MOELLER

Hardware and Engineering

DM 4
Soft Starter

08/99 AWB 8250-1341 GB

1st published 1999, edition 08/99

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Caution!

Dangerous Electrical Voltage!

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the engineering instructions (AWA) of the device concerned.
- Only suitably qualified personnel may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause uncontrolled operation or restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- According to their degree of protection frequency inverters may feature during operation live, bright metal, or possibly moving, rotating parts or hot surfaces.
- The impermissible removal of the necessary covers, improper installation or incorrect operation of motor or frequency inverter may cause the failure of the device and may lead to serious injury or damage.
- The relevant national regulations apply to all work carried on live frequency inverters.
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross sections, fuses, PE).

- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 and HD 384 and national work safety regulations).
- Installations fitted with frequency inverters must be provided with additional monitoring and protective devices in accordance with the relevant safety regulations etc. Modifications to the frequency inverters using the operating software are permitted.
- All shrouds and doors must be kept closed during operation.
- In order to reduce hazards to persons or equipment, the user must include in the machine design measures that restrict the consequences of a malfunction or failure of the drive (increased motor speed or sudden standstill of motor). These measures include:
  - Other independent devices for monitoring safety-related variables (speed, travel, end positions etc.)
  - Electrical or non-electrical system related measures (interlocks or mechanical interlocks).
  - Live parts or cable connections of the frequency inverter must not be touched after it has been disconnected from the power supply due to the charge in capacitors. Appropriate warning signs must be provided.

Contents

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About This Manual

This manual contains the information you need to connect the soft starter correctly and to configure the drive parameters to your requirements.

The information in this manual applies to the software from version 52.09 or later and to the specified hardware.

The manual covers all models of the soft starter range. Specific references are made to differences and special features of individual variants.

The following abbreviations and symbols are used in the manual:

PNU: Parameter number
Default: Default factory setting

▶ Indicates actions to be taken.

Indicates useful tips and additional information.

Attention!
Warns about potential damage to the product or its environment. Also indicates the potential for partial loss of data.

Warning!
Warns about risk of serious or fatal personal injury and the possibility of serious damage to the product or its environment.
Also indicates the potential for complete loss of data.

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1 About the Series

System overview

The soft starters' type designation is based on the following type code, and provides the following information:

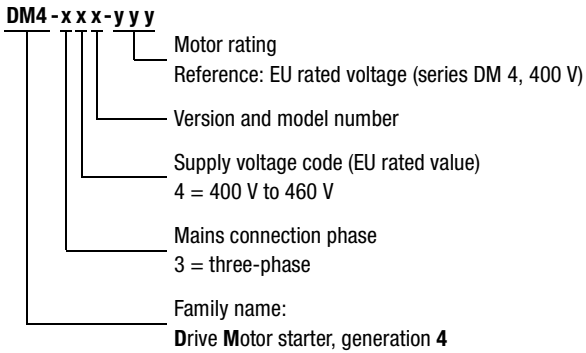

Figure 1: Structure of type code

The following example shows the type code for a typical frequency inverter.

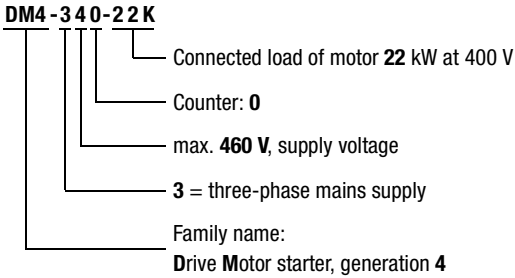

Figure 2: Sample type code

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The series DM 4 soft starters regulate the supply voltage from an adjustable starting value up to 100 %. If a three-phase induction motor is used on this net, its startup torque is significantly lowered. This ensures that three-phase induction motors start up smoothly at a reduced starting current.

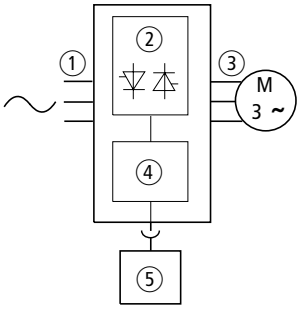

Figure 3: Function chart

① Mains voltage (U_{LN}): 3 × 230 V to 3 × 460 V

② Anti-parallel thyristors in all three phases control the motor voltage

③ Output voltage (U_2):
three-phase, ramped from an adjustable starting voltage to 100 % mains voltage at constant mains frequency.

Output current (I_2N):
15 A to 900 A at a maximum
ambient temperature of 40 °C.

Motor shaft rating (P_2):
7.5 to 500 kW at 400 V with standard connection
or 10 to 750 HP at 460 V
11 to 900 kW at 400 V with In-Delta connection
or 15 to 1300 HP at 460 V

④ Controller card: controls the power section. Control commands are processed here and parameters defined.

⑤ With the plug-in LCD keypad, parameters can be changed or viewed as plain text.

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Soft starter features

Compact construction	✓
Current limit	✓
Adjustable starting voltage	✓
Adjustable breakaway torque (kick)	✓
Separately adjustable ramp times for startup and stop	✓
Adjustable current limitation	1 to 8-fold
Energy saving function (cos φ control)	✓
Preprogrammed, application-dependent parameter sets	✓
Configurable digital inputs	2
Configurable analog inputs/outputs	2/2
Configurable relay outputs	4
Can be used as soft starter and generalized phase control	✓
Standardized controller card and parameters across the whole power range	✓
Networkable	Optional
Serial interface	Optional
LCD keypad	Optional
Fault memory	5 messages
Two parameter sets	✓
In-line (default) or In-Delta control (reduction of phase current by $1/\sqrt{3}$)	✓

Selection criteria

Choose your soft starter according to the rated motor current and the type of load. The load must have quadratic speed/torque characteristics. Loads with linear or constant speed/torque characteristics cannot be started at full load with the soft starter (e.g. piston pumps can be run up only with bypass valves).

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The rated output current of the soft starter must be the same as or greater than the rated motor current. For motors with a high starting resistance, the selected starter must be dimensioned accordingly to avoid overloads.

Parallel connection of several motors to one soft starter

Select the soft starter according to the sum of the rated currents of all motors.

Connecting motors during soft starter operation

No soft start is performed in this case. The starter must be able to supply the full starting current (approx. 6 to 8 times rated motor current) and the current for the remaining motors. Otherwise an overcurrent trip is triggered.

Permissible rated motor output

With standard motors and normal loads suitable for soft starters, motors with the following ratings can be connected.

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Standard connection

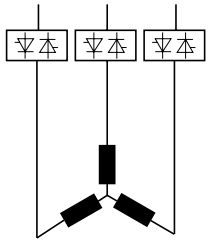

Figure 4: Standard connection diagram

DM 4-340-...	Rated motor output		
	in kW at 230 V	in kW at 400 V	in HP at 460 V
...-7K5	3	7.5	10
...-11K	5.5	11	15
...-15K	7.5	15	20
...-22K	11	22	30
...-30K	15	30	40
...-37K	18.5	37	50
...-45K	22	45	60
...-55K	30	55	75
...-75K	37	75	100
...-90K	45	90	125
...-110K	55	110	150
...-132K	75	132	200
...-160K	90	160	250
...-200K	110	200	300
...-250K	132	250	400
...-315K	160	315	500
...-400K	200	400	600
...-500K	250	500	750

In-Delta connection

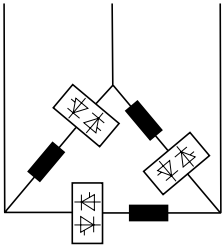

Figure 5: Connection chart – In-Delta connection

DM 4-340-...	Motor rating		
	in kW at 230 V	in kW at 400 V	in HP at 460 V
...-7K5	7.5	11	15
...-11K	11	15	20
...-15K	15	22	30
...-22K	22	37	50
...-30K	30	55	75
...-37K	37	55	75
...-45K	45	75	100
...-55K	55	90	125
...-75K	75	132	200
...-90K	90	160	250
...-110K	110	160	250
...-132K	132	200	300
...-160K	160	250	400
...-200K	200	315	500
...-250K	250	400	600
...-315K	315	560	850
...-400K	400	750	1100
...-500K	500	900	1300

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Power dissipation P_V

The soft starter's power dissipation P_V depends on the operating condition of the connected motor. The values listed below apply to rated operation of the motor parameters (rated motor output, 4-pole three-phase induction motor) at an ambient temperature of 40 °C.

At startup, the current exceeds the rated current. All types of enclosures in which the starter is to be installed must allow discharge of the dissipated power. Depending on the defined ramp time and current limit this current may flow for several seconds. Any power dissipation must be accounted for in the enclosure layout.

DM 4-340-...	Controller supply	Power section				
	[W]	1 × I_e [W]	2 × I_e [W]	3 × I_e [W]	4 × I_e [W]	5 × I_e [W]
...-7K5	5	45	107	186	282	395
...-11K	5	58	132	221	325	445
...-15K	8	83	195	335	504	702
...-22K	8	109	246	411	603	824
...-30K	11	141	325	553	824	1139
...-37K	11	179	404	677	996	1361
...-45K	11	216	497	844	1255	1731
...-55K	11	265	606	1023	1516	2085
...-75K	11	370	875	1516	2292	3203
...-90K	14	438	1019	1742	2607	3614
...-110K	14	531	1258	2182	3303	4621
...-130K	14	648	1556	2722	4148	5833

DM 4-340-...	Controller supply [W]	Power section 1 × e [W]	2 × e [W]	3 × e [W]	4 × e [W]	5 × e [W]
...-160K	14	781	1916	3403	5242	7435
...-200K	14	911	2130	3658	5494	7640
...-250K	125	1246	2917	5013	7534	10481
...-320K	125	1580	3796	6647	10133	14254
...-400K	125	1981	4520	7618	11275	15490
...-500K	125	2649	6222	10719	16138	22481

Permissible environmental influences

Protection class:
IP 20

Installation height:
Up to 1000 m above sea level; above this up to 2000 m with a current drop of 1 % per 100 m additional height.

Temperature:

Operation	0 to 40 °C without reduction, up to 60 °C with a reduction of 2 % per °C
Storage	–25 to +55 °C constant, –25 to +75 °C max. 24 hours
Transport	as for storage

Climate withstand capability:
Damp heat, cyclic, to DIN IEC 60 068-2-30
Damp heat, constant, to DIN IEC 60 068-2-3

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Intended use

DM 4 soft starters are electrical apparatus for installation in control cabinets for electrical systems or machines.

The DM 4 series devices are intended for use as components for the smooth control of three-phase induction motors (squirrel cage motors). They are designed for installation in machines or for use in combination with other components forming a machine or system.

After installation in a machine, the soft starter must not be taken into operation until the associated machine complies with the safety requirements of Machine Directive 89/392/EEC. EN 60 204 must also be observed.

Use of the apparatus is permitted only in compliance with the EMC Directive (89/336/EEC).

The soft starters meet the requirements of the Low Voltage Directive 73/23/EEC.

The soft starters meet product standard EN 60 947-4-2.

The soft starter's output (terminals 2T1, 4T2, 6T3) must not be used to

- connect a capacitive load (e.g. power factor compensation capacitors);
- connect several soft starters with each other.

Observe the technical data and terminal requirements. Refer to the equipment nameplate or label and the documentation for more details.

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The devices of the DM 4 series

- are suitable for use on public and non-public networks (for restrictions see section “EMC compliance” on page 18);
- are not household devices but are components solely intended for use in commercial applications;
- are not machines as covered by the EU Machine Directive;
- can be used in an industrial environment and in a domestic and business environment with the system configurations described in this manual;
- comply in typical drive configurations with the EU EMC Directive, the EU Low-Voltage Directive for the specified standards.

The user of the equipment is responsible for ensuring that the machine application complies with the relevant EU Directives.

Any other usage constitutes improper use.

Storage, transport, disposal

DM 4 soft starters are carefully packaged and prepared for shipment. They must be transported only in their original packaging and by suitable transport means (see weight information in “Dimensions” section from page 183). Observe the labels and instructions on the packaging. This applies also to the unpacked equipment.

After receiving the delivery,

- check for external damage of the packaging;
- confirm that the details on the delivery note match your original order.

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Open the packaging with suitable tools and check whether:

- parts have been damaged during transportation;
- the equipment corresponds to the model that you ordered;
- the installation instructions are enclosed.

In case of damage, incomplete or incorrect shipment, please notify the responsible sales office.

According to the currently applicable national regulations, DM 4 series soft starters can be recycled as electronic scrap.

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2 Engineering

Device selection

For standard applications with standard asynchronous motors, soft starters can be dimensioned according to the rated motor output using the information provided in the technical data (see appendix).

For drives with a high starting torque or high mass inertia, more precise dimensioning is required. To select a device, the machine's overload cycle must be known:

- Starting time for d.o.l. start or star/delta start
- Max. starting current
- Load cycle
- The load to be driven by the motor

For precise dimensioning, the mass inertia moments and the speed/torque characteristics of motor and load must also be known. With these values, the appropriate soft starter can be selected. The selection procedure – which generally applies to all Moeller soft starters – is described in the manual "Soft starter dimensioning" (AWB 8250-1346 GB). The required key data for the DM 4 series (rate current, overload capability, r.m.s. current at rated operating frequency), which is also needed for dimensioning, is listed in the technical data (see appendix).

EMC compliance

EMC = **E**lectro**m**agnetic **C**ompatibility.

The standard EN 60 947-4-2 refers to the limit classes described in EN 55 011.

No additional measures are required to limit transmission of radio interference to EN 55 011 Class A (industrial environments). For Class B a bypass contactor must be used. Use a bypass contactor according to AC 1 (see bypass contactor recommendations in the appendix).

Mains configurations

In the following system configurations, DM 4 series soft starters can be used without restrictions:

with grounded and ungrounded star point

with isolated star point (IT networks)

with grounded phase conductor

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Power terminal

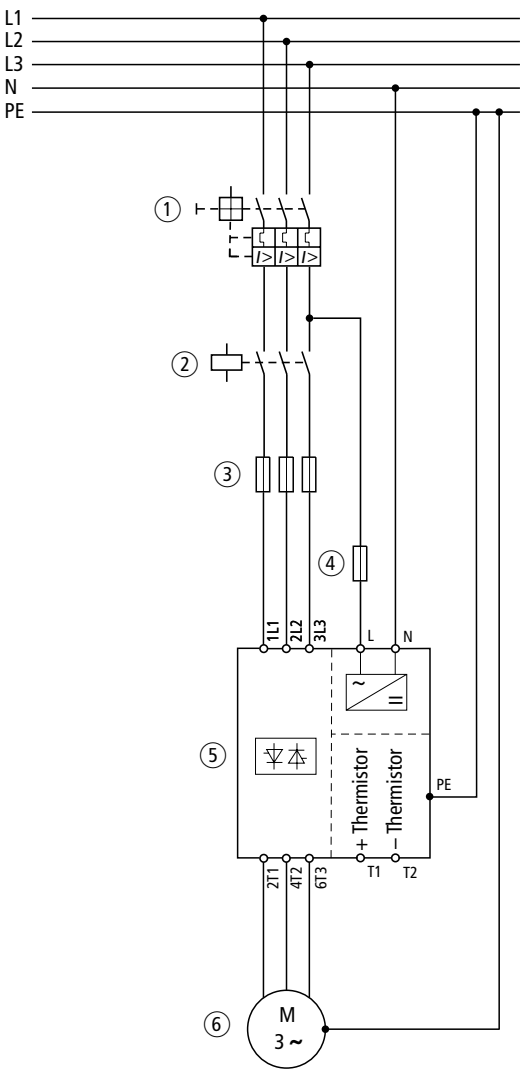

Figure 6: Connection of power lines

Legend to figure 6:

① Line protection
② Mains contactor
③ Semiconductor fuse
④ Controller supply line protection
⑤ Soft starter
⑥ Motor

The soft starter's output (terminals 2T1, 4T2, 6T3) must not be used to

- connect a capacitive load (e.g. pfc compensation capacitors),
- connect several soft starters in parallel,
- supply mains voltage,

Protective elements for the power section should be dimensioned according to the mains network configuration being used.

Line and device protection on the supply side:

- Input AC..., through commercially available fuses for line protection or motor-protective circuit-breaker
- Fuses for UL compliant systems must have UL approval
- The rated voltages of fuses must be chosen according to the mains voltage at the installation site.

On the motor side, no fuses are required.

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Device protection

Protect the devices with the protective elements listed in the table “External auxiliary components” (see appendix in section “External auxiliary components“). Depending on the coordination type required, different protective components must be used.

Coordination type “1”:
The specified circuit-breakers protect the line and the motor. Short-circuits can damage the soft starter.

Coordination type “2”:
In addition to the protective elements of coordination type “1”, quick-acting semiconductor fuses are required, which protect the soft starter from damage in the event of a short-circuit. The semiconductor fuses do not have line protection functions.

For soft starters up to 174 A (up to and including DM 4-340-90K), the semiconductor fuses must be arranged externally; for larger devices, they can be fitted inside the device. To do this, remove the metal jumpers fitted in the device. The appropriate fuse types are listed in section “External auxiliary components” of the appendix.

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Cables, contactors, mains filters

The cable types used must comply with the regulations applicable at the installation site.

If frequent startups and high starting currents are likely, larger capacity lines and contactors may have to be used. The contactors' load capacities are listed in their documentation. The correct assignment of mains contactors for selected start cycles to the soft starters is given in section "External auxiliary components" in the appendix.

Always connect the soft starter to the ground circuits via the enclosure using the designated PE terminals and using the enclosure. Always observe the minimum cross-section of PE cables specified in the relevant standards and directives (EN 50 178, VDE 0160). The cross-section of the PE conductor must be at least as large as that of the power cables (≧ 10 mm^2, AWG 8).

Information on the correct fuses and cable cross sections for incoming and outgoing cables are described under "External auxiliary components" in the appendix.

The information in the appendix applies to:

installation in control cabinets and machines,

installation in cable ducts,

the max. ambient temperature of +40 °C,

the normal start frequency.

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The fuses and cable cross-sections depend on the soft starter's performance characteristics and the start cycles (operating frequency, overcurrent).

When choosing cable cross-sections, allow for the voltage drop under load. The user is responsible for ensuring conformance with any other applicable standards.

Connecting motors

Although the DM 4 series soft starters are designed for use with three-phase induction motors, they can also be used with the following motor types, provided that the application (machine) allows it and this use has been approved by the motor manufacturer:

- Multi-speed three-phase motor (pole-changing motor)
- Three-phase slipring motors (slipring rotor)

With multi-speed motors, you must disable the soft starter before changing the windings.

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The soft starter's output voltage determines the torque of the motor. You should therefore ensure a sufficiently high starting voltage to prevent overheating of the motor before it starts up.

Three-phase motors can be operated with various circuit configurations. The circuit configuration is dependent on the rated power of the motor.

With mains supplies of 3 × 400 V, motors are typically connected as follows:

up to approx. 4 kW in a star connection (230/400 V)

above 4 kW in delta connection (400/690 V)

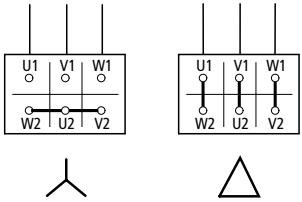

Figure 7: Circuit types

Standard connection produces a clockwise rotating field. Interconnect the motor and the soft starter as follows to ensure that the motor turns in a clockwise direction:

Mains	**DM 4**		**Motor**
	Input	**Output**	
L1	1L1	2T1	U1
L2	3L2	4T2	V1
L3	5L3	6T3	W1

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The direction of rotation of the motor can be reversed in a number of ways by reversing two phases on the motor:

- Changing the connection permanently
- Using a reversing contactor combination
- Using an electronic reversing contactor

Before reversing the rotation, disable the soft starter's output.

Full motor protection to VDE standards is achieved by using overcurrent relays and temperature monitoring. PTC thermistors or temperature switches with PTC characteristics are best suited for monitoring the motor temperature.

Length of motor cables

The motor cables should not be longer than 100 m, as the capacitance and inductance of cabling could otherwise result in soft starter malfunction. If necessary, it may be possible to use a longer cable with an inductive base load directly at the soft starter's output.

Connection types

General Enable/immediate stop without ramp function (e.g. for EMERGENCY STOP)

Digital input E2 is factory-programmed with the "Enable" function. The soft starter is enabled only when a high signal is applied to the terminal. Without the Enable signal, the soft starter cannot be operated.

In the event of a wire break or a signal interruption by the EMERGENCY STOP circuit, the soft starter's controller is immediately disabled and the power circuit is disconnected before the Run relay drops out.

Normally, the drive is always stopped with a ramp function. If operating conditions require immediate voltage isolation, this is done with the Enable signal.

Warning!
Before disconnecting the power lines mechanically, you must always stop the soft starter first (scan the Run relay). Otherwise a flowing current is interrupted, resulting in voltage peaks, which may destroy the soft starter's thyristors.

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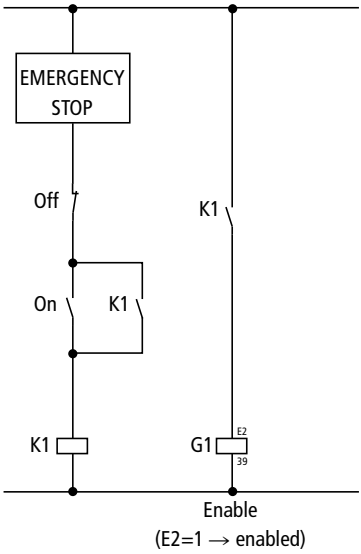

Figure 8: DM 4-340 EMERGENCY STOP immediate stop

Incorporating the overload relay in the controller

Instead of using a motor-protective circuit-breaker with integral overload relay, we recommend the use of an external overload relay. This ensures that the soft starter will be ramped down in a controlled manner by the control circuit in the event of an overload.

Warning!
Overvoltages can result if the power lines are disconnected directly. This can destroy the soft starter's semiconductors.

There are two possibilities of protecting against this, which are shown in the illustration below:

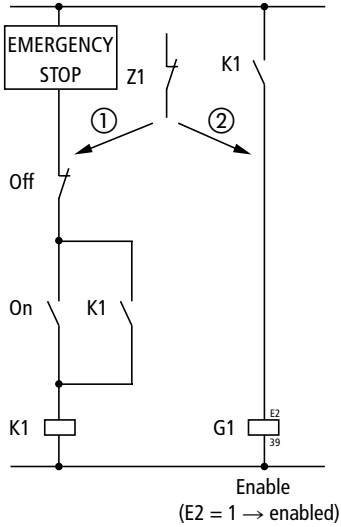

Figure 9: DM 4 with Z relay, control circuit

① The signal contacts of the overload relay are incorporated in the ON/OFF circuit. In the event of a fault, the soft starter ramps down over the specified time before disconnecting.

② The signal contacts of the overload relay are incorporated in the Enable circuit. In the event of a fault, the soft starter's output is disabled immediately. The soft starter ramps down, but the mains contactor remains switched on. To switch the mains contactor off as well, a second contact of the overload relay must be incorporated in the ON/OFF circuit.

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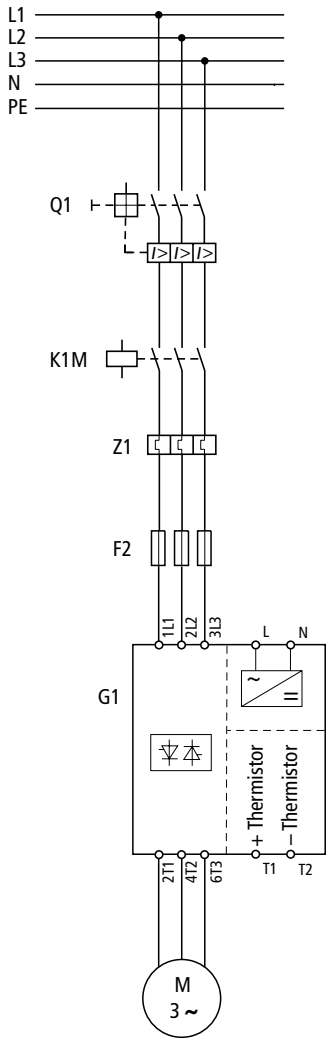

Figure 10: DM 4 with Z relay

Standard connection

In normal operation, the soft starter is connected into the motor supply line. To isolate it from the mains, a mains contactor before the soft starter or a central switching element (contactor or master switch) is required. The illustrations below show examples of both options.

To achieve radio interference level B, a bypass contactor must be fitted.

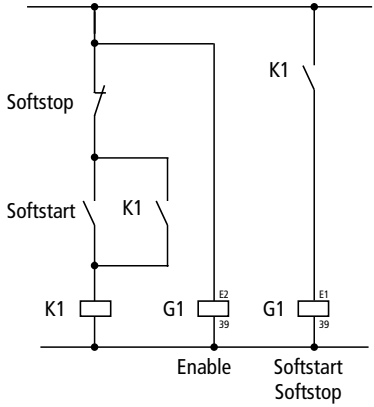

Figure 11: DM 4-340 without separate mains contactor, control circuit

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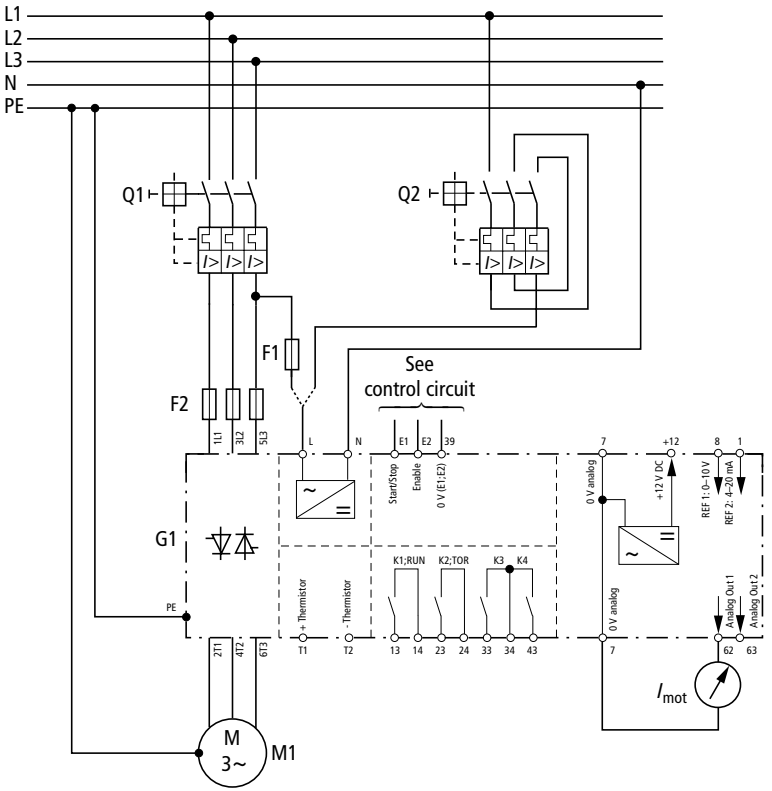

Figure 12: DM 4-340 without separate mains contactor

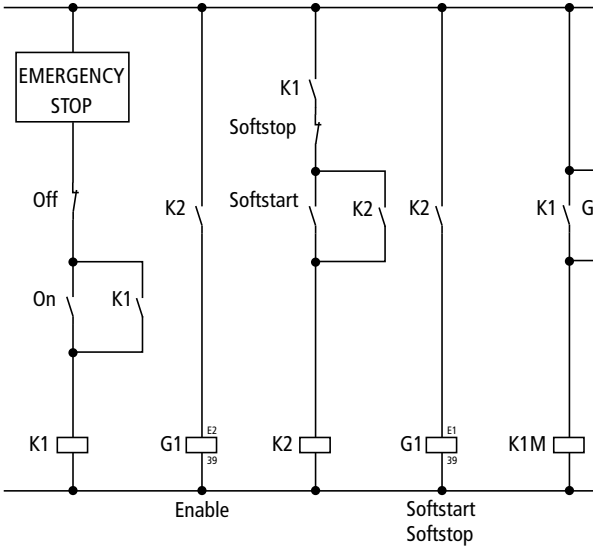

Figure 13: DM 4-340 with separate mains contactor, control circuit

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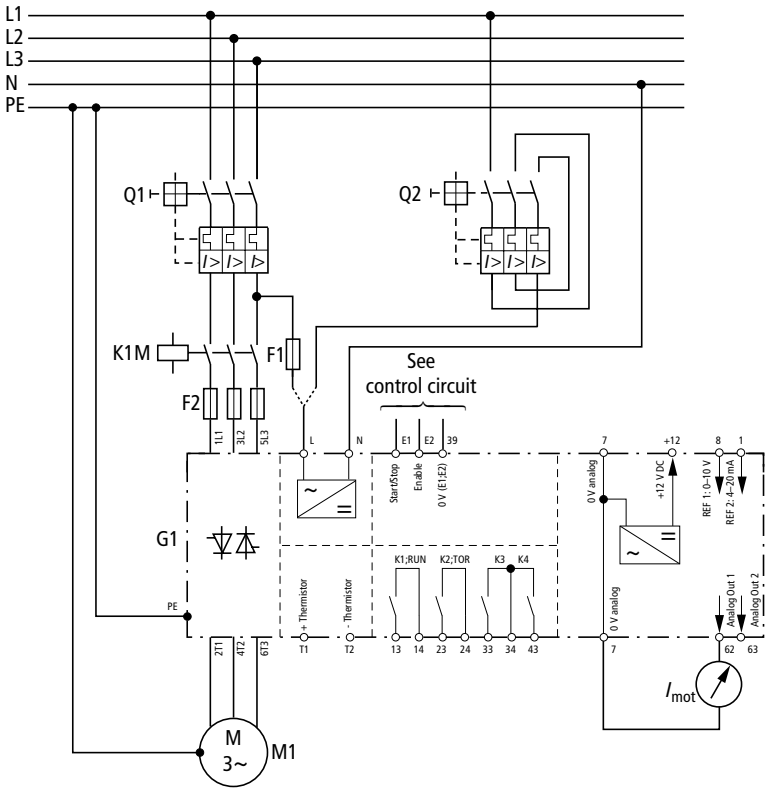

Figure 14: DM 4-340 with separate mains contactor

Bypass connection

With the bypass connection, the motor can be connected directly to the mains, thereby suppressing power dissipation through the soft starter. After completion of the startup, the soft starter controls the bypass contactor (full mains voltage reached). The Top of Ramp function is by default assigned to relay K2, so that the bypass contactor is controlled by the soft starter. No further user input is required. Because the bypass contactor does not have to switch the motor load, being switched only at zero current, it can be dimensioned to AC 1. Suitable bypass contactors are listed in the technical data (see appendix).

In bypass operation, you must set the soft starter's protection function to Phase Failure Only or Start+Bypass, otherwise cos-φ optimization is active, resulting in soft starter malfunction. Parameter PNU 655 AutoBypass is factory set to 1. With this setting, the DM 4 automatically recognizes a connected bypass and sets the protection function to Start+Bypass. No further user input is then required.

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If, in an EMERGENCY STOP, an immediate voltage isolation is required, the bypass may have to actuate under AC 3 conditions (e.g. on removal of the Enable signal on terminal E2). In this case, ensure that a higher-level isolating element is actuated first or dimension the bypass to AC 3. In the recommended standard connections, the mains contactor and the soft starter Enable are maintained until the bypass contactor has safely disconnected. Then the starter and the mains contactor are shut down immediately. If the circuit is laid out according to these diagrams, an AC 1 bypass can therefore be used.

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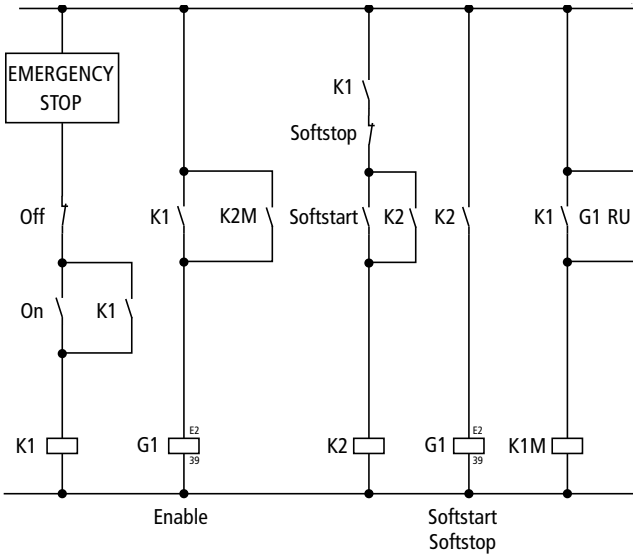

Figure 15: DM 4-340 bypass, control circuit

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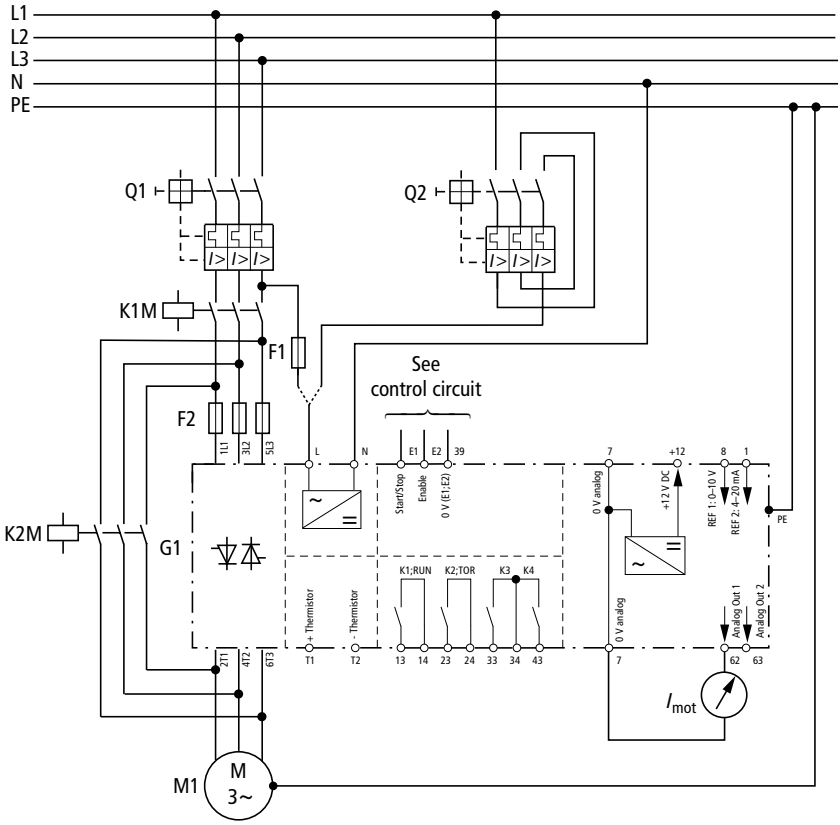

Figure 16: DM 4-340 with bypass

Connecting pumps

When pumps are used with the soft starter, it must be possible to perform frequent emergency operations with the bypass contactor. For selection between soft starter operation and direct start through the bypass contactor, a service switch is used. In the latter case, the soft starter is completely isolated. Because the output circuit cannot be opened during operation, interlocks ensure that switching is possible only after a stop.

In contrast to simple bypass operation, a bypass contactor to AC 3 must be used in this case. The mains contactor recommended in the technical data (see appendix) can be used for this purpose.

The soft starter's protection function must be set to Phase Failure Only or Start+Bypass, otherwise cos--φ optimization is active, resulting in soft starter malfunction.

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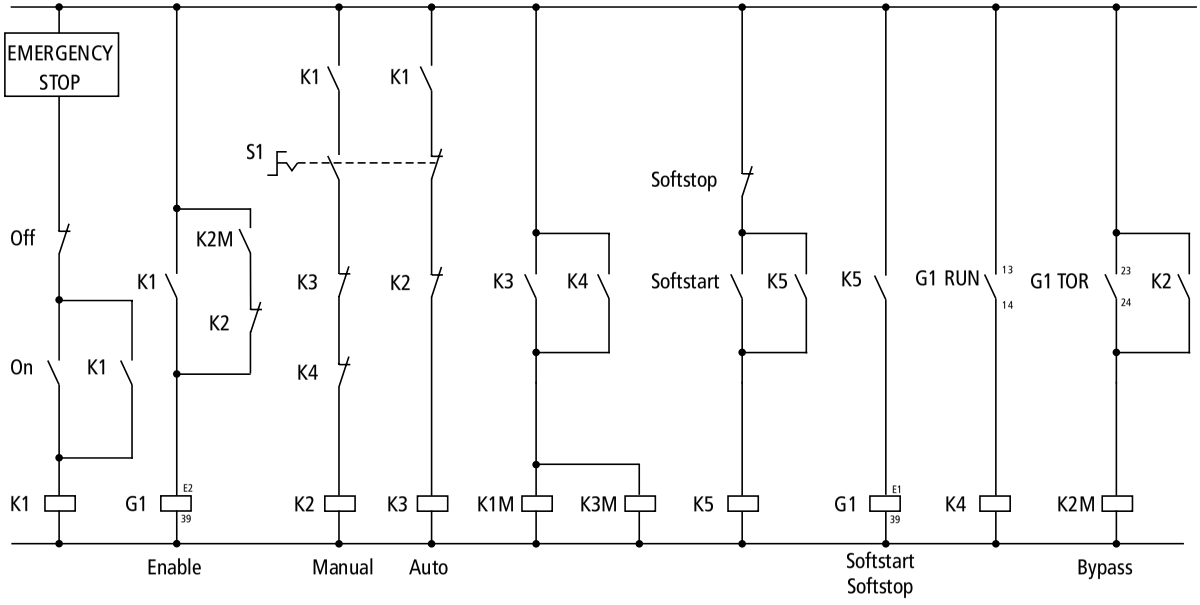

Figure 17: DM 4-340 pump, control circuit

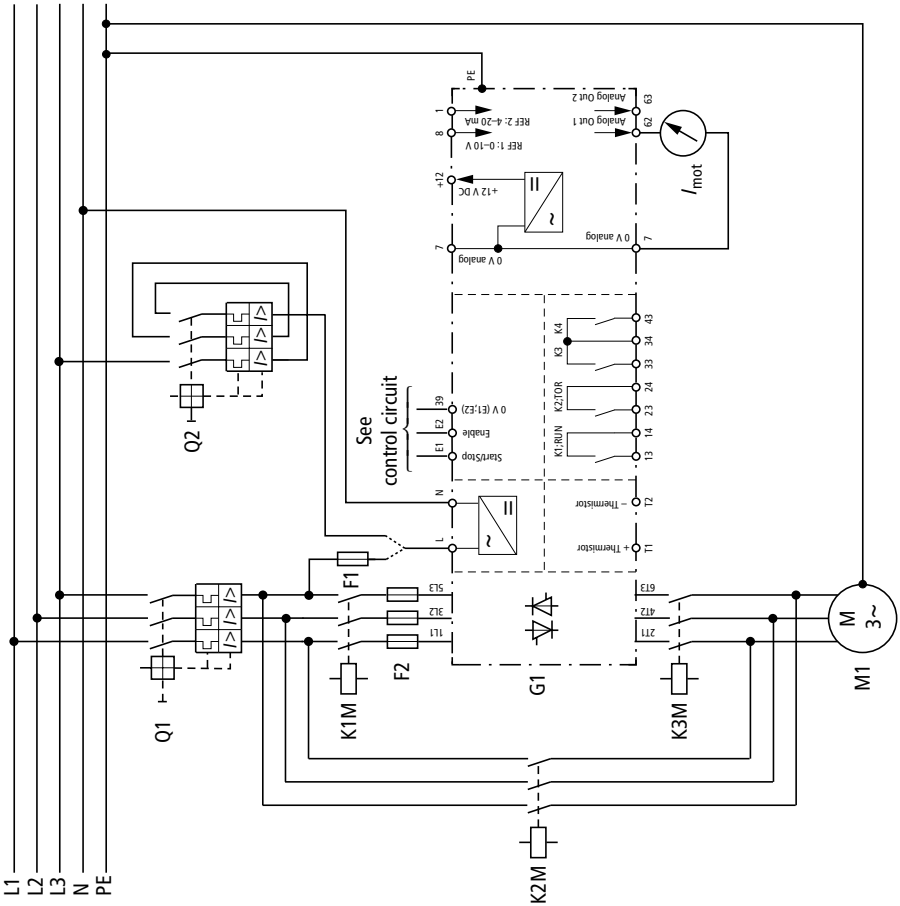

Figure 18: DM 4-340 pump

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“In-Delta connection

In-Delta connection reduces the required soft starter power at a given rated motor output. A series connection with the motor winding reduces the current by a factor of $\sqrt{3}$. The drawback of this connection type is that six motor cables are required. Apart from that, there are no limiting factors. All soft starter functions remain intact.

The motor must be connected in a delta configuration, and the voltage must correspond to the mains voltage, i.e. at a mains voltage of 400 V, the motor must be rated for 400 V/690 V.

In this operating mode, cos-φ optimization is not possible and must be disabled (see section “cos-phi optimization (submenu)” on page 88). The permissible motor rating is listed in the technical data (see appendix).

For In-Delta connection, the Mode parameter must be changed to “1 = In-Delta” with the DE 4-KEY-2 keypad or one of the interface modules (see section “Configuration of controlled device” from page 70).

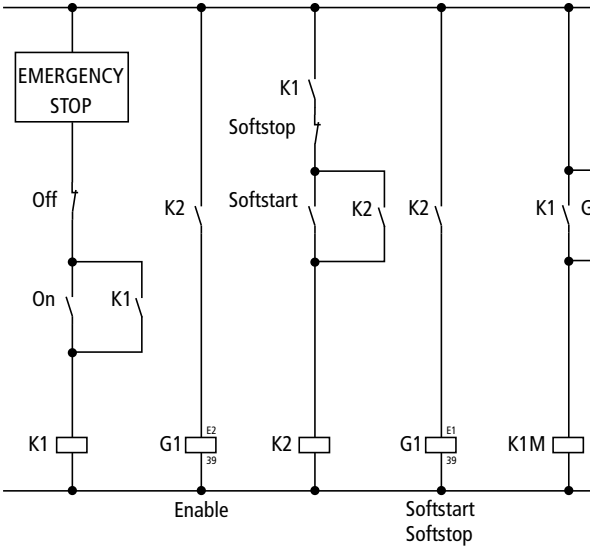

Figure 19: DM 4-340 In-Delta, control circuit

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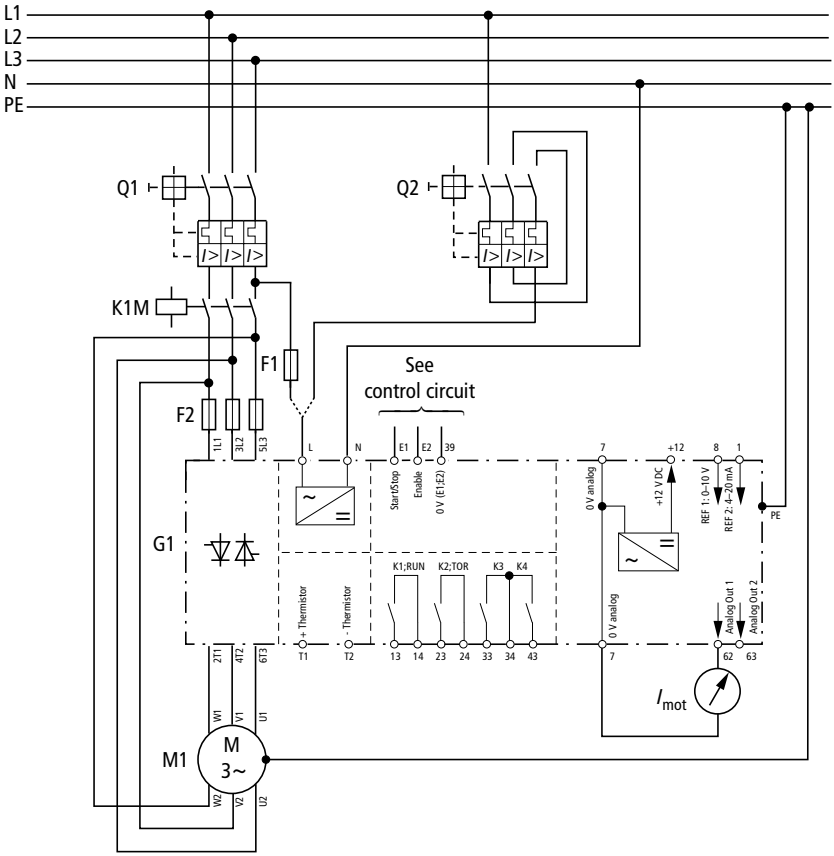

Figure 20: DM 4-340 In-Delta

Reversing circuit

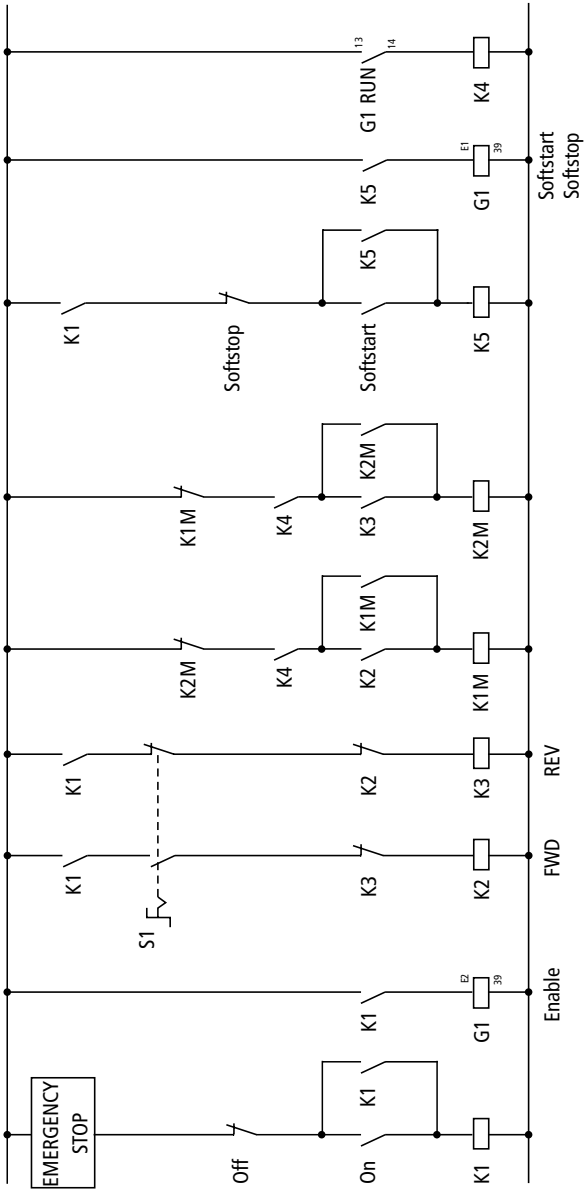

Figure 21: DM 4-340 reversing circuit, control circuit

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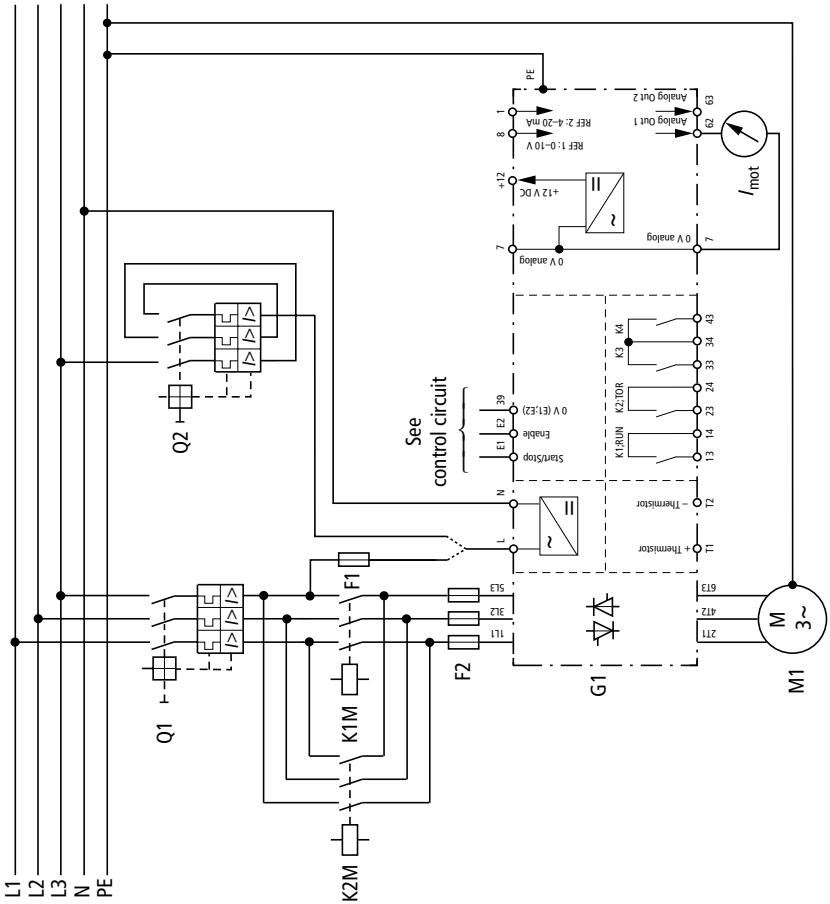

Figure 22: DM 4-340 reversing circuit

The external reversing contactor is switched over only after completion of the soft stop ramp.

Starting several motors in succession with a soft starter

When starting several motors in succession with a soft starter, observe the following order for switchovers:

Start with soft starter

Switch on bypass contactor

Disable soft starter

Switch soft starter output to next motor

Restart

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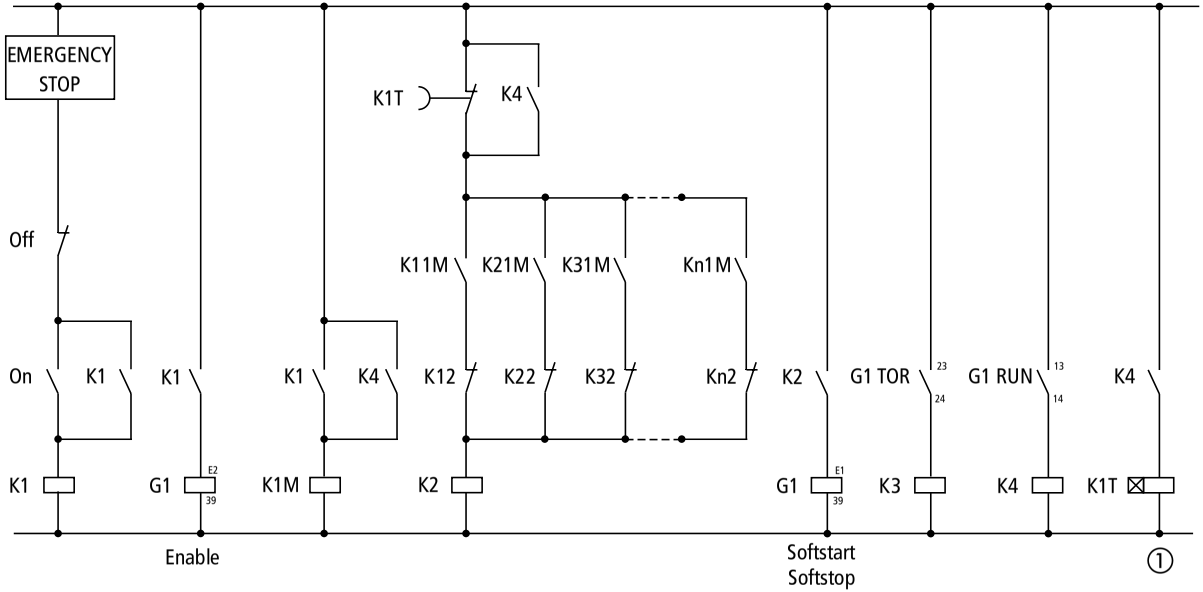

Figure 23: DM 4-340 cascade, control circuit part 1

① Set the time relay so that the soft starter does not suffer thermal overload. The appropriate time depends on the permissible operating frequency of the selected soft starter. Otherwise, select a soft starter that allows the required times to be achieved.

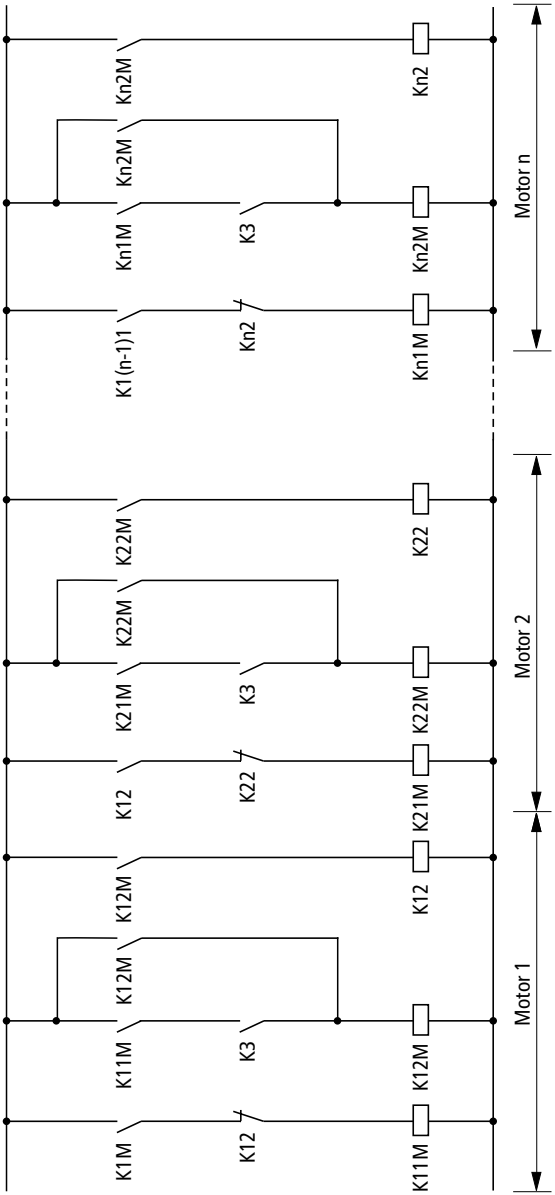

Figure 24: DM 4-340 cascade, control circuit part 2

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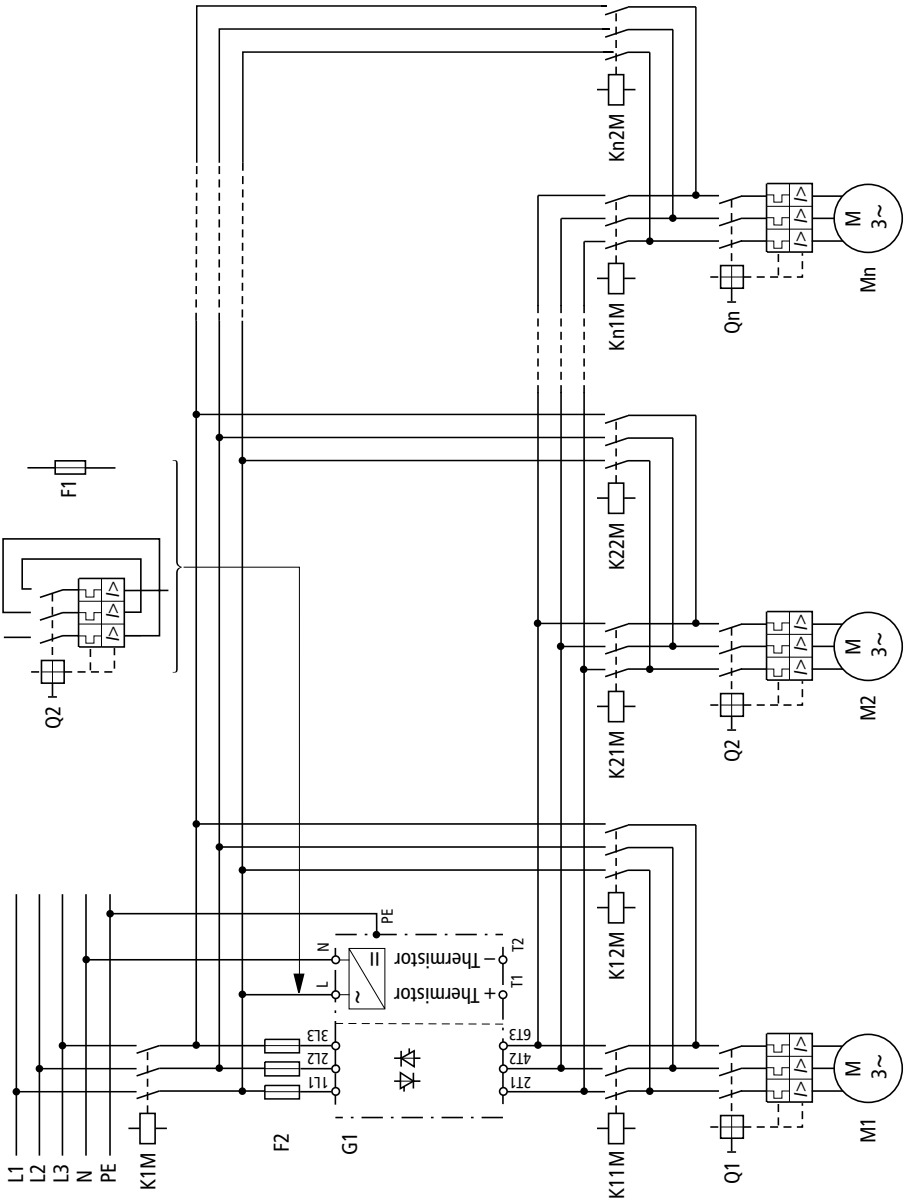

Figure 25: DM 4-340 cascade

Take into account the thermal load on the soft starter (start frequency, current load). You may have to select a soft starter capable of handling a higher load cycle.

Connecting motors to a soft starter in parallel

You can also start several motors in parallel with a soft starter. The behaviour of individual motors cannot, however, be influenced in this case. Each motor should be fitted with suitable overload protection.

Warning!
In case of a fault, disable the soft starter rather than switching motors off individually, since the voltage peaks generated in the latter case can destroy the soft starter.

The total current consumption of all connected motors must not exceed the soft starter's rated operating current I_e.

If several motors are connected in parallel, the soft starter's electronic motor protection cannot be used. Each motor must be protected separately with thermistors and/or bimetal relays.

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Warning!
The soft starter's output must not be switched, since the resulting voltage peaks could destroy the thyristors in the power section.

If motors with large differences in rated power (e.g. 1.5 kW and 11 kW) are connected in parallel to the output of a soft starter, problems may arise at startup. In some cases, the motor with the smaller rated power may be unable to produce the required torque. Due to the relatively large resistive load in the stators of these motors, they require a higher voltage during startup.

Connecting the controller

Controller supply voltage (Rated controller supply voltage U_c)

With a slide switch, match the controller supply voltage (terminals L, N) to the corresponding supply voltage of either 110 V AC or 230 V AC. Move the slide switch into the appropriate position.

Before switching on, check that the set voltage is the same as the supply voltage.

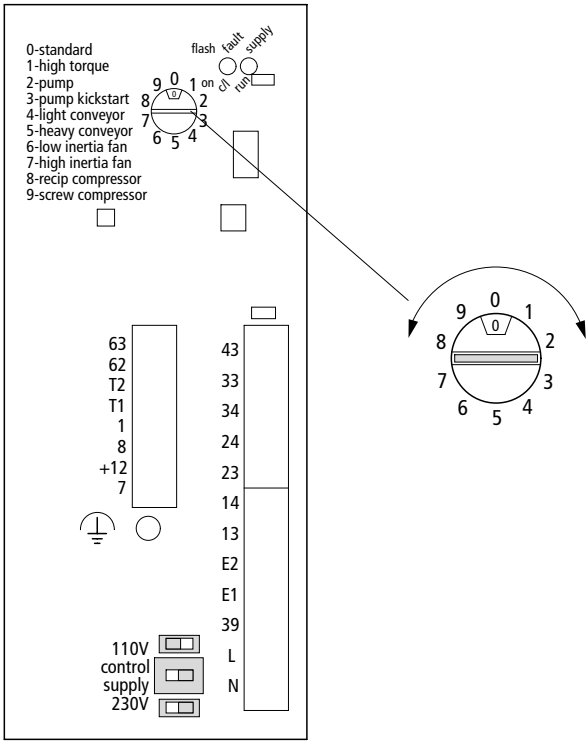

Figure 26: Controller supply switch

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Internal power feed

The DM 4 series soft starters provide an internal voltage, which is available at the following terminals:

Terminal +12:
for analog reference value input in open-loop operation and as supply for the digital inputs

Terminal 7:
0 V potential (linked to PE)

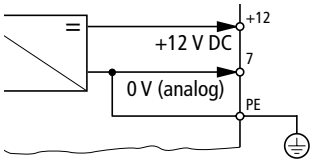

Figure 27: Internal voltage source

Grounding the zero potential (terminal 39)

In standard soft starter operation, the 0 V potential of the control signal inputs of terminal 39 (zero potential of terminals E1 and E2) must be grounded. A cable cross-section of at least 1.5 mm^2 (AWG 16) should be used.

If terminals E1 and E2 are supplied by the internal power feed (terminal +12), the zero potential of the voltage regulator (terminal 7) and the zero potential of the control signal inputs (terminal 39) must be connected.

To do this, fit a jumper from terminal 7 to terminal 39 (connected to the same 0 V rail).

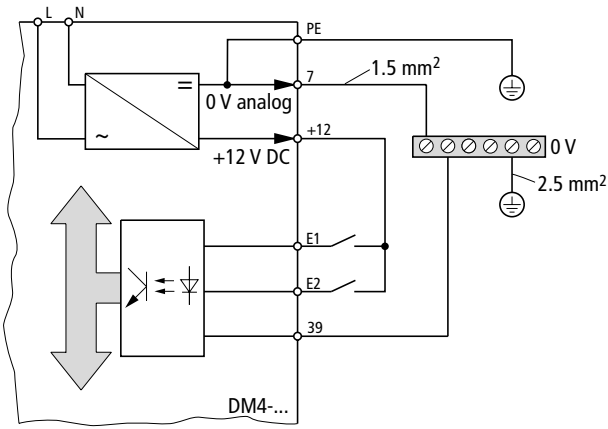

Figure 28: 0 V for control signal terminals

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To install several soft starters or automation devices in a system, the zero potentials of each of the devices must be interconnected point-to-point in a star configuration. Each of the devices must have a common ground at the “weakest” component, e.g. a PLC.

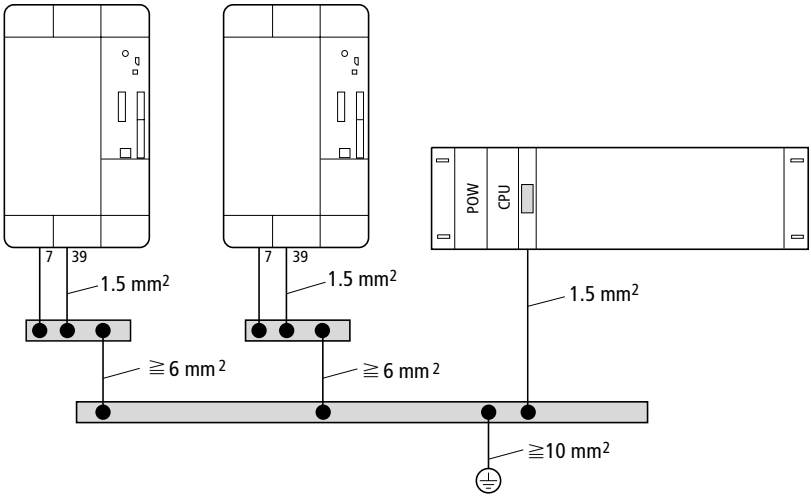

Figure 29: Grounding with star arrangement

Digital Inputs, PLC interconnection

The digital inputs of the DM 4 series soft starters are opto-isolated and galvanically isolated from the control section. This allows them to be directly connected to a programmable logic controller (PLC). To increase their interference immunity, the zero potential of the control signal inputs (terminal 39) can be connected directly to ground through an unpolarised capacitor (0.1 µF, 250 V DC).

If terminals E1 and E2 are supplied by an external power feed from a PLC, the zero potential of the PLC outputs must be connected to zero potential of the control signal inputs (terminal 39).

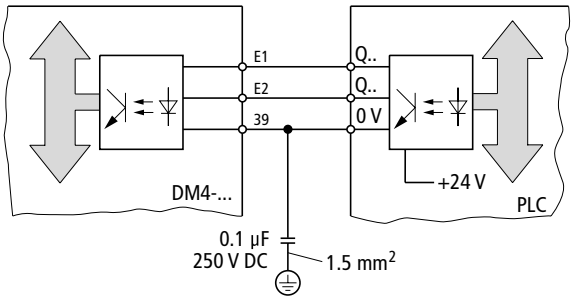

Figure 30: Connecting a PLC

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If several soft starters are controlled by the same PLC within a system, connect the zero potentials of all devices point-to-point in a star arrangement. The devices must have a common ground at the “weakest” element, i.e. the PLC. In addition, if you experience any problems, connect terminal 39 of each soft starter through a capacitor. The zero potential of the PLC can be grounded directly.

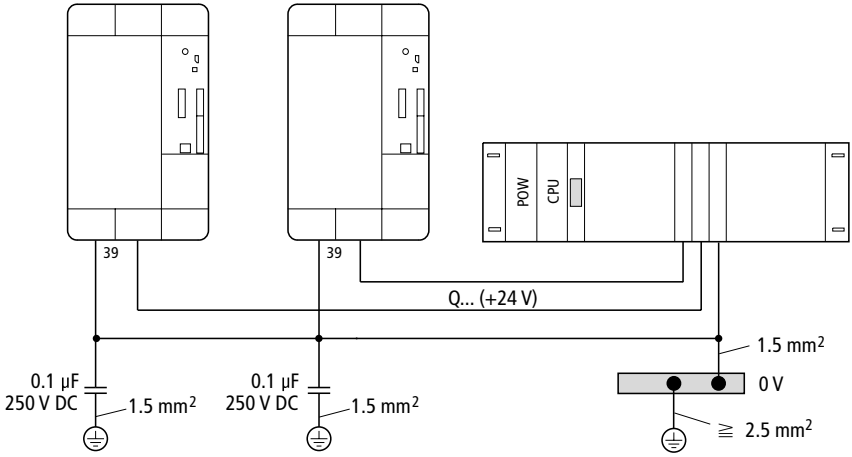

Figure 31: Grounding when a PLC is used

Inputs for analog reference values

The analog reference values are normally used only in Open-Loop control mode.

However, you can also provide an internal signalling threshold for external voltage and current values to trigger control functions. A current temperature value, for example, (0 to 10 V DC) can be used to disable the soft starter at a specific temperature or to set a relay output.

The reference value can be specified with an analog signal through input terminals 7 (0 V) and 8 (0 to 10 V DC) or through terminal 1 (4 to 20 mA).

Terminal 7 (0 V of the analog inputs) is connected directly with PE (functional ground).

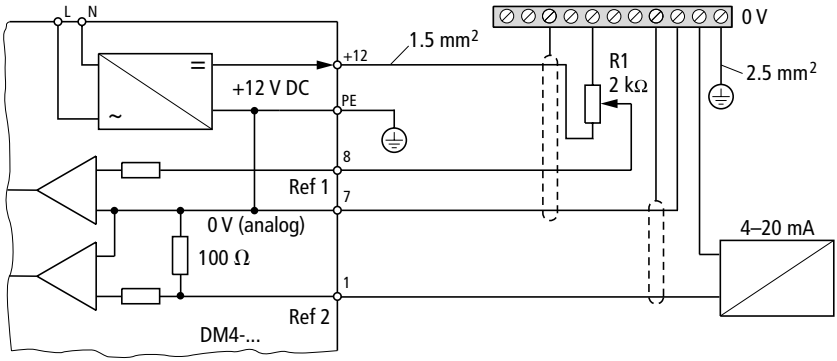

Figure 32: Reference value connection

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Default reference value input with current signal

Because terminal 7 is connected directly to PE (functional ground), it is not possible to transmit a default reference variable to more than one device. At the second starter, the signal input (terminal 1) and the reference point (terminal 7) would be short-circuited through terminal 7, which is PE of the first device. The reference variable for current can therefore be used only for a point-to-point connection.

The internal load resistance is 100 Ω.

Analog outputs

Analog measuring instruments can be connected to terminals 62 and 63. Parameter settings are used to specify which monitor signal is to be displayed. By default, the motor current is output on terminal 62, and the delay angle on terminal 63. The maximum voltage range at both terminals is 0 to 10 V, 10 mA.

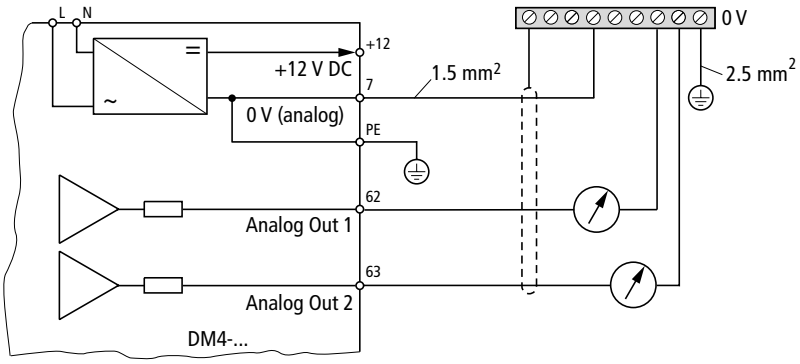

Figure 33: Analog output connection

Relay outputs

The DM 4 series soft starters have four relays with a make contact. The assignment of signals to these contacts can be programmed as required. The relay contacts are galvanically isolated from the soft starter. Relays K1 and K2 are floating relative to each other. Relays K3 and K4 share a common terminal, but are floating relative to K1 and K2.

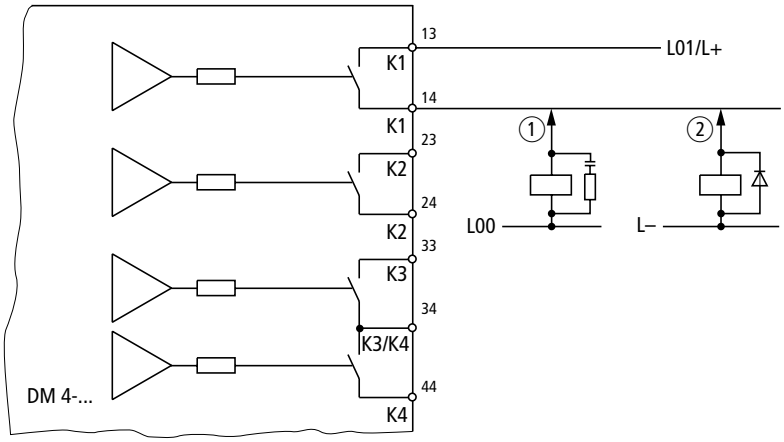

Figure 34: Relay connection

① Suppressor circuit for AC control voltage

② Suppressor circuit for DC control voltage

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Terminal	Standard function	Assignment	Use	Rating
13	Run	Input K1	Programmable make contact	230 V AC, 3 A, AC 11
14		Output K1		
23	TOR (Top of ramp)	Input K2		
24		Output K2		
33	Alarm	Output K3		
34		Input K3 and K4		
43	Overload	Output K4		

If external contactors are to be connected at a relay contact, the interference immunity can be increased by connecting

an RC filter in parallel with the AC voltage contactor coil;

a free-wheeling diode to the contactor coil for DC voltage.

3 Defining Parameters

Principles of operation

You can use parameters to adapt the soft starter to your application. The settings are grouped into different parameters with unique parameter numbers (PNU).

Device parameters are defined either with

the application selector switch,

the interface modules or

the keyboard of LCD keypad DE 4-KEY-2.

The LCD keypad and the serial interface modules are both available as accessories.

The DM 4-340 series has two parameter sets. To address the second parameter set (PAR 2), add an offset of 2000 to the parameter number from PAR 1. The following functional descriptions refer to the parameter numbers of the first parameter set (PAR 1). Parameter numbers of parameters that can have an independent value in the second parameter set (PAR 2), are given in square brackets in the tables. All other parameter numbers above 2000 are set internally to the corresponding parameter of the first parameter set.

The information in this manual applies to the software from version 52.09 or later (PNU 99).

Example:

PNU 12 belongs to the first parameter set. The same parameter in the second parameter set has PNU 2012.

Most of the parameters of the DM 4 soft starter can be changed only when the controller is disabled.

Any parameter changes are applied when the input is confirmed (with Shift + PRG on LCD keypad DE 4-KEY-2), but are lost when the power supply is switched off. To save the parameters permanently, you must program parameter Parameterset with the value “1” in the Config/ Control menu (“save Para.” = save parameter set).

Display of special characters on the LCD keypad

Due to the dot matrix size, the LCD keypad cannot display some special characters for certain languages.

Accented upper case characters (e.g. “Ü”) are displayed as their lower-case equivalent (e.g. “ü”).

In the following chapters and tables, the parameter names are given as they appear on the keypad display.

Application selector switch

With this switch on the front of the device, preset parameter sets can be selected for different applications. One standard and nine application-specific settings are available. If necessary, you can use the LCD keypad or interface to make fine adjustments to the default settings. The following applications can be selected:

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Labelling on the device	Display on the LCD keypad	Use	Notes
0-Standard	Standard	Standard	Default setting, suitable without changes for most applications
1-High torque[1)]	High torque	Breakaway torque	Drives with increased breakaway torque
2-Pump	Pump	Small pump	Pump drives up to 15 kW
3-Pump Kickstart	Pump W.Kick	Larger pump	Pump drives over 15 kW; Longer ramp-down times.
4-Light conveyor	LightConvey	Light conveyor	–
5-Heavy conveyor	HeavyConvey	Heavy conveyor	–
6-Low inertia fan	LowInert.Fan	Low inertia fan	Fan drives with low mass inertia moment, max. 15 x inertia moment of motor
7-High inertia fan	HighInertFan	High inertia fan	Fan drives with high mass inertia moment, more than 15 x inertia moment of motor. Longer ramp-up times
8-Recip compressor	RecipCompres	Reciprocal (piston) compressor	Increased starting voltage, adapted for cos-φ optimization
9-Screw compressor	ScrewCompres	Screw compressor	Increased current demand; No limit current

1) A prerequisite for the “High torque” setting is that the soft starter can always deliver 1.5 times more current than the motor’s rated current.

If the LCD keypad is fitted, the rotary switch is not accessible. The application can then be selected in the corresponding submenu on the LCD keypad.

The preprogrammed parameter sets for applications change the following parameters to the specified values:

PNU	Name	Position of application selector switch									
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
11	U-Start	20	60	10	25	10	40	30	40	45	40
12	t-Start	5	5	7	10	10	10	15	3	3	7
30	Imax-Start	3.5	4.5	3.5	3.5	3.5	3.5	3.5	3.75	3.5	7.9
31	t-Imax	30	15	25	25	20	30	30	60	25	25
16	U-Stop	10	10	10	10	10	10	10	10	10	10
17	t-Stop	0	0	30	45	5	7	0	0	0	0
19	Rate	5	5	5	5	5	5	5	5	15	5
627	Kickstart	0	0	0	1	0	0	0	0	0	0
628	CurrentLimit	1	1	1	1	1	1	1	1	1	1
629	OverLoad	1	1	1	1	1	1	1	1	1	1
630	OverCurrent	1	0	0	0	0	0	0	0	0	0
631	UnderCurrent	0	0	0	0	0	0	0	0	0	0
632	Thermistor	0	0	0	0	0	0	0	0	0	0
633	Command source	0	0	0	0	0	0	0	0	0	0
634	U-Stopramp	1	1	1	1	1	1	1	1	1	1
641	Pf-1 Logic	1	1	1	1	1	1	1	1	1	1
642	Pf2 Logic	1	1	1	1	1	1	1	1	1	1
643	Set Imax	0	0	0	0	0	0	0	0	0	0
644	ExtFault	0	0	0	0	0	0	0	0	0	0
645	AutoEndStop	0	0	0	0	0	0	0	0	0	0
646	AutoStopProf	1	1	1	1	1	1	1	1	1	1
647	AutoEndStart	0	1	1	0	0	0	1	1	1	1
648	AutoU-Start	0	1	1	0	1	1	1	1	1	1

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Default settings of the basic unit

The default settings of the DM 4 series soft starters are chosen such that no parameter changes are necessary for standard applications. The table below lists the key settings.

Except for the application selector switch and its possible positions, the following can be changed only with the LCD keypad or the interface modules.

Terminal, function	Default setting
E1	Start/stop
E2	Enable
Ramp times	t-Start: 5 s t-Stop: 0 s
Start pedestal	20 %, with automatic load adaptation
Current limit	3.5 $_{e}$, after 30 s current limit error
Analog Out 1	Motor current
Analog Out 2	Delay angle
Relay K1	Run
Relay K2	TOR: Top of ramp, rated voltage reached
Relay K3	Alarm
Relay K4	Overload operation
Operating mode	Start/stop through terminals, parameter selection with application selector switch

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Basic settings

The main menu “Basic” contains the key data for adapting the starter to the required application. This main menu does not have submenus. The parameters are displayed directly.

The first parameter indicates the device and is displayed only for information.

Parameter Application performs the same task as the application selector switch.

With the remaining parameters in this menu, the key starting parameters can be adjusted if the default settings are not ideal.

PNU	Name	Value	Function	Default
113	Drive		Indicates the current soft starter type	–
1	Startcommand	0	Terminal start/stop, Application switch active, Key/options are read-only	0
		1	Terminal start/stop, App. switch active, Key/options are read-only for app. parameters, read/write for other parameters	
		2	Terminal start/stop, application switch inactive, Key/options are read/write for all parameters	
		3	Key/options start/stop, App. switch inactive, Key/options read/write for all parameters	
115	Application	0	Standard	0
		1	High torque	
		2	Small pump	
		3	Large pump (with kick)	
		4	Light conveyor	
		5	Heavy conveyor	
		6	Low inertia fan	
		7	High inertia fan	
		8	Reciprocal compressor	
		9	Screw compressor	

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PNU	Name	Value	Function	Default
11 [2011]	U-Start [U-Start 2]	10 % to 60 %	Voltage at which soft start function begins	20 %
12 [2012]	t-Start [t-Start 2]	1 s to 255 s	Ramp time until 100 % input voltage is reached	5 s
17 [2017]	t-Stop [t-Stop 2]	0 s to 255 s	Ramp time until 0 % output voltage is reached	0 s
30 [2030]	Imax-Start [Imax-Start 2]	1.0 to 8.0 $_e$	Current limiting value at start in multiples of device rated current $_e$	3.5 $_e$
66	Language	0 to 255	Select display language	49
		44	English	
		49	Deutsch	
62	Parameterset	1	Save Para.	–
		2	Default	
		3	Load power-on parameters	

Configuring the basic unit

Control (submenu)

The main menu Configuration contains two submenus, which in turn contain the Parameters for configuring the basic unit.

As supplied, the soft starter's parameters can be configured only with the application selector switch.

With "Startcommand", the channel through which control and parameter configuration is to take place is defined. If "Terminal Start/Stop" is selected, any start/stop command entered on the keypad is ignored.

PNU	Name	Value	Function	Default
1	Start commands	0	Terminal start/stop, App. switch active, Key/options are read-only	0
		1	Terminal start/stop, App. switch active, Key/options are read-only for app. parameters, read/write for other parameters	
		2	Terminal start/stop, App. switch inactive, Key/options are read/write for all parameters	
		3	Key/options start/stop, App. switch inactive, Key/options are read/write for all parameters	

The basic function of the device is defined with the operating mode. The default setting is soft starter mode. Alternatively, the soft starter can work as a phase controller. There are two options:

Open- or closed-loop

controller

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Warning!
The Phase Control functions are not intended for motor speed control. The motor can be damaged if generalized phase control is used to regulate its speed (i.e. slip regulation: at low speeds, extreme power dissipation occurs in the motor).

If a setpoint is used directly in Open-Loop Control mode to specify an output voltage, a closed control circuit is established in Closed-Loop Control mode. By default, the output current is looped back. However, you can also program another value, e.g. the second analog input or a constant.

PNU	Name	Value	Function	Default
6	Mode	0	Soft starter “Standard”	0
		1	Soft starter “In-Delta”	
		2	Closed-loop phase control	
		3	Open-loop phase control	

Password
On delivery, the soft starter is not password-protected and all parameters can be changed. Once a password has been set, the password must be entered before any parameters can be changed.

The password is not shown on the display. “255” indicates that no password has been set. Otherwise, the password is displayed in encoded form..

PNU	Name	Value	Function	Default
5	Password	0 to 255	Enter password	0 Encoded display: “255”

Enter password:

- ▶ To set a password, select the Password parameter in the Config/Control menu.
- ▶ Enter a number between 1 and 255.
- ▶ To save the password permanently, press Shift+PRG.

You do not need to perform the Save Parameter function. If the correct password is entered, the message “OK” appears; if an incorrect password is entered, the display reads “NOT OK”.

Changing the password:

- ▶ Enter the current password and confirm with Shift+PRG.
- ▶ When “OK” appears on the display, enter a new password.

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Removing the password:

- ▶ Enter the current password and confirm with Shift+PRG.
- ▶ When “OK” appears on the display, enter “0” zero as the new password.

The display now reads “255” again, indicating that the password has been reset.

Accessing parameters with password protection:

When a password has been set, parameters can be viewed but not modified, and the programming mode is disabled (operator panel). Write access to the parameters is also disabled for the LCD keypad and the interface modules.

No special message appears if parameters cannot be changed. On the display, the “SHPRG” symbol no longer appears next to the parameters.

To be able to change parameters, you must correctly enter and save the Password parameter. Parameters can then be modified until the power supply is switched off. Once power is disconnected, the password becomes active again.

Forgotten password:

If the “SHPRG” symbol does not appear next to parameters that can normally be edited, then all parameters – with a few exceptions – behave like read-only parameters, a password has been set. If you have forgotten the password, it can be calculated from the displayed value:

A = 255 – (displayed password value)

If A is even

$$\text{Password} = \frac{A}{2}$$

The calculated value is the actual password.

If A is odd:

$$\text{Password} = \frac{(A + 256)}{2}$$

Remove the digits after the decimal point to obtain the actual password.

Parameterset

With the LCD keypad, parameter changes can be saved permanently in the soft starter. Three options are available for the Parameterset parameter:

PNU	Name	Value	Function	Default
62	Parameterset	1	Save parameters	–
		2	Default	
		3	Load power-on parameters	

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Save parameters (save Para.):
The current settings are saved permanently in the soft starter. The changed values are not lost when the supply voltage is disconnected and are reloaded the next time power is switched on again.

Load default parameters (Default):
With this function, the default parameters are reloaded. As long as they are not saved permanently, the previously active parameter set is reloaded when power is switched off and on again.

Load power-on parameters (PowerOn Para):
If changes are made during soft starter operation, results may deteriorate. With this function, all changes made since the supply voltage was first switched on or the last time changes were saved can be reversed. This function has the same effect as switching the supply off and on again.

If you have changed parameters without running the Save Parameters function (save Para.), all changes are lost when the supply voltage is disconnected. Depending on the soft starter's required parameter settings, soft starter or PLC malfunction can result.

Transferring parameter sets

PNU	Name	Value	Function	Default
2	KEY->PAR	20	Load parameter data from the LCD keypad	–
3	PAR->KEY	11	Save parameter data to the LCD keypad	–

KEY->PAR:

This function reads the parameters from the LCD keypad and copies them to the soft starter. To save the parameters permanently, the Save Parameters function must be run.

PAR->KEY:

This function copies the parameters from the soft starter to the LCD keypad.

Switching parameter sets
The DM 4-340 series has two parameter sets that can be switched in when the soft starter is disabled. With them, additional soft start and soft stop times or current limits and start voltages become available. Each parameter set contains all parameters relevant to starting. This function can be selected directly on the LCD keypad. Alternatively, one of the two digital inputs can be configured for this function.

PNU	Name	Value	Function	Default
639	PAR1/PAR2	0	PAR 1	0
		1	PAR 2	

To select the parameters of the second parameter set, add 2000 to the parameter numbers.

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Some parameters do not have independent values in the second parameter set. When these parameters are accessed, they are automatically replaced with the values from the first set.

If you have switched to PAR2, the parameter name shown in square brackets [...] in the table below is displayed on the LCD keypad. Due to system limitations, the number from of the PAR1 parameter will continue to be displayed, but all changes are applied to PAR2.

The following parameters can have different values in PAR1 and PAR2:

Brief description of parameter	**Parameter name on display**	**PNU**
Protection function	Protection [Protection 2]	7 [2007]
Start pedestal	U-Start [U-Start 2]	11 [2011]
Start time	t-Start [t-Start 2]	12 [2012]
Kickstart voltage	U-Kick [U-Kick 2]	13 [2013]
Kickstart time	t-Kick [t-Kick 2]	14 [2014]
Dwell	t-Dwell [t-Dwell 2]	15 [2015]
Stop pedestal	U-Stop [U-Stop 2]	16 [2016]
Stop time	t-Stop [t-Stop 2]	17 [2017]
Undercurrent limit	Imin [Imin 2]	28 [2028]
Undercurrent time	t-Imin [t-Imin 2]	29 [2029]
Current limit	Imax-Start [Imax-Start 2]	30 [2030]

Brief description of parameter	Parameter name on display	PNU
Current limit time	t-Imax [t-Imax 2]	31 [2031]
Overcurrent limit	OverCurr.ma [OverCurrMax2]	32 [2032]
Overcurrent time	t-Overcurr. [t-Overcurr.2]	33 [2033]
Overcurrent limit	Overload ma [OverloadMax2]	34 [2034]
Overload time	t-Overload [t-Overload 2]	35 [2035]
Kickstart	Kickstart [Kickstart 2]	627 [2627]
Current limit	CurrentLimit [CurrentLim.2]	628 [2628]
Overload	OverLoad [Overload 2]	629 [2629]
Overcurrent	OverCurrent [OverCurrent 2]	630 [2630]
Undercurrent reaction	UnderCurrent [Undercurr.2]	631 [2631]
Thermistor reaction	Thermistor [Thermistor 2]	632 [2632]
Stop ramp control	U-Stopramp [U-Stopramp2]	634 [2634]
Invert reference	InvertRef0 [InvertRef0 2]	635 [2635]
Auto end stop	AutoEndStop [AutoEndStop2]	645 [2645]
Auto stop	AutoStopProf [AutoStopPrf2]	646 [2646]
Auto end start	AutoEndStart [AutoEndStrt2]	647 [2647]
Auto start pedestal	AutoU-Start [AutoU-Start2]	648 [2648]
Automatic recognition of connected bypass	AutoBypass [AutoBypass 2]	655 [2655]

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Misc (submenu)

Language selection

On the LCD keypad, you can choose the language in which messages are displayed. To select a language, enter the international dialling code in the appropriate parameter. Two languages are available.

PNU	Name	Value	Function	Default
66	Language	44	English	49
		49	German	

Device address and baud rate

The device address allows specific bus stations to be addressed individually. The address is stored in this parameter. The parameter is only relevant in network operation, for which interface module DE 4-NET-xxx is required.

PNU	Name	Value	Function	Default
9	Address	1 to 99	Device address for communication modules	1
125	Baud rate		Baud rate	0

Rated device current

The PNU 24 "I_e" must be changed only by Moeller service personnel, because it requires additional hardware modifications. This parameter is used to match a larger device to a smaller motor at extreme startup conditions.

Communication behaviour
With PNU 126, the soft starter's behaviour after an interruption to communications with the interface module (due to disconnection of or a fault in the interface module) can be specified to prevent subsequent uncontrolled operation of the soft starter. This parameter is used only when PNU 1 (Startcommand) has a value of 1 to 3 and a network module has been installed. If PNU 1 = 0, the parameter has no effect.

PNU	Name	Value	Function	Default
126	Bus Error	0	Continue	0
		1	Shutdown	

If PNU 126 = 0, no error message is displayed after a communication failure between soft starter and interface module. The soft starter remains in the current status. As soon as the connection is reestablished, a reinitialisation is automatically performed.

If PNU 126 = 1, the message "Bus error" is displayed after a communication failure. The soft starter then goes into "Controller disable" mode, i.e. the drive spins down. A reinitialisation takes place only once the connection is reestablished and a reset is performed.

Startup display (Init.Display)
The parameter whose number is stored in PNU 4 (Init.Display), is shown on the lower line of the LCD keypad when the device is in operation mode.

PNU	Name	Value	Function	Default
4	Init.Display	20 to 111	Initial display parameter	26

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Open and closed-loop control functions

The Functions main menu contains ten submenus, through which the open and closed-loop control parameters can be accessed for the basic unit.

StartData (submenu)

PNU	Name	Value	Function	Default
11 [2011]	U-Start [U-Start 2]	10 % to 60 %	Voltage at which softstart function begins	20 %
12 [2012]	t-Start [t-Start 2]	1 s to 255 s	Ramp time to 100 % input voltage	5 s
16 [2016]	U-Stop [U-Stop 2]	10 % to 60 %	At this voltage, the stop ramp ends	10 %
17 [2017]	t-Stop [t-Stop 2]	0 s to 255 s	Ramp time to 0 % output voltage	0 s
634 [2634]	U-Stopramp [U-Stopramp2]	0	Off	0
		1	Run stop ramp voltage-referenced	
640	Tmp t-Stop=0	0	Off	0
		1	Override stop ramp	
648 [2648]	AutoU-Start [AutoU-Start2]	0	Off	0
		1	Automatic start pedestal adaption	
647 [2647]	AutoEndStart [AutoEndStrt2]	0	Off	0
		1	Automatic end of start ramp when TOR reached prematurely by motor	
646 [2646]	AutoStopProf [AutoStopPrf2]	0	Off	1
		1	Adapt softstop profile to load	
645 [2645]	AutoEndStop [AutoEndStop2]	0	Off	0
		1	Automatic end of stop ramp	

The ramp time and start pedestal have a significant effect on the startup behaviour. With increasing ramp times, the thermal load on the motor also rises. The ramp times should therefore be no longer than required by the machine.

Here are two examples:

Conveyor belts:
set time only as long as required to prevent transported items from falling over.

Belt drives:
set time only as long as required to prevent belt slippage.

To prevent unnecessary delay of the stop ramp, the initial voltage is rapidly reduced by an internally determined value when the AutoStopProf function is active. This ensures that the stalling torque is bypassed so that the delay can begin immediately. If AutoStopProf = 0, the softstop function begins at 100 % mains voltage. At the drive, this results in a short delay before the motor speed changes after the Stop command before the ramp begins and the motor evenly decelerates.

If U-Stopramp = 1, the voltage is ramped down to the value of U-Stop. This ensures a gentle stop of motors with a high load. If the motor load is low, however, oscillations can result. When U-Stopramp = 0, the voltage is ramped down to a value determined by the soft starter. This voltage is generally higher than U-Stop. Once the switching threshold is reached, the softstop is terminated and the power section disabled. The motor then spins down by itself.

Drives with a high breakaway torque (e.g. long conveyor belts) may, in addition, need a breakaway pulse. This is provided by the Kickstart function.

With function Tmp t-Stop=0, the softstop ramp is temporarily overwritten with 0 s if the softstop command is issued within 1 s of the softstart command, thereby reducing the time to the next start.

With AutoU-Start, the soft starter determines whether the motor can generate any torque at the current startup voltage. If the start pedestal is too low, the start is delayed and the motor heats up unnecessarily. If this function is active and soft starter determines that the motor is not generating torque, it rapidly increases the startup voltage to a value at which the motor can generate torque.

AutoEndStart terminates the start ramp if the motor has already reached its full speed before its rated voltage is reached (e.g. idling motors, machines at partial load).

AutoEndStop ends the softstop ramp if the soft starter determines that the motor is continuing to run at low speed without decelerating at the current output voltage.

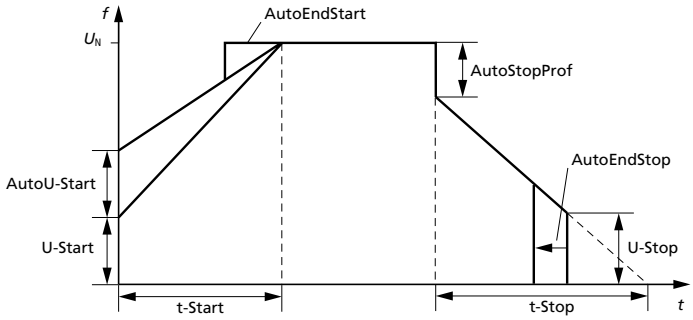

Figure 35: Start time/start pedestal

Kick-Start (submenu)

Some drives need an increased breakaway torque. This can be implemented with the Kickstart function.

PNU	Name	Value	Function	Default
13 [2013]	U-Kick [U-Kick 2]	60 % to 90 %	Voltage level before start of actual ramp, for overcoming breakaway torque	75 %
14 [2014]	t-Kick [t-Kick 2]	10 to 40	Number of half-waves for which the kickstart voltage is to be applied	25
627 [2627]	Kickstart [Kickstart 2]	0	Off	0
		1	Activate kickstart	

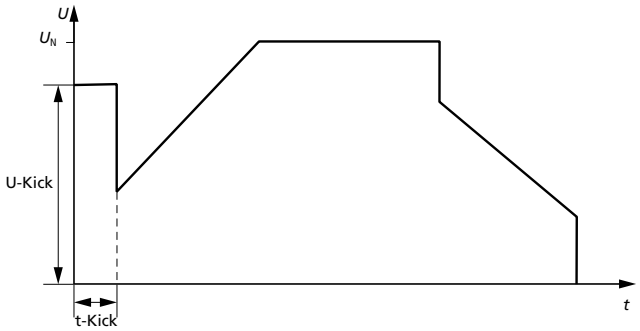

Figure 36: Kickstart

Current (submenu)

The current limiting functions prevent excessive current being drawn by the motor during startup. The voltage ramp is halted as long as the motor current exceeds the current limit. If the current limit is set too low, the motor cannot continue to accelerate.

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To prevent overheating, the Current Limit function is disabled after the adjustable current limit time and the normal ramp either continued without regard to the set current limit or cut off with an error message.

PNU	Name	Value	Function	Default
30 [2030]	Imax-Start [Imax-Start 2]	1.0 to 8.0 $_e$	Current limiting value at start in multiples of device's rated current	3.5 $_e$
31 [2031]	t-Imax [t-Imax 2]	5 s to 255 s	Maximum time for which the starter maintains the current limit	30 s
28 [2028]	Imin [Imin 2]	0.03 to 0.78 $_e$	Undercurrent limit value at startup in multiples of device's rated current	0.09 $_e$
29 [2029]	t-Imin [t-Imin 2]	5 to 255	Number of half-waves before an undercurrent message is triggered	50
631 [2631]	Undercurrent [Undercurr.2]	0	Off	0
		1	Shut down with error message	
628 [2628]	CurrentLimit [CurrentLim.2]	0	Continue ramp	1
		1	Shut down with error message	

The behaviour after completion of the current limiting time (t-Imax) is defined by parameter "CurrentLimit". If Continue Ramp is set, the softstart ramp is continued without further current limitation. Depending on the chosen settings (high current limit, long ramp time, long current limit time), protective elements may trip.

This setting may be appropriate to ensure that a motor starts under all circumstances. The whole drive should be dimensioned so as to prevent overheating. Alternatively, the end of the current limiting time can be used for tripping in case of a fault. This may be appropriate if such excessive loads are not expected to occur in normal operation.

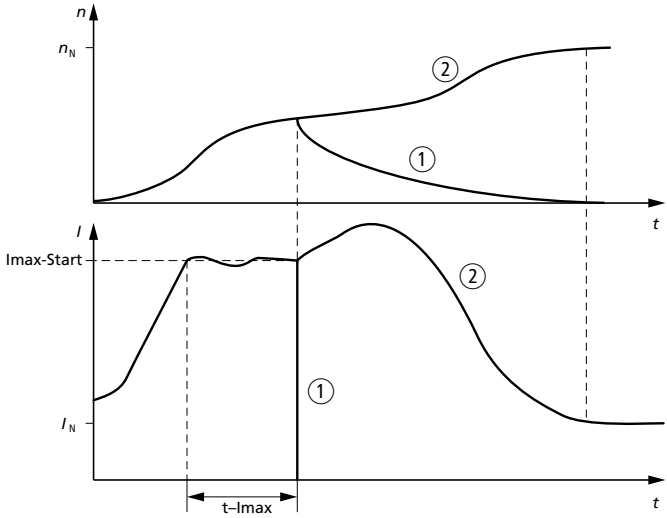

Figure 37: Current limit

① Shut down with error message; motor spins down

② Continue ramp function without current limit

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The Undercurrent function identifies when the load drops and the motor runs at idle after ramping ends. With this function, a drive belt breakage can, for example, be recognized.

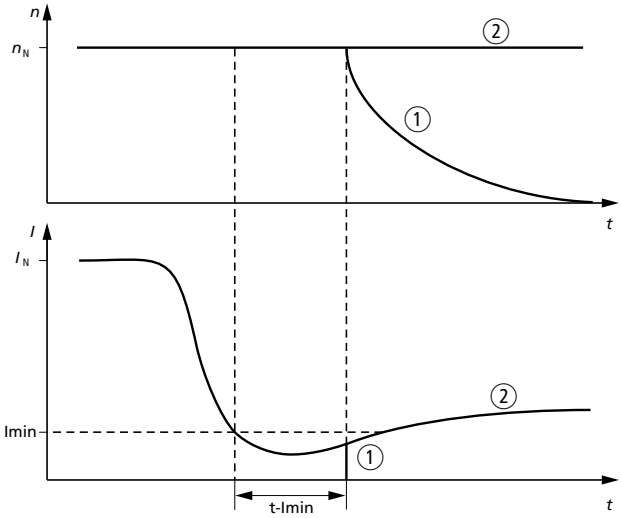

Figure 38: Undercurrent

① Shut down with error message; motor spins down

② No shutdown on undercurrent;
the drive continues to operate

Cos-phi (submenu)

The Protection parameter specifies when cos-φ optimization and the protection functions are applied.

If the system contains a bypass contactor or is connected in an In-Delta configuration, the optimization functions must be disabled.

To ensure adherence to the EMC Directive, cos-φ optimization must be disabled.

PNU	Name	Value		Function	Default
15 [2015]	t-Dwell [t-Dwell 2]	1 s to 255 s		Time from reaching rated voltage to start of cos-φ optimization	5 s
19	Rate	4 to 30		Speed with which cos-φ optimization is performed. Important for low-slip motors with low mass inertia loads.	5
7 [2007]	Protection [Protection 2]	Bit 6	Bit 7		"Start+ Bypass"
		0	0	No cos-φ optimization; no protection PhaseLoss functions (0 dec)	
		1	0	No cos-φ optimization; no protection functions (continuous) (64 dec)	
		0	1	No cos-φ optimization; protection functions at start (to top of ramp) Start+Bypass (128 dec)	
		1	1	Cos-φ optimization, protection functions (continuous) Protect+Opti (192 dec)	

The optimization phase starts after completion of the t-Dwell duration, which finishes after the end of the ramp. With cos-φ optimization, the output voltage is reduced after completion of the t-Dwell duration. The voltage is reduced only to a level at which the motor speed does not collapse.

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This reduces power dissipation in the motor. The savings are greatest with small motors and can be achieved only at partial load. If the motor is continuously working at full load, set the optimization rate to 30 (slow).

Motors with low rated slip and low mass inertia moment can exhibit unstable behaviour if cos-φ optimization is active. The optimization rate should then be increased until the motor exhibits stable speed characteristics again.

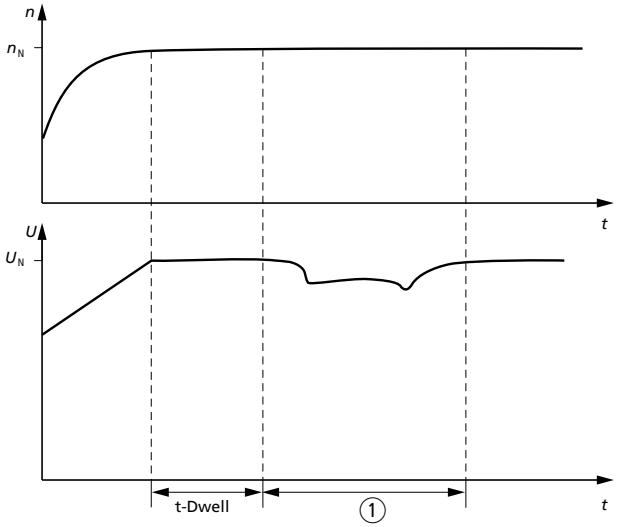

Figure 39: cos-φ

① Time during which cos-φ optimization is performed

Terminal configuration

Each input and output of the DM 4-340 series can be programmed individually by programming a pointer (parameter) with the PNU of the parameter to be displayed.

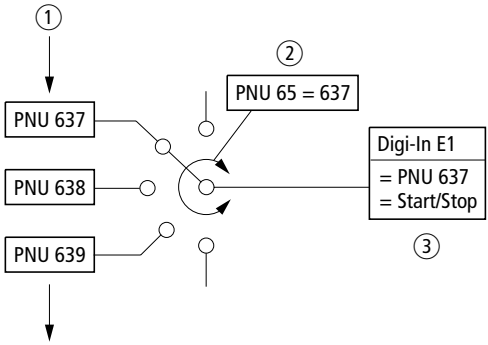

Figure 40: Allocating pointers

① Parameter list

② PNU 65 is the pointer for digital input E1

③ PNU 65 = 637: digital input E1 will enable/disable parameter 637

The control inputs/outputs are described in the following sections.

To disable a function, set its pointer to zero, (= PNU 0).

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Digital-In (submenu)

PNU	Name	Value	Function	Default
65	E1-Pointer	0, 600 to 655	Digital input E1 is to affect the specified parameter	637
653	E1-Logic	0	Low signal for activating the defined function	1
		1	High signal for activating the defined function	
67	E2-Pointer	0, 600 to 655	Digital input E2 is to affect the specified parameter	633
654	E2-Logic	0	Low signal for activating the defined function	0
		1	High signal for activating the defined function	

PNU 637 controls the Start/Stop signal. If a signal is applied to terminal E1, a softstart is initiated. If no signal is applied, a softstop is initiated. Before a softstart can be performed, PNU 40 must be set (high signal on terminal E2 at default settings or value 1 saved in PNU 40).

PNU 633 has the opposite effect to PNU 40. An inversion if the input signal (PNU 652 = 0) has the effect that input E2 acts like an Enable signal. When a signal is applied to terminal E2, the soft starter is enabled. If no signal is applied, the soft starter (the controller) is disabled and a softstart cannot be carried out. PNU 40 and PNU 633 are identical within the device. For technical reasons, PNU 40 cannot be linked to the inputs. PNU 633 can be used instead.

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Analog-In (submenu)

The analog inputs 0 to 10 V DC and 4 to 20 mA analog inputs have two functions:

In phase control operation mode, they can provide the setpoint for the desired output voltage.

In starter operating mode, they can provide a monitoring message for a system variable. From a particular signalling threshold, they can set a predefined bit. In this way, for example, the starter can be switched in depending on the system status.

The 0 to 10 V DC and 4 to 20 mA analog inputs are independent from each other.

PNU	Name	Value	Function	Default
0 to 10 V DC analog input				
46	Ref1	0.0 to 9.9 V	Value of analog input Ref1	–
47	Ref1-Pointer	11 to 111; 2011 to 2035	Specifies the parameter to which analog input Ref1 transmits its value	0 = not used
48	Ref1 Level	0.0 to 10.0 V	Signalling threshold for the Ref1-Level bit	4.9 V
614	Ref1 Flag	0	Value at Ref1 below the signalling threshold in PNU 48	Status information
		1	Value at Ref1 above the signalling threshold in PNU 48	
4 to 20 mA analog input				
43	Ref2	0 to 20.4 mA	Value of analog input Ref2	–
45	Ref2-Pointer	11 to 111; 2011 to 2035	Specifies the parameter to which analog input Ref2 transmits its value	0 = not used
41	Ref2 Level	0.1 to 20.4 mA	Signalling threshold for the Ref2-Level bit	10.2 mA
615	Ref2 Flag	0	Value at Ref2 below the signalling threshold in PNU 41	Status information
		1	Value at Ref2 above the signalling threshold in PNU 41	

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Command (submenu)

PNU	Name	Value	Function	Default
Command 1				
40	Enable	0	Disable	1
		1	Enable	
627 [2627]	Kickstart [Kickstart 2]	0	Off	0
		1	Kickstart active	
628 [2628]	CurrentLimit [CurrentLim.2]	0	Continue ramp	1
		1	Shut down with error message	
629 [2629]	OverLoad [OverLoad 2]	0	Off	1
		1	Overload monitoring active	
630 [2630]	OverCurrent [OverCurrent 2]	0	Continue	0
		1	Shut down at overcurrent	
631 [2631]	UnderCurrent [UnderCurr.2]	0	Off	0
		1	Shut down with error message	
632 [2632]	Thermistor [Thermistor 2]	0	Off	0
		1	Thermistor active	
Command 2				
634 [2634]	U-Stopramp [U-Stopramp2]	0	Off	0
		1	Voltage-controlled stop ramp	
635 [2635]	Invert Ref0 [InvertRef0 2]	0	No reference inversion	1
		1	Invert reference	
636	OptionStart	0	Stop signal applied	Status information
		1	Start signal applied	
637	TerminlStart	0	Stop signal applied	Status information
		1	Start signal applied	
638	Run-Relay	0	Off	Status information
		1	Enable signal for activating main contactor	
639	PAR1/PAR2	0	Parameter set 1 active	0
		1	Parameter set 2 active	
640	Tmp t-Stop=0	0	Off	0
		1	Overwrite softstop ramp	

PNU	Name	Value	Function	Default
Command 3				
641	not used			1
642	not used			1
643	Set Imax	0	Off	0
		1	Simulate operation at current limit	
644	ExtFault	0	Off	0
		1	External fault has occurred	
645 [2645]	AutoEndStop [AutoEndStop2]	0	Off	0
		1	Automatic ramp end at softstop	
646 [2646]	AutoStopProf [AutoStopPrf2]	0	Off	1
		1	Adapt softstop profile to load	
647 [2647]	AutoEndStart [AutoEndStrt2]	0	Off	0
		1	Automatic ramp end at softstop	
648 [2648]	AutoU-Start [AutoU-Start2]	0	Off	0
		1	On	
655 [2655]	AutoBypass [AutoBypass2]	0	Off	1
		1	On	

When PNU 655 = 1, the DM 4 automatically recognizes a connected bypass and sets PNU 7 to Start+Bypass.

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PhaseControl (submenu)

To set the output voltage, specify the control angle (the smaller the angle, the greater the voltage). The relationship between angle and output voltage is nonlinear. The Invert Ref0 switch specifies whether the maximum voltage will be reached at setpoint zero or at maximum setpoint (value = 0 or 1).

As for Soft starter mode (Standard and In-Delta), terminal E2 (PNU 40 = 1) must carry an Enable signal and terminal E1 (Start/Stop) a control signal. When terminal E1 carries a High signal, the specified setpoint is activated.

To conform with the EMC Directive, an external radio interference filter must be installed. Because the filter required depends on the type of load (resistive, inductive, resistive/inductive), responsibility for choosing the appropriate filter must rest with the user.

PNU	Name	Value	Function	Default
Open-Loop and Closed-Loop Control modes				
109	KI	0 to 50	I-component of the voltage regulator	10
110	Umax	0 to 50	Maximum output voltage	10
635	Invert Ref0	0	No inversion; Max In = Max Out	1
[2635]	[InvertRef0 2]	1	Signal inversion active; Max In = Min Out	
105	Ref0-Pointer	0 to 111	Pointer to parameter to deliver setpoint	46
111	UserParametr	0 to 255	User-defined value	0
In addition, for Closed-Loop Control mode				
106	FeedBackPntr	0 to 111	Contains the PNU of the parameter that delivers the actual value	26
107	KP (Mul)	1 to 255	P-component of the closed-loop voltage controller (gain)	37
108	KP (Div)	1 to 255	P-component of the closed-loop voltage controller (divide)	7

In addition to Open-Loop Control mode, an actual value is returned in Closed-Loop Control mode. The actual value is compared with the setpoint. If the values are different, the output voltage is adjusted.

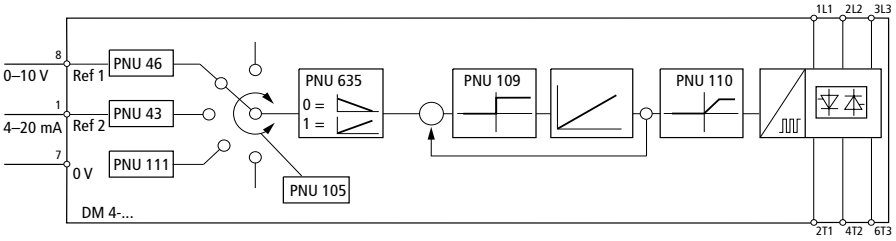

Figure 41: Open-loop voltage controller

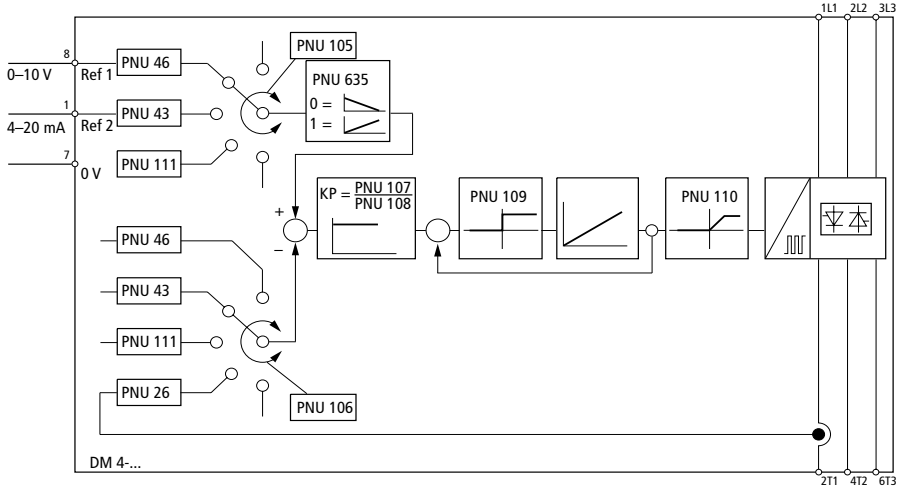

Figure 42: Closed-loop voltage controller

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Display functions

The Indications main menu contains seven submenus.

Device Data (submenu)

PNU	Name	Value	Function	Default
9	Address	1 to 99	Device address for bus and interface operation	1
93	Drive Type	10	Drive type code	–
200	Software Type	53BDM 434050000	Manufacturer's code for software used	–
99	Software Ver		Manufacturer's code for internal software version	Device-dependent
201	Software Dat		Manufacturer's code for the internal software creation date	Device-dependent
24	I_e	5 to 2000 A	Rated operating current of the soft starter	Device-dependent

Status (submenu)

PNU	Name	Value	Function
Status 1			
600	Stopped	0	Motor running
		1	Motor stopped
601	Ramp	0	Soft starter not in ramp function
		1	Soft starter working in ramp function
602	Imax-Limit	0	Current limit from PNU 30 reached
		1	Output current below current limit specified in PNU 30
603	Top of Ramp	0	Soft starter working in ramp function or is in Stop
		1	Top of ramp reached; 100 % output voltage
604	t-Dwell off	0	Dwell time since Top of Ramp incomplete
		1	Dwell time since Top of Ramp completed; drive can perform cos-φ optimization

PNU	Name	Value	Function
605	Umax reached	0	Thyristors working with phase control
		1	Thyristors working at maximum delay angle
606	Optimising	0	cos-φ optimization not active
		1	cos-φ optimization active
607	Stop-Ramp	0	Soft starter not in stop ramp mode
		1	Soft starter working in stop ramp mode
Status 2			
608	Alarm	0	Normal operation
		1	Soft starter malfunction
609	Overload>0	0	Overload function is zero
		1	Overload function was activated
610	Stalling	0	Motor is working correctly
		1	Motor wants to stall and is being automatically corrected by the soft starter. May occur with cos-φ optimization
611	Full Load	0	cos-φ optimization can be activated
		1	Due to high load, cos-φ optimization cannot be activated, even if selected. Motor always running at 100 % voltage.
612	Noise	0	Soft starter working correctly
		1	The soft starter has identified excessive external interference voltage
614	Ref1 Flag	0	Value at Ref1 below the signalling threshold in PNU 48
		1	Value at Ref1 above the signalling threshold in PNU 48
615	Ref2 Flag	0	Value at Ref2 below the signalling threshold in PNU 46
		1	Value at Ref2 above the signalling threshold in PNU 46
Status 3			
616	Relay K1	0	Relay not energized
		1	Relay energized
617	Relay K2	0	Relay not energized
		1	Relay energized
618	Relay K3	0	Relay not energized
		1	Relay energized

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PNU	Name	Value	Function
619	Relay K4	0	Relay not energized
		1	Relay energized
620	Digi-In. E1	0	Input signal is Low (0)
		1	Input signal is High (1)
621	Digi-In. E2	0	Input signal is Low (0)
		1	Input signal is High (1)
Status 4			
622	50/60 Hz	0	50 Hz
		1	60 Hz
623	Rotation	0	Clockwise rotation at startup
		1	Anticlockwise rotation at startup
624	OverCurr.LIM	0	Off
		1	Overcurrent reached and still flowing
625	UnderCurr.LIM	0	Off
		1	Undercurrent reached and still flowing
626	Thermis.LIM	0	Off
		1	A thermistor message is being sent

Display (submenu)

Many values are monitored while the soft starter is operating. They can be displayed on the LCD keypad or sent to one of the Analog outputs for display.

PNU	Name	Value	Function	Unit/representation
20	cos-phi ref	0 to 146°	Optimum cos-φ of the motor (calculated)	Angle
21	cos-phi	0 to 146°	Current cos-φ of the motor (measured)	Angle
22	DelayAngle	0 to 146°	Time during which the thyristor is shut down	Angle
23	Max.Delay	17 to 146°	Maximum delay angle during the optimization phase	Angle

PNU	Name	Value	Function	Unit/representation
26	LoadCurrent	0 to $8 \times I_e$	Output current (per phase, independent from the connection type (Standard/In-Delta))	Amps
27	PeakCurrent	0 to $8 \times I_e$	Maximum current during the last start	Amps
36	Overload-Sum	0 to 100 %	Current I^2t value of the overload integrator in % of the permissible device limit value	%
37	T-Heatsink	0 to 255	When the temperature rises, the displayed value jumps from $<$ 20 to $>$ 200	–
46	Ref1	0 to 10 V	Current actual value at Ref1	–
43	Ref2	0 to 20 mA	Current actual value at Ref2	–
42	ThermistorVal	0 to 255	Indicates the actual value of the connected thermistor as a relative value. When the temperature rises, the displayed value usually jumps from $<$ 20 to $>$ 200	–
55	Load	0.0 to $8.0 \times I_e$	Current device load in multiples of the rated current	–
56	PeakLoad	0.0 to $8.0 \times I_e$	Peak device load in multiples of the rated current	–

Analog-Out (submenu)

PNU	Name	Value	Function	Default
Analog Out 1				
49	AnOut1 Pntr	20 to 111	Specifies a PNU to be transmitted to analog output 1 Output signal: 0 to 10 V DC, 10 mA	26 = load current
Analog Out 2				
50	AnOut2 Pntr	20 to 111	Specifies a PNU to be transmitted to analog output 2 Output signal: 0 to 10 V DC, 10 mA	22 = delay angle

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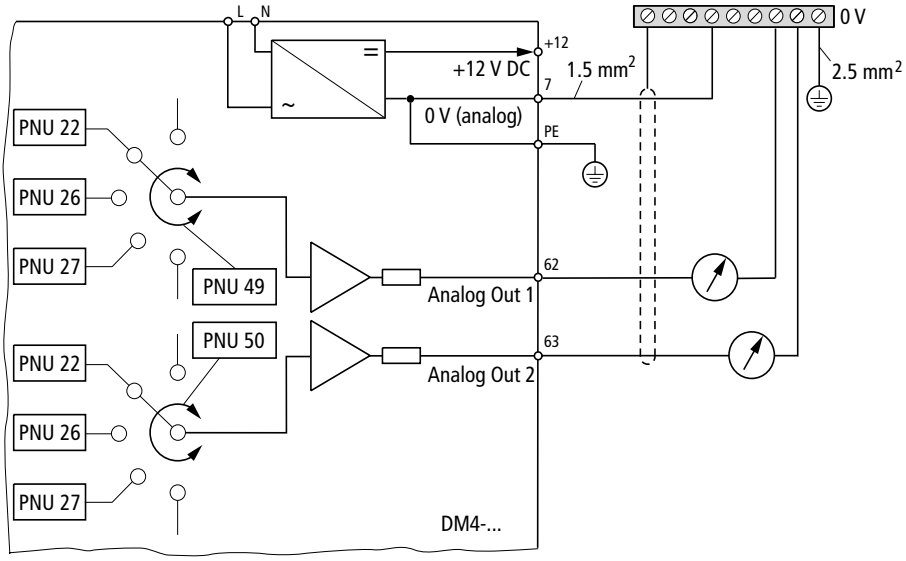

Figure 43: Analog output with PNUs

The following parameters can be transmitted for display through the analog outputs:

PNU	Name	Value	Function	Output voltage 10 V =
20	cos-phi ref	0 to 146°	Optimum cos-φ of the motor (calculated)	8.16 ms[1)]
21	cos-phi	0 to 146°	Current cos-φ of the motor (measured)	8.16 ms[1)]
22	DelayAngle	0 to 146°	Time during which the thyristor is shut down	8.16 ms[1)]
23	Max.Delay	17 to 146°	Maximum delay angle during the optimization phase	8.16 ms[1)]
26	LoadCurrent	0 to $8 \times I_e$	Output current (per phase, independent from the connection type (Standard/In-Delta)	$8 \times I_e$ (PNU 24) Rated current = 1.25 V
27	PeakCurrent	0 to $8 \times I_e$	Maximum current during the last start	$8 \times I_e$ (PNU 24) Rated current = 1.25 V

PNU	Name	Value	Function	Output voltage 10 V =
36	Overload-Su	0 to 100 %	Current I^2t value of the overload integrator in % of the permissible device limit value	100 %
37	T-Heatsink	0 to 255	When the temperature rises, the displayed value jumps from $<$ 20 to $>$ 200	255
46	Ref1	0 to 9.9 V	Actual current at Ref1	10 V
43	Ref2	0 to 20.4 mA	Actual current at Ref2	20 mA
42	ThermistorVal	0 to 255	Indicates the actual value of the connected thermistor as a relative value. When the temperature rises or in the event of a wire break the displayed value usually jumps from $<$ 20 to $>$ 200	255
111	UserParameter	0 to 255	User-defined value	255

1) The delay angles are displayed according to the mains frequency.

At 50 Hz, the actual angle is calculated as follows:

$$\alpha = 180° \times \frac{8{,}16\ \text{ms}}{10\ \text{ms}} \times \frac{\text{output voltage in V}}{10\ \text{V}} = \frac{14{,}688°}{\text{V}} \times \text{output voltage in V}$$

At 60 Hz, the actual angle is calculated as follows:

$$\alpha = 180° \times \frac{8{,}16\ \text{ms}}{8{,}16\ \text{ms}} \times \frac{\text{output voltage in V}}{10\ \text{V}} = \frac{18°}{\text{V}} \times \text{output voltage in V}$$

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Monitoring functions

The Monitoring main menu contains seven submenus.

Four make contacts and several protection functions are available for monitoring the soft starter.

Various functions can be assigned to the relay contacts. This is done in the same way as for the digital inputs. A pointer is used to specify a parameter to which the relay is to respond. The Output Logic switch can be used to specify whether the relay is to energize with the respective bit in High or Low state.

Appropriate parameters are the four status parameters and parts of the command.

With the LCD keypad, current error messages can be shown directly on the display. To facilitate diagnosis, the error register provides information about past faults.

The motor protection function provides the best protection for the motor, since a trip class greater than Class 15 is available for heavy and/or frequent starting. Normal bimetallic relays are not suitable for trip classes aboveClass 15. Here, special-purpose or electronic relays are required. The series DM 4-340 soft starters can perform this function.

This function does not have a thermal memory. In other words, when the controller supply voltage is switched off, the calculated I^2t value is reset to zero.

The required motor rating must be determined from the expected load. A standard-conformant motor may not always be able to deliver its indicated rated power under heavy starting conditions with a trip class > Class 15. Under heavy starting conditions, contact the motor manufacturer to establish the motor's maximum permissible power.

Relay output K1 (submenu)

PNU	Name	Value	Function	Default
57	K1-Pointer	600 to 656	Specifies the parameter to be used for controlling relay K1	638 (Run Relay)
649	K1-Logic	0	Low signal triggers switching	1
		1	High signal triggers switching	–
71	K1-delaytime	20 to 800 ms	Delay time for Run, TOR and Alarm	160 ms

The K1-Pointer specifies the status bit by which the relay is controlled. In addition, K1-Logic can be used to specify whether the relay will switch on a High or a Low signal (make contact or break contact).

Delay time (K1-Time) in submenu Relay K1

A delay time (K1-Time) can be programmed for three status parameters. Run Relay, TOR and Alarm (PNU 638, PNU 603, PNU 608).

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If a time other than zero is programmed, the soft starter responds with delays, irrespective of the relay for which the messages are programmed. If one of these status parameters is programmed to a relay, the relay also switches with a corresponding delay (analogous to the status parameters). This provides a simple way for bypass contactors to be safely switched off in AC-1 operation or to control the mains contactor through the soft starter. The number of required external switching operations can therefore be reduced.

Effect on the Run Relay status bit (PNU 638):

When relay K1 is energized, the power section begins after the time set with K1-delaytime. Only then do the monitoring functions become active. With the Run Relay function, the mains contactor can therefore be disconnected from the device without triggering an error (phase failure). The control sequence is then:

Apply softstart command

Relay K1 energizes

Relay K1 energizes the mains contactor

After the time specified in PNU 71, the start procedure and phase monitoring begin.

Without this delay, phase monitoring would be initiated immediately by the start command and the soft starter would shut down with an error message before the mains contactor is energized.

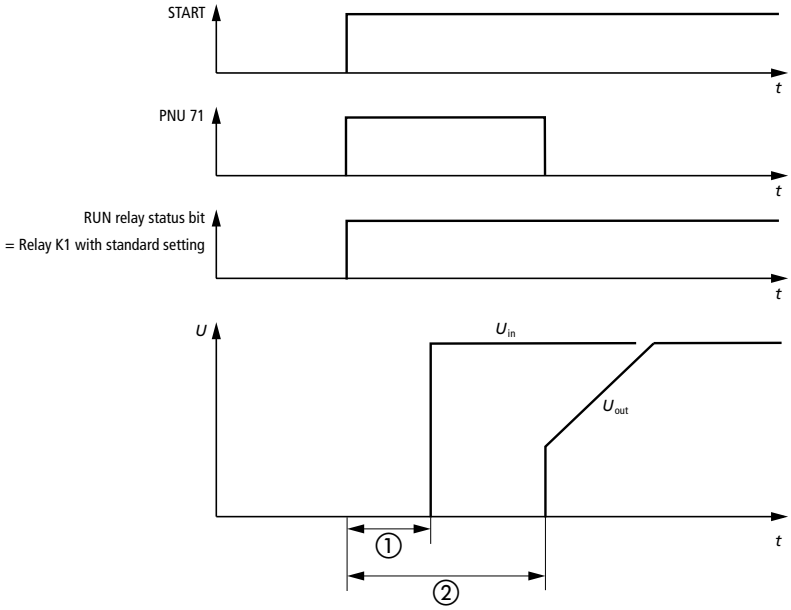

Figure 44: Parameter K1 with Run

① Time before the mains contactor is switched and voltage is applied to the soft starter's input

② PNU 71 = K1-delaytime
Delay between energizing K1 and start of the first thyristor firing

Effect on status bit TOR (PNU 603):

When the softstop command is issued, the TOR bit drops to Low. The actual softstop is initiated only after completion of K1-delaytime. This ensures that current flows to the soft starter before the ramp function is initiated.

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If the bypass contactor is relatively slowly to drop off, the ramp can already have started while the bypass contactor is still closed. In this case, the soft starter would be supplied from the secondary side, which could lead to soft starter malfunction. The control sequence is then:

Apply softstop command

K1-delaytime expires

Softstop ramp is initiated

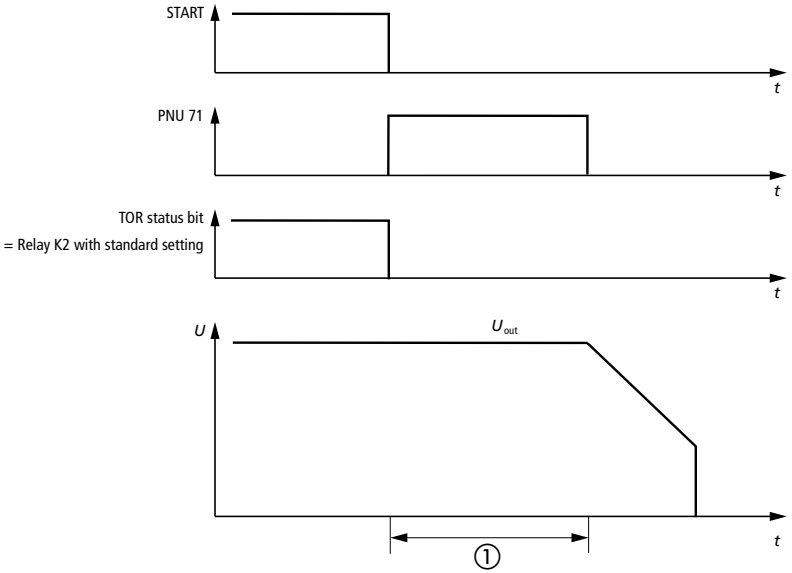

Figure 45: Parameter K1 with TOR

① PNU 71 = K1-delaytime
time between deactivation of TOR message and start of softstop ramp

Effect on Alarm status bit (PNU 608):

When a fault occurs, the soft starter is disabled. If a K1-delaytime is programmed, the shutdown procedure is as follows:

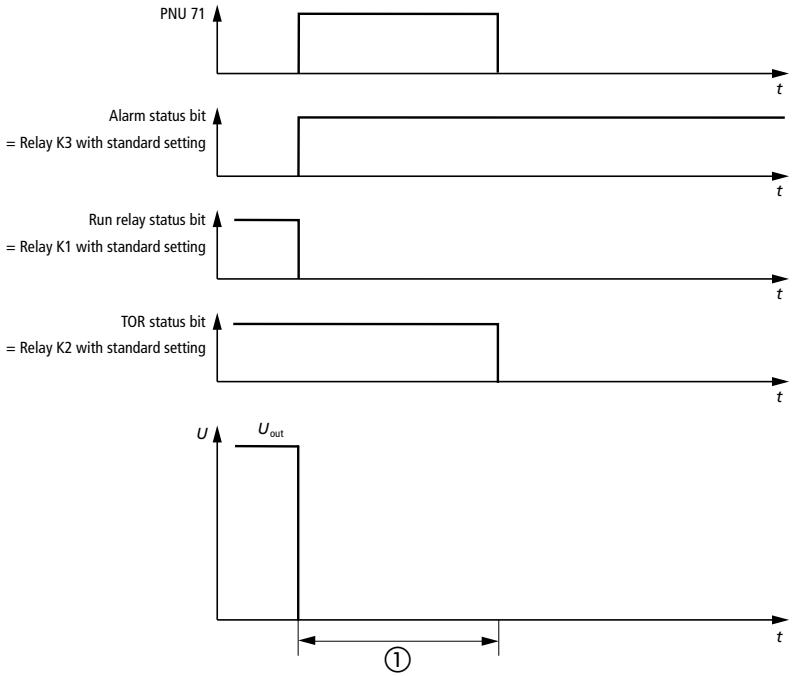

Figure 46: Parameter K1 with Alarm

① PNU 71 = K1-delaytime
Time from error to shutdown of the TOR status bit

When the Alarm bit is set, the Run Relay bit is reset at the same time and the power section is shut down. The K1-delaytime then expires and the TOR bit is reset. The control sequence is then:

Alarm message

Disable power section

Set alarm flag

Delete Run status bit

K1-delaytime expires

Delete TOR status bit

Relay outputs K2 to K4 (submenus)

PNU	Name	Value	Function	Default
Relay output K2				
59	K2-Pointer	0, 600 to 655	Specifies the parameter from which a bit is to be used to control relay K2	603 (Top of Ramp)
650	K2-Logic	0	Low signal triggers switching	1
		1	High signal triggers switching	
Relay output K3				
61	K3-Pointer	0, 600 to 655	Specifies the parameter from which a bit is to be used to control relay K3	608 (Alarm)
651	K3-Logic	0	Low signal triggers switching	1
		1	High signal triggers switching	
Relay output K4				
63	K4-Pointer	0, 600 to 655	Specifies the parameter from which a bit is to be used to control relay K4	609 (Overload>0)
652	K4-Logic	0	Low signal triggers switching	1
		1	High signal triggers switching	

Heatsink (submenu)

The display value is in the form of an internal representation, not in degrees Celsius. Display values below 20 represent normal temperatures.

PNU	Name	Value	Function	Default
37	T-Heatsink	0 to 255	When the temperature rises, the displayed value jumps from < 20 to > 200	–
44	Temp.Limit	0 to 255	Switching threshold for temperature error message	250

Temp.Limit specifies the heatsink temperature at which an error message is generated.

Thermistor (submenu)

The thermistor input is suitable for connecting thermistors or temperature switches (break contacts to IEC 60 034-11). With them, the motor temperature can be determined and included in the soft starter monitoring function. The default setting for this input is Off (thermistor monitoring disabled).

PNU	Name	Value	Function	Unit/ representation
42	ThermistorVal	0 to 255	Indicates the actual value of the connected thermistor as a relative value. When the temperature rises, the displayed value usually jumps from < 20 to > 200	–
626	Thermis.LIM	0	Off	No
		1	Limit value exceeded; shut down with error message	Too hot
632	Thermistor	0	Off	0
		1	Thermistor protection active	

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The display value is in the form of an internal representation, not in degrees Celsius. Display values below 20 represent normal temperatures.

If the internally specified signalling threshold is exceeded, the DM 4-340 shuts down with an error message (Motor overtemperature). When the fault condition is rectified, the soft starter can be restarted after a reset (see Section “Error message and remedy” on Page 136).

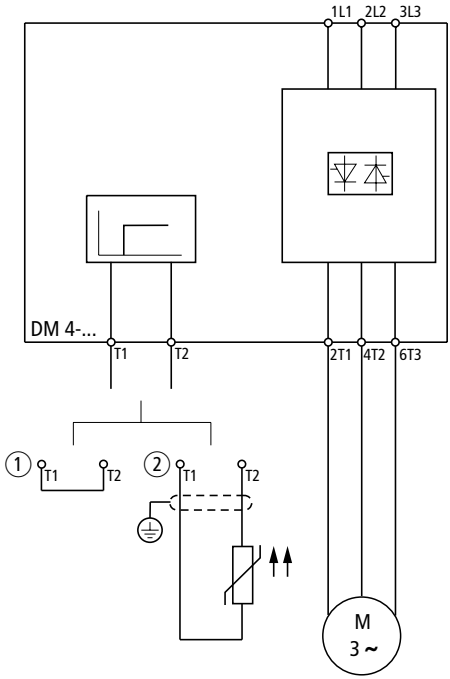

Figure 47: Thermistor connection

① No thermistor connected, insert jumper or set PNU 632 = 0 (default setting!)

② With thermistor

Motorprotect (submenu)

PNU	Name	Value	Function	Default
32 [2032]	OverCurr.max [OvercurrMax2]	1.0 to 5.0 $_e$	Limit value for overcurrent shutdown after top of ramp	3.12 $_e$
33 [2033]	t-Overcurr. [t-Overcurr.2]	5 to 255	Number of half waves by which the overcurrent limit value must be exceeded before an overcurrent shutdown is triggered. OverCurrent must be set (PNU 630 = 1) for a shutdown to take place.	100
630 [2630]	OverCurrent [OverCurrent 2]	0	OverCurrent function disabled	1
		1	Shut down at overcurrent	
34 [2034]	Overload max [OverloadMax2]	0.6 to 2.0 $_e$	Overload limit for the motor after top of ramp in multiples of the device rated current	1.09 $_e$
35 [2035]	t-Overload [t-Overload 2]	10 to 140	Dimensionless factor. Determines the time for which a drive must be overloaded before an overload shutdown takes place. This function is always active.	140
36	Overload-Sum	0 to 100 %	Current ^{2}t value of the overload integrator in % of the permissible device limit value	
629 [2629]	OverLoad [OverLoad 2]	0	Off	1
		1	Shut down with error message	

The overload function provides blocking protection. If the current rises significantly above the motor's rated current during operation, the machine is – as a rule – blocked. The soft starter recognizes this condition and shuts the motor down before the motor suffers excessive thermal overload.

Do not set this value too low, otherwise the protective function could trigger on a permissible overload.

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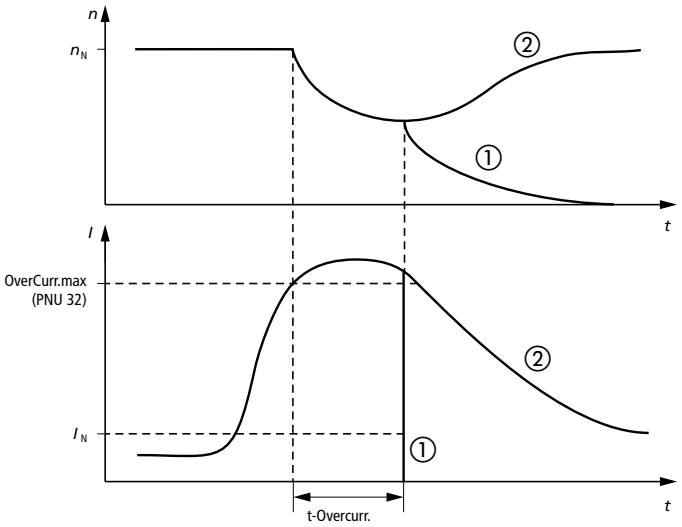

Figure 48: Overcurrent

① Shut down with error message; motor spins down

② Continue operation as long as the soft starter's thermal monitoring function does not respond

With the motor protection function, the temperature of self-ventilated three-phase induction motors can be monitored. The technical data of the motor are defined with the current limit values.

Provided the motor data is entered correctly, the series DM 4-340 soft starter performs the function of the overload relay. The calculated values are maintained as long as the controller supply voltage is applied.

This function does not have a thermal memory. In other words, when the controller supply voltage is disconnected, the calculated I^2t value is reset to zero.

To ensure that the motor protection function works correctly, the controller supply voltage should not be interrupted between starts. The power supply of terminals 1L1, 2L2 and 3L3 can be switched off between two starts. This has no effect on the motor protection function.

PNU 34 and PNU 35 determine the trip characteristics.

Example:

PNU 34 = Rated motor current× 1.1
PNU 35 = read off graph below

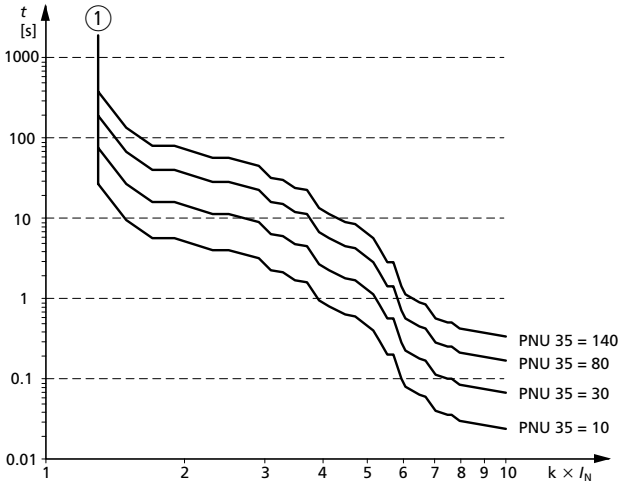

Figure 49: Overload

① Limit curve, above which a shutdown is tripped

Viewing error messages

The Trips main menu does not contain any submenus. The parameters are displayed directly.

The last five trips are saved in the soft starter analogous to a stack register. When a new fault occurs, the oldest trip is discarded from the stack.

The error messages can be viewed on the LCD keypad or scanned through the interface modules.

PNU	Name	Value	Function
72	Trip-Sens.	1 to 15	Trip sensitivity
161	TripHistory1	1 to 15	Stores the specified fault
162	TripHistory2		
163	TripHistory3		
164	TripHistory4		
165	TripHistory5		

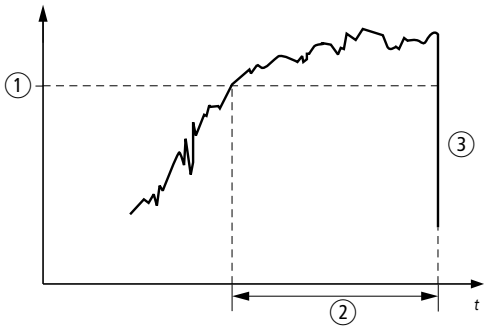

Figure 50: Trip sensitivity

① Response threshold for recognition of a fault condition; factory preset

② PNU 72: Trip-Sens.; specifies the time at which a recognized fault is reported

③ Shutdown after expiry of the tolerance time (PNU 72)

The defines the time that the soft starter waits before an identified fault condition is reported. This is useful for smoothing information affected by noise.

1 = fast response
15 = slow response

If no LCD keypad or interface is connected to the soft starter, the LEDs on the front panel show a diagnostic message (see chapter “Diagnostics”).

Error codes

Error number	Message	Error
0	No Trip	No Trip
1	PhaseLoss	One or more phases missing on mains side
2	OverTemp.	Soft starter’s heatsink overheated
3	Thyristor	Fault in thyristor or its control circuit
4	Firing	Thyristor has not fired
5	Thyristor	Faulty control signal
6	Thyristor	Error in control signal
7	Thyristor	Fault in thyristor monitoring
8	Thyristor	Motor phase missing or thyristor always conducting
9	Thyristor	Fault in thyristor monitoring
10	Thy Shorted	Thyristor is always conducting
11	UnderCurrent	Not enough current flowing after top of ramp
12	Curr.Limit	Drive at set current limit for too long at start
13	Overload	Motor protection function has responded after startup
14	OverCurr.max	Max. overcurrent exceeded
15	Thermistor	Motor thermistor has tripped

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Resetting error messages/trip register

The trip register cannot be deleted. It can only be overwritten with new trips. New trips are entered under TripHistory1. All other errors move one place down, the last one being pushed off the list and thereby deleted from the register.

When an error message occurs, the soft starter is disabled. To restart it, you must reset and reissue the start command. If the old error is still pending, the soft starter returns directly to the fault condition and generates a new error message.

Parameters not in the menu structure

For communication modules etc., there are other parameters that cannot be accessed through the menu. PNU 135 and PNU 150 can be read or written to only with the network modules or the PC software. The content of these two parameters consists of the parameters already described.

PNU 633 always has the opposite state of PNU 40. For device-specific reasons, PNU 633 is available instead of PNU 40 in the list of possible parameters for the digital inputs.

PNU	Name	Value	Function
135	ComCommandW	Bit 3 = 0 = 1	Softstart (RUN) Softstop (STOP)
		Bit 9 = 0 = 1	Enable Disable
		Bit 12 = 0 = 1	PAR1 selected PAR2 selected
150	ComStatusW	Bit 0 = 0 = 1	PAR1 active PAR2 active
		Bit 1 = 0 = 1	Motor running Motor stopped
		Bit 2 = 0 = 1	Below current limit Current limit from PNU 30 reached
		Bit 3 = 0 = 1	Starter in ramp function or stop TOR
		Bit 4 = 0 = 1	Starter in ramp function Starter not in ramp function
		Bit 6 = 0 = 1	Running Stopped
		Bit 7 = 0 = 1	Enabled Disabled
		Bit 8 to 11 = 0 = 3 = 6 = 7 = 8 = 15	Device status Initializing Disabled (PNU 40 = 0) Enabled (PNU 40 = 1) Warning issued Error DM 4 switched off (for external interface module supply only)
		Bit 14 = 0 = 1	Clockwise rotation Anticlockwise rotation
		Bit 15 = 0 = 1	Not ready for operation Ready for operation
633	Not Enable	0	Device not disabled = Enable
		1	Device disabled

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4 Mounting/Installation

Scope of delivery

When you first receive the soft starter, check that the delivery is complete and correct. If any items are missing or faulty, please contact your sales outlet.

Package content	Quantity
DM 4-340 devices	1
Installation instructions (AWA)	1
CD with device descriptions	1

Installing in a control cabinet

During assembly, please consider the weight and dimensions of the soft starter. Use appropriate handling and lifting equipment (lifting trolley and/or crane for larger weights) and tools. Improper handling and the use of incorrect tools can damage the soft starter.

Attention!
Soft starters are designed for use only as built-in devices.
Take appropriate preventive measures in case of

- cooling air containing dust, fibres or grease, as these can cause short-circuits on the printed circuit boards (install filters, use separate ventilation air supply);
- aggressive gases, which can etch tracks on printed circuit boards (install filters, use separate ventilation air supply)
- clogged filters. which can cause overheating (clean the filters regularly).

To avoid overheating,

- ensure a free flow of cooling air, both to and from the device;
- do not install other equipment that generates a lot of heat close to the soft starter;
- ensure that the specified clearance of above and below the soft starter is maintained, since the temperature of the cooling air can otherwise rise to inadmissible values, causing the soft starter to shut down.

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For all DM 4 series soft starters, the clearance in front of the device must be 25 mm. Above and below the device, the clearance must be 75 mm for models up to 350 A or 200 mm for models over 350 A; to each side, 30 mm are required. For soft starters over 350 A, a larger side clearance is required if the housing doors are to open 90°. A clearance of 75 mm is then necessary to the left side.

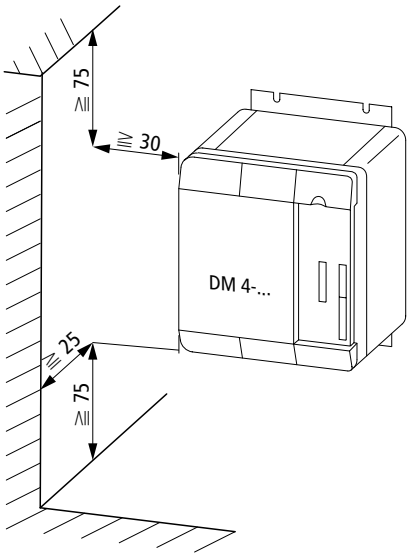

Figure 51: Installation clearances, DM 4-340-7K5 to DM 4-340-200K

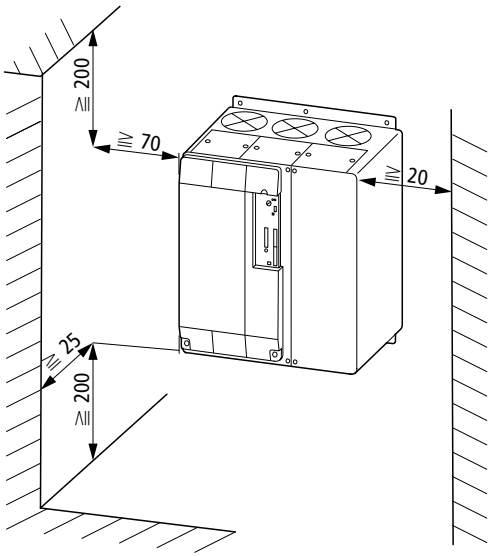

Figure 52: Installation clearances, DM 4-340-250K to DM 4-340-500K

If the soft starter will be subjected to continuous vibration or frequent shock, consider the use of vibration dampers.

Mounting angles

The maximum admissible angle of inclination for all soft starters is 30°.

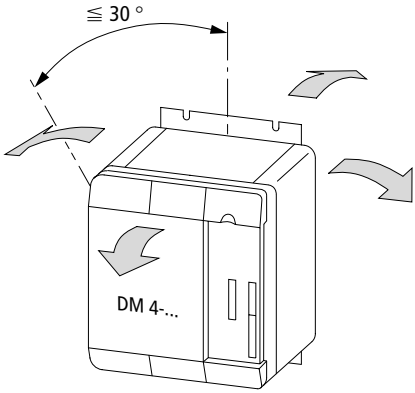

Figure 53: Inclination, DM 4-340-7K5 to DM 4-340-500K

Using M6 screws, mount the soft starter on the cabinet wall (mounting plate), so that the control signal terminals point forward.

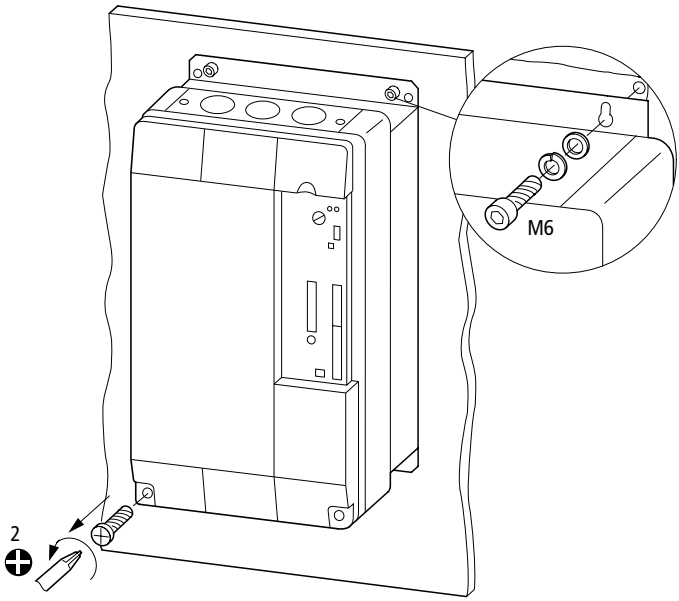

Figure 54: Installation on mounting plate, DM 4-340-7K5 to DM 4-340-200K

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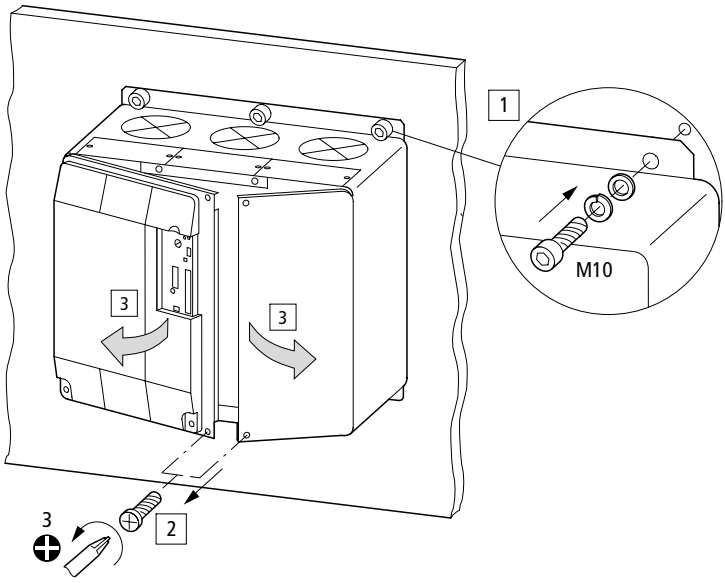

Figure 55: Installation on mounting plate, DM 4-340-250K to DM 4-340-500K

Mounting instructions are provided with each soft starter.

Connections

Only insert or remove the plug-in screw terminals when the power is off.

The DM 4-340 series soft starters have terminals for temperature monitoring. If no temperature sensor is connected, fit a jumper between the thermistor input connectors.

Attention!
The devices contain components that are sensitive to electrostatic charges. Before undertaking installation and service work on or near the terminals, discharge yourself by touching a PE mounting screw or another grounded metal surface in the control cabinet.

Attention!
Electrical installation and commissioning must be carried out by suitably qualified personnel. You are responsible for implementing suitable grounding and power supply line protection in conformance with local and national regulations. The motor must be protected against overload.

Attention!
The soft starter's power section contains semiconductor elements. These do not have isolating properties between mains and load. There is always a leakage current of several milliamps. You should therefore disconnect the starter and motor with an upstream isolating switch before carrying out work on it.

Connecting the motor supply cable

If possible, route all control lines separate from the motor power cable.

The cable cross-sections apply to cables 1L1, 3L2, 5L3, N, 2T1, 4T2 and 6T3.

Connect the PE with a stud. The cable cross-sections required for the soft starter and the tightening torques for the cable terminals are listed in the appendix.

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Screening motor cables

The motor cables do not need to be screened.

Connecting control cables

The cross-sections for connecting cables are listed in the technical data (see appendix).

The control cable connectors feature a mechanical reverse voltage protection, which prevents an incorrect connection of the internal control inputs.

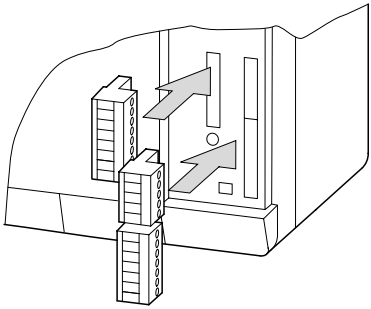

Figure 56: Inserting the plug-in control signal terminals

If the control signal cables (terminal block, relays) are not installed in a single cable run, connect the screening of the two sections to each other with a short grounding cable.

Screening control cables

Attention!
Always screen cables for analog signals. Do avoid signal distortion, connect the screen at only one cable end.

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5 Operation

Commissioning

The DM 4-340 series soft starters are factory-preset to be able to control a power-referenced, standard-conformant 4-pole motor in a typical soft starter application without any modifications.

Attention!
Before switching the soft starter on, make sure that the admissible ambient conditions have not been exceeded and that no signs of moisture are visible within the soft starter. Moisture can condense if the soft starter is stored in a cold place. If moisture has entered the device, dry it out completely before use.

Attention!
Electrical installation and commissioning must be carried out by suitably qualified personnel. You are responsible for implementing suitable grounding and power supply line protection in conformance with local and national regulations. The motor must be protected against overload.

Do not carry out voltage breakdown tests on any of components of the soft starter. To measure signal voltages, use a suitable measuring device (internal resistance at least 10 kΩ/V).

Before switching on the soft starter, check that the set controller voltage is the same as your supply voltage.

For precise matching of the soft starter to the application, the application selector switch can be used. Select an application that matches your application the most closely. If you are not sure which is the most appropriate application, leave the selector switch on “Standard”.

When making changes to the parameters, take the following into account:

Do not set the ramp time too large
If the ramp times are too long, motor acceleration is slow, causing increased motor load for an excessively long time. In extreme cases, the motor may shut down due to overtemperature.

Do not set the current limit too low
If the current supplied to the motor is too low, it cannot generate the torque it needs to accelerate. Acceleration will then be slow, or the motor may not start up at all. If the motor does not accelerate quickly enough, it may be shut down due to overtemperature.

If you want to change parameters yourself, use the values listed in manual “Soft Starter Configuration” (AWB 8250-1346 GB).

Switching on

Before switching on the soft starter, ensure that:

terminals 7 and 39 are connected if using the internal voltage supply,

the mains voltage is connected and the device is immediately ready for operation.

Start the drive with a High signal at terminal E1 (Start/Stop).

If you want to adapt the soft starter's parameters to particular applications and the preset options provided by the application selector switch are not suitable, you will need the LCD keypad (DE 4-KEY-2) or an interface module.

Starting the motor

When the start command is applied (High signal at terminal E1 or Run key on the LCD keypad), the motor accelerates at the specified rate. Depending on the load, the actual startup time may deviate from the defined values.

During a start, the soft starter warms up. To prevent overheating, it is essential that you observe the required cooling times. If frequent starts are made in normal operation, a soft starter with a higher rating may have to be used. See Technical Data and manual "Soft Starter Configuration" (AWB 8250-1346 GB).

Operation

Switches or contactors for safety functions (e.g. EMERGENCY STOP) may be installed on the outgoing (motor) side of the soft starter. The soft starter must first be disabled, however (see also section "Connection types" on page 26).

Attention!
If the motor is switched during normal operation with the soft starter enabled, error messages may appear and thyristors may be damaged.

The DM 4-340 series soft starters are equipped with a heatsink temperature monitor.

Warning!
Never open the unit when the mains power supply or the controller supply voltage is switched on, as fatal injury may otherwise result.

Warning!
Soft starters are electrical apparatus for use in industrial power installations. During operation, the components of the soft starter can carry dangerous voltages and may also have moving or rotating parts and hot surfaces. These present a risk of serious injury.

Warning!
The unauthorized removal of the necessary covers, incorrect installation and operation of the motor or soft starter can lead to failure of the device, serious injury to operating personnel and material damage.

Warning!
If the device issues an error message, the error must be carefully verified. If a hardware fault is indicated, it is possible that not all phases of the soft starter have been switched off. You must therefore securely disconnect the mains power before carrying out work on the motor (e.g. by switching the mains switch OFF).

Attention!
If the drive is not disconnected from the mains power supply when stationary (at the mains contactor/mains switch),

a fault may cause the motor to start unintentionally;

a voltage may be present at the motor terminals even though the motor is stationary (leakage current through the thyristors).

After the start, the soft starter initiates the operating phase. This is indicated on the the LCD keypad (if fitted). In addition, the output current is displayed.

When the t-Dwell time (PNU 15) has expired, the soft starter initializes the optimization phase. By reducing the voltage applied to the motor terminals, cos φ is maintained as near as possible to the optimum value (cos φ on the motor's nameplate). This enables the soft starter's output current to be reduced without reducing the drive's speed. This function only applies to drives operating at partial load and is more noticeable with lower rated drives ($<$ 30 kW). If a drive is constantly working at full load, this function can be disabled to avoid instability. Depending on the motor characteristics and load behaviour, the drive may oscillate during cos-φ optimization.

Stopping

When the Stop command is issued (Low signal at terminal E1 or Stop key on LCD keypad DE 4-KEY-2), a softstop is initiated. The drive then decelerates over the specified softstop time to the stop voltage value. Once this voltage is reached, the soft starter shuts the output down. If the motor is still rotating at this point, it spins down without control.

By default, the softstop time is 0 s, i.e. the motor deceleration is not controlled by the soft starter.

The Softstop function is particularly useful for pump applications, where long softstop times ($>$ 1 min) are needed to achieve controlled deceleration and to effectively suppress water knock.

6 Diagnostics

Warning!
Never open the unit when the mains power supply or the controller supply voltage is switched on, as fatal injury could otherwise result.

Troubleshooting

Motor does not start
Possible causes:

- Controller enable signal not present
- Start signal not present
- No mains voltage available
- Current limit too low
- Ramp time too long
- Start pedestal too low
- Mode parameter incorrect (In-Line, In-Delta, etc.)

Motor stops immediately after start
Possible causes:

- Shutdown due to error, e.g. overload, overtemperature
- Start signal temporarily interrupted. After the start, a softstop is initiated, even when a start signal is present again.

Motor running unevenly
Possible causes:

- Cos-φ optimization causes unstable behaviour with some motors

Motor absorbing excessive current
Possible causes:

- Ramp time too long
- Start pedestal too low
- Motor overload

Overcurrent shutdown by soft starter
Possible causes:

- Motor blocked
- Mismatched soft starter/motor combination
- Monitoring function incorrectly programmed in soft starter
- Motor too small

Connected motor is overheating
Possible causes:

- Ramp time too long
- Current limit too low
- Too many successive starts
- Heavy starting of motor not sufficiently taken into account in motor size selection

Error message and remedy

The following messages (except for those signalled by the LEDs) can be viewed only on the LCD keypad or queried through interface modules.

Error reset

Current error messages must be reset before the drive can be restarted. To reset messages, the softstart signal must be disabled. If the motor is controlled via the terminals using default settings, apply a Low signal to terminal E1; if the keypad is used, press the Stop key.

LEDs

If no LCD keypad or interface is connected to the soft starter, error messages are displayed by the LEDs on the front panel. The LCD keypad hides the LEDs. The remaining interfaces contain optical conductors, so that the information remains visible.

Red LED	Green LED	Operating status
Off	Off	Device is off
Off	Flashing	Supply OK, but no start signal
Off	On	Device working, thyristors activated
Flashing	Off	Error
On	On	Operation at current limit
Flashing 3 ×	Flashing 3 ×	Application selector switch operated, changes accepted
Flashing 3 ×	Off	Application selector switch operated with password set, changes not accepted

Monitoring messages The following messages are displayed in the LCD keypad.

Error messages at mains connection

Message	Error	Cause	Remedy
OverTemp.	Soft starter's heatsink overheated	Too many starts	Check configuration and dimensioning; observe pause times
		Current limit too low	Increase current limit
		Ramp time too long	Reduce ramp time
Thyristor	Fault in thyristor or its control circuit	Thyristor fault or control circuit failed, e.g. due to mains overvoltages or thermal overload	Contact manufacturer
		Mode parameter incorrectly set	Check connection type and adjust Mode parameter accordingly (In-Line, In-Delta, etc.)
Thy Shorted	Thyristor is always conducting	Thyristor was damaged, e.g. by mains overvoltages or thermal overload	Contact manufacturer
Thermistor	Motor thermistor has tripped	Motor is overheated	Observe pause times, check motor load, check number of motor starts, reduce ramp time, increase current limit
		If no thermistor is connected, the jumper between terminals T1 and T2 is missing	Fit jumper or set PNU 632 = 0 (Thermistor)

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Error messages during operation

Display messages	Error	Cause	Remedy
PhaseLoss	One or more phases missing on mains side	Fuse has blown	Change fuse
		Faulty wiring	Check wiring
OverTemp.	Soft starter's heatsink overheated	Too many starts	Check configuration and dimensioning; observe pause times
		Current limit too low	Increase current limit
		Ramp time too long	Reduce ramp time
Thyristor	Fault in thyristor or its control circuit	Thyristor fault or control circuit failed, e.g. due to mains overvoltages or thermal overload	Contact manufacturer
	Motor phase missing or thyristor always conducting	Open circuit in motor cable	Check wiring
Firing	Thyristor has not fired	Fault in thyristor	Contact manufacturer
Thy Shorted	Thyristor is always conducting	Thyristor was damaged, e.g. by mains overvoltages or thermal overload	Contact manufacturer
UnderCurrent	Not enough current flowing after top of ramp	Undercurrent and undercurrent time parameters are incorrectly programmed	Check plausibility of parameters
		Motor has no load, e.g. after belt breakage	Check mechanical components
Curr.Limit	Drive at set current limit for too long at start	Current limit too low, drive cannot accelerate	Increase current limit
		Ramp time too long, drive remains in high slippage range for too long and cannot accelerate	Reduce ramp time

Display messages	Error	Cause	Remedy
Overload	Motor protection function has responded after startup	Motor is overloaded	Check load; check mechanical components
		Motor is blocked	Check mechanical components
		Overload curve incorrectly parameterized	Check parameters in soft starter
OverCurr.max	Max. overcurrent exceeded	Motor is too large for soft starter	Check dimensioning
		Short-circuit on motor side	Check motor and motor cable
		Incorrect parameter settings	Check parameter settings

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7 Menu Structure/Operating Software

To use the menu structure, LCD keypad DE 4-KEY-2 or the DE 4-CFG-200 operating software and interface module DE 4-COM-2X are required. They are not part of the standard soft starter package content.

Menu structure

The operating menu contains several levels. The first level is the operating level. Here, start/stop commands can be issued and the present current viewed. The menu level is split into the main menus and submenus. Both of these can contain parameters and a variety of functions. The parameters themselves can contain variable values or values from a predefined list. For a detailed description of the individual parameters, see chapter “Defining Parameters” from Page 63.

To learn about how to use the keypad and navigate through the menus, see manual “DE 4-KEY-2 LCD Keypad” (AWB 8250-1344 GB).

The table below illustrates the menu structure with the menus and their parameters.

Main menu	Submenu	Parameter name on display	Short description of parameter	Page
Basic	–	Drive	Drive Type	68
		Startcommand	Start command selection	68
		Application		68
		U-Start [U-Start 2]	Start pedestal	69
		t-Start [t-Start 2]	Start time	69
		t-Stop [t-Stop 2]	Stop time	69
		Imax-Start [Imax-Start 2]	Current limit	69
		Language	Language selection	76
		Parameterset		69
Config	Control	Startcommand	Start command selection	68
		Operating mode	Operating mode	71
		Password	Set/reset password	72
		Parameterset		69
		PAR->KEY	Transfer parameters to keypad	76
		KEY->PAR	Transfer parameters from keypad	76
		PAR1/PAR2	Select parameter sets	76
	Misc	Language	Language selection	79
		Address	Device address	79
		Baudrate	Baudrate	79
		Bus error	Communication behaviour	80
		I_e	Nominal device current	79
		Init.Display	Initial display parameter	80

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Main menu	Submenu	Parameter name on display	Short description of parameter	Page
Functions	StartData	U-Start [U-Start 2]	Start pedestal	69
		t-Start [t-Start 2]	Start time	69
		U-Stop [U-Stop 2]	Stop pedestal	81
		t-Stop [t-Stop 2]	Stop time	69
		U-Stopramp [U-Stopramp2]	Stop ramp control	81
		Tmp t-Stop=0	Auto jog	81
		AutoU-Start [AutoU-Start2]	Auto pedestal	81
		AutoEndStart [AutoEndStrt2]	Auto end start	81
		AutoStopProf [AutoStopPrf2]	Auto stop	81
		AutoEndStop [AutoEndStop2]	Auto end stop	81
	Kickstart	U-Kick [U-Kick 2]	Kickstart voltage	84
		t-Kick [t-Kick 2]	Kickstart time	84
		Kickstart [Kickstart 2]	Kickstart	84
	Current	Imax-Start [Imax-Start 2]	Current limit for starting	69
		t-Imax [t-Imax 2]	Current limit time	85
		Imin [Imin 2]	Undercurrent	85
		t-Imin [t-Imin 2]	Undercurrent time	85
		Undercurrent [Undercurr.2]	Undercurrent reaction	85
		CurrentLimit [CurrentLim.2]	Current limit reaction	85

Main menu	Submenu	Parameter name on display	Short description of parameter	Page
Functions	cos-phi	t-Dwell [t-Dwell 2]	Dwell	88
		Rate	Optimizing rate	88
		Protection [Protection 2]	Protection	88
	Digital-In	E1-Pointer	Pointer to a PNU for E1	91
		E1-Logic	Input logic E1	91
		E2-Pointer	Pointer to a PNU for E2	91
		E2-Logic	Input logic E2	91
	Analog-In	Ref1	Ref 1	100
		Ref1-Pointer	Pointer to PNU for Ref 1	92
		Ref1 Level	Ref 1 level	92
		Ref1 Flag	Ref 1 level bit	98
		Ref2	Ref 2	100
		Ref2-Pointer	Pointer to PNU for Ref 2	92
		Ref2 Level	Ref 2 level	92
		Ref2 Flag	Ref 2 level bit	98
	Command 1	Enable	Enable	93
		Kickstart [Kickstart 2]	Kickstart	84
		CurrentLimit [CurrentLim.2]	Current limit reaction	85
		OverLoad [OverLoad 2]	Overload reaction	112
		OverCurrent [OverCurrent 2]	Overcurrent reaction	112
		Undercurrent [Undercurr.2]	Undercurrent reaction	85
		Thermistor [Thermistor 2]	Thermistor reaction	110

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Main menu	Submenu	Parameter name on display	Short description of parameter	Page
Functions	Command 2	U-Stopramp [U-Stopramp2]	Voltage-controlled stop ramp	81
		Invert Ref0 [Invert Ref0 2]	Invert reference	95
		OptionStart	Keypad start/stop	93
		TerminlStart	Terminal start/stop	93
		Run-Relay	Run relay	93
		PAR1/PAR2	Parameter set selection	76
		Tmp t-Stop=0	Overwrite stop ramp	81
	Command 3	Pf1-Logic	not used	94
		Pf2-Logic	not used	94
		Set Imax	Set current limit	94
		ExtFault	External fault	94
		AutoEndStop [AutoEndStop2]	Auto end stop	81
		AutoStopProf [AutoStopPrf2]	Auto stop	81
		AutoEndStart [AutoEndStrt2]	Auto end start	81
		AutoU-Start [AutoU-Start2]	Auto start pedestal	81
		AutoBypass [AutoBypass 2]	Detect connected bypass and automatically switch parameter protection to the value “Start+Bypass”	94
	PhaseControl	KI	Voltage regulator, -part	95
		Umax	Umax	95
		Invert Ref0 [InvertRef0 2]	Invert reference	95
		Ref0-Pointer	Pointer to reference	95
		FeedBackPntr	Feedback pointer	95
		KP (Mul)	Voltage regulator -part (gain)	95
		KP (Div)	Voltage regulator -part (divide)	95
		UserParametr	User parameter	95

Main menu	Submenu	Parameter name on display	Short description of parameter	Page
Indications	Device Data	Address	Device address	79
		Drive Type	Soft starter type	97
		Software Type	Software type	97
		Software Ver	Software version	97
		Software Dat	Software date	97
		I_e	Rated device current	97
	Status 1	Stopped	Unit stopped	97
		Ramp	Ramp function active	97
		Imax-Limit	Current limit	97
		Top of Ramp	Top of ramp	97
		t-Dwell off	Dwell	97
		Umax reached	Max. output voltage reached	98
		Optimising	Optimising	98
		Stop-Ramp	Stop ramp function active	98
	Status 2	Alarm	Alarm	98
		Overload>0	Overload	98
		Stalling	Stalling	98
		Full Load	Full load operation	98
		Noise	Noisy signal	98
		Ref1 Flag	Ref 1 level bit	98
		Ref2 Flag	Ref 2 level bit	98
	Status 3	Relay K1	Relay K1	98
		Relay K2	Relay K2	98
		Relay K3	Relay K3	98
		Relay K4	Relay K4	99
		Digi-In. E1	Digital input E1	99
		Digi-In. E2	Digital input E2	99

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Main menu	Submenu	Parameter name on display	Short description of parameter	Page
Displays	Status 4	50/60 Hz	50/60 Hz	99
		Rotation	Direction of rotation	99
		OverCurr.LIM	Overcurrent limit reached	99
		UnderCurr.LIM	Undercurrent limit reached	99
		Thermis.LIM	Thermistor	99
	Display	cos-phi ref	cos φ reference	99
		cos-phi	cos φ actual	99
		DelayAngle	Delay angle	99
		Max.Delay	Max. delay angle during optimizing	99
		Load current	Load current (in amperes)	100
		PeakCurrent	Peak load current (in amperes)	100
		Overload-Sum	Overload integrator	100
		T-Heatsink	Heatsink temperature	100
		Ref1	Ref 1	100
		Ref2	Ref 2	100
		ThermistorVal	Thermistor actual value	100
		Load	Load of unit (in multiples of $_e$)	100
		PeakLoad	Max. unit load (in multiples of $_e$)	100
	Analog-Out	AnOut1 Pntr	Pointer to PNU for Analog Out 1	100
		AnOut2 Pntr	Pointer to PNU for Analog Out 2	100
Monitoring	Relay K1	K1-Pointer	Pointer to PNU for K1	104
		K1-Logic	Output polarity K1	104
		K1-delaytime	Contact delay	104
	Relay K2	K2-Pointer	Pointer to PNU for K2	109
		K2-Logic	Output polarity K2	109
	Relay K3	K3-Pointer	Pointer to PNU for K3	109
		K3-Logic	Output polarity K3	109
	Relay K4	K4-Pointer	Pointer to PNU for K4	100
		K4-Logic	Output polarity K4	109

Main menu	Submenu	Parameter name on display	Short description of parameter	Page
Monitoring	Heatsink	T-Heatsink	Heatsink temperature	100
		Temp.Limit	Temperature limit	110
	Thermistor	ThermistrVal	Thermistor actual value	100
		Thermis.LIM	Thermistor status	99
		Thermistor [Thermistor 2]	Thermistor reaction	110
	Motorprotect	OverCurr.Max [OverCurrMax2]	Overcurrent limit	112
		t-Overcurr. [t-Overcurr2]	Overcurrent time	112
		OverCurrent [OverCurrent 2]	Overcurrent	112
		Overload max [OverloadMax2]	Overload limit	112
		t-Overload [t-Overload 2]	Overload delay	112
		Overload-Sum	Overload integrator	100
		OverLoad [Overload 2]	Overload	112
Trips	–	Trip-Sens.	Trip sensitivity	115
		TripHistory1	Last trip	115
		TripHistory2	2nd to last trip	115
		TripHistory3	3rd to last trip	115
		TripHistory4	4th to last trip	115
		TripHistory5	5th to last trip	115

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Special features of the LCD keypad

The soft starter uses the status display of the DE 4-KEY-2 LCD keypad as follows:

Status message	Use
RDY	The device is ready for operation. When a softstart command is issued, the softstart is initiated. The display is linked to the Enable message.
IMP	The power section is disabled and the flow of current interrupted. The display is linked to the Run Relay message. Caution! Due to leakage current, the output side is always live!
Imax	Is lit during the start when the drive has reached the set current limit. When ramping is completed, this message goes out, even if the current limit is exceeded. This is because the current limiting function applies only to the softstart, not for continuous operation. The display is linked to the Imax-Limit message.
Mmax	Top of ramp reached; voltage is applied to the motor. The motor is now able to deliver its maximum torque. The display is linked to the Top of Ramp message.
Fault	An error message was issued.

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Appendix

Standards

Standard type	Standard	Title	Limit values
Mounting	IP 20 to EN 60 947-1 (EN 60 529)		
Interference immunity	IEC 1000-4-2	Electrostatic discharge	6 kV air discharge, 8 kV contact discharge
	IEC 1000-4-3	Electromagnetic fields Frequency range 80 to 1000 MHz	10 V/m
	IEC 1000-4-6	High frequency field Frequency range 0.15 to 80 MHz, 80 % amplitude-modulated	140 dB µV
	IEC 1000-4-4	Fast transients, burst to power terminals	2 kV/5 kHz
		Burst on bus and control cables	2 kV/5 kHz
	IEC 1000-4-5	Surge voltage test, mains power cable	2 kV phase ground 1 kV phase ground
Emission	EN 60 947-4-2	Radio interference, housing and mains	Class A for use in industrial environments
			Class B with bypass contactor for use in residential environments
Insulation resistance	Insulation resistance test to EN 60 947-1 Annex K		
Admissible pollution	Degree of pollution 2 to EN 60 947-1		
Admissible humidity	Relative humidity 85 %, non-condensing		

Technical data

	DM 4-340-...									
	...-7K5	...-11K	...-15K	...-22K	...-30K	...-37K	...-45K	...-55K	...-75K	...-90K
Main contacts										
Rated operating voltage [V]	230 to 460 V AC				230 to 460 V AC					
Rated insulation voltage U_i [V]	460 V AC				460 V AC					
Mains frequency [Hz]	50/60 Hz				50/60 Hz					
Voltage supply, control section [V]	110/230 V AC				110/230 V AC					
Rated operating current I_e AC-53 [A]	16	23	30	44	59	72	85	105	146	174
Assigned motor rating (standard connection)										
230 V [kW]	4	5.5	7.5	11	15	18.5	22	30	37	45
400 V [kW]	7.5	11	15	22	30	37	45	55	75	90
460 V [HP]	10	15	20	30	40	50	60	75	100	125
Phase current at In-Delta connection [A]	27	39	51	76	102	124	147	181	252	301
Assigned motor rating (In-Delta connection)										
230 V [kW]	7.5	11	15	22	30	37	45	55	75	90
400 V [kW]	11	15	22	37	55	55	75	90	132	160
460 V [HP]	20	25	30	50	75	100	100	150	200	250

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	DM 4-340-...											
	...-7K5	...-11K	...-15K	...-22K	...-30K	...-37K	...-45K	...-55K	...-75K	...-90K		
General												
Standards and regulations	IEC/EN 60 947-4-2											
Climatic proofing	Damp heat, cyclic, to DIN IEC 60 068 Part 2-10, Damp heat, constant, to DIN IEC 60 068 Part 2-3											
Ambient temperature	0 to 40 °C, to 60 °C with reduction of I_e of 2 % per °C											
Storage temperature	–25 to +55 °C											
Installation height	0 to 1000 m, up to 2000 m with a current drop of 1 % per 100 m											
Mounting position	Vertical											
Protection class	IP 20											
Protection against accidental contact	Back-of-hand and finger-proof											
Degree of pollution	2											
Power dissipation at rated operating current I_e [W]	50	63	91	120	152	190	227	276	380	452		
Dimensions (W × H × D) [mm]	222 × 290 ×195				222 × 290 ×195		222 × 420 × 195			520 × 338 × 248		
Weight [kg]	6.7				6.7		15			15.7		
Cable cross-sections												
Power cables							M8 stud for cable lug					
Solid [mm^2]	1 × (1.5 to 16, AWG 16 to 6)× (1 to 4, AWG 17 to 12				1 × (4 to 35, AWG 12 to 2) × (4 to 10, AWG 12 to 8)		–					
Flexible with ferrule/cable lug [mm^2]	1 × (1 to 16, AWG 17 to 6); 2 × (1 to 4, AWG 17 to 14)				1 × (6 to 35, AWG 10 to 2); 2 ×(6 to 10, AWG 10 to 8)		–/35 to 95					
Stranded/ with cable lug [mm^2]	1 × (2.5 to 25, AWG 13 to 4); 2 × (2.5 to 4, AWG 13 to 12)				1 × (10 to 50, AWG 8 to 1/0); 2 × 10 (AWG 8)		–/50 to 120					
Solid or stranded												
Min. AWG	12				10		1-0					
Max. AWG	4				1		250 MCM					
Band [mm]	–				–		6 × 16 × 0.8					
Tightening torque [Nm]	1.2				2.5		12					
Screwdriver [mm]	0.8 × 4				1.2 × 6.5		–					

	DM 4-340-...					
	...-7K5	...-11K	...-15K	...-22K	...-30K	...-37K
Control cables						
Solid [mm^2]	1 or 2 × (0.75 to 2.5, AWG 18 to 13)				1 or 2 × (0.75 to 2.5, AWG 18 to 13)	
Flexible with ferrule [mm^2]	1 or 2 × (0.75 to 2.5, AWG 18 to 13)				1 or 2 × (0.75 to 2.5, AWG 18 to 13)	
Stranded [mm^2]	1 or 2 × (0.75 to 2.5, AWG 18 to 13)				1 or 2 × (0.75 to 2.5, AWG 18 to 13)	
Solid or stranded						
Min. AWG	22				22	
Max. AWG	12				12	
Band [mm]	–				–	
Tightening torque [Nm]	0.5				0.5	
Screwdriver [mm]	0.6 × 3.5				0.6 × 3.5	
Control circuit						
Current consumption of controller supply	110 V/0.15 A; 230 V/0.07 A				110 V/0.15 A; 230 V/0.07 A	
Current consumption of inputs						
Digital inputs	24 V/0.45 mA; 230 V/4.5 mA				24 V/0.45 mA; 230 V/4.5 mA	
Analog inputs	10 V/1 mA				10 V/1 mA	
Pick-up voltage						
DC-operated	+12 to +230 V DC				+12 to +230 V DC	
AC-operated	+24 to 230 V AC				+24 to 230 V AC	
Drop-out voltage						
DC-operated	0 to +3 V DC				0 to +3 V DC	
AC-operated	0 to 3 V AC				0 to 3 V AC	

DM 4-340-...				
...-45K	...-55K	...-75K	...-90K	
				Control cables
1 or 2 × (0.75 to 2.5, AWG 18 to 13)				Solid [mm^2]
1 or 2 × (0.75 to 2.5, AWG 18 to 13)				Flexible with ferrule [mm^2]
1 or 2 × (0.75 to 2.5, AWG 18 to 13)				Stranded [mm^2]
				Solid or stranded
22				Min. AWG
12				Max. AWG
–				Band [mm]
0.5				Tightening torque [Nm]
0.6 × 3.5				Screwdriver [mm]
				Control circuit
110 V/0.15 A; 230 V/0.07 A				Current consumption of controller supply
				Current consumption of inputs
24 V/0.45 mA; 230 V/4.5 mA				Digital inputs
10 V/1 mA				Analog inputs
				Pick-up voltage
+12 to +230 V DC				DC-operated
+24 to 230 V AC				AC-operated
				Drop-out voltage
0 to +3 V DC				DC-operated
0 to 3 V AC				AC-operated

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	DM 4-340-...			
	...-7K5	...-11K	...-15K	...-22K
Programmable relay outputs				
Number	4			
Voltage range [V]	250 V AC			
Current range [A]	3 A, AC11			
Programmable analog outputs				
Number	2			
Voltage range [V]	0 to 10 V DC			
Current range [A]	4 to 20 mA			
Softstart functions				
Ramp times				
Acceleration [s]	1 to 255			
Delay [s]	0 to 255			
Start pedestal (= stop pedestal) [V]	10 % to 60 %			
Voltage drop at stop [V]	0 % to 100 %			
Kickstart				
voltage [V]	60 % to 90 %			
Duration				
50 Hz	200 to 800 ms			
60 Hz	166 to 664 ms			
Current limit [A]	1 to 8 I_e			

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...-30K	...-37K	...-45K	...-55K	...-75K	...-90K
4					
250 V AC					
3 A, AC11					
2					
0 to 10 V DC					
4 to 20 mA					
1 to 255					
0 to 255					
10 % to 60 %					
0 % to 100 %					
60 % to 90 %					
200 to 800 ms					
166 to 664 ms					
1 to 8 I_e					

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	DM 4-340-...							
	...-110K	...-132K	...-160K	...-200K	...-250K	...-315K	...-400K	...-500K
Main conducting paths								
Rated operating voltage [V]	230 to 460 V AC				230 to 460 V AC			
Rated insulation voltage U_i [V]	460 V AC				460 V AC			
Mains frequency [Hz]	50/60 Hz				50/60 Hz			
Voltage supply, control section [V]	110/230 V AC				110/230 V AC			
Rated operating current I_e AC-53 [A]	202	242	300	370	500	600	750	900
Assigned motor rating (standard connection)								
230 V [kW]	55	75	90	110	132	160	200	250
400 V [kW]	110	132	160	200	250	315	400	500
460 V [HP]	150	200	250	300	400	500	600	750
Phase current at In-Delta connection [A]	349	419	519	640	866	1039	1299	1558
Assigned motor rating (In-Delta connection)								
230 V [kW]	110	132	160	200	250	315	400	500
400 V [kW]	160	200	250	315	400	560	750	900
460 V [HP]	250	350	400	500	600	750		

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	DM 4-340-...							
	...-110K	...-132K	...-160K	...-200K	...-250K	...-315K	...-400K	...-500K
General								
Standards and regulations	IEC/EN 60 947-4-2				IEC/EN 60 947-4-2			
Climatic proofing	Damp heat, cyclic, to DIN IEC 60 068 Part 2-10, Damp heat, constant, to DIN IEC 60 068 Part 2-3				Damp heat, cyclic, to DIN IEC 60 068 Part 2-10, Damp heat, constant, to DIN IEC 60 068 Part 2-3			
Ambient temperature	0 to 40 °C, to 60 °C with reduction of I_e of 2 % per °C				0 to 40 °C, to 60 °C with reduction of I_e of 2 % per °C			
Storage temperature	–25 to +55 °C				–25 to +55 °C			
Installation height	0 to 1000 m, up to 2000 m with a current drop of 1 % per 100 m				0 to 1000 m, up to 2000 m with a current drop of 1 % per 100 m			
Mounting position	Vertical				Vertical			
Protection class	IP 20				IP 20			
Protection against accidental contact	Back-of-hand and finger-proof				Back-of-hand and finger-proof			
Degree of pollution	2							
Power dissipation at rated operating current I_e [W]	545	662	795	925	1371	1705	2106	2775
Dimensions (W × H × D) [mm]	338 × 520 × 248				640 × 610 × 375			
Weight [kg]	15.7	22	22	22	56	65	72	72
Cable cross-sections								
Power cables	M8 stud for cable lug				2 × M12 screws for cable lug		2 × M12 screws for rail connection	
Solid [mm^2]	–				–			
Flexible with cable lug [mm^2]	2 × (35 to 95, AWG 2 to 4/0)				2 × (50 to 240, AWG 1/0 to 500.000)		–	
Stranded with cable lug [mm^2]	2 × (50 to 120, AWG 1/0 to 250.000)				2 × (70 to 240, AWG 2/0 to 500.000)		–	
Solid or stranded								
Min. AWG	2 × 1/0				2 × 2/0		–	
Max. AWG	2 × 250 MCM				2 × 500 MCM		–	
Band [mm]	6 × 16 × 0.8				2 × (10 × 21 × 1)		–	
Copper rail [mm]	–				30 × 10		45 × 20; 60 × 10; 80 × 10	
Tightening torque [Nm]	12				24			

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	DM 4-340-...							
	...-110K	...-132K	...-160K	...-200K	...-250K	...-315K	...-400K	...-500K
Control cables								
Solid [mm^2]	1 × (0.75 to 2.5, AWG 18 to 13)				1 × (0.75 to 2.5, AWG 18 to 13)			
Flexible with ferrule [mm^2]	1 × (0.75 to 2.5, AWG 18 to 13)				1 × (0.75 to 2.5, AWG 18 to 13)			
Stranded [mm^2]	1 × (0.75 to 2.5, AWG 18 to 13)				1 × (0.75 to 2.5, AWG 18 to 13)			
Solid or stranded								
Min. AWG	22				22			
Max. AWG	12				12			
Band [mm]	–				–			
Tightening torque [Nm]	0.5				0.5			
Screwdriver [mm]	0.6 × 3.5				0.6 × 3.5			
Control circuit								
Current consumption of controller supply	110 V/0.15 A; 230 V/0.07 A				110 V/1.4 A; 230 V/0.8 A			
Current consumption of inputs								
Digital inputs	24 V/0.45 mA; 230 V/4.5 mA				24 V/0.45 mA; 230 V/4.5 mA			
Analog inputs	10 V/1 mA				10 V/1 mA			
Pick-up voltage								
DC-operated	+12 to +230 V DC				+12 to +230 V DC			
AC-operated	+24 to 230 V AC				+24 to 230 V AC			
Drop-out voltage								
DC-operated	0 to +3 V DC				0 to +3 V DC			
AC-operated	0 to 3 V AC				0 to 3 V AC			

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	DM 4-340-...			
	...-110K	...-132K	...-160K	...-200K
Programmable relay outputs				
Number	4			
Voltage range [V]	250 V AC			
Current range [A]	3 A, AC11			
Programmable analog outputs				
Number	2			
Voltage range [V]	0 to 10 V DC			
Current range [A]	4 to 20 mA			
Softstart functions				
Ramp times				
Acceleration [s]	1 to 255			
Delay [s]	0 to 255			
Start pedestal (= stop pedestal) [V]	10 % to 60 %			
Voltage drop at stop [V]	0 % to 100 %			
Kickstart				
voltage [V]	60 % to 90 %			
Duration [s]				
50 Hz	200 to 800 ms			
60 Hz	166 to 664 ms			
Current limit [A]	1 to 8 I_e			

...-250K	...-315K	...-400K	...-500K
4			
250 VAC			
3 A, AC11			
2			
0 to 10 V DC			
4 to 20 mA			
1 to 255			
0 to 255			
10 % to 60 %			
0 % to 100 %			
60 % to 90 %			
200 to 800 ms			
166 to 664 ms			
1 to 8 I_e			

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Control inputs/ outputs

Terminal	Function	Default	Current consumption/ Load rating
Digital inputs			
E1	Programmable control input	Start/stop	24 V DC/0.45 mA 230 V AC/4.5 mA
E2	Programmable control input	Enable	
39	0 V reference for E1 and E2		
Analog inputs			
8	Setpoint 0 to 10 V DC		10 V DC/1 mA 5 V AC/0.4 mA
1	Setpoint 4 to 20 mA		
7	0 V reference for terminal +12, 1, 8, 62 and 63		
Analog outputs			
62	Programmable analog output	Output current	0 to 10 V DC, 10 mA
63	Programmable analog output	Delay angle	0 to 10 V DC, 10 mA
7	0 V reference for terminal +12, 1, 8, 62 and 63		
Relay outputs			
13	Programmable make contact K1	OK	230 V AC, 3 A, AC11
14	Supply to K1		
23	Programmable make contact K2	TOR – top of ramp/ ramp end	
24	Supply to K2		
33	Programmable make contact K3	Alarm	
34	Supply to K3 and K4		
35	Programmable make contact K4	Overload operation	
Thermistor input			
T1	Thermistor input to IEC 60 034-11	Not active	
T2			

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Overload rating

The table below shows the overload rating of the soft starter according to product standard IEC/ EN 60 947-4-2.

DM 4-340-...	Overcurrent X	Overcurrent duration Tx [s]	Duty factor F [%]	Starts per hour S	Off
Overload rating without bypass (loading to AC-53a)					
...-7K5 to -55K	3	35	99	10	–
	5	4	99	10	–
...-75K to -90K	3	35	99	10	–
	4	6	99	10	–
...-110K to -132K	3	35	60	10	–
	4	6	60	10	–
...-160K to -500K	3	35	60	3	–
	4	6	60	3	–
Overload rating with bypass (loading to AC-53b)					
...-7K5 to -55K	3	35	–	–	120
	5	4	–	–	120
...-75K to -90K	3	35	–	–	120
	4	6	–	–	120
...-110K to -132K	3	35	–	–	360
	4	6	–	–	360
...-160K to -500K	3	35	–	–	360
	4	6	–	–	360

X = Level of basic overcurrent in multiples of the device rated current

Tx = Duration of overcurrent in seconds

F = Duty factor within the load cycle in %

S = Number of starts per hour

Off = Minimum (zero current) time between two starts in seconds

Conversion of overload rating to lowest overcurrents

The specified cycle can be converted for lower overcurrents according to the formula below, but not for higher ones.

$$Tx_{new} = \frac{X^2 \times Tx}{X_{new}^2}$$

X_{new} = Required overcurrent
(must be less than the specified values)

Tx_{new} = New admissible time for the new overcurrent X_{new}

Example:

for X = 3, Tx = 35 s; calculate Tx for X = 2.5

$$Tx_{new} = \frac{3{,}5^2 \times 35\ s}{2{,}5^2} = 50\ s$$

Other overload cycles/operating frequencies on request.

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Parameters/Equipment

Abbreviation	Use
PNU	Parameter number
PNU 000 [2000]	Parameter can have different values in parameter set 1 and parameter set 2. The PNU for parameter set 2 is given in square brackets.
PNU 000	Parameter always has the same value in parameter set 1 and parameter set 2, but is shown only in parameter set 1.
(= $\overline{\text{PNU 000}}$)	Parameter has the inverse state of the specified parameter.
✓	Available
%	not applicable/not used
ONLINE	Direct transfer of values
SH + PRG	Values accepted when SHIFT + PRG is pressed
SH + PRG/dis	Values accepted when controller disable active and SHIFT + PRG is pressed
rw	Parameter has read/write access
ro	Parameter is read-only
w=exe	Parameter is a command; can only be executed (save = execute)

Parameter types

The following parameter types are defined. You will need this information for data transmission through an interface.

Model	Use
Fix32	The parameter value is a 32 bit integer. It is represented as a number with fixed decimal point and four decimal places. To determine the value to be sent to the soft starter, multiply this value with 10000. The integer component of the result is the transferred value, e.g. Transfer 37.8473933 -> × 10000 = 378473.933 -> INT -> send 378473 Transfer 1 -> × 10000 = 10000 -> INT -> send 10000 The digits after the decimal point are omitted. The same encoding is used for transmission from soft starter to programmable controller. The sent integer value must be divided by 10,000 to obtain the actual parameter value.
Int16	The parameter value is stored as a 16 bit integer. No conversions are necessary.
Bit16	The data is a 16 bit string. The data is coded bitwise (status bit, control bits).

Parameter table (PNU)

PNU	Parameter name on display
1	Startcommand
2	KEY->PAR
3	KEY->PAR
4	Init.Display
5	Password
6	Mode
7	Protection
[2007]	[Protection 2]
9	Address
11	U-Start
[2011]	[U-Start 2]
12	t-Start
[2012]	[t-Start 2]
13	U-Kick
[2013]	[U-Kick 2]
14	t-Kick
[2014]	[t-Kick 2]
15	t-Dwell
[2015]	[t-Dwell 2]
16	U-Stop
[2016]	[U-Stop 2]
17	t-Stop
[2017]	[t-Stop 2]
19	Rate
20	cos-phi ref
21	cos-phi
22	Delay angle
23	Max.Delay
24	Ie
26	LoadCurrent

PNU	Parameter name on display
27	PeakCurrent
28	Imin
[2028]	[Imin 2]
29	t-Imin
[2029]	[t-Imin 2]
30	Imax-Start
[2030]	[Imax-Start 2]
31	t-Imax
[2031]	[t-Imax 2]
32	OverCurr.max
[2032]	[OverCurrMax2]
33	t-Overcurr.
[2033]	[t-Overcurr.2]
34	Overload max
[2034]	[OverloadMax2]
35	t-Overload
[2035]	[t-Overload 2]
36	Overload-Sum
37	T-Heatsink
40	Enable
41	Ref2 Level
42	ThermistorVal
43	Ref2
44	Temp.Limit
45	Ref2-Pointer
46	Ref1
47	Ref1-Pointer
48	Ref1 Level
49	AnOut1 Pntr
50	AnOut2 Pntr

PNU	Parameter name on display
55	Load
56	PeakLoad
57	K1-Pointer
59	K2-Pointer
61	K3-Pointer
62	Parameterset
63	K4-Pointer
65	E1-Pointer
66	Language
67	E2-Pointer
71	K1-delaytime
72	Trip-Sens.
93	Drive Type
99	Software Ver
105	Ref0-Pointer
106	FeedBackPntr
107	KP (Mul)
108	KP (Div)
109	KI
110	Umax
111	UserParametr
113	Drive
115	Application
125	Baud rate
126	Bus Error
135	ComCommandW
150	ComStatusW
161	TripHistory1
162	TripHistory2
163	TripHistory3

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PNU	Parameter name on display
164	TripHistory4
165	TripHistory5
200	Software Type
201	Software Dat
600	Stopped
601	Ramp
602	Imax-Limit
603	Top of Ramp
604	t-Dwell off
605	Umax reached
606	Optimising
607	Stop-Ramp
608	Alarm
609	Overload>0
610	Stalling
611	Full Load
612	Noise
614	Ref1 Flag
615	Ref2 Flag
616	Relay K1
617	Relay K2
618	Relay K3
619	Relay K4
620	Digi-In. E1
621	Digi-In. E2
622	50/60 Hz
623	Rotation
624	OverCurr.LIM
625	UnderCurr.LIM
626	Thermis.LIM

PNU	Parameter name on display
627	Kickstart
[2627]	[Kickstart 2]
628	CurrentLimit
[2628]	[CurrentLim.2]
629	OverLoad
[2629]	[Overload 2]
630	OverCurrent
[2630]	[OverCurrent 2]
631	UnderCurrent
[2631]	[Undercurr.2]
632	Thermistor
[2632]	[Thermistor 2]
633	Not Enable
634	U-Stopramp
[2634]	[U-Stopramp2]
635	Invert Ref0
[2635]	[InvertRef0 2]
636	OptionStart
637	TerminlStart
638	Run-Relay
639	PAR1/PAR2
640	Tmp t-Stop=0
641	Pf1-Logic
642	Pf2-Logic
643	Set Imax
644	ExtFault
645	AutoEndStop
[2645]	[AutoEndStop2]
646	AutoStopProf
[2646]	[AutoStopPrf2]

PNU	Parameter name on display
647	AutoEndStart
[2647]	[AutoEndStrt2]
648	AutoU-Start
[2648]	[AutoU-Start2]
649	K1-Logic
650	K2-Logic
651	K3-Logic
652	K4-Logic
653	E1-Logic
654	E2-Logic
655	AutoBypass
[2655]	[AutoBypass 2]

Parameter table (alphabetic)

Parameter name on display	PNU	Brief description of parameter	Permissible values/meaning
50/60 Hz	622	50/60 Hz	0 = 50 Hz
			1 = 60 Hz
Address	9	Device address	1 to 99
Alarm	608	Alarm	0 = Normal operation
			1 = Soft starter fault
AnOut1 Pntr	49	Pointer to PNU for Analog Out 1	0; 20 to 111
AnOut2 Pntr	50	Pointer to PNU for Analog Out 2	0; 20 to 111
Application	115		0 = Standard
			1 = Breakaway torque
			2 = Small pump
			3 = Large pump
			4 = Light conveyor
			5 = Heavy conveyor
			6 = Low inertia fan
			7 = High inertia fan
			8 = Reciprocating compressor
			9 = Screw compressor
AutoBypass [AutoBypass 2]	655 [2655]	Detect connected bypass and automatically switch parameter protection to Start+Bypass	0 = Off
			1 = On
AutoEndStart [AutoEndStrt2]	647 [2647]	Auto end start	0 = Off
			1 = Automatic end of start ramp when TOR reached prematurely
AutoEndStop [AutoEndStop2]	645 [2645]	Auto end stop	0 = Off
			1 = Automatic end of stop ramp
AutoEndStop [AutoEndStop2]	646 [2646]	Auto stop	0 = Off
			1 = Load-dependent reduction of soft-stop voltage

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Value selection on display	Data type	Access rights	Accept-ance	Default	Main menu	Submenu	Page
50 Hz	Fix32	ro	%		Indications	Status 4	99
60 Hz							
1 to 99	Fix32	rw	SH + PRG	1	Indications	Device Data	79
					Config	Misc	79
No	Fix32	ro	%		Indications	Status 2	98
Yes							
Text-List	Fix32	rw	SH + PRG	26 = Load current	Indications	Analog Out	100
Text-List	Fix32	rw	SH + PRG	22 = Delay angle	Indications	Analog Out	100
Standard	Fix32	rw	SH + PRG/ dis	0	Basic		68
High torque							
Pump							
Pump W.Kick							
LightConvey							
HeavyConvey							
LowInert.Fan							
HighInertFan							
RecipCompres							
ScrewCompres							
Off	Fix32	rw	SH + PRG	1	Functions	Command 3	94
On							
Off	Fix32	rw	SH + PRG	0	Functions	StartData	81
On						Command 3	81
Off	Fix32	rw	SH + PRG	0	Functions	StartData	81
On						Command 3	81
Off	Fix32	rw	SH + PRG	1	Functions	StartData	81
On						Command 3	81

Parameter name on display	PNU	Brief description of parameter	Permissible values/meaning
AutoU-Start [AutoU-Start2]	648 [2648]	Auto start pedestal	0 = Off
			1 = Automatic start pedestal adaption
Baudrate	125	Baud rate	0 to 4
Bus Error	126	Communication behaviour	0 = Continue
			1 = Disable with error message
ComCommandW	135	ComCommandW Bit 3 = PNU 603 Bit 9 = PNU 40 = PNU 633 Bit 12 = PNU 639	Bit 3= 0: softstart (Run) = 1: softstop (Stop)
			Bit 9= 0: enable = 1: disable
			Bit 12= 0: PAR1 = 1: PAR2
ComStatusW	150	ComStatusW Bit 0 = PNU 639 Bit 1 = PNU 600 Bit 2 = PNU 602 Bit 3 = PNU 601 Bit 14 = PNU 633	Bit 0= 0: PAR1 = 1: PAR2
			Bit 1= 0: motor running = 1: motor stopped
			Bit 2= 0: below current limit = 1: current limit PNU 30 reached
			Bit 3= 0: in Ramp or Stop = 1: TOR
			Bit 4= 0: starter in Ramp = 1: starter not in Ramp
			Bit 6= 0: running = 1: stopped
			Bit 7= 0: enabled = 1: disabled
			Bit 8 to 11: device status = 0: initializing = 3: disabled (PNU 40 = 0) = 6: enabled (PNU 40 = 1) = 7: warning message issued = 8: error = 15: DM 4 switched off (only at external supply of interface modules)
			Bit 14= 0: Clockwise rotation = 1: anticlockwise rotation
			Bit 15= 0: not ready for operation = 1: ready for operation

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Value selection on display	Data type	Access rights	Accept-ance	Default	Main menu	Submenu	Page
Off	Fix32	rw	SH + PRG	0	Functions	StartData	81
On						Command 3	81
0 to 4	Fix32	rw	SH + PRG	0	Config	Misc	79
Continue	Fix32	rw	SH + PRG	0	Config	Misc	80
Shutdown							
	Bit16	rw			Without		118
	Bit16	ro			Without		118

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Parameter name on display	PNU	Brief description of parameter	Permissible values/meaning
cos-phi	21	cos φ actual value	0 to 146°
cos-phi ref	20	cos φ reference	0 to 146°
Curr.Limit [CurrentLim.2]	628 [2628]	Current limit	0 = Continue ramp
			1 = Disable with error
Delay angle	22	Delay angle	0 to 146°
Digi-In. E1	620	Digital input E1	0 = Input signal is Low
			1 = Input signal is High
Digi-In. E2	621	Digital input E2	0 = Input signal is Low
			1 = Input signal is High
Disable	633	Inverted Enable signal	0 = Enable
			1 = Disable
Drive	113	Drive Type	
Drive Type	93	Soft starter type	10
E1-Logic	653	Input logic E1	0 = Low for active
			1 = High for active
E1-Pointer	65	Pointer to a PNU for E1	0; 600 to 655
E2-Logic	654	Input logic E2	0 = Low for active
			1 = High for active
E2-Pointer	67	Pointer to a PNU for E2	0; 600 to 655
ExtFault	644	External fault	0= No fault
			1 = external fault
Enable	40	Enable	0 = Disable
			1 = Enable
FeedBackPntr	106	Feedback pointer	0; 20 to 111
Full Load	611	Full load operation	0 cos-φ optimization can be activated
			1 = Due to high load, cos-φ optimization cannot be activated, even if selected.

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Value selection on display	Data type	Access rights	Accept-ance	Default	Main menu	Submenu	Page
0 to 146°	Fix32	ro	%		Indications	Display	99
0 to 146°	Fix32	ro	%		Indications	Display	99
Continue	Fix32	rw	SH + PRG	1	Functions	Command 1	85
Shutdown						Current	85
0 to 146°	Fix32	ro	%		Indications	Display	99
Low	Fix32	ro	%		Indications	Status 3	99
High							
Low	Fix32	ro	%		Indications	Status 3	99
High							
Enabled	Fix32	rw		0	Without		118
Disabled							
Text	String	ro	%		Basic		68
10	Fix32	ro	%		Indications	Device Data	97
Low = active	Fix32	rw	SH + PRG	1	Functions	Digital-In	91
High = active							
Text-List	Fix32	rw	SH + PRG	637	Functions	Digital-In	91
Low = active	Fix32	rw	SH + PRG	0	Functions	Digital-In	91
High = active							
Text-List	Fix32	rw	SH + PRG	633	Functions	Digital-In	91
No	Fix32	rw	SH + PRG	0	Functions	Command 3	94
Yes							
Disabled	Fix32	rw	Online	1	Functions	Command 1	93, 26
Enabled							
Text-List	Fix32	rw	SH + PRG	26	Functions	PhaseControl	95
No	Fix32	ro	%		Indications	Status 2	98
reached							

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Parameter name on display	PNU	Brief description of parameter	Permissible values/meaning
Ie	24	Rated device current	5 to 2000 A
Imax-Limit	602	Curr.Limit	0 = Current limit from PNU 30 (= Imax-Start) reached
			1 = Output current below value from PNU 30
Imax-Start [Imax-Start 2]	30 [2030]	Current limit	0.5 to 8.0 I_e
Imin [Imin 2]	28 [2028]	Undercurrent limit	0.00 to 1.00 I_e
Init.Display	4	Initial display parameter	0; 20 to 111
Invert Ref0 [InvertRef0 2]	635 [2635]	Invert reference	0 = Do not invert
			1 = Invert reference
K1-Logic	649	Output polarity K1	0 =Low signal triggers switching
			1 = High signal triggers switching
K1-Pointer	57	Pointer to PNU for K1	0; 600 to 655
K1-delaytime	71	Contact delay	20 to 800 ms
K2-Logic	650	Output polarity K2	0 = Low signal triggers switching
			1 = High signal triggers switching
K2-Pointer	59	Pointer to PNU for K2	0; 600 to 655
K3-Logic	651	Output polarity K3	0 =Low signal triggers switching
			1 = High signal triggers switching
K3-Pointer	61	Pointer to PNU for K3	0; 600 to 655
K4-Logic	652	Output polarity K4	0 = Low signal triggers switching
			1 = High signal triggers switching
K4-Pointer	63	Pointer to PNU for K4	0; 600 to 655
KEY->PAR	2	Transfer parameters from keypad	20 = Execute
KI	109	Voltage regulator, I-part	0 to 50
Kickstart [Kickstart 2]	627 [2627]	Kickstart	0 = Off
			1 = Activate kickstart

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Value selection on display	Data type	Access rights	Accept-ance	Default	Main menu	Submenu	Page
5 to 2000 A Adjustments only by Moeller service	Int16	rw	SH + PRG/ dis	Device-dependent	Indications	Device Data	97
					Config	Misc	97
reached	Fix32	ro	%		Indications	Status 1	97
not reached							
0.5 to 8.0 I_e	Fix32	rw	Online	3.5 I_e	Basic		69
					Functions	Current	69
0.00 to 1.00 I_e	Fix32	rw	SH + PRG	0.09 I_e	Functions	Current	85
Text-List	Fix32	rw	SH + PRG	26	Config	Misc	80
MaxIn=MaxOut	Fix32	rw	SH + PRG	1	Functions	PhaseControl	95
MaxIn=MinOut						Command 2	95
Low = On	Fix32	rw	SH + PRG	1	Monitoring	Relay K1	104
High = On							
Text-List	Fix32	rw	SH + PRG	638	Monitoring	Relay K1	104
20 to 800 ms	Fix32	rw	Online	160 ms	Monitoring	Relay K1	104
Low = On	Fix32	rw	SH + PRG	1	Monitoring	Relay K2	109
High = On							
Text-List	Fix32	rw	SH + PRG	603	Monitoring	Relay K2	109
Low = On	Fix32	rw	SH + PRG	1	Monitoring	Relay K3	109
High = On							
Text-List	Fix32	rw	SH + PRG	608	Monitoring	Relay K3	109
Low = On	Fix32	rw	SH + PRG	1	Monitoring	Relay K4	109
High = On							
Text-List	Fix32	rw	SH + PRG	609	Monitoring	Relay K4	109
Execute	%	w=exe	SH + PRG/ dis		Config	Control	76
0 to 50	Fix32	rw	Online	10	Functions	PhaseControl	95
Off	Fix32	rw	SH + PRG	0	Functions	Kickstart	84
On						Command 1	84

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Parameter name on display	PNU	Brief description of parameter	Permissible values/meaning
KP (Div)	108	Voltage regulator, P-part (divide)	1 to 255
KP (Mul)	107	Voltage regulator P-part (gain)	1 to 255
Language	66	Language selection	44 = English
			49 = German
Load	55	Device load (in multiples of I_e)	0.0 to 8.0 I_e
LoadCurrent	26	Load current (in amperes)	0 to 2000 A
Max.Delay	23	Max. optimization, max. delay angle at optimization	17 to 146°
Mode	6	Operating mode	0 = Soft starter In-Line
			1 = Soft starter In-Delta
			2 = Closed-loop phase control
			3 = Open-loop phase control
Noise	612	Noise	0 = Soft starter working correctly
			1 = excessive external interference voltage
Optimising	606	Optimising	0 = cos φ not active
			1 = cos φ active
OptionStart	636	Keypad start/stop	0 = No signal/ Option not fitted
			1 = Start signal
OverCurrent [OverCurrent 2]	630 [2630]	OverCurrent	0 = Off
			1 = Disable with error
OverCurr.LIM	624	Overcurrent limit reached	0 = Off
			1 Overcurrent reached and still flowing
OverCurr.max [OverCurrMax2]	32 [2032]	Overcurrent limit	1.0 to 5.0 I_e
Overload [Overload 2]	629 [2629]	Overload	0 = Off
			1 = Disable with error
Overload max [OverloadMax2]	34 [2034]	Overload limit	0.6 to 2.0 I_e

Value selection on display	Data type	Access rights	Accept-ance	Default	Main menu	Submenu	Page
1 to 255	Fix32	rw	Online	7	Functions	PhaseControl	95
1 to 255	Fix32	rw	Online	37	Functions	PhaseControl	95
English	Fix32	rw	SH + PRG/ dis	49	Basic		76
Deutsch					Config	Misc	79
0.0 to 8.0 I_e	Fix32	ro	%		Indications	Display	100
0 to 2000 A	Fix32	ro	%		Indications	Display	100
17 to 146°	Fix32	ro	%		Indications	Display	99
Standard	Fix32	rw	SH + PRG/ dis	0	Config	Control	71
In-Delta							
Closed Loop							
Open-Loop							
No	Fix32	ro	%		Indications	Status 2	98
Too high							
No	Fix32	ro	%		Indications	Status 1	98
active							
Off	Fix32	rw	SH + PRG	0	Functions	Command 2	93
On							
Continue	Fix32	rw	SH + PRG	1	Functions	Command 1	112
Shutdown					Monitoring	Motorprotect	112
No	Fix32	ro	%		Indications	Status 4	99
reached							
1.0 to 5.0 I_e	Fix32	rw	SH + PRG	3.12 I_e	Monitoring	Motorprotect	112
Continue	Fix32	rw	SH + PRG	1	Functions	Command 1	112
Shutdown					Monitoring	Motorprotect	112
0.6 to 2.0 I_e	Fix32	rw	SH + PRG	1.09 I_e	Monitoring	Motorprotect	112

Parameter name on display	PNU	Brief description of parameter	Permissible values/meaning
Overload>0	609	Overload	0 = Overload function on zero
			1 = Overload function was initiated
Overload-Sum	36	Overload integrator	0 to 100 %
PAR->KEY	3	Transfer parameters to keypad	11 = Execute
PAR1/PAR2	639	Parameter set selection	0 = PAR 1
			1 = PAR 2
Parameterset	62		1 = Save parameter set
			2 = Load defaults
			3 = Load power-on
Password	5	Set/reset password	1 to 255
PeakCurrent	27	Peak load current (in amperes)	0 to 2000 A
PeakLoad	56	Max. unit load (in multiples of I_e)	0.0 to 8.0 I_e
Pf1-Logic	641	Not used	0 = Low = On
			1 = High = On
Pf2-Logic	642	Not used	0 = Low = On
			1 = High = On
Protection [Protection 2]	7 [2007]	Protection function	0 = Phase failure
			64 = activate protection functions
			128 = protection functions only at start, then bypass
			192 = protection functions and optimization
Ramp	601	Ramp function active	0 = Soft starter not in Ramp
			1 = Soft starter in Ramp
Rate	19	Rate of optimization	4 to 30

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Value selection on display	Data type	Access rights	Accept-ance	Default	Main menu	Submenu	Page
No	Fix32	ro	%		Indications	Status 2	98
Yes							
0 to 100 %	Fix32	ro	%		Indications	Display	100
					Monitoring	Motorprotect	100
Execute	%	w=exe	SH + PRG/ dis	11	Config	Control	76
PAR 1	Fix32	rw	SH + PRG	0	Functions	Command 2	76
PAR 2					Config	Control	76
save Para.	Fix32	w = exe	SH + PRG/ dis		Basic		69
Default					Config	Control	69
PowerOn Para							
1 to 255 Display: 255 = No password ≠255 = Password set	Fix32	rw	SH + PRG/ dis	0	Config	Control	72
0 to 2000 A	Fix32	ro	%		Indications	Display	100
0.0 to 8.0 I_e	Fix32	ro	%		Indications	Display	100
Low = On	Fix32	rw	SH + PRG	1	Functions	Command 3	94
High = On							
Low = On	Fix32	rw	SH + PRG	1	Functions	Command 3	94
High = On							
PhaseLoss	Fix32	rw	SH + PRG	128	Functions	cos-phi	88
Protection							
Start+Bypass							
Protect+Opti							
no ramp	Fix32	ro	%		Indications	Status 1	97
Ramp active							
4 to 30	Fix32	rw	Online	5	Functions	cos-phi	88

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Parameter name on display	PNU	Brief description of parameter	Permissible values/meaning
Ref0-Pointer	105	Pointer to reference	0; 20 to 111
Ref1	46	Ref 1	0.0 to 9.9 V
Ref1 Flag	614	Ref 1 level bit	0 = Value at Ref 1 below signalling threshold in PNU 48
			1 = Value at Ref 1 above the signalling threshold in PNU 48
Ref1 Level	48	Ref 1 level	0.1 to 9.9 V
Ref1-Pointer	47	Pointer to PNU for Ref 1	0 = not used 11 to 111, 2011 to 2035
Ref2	43	Ref 2	0.1 to 20.4 mA
Ref2 Flag	615	Ref 2 level bit	0 = Value at Ref 2 below signalling threshold in PNU 41
			1 = Value at Ref 2 above the signalling threshold in PNU 41
Ref2 Level	41	Ref 2 level	0.1 to 20.2 mA
Ref2-Pointer	45	Pointer to PNU for Ref 2	0 = not used 11 to 111, 2011 to 2035
Relay K1	616	Relay K1	0 = Relay not energized
			1 = Relay energized
Relay K2	617	Relay K2	0 = Relay not energized
			1 = Relay energized
Relay K3	618	Relay K3	0 = Relay not energized
			1 = Relay energized
Relay K4	619	Relay K4	0 = Relay not energized
			1 = Relay energized
Rotation	623	Direction of rotation	0 = Clockwise rotation
			1 = Anticlockwise rotation
Run-Relay	638	Run-Relay	0 = Off
			1 = Set Run Relay

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Value selection on display	Data type	Access rights	Accept-ance	Default	Main menu	Submenu	Page
Text-List	Fix32	rw	SH + PRG	46	Functions	PhaseControl	95
0.0 to 9.9 V	Fix32	ro	%		Indications	Display	100
					Functions	Analog-In	100
< Ref1 Level	Fix32	ro	%		Indications	Status 2	98
> Ref1 Level					Functions	Analog-In	98
0.1 to 9.9 V	Fix32	rw	Online	4.9 V	Functions	Analog-In	92
Text-List	Fix32	rw	SH + PRG	0	Functions	Analog-In	92
0.1 to 20.4 mA	Fix32	ro	%		Indications	Display	100
					Functions	Analog-In	100
< Ref2 Level	Fix32	ro	%		Indications	Status 2	98
					Functions	Analog-In	98
> Ref2 Level							
0.1 to 20.2 mA	Fix32	rw	Online	10.2 mA	Functions	Analog-In	92
Text-List	Fix32	rw	SH + PRG	0	Functions	Analog-In	92
Off	Fix32	ro	%		Indications	Status 3	98
On							
Off	Fix32	ro	%		Indications	Status 3	98
On							
Off	Fix32	ro	%		Indications	Status 3	98
On							
Off	Fix32	ro	%		Indications	Status 3	99
On							
L1/L2/L3	Fix32	ro	%		Indications	Status 4	99
L1/L3/L2							
Off	Fix32	ro	%		Functions	Command 2	93
On							

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Parameter name on display	PNU	Brief description of parameter	Permissible values/meaning
Set Imax	643	Set current limit	0 = Off
			1 = Simulate operation at current limit
Software Dat	201	Software date	99/08/10
Software Type	200	Software Type	53BDM434050000
Software Ver	99	Software version	52.06
Stalling	610	Stalling	0 = Motor working correctly
			1 = Motor wants to stall; automatically corrected by soft starter
Startcommand	1	Start command selection	0 = Terminal Start/Stop, app. switch active, key/options read-only
			1 = Terminal Start/Stop, app. switch active, key/options Read-only on app-switch influenced parameters, read/write on the rest
			2 = Terminal Start/Stop, app. switch not active, use saved parameters
			3 = Keypad/options Start/Stop, app. switch not active, use saved parameters
Stop-Ramp	607	Stop ramp function active	0 = Soft starter not in stop ramp mode
			1 = Soft starter in Stop Ramp
t-Dwell [t-Dwell 2]	15 [2015]	Dwell	1 to 255 s
t-Dwell off	604	Dwell	0 = Dwell time since Top of Ramp incomplete
			1 Dwell time since Top of Ramp completed; drive can perform cos-φ optimization
Temp.Limit	44	Temperature limit	20 to 255
TerminlStart	637	Terminal start/stop	0 = No signal
			1 = Start signal
T-Heatsink	37	Heatsink temperature	0 to 255

Value selection on display	Data type	Access rights	Accept-ance	Default	Main menu	Submenu	Page
Off	Fix32	rw	SH + PRG	0	Functions	Command 3	94
On							
99/08/10	String	ro	%	99/08/10	Indications	Device Data	97
53BDM4340500	String	ro	%		Indications	Device Data	97
52.06	Fix32	ro	%	52.06	Indications	Device Data	97
No	Fix32	ro	%		Indications	Status 2	98
stalling							
Terminals	Fix32	rw	SH + PRG	0	Basic		68
					Config	Control	68
Terminal/KEY							
Term./Para							
KEY/Option							
No	Fix32	ro	%		Indications	Status 1	98
active							
1 to 255 s	Fix32	rw	SH + PRG	5 s	Functions	cos-phi	88
No	Fix32	ro	%		Indications	Status 1	97
Yes							
20 to 255	Fix32	rw	Online	250	Monitoring	Heatsink	110
Off	Fix32	ro	%		Functions	Command 2	93
On							
0 to 255	Fix32	ro	%		Indications	Display	100
					Monitoring	Heatsink	100

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Parameter name on display	PNU	Brief description of parameter	Permissible values/meaning
Thermistor [Thermistor 2]	632 [2632]	Thermistor reaction	0 = Off
			1 = Disable with error
Thermis.LIM	626	Thermistor status	0 = Off
			1 = A thermistor message has been sent
ThermistorVal	42	Thermistor actual value	0 to 255
t-Imax [t-Imax 2]	31 [2031]	Current limit time	5 to 255 s
t-Imin [t-Imin 2]	29 [2029]	Undercurrent time	5 to 255 half waves
t-Kick [t-Kick 2]	14 [2014]	Kickstart time	10 to 40
Tmp t-Stop=0	640	Auto jog	0 = Off
			1 = Overwrite softstop
Top of Ramp	603	Top of Ramp	0 = Soft starter working in ramp function or is in Stop
			1 Top of ramp reached; 100 % output voltage
t-Overcurr. [t-Overcurr.2]	33 [2033]	Overcurrent time	5 to 255 half waves
t-Overload [t-Overload 2]	35 [2035]	Overload delay	10 to 140

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Value selection on display	Data type	Access rights	Accept-ance	Default	Main menu	Submenu	Page
Continue	Fix32	rw	SH + PRG	0	Functions	Command 1	110
Shutdown					Monitoring	Thermistor	110
No	Fix32	ro	%		Indications	Status 4	99
Too hot					Monitoring	Thermistor	99
0 to 255	Fix32	ro	%		Indications	Display	100
					Monitoring	Thermistor	100
5 to 255 s	Fix32	rw	Online	30 s	Functions	Current	85
5 to 255 cyc	Fix32	rw	Online	50 half waves	Functions	Current	85
10 to 40 cyc	Fix32	rw	SH + PRG	25 half waves	Functions	Kickstart	84
Off	Fix32	rw	SH + PRG	0	Functions	StartData	81
On						Command 2	81
No	Fix32	ro	%		Indications	Status 1	97
reached							
5 to 255 cyc	Fix32	rw	Online	100 half waves	Monitoring	Motorprotect	112
10 to 140	Fix32	rw	Online	140	Monitoring	Motorprotect	112

Parameter name on display	PNU	Brief description of parameter	Permissible values/meaning
TripHistory1	161	Most recent trip	1 to 15
			0 = No trip
			1 = Phase loss
			2 = Overtemperature
			3 = Thyristor
			4 = Firing
			5 = Thyristor
			6 = Thyristor
			7 = Thyristor
			8 = Thyristor
			9 = Thyristor
			10 = Thyristor shorted
			11 = Undercurrent
			12 = Current limit
			13 = Overload
			14 = Max. overcurrent
			15 = Thermistor
TripHistory2	162	2nd to last trip	1 to 15
TripHistory3	163	3rd to last trip	1 to 15
TripHistory4	164	4th to last trip	1 to 15
TripHistory5	165	5th to last trip	1 to 15
Trip-Sens.	72	Trip sensitivity	1 to 15
t-Start [t-Start 2]	12 [2012]	Start time	1 to 255 s
t-Stop [t-Stop 2]	17 [2017]	Stop time	0 to 255 s
Unit Stopped	600	Stopped	0 = Motor running
			1 = Motor stopped
U-Kick [U-Kick 2]	13 [2013]	Kickstart voltage	60 to 90 %

Value selection on display	Data type	Access rights	Accept-ance	Default	Main menu	Submenu	Page
1 to 15 Trip after PRG Message text:	Fix32	ro	%		Error		115
No Trip							
PhaseLoss							
OverTemp.							
Thyristor							
Firing							
Thyristor							
Thyristor							
Thyristor							
Thyristor							
Thyristor							
Thy Shorted							
UnderCurrent							
Curr.Limit							
Overload							
OverCurr.max							
Thermistor							
Message text	Fix32	ro	%		Trips		115
Message text	Fix32	ro	%		Trips		115
Message text	Fix32	ro	%		Trips		115
Message text	Fix32	ro	%		Trips		115
1 to 15	Fix32	rw	SH + PRG	1	Error		115
1 to 255 s	Fix32	rw	SH + PRG	5 s	Basic		69
					Functions	StartData	69
0 to 255 s	Fix32	rw	SH + PRG	0 s	Basic		69
					Functions	StartData	69
Motor running	Fix32	ro	%		Indications	Status 1	97
Motor stop							
60 to 90 %	Fix32	rw	SH + PRG	75 %	Functions	Kickstart	84

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Parameter name on display	PNU	Brief description of parameter	Permissible values/meaning
Umax	110	Umax	0 to 50
Umax reached	605	Max. output voltage reached	0 = Thyristors working with phase control
			1 = Thyristors working at max. delay angle
UnderCurrent [Undercurr.2]	631 [2631]	Undercurrent reaction	0 = Off
			1 = Disable with error
UnderCurr.LIM	625	UnderCurrent	0 = Off
			1 = Undercurrent reached and still flowing
UserParametr	111	User parameter	0 to 255
U-Start [U-Start 2]	11 [2011]	Start pedestal	10 to 60 %
U-Stop [U-Stop 2]	16 [2016]	Stop pedestal	10 to 60 %
U-Stopramp [U-Stopramp2]	634 [2634]	Stop ramp control	0 = Off
			1 = Run stop ramp voltage-referenced

Value selection on display	Data type	Access rights	Accept-ance	Default	Main menu	Submenu	Page
0 to 50	Fix32	rw	Online	10	Functions	PhaseControl	95
No	Fix32	ro	%		Indications	Status 1	98
Yes							
Continue	Fix32	rw	SH + PRG	0	Functions	Command 1	85
Shutdown						Current	85
No	Fix32	ro	%		Indications	Status 4	99
Undercurrent has occurred							
0 to 255	Fix32	rw	Online	0	Functions	PhaseControl	95
10 to 60 %	Fix32	rw	SH + PRG	20 %	Basic		69
					Functions	StartData	69
10 to 60 %	Fix32	rw	SH + PRG	10 %	Functions	StartData	81
Off	Fix32	rw	SH + PRG	0	Functions	StartData	81
On						Command 2	81

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External auxiliary components

Notes on the tables below:

DM 4-340-...:
With different operating cycles, the r.m.s. current value may change, so that higher rated components have to be used.
The switching and protective elements were selected for the following operating cycle (no bypass used for any operating cycle):

Devices DM 4-340-7K5 to DM 4-340-90K
per 10 operations per hour, continuous operation

Devices DM 4-340-110K and DM 4-340-132
per 10 operations per hour with zero-current break of at least 3 minutes before the next start

Devices from DM 4-340-160K
per 3 operations per hour with zero-current break of at least 8 minutes before the next start

For other cycles or if a bypass is used, the available power changes, and a different device must therefore be used. The rated operating current (device) must always be greater than the motor's rated current indicated on the motor's nameplate (In-Line operation) or motor current/$\sqrt{3}$ (In-Delta operation).

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Rated operating current
Related to the specified load cycle.

***I* (cable)**
Indicates the current for which the supply cable must be dimensioned at the specified operating cycle and motor current. For other operating cycles (operating frequency, overcurrent, overcurrent time, duty factor), this value changes and must be adapted accordingly. The same applies to higher motor currents.

Mains contactor
If the control circuit ensures that the controller is disabled before the mains contactor switches off, the contactors in column “Bypass contactor” can also be used as mains contactors.

Overload relay
If the soft starter is continuously live, it can act as overload relay.

In-Delta connection
(in series with each motor winding):
The overload relay is connected in series with each motor winding (In-Delta connection) and set to the value Motor Current/$\sqrt{3}$.

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Soft starters for three-phase mains connection, short startup time, tripping class 10 (15 s, 3.5 × I_e)

DM 4-340-...	Motor output at 400 V [kW]	Rated operating current (device) [A]	I_e (motor) [A]	I (cable) [A]	Motor/cable protection Line protection	Mains contactor (optional)	Overload relay	Bypass contactor (optional)	Controller supply circuit-breaker	Semiconductor protection (optional, requires fuse for type 2 coordination)
In-Line connection (before load, standard)										
...-7K5	7.5	16	15.2	16	PKM 0-16 (+ CL-PKZ 0)	DIL 0M	Z 00-16 (+ EZ 00)	DIL 00M	PKZM 0-0,16	S00UF1/80/40A/660V
...-11K	11	23	21.7	23	PKM 0-25 (+ CL-PKZ 0)	DIL 0AM	Z 00-24 (+ EZ 00)	DIL 0M		S00UF1/80/80A/660V
...-15K	15	30	29.3	30	PKZ 2 +M-32-PKZ 2 (+ CL-PKZ 2)	DIL 1M	Z 1-40 (+ EZ 1)	DIL 0M		S00UF1/80/80A/660V
...-22K	22	44	41	44	NZM 7-63N-OBI	DIL 2M	Z 1-57 (+ EZ 1)	DIL 1M		S00UF1/80/125A/660V
...-30K	30	59	55	59	NZM 7-63N-OBI	DIL 2AM	Z 1-63 (+ EZ 1)	DIL 2M		S00UF1/80/125A/660V
...-37K	37	72	68	72	NZM 7-80N-OBI	DIL 3M80	Z 5-100/SK3	DIL 2M		S00UF1/80/200A/660V
...-45K	45	85	81	85	NZM 7-100N-OBI	DIL 3AM85	Z 5-100/SK3	DIL 2M		S00UF1/80/200A/660V
...-55K	55	105	99	105	NZM 7-125N-OBI	DIL 4M115	Z 5-125/SK4	DIL 3M80		2061032-350
...-75K	75	146	134	146	NZM 7-160N-OBI	DIL 4AM145	Z 5-150/SK4	DIL 4M115		2061032-350
...-90K	90	174	161	174	NZM 7-200N-OBI	DIL M185	Z 5-220/FF6	DIL M185		2061032-450
...-110K	110	202	196	202	NZM 7-200N-OBI	DIL M225	Z 5-220/FF6	DIL M185		2061032-450
...-132K	132	242	231	242	NZM 10-400S/ZMM-400	DIL M250	ZW 7-290	DIL M225		2061032-500
...-160K	160	300	279	300	NZM 10-400S/ZMM-400	DIL M300	ZW 7-400	DIL M250		2061032-500
...-200K	200	370	349	370	NZM 10-400S/ZMM-400	DIL M400	ZW 7-400	DIL M300		2061032-630
...-250K	250	500	437	500	NZM 10-630S/ZMM-630	DIL M500	ZW 7-540	DIL M400	PKZM 0-1,6	2063032-900
...-315K	315	600	544	600	NZM 10-630SN/ZMM-630	DIL M580	ZW 7-630	DIL M500		2063032-900
...-400K	400	750	683	750	NZM 14-800S	DIL M750	ZW 7-820	DIL M650		2063032-1250
...-500K	500	900	860	900	NZM 14-1000S + R-NZM 14		–	NZM 14-1000 + R-NZM14		2063032-1250

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Soft starters for three-phase mains connection, short startup time, trip class 10 (15 s, 3.5 × I_e)

DM 4-340-...	Motor output at 400 V [kW]	Rated operating current (device) [A]	I_e (motor) [A]	I (cable) [A]	Motor/cable protection Line protection	Mains contactor (optional)	Overload relay	Bypass contactor (optional)	Controller supply circuit-breaker	Semiconductor protection (optional, requires fuse for type 2 coordination)
In-Delta connection (in series with each motor winding):										
...-7K5	11	16	21.7	21.7	PKM 0-25 (+ CL-PKZ 0)	DIL 0AM	Z 00-16 + EZ 00	DIL 00M	PKZM 0-0,16	S00UF1/80/40A/660V
...-11K	15	23	29.3	29.3	PKZ 2 +M-32-PKZ 2 (+ CL-PKZ 2)	DIL 1M	Z 00-24 + EZ 00	DIL 0M		S00UF1/80/80A/660V
...-15K	22	30	41	41	NZM 7-63N-OBI	DIL 2M	Z 1-40 + EZ 1	DIL 0M		S00UF1/80/80A/660V
...-22K	30	44	55	55	NZM 7-63N-OBI	DIL 2AM	Z 1-57 + EZ 1	DIL 1M		S00UF1/80/125A/660V
	37		68	68	NZM 7-80N-OBI	DIL 3M80	Z 1-57 + EZ 1			
...-30K	45	59	81	81	NZM 7-100N-OBI	DIL 3AM85	Z 1-63 + EZ 1	DIL 2M		S00UF1/80/125A/660V
	55		99	99	NZM 7-125N-OBI	DIL 4M115	Z 1-63 + EZ 1			
...-45K	75	85	134	134	NZM 7-160N-OBI	DIL 4AM145	Z 5-100/KK4	DIL 2M		S00UF1/80/200A/660V
...-55K	90	105	161	161	NZM 7-200N-OBI	DIL M185	Z 5-125/KK4	DIL 4M115		2061032-350
...-75K	110	146	196	196	NZM 7-200N-OBI	DIL M225	Z 5-150/KK4	DIL 4M115		2061032-350
	132		231	231	NZM 10-400S/ZMM-400	DIL M250	Z 5-150/KK4			2061032-450
...-90K	160	174	279	279	NZM 10-400S/ZMM-400	DIL M300	Z 5-220/FF6	DIL M185		2061032-450
...-132K	200	242	349	349	NZM 10-400S/ZMM-400	DIL M400	ZW 7-290	DIL M225		2061032-500
...-160K	250	300	437	437	NZM 10-630S/ZMM-630	DIL M500	ZW 7-400	DIL M250		2061032-500
...-200K	315	370	544	544	NZM 10-630SN/ZMM-630	DIL M580	ZW 7-400	DIL M400		2061032-630
...-250K	400	500	683	683	NZM 14-800S	DIL M750	ZW 7-540	DIL M500	PKZM 0-1,6	2063032-900
...-315K	500	600	860	860	NZM 14-1000S + R-NZM 14		ZW 7-630	DIL M580		2063032-900
	560		960	960	NZM 14-1250S + R-NZM 14		ZW 7-630			2063032-900
...-400K	750	750	1280	1280	NZM 14-1600H + R-NZM 14		ZW 7-820	DIL M750		2063032-1250
...-500K	900	900	1540	1540	IZM 32-2000 + M (200-240 V AC)-IZM		–	NZM 14-1000 + R-NZM 14		2063032-1250

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Soft starters for three-phase mains connection, short startup time, trip class 20 (40 s, 3.5 × I_e)

DM 4-340-...	Motor output at 400 V [kW]	Rated operating current (device) [A]	I_e (motor) [A]	I (cable) [A]	Motor/cable protection Line protection	Mains contactor (optional)	Motor protection relay	Bypass contactor (optional)	Controller supply circuit-breaker	Semiconductor protection (optional, requires fuse for type 2 coordination)
In-Line connection (before load, standard)										
...-7K5	5.5	13	11.3	17	PKM 0-20 (+ CL-PKZ 0)	DIL 00AM	ZWA-25	DIL 00M	PKZM 0-0,16	S00UF1/80/40A/660V
...-11K	7.5	16	15.2	21	PKM 0-25 (+ CL-PKZ 0)	DIL 0M	ZWA-25	DIL 00M		S00UF1/80/80A/660V
...-15K	11	22	21.7	31	PKZ 2 +M-32-PKZ 2 (+ CL-PKZ 2)	DIL 0AM	ZWA-25	DIL 0M		S00UF1/80/80A/660V
...-22K	15	30	29.3	41	NZM 7-63N-OBI	DIL 1M	ZWA-100	DIL 0M		S00UF1/80/125A/660V
...-30K	22	44	41	58	NZM 7-63N-OBI	DIL 2M	ZWA-100	DIL 1M		S00UF1/80/125A/660V
...-37K	30	55	55	78	NZM 7-80N-OBI	DIL 2AM	ZWA-100	DIL 2M		S00UF1/80/200A/660V
...-45K	37	72	68	96	NZM 7-100N-OBI	DIL 3M80	ZWA-100	DIL 2M		S00UF1/80/200A/660V
...-55K	45	85	81	114	NZM 7-160N-OBI	DIL 4M115	ZWA-100	DIL 2M		2061032-350
...-75K	55	105	99	140	NZM 7-160N-OBI	DIL 4M115	ZWA-205	DIL 3M80		2061032-350
...-90K	75	140	134	189	NZM 7-200N-OBI	DIL M185	ZWA-205	DIL 4M115		2061032-450
...-110K	90	170	161	227	NZM 7-250N-OBI	DIL M225	ZWA-205	DIL M185		2061032-450
...-132K	110	200	196	276	NZM 10-400S/ZMM-400	DIL M250	ZWA-205	DIL M185		2061032-500
...-160K	132	240	231	326	NZM 10-400S/ZMM-400	DIL M300	ZWA-500	DIL M225		2061032-500
...-200K	160	280	279	393	NZM 10-400S/ZMM-400	DIL M400	ZWA-500	DIL M250		2061032-630
...-250K	200	350	349	492	NZM 10-630S/ZMM-630	DIL M500	ZWA-500	DIL M300	PKZM 0-1,6	2063032-900
...-315K	250	450	437	616	NZM 10-630S/ZMM-630	DIL M580	ZWA-500	DIL M400		2063032-900
...-400K	315	550	544	767	NZM 14-800S	DIL M750	ZWA-820	DIL M500		2063032-1250
...-500K	400	700	683	963	NZM 14-1000S + R-NZM 14		ZWA-820	DIL M650		2063032-1250

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Soft starters for three-phase mains connection, short startup time, trip class 20 (40 s, 3.5 × I_e)

DM 4-340-...	Motor output at 400 V [kW]	Rated operating current (device) [A]	I_e (motor) [A]	I (cable) [A]	Motor/cable protection Line protection	Mains contactor (optional)	Motor protection relay	Bypass contactor (optional)	Controller supply circuit-breaker	Semiconductor protection (optional, requires fuse for type 2 coordination)
In-Delta connection (in series with each motor winding):										
...-7K5	11	13	21.7	31	PKZ 2 +M-32-PKZ 2 (+ CL-PKZ 2)	DIL 0AM	ZWA-25	DIL 0M	PKZM 0-0,16	S00UF1/80/40A/660V
...-15K	15	22	29.3	41	NZM 7-63N-0BI	DIL 1M	ZWA-25	DIL 0M		S00UF1/80/80A/660V
...-22K	22	30	41	58	NZM 7-63N-0BI	DIL 2M	ZWA-100	DIL 1M		S00UF1/80/125A/660V
...-30K	30	44	55	78	NZM 7-80N-0BI	DIL 2AM	ZWA-100	DIL 2M		S00UF1/80/125A/660V
	37		68	96	NZM 7-100N-0BI	DIL 3M80	ZWA-100	DIL 2M		
...-37K	45	55	81	114	NZM 7-160N-0BI	DIL 4M115	ZWA-100	DIL 2M		S00UF1/80/200A/660V
...-45K	55	72	99	140	NZM 7-160N-0BI	DIL 4M115	ZWA-100	DIL 3M80		S00UF1/80/200A/660V
...-55K	75	85	134	189	NZM 7-200N-0BI	DIL M185	ZWA-205	DIL 4M115		2061032-350
...-75K	90	105	161	227	NZM 7-250N-0BI	DIL M225	ZWA-205	DIL M185		2061032-350
...-90K	110	140	196	276	NZM 10-400S/ZMM-400	DIL M250	ZWA-205	DIL M185		2061032-450
	132		231	326	NZM 10-400S/ZMM-400	DIL M300	ZWA-205	DIL M225		2061032-450
...-110K	160	170	279	393	NZM 10-400S/ZMM-400	DIL M400	ZWA-500	DIL M250		2061032-500
...-160K	200	240	349	492	NZM 10-630S/ZMM-630	DIL M500	ZWA-500	DIL M300		2061032-500
...-200K	250	280	437	616	NZM 10-630S/ZMM-630	DIL M580	ZWA-500	DIL M400		2061032-630
...-250K	315	350	544	767	NZM 14-800S	DIL M750	ZWA-500	DIL M500	PKZM 0-1,6	2063032-900
...-315K	400	450	683	963	NZM 14-1000S + R-NZM 14	DIL M750	ZWA-500	DIL M650		2063032-900
...-400K	500	550	860	1213	NZM 14-1250S + R-NZM 14		ZWA-820	NZM 14-1000 + R-NZM 14		2063032-1250
...-500K	560	700	960	1354	NZM 14-1600S + R-NZM 14		ZWA-820	NZM 14-1000 + R-NZM 14		2063032-1250

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Dimensions

When fitting the soft starter, take its weight and dimensions into account. Use appropriate handling and lifting equipment (lifting trolley and/or crane for larger weights) and tools. Improper handling and the use of incorrect tools can damage the soft starter.

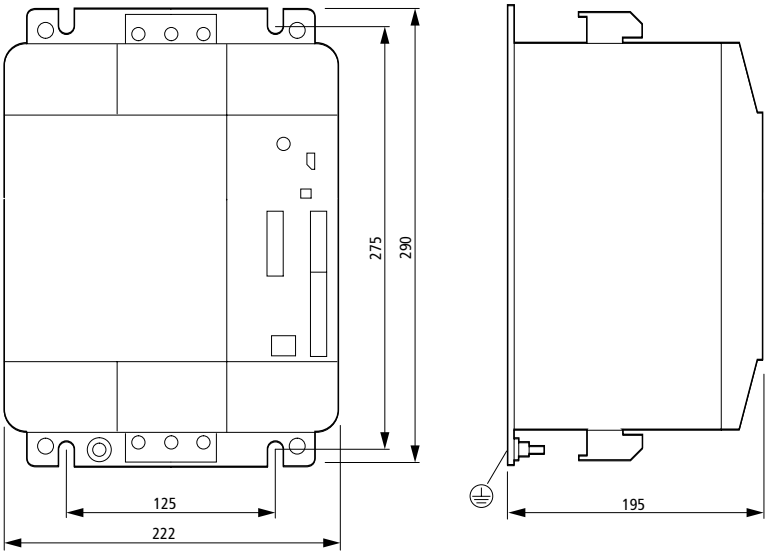

Figure 57: Dimensions, DM 4-340-7K5 to DM 4-340-37K

DM 4-340-...	∅	**kg**
...-7K5	M6	6.7
...-11K		
...-15K		
...-22K		
...-30K		
...-37K		

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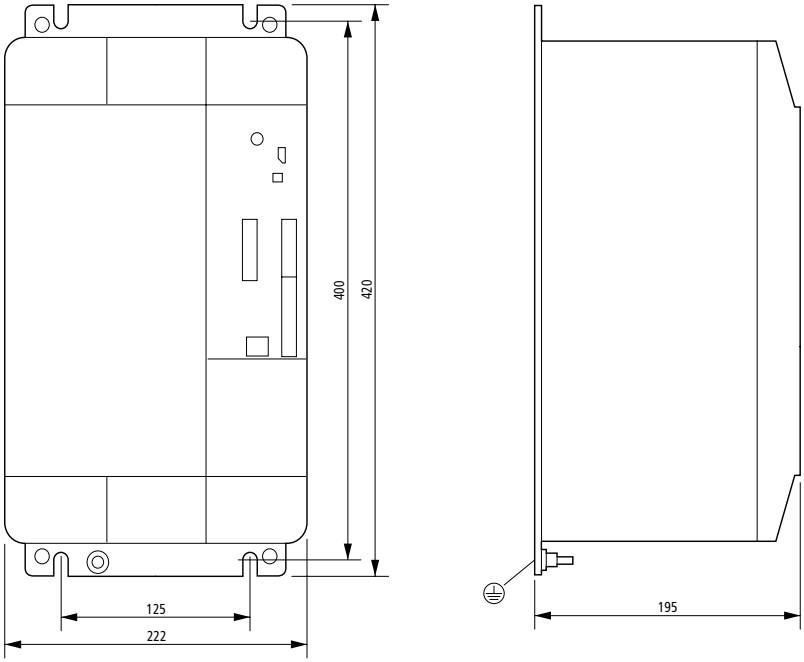

Figure 58: Dimensions, DM 4-340-45K to DM 4-340-75K

DM 4-340-...	∅	**kg**
...-45K	M6	15
...-55K		
...-75K		

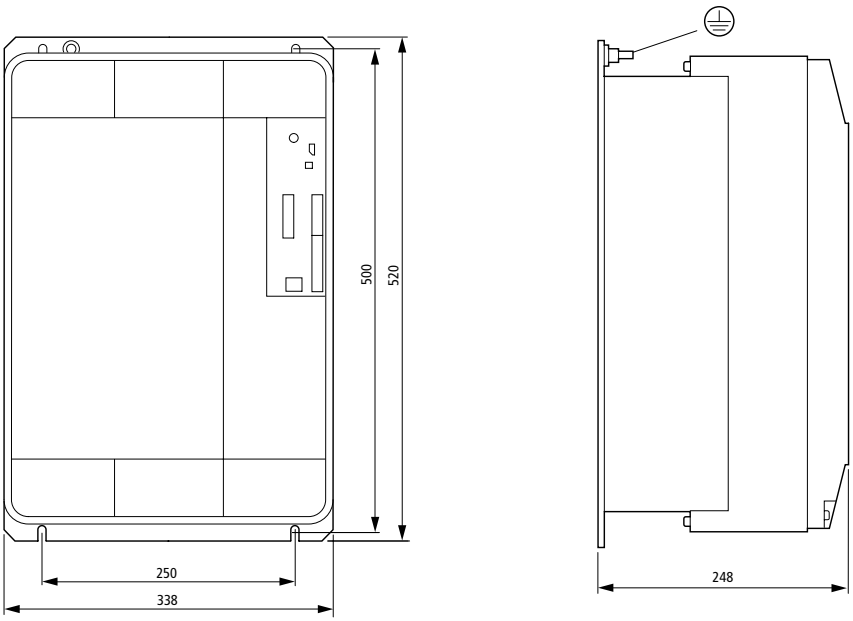

Figure 59: Dimensions, DM 4-340-90K to DM 4-340-200K

DM 4-340-...	∅	**kg**
...-90K	M6	15.7
...-110K		
...-132K		22
...-160K		
...-200K		

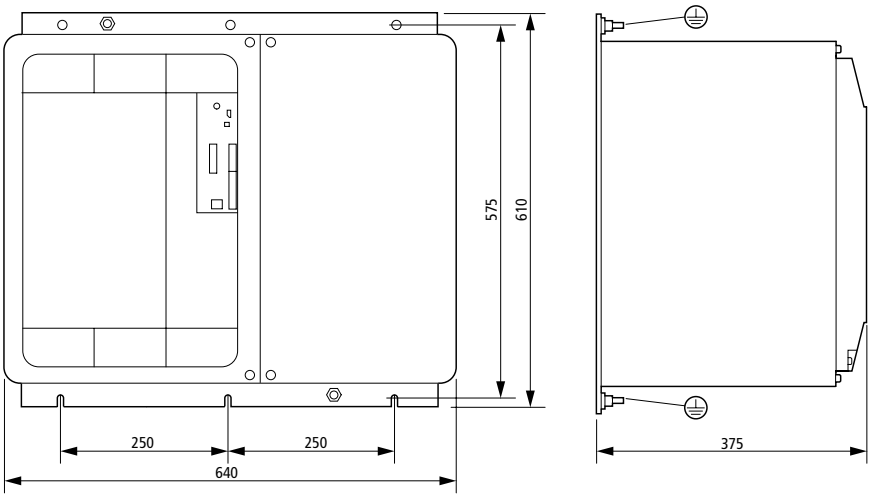

Figure 60: Dimensions, DM 4-340-250K to DM 4-340-500K

DM 4-340-...	∅	**kg**
...-250K	M10	65
...-315K		
...-400K		72
...-500K		

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