Power Electronics

MINISTART
Smart Motorstarter
UG 9256

DOLD ®

Function Diagram

t_u = switchover delay time

Your Advantages

- Up to 6 function in one unit
  - Reversing anticlockwise
  - Reversing clockwise
  - Softstart
  - Softstop
  - Current monitoring or motor protection
  - Galvanic separation
- 80 % less space
- Simple and time-saving commissioning as well as user-friendly operation through setting via potentiometers on absolute scales
- Blocking protection
- Hybrid relay combines benefits of relay technology with non-wearing semiconductor technology
- High availablility by
  - Temperature monitoring of semiconductors
  - High withstand voltage up to 1500 V
  - Load free relay reversing function
- As option with disabling current monitoring
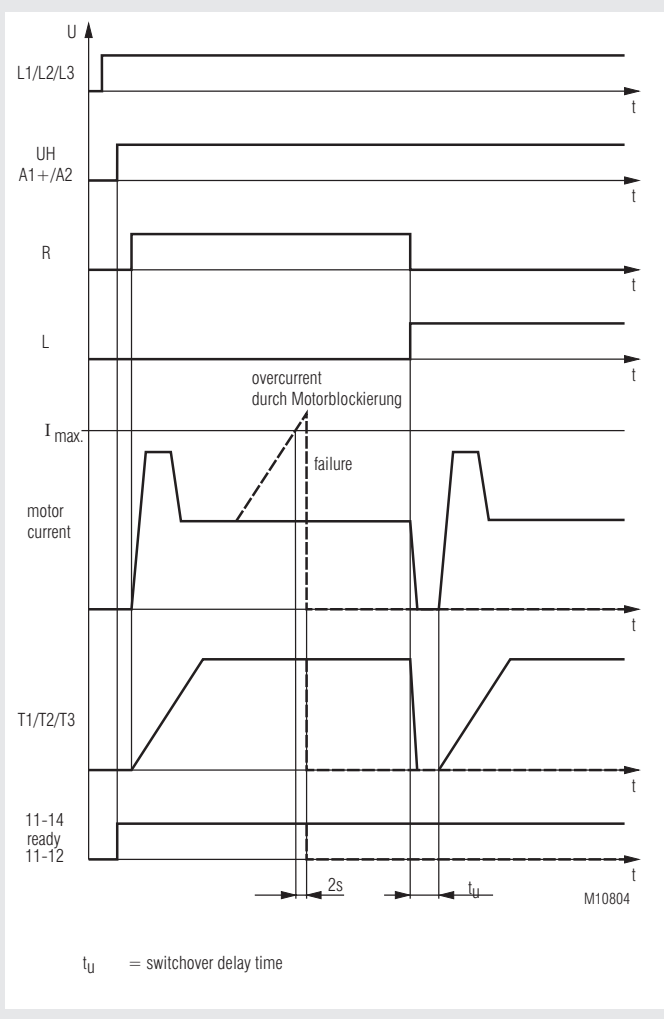
Features

- According to IEC/EN 60 947-4-2
- To reverse 3 phase motors up to 4 kW
- 2-phase softstart
- 4 potentiometer für setting of starting torque, deceleration torque , softstart /-stop, overcurrent limit or rated motor current
- 4 LEDs for status indication
- Reversing with relays without current, softstart, softstop with thyristor
- Galvanic separated 24V-inputs for clockwise- and anticlockwise
- Reset button on front
- Connection facility for external reset button
- Relay indicator output for operation
- Indicator output at customers specification (on request)
- Galvanic separation between control circuit and power circuit
- Galvanic separation between motor terminals and supply voltage in the off or fault state
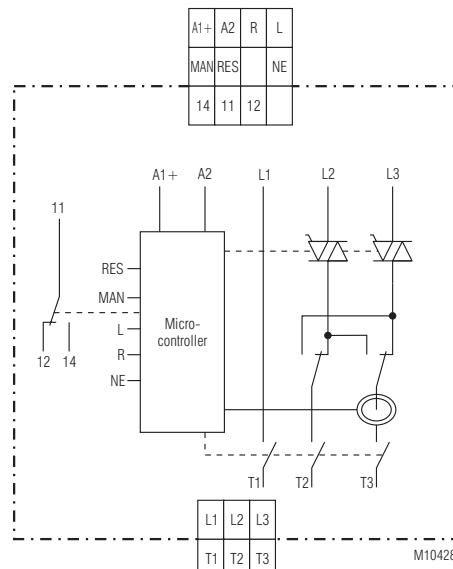- Width: 22,5 mm

Approvals and Markings

CE

Application

- Reversing operation for door and gate controls, bridge drives and lifting applications with monitoring of blockage
- Conveyor systems with monitoring of blockage
- Actuating drives in process controls with blockage monitoring

Circuit Diagram

Function

The smart motorstarter function is a softstart, reversal and protection of 3-phase asynchronous motors. Overcurrent is detected when the set current is exceeded longer than 2 sec. Direction reversal takes place via relay switching.
The relays are de-energised at this. This ensures a long service life.

Soft start

Two motor phases are impacted through thyristor phase-fired control to allow a steady increase of the currents. The motor torque behaves in the same manner when ramping up. This ensures that the drive can start without jerking and the drive elements are not damaged. Starting time and starting torque can be adjusted via rotary switch.

Softstop (variant / 1_ _)

The softstop function shall extend the natural running down time of the drive to also prevent jerky stopping.
The deceleration time is set with rotary switch ton, the running-down torque with rotary switch M_{off} .

Motor protection (variant / 1_ _)

The thermal load of the motor is calculated using a thermal model. To calculate the thermal load the current is measured in phase T3.
A symmetric current load of all 3 phases of the motor is assumed for flawless functioning. When the trigger value – stored in the trigger characteristics -, is reached, the motor is switched off and the device switches to fault 8. The fault can be acknowledged via the reset button or reset input.

Attention: The data of the thermal model is cleared through reset or voltage failure. In this case, the user must provide adequate cooling time of the motor.

Phase failure

To make sure the motor is not loaded with asymmetric currents, a check takes place during motor start whether phases L1, L2 and L3 are present. If one or several phases are absent, the device switches to fault 4. The fault can be acknowledged via the reset button or reset input.

Motor current protection (variant / 0_ _)

To ensure blocking protection is in place, the motor current is monitored in T3. The switching threshold can be adjusted via potentiometer. In the event of overcurrent, the power semiconductors deactivate and the signal relay for normal operation is reset. The red "ERR" LED flashes code 5. This status is stored. The fault can be acknowledged by switching the auxiliary voltage off / on, operating the reset button or selecting the reset control input.

Motor connection

In the off or fault state the motor terminals are separated from the mains voltage via a 4-pole guided relay.

Control inputs

Clockwise rotation and anticlockwise rotation can be selected via two control inputs. The input signal detected first is executed if both inputs are selected simultaneously. After the detected signal is cancelled, the rotational direction is reversed via the soft start function.
The control inputs have a common isolated ground connection NE.

Signalling output "Ready"

Contact 11/14 is closed if no device fault is present.

Indication

green LED "ON":	permanent on	- auxiliary supply connected
yellow LED "R":	permanent on	- clockwise, power semiconductors bridged
	flashing	- clockwise, ramp operation
yellow LED "L":	permanent on	- anticlockwise, power semiconductors bridged
	flashing	- anticlockwise, ramp operation
red LED "ERROR":	flashing	- Error
	1*)	- Overtemperature on semiconductors
	2*)	- Wrong mains freqency
	3*)	- Phase reversal detected
	4*)	- Icorrect synchronisation signal
	5*)	- Motor overcurrent detected
	6*)	- Mains isolating relay not disconnected
	7*)	- Incorrect temperature measurement circuit
	8*)	- Motor protection has responded

1*) - 8*) = Number of flashing pulses in sequence

Reset Function

2 options are available to acknowledge the fault

Manual (reset button):

Acknowledgement is performed by operating the reset button at the front of the device. If the button is still actuated after 2 seconds, the device resumes the fault state.

Manual (remote acknowledgement):

Remote acknowledgement can be realised by connecting a button (N/O contact) between the terminals MAN and RES. Acknowledgement is triggered as soon as the contact of the button closes. If the button is still actuated after 2 seconds, the device resumes the fault state since a defect in the acknowledgement circuit cannot be ruled out.

Setting Facilities

Rotary switch M_{on}:	- Starting torque at softstart 30 ... 80 %
Rotary switch M_{off} (variant / 1_ _):	- Deceleration torque at softstop 80 ... 30 %
Rotary switch t_{on} / t_{off}:	- Start / deceleration ramp 1 ... 10 s
Rotary switch t_{on} / t_{off} (variant /2_ _):	- Start / deceleration ramp 0 ... 1 s
Rotary switch I_{max} (variant / _ _ 0):	- Motor current monitoring 5 ... 50 A_{eff}
Rotary switch I_e (Variante / _ _1):	- Nom. motor current 1.6 A_{eff} ... 9.0 A_{eff}

Only at variant /800

Rotary switch Fkt:	- Selector switch operating mode
	1 Standard device
	2 Disabled current monitoring
	3 not uesd
	4 not uesd

Set-up Procedure

1. Connect motor and device according to application example.
   A clockwise rotating field is assumed for operation. A anti-clockwise rotating field triggers a fault message
2. Turn rotary switch t_{on} / t_{off} fully clockwise, M_{on} e. g. M_{off} fully anticlockwise and rotary switch I_{max} e. g. I_e of the requried current.
   At variant /800: select operating mode
3. Connect voltage and starting via input R- or softstop L-.
4. The starting time is set by turning the rotary switch ton anti-clockwise and the starting torque is set by turning the rotary switch M_{on} clockwise to the desired value. If set correctly, the motor shall swiftly accelerate to the nominal speed.

Safety Notes

- Never clear a fault when the device is switched on
- The user must ensure that the device and the necessary component are mounted and connected according to the locally applicable regulations and technical standards (VDE, TÜV, BG).
- Adjustments may only be carried out by qualified specialist staff and the applicable safety rules must be observed.
- After a short circuit the motor starter is defective and has to be replaced (Assignment type 1).
- Group supply:
  If several motor starters are protected together, the sum of the motor currents must not exceed 25 A.

Mounting Notes

When operated with rated continuous current the devices must not be placed closer than 10 mm side-by-side.

Technical Data

Nominal voltage L1/L2/L3:	3 AC 200 ... 480 V $\pm$ 10%
Nominal frequency:	50 / 60 Hz , automatic detection
Auxiliary voltage:	DC 24 V $\pm$ 10%
Motor power:	4 kW at AC 400 V
Min. motor power:	25 W
Operating mode:	9.0 A:
	AC 53a: 6-2: 100-30 IEC/EN 60947-4-2
Rated continuous current [1] **:**	9.0 A
Measured nominal current:	9.0 A

[1] The rated continuous current is the arithmetic mean value of starting and rated operating current of the motor in a reversing cycle.

Surge current:	200 A (tp = 20 ms)
Load limit integral:	200 A^{2}s (tp = 10 ms)
Peak reverse voltage:	1500 V
Overvoltage limiting:	AC 550 V
Leakage current in off state:	< 3 x 0.5 mA
Starting voltage:	30 ... 80 %
Start / deceleration ramp:	1 ... 10 s
Start / deceleration ramp	
at variant /2 _ _:	0 ... 1 s
Consumption::	2 W
Switchover delay time:	250 ms
Start up delay	
for master tick:	min. 100 ms
Release delay	
for master tick:	min. 50 ms
Overcurrent measuring device:	AC 5 ... 50 A
Measuring accuracy:	$\pm$ 5% of end of scale value
Measured value update time	
at 50 Hz:	100 ms
at 60 Hz:	83 ms
Motor protection	
up to 3 kW:	Class 10 A
3 kW up to 4 kW:	Class 5
Short circuit strength:	
max. fuse rating:	**25 A gL** **IEC/EN 60 947-5-1**

Inputs

Control input right, left:	DC 24V
Rated current:	4 mA
Response value ON:	DC 10 V ... 30 V
Response value OFF:	DC 0 V ... 8 V
Connection:	polarity protected diode
Manuel:	DC 24 V
	(connect button on terminals "MAN" and "RES")

Technical Data

Indicator Outputs

RES:	DC 24 V, semiconductor, short circuit proof, rated continuous current 0.2 A programmable at customers specification (on request)
Ready:	Changeover contact 250 V / 5 A
Contact:	1 changeover contact
Switching capacity	
to AC 15	
NO contact:	3 A / AC 230 V IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V IEC/EN 60 947-5-1
Electrical life	
to AC 15 at 3 A, AC 230 V:	2 x 10^5 switch. cycles IEC/EN 60 947-5-1
Mechanical life:	30 x 10^6 switching cycles
Permissible switching	
frequency:	1800 switching cycles/h
Short circuit strength	
max. fuse rating:	4 A gL IEC/EN 60 947-5-1

General Data

Operating mode:	Continuous operation
Temperature range:	0 ... + 60 °C (see derating curve)
Clearance and creepage distances	
overvoltage category / contamination level between control input- , auxiliary voltage and Motor voltage respectively	
indicator contact:	4 kV / 2 EN 50 178
EMC	
Electrostatic discharge (ESD):	8 kV (air) IEC/EN 61 000-4-2
Fast transients:	2 kV IEC/EN 61 000-4-4
Surge voltage between	
wires for power supply:	1 kV IEC/EN 61 000-4-5
between wire and ground:	2 kV IEC/EN 61 000-4-5
HF-wire guided:	10 V IEC/EN 61 000-4-6
Voltage dips:	IEC/EN 61 000-4-11
Industrial RF interference emission	
Radio interference:	EN 55 011
Radio interference voltage:	EN 55 011
Harmonics:	EN 61 000-3-2
Degree of protection:	
Housing:	IP 40 IEC/EN 60 529
Terminals:	IP 20 IEC/EN 60 529
Vibration resistance:	Amplitude 0.35 mm
	frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
Climate resistance:	0 / 055 / 04 IEC/EN 60 068-1
Wire connection:	DIN 46 228-1/-2/-3/-4
Screw terminal (fixed):	
Cross section:	1 x 0.34 ... 2.5 mm² solid or stranded ferruled (isolated)
Insulation of wires or sleeve length:	8 mm
Wire fixing:	captive slotted screw
Mounting:	DIN rail IEC/EN 60 715
Weight:	220 g

Dimensions

Width x height x depth:	22.5 x 105 x 120.3 mm

Characteristics

M10805

—— single Device

- - - mounted with 2cm distance

· — · — mounted without distance
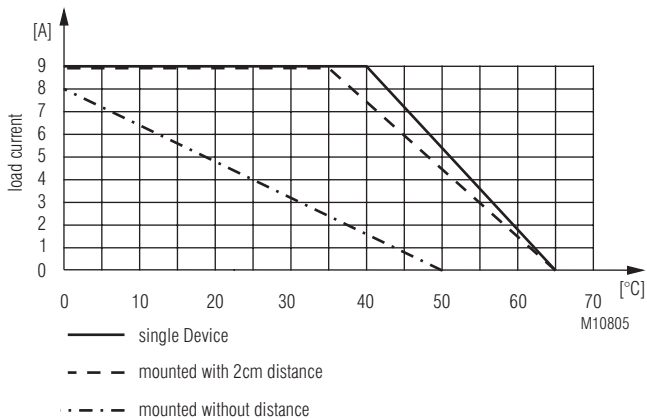
Derating curve:
Rated continuous current depending on ambient temperature and distance
Enclosure without ventilation slots
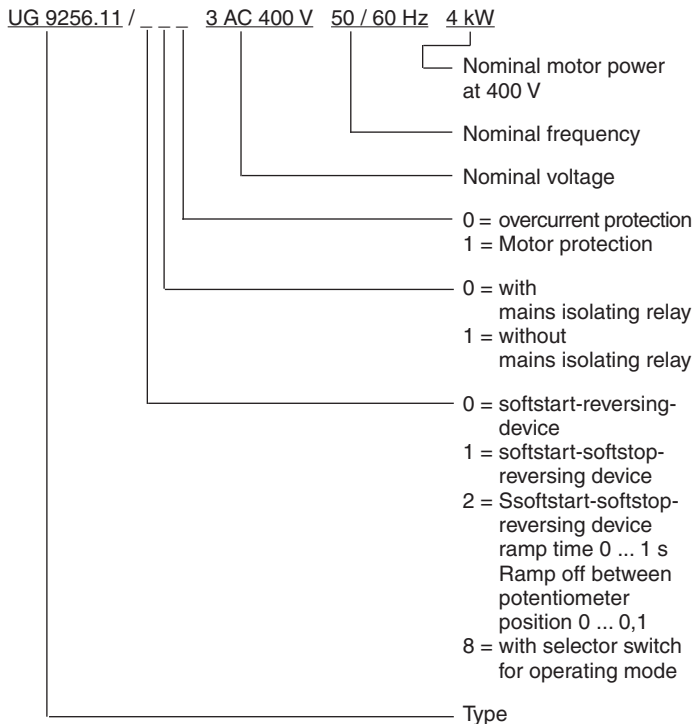

M11011
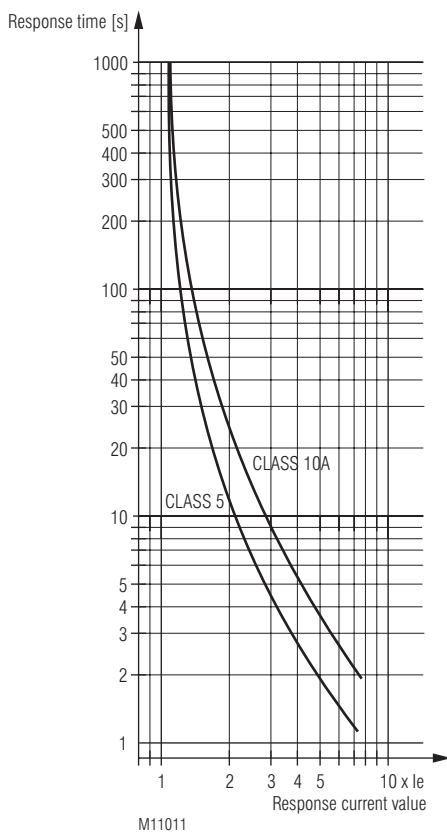
Variant / _ _ 1:
Trigger characteristics
Motor overload protection

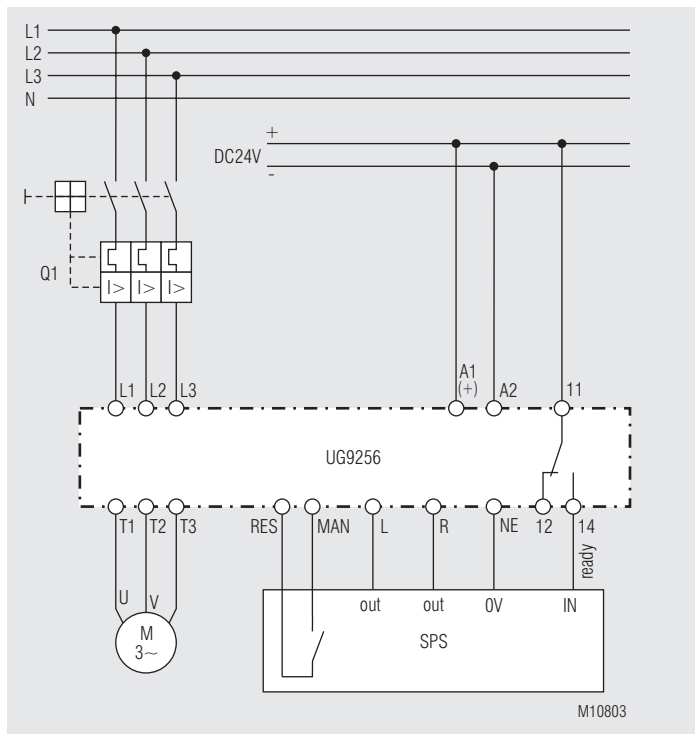## Standard Type

UG 9256.11   3 AC 400 V   4 kW   50/60Hz   9,0A
Article number: 0063850
- Nominal voltage: 3 AC 400 V
- Nominal motor power: 4 kW
- Control input R, L
- Width: 22.5 mm

Ordering Example

UG 9256.11 / _ _ _   3 AC 400 V   50 / 60 Hz   4 kW

Nominal motor power
at 400 V

Nominal frequency

Nominal voltage

0 = overcurrent protection
1 = Motor protection

0 = with
      mains isolating relay
1 = without
      mains isolating relay

0 = softstart-reversing-
      device
1 = softstart-softstop-
      reversing device
2 = Ssoftstart-softstop-
      reversing device
      ramp time 0 ... 1 s
      Ramp off between
      potentiometer
      position 0 ... 0,1
8 = with selector switch
      for operating mode

Type

Application Example

M10803

Motor control with UG 9256 and PLC