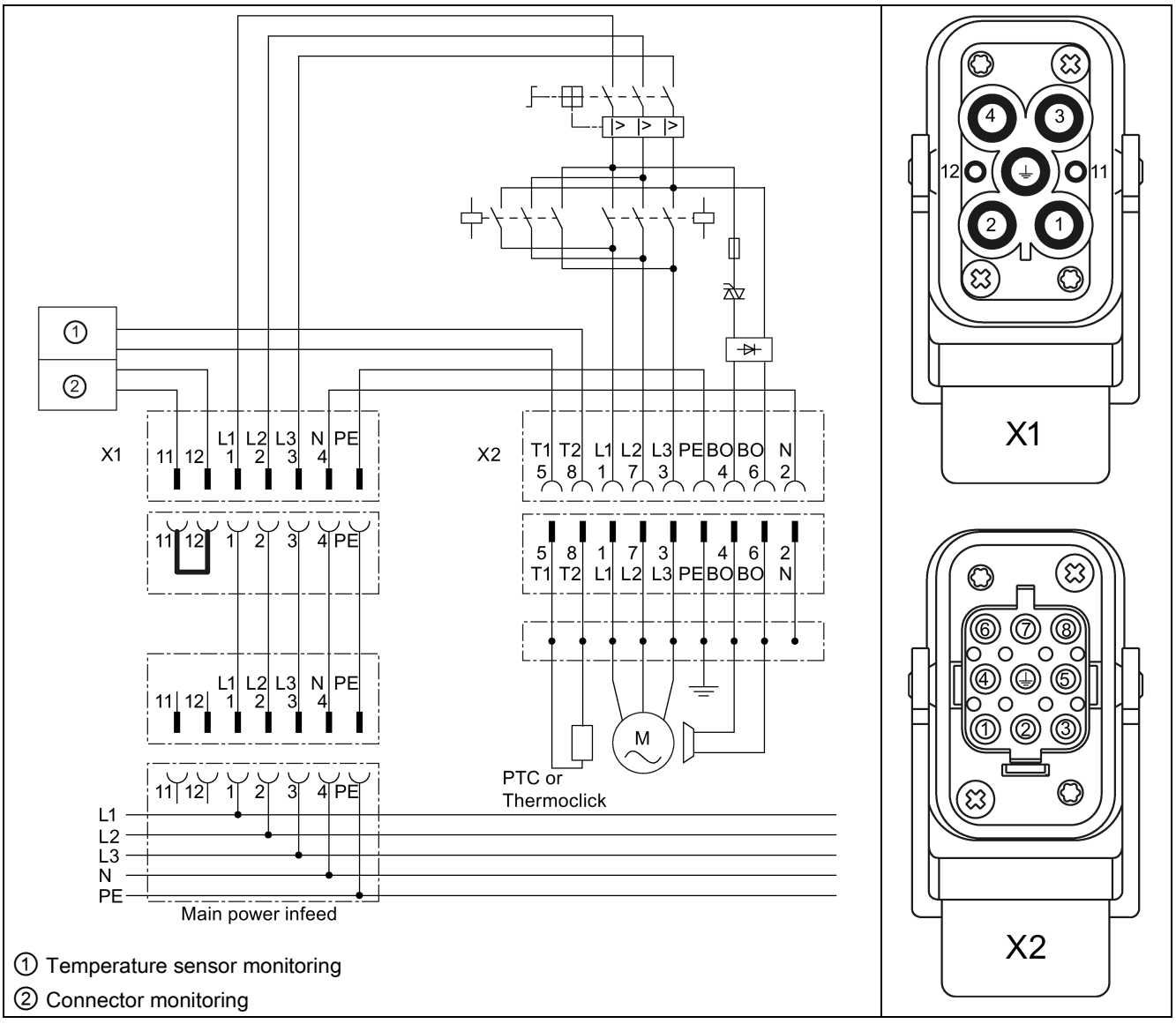
3.7.5 Connector monitoring

3.7.5.1 Power connector

The motor starter monitors whether the infeed connector on the line side of the motor starter is plugged in. Connector monitoring is implemented by means of an input activated via a jumper between pins 11 and 12, which informs the motor starter that the connector is plugged in.

Note

When you use the "connector monitoring" function, you have to connect pin 11 to pin 12 in the connector.



① Temperature sensor monitoring
② Connector monitoring

Connector monitoring

Line-side connector monitoring can be deactivated via the DIP switch.

For more information, see Parameterization via local setting (Page 74).

Response when connector is unplugged

When the connector is unplugged, the motor starter outputs a group fault.

Settings

Device parameter	Default setting	Setting range
Connector monitoring	Line side	• Deactivated • Line side

3.7.5.2 Motor connector

The "connector monitoring" function is only valid for the infeed connector.

A connector monitoring function for the motor connector can be logically combined with the thermistor cable and/or thermistor evaluation function.

If a motor is operated without a thermistor, you can activate thermistor monitoring (thermoclick) and use it to monitor the connector by means of a wire jumper on the motor terminal board or in the motor connector.

Note

The "overload" message must be interpreted to mean that the motor connector has been unplugged.

3.8 Short-circuit protection (circuit breaker / disconnecting means)

Description

The motor starter is equipped with an integrated circuit breaker for short-circuit protection to ensure that the system is safe and to protect personnel. Short-circuits between one phase and ground (= ground fault) as well as between two phases are monitored.

Properties of the circuit breaker

The circuit breaker / disconnecting means is designed for the following functions:

- Disconnecting the series-connected starter and consumer from the supply voltage
- Closing lockout by means of a padlock on the rotating element
- Short-circuit protection for the series-connected consumer with circuit breaker

Response when circuit breaker is OFF:

If a short circuit occurs or the circuit breaker is tripped manually, the motor starter responds with a group fault.

3.9 Communication

Description

Communication is a higher-level device function comprising a number of sub-functions:

- Mode monitoring
- Fieldbus interface
- Data plausibility check
- Message output

3.9.1 Mode monitoring

Data channels

The M200D AS-i Basic motor starter has three different data channels:

- Local optical device interface (for hand-held device)
- Control with integrated manual local control in "Manual operation local" mode (key-operated switch + keypad; order variant)
- Via the fieldbus interface AS-Interface:
  - Cyclic data via AS-i

The data channel used for control purposes depends on the operating mode.

Operating modes

The following operating modes are available (in ascending order of priority):

- Automatic (lowest priority)
  The motor starter can only be controlled with the PLC via the fieldbus.
- Manual operation local
  The motor starter can be controlled with:
  - Integrated manual local control (key-operated switch + keypad; order variant)
  - Local device interface (e.g. hand-held device) (highest priority)

  In this operating mode, the message "Manual local operation" is output when diagnosis is performed via the parameter channel.

3.9.2 Plausibility check for settings

Description

The motor starter checks all the parameters that have been set to ensure that they are valid and plausible.

Motor protection deactivation rule

At least one of the motor protection functions supported by the motor starter (thermal motor model, temperature sensor) must always be active at any one time, that is, you are not permitted to deactivate all the motor protection functions by means of parameterization.

If the temperature sensor is deactivated via the DIP switch and, at the same time, the rotary coding switch is set to "Class OFF", the following applies:

- If no motor ON command is present, a group alarm is output.
  The alarm is canceled when motor protection is reactivated.
- If a motor ON command is present, a group fault is output immediately and a corresponding internal shutdown command generated, which must be acknowledged with "trip reset".
  - If the motor ON command remains, the fault can only be acknowledged with "trip reset" once the fault has been rectified (activate at least one motor protection function).
  - If the motor ON command is reset, the group fault can be "downgraded" to a group alarm even if a setting is incorrect.

3.9.3 Message output

Message	Meaning	Output via
General messages		
Ready (automatic)	• Device can be controlled via BUS • Automatic mode • No fault	Process image of inputs
Group fault	At least one fault is set.	• LED • Diagnostics via parameter channel
Group alarm	At least one alarm is present.	• LED • Diagnostics via parameter channel
Mode monitoring		
Manual operation local mode	Manual operation via integrated manual local control or via the local device interface (hand-held device)	Diagnostics via parameter channel

3.10 Trip reset

Trip reset acknowledges all the faults that are currently present in the starter and that can be acknowledged. A fault can be acknowledged if its cause has been rectified or if it is no longer present.

The trip reset can be triggered by:

- Remote reset via the bus interface (DO 0 CW ON and DO 1 CCW ON simultaneously)
- Local reset via the key-operated switch (0 position; order option)
- Local reset via the device interface (hand-held device)

3.11 Self-test

Description

Two types of self-test can be carried out:

- Self-test at startup
  This is automatically selected when the device is switched on or initialized.
- Self-test during operation:
  The motor starter monitors (cyclically) specific device components and signals any faults (device faults).

Self-test fault

If a fault occurs, the "DEVICE" LED lights up red. The fault can only be acknowledged by switching the device off and then on again. If the fault is still present, the self-test will return a fault again when the device is switched on. In this case, the motor starter must be replaced.

Note

Specific device components are monitored continuously (internally) by the motor starter and the results signaled with the message "Device fault".

3.12 Solid-state/mechanical switching technology

Solid-state switching

The motor starter controls the motor (two phases) with thyristors. Phase L1 is not switched but is instead looped through from the 400 V power connection to the motor connection via the integrated disconnecting means.

⚠ DANGER

Hazardous voltage

Can cause death or serious injury.

If the line voltage is present at the 400 V power connection of the motor starter, hazardous voltage may still be present at the motor starter output even if a start command has not been issued.

When carrying out any work on the branch, make sure that you disconnect it via the disconnecting means.

Mechanical switching

The motor starter controls the motor (three phases) with contactors.
On device versions with a rated operating current of 0.15 - 2A (3RK13..-6KS41) RC elements are integrated on the motor output side to dampen interference pulses.

Contact block defective

If a contact block is defective (contactor welded / thyristor failure), the motor starter cannot shut down the motor.

If necessary, evaluate the message "Device fault" and shut down the branch on the basis of this by means of an upstream contact block.

3.13 Local device interface

Description

The local optical device interface can be used to connect the motor starter to a hand-held device (order no.: 3RK1922-3BA00; RS232 interface cable: 3RK1922-2BP00). This control source has the highest priority.

To stop the fiber-optic cable for the device interface from getting dirty, it is located under the removable unit labeling plate.

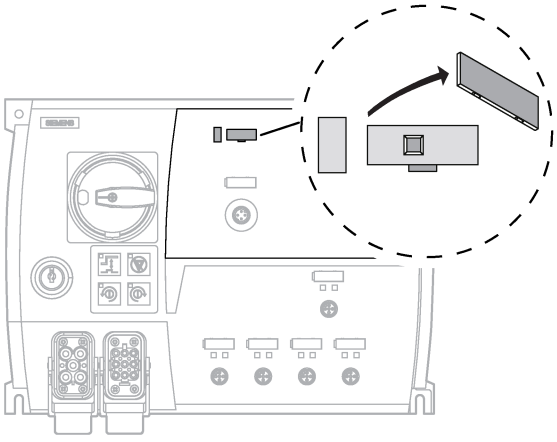


Figure 3-5 Optical device interface

Note

To ensure that data can be transferred without any problems, make sure that the device interface is clean at all times.

3.14 Integrated manual local control

Integrated manual local control (ordering option) for the M200D motor starter involves a key-operated switch and a keypad with four pushbuttons.

Key-operated switch

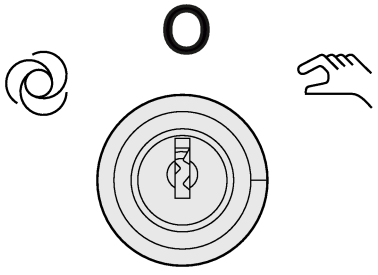


Figure 3-6 Key-operated switch

The key-operated switch can be set to three different positions.

Position	Meaning	Function
	Automatic mode	The pushbuttons on the keypad have no function. The LEDs on the "quick stop disable", "RIGHT", and "LEFT" pushbuttons, however, are active. They are used for indicating the status (= status of control via the PIO).
	Manual mode	Control priority is assumed by a lower-priority control source (automatic mode) and transferred to the keypad. When you switch back to "REMOTE", control priority is always initially passed to the CPU/master.
	OFF / Reset	When you switch to this position, a fault that is present can be acknowledged with trip reset (provided that it can be reset). If the key-operated switch remains in this position, the motor starter is in the "O" position once the "Reset" command has been issued. The motor starter does not execute any control commands in this position (regardless of the control source).

Note

The key can be inserted/removed in any position.

Keypad

The keypad has four pushbuttons arranged in a square.

Note

They are only active when the key-operated switch is set to manual mode.

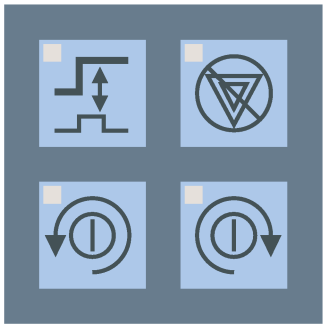
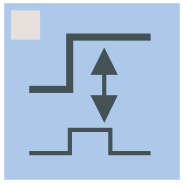
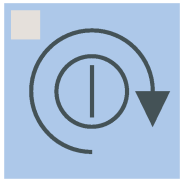
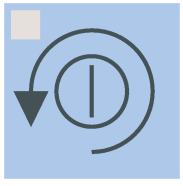


Figure 3-7 Keypad

Pushbutton	Meaning	Function
	Continuous operation / jog mode	The mode switches every time you press this pushbutton (continuous / jog). "Continuous" mode is indicated via the corresponding LED (yellow, lit up) (in manual mode only). When manual mode is deactivated, the system is reset to jog mode.
	Quick stop disable	The "quick stop" input actions are deactivated for all inputs. This pushbutton is active in jog mode and continuous operation. In continuous operation, the function "quick stop disable" is switched on by pressing once and then switched off again by pressing again. The yellow LED lights up while the function is active, independently of the operating mode.
	Clockwise rotation	The main circuit for CW operation is activated. In continuous operation, the main circuit can be activated by pressing the pushbutton once and deactivated by pressing it again. With reversing starters, an ongoing action can also be interrupted in continuous operation by pressing the "CCW rotation" pushbutton. The green LED lights up regardless of the operating mode (as long as the selected function is active).
	Counterclockwise rotation	The pushbutton function is only enabled for reversing starters. The main circuit for CCW operation is activated. In continuous operation, the main circuit can be activated by pressing the pushbutton once and deactivated by pressing it again. In continuous operation, an ongoing action can also be interrupted by pressing the "CW" pushbutton. The green LED lights up while the selected action is active, independently of the operating mode.

Note

If the "CW rotation" and "CCW rotation" pushbuttons are pressed simultaneously, this is classed as an operation fault. A function cannot be restarted. A function that is being executed is interrupted (the starter shuts down).

A function cannot be restarted until both pushbuttons have been released.

Note

When the "CCW rotation" or "CW rotation" pushbuttons are actuated, a connected brake is also always actuated.

Installation / connection

4

4.1 Installation

4.1.1 Installation rules

DANGER

Hazardous voltage

Can Cause Death, Serious Injury, or Property Damage

Before starting work, disconnect the system and devices from the power supply.

Simple installation

The distributed M200D AS-i motor starter is designed as a complete device that is easy to install. Carry out the following steps:

1. If you are using the optional protection guards, install these first.
2. Install the motor starter on a flat surface.

Installation position

The M200D AS-i motor starter is designed for the following installation positions on a flat surface:

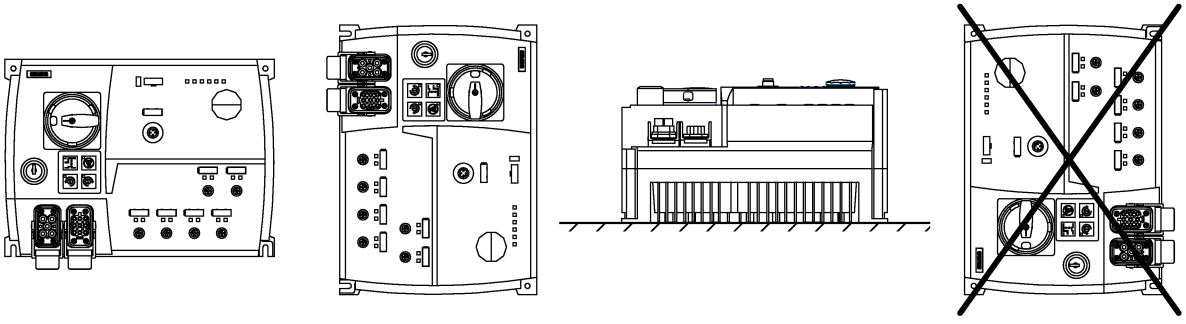


Figure 4-1 Installation positions: horizontal, vertical, flat; must not be positioned as shown on the right

4.1.2 Derating

What is derating?

Derating allows devices to be used even in harsh operating conditions by selectively restricting the output capacity.

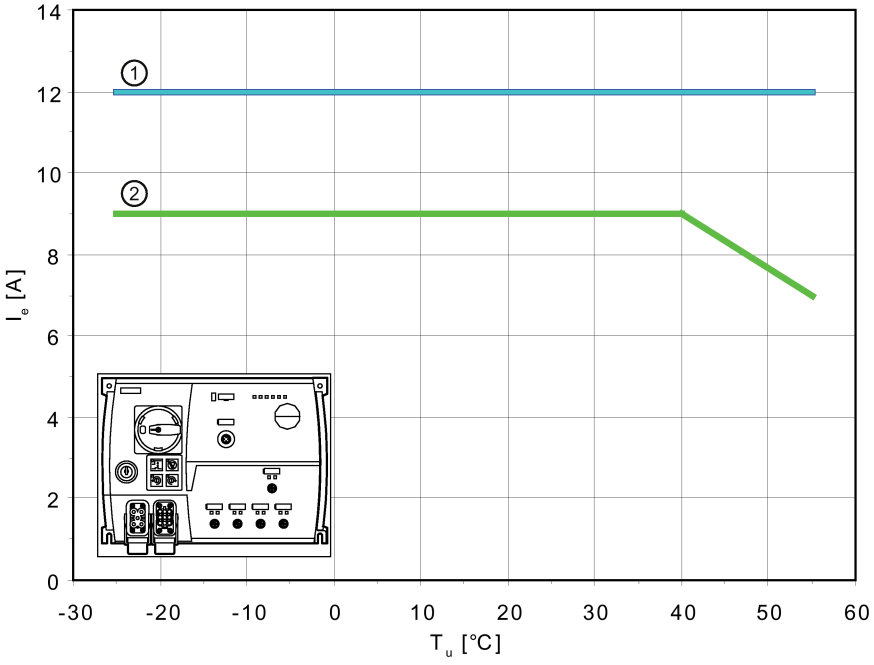
Derating factors

When M200D AS-i motor starters are operated under harsh conditions, the following factors must be taken into account:

- Ambient temperature T_a:
  - The ambient temperature T_a is the temperature of the air surrounding the motor starter enclosure.
    The lower the maximum ambient temperature T_a, the higher the current load on the motor starter can be.
  - The installation position affects how quickly the motor starter cools.
- Absolute current load:
  The lower the current flowing through the motor starter, the lower the power loss (= heat) inside the device. If a small amount of self-heating occurs, the ambient temperature T_a can be higher.

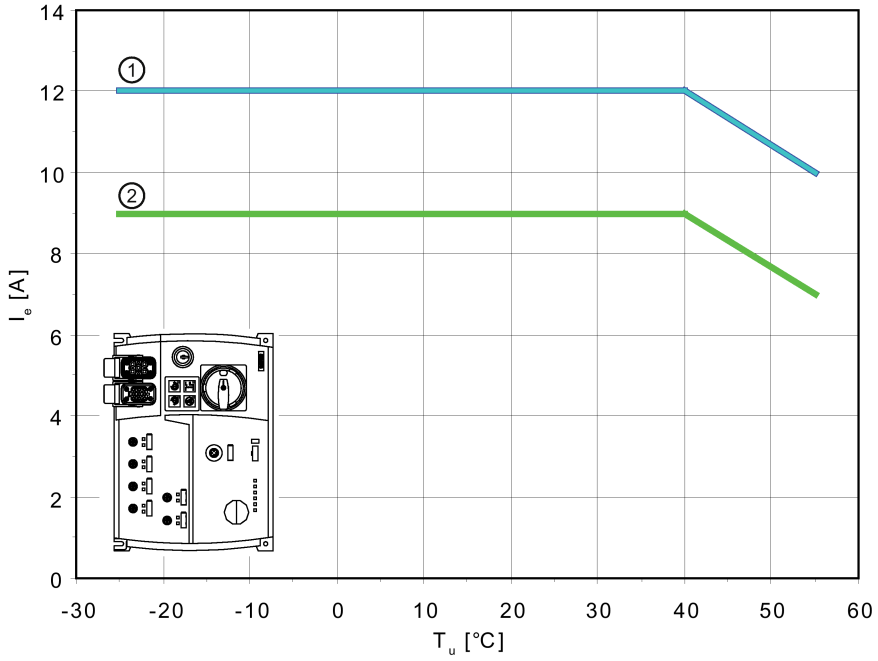
Derating diagrams

You can use the following diagrams to determine the derating factors for horizontal, vertical, or flat mounting.



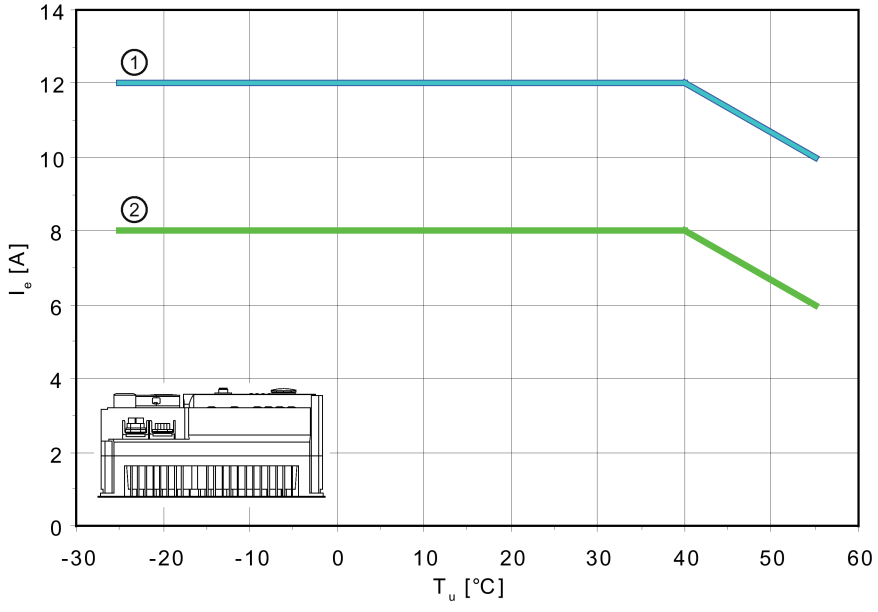
① DSte, RSte (mechanically switching)
② sDSte, sRSte (electronically switching)

Figure 4-2 Derating for horizontal mounting



① DSte, RSte (mechanically switching)
② sDSte, sRSte (electronically switching)

Figure 4-3 Derating for vertical mounting



① DSte, RSte (mechanically switching)
② sDSte, sRSte (electronically switching)

Figure 4-4 Derating for flat mounting

Motors with a high efficiency and high motor starting currents

High starting currents may have to be taken into consideration when using motor starters on high-efficiency motors. Motor starters are designed for motors with a maximum 8-fold starting current in accordance with IEC 60947-4-2.

If motors are operated that have a higher starting current, refer to the following table for the maximum adjustable motor current:

Motor starter version I_e [A] at 40 °C max. motor starting current	3RK1315-6KS*	3RK1315-6LS41*	3RK1315-6LS71*
<= 8-fold I_e	2 A	12 A	12 A
9-fold I_e	1.7 A	10 A	8 A
10-fold I_e	1.5 A	9 A	7 A

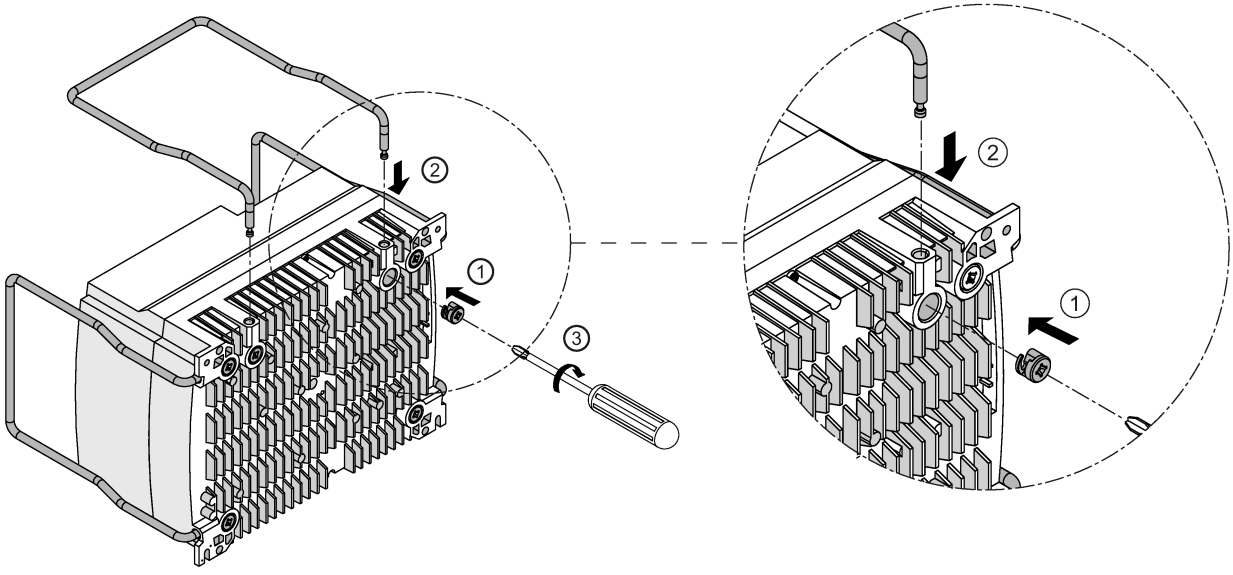
4.1.3 Installing the protection guards

Protection guard (accessory)

NOTICE
The protection guards are designed for a maximum load of 10 kg.

To prevent mechanical damage to the motor starter cables and connections, you can install protection guards on the side and top (order no.: 3RK1911-3BA00).

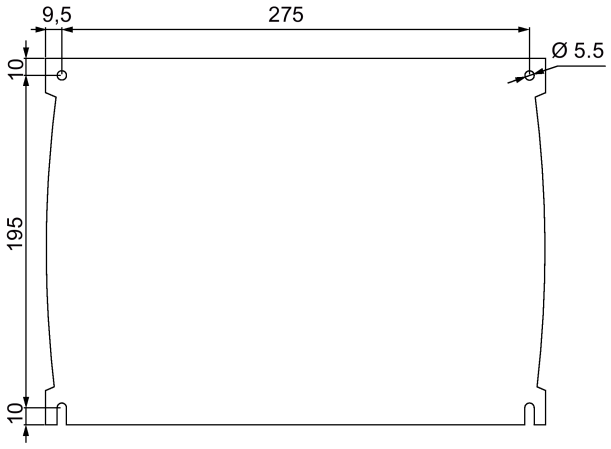
To secure the protection guards, the angled ends can be used as clamping bolts, which are secured in the device base by means of eccentric elements.



①	Insert the eccentric elements in the locating holes on the bottom of the motor starter. Make sure that the holes are aligned for the protection guards.
②	Push the ends of the protection guards into the holder until they engage.
③	Turn the eccentric elements clockwise until the protection guard is secure.

4.1.4 Installing the motor starter

Carry out the following steps to install the motor starter:

Step	Description
1	Find a flat surface for mounting the device.
2	Drill four holes for the screws. 
3	Secure the motor starter using four screws (M5). If necessary, use plain washers and spring washers. The tightening torque must not exceed a maximum of 2.5 Nm.

4.1.5 Functional ground

The motor starter must be connected to functional ground. The connection to functional ground is required to discharge interference and ensure EMC resistance. Unlike the protective conductor, functional ground does not offer protection against electric shock, which is why it must be routed separately.

The contact plate at the fixing point on the bottom right is connected to functional ground within the device. This connection must be connected to the ground potential with as little resistance as possible.

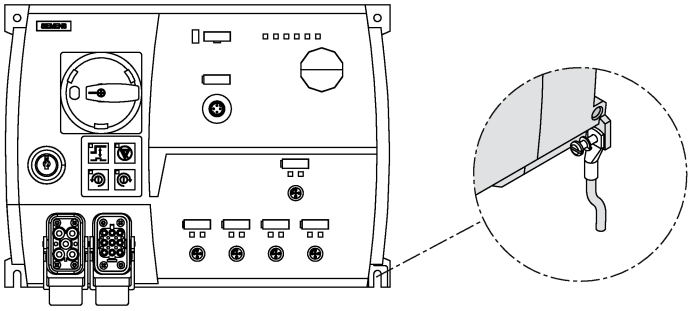


Figure 4-5 Connection for functional ground

If you do not install the motor starter on a grounded, conductive base, you have to establish a connection with the ground potential (grounding cable with cable lug, spring washer, and plain washer).

4.1.6 Setting the AS-i address

Unique addressing

In the factory setting, an I/O module (slave) has the address 0. It is detected by the master as a new slave that has not yet been addressed and, in this condition, has not yet been integrated in standard communication/data exchange.

To enable data to be exchanged between the master and slaves, you have to assign a unique address for each slave (i.e. each slave address must be different) when commissioning the AS-Interface network.

You can select any address in the address space from 1A to 31A and 1B to 31B.
Thus a maximum of 62 nodes are possible in one AS-Interface network.

Addressing the slaves

You can set the slave address in different ways:

- Offline with the addressing unit at the AS-i connection.
  Recommended if you want to assign addresses for the entire system. The direct connection between the slave (motor starter) and addressing unit ensures that the slaves are not mixed up.
- Online by the AS-i master or in the PLC configuration software.
  Recommended if you want to assign addresses to individual slaves if an addressing unit is not available.
  Before assigning addresses, you must ensure that each address exists only once in the AS-i network, that is, several new, additional modules (with address 0 in as-delivered condition) must not be connected to the AS-i cable.

⚠ CAUTION

As soon as you have assigned a valid address outputs can be set or inputs read that result in follow-up switching operations. To prevent a hazardous condition switch off the voltage U_{AUX}.

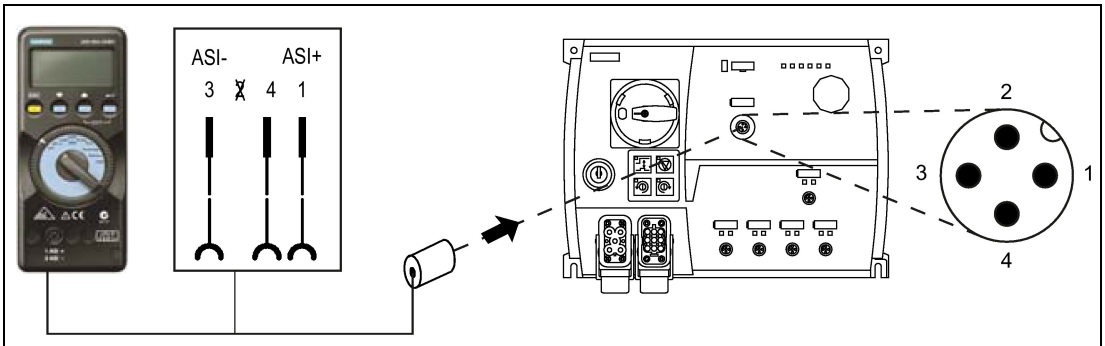
Offlline addressing with the addressing unit

The motor starter is addressed via the AS-i connection socket.

Note

When assigning the address via the addressing unit, unscrew the encoders (sensors) from the digital inputs to prevent the addressing unit from being overloaded by their power consumption.

If the older version of the addressing unit (3RK1904-2AB00) is used, a special addressing cable (3RK1901-3RA00) is required to connect the module to the addressing unit.



1.	Connect the motor starter to the addressing unit (3RK1904-2AB02) using a standard M12 connection cable (2 or 3-pin) (e.g. 3RK1902-4PB15-3AA0). (4 or 5-pin connection cables must not be used for addressing purposes.)
2.	Assign an address to the module. • Set the selector switch to **ADDR**. • Press ↵. The address of the connected module is read and displayed. • Select the address by choosing ↓ ↑. • To transfer the address to the module, choose ↵.
3.	Unplug the addressing cable and reconnect the motor starter using the AS-i cable.

Online addressing with the AS-i master and in the PLC configuration software

For instructions on how to address the motor starter using the AS-i master or in the configuration software, refer to the manual for the AS-i master you are using.

4.2 Connection

More connection technology products can be found in "Siemens Solution Partners" (www.siemens.com/automation/partnerfinder) under "Distributed Field Installation System".

4.2.1 Required components/cables

Selecting the power cables

⚠ DANGER

Hazardous Voltage

Can Cause Death, Serious Injury, or Property Damage

Before starting work, disconnect the system and devices from the power supply.

The cross-section of the power cables must be suitable for the prevailing ambient conditions. The following factors determine the cross-section:

- The current set on the device
- The cable installation type
- The ambient temperature
- The type of material (PVC, rubber)

The following maximum current-carrying capacities apply for PVC power cables when installed, for example, in the cable duct (depending on the ambient temperature):

Cross-section	T_U = 30 °C	T_U = 40 °C	T_U = 45 °C	T_U = 50 °C	T_U = 55 °C
1.5 mm^2	14 A	12.2 A	11.1 A	9.9 A	8.5 A
2.5 mm^2	19 A	16.5 A	15.0 A	13.5 A	11.6 A
4.0 mm^2	26 A	22.6 A	20.5 A	18.5 A	15.9 A
6.0 mm^2	33 A	28.7 A	26.1 A	23.4 A	18.2 A

Note

Unused connections

Seal unused connections by means of the sealing caps enclosed since this is the only way to ensure degree of protection IP65.

The sealing caps are also available as accessories:

Item	Quantity	Order no.
Sealing cap M12	10 pieces	3RK1901-1KA00

4.2.2 Prefabricating power cables

To prefabricate power cables, you require the following:

- A crimping tool for attaching the sockets and pins on the individual wires
- For infeed on motor starters
  Assignment of X1: see section Power terminal (Page 60):
  - A flexible Cu cable with 4 x 2.5 mm^2 / 4 mm^2 / 6 mm^2 (3 wire + PE)
    (for motor starters with 230 V AC brake output: 5-core cable; 3 wire + N + PE)
  - Han Q4/2 socket power connector

Item	Quantity	Order no.
Contact socket 2.5 mm^2, for Han Q4/2 sockets	5	3RK1911-2BE50
Contact socket 4 mm^2, for Han Q4/2 sockets	5	3RK1911-2BE10
Contact socket 6 mm^2, for Han Q4/2 sockets	5	3RK1911-2BE30
Crimping tool 4 / 6 mm^2	1	3RK1902-0CW00

Consumer connection on the motor starter

For the assignment of X2, see Power terminal (Page 60):

- A flexible Cu cable with 1.5 mm^2 or 2.5 mm^2
  - Without brake control: 3 wire + PE
  - With brake control: 5 wire + PE
  - With temperature sensor: 2 additional wires
  - Han Q8/0 pin power connector

Item	Order no.
Connector set, 8 X 1.5 mm^2, 9 pin, complete with PG16 cable entry	3RK1902-0CE00
Connector set, 8 X 2.5 mm^2, 9 pin, complete with PG16 cable entry	3RK1902-0CC00

4.2.3 Installing and wiring power connectors

⚠ DANGER

Hazardous voltage

Can Cause Death, Serious Injury, or Property Damage

Before starting work, disconnect the system and devices from the power supply.

Installa and wire the power connectors as follows:

Step	Procedure	
1	Route the cable through the cable gland, sealing insert (enclosed), and the connector housing. The sealing insert is available in the following gradings:	
	Permissible external diameter of the cable	Sealing insert
	7.0 to 10.5 mm 9.0 to 13.0 mm 11.5 to 15.5 mm	Green Red White
2	Strip the cable over a length of 20 mm.	
3	Strip the cores over a length of 8 mm.	
4	Secure the contact sockets/pins on the cores by crimping or soldering them.	
5	Sort the contact sockets/pins in the socket/pin insert in accordance with the assignments (see section Power terminal (Page 60)). The contact sockets/pins should not engage yet. Make sure that they are correctly assigned. Push the contact sockets/pins into the socket/pin insert until they engage. Use a suitable tool to remove contact sockets/pins that have already been installed (Han Q4/2: 3RK1902-0AB00, Han Q8/0: 3RK1902-0AJ00).	
6	Make sure that the position of the coding is correct, pull the cable back, and secure the socket/pin insert in the connector housing using the cross-recessed screws enclosed.	
7	Secure the cable gland. When doing so, make sure that the cable is not twisted against the connector housing.	

4.2.4 Power terminal

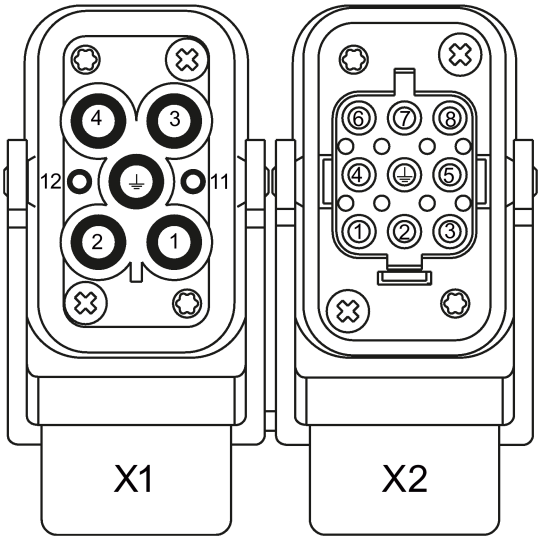
Wiring X1 (power supply) and X2 (motor connection)

The supply voltage is fed via power connector X1.

The motor is supplied via power connector X2.

Note

When inserting the pin/female contact insert into the connector housing, make sure that the coding is positioned correctly.

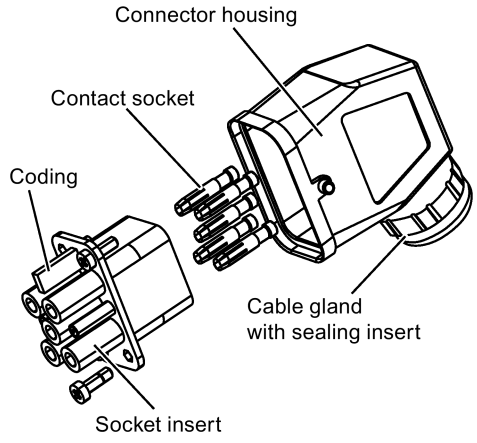


Pin	Connector X1	Socket X2 without brake	Socket X2 with 400 V / 230 V AC brake	Socket X2 with 180 V DC brake
1	Phase L1	L1 out	L1 out	L1 out
2	Phase L2	---	N (for 230 V AC brake)	---
3	Phase L3	L3 out	L3 out	L3 out
4	N	---	Brake L1 (switched)	Brake L1 (switched) "-"
5	---	2)	2)	2)
6	---	---	Brake L3 (direct, for 400 V AC brake)	Brake L3 (direct) "+"
7	---	L2 out	L2 out	L2 out
8	---	2)	2)	2)
11	1)	---	---	---
12	1)	---	---	---
⏚	PE	PE	PE	PE

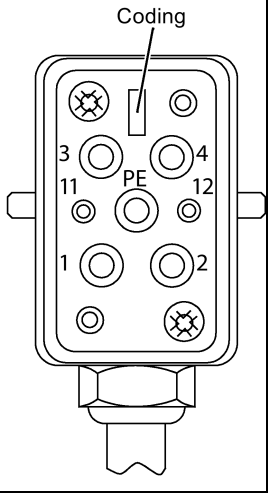
1) Connector monitoring

2) Temperature sensor

Power supply: Han Q4/2 socket (connection for X1)



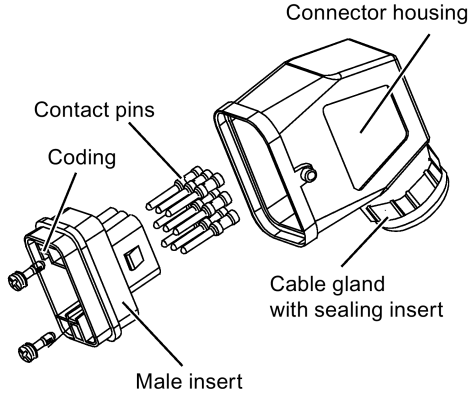
Socket	Assignment
1	Phase L1
2	Phase L2
3	Phase L3
4	N
11	Connector monitoring
12	Connector monitoring
⏚	PE (yellow/green)



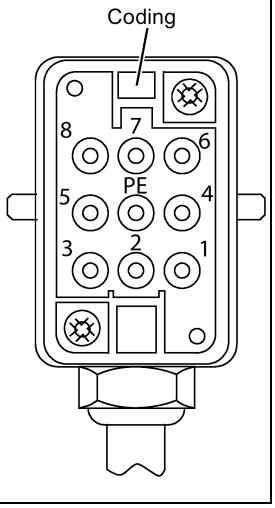
Note

When you use the "connector monitoring" function, you have to connect pin 11 to pin 12 in the connector.

Motor connection Han Q8/0 pin (connection for X2)

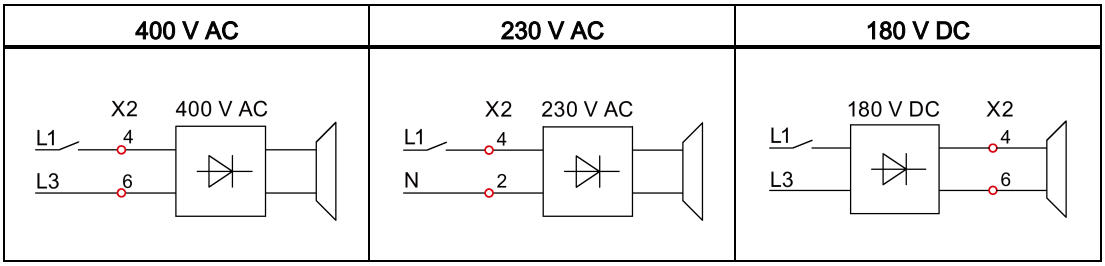


Pin	Assignment
1	L1 out
2	N[1)]
3	L3 out
4	Brake L1 (switched)[1)]
5	Temperature sensor
6	Brake L3 (direct)[1)]
7	L2 out
8	Temperature sensor
⏚	PE (yellow/green)



[1)] See brake variants

Brake variants



Note

Please note the different pin assignment in the case of the operating voltages of the brake.

4.2.5 Brake output

M200D motor starters can be equipped with an optional electronic brake control (order variant). The brake control is suitable for externally-suppled brakes with the coil voltages shown below:

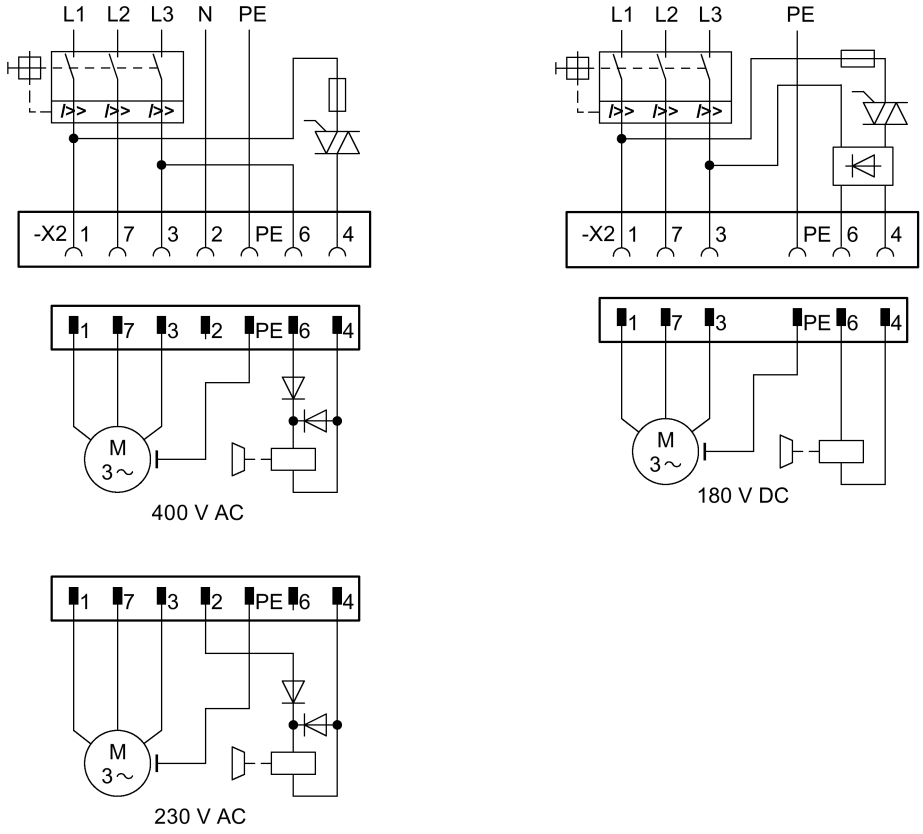
- 400 V AC / 230 V

  The brake rectifier must be installed in the motor. The rectifier input is controlled via the motor starter.

- 180 V DC

  A rectifier is not required for the brake in the motor because the 180 V DC is provided by the motor starter. In this way, brake coils for 180 V DC can be switched directly.

The brake output for the M200D motor starter



The brake voltage is fed to the motor together with the motor infeed via a joint cable (e.g. 6 x 1.5 mm^2).

WARNING

Hazardous Voltage

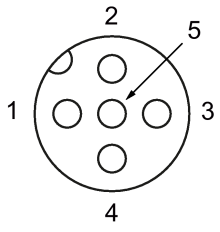
Can Cause Death or Serious Injury.

The brake is only switched in a single phase. This therefore means that voltage can be applied at pin 6 even when the system is switched off.

4.2.6 Digital inputs/outputs

Socket assignment

The digital inputs and output are equipped with standard 5-pin M12 sockets (A coding):

Assignment	Pin	Input	Output
	1	+ 24 V (PWR+)	N/C
	2	N/C	N/C
	3	0 V (PWR-)	0 V (PWR AUX-)
	4	Input signal (IN x)	Output signal (OUT 1)
	5	Functional ground (FE)	Functional ground (FE)

Note

Potential transfer

With AS-i, digital inputs must not be connected to digital outputs because this can establish an impermissible connection between the U_{AS-i} and U_{AUX} voltages.

4.2.6.1 Digital inputs

The motor starters are equipped with four digital inputs, which you can connect directly to sensors (PNP) (2 and 3-wire system).

Connectors (M12, 5-pin, A-coded) are used for this purpose. The motor starter is equipped with a range of sockets.

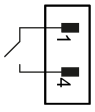
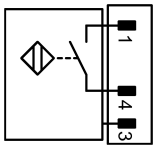
Note

Short-circuit hazard

Do not use an external power supply since this can result in a short-circuit.

Pin assignment

The following diagrams show examples of circuits (2 and 3-wire system):

2-wire system	3-wire system
	

Note

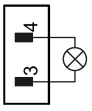
The supply voltage for the digital inputs is short-circuit proof. The current is limited to max. 200 mA. If a short-circuit or overload situation occurs in the sensor supply, the switching element (motor) and brake output are shut down and a group fault is output. You must acknowledge this fault with a trip reset.

4.2.6.2 Digital output

The motor starter is equipped with a digital output, which you can connect directly to an actuator. The output is active when a group fault is present.

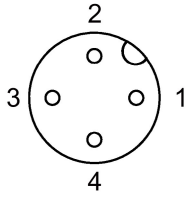
The output can be loaded to max. 0.5 A and protected electronically against short-circuits.

A connector (M12, 4 or 5-pin, A-coded) is used for establishing the connection. The motor starter is equipped with a range of sockets.

Example: Connecting the digital output


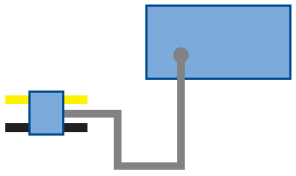
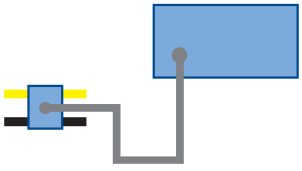
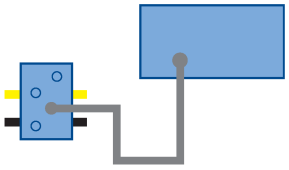
4.2.7 AS-Interface

Pin assignment

	Pin	Assignment
	1	U_{AS-i+}
	2	PWR-AUX -
	3	U_{AS-i-}
	4	PWR-AUX +

4.2.8 Connection options for AS-Interface

The different methods of connecting the motor starter to the AS-Interface bus cable and the 24 V DC auxiliary voltage are shown in the following table:

Motor starter	AS-i connection with U_{AUX}	
Plus M12 branch with integral cable		3RK1901-1NR21 (1 m) 3RK1901-1NR22 (2 m)
Plus M12 branch with socket plus separate M12 cable [1]		3RK1901-1NR20
Plus 4 x M12 branch plus separate M12 cable [1]		3RK1901-1NR00

1) These cables can be assembled from:
3RK1 902-4GB50-4AA0 control cable, prepared at one end, M12 socket, angled with 5 m cable, max. 4 A and
3RK1 902-4CA00-4AA0 M12 socket, angled for screw-type connection, 4-pin, max. 0.75 mm², A-coded, max. 4 A
The cables can be replaced by:
3RK1 902-4GB50-4AA0 control cable, prepared at one end, M12 socket, 5 m and
3RK1 902-4CA00-4AA0 M12 socket, angled for screw-type connection, 4-pin, max. 0.75 mm², A-coded, max. 4 A

Connection examples for motor starters

The installation guidelines for AS-Interface must always be observed:

- The maximum permissible current for all M12 connection cables is restricted to 4 A. The cross-section of these cables is just 0.34 mm². To connect the motor starter, you can use the M12 connection cables mentioned above as spur lines.
- The voltage drop induced by the ohmic resistance (approx. 0.11 Ω/m) must be taken into account.
- The following maximum lengths apply to round cable connections in which AS-i and U_{AUX} are routed in the same cable:
  - For each spur line from the branch to the module: max. 5 m
  - Total of round cable components in one AS-Interface network: max. 20 m

AS-Interface M12 branches and distributor

Closed

Open

Note

If you are using a non-angled connector, you are advised to install the safety bars (accessories) to protect the AS-i connection against mechanical damage (refer to the Installing the safety bars).

See also

Installing the protection guards (Page 52)

Configuration / parameterization

5

5.1 Configuration

Configuration involves integrating the motor starter in the overall system by assigning addresses and parameters.

Master requirements

The M200D AS-i Basic motor starter requires at least one AS-i master to AS-i spec. 2.1 with master profile M3.

5.1.1 ID1 code

You can use the ID1 code to set the bit DI 1 assignment for the process image input (PII).

ID1 code	Meaning	Explanation
7 (default)	Motor on	0: OFF 1: ON (CW/CCW)
6	Automatic	0: Starter in "Manual" mode 1: Starter in "Automatic" mode
5	Group fault	0: No fault 1: Fault

You can change the ID1 code using the addressing unit.

Note

Please note that the ID1 values set in the configuration software and on the device must match, otherwise the motor starter will not start up.

Note

If the ID1 code is changed, the new setting will only take effect once the motor starter has been restarted.

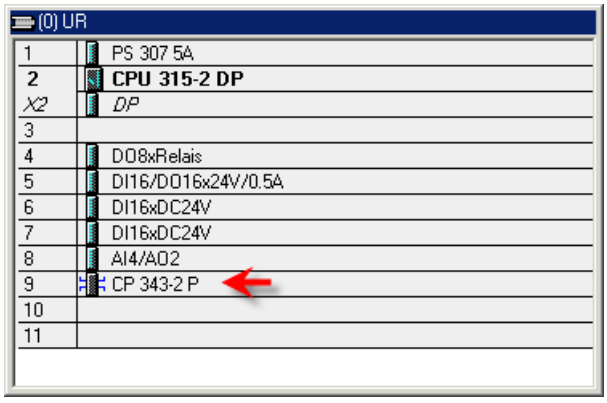
5.2 Configuration on the AS-i master CP 343-2

Requirement

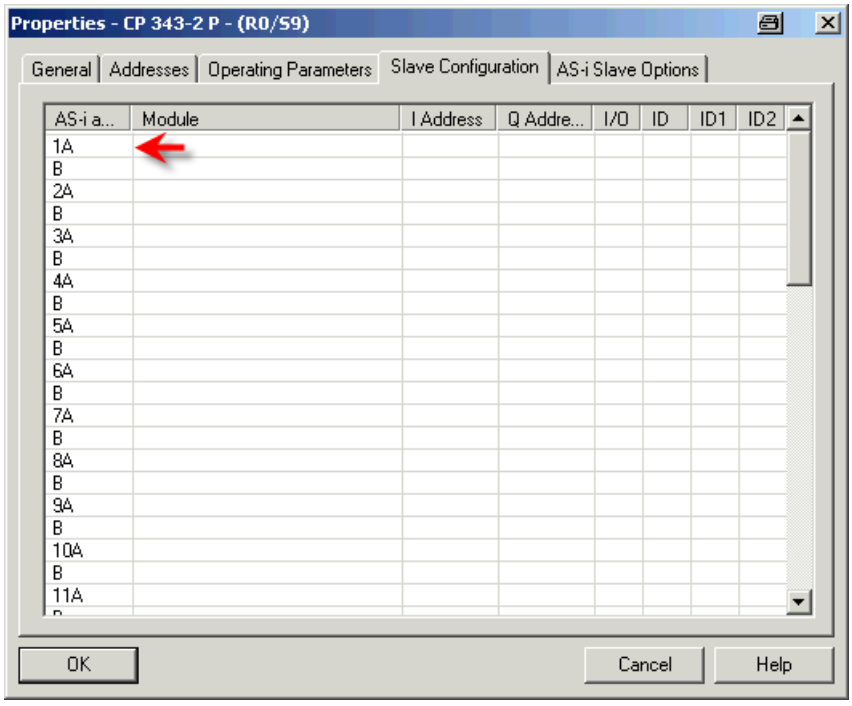
The CP 343-2 communications processor has already been configured.

Procedure

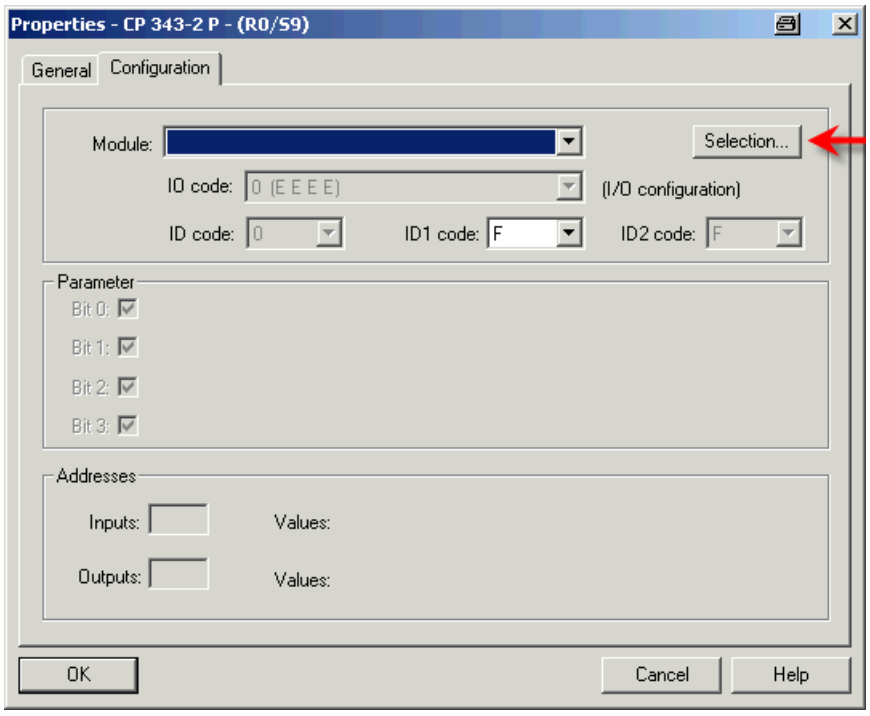
1. Double-click CP 343-2 DP. The **Properties** window is displayed.



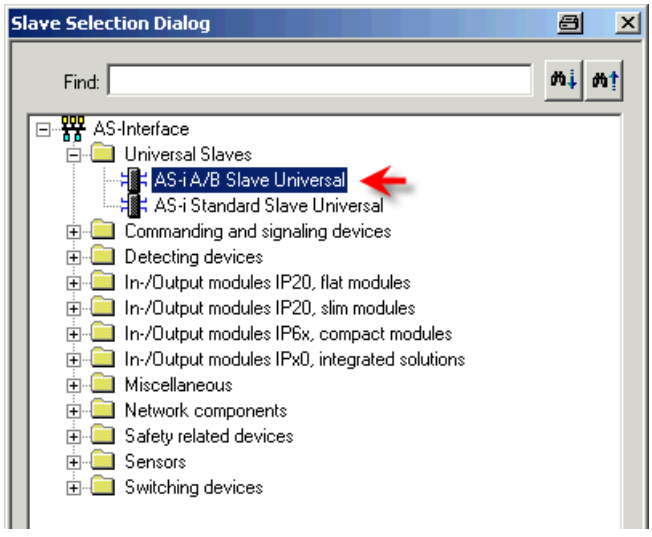
2. Choose the **Slave Configuration** tab. Open the **object properties** by double-clicking the address (in this case, row 1A) to which the M200D AS-i Basic motor starter is to be configured.



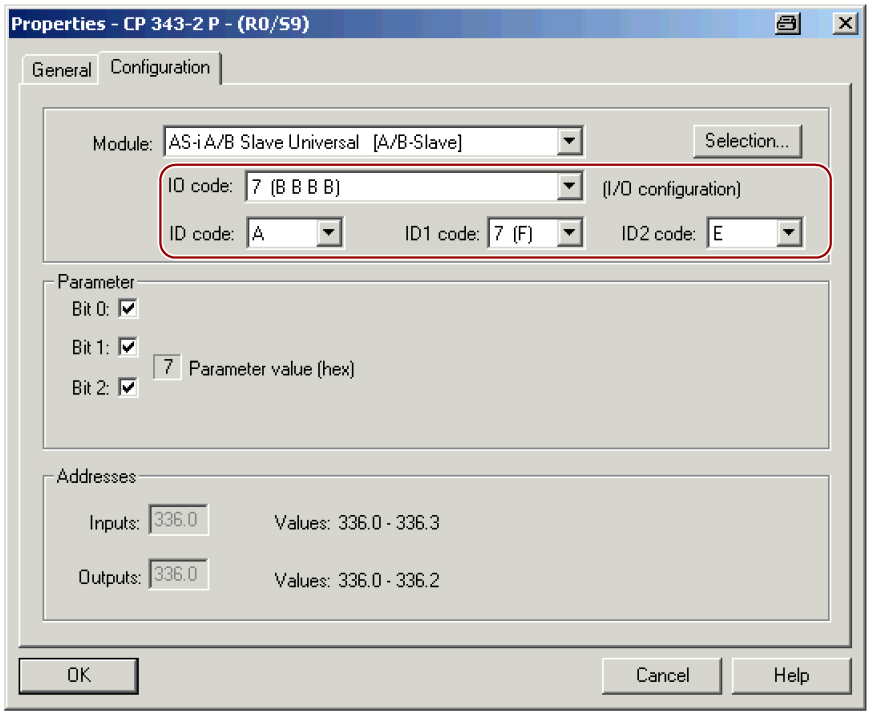
3. Choose the **Configuration** tab. When you click **Selection...**, the **slave selection dialog** is displayed.



4. Select **AS-i A/B Slave Universal** by double-clicking it.



5. Enter the following values for the AS-i profile:



Field	Value
IO code:	7 (B B B B)
ID code:	A
ID1 code:	7 (F), or 6 or 5 depending on the PII setting
ID2 code:	E

6. This completes the process of configuring the M200D AS-i Basic motor starter on the CP 343-2 DP.

5.3 Parameterization

5.3.1 Parameterization

The parameters for the motor starter can be assigned using the following:

- Rotary coding switch for:
  - Setting the rated operating current I_e
  - Deactivating the thermal motor model (class OFF)

  Note

  We recommend the use of a thermistor as motor overload protection in the case of a deactivated thermal motor model (CLASS OFF).

- DIP switch
  - To (de)activate the temperature sensor
  - To set the temperature sensor type
  - To (de)activate connector monitoring
  - To set the shutdown response of thermal motor protection

5.3.2 Parameterization via local setting

Setting the current limit value

The rotary coding switch for setting the operating current I_e (0.15 … 2 A, 1.5 … 9 A or 1.5 … 12 A depending on the device version) is located under the cover on the front of the starter.

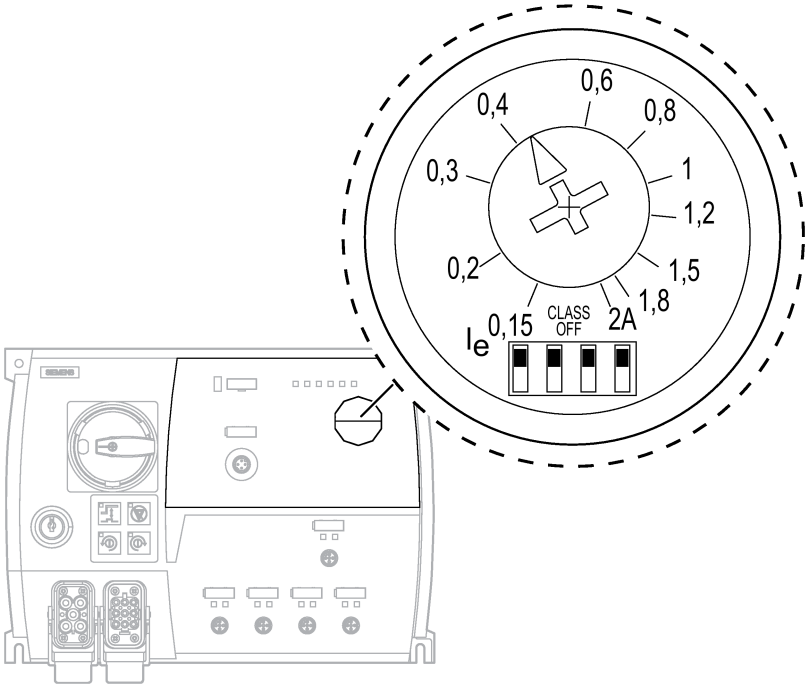


Figure 5-1 Rotary coding switch with 2 A scale

Before commissioning the motor starter, set the operating current I_e for the overload trip:

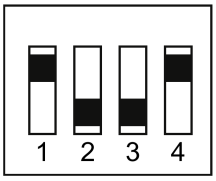
Step	Procedure
1	Open the transparent cover at the top of the housing for the motor starter.
2	Use a screwdriver to set the operating current I_e on the scale of the rotary coding switch.
3	Close the transparent cover.

Note

In the delivery condition, the minimum current limit is set.

Changes to the position of the rotary coding switch require approx. 500 ms to take effect.

Setting the device parameters on the DIP switch

Diagram	Switch	Function	Setting
	1	Temperature sensor	0: deactivated 1: activated
	2	Temperature sensor	0: PTC type A 1: Thermoclick
	3	Line-side connector monitoring	0: deactivated 1: activated
	4	Shutdown response of thermal motor protection	0: with restart (= autoreset) 1: no restart

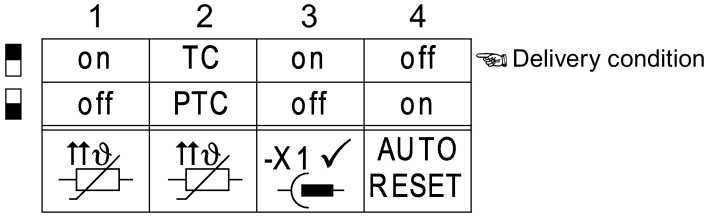


Figure 5-2 DIP switch labeling

5.4 Process images

Definition of process image

The process image is a component of the AS-i master system memory.

At the start of the cyclic program, the signal states of the inputs are transferred to the process image of inputs.

At the end of the cyclic program, the process image of the output is transferred to the slave as a signal state.

Input process image (PII)

The PII assignment may change depending on the ID1 code.

The tables below contain process data and a process image of inputs DI 0 to DI 3:

Process image for ID1 = 7:

Byte/bit	Process image	Signal: 1 = HIGH, 0 = LOW
DI 0	Ready (automatic)	0: Starter not ready for host/PLC 1: Starter ready to be operated via host
DI 1	Motor on	0: OFF 1: ON (CW/CCW)
DI 2	Input 1 (input action: quickstop)	0: Not active 1: Active
DI 3	Input 2 (no action)	0: Not active 1: Active

Process image for ID1 = 6:

Byte/bit	Process image	Signal: 1 = HIGH, 0 = LOW
DI 0	Ready (automatic)	0: Starter not ready for host/PLC 1: Starter ready to be operated via host
DI 1	Automatic	0: Starter in "Manual" mode 1: Starter in "Automatic" mode
DI 2	Input 1 (input action: quickstop)	0: Not active 1: Active
DI 3	Input 2 (no action)	0: Not active 1: Active

Process image for ID1 = 5:

Byte/bit	Process image	Signal: 1 = HIGH, 0 = LOW
DI 0	Ready (automatic)	0: Starter not ready for host/PLC 1: Starter ready to be operated via host
DI 1	Group fault	0: No fault 1: Fault
DI 2	Input 1 (input action: quickstop)	0: Not active 1: Active
DI 3	Input 2 (no action)	0: Not active 1: Active

Note

The allocation/assignment of the cyclic process data depends on the ID1 code.
You can change the ID1 code using the addressing unit.
If the ID1 code is changed, the new setting will only take effect following a restart.

Output process image (PIO)

The following table contains process data and a process image of outputs DO 0 to DO 3:

Byte/bit	Process image	Signal: 1 = HIGH, 0 = LOW
DO 0	Motor CW	0: Motor off 1: Motor on
DO 1	Motor CCW	0: Motor off 1: Motor on
DO 2	Quickstop disable	0: Not activated 1: Activated
DO 3	Reserved (A/B switchover)	-

Reference

For more information about system integration and data management in the controller, refer to the "AS-Interface system" (http://support.automation.siemens.com/WW/view/en/26250840) System Manual.

Commissioning

6

6.1 Prerequisites

Software requirements

Configuration software used	Explanations
Configuration software for the AS-i master used	See the manual for the AS-i master

Commissioning requirements

Prior activity		For more information, see ...
1.	Motor starter installed	"Installation"
2.	Address set on motor starter	"Installation"
3.	Supply voltage for motor starter switched on	—
4.	Supply voltage for load switched on (if necessary)	See manual for motor
5.	Motor starter configured (configured and parameterized)	"Configuration / parameterization"
6.	Supply voltage for AS-i master switched on	—
7.	AS-i master switched to RUN mode	Manual for AS-i master

6.2 M200D AS-i components

Minimum configuration

The overview shows the components you need for operation:

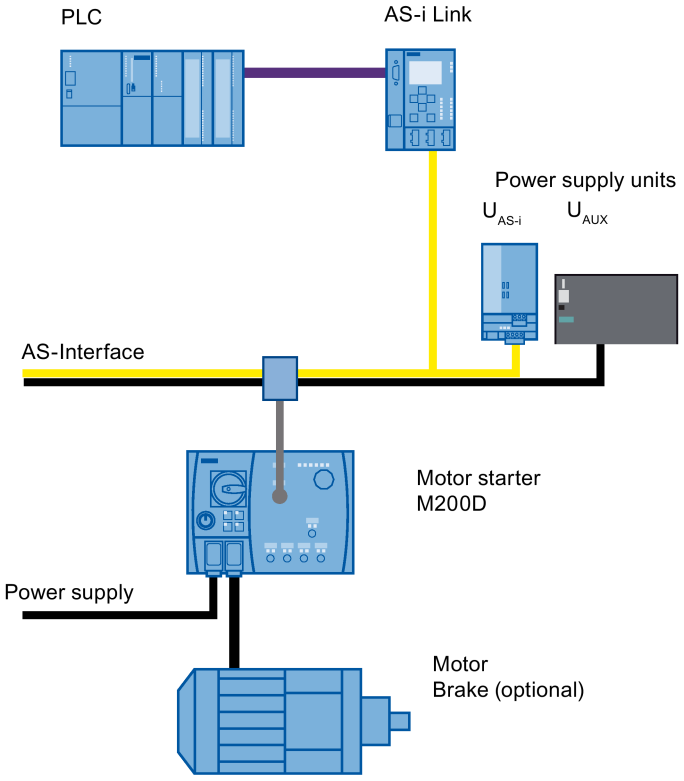


Figure 6-1 Minimum configuration of a motor controller

Required components

For this example, you need the following components:

- A higher-level controller (e.g. S7 series)
- A suitable AS-i master to AS-i spec. 2.1, profile M3
- The motor starter
- Power supply units for the AS-i bus (U_{AS-i}) and the AS-i auxiliary voltage (U_{AUX})
- Connection material:
  - PLC ⇒ AS-i link
  - AS-i branch M12 with a yellow AS-i cable and black auxiliary voltage cable or AS-i round cable M12 (with auxiliary voltage supply)
  - Power connection cable (X1)
  - Motor connection cable (X2)

6.3 Procedure

Commissioning procedure

The following chart shows a logical, step-by-step commissioning procedure.

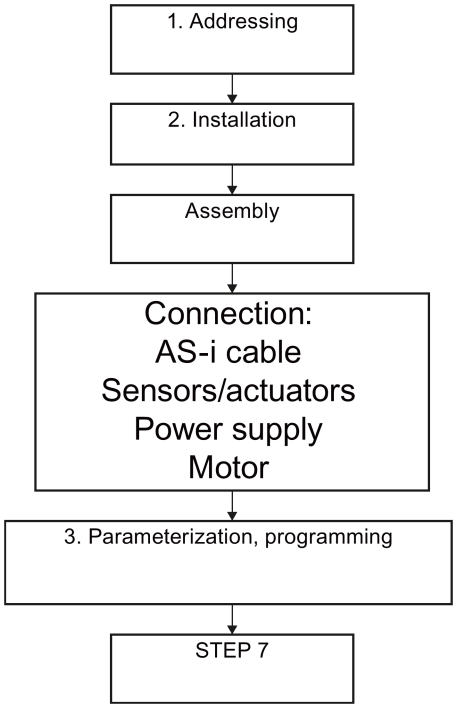


Figure 6-2 Commissioning procedure

Diagnostics

7

7.1 Diagnostics

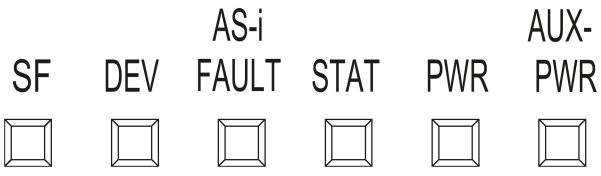
Diagnostics data can be read from the motor starter in a number of different ways:

- Diagnostics on the device:
  - Status LEDs
- Diagnostics via AS-Interface
  - S1 bit in the AS-i status register
  - Parameter echo after AS-i command "Write_Parameter"
    P0 = 0 → messages, alarms
    P0 = 1 → fault messages
- Further diagnostics options:
  - Addressing and diagnostic unit
  - AS-Interface analyzer

7.2 Diagnostics with LED

7.2.1 Statuses of the individual LEDs

The following LEDs indicate the status of the motor starter:



SF LED (possible colors: Red/OFF)

Status	Meaning	Dependencies
Off	No error	
Red	Device detects error	Device error: • Current flowing with no ON command • Self-test error
		Device detects system fault: • Residual current detected • No U_{AUX} • External encoder supply short-circuit

DEVICE LED (possible colors: Red/green/yellow/OFF)

Status	Meaning	Cause
Off	Device not ready	System error: • No supply voltage for electronics or power supply is < 18 V
Green	Device ready	—
Flashing green	Device not starting up	Device not initialized in factory or no startup parameters received (parameter bits from master)
Yellow	Internal tripping	—
Flashing yellow	Group warning	The device has detected a system fault and issues a group warning due to: • Prewarning limit of thermal motor model being exceeded • Incorrect parameter value: therm. motor model + temperature sensor deactivated (motor protection deactivation rule)
Red	Device defective	A device defect was detected during the self-test.

AS-i/fault LED (possible colors: Red/green/OFF)

Status	Meaning	Cause
Off	Device not ready	• No supply voltage for electronics • Hardware fault in AS-i slave
Green	Device ready	Communication active, normal operation
Flashing red/yellow	Slave address = 0	—
Flashing red/green	I/O fault	S1 bit set
Flashing red	Serious I/O fault	• Hardware fault in AS-i slave
Red	No data exchange	• Master in stop mode • Slave not entered in LPS • Slave has wrong IO/ID code • Slave in reset status

STATE LED (possible colors: Red/green/yellow/OFF)

Status	Meaning	Cause
Off	No control	Switching element OFF
Green	Control	Switching element ON by means of controller or hand-held device
Flickering green	Manual mode local input controls	Switching element ON by means of input action
Flashing yellow	Mode fault	Switching element OFF Manual mode connection abort without reset to automatic mode
Flickering yellow	Manual mode local input controls	Switching element OFF by means of input control function (e.g. quickstop)
Red	Switching element defective	Switching status ≠ switching command

PWR LED (possible colors: Green/OFF)

Status	Meaning	Cause
Off	No U_{AS-i}	No AS-i voltage
Green	U_{AS-i} present	AS-i voltage present

PWR-AUX LED (possible colors: Green/OFF)

Status	Meaning	Cause
Off	No U_{AUX}	No auxiliary voltage
Green	U_{AUX} present	Auxiliary voltage present

Input LEDs IN1 to IN4 (possible colors: Green/OFF)

Status	Meaning	Cause
Off	No 24 V DC	No input signal
Green	24 V DC present	Input signal present

Output LED OUT1 (possible colors: Green/OFF)

Status	Meaning	Cause
Off	No 24 V DC	No output signal
Green	24 V DC present	Output signal present

7.2.2 LED display combinations

You can define certain faults more accurately by looking at the combination of indicator statuses.

Device status/mode

SF LED	STATE LED	DEVICE LED	Device status/mode
Off	Green	Green	Motor ON; no fault/error
Off	Off	Green	Motor OFF; no fault
Off	Flashing yellow	Green	Manual mode connection abort without reset to automatic mode
Off	Flickering yellow	Green	Tripping by means of input control function (e.g. quickstop)
Off	Off	Flashing green	Device not initialized in factory or no startup parameters received (parameter bits from master)

Device error

Note
Acknowledging device errors

A device error can only be acknowledged by switching the power off and then on again.

If the error occurs again, however, the motor starter will need to be replaced.

SF LED	STATE LED	DEVICE LED	Device error
Red	Red	Red	Current flowing with no ON command (e.g.: contactor welded, thyristor fused)
Red	Off	Red	Electronics defective, self-test error
Red	Off	Off	No connection with AS-i

System error/Warning

SF LED	STATE LED	DEVICE LED	System error/Warning
Red	Off	Yellow	• Current not flowing despite ON command (residual current detected) • Internal tripping – Connector monitoring – Circuit breaker tripped / shut down • No switching element supply voltage • External encoder supply short-circuit
Off	Green (when switching element is ON)	Flashing yellow	Group warning due to: • Thermal motor model overload • Temperature sensor overload • Asymmetry • Invalid parameter value
Off	Off	Off	No supply voltage for electronics

Group fault

SF LED	STATE LED	DEVICE LED	Group fault
Red	Off	Off	Device diagnostics available

7.3 Diagnostics via parameter channel (parameter echo)

Diagnostics (diagnostic message and diagnostic read procedure)

In the PLC, you can tell whether a fault has occurred by looking at the "I/O fault bit" (S1) on the slave status tab. The AS-i master enters the S1 value in the list of I/O faults (LPF) that have been signaled. The PLC can read this list via the "GET_LPF" command and then signal a specific diagnostic value from the slave.

Slave diagnostics echo (parameter echo)

Bit P0 defines whether a fault diagnosis (P0 = 1) or warning/message diagnosis (P0 = 0) is returned to the master as a slave response.

The parameter value (P0 = (0/1)) is sent to the master via the "Write_Parameter" command. The value set in P1 and P2 is not important here since these bits are not evaluated by the system. P3 is set automatically by the system for A/B switchover.

Output of messages/alarms in order of priority

In the parameter echo, only one fault or message is output at any one time; this is always the one with the highest priority. No further messages/faults can be output while this message/fault is present.

Call (AS-i master to motor starter M200D):			
P3	**P2**	**P1**	**P0**
A/B switchover[1)]	x (any state)	x (any state)	**0**

1) automatically set by the system

Feedback (motor starter M200D to AS-i master): Parameter echo – warnings (A) / messages (M)						
P3	**P2**	**P1**	**P0**	**Decimal**	**Message/Warning**	**Priority**
0	0	0	0	00	No warning/message	16
0	1	0	0	04	(M) Thermal motor model deactivated	9
1	0	1	0	10	(M) Manual local control	8
1	0	1	1	11	(W) Prewarning limit of motor model exceeded	7
1	1	0	0	12	(M) Temperature sensor deactivated	10

Call (motor starter M200D to AS-i master):			
P3	**P2**	**P1**	**P0**
A/B	x (any state)	x (any state)	**1**

Feedback (motor starter M200D to AS-i master): Parameter echo – faults (F)						
P3	**P2**	**P1**	**P0**	**Decimal**	**Fault**	**Priority**
0	0	0	0	00	No fault	16
0	0	1	0	02	(F) Main circuit breaker OFF	7
0	0	1	1	03	(F) Residual current tripping	10
0	1	0	0	04	(F) Overload	8
0	1	0	1	05	(F) Device error	1
0	1	1	0	06	(F) No switching element supply voltage	3
1	0	0	1	09	(F) Connector removed on line side	5
1	0	1	0	10	(F) Electronics supply voltage too low	2
1	1	0	0	12	(F) Short-circuit trip	6
1	1	0	1	13	(F) Asymmetry tripping	9
1	1	1	0	14	(F) Invalid parameter value	4
1	1	1	1	15	(F) Group fault	11

Sample program

Sample program: Slave diagnostics echo (parameter echo). The standard function ASi_3422 (FC7) of the AS-i master (PROFIBUS-ASi) is used for this purpose.

Alternatively, you can use an ASI_Control function block (FB19) for this task. You can find this block on the Siemens Service & Support page (http://support.automation.siemens.com/WW/view/de/51678777).

For a description of the block, please refer to the manual for the AS-i master (DP-ASi Link, CP343-2). This also describes the call interfaces and commands.

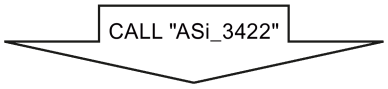
Block ASi_3422 must be called up once when the system is restarted (OB100).

Call in OB100:

```
CALL  "ASi_3422"
    ACT    :=FALSE
    ACT    :=FALSE                      // not required
    STARTUP:=TRUE
    LADDR  :=W#16#14                    // I/O address AS-i master
    SEND   := P#M 4.0 BYTE 1            // irrelevant
    RECV   := P#M 4.0 BYTE 1            // irrelevant
    DONE   :=M19.2
    ERROR  :=M19.3
    STATUS :=MD24
```

To read the parameter echo, the "Write_Parameter" command must be sent to the M200D AS-i Basic motor starter.

Structure of the "Write_Parameter" command:

Structure of the job data in the send buffer				
Byte	**Meaning**			
	Bit 7	**Bit 4**	**Bit 3**	**Bit 0**
0	AS-i command for "Write Parameter" (command number: 02_H)			
1	Slave address (AS-i address that is to be read out of the diagnostics)			
2	0		AS-i parameter bits P 0 ... P3	
				

Structure of the job data in the receive buffer				
Byte	**Meaning**			
	Bit 7	**Bit 4**	**Bit 3**	**Bit 0**
0	0		Parameter echo	

With this command, however, all four parameter bits (P0 … P3) must be sent to the starter.

Sample program:

```
// Parameters in memory byte MB4
    SET
    R    M    4.0              // read messages/warnings from starter
                                //: Bit P0 = 0
// or
    SET
    S    M    4.0              // read faults from starter: Bit P0 = 1
// trigger parameter echo
// command for SEND buffer
    L    2                     // "Write_Parameter" command
    T    MB    2
    L    2                     // slave address of starter
    T    MB    3
// job parameters are in MB4
// write parameters to starter: "Write_Parameter_Value"
// create job for SEND buffer:
CALL  "ASi_3422"
    ACT    :=M10.4             // trigger for writing parameters
    STARTUP:=FALSE             // not required in cycle
    LADDR  :=W#16#14           // address of AS-i master
    SEND   :=P#M 2.0 BYTE 3    // command data range
    RECV   :=P#M 6.0 BYTE 1    // range for response
    DONE   :=M10.5
    ERROR  :=M10.6
    STATUS :=MD16
// parameter echo stored in MB6
```

7.4 Diagnostics with the addressing and diagnostics unit

Diagnostics functions

The addressing and diagnostics unit (order no.: 3RK1904-2AB02) features a range of diagnostics functions, such as:

- Detecting incorrect polarity or overload
- Measuring the AS-i supply voltage
- Detecting faults (with comments)
- Displaying I/O faults

For more information, refer to the operating instructions for the addressing and diagnostics unit.

7.5 Troubleshooting

7.5.1 Response to faults

Description

In some cases, the device can be set in such a way that it responds to faults by either issuing an alarm or by shutting down. Examples: "Response to asymmetry", "response to temperature sensor overload".

The following table shows how the motor starter responds (depending on how it has been parameterized):

	Fault	
	Response 1	**Response 2**
Response:	Alarm	Shutdown
Message bit:	Group alarm set	Group fault set
LED display:	DEVICE flashes yellow	DEVICE lights up yellow SF lights up red
Motor and brake:	Not shut down	Shut down

Note

With certain faults (e.g. "process mapping error" or device faults, such as "Contact block defective"), however, the device always responds by shutting down.
This response cannot be changed.

7.5.2 Acknowledging faults

Restart after device-internal shutdown

If the motor starter shuts down the contact blocks automatically, it does not restart until:

- The fault has been rectified
- The fault has been acknowledged

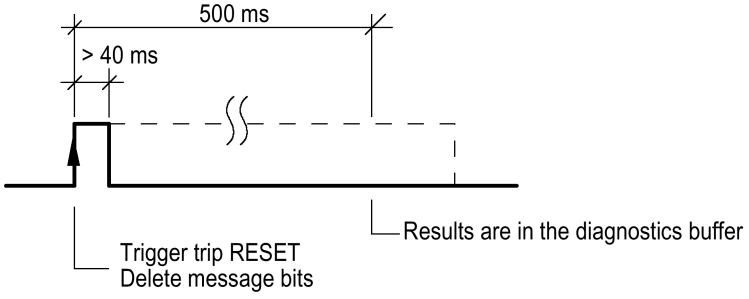
Acknowledgement

You can acknowledge faults as follows:

- With "trip reset"
  - DO0 and DO1 simultaneously (motor CW and motor CCW)
  - Key-operated switch (order variant) in position O
- Parameterized "shutdown with restart" (autoreset)
- With the opposite command, e.g. "motor OFF" (process mapping errors only)

Note

Trip reset is edge-triggered.
If trip reset is present permanently, acknowledgement is only triggered once.



Technical specifications

8

8.1 General technical specifications

Location	In the plant	Wall mounted (near motor)	
Permissible mounting positions		Vertical, horizontal, flat	
Degree of protection	IP65 Type 12	According to IEC 529 (DIN 40050) According to UL	
Protection class	1	IEC 60364-4-41 (DIN VDE 0100-410)	
Touch protection	Finger-safe		
Degree of pollution	3	To IEC 60664	
Cooling	Convection	No additional cooling required	
Operating temperature	–25°C to + 40°C max. 55°C	With reduction of I_e (see "Derating")	
Transport and storage temperature	–40°C to + 70°C	—	
Air humidity	10 % to 95 %	Condensation must not be allowed to form	
Max. temperature change	1 K / min	IEC 60068, Part 2-14	
Chemical environment conditions	3C3	conforming to IEC 60721-3-3	
Installation altitude	1000 m 2000 m	No restrictions With restrictions (reduction of I_e by 1 % every 100 m up to 2000 m)	
Vibration resistance	2 g	To IEC 60 068, Part 2-6	
Shock	12 g with 11 ms without influencing point of contact: 9.8 g / 5 ms or 5.9 g / 10 ms	To IEC 60 068, Part 2-27 half-sine	
Free fall	0.6 m	In product packaging	
ESD	8 kV air discharge 4 kV contact discharge	IEC 61000-4-2	Severity grade 3
Electromagnetic fields	10 V/m	IEC 61000-4-3	Severity grade 3
BURST	2 kV / 5 kHz supply voltage 2 kV / 5 kHz data cables 2 kV / 5 kHz process cables	IEC 61000-4-4	Severity grade 3
SURGE Installation class 1 to 3 [1)]	1 / 2 kV	IEC 61000-4-5	Severity grade 3
Emitted interference	Limit value class A	EN 55011	

[1)] If the starter is used in installation class 3 (increased overvoltage due to parallel cable installation), an overvoltage protection module (3RK1901-1GA00 and 3RG9030-0AA00) must be used.

Note

This product is designed for environment A (industrial environments). In household environments, this device can cause unwanted radio interference. The user may be required to implement appropriate measures in this case.

8.2 Motor starter

Motor starter version		**DSte/RSte**	**sDSte / sRSte**
Installation dimensions in mm (in parentheses: with safety bars)	Width Height Depth	294 (320) 215 (228) 159 (230)	
Weight (g)		2880 g/3130 g	3220 g / 3420 g
Control circuit (AS-i interface)			
Slave type		A/B slave	
Suitable for AS-i master to spec.... (or higher)		AS-i Spec. 2.1 (M3)	
AS-i slave profile IO.ID.ID2		7.A.E	
ID1 code (factory setting)		7	
Operating voltage U_{AS-i}		26.5 to 31.6 V DC	
Auxiliary voltage U_{AUX}		20.4 to 28.8 V DC	
Total power consumption from AS-i Without connected sensors With connected sensors		max. 100 mA max. 300 mA (total sensor power consumption < 200mA)	
Current consumption from U_{AUX} at 24 V (without digital output)		Max. 155 mA Typ. 75 mA	Max. 15 mA / 175 mA Typ. 10 mA / 75 mA
Main circuit			
Max. power of three-phase motors at 400 V		5.5 kW	4 kW
Max. rated operating current I_e			
AC-1 / 2 / 3	At 400 V At 500 V	12 A 9 A	—
AC-4	At 400 V	4 A	—
AC-53a (8 h operation)	At 400 V	—	9 A
Rated operating current - Certification to EN 60947-1 Appendix N - Certification to UL508 and CSA C22.2 No. 14		400 V AC, 50 / 60 Hz 600 V AC, 50 / 60 Hz	400 V AC, 50 / 60 Hz 480 V AC, 50 / 60 Hz
Product category according to UL		NLDX	NMFT

Motor starter version		DSte/RSte	sDSte / sRSte
Motor ratings according to UL / CSA			
3RK13.5- .K (2 A) power (3ph /hp) / max. FLA	for 460/480 V AC	3/4 hp / 1.6 A	3/4 hp / 1.6 A
	for 575/600 V AC	1 hp / 1.7 A	—
3RK13.5- .L (12 A) power (3ph /hp) / max. FLA	for 230/240 V AC	3 hp / 9.6 A	2 hp / 6.8 A
	for 460/480 V AC	7.5 hp / 11 A	5 hp / 7.6 A
	for 575/600 V AC	10 hp / 11 A	—
Typ. switching times incl. internal signal processing at 0.85 to 1.1 x U_e	- Closing delay - Opening delay	50 to 85 ms 40 to 65 ms	65 to 105 ms[1)] 35 to 35 ms
Mechanical service life of contactor		10 million	—
Electrical service life of contactor		See diagram	—
B10 value		1000000[2)]	
Permissible switching frequency		—	See diagram or separate section
Isolation stability			
Rated impulse withstand voltage U_{imp}		6 kV	
Rated insulation voltage U_i		500 V	
Safe isolation between main and control circuits to IEC 60947-1 Appendix N		400 V	
Short-circuit protection			
Instantaneous overcurrent release - $I_{e\ max}$ = 2 A - $I_{e\ max}$ = 9/12 A		 26 A 208 A	
Rated short-circuit¬breaking capacity I_{CU} at 400 V in accordance with IEC 60947			
at 400 V at 500 V		50 kA 50 kA	50 kA 20 kA
Short circuit ratings according to UL / CSA		65 kA / 480 V / Any circuit breaker or any fuse 10 kA / 600 V / Any circuit breaker or any fuse	5 kA / 480 V / Fuse: 60 A class J 42 kA / 480 V / Fuse: 45 A class J
Group installation		Suitable for Group installation	
Motor disconnect		Suitable as motor disconnect	

1) incl. 40 ms negative braking delay time

2) This specification refers exclusively to the mechanical switching element under its reference conditions.

Note

To reverse the direction of rotation, a mechanically-switching reversing contactor is integrated in reversing starters with electronic switching. The preferred position of this contactor is "CW rotation". When the direction is changed to "CCW rotation", the reversing contactor is activated first, followed by the electronic contacts after an 80 ms delay.

8.3 Brake control

Brake version	**400 V AC / 230 V**	**180 V DC**
Rated operating voltage	AC 220 ... 600 V (-10% / +5%), 50 / 60 Hz	
Output voltage	-	0.45 x U_e e. g. 180 V DC at 400 V AC 215 V DC at 480 V AC
Shutdown delay	-	50 ms
Continuous current	< 0.5 A	< 0.8 A
Voltage drop during continuous current	7 V	3.5 V
Inrush current at t < 120 ms	< 5 A	< 5 A
Switching capacity to IEC60947-5-1 - AC 15, at 400 V AC - DC 13, at 180 V DC	 0.4 A -	 - 0.8 A
Fault message with non-controlled brake	No	
Protective measures		
Short-circuit protection	Yes, 1 A melting fuse	
Inductive interference protection	Integrated varistors	
Max. energy absorption of switching voltage limit		> 43 J (for 2 ms)

8.4 Inputs

Input characteristic to IEC60947-1 Appendix S and IEC61131-2		Type 1
Input voltage	- Rated value - for signal "0" - for signal "1"	24 V DC -3 to +5 V 11 to 30 V
Input current for signal "1"		7 mA, typ.
Connection of 2-wire BEROs		Possible
Permissible residual current		1.5 mA, max.
Input signal delay		10 ms fixed setting
Supply from U_{AS-i}		Short-circuit and overload proof
Sensor supply		16.5 to 30 V DC
Total current sensor supply		Max. 200 mA (sensor supply is short-circuit proof)
Connection		M12 connectors
Assignment of inputs		
IN1 IN2 IN3 IN4		Input 1 (PII DI2) Input 2 (PII DI3) Input 3 Input 4

8.5 Output

Number of digital outputs		1
Switching capacity		0.5 A continuous current
Cable length	Shielded Unshielded	30 m, max.
Short-circuit protection Response threshold		Electronic > 0.7 A, typ.
Limiting of inductive shutdown voltage		Integrated free-wheeling diode
Lamp load		5 W, max.
Sets an AS-i digital input		Not permissible
Voltage drop	For signal 1	U_{AUX} + (- 0.8 V), min.
Residual current	For signal 0	0.5 mA max.
Assignment of output		
OUT1		Output 1

8.6 Thermistor motor protection

Temperature sensor		**PTC**	**Thermoclick**
Evaluation characteristic to IEC 60947-8		Type A	—
Summation cold resistance sensor circuit		< 1.5 kΩ	
No-load voltage of sensor circuit		< 30 V	
Short-circuit current sensor circuit		< 1.2 mA	
Trip level		3.4 … 3.8 kΩ	
Reset level		1.5 … 1.65 kΩ	
Short-circuit detection		< 30 Ω	No
Electrical isolation vis-à-vis	Main circuit U_{AS-i} U_{PWR}	Yes (U_i = 400 V) Yes (U_i = 400 V) Yes (U_i = 400 V)	

8.7 Switching frequency

If motors are switched too often, this causes the thermal motor model to respond.
The maximum permissible switching frequency depends on the following operating data:

ON period (ED)

The relative ON period (ED) in % is the ratio between load duration and cycle duration for loads that are often switched on and off.

The ON period (ED) can be calculated using the following formula:

$$ED = \frac{t_s + t_b}{t_s + t_b + t_p}$$

ED ON period [%]
t_s Start time [s]
t_b Operating time [s]
t_p Pause interval [s]

Graphics-based representation:

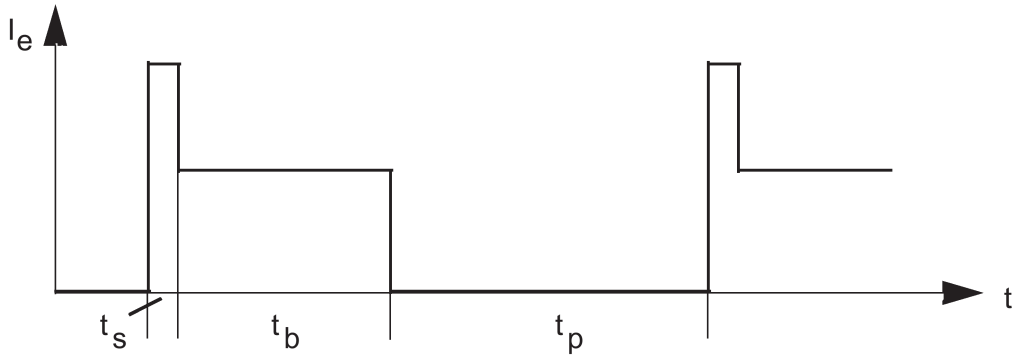


Figure 8-1 ON period (ED)

Direct and reversing starters, electronic (sDSte / sRSte) up to 4 kW

3RK1315-6KS71-.AA. (0.15 A to 2 A)												
Operating cycles/hour for Class 10												
Mounting position	Vertical						Horizontal					
Rated current I_e	2 A		2 A		2 A		2 A		2 A		2 A	
Ambient temperature	40 °C		50 °C		55 °C		40 °C		50 °C		55 °C	
Motor protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
ED=30 % (8 x I_e) / 0.1 s	600	3600	600	3600	600	3600	600	3600	600	3600	600	3600
ED=70 % (8 x I_e) / 0.1 s	360	2000	360	2000	360	2000	360	2000	360	2000	360	2000
ED=30 % (8 x I_e) / 0.2 s	300	2000	300	2000	300	2000	300	2000	300	2000	300	2000
ED=70 % (8 x I_e) / 0.2 s	180	1000	180	1000	180	1000	180	1000	180	1000	180	1000
ED=30 % (8 x I_e) / 0.4 s	150	1000	150	1000	150	1000	150	1000	150	1000	150	1000
ED=70 % (8 x I_e) / 0.4 s	90	500	90	500	90	500	90	500	90	500	90	500
ED=30 % (8 x I_e) / 0.8 s	75	490	75	490	75	490	75	490	75	490	75	490
ED=70 % (8 x I_e) / 0.8 s	45	250	45	250	45	250	45	250	45	250	45	250

1) Duty cycle current rms value = 1.15 x I_e → motor protection

2) Duty cycle limit for motor starter. The motor should be protected against overload here by means of a thermistor.

3RK1315-6NS71-.AA. (1.5 A to 9 A)												
Operating cycles/hour for Class 10												
Mounting position	Vertical						Horizontal					
Rated current I_e	5 A		5 A		5 A		5 A		5 A		4.5 A	
Ambient temperature	40 °C		50 °C		55 °C		40 °C		50 °C		55 °C	
Motor protection	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
ED=30 % (8 x I_e) / 0.25 s	240	1300	240	1000	240	820	240	1100	240	820	240	820
ED=70 % (8 x I_e) / 0.25 s	160	760	160	500	160	350	160	640	160	350	160	350
ED=30 % (8 x I_e) / 0.5 s	120	700	120	520	120	420	120	580	120	430	120	430
ED=70 % (8 x I_e) / 0.5 s	70	400	70	280	70	200	70	340	70	200	70	200
ED=30 % (8 x I_e) / 1 s	60	350	60	260	60	220	60	290	60	220	60	220
ED=70 % (8 x I_e) / 1 s	37	190	37	140	37	100	37	170	37	100	37	100

1) Duty cycle current rms value = 1.15 x I_e → motor protection

2) Duty cycle limit for motor starter. The motor should be protected against overload here by means of a thermistor.

3RK1315-6NS71-.AA. (1.5 A to 9 A)												
Operating cycles/hour for Class 10												
Mounting position	Vertical						Horizontal					
Rated current I_e	7 A		5.8 A		5 A		6 A		5 A		4.5 A	
Ambient temperature	40 °C		50 °C		55 °C		40 °C		50 °C		55 °C	
Motor protection	1) 2)		1) 2)		1) 2)		1) 2)		1) 2)		1) 2)	
ED = 30%, start 4 x I_e/2 s	120	290	120	300	120	320	120	320	120	320	120	320
ED = 70 %, start 4 x I_e/2 s	70	130	70	130	70	130	70	140	70	140	70	140
ED = 30%, start 4 x I_e/4 s	60	145	60	150	60	160	60	160	60	160	60	160
ED = 70 %, start 4 x I_e/4 s	37	65	37	65	37	70	37	70	37	70	37	70

1) Duty cycle current rms value = 1.15 x I_e → motor protection

2) Duty cycle limit for motor starter. The motor should be protected against overload here by means of a thermistor.

3RK1315-6NS71-.AA. (1.5 A to 9 A)												
Operating cycles/hour for Class 10												
Mounting position	Vertical						Horizontal					
Rated current I_e	9 A		9 A		9 A		9 A		9 A		9 A	
Ambient temperature	40 °C		50 °C		55 °C		40 °C		50 °C		55 °C	
Motor protection	1) 2)		1) 2)		1) 2)		1) 2)		1) 2)		1) 2)	
ED = 30%, start 4 x I_e/2 s	120	170	120	120	105	105	120	145	105	105	88	88
ED = 70 %, start 4 x I_e/2 s	70	140	70	100	70	80	70	120	70	82	63	63
ED = 30%, start 4 x I_e/4 s	60	85	60	60	53	53	60	72	53	53	44	44
ED = 70 %, start 4 x I_e/4 s	38	72	38	50	38	38	38	60	38	41	31	31

1) Duty cycle current rms value = 1.15 x I_e → motor protection

2) Duty cycle limit for motor starter. The motor should be protected against overload here by means of a thermistor.

8.8 Electrical service life of contactor

Service life of main contacts (DSte / RSte) to 5.5 kW

The curves show the contact service life of contactors when switching ohmic and inductive three-phase loads (AC-1/AC-3) as a function of breaking current and rated operating voltage. The prerequisite for this are command devices that switch at random, i.e. not synchronously to the phase angle of the line.

The rated operating current I_e in accordance with utilization category AC-4 (breaking of 6 times the rated operating current) is determined for a contact service life of at least 200 000 operating cycles.

If a smaller contact service life is sufficient, the rated operating current I_e/AC-4 can be increased.

If **mixed operation** is available, i.e. if normal switching operation (breaking of rated operating current in accordance with utilization category AC-3) is mixed with occasional inching (breaking of the multiple rated operating current in accordance with utilzation category AC-4), the service life of the contacts can be calculated approximately with the following formula:

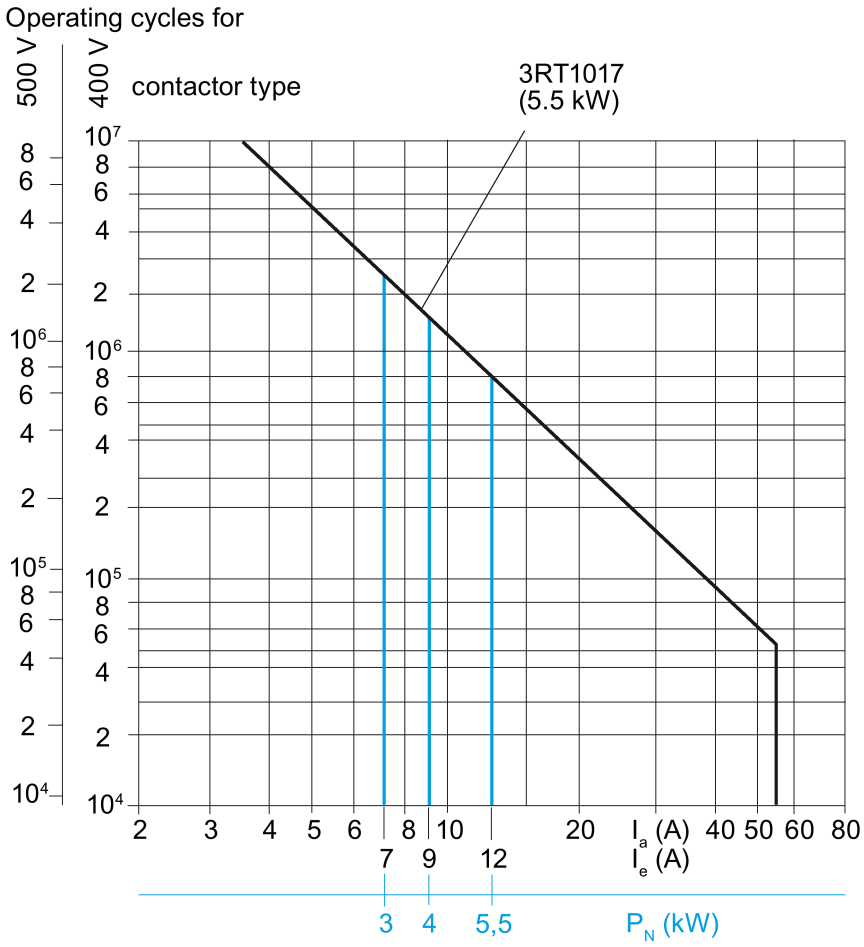
$$X = \frac{A}{1+\frac{C}{100} * \left(\frac{A}{B} - 1\right)}$$

X Contact service life for mixed operation in operating cycles

A Contact service life for normal operation ($I_a = I_e$) in operating cycles

B Contact service life for inching (I_a = multiple of I_e) in operating cycles

C Proportion of inching operations in the total operations as a percentage



P_N Rated power of three-phase motors at 400 V

I_a Breaking current

I_e Rated operating current

Figure 8-2 Service life of main contacts for contactor 3RT1017

8.9 Dimension drawing

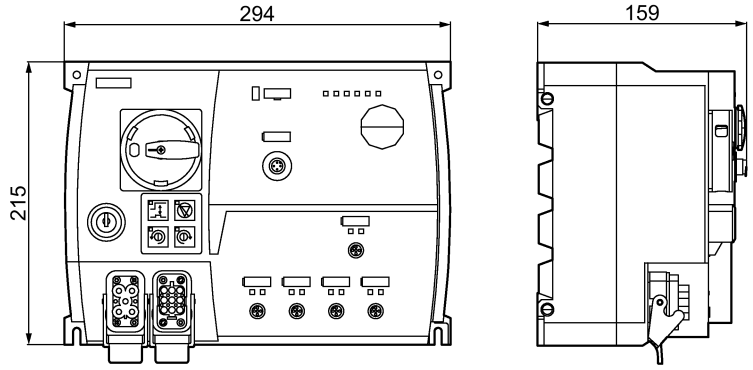


Figure 8-3 M200D AS-i motor starter without protection guard

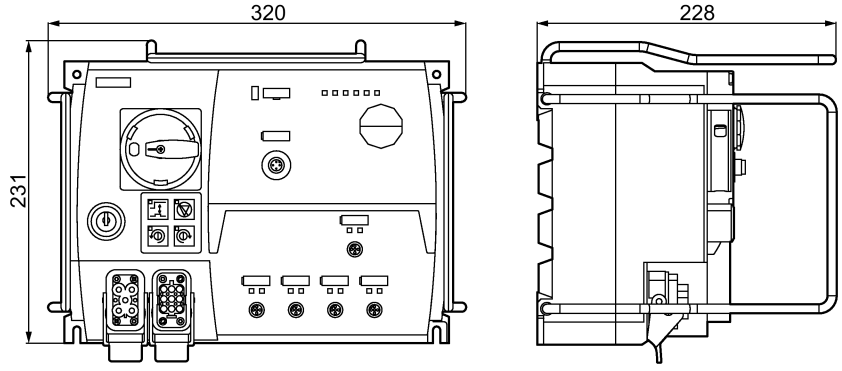


Figure 8-4 M200D AS-i motor starter with protection guard

Appendix

A

A.1 Order numbers

A.1.1 M200D AS-i motor starter

Position												Meaning
1 – 7	—	8	9	10	11	12	—	13	14	15	16	
3RK1315	–	6	⇓	S	⇓	1		⇓	A	A	⇓	M200D starter
			K		⇓			⇓			⇓	0.15 - 2.0 A
			N		⇓			⇓			⇓	1.5 - 9.0 A (only for electronic motor starters)
			L		⇓			⇓			⇓	1.5 - 12.0 A (only for electromechanical motor starters)
					4			⇓			⇓	Electromechanical
					7			⇓			⇓	Electronic
								0			⇓	Direct starter without OCM
								1			⇓	Reversing starter without OCM
								2			⇓	Direct starter with OCM
								3			⇓	Reversing starter with OCM
											0	Without brake output
											3	Brake output 400 V / 230 V AC
											5	Brake output 180 V DC

You can combine the key numbers/letters to create the MLFB of the required motor starter:

Position												Meaning
1 – 7	—	8	9	10	11	12	—	13	14	15	16	
3RK1315	–	6	L	S	7	1	–	1	A	A	3	Reversing starter without OCM, 1.5 - 12.0 A, electronic, with brake output 400 V AC / 230 V AC

A.1.2 Spare parts/accessories

Power supply

Designation	Order no.
Power outlet connector, connector set consisting of coupling housing for connection to T distributor , straight cable outlet (with clip), pin insert for HAN Q4/2, incl. cable gland	
5 pins 2.5 mm^2	3RK1911-2BS60
5 pins 6 mm^2	3RK1911-2BS20
5 pins 4 mm^2	3RK1911-2BS40
Power connector, connector set for connection to M200D motor starters, consisting of socket shell, angled outlet, socket insert for HAN Q4/2, incl. gland	
5 socket contacts 2.5 mm^2, 2 socket contacts 0.5 mm^2	3RK1911-2BE50
5 socket contacts 4 mm^2, 2 socket contacts 0.5 mm^2	3RK1911-2BE10
5 socket contacts 6 mm^2, 2 socket contacts 0.5 mm^2	3RK1911-2BE30
Power supply cable, one end prefabricated, with "N" und jumper pin 11 und 12 for connector monitoring, with HAN Q4/2, angled; one end open; 5 x 4 mm^2	
Length 1.5 m	3RK1911-0DC13
Length 5.0 m	3RK1911-0DC33

Motor cable

Designation	Order no.
Motor connector for connection to M200D motor starters, consisting of socket shell, angled outlet, pin insert for HAN Q8/0, incl. gland	
8 pins 1.5 mm^2	3RK1902-0CE00
6 pins 2.5 mm^2	3RK1902-0CC00
Motor connector for connection to motor, consisting of socket shell, angled outlet, socket insert for HAN 10e, incl. neutral bridge, incl. gland	
7 socket contacts 1.5 mm^2	3RK1911-2BM21
7 socket contacts 2.5 mm^2	3RK1911-2BM22
Motor cable, one end prefabricated, one end open, HAN Q8/0, angled, length 5 m	
for motor without brake for M200D, 4x1.5 mm^2	3RK1911-0EB31
for motor without brake for M200D with thermistor, 6x1.5 mm^2	3RK1911-0EF31
for motor with brake 400 V AC/180 V DC, 6 x 1.5 mm^2	3RK1911-0ED31
for motor with brake 400 V AC/180 V DC and thermistor, 8 x 1.5 mm^2	3RK1911-0EG31
for motor with brake 230 V AC, 6 x 1.5 mm^2	3RK1911-0EH31
for motor with brake 230 V AC and thermistor, 8 x 1.5 mm^2	3RK1911-0EE31

Motor controller with AS-i communication

Designation	Order no.
Control cable, one end prefabricated / open, M12 angled cable plugs for screw mounting, degree of protection IP67, 4-pole, 4 x 0.34 mm^2 Cable length 5 m	 3RK1902-4GB50-4AA0
Coupling plug with connection space, prefabricated, M12 angled cable plugs for screw mounting, degree of protection IP67, 4-pole, 4 x 0.34 mm^2	3RK1902-4CA00-4AA0
AS-Interface M12 branch for flat cables AS-i / U_{AUX} cable end in branch not possible M12 socket M12 cable plug, cable length 1 m M12 cable plug, cable length 2 m	 3RK1901-1NR20 3RK1901-1NR21 3RK1901-1NR22
AS-Interface M12 screw caps for sealing unassigned input/output sockets (one set contains ten screw caps)	3RK1901-1KA00
Cable end terminator for sealing open cable ends (AS-Interface shaped cable) with IP67	3RK1901-1MN00

Motor controller with IO communication

Designation	Order no.
Control cable, one end prefabricated / open, M12 angled cable connectors, degree of protection IP67, 5 x 0.34 mm^2 (metal screw cap) Cable length 5 m cable length 10 m	 3RK1902-4HB50-5AA0 3RK1902-4HC01-5AA0
M12 coupler plug, straight, screw-type connection max. 0.75 mm^2, 5-pin, A-coded, max. 4 A	3RK1902-4BA00-5AA0
M12 coupler plug, angled, screw-type connection max. 0.75 mm^2, 5-pin, A-coded, max. 4 A	3RK1902-4DA00-5AA0

Further options

Designation	Order no.
M200D protection guards	3RK1911-3BA00
RS 232 interface cable	3RK1922-2BP00
Hand-held device for motor starters for local control Serial interface cable must be ordered separately	3RK1922-3BA00
AS-i addressing unit in accordance with AS-Interface version 2.1 Scope of supply: Adressing unit, operating instructions, addressing cable (1.5 m with jack plug)	3RK1904-2AB02
M12 addressing cable for M12 for addressing slaves with M12 connection	3RK1902-4PB15-3AA0
Identification label 9 x 20, petrol (19 frames, 380 labels)	3RT1900-1SB50
Dismantling tool Han Q4/2	3RK1902-0AB00
Dismantling tool Han Q8/0	3RK1902-0AJ00

A.2 Bibliography

Documentation for M200D AS-i at a glance

All the documents in this overview are available for download at SIRIUS M200D Motor Starters (www.siemens.de/sirius-m200d).

Each document has an **entry ID**, which you can use to search for a specific document.

The following tables list a selection of available AS-i documents.

Topic	AS-i master
Document title	**AS-Interface system manual**
Entry ID	26250840
For products	3RK11, 3RK12, 3RK14, 3RK21, 3RK22, 3RK24, 3RK3141, 3RX95, 6GK14, 6GK72, 6GK73
Document title	**CP 343-2 / CP 343-2 P AS-Interface Master**
Entry ID	5581657
For products	6GK7343-2AH00-0XA0; 6GK7343-2AH10-0XA0
Document title	**Distributed I/O System DP/AS-i Link**
Entry ID	1144898
For products	6GK1415-2AA00; 6GK1415-2AA01
Document title	**ASiSafe DP/AS-i F-Link**
Entry ID	24196041
For products	3RK3141-1CD10; 3RK3141-2CD10
Document title	**Manual DP/AS-Interface Link Advanced**
Entry ID	22710305
For products	6GK1415-BA10; 6GK1415-2BA20
Document title	**Manual DP/AS-Interface Link 20E**
Entry ID	5281638
For products	6GK1415-2AA01

Topic	Addressing and analyzing
Document title	**Addressing and Diagnosis Instrument for AS-i Modules**
Entry ID	48532283
For products	3RK1904-2AB02
Document title	**AS-Interface Analyzer**
Entry ID	26267998
For products	3RK1904-3AB01

Topic	Control systems
Document title	**S7-200 Automation System**
Entry ID	1109582
For products	6ES7214; 6ES7221-1BF00-0XA0; 6ES7221-1EF00-0XA0; 6ES7221-1BF10-0XA0; 6ES7221-1JF00-0XA0; 6ES7222-1BF00-0XA0; 6ES7222-1HF00-0XA0; 6ES7222-1EF00-0XA0; 6ES7223-1BF00-0XA0; 6ES7215; 6ES7216; 6ES7223-1HF00-0XA0; 6ES7223-1EF00-0XA0; 6ES7223-1PH00-0XA0

Correction sheet

B

Correction sheet

Have you noticed any errors while reading this manual? If so, please use this form to tell us about them. We welcome comments and suggestions for improvement.

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92220 Amberg / Germany	Address

Fax: +49 (0)9621-80-3337

Manual title:

Table 8- 1 Errors, comments, and suggestions for improvements

Glossary

24 V-NS DC

Electronics supply voltage

24 V-S DC

Switching element supply voltage

AS-Interface (AS-i)

The AS-Interface (or actuator/sensor interface; abbreviated to AS–i) is a connection system for the lowest process level in automation systems.

BO

Brake output

Combined Transaction Type 2 (CTT2)

Communication protocol on AS-Interface in accordance with Specification V3.0 for the transfer of large volumes of data (analog values, strings, etc.).

Degree of protection

The degree of protection of a device indicates the extent of protection. The extent of protection includes the safety of persons against coming in contact with live or rotating parts, and the protection of electric resources against the penetration of water, foreign bodies and dust.

The M200D has an IP65 degree of protection when all the unused connections are sealed.

DSte

Abbreviation for "direct starter, electromechanical"

ESD

Components sensitive to electrostatic charge
Electronic components (e.g. field effect transistors, integrated circuits) that may be destroyed by high voltages (for instance by electrically charged non-grounded persons)

Ground fault

Fault whereby an external conductor comes into contact with ground or the grounded neutral point.

GSD

Device master data

GSDML

The GSDML language is defined by the GSDML scheme. A GSDML scheme contains validity rules that allow you to check the syntax of a GSD file, for example. Manufacturers of IO devices can obtain GSDML schemes (in the form of scheme files) from PROFIBUS International.

HMI

Operator control and monitoring
With HMI components, process data can be visualized and systems can be operated.

Integrated manual local control

Integrated manual local control is an orer variant for the M200D and involves a key-operated switch and keypad.

IP

Degrees of protection to DIN EN 60529 (IEC 529/VDE 047 T1)
(**I**nternational **P**rotection Classes)

LPS

List of configured slaves

MLFB

Machine-readable product designation

Motor Starter ES

The Motor Starter ES software is used for commissioning, parameterization, diagnostics, documentation, and preventive maintenance of the High Feature motor starters in the ranges:

- SIMATIC ET 200S (High Feature)
- ET 200pro
- ECOFAST (High Feature) and
- M200D (AS-i Standard, PROFIBUS, PROFINET)

N conductor (neutral conductor)

EN 60947-1: A conductor connected to the center point or neutral point of the system and designed to transfer electrical energy. EN 60050-141: Conductor in a multi-phase cable that is connected to the neutral point N) of a multi-phase combination.

PE (protective conductor)

- EN 60947-1: Conductor required for certain measures to protect against electric shock to establish an electrical connection between the following components:
  - Components of the electrical equipment
  - External, conductive components
  - Main grounding terminal
  - Ground electrode
  - Grounded point in the current source or artificial neutral point
- EN 60050-195: Conductor for safety purposes (e.g. to protect against electric shock).

PII/PIO

Process input image/process output image

Process image

Image of the signal states of the digital inputs and outputs in the memory of a controller.

PROFIBUS

PROFIBUS stands for "process fieldbus". PROFIBUS is a manufacturer-independent standard to network the field devices (e.g. PLCs, actuators, final controlling elements and sensors). PROFIBUS is compatible with protocols such as DP (decentralized peripherals), FMS (fieldbus message specification) and PA (process automation).

PROFIenergy

The PROFINET profile supports energy management systems in process plants by reading out measured values or by, for example, briefly shutting down the entire plant during breaks via standardized PROFIenergy commands.

PROFINET

This is an open component-based industrial communication system based on Ethernet for distributed automation systems. Communications technology required by the PROFIBUS User Organization.

Reversing starter

Starting control function for the direction of rotation (CW / CCW).

RSte

Abbreviation for "reversing starter, electromechanical"

sDSSte

Abbreviation for "direct soft starter, electronic"

sDSte

Direct starter (electronic)

Soft starter

Function for starting/stopping motors smoothly.

sRSSte

Abbreviation for "reversing soft starter, electronic"

sRSte

Reversing starter (electronic)

Step 7

The basic STEP 7 software is the standard tool for the SIMATIC S7, SIMATIC C7 and SIMATIC WinAC automation systems.

Trip class (shutdown class)

The trip class defines the start time at a particular current before the trip occurs. Different classes exist (e.g. CLASS 10, 20, 30, etc.), whereby CLASS 30 is the longest permissible start time.

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