Power electronics

Product range

Safety technique

- Safety switching devices
- Standstill / speed monitoring
- Multifunctional safety devices
- Wireless Safety System
- Safety switches
- Guard locks
- Key transfer

Monitoring technique

- Residual current monitors
- Insulation monitors
- Insulation fault location system
- Measuring and monitoring relays
- Fault annunciators and fault annunciator systems
- SMS-Telecontrol module

Power electronics

- Solid-state relays /- contactors
- Reversing contactors
- Softstarters
- Motor brake relays
- Speed and phase controllers
- Multifunctional motor control units

Control technique

- Latching / interface / switching relays
- Interface modules
- Power supply units
- I / O modules
- CANopen PLC
- CANopen I / O modules

Time control technique

- Multifunction relays
- Flasher relays
- Cyclic timers
- Fleeting action relays
- Pulse extender
- Star delta timers
- Timers
  - on delayed
  - off delayed

Installation technique

- Time switches
- Remote switches
- Specific installation electronics

- Machinery and plant
- Power generation/distribution
- Oil and gas industry
- Automation
- Transport and material handling systems
- Rail technology
- Aviation/marine industry
- Paper and printing industry
- Food industry
- Rubber/plastics industry
- Heating and refrigeration
- Automotive
- Mining/metal working
- Chemical/pharmaceutical applications
- Medical technology
- Water/waste water treatment
- Cable cars/ski lifts

… and wherever safety has high priority.
We can cover your industrial applications as well!

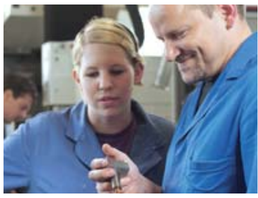
DOLD –
Solutions for you









The DOLD philosophy, “Our experience. Your safety” constitutes our program: Offering solutions based on over 80 years of experience with a workforce of more than 400 employees, we manufacture high quality products using state-of-the-art production plant at our Furtwangen facility in Germany.

The comprehensive product range includes relay modules, safety relays with positively-driven contacts and electronic housings with virtually unparalleled production detail. The combination of know-how, innovation and experience makes us one of the leading worldwide manufacturers.

Apart from standard solutions, we are also the right partner when individual industrial solutions with that special touch are required.

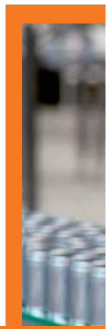
Staying in close contact with our customers is very important to us. We listen, analyze and act by offering flexible, custom high-tech solutions, from a single source.

Thanks to our own development laboratory, highly automated production facilities with a modern tool & die shop in addition to injection moulding facility togehter with a well organized sales and marketing department, we guarantee high quality and short delivery times. Your benefits: Increased plant and machine availability, planning reliability and low production costs.

With soft starters by DOLD, you'll have an intelligent, reliable, and user-friendly motor start and motor management system.

Smart Drive Solutions

Demanding drive tasks call for high-performance and flexible device solutions. High-performing electronics by DOLD include a wide range of products such as solid state contactors, motor starters, soft start and braking devices, as well as reversing contactors, speed controllers, and multifunctional motor control devices.



3-phase controlled soft starter device with integrated monitoring function for soft starting motors. With just 67.5 mm width, the intelligent motor controller offers soft starting, motor protection, start-up current limiting, voltage and phase sequence monitoring in a single device.

PF 9029

MINISTART – Powerful soft-starter device

PI 9260

POWERSWITCH
– Intelligent control and monitoring

Semiconductor contactors from DOLD have a long service life and are used everywhere that high switching frequencies and switching cycle are required.

UG 9410

UG 9256

MINISTART
– Intelligent motorstarter

The intelligent, hybrid motor starter offers up to 6 functions in a compact enclosure with just 22.5 mm width. It combines the functions of reversing, soft starting, soft run-down, and protection of 3-phase motors up to 4 kW in a single device.

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Function index

Product selection

Solid-state relays / -contactors POWERSWITCH

Solid-state relay: For screwing on the heat sink.
Solid-state contactors: With integrated heat sink, top hat rail mounting

Function	Load Current 1-pole [A]	Load Current 2-pole [A]	Load Current 3-pole [A]	Load current AC up to [V]	Auxiliary Voltage DC [V]	On/Off Input Control DC	On/Off Input Control AC/DC	On/Off Input Control AC	Analog Input Control [V]	Analog Input Control [mA]	Temperature Monitoring	Signalling Output	Widths [mm]	Type	Page
Solide-state contactor	50	25	15	480		+	+				+	+	22,5; 45; 90	**BF 9250**	21
Solide-state contactor	50	25	15	480		+							22,5; 45; 90	**BF 9250/_ _8**	29
Semiconductor contactor with analogue input for pulsed output	50			480	24				0 ... 10	4 ... 20	+		22,5; 45; 90	**BF 9250/002**	34
Solide-state relay / - contactor for resistive load	88			600		+	+	+					22,5 45 67,5	**PK 9260**	38
Semiconductor contactor with current monitoring	40			400			+				+	+	45; 67,5; 112,5	**BH 9251**	44
Solide-state contactor	50	25	15	480		+					+	+	45; 67,5; 112,5	**BH 9250**	21
Solide-state relay / - contactor	50			600		+	+						45	**PH 9260**	48
Solide-state relay / - contactor		48		480		+							45	**PH 9260.92**	53
Solide-state relay / - contactor with analogue input for pulse package control	50			480						4 ... 20			45	**PH 9260/042**	56
Solid-state relay / - contactor	40			480	24	+						+	45	**PH 9270**	59
Solid-state relay / - contactor with load current measurement	45			480	24	+						+	45	**PH 9270/003**	64
Solid-state relay / - contactor			60	600		+		+					67,5	**PI 9260**	67

Product selection

Reversing contactors POWERSWITCH

Function	Load Current 3-pole [V]	Load Voltage 3 AC [V]	Auxiliary Voltage	On/Off Input Control DC	On/Off Input Control AC/DC	On/Off Input Control AC	Temperature Monitoring	Signalling Output [V]	Enclosure Design	Widths [mm]	Type	Page
Reversing contactor	20	24 ... 480			+	+	+	+	Switch cabinet	45; 67,5; 112,5	**BH 9253**	74
Reversing contactor with current monitor	20	24 ... 480	+	+	+		+	+	Switch cabinet	45; 67,5; 112,5	**BH 9255**	78
Reversing contactor with softstart and active power monitoring	12	400		+			+	+	Switch cabinet	90	**BI 9254**	83

Zero-voltage switching with integrated electrical interlock and heat sink, top hat rail mounting

Product selection

Softstarters MINISTART

Function	For Three-Phase Motors, 400 V up to [kW]	For Single-Phase Motors, 230 V up to [kW]	Signalling Output	Load Voltage [V]	Auxiliary Voltage Required	Extra Functions: **T**emperature / System **M**onitoring	Widths [mm]	**Type**	**Page**
Softstarter with softstop	4		+	480	+	T; M	22,5	**UG 9019**	87
Softstarter		1,5		230			35	**IL 9017**	91
Softstarter with softstop		1,5		230			35	**IL 9017/300**	93
Softstarter		1,5		230			35	**SL 9017**	91
Softstarter	5,5	3		480			45	**BA 9010**	95
Softstarter with softstop	5,5			460	+	T	45	**BA 9019**	98
Softstarter with softstop	5,5			460	+	T	45	**BA 9026**	101
Softstarter and softstop device	22		+	400		T; M	45; 52,5	**GF 9016**	104
Softstarter	7,5		+	400		T; M	45	**UH 9018**	108
Softstarter for heating pumps	18,5		+	460	+	T; M	67,5	**PF 9029**	114
Softstart / softstop with reverse function	0,75		+	400	+	T	72	**RP 9210/300**	120
Softstarter	15			480	+	T	90	**BI 9025**	124
Softstarter with DC-brake	15		+	480	+	T; M	90	**BI 9028**	127
Softstarter for 1-phase motors		5	+	230	+	T; M	90	**BI 9028/900**	135
Softstarter	11			480	+	T	90	**BL 9025**	124
Softstart- / softstop device	110		+	575	+	T; M	98; 145; 202	**GI 9014**	138
Softstarter	11	5,5		480			100	**BN 9011**	95
Softstart- / softstop device	800		+	525	+	T; M	156 ... 574	**GI 9015**	141

Product selection

Motor brake relays MINISTOP

Function	Braking Current Adjustable up to max. [A]	Braking Time Adjustable up to max. [s]	Automatic Standstill Monitoring	Temperature Monitoring	External Brake Contactor Required	Signalling Output	Widths [mm]	Type	Page
Motor brake relay	32	30	+			+	45	**BA 9034N**	144
Motor brake relay	60	30	+	+		+	90	**BI 9034**	150
Motor brake relay	25	15	+	+		+	100	**BN 9034**	157
Motor brake relay	600	320	+	+	+	+	110 ... 310	**GB 9034**	157

Speed and phase controllers

Function	Power 1 AC-Motors 230 V [kw]	Power 3 AC-Motors 400 V [kw]	Controlled Phases	Signalling Output	External Start Signal	Temperature Monitoring	Enclosure Design	Widths [mm]	Type	Page
Phase controller	0,3		1		+	+	Distribution board	53	**IN 9017**	161
Speed controller, 1-phase	1,5		1	+	+	+	For outdoor installations	100; 122	**SX 9240.01**	164
Speed controller, 3-phase		5,5	3	+	+	+	For outdoor installations	100; 122; 168	**SX 9240.03**	168

Multifunctional motor control unit MINISTART

Function	Load current AC [A]	Load Voltage AC [V]	Load Voltage 3 AC [V]	Auxiliary Voltage DC [V]	On/Off Input Control DC	On/Off Input Control AC/DC	On/Off Input Control AC	Temperature Monitoring	Signalling Output	Bus Interface	Widths [mm]	Type	Page
Smart motorstarter	5		200 ... 480	24				+		Modbus RTU	22,5	**UG 9410**	172
Smart motorstarter	7	230		24				+		Modbus RTU	22,5	**UG 9411**	177
Smart motorstarter	9		200 ... 480	24	+			+	+		22,5	**UG 9256**	183
Smart motorstarter with autom. phase sequence correction	9		200 ... 480	24	+			+	+		22,5	**UG 9256/804**	189
Smart motorstarter with autom. phase sequence correction	9		200 ... 480	24	+			+	+		22,5	**UG 9256/807**	189

Solid-state Contactors - Basics and applications

Application fields
Solid-state contactors and relays proved to be good in industrial applications where high switching frequencies or a large number of switching cycles are required. With their long service life and wearless switching they solve switching and control tasks in specific applications in an extremely economic manner. Fields of application include:

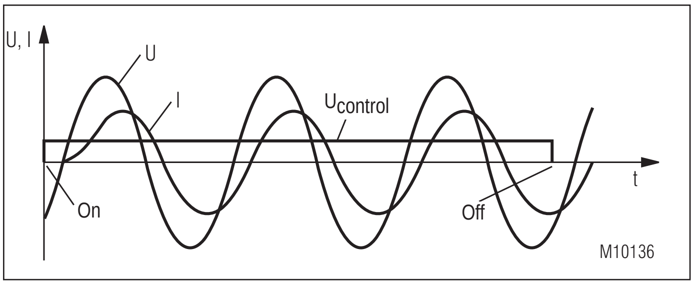
- Extrusion and injection moulding plants
- Heating controls
- Soldering lines
- Hot-melt glueing robots
- Oven controls
- Three-phase motors
- Lighting controls
- Materials handling installations
- Dispensing equipment
- Packaging machines
- Automats
- Copiers
- Pumps
- Automated self-service machines
- Traffic lights
- ... and many more

Technology
Like mechanical contactors or relays, solid-state relays provide a full electrical isolation between control and load circuit thanks to optocouplers. In contrast to mechanical contacts the solid-state relay in the load circuit has a finite, although high resistance even in blocked (opened) state through which low leakage currents may flow to the load. Two antiparallel connected thyristors suited to switch alternating voltage in a range up to 100 Hz are used as semiconductors.

Advantages compared to contacts include:
- Long service life, $>10^9$ switching cycles
- No wearing $\rightarrow$ high reliability
- Noiseless switching
- Insensitive to surge currents
- Resisting to mechanical shocks and vibrations
- High resistance to dirt and chemicals
- Very low control power, logic compatible
- Low electromagnetic radiation
- No contact bounce, high switching frequencies

This is opposed by following disadvantages:
- Power loss in ON state, that means a heat sink is required
- Leakage current in OFF state; negligible in industrial practice
- Limited resistance to voltage spikes. Normally, this is counteracted by integrated RC combinations or MOVs.

1. Zero crossover switches
In practice, zero crossover switching solid-state relays became widely prevalent. The thyristors are switched on at the zero crossing of the alternating mains voltage. A special control electronic is used for this. That means the load current only flows 10 ms after application of the control voltage. Switching off occurs in a similar way. Due to physical laws the load current continues to flow after the control power is removed until the zero crossing is reached. The delay time between OFF command and OFF state is 10 ms as a maximum.



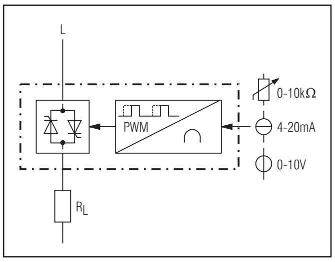
Current and voltage characteristics in the AC system with zero-voltage switching solid-state contactor

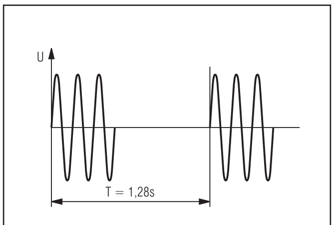
Zero crossover switching solid-state relays are mainly used for switching ohmic loads. These include all types of electric heaters in industrial installations. Less often they are used to switch inductive loads such as motors and transformers.

2. Instantaneous / peak voltage switches
There are only a few applications for instanteanously and peak voltage switching solid-state relays. Therefore, DOLD manufactures these devices only on request.

3. Full-wave control

Analogue full-wave control is an interesting control method, but for ohmic loads only. In contrast to phase-angle control, this method is EMC-conform. Thanks to switching at full sinusoidal half-waves the electromagnetic radiation and conducted interference are reduced to a minimum. Such devices generate a corresponding number of half-waves on the load output in proportion to an analogue signal on the control input. In combination with a set-point adjuster, temperature controllers can be easily built in this way.

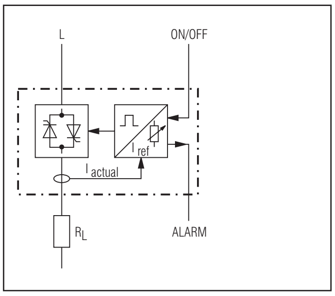




Burst firing control

4. Load circuit monitoring
The merger of power electronics and monitoring equipment is an interesting device combination. Solid-state relays with load circuit monitoring can signal following faults:

- Broken load circuits
- Partial-load faults
- Broken thyristor
- Thyristor short-circuit (failed thyristor)
- Missing load voltage
- Threshold over/underrun



In this way, changes in the load circuit can be exactly monitored. In particular, resistance variations of ohmic loads such as heating cartridges in plastic injection molding machines are interesting in this connection. In these cases, it is crucial to know when the condition of the plant deteriorates before a failure occurs, which would cause reject production. If a solid-state relay fails and is no longer able to cut off the heaters in injection molding machines, they will be are cut off by mechanical contactors that are arranged upstream of the solid-state relays. For this, the signal output on the solid-state relay is used, which signals the failure to an overriding control system. This method outclasses the temperature monitoring in terms of swiftness and may prevent fire.

5. Reversing contactor
Solid-state relays can be qualified for universal use if combined to reversing contactors. Together with further functions such as load monitoring, integrated soft start and alarms they are perfect control units for electric motors. Integrated thermal monitoring and electrical interlocking of both directions of rotation top the function range off. Thanks to their compact design, these devices can be a proper alternative to frequency converters for simple applications.

Notes for users
To ensure a trouble-free operation users have to consider following issues: cooling, protection by fuses and isolation of solid-state contactors.

1. Cooling
Heat sinks have to be selected because of the heat loss arising in the semiconductor. The thermal resistance R_{th} is the characteristic parameter of a heat sink and is measured in [K/W] (K = Kelvin, W = Watt). Where: The higher the thermal resistance the poorer is the solid-state relay cooling. The relation between temperature of the solid-state relay, loss power and heat sink is as follows:

$$T_{HLR} = P_L R_{th} + T_{amb.}$$

T_{HLR}	[K]:	Temperature on the bottom of the solid-state relay
$T_{amb.}$	[K]:	Ambient temperature
P_L	[W]:	Loss power
R_{th}	[K/W]:	Thermal resistance of the heat sink

The loss power "struggles" through the thermal resistance Rth between bottom of the solid-state relay and environment and causes a corresponding overheating in the semiconductor. The user can only influence the overtemperature by selecting a suited heat sink that affects the thermal resistance. The objective should be to keep the temperature within the semiconductor below 125 °C. To exempt users from carrying out calculations by their own the data sheets include selection recommendations for heat sinks. These have to be mounted on the solid-state relay by means of heat transfer compound or graphite foil. However, many devices are available ready-to-use complete with heat sink. The loss power within the semiconductor can be calculated according to the equation below:

$$P_L = I_L U_{TO}$$

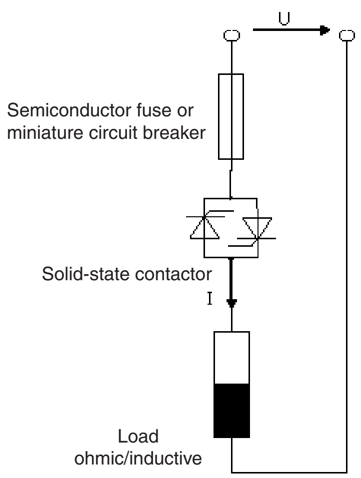
P_L	[W]:	Loss power
I_L	[A]:	Load current
U_{TO}	[V]:	Forward voltage of the semiconductor (typically approx. 1.3 V)

Using this equation users can quickly determine the heat to be carried off from the switch cabinet enabling them to properly rate the cabinet ventilation.

2. Semiconductor protection by fuses
The I^2t value measured in [A^2s] is an essential parameter of a semiconductor. It measures the heat development in case of a short circuit that would destroy the semiconductor. To protect the semiconductor a high-speed fuse has to be selected the I^2t value of which is smaller than that of the semiconductor.

$$I^2t_{Fuse} < I^2t_{Semiconductor}$$

For detailed information see the data sheets for our products. In recent time, users more and more prefer to use normal miniature circuit breakers instead of expensive semiconductor fuses. This requires a higher rating (higher I^2t value) of the semiconductors to ensure that they can withstand a short-circuit without damages. After a failure, it is then possible to restart the installation very quickly.



3. Disconnecting device for isolation from power
In OFF state, semiconductors cannot establish an electric isolation from the mains. Therefore, the miniature circuit breaker described under 2. has the additional function of being a disconnecting device for isolation from the system. This is required by VDE standards to be able to perform maintenance work safely.

Softstarters

Why are softstarters used?

1. Starting motors
Three-phase asynchronous motors are most common as drives in today's machinery and installations. In the power range up to 5.5 kW, such motors are mostly started by a direct-online starter, and by star/delta starters above this power. When doing so, it may happen that the driving elements and thus the driven machine connected to them are suddenly loaded and therefore overloaded in the moment of starting. Also work pieces and handled parts may be damaged. These problems can be perfectly solved by the use of softstarters. By phase-angle control of the mains voltage they provide for a slow increase of motor voltage. The torque developed by the motor is built up gradually and allows a smooth and thus gentle start. This reduces wear and tear and extends the service life of the whole installation.

2. Stopping motors
There are three options for stopping drives:

2.1
The motor is cut off and coasts to a standstill.

2.2
Drives that must not come to a sudden standstill when cut off can be softly stopped using a softstop function. That means the coasting time is extended. For this, the voltage applied to the motor is gradually decreased. This may be required for conveyor drives or pumps, for example. These can come to a sudden standstill after a cut-off due to large counter-torques.

2.3
Drives with a large centrifugal mass (e.g. centrifuges, planing machines) that coast for a long time after cut-off must be quickly decelerated for safety and time reasons in the most cases.

2.3.1
For this, devices (BI 9028) are offered that have a brake function integrated rather than a softstop function. The braking effect is obtained by injection of a direct current in the motor windings.

2.3.2
Using a trick, the braking effect can also be obtained in a different way. For soft plugging, two mains phases are interchanged upstream of the softstarter. This method only works with 2-phase or 3-phase controlled softstarters (Fig. 2 and 3). When the dead stop is reached the power must be disconnected immediately. Otherwise the drive would restart in reverse direction. This requires the use of time relays or zero-speed switches. Please request our Application Guide AP 23/24 where this issue is described in more detail.

3. Three types of softstarters
From the technical aspect there is one main distinctive feature between the devices, namely whether one, two or all three mains phases to the motor are controlled by a power semiconductor. For this, see the figures 1 through 3.

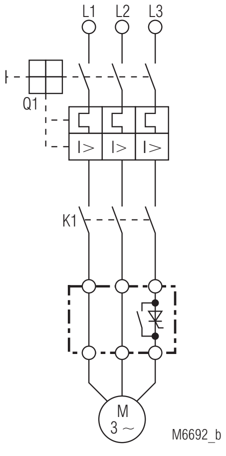


Fig. 1:
1-phase controlled

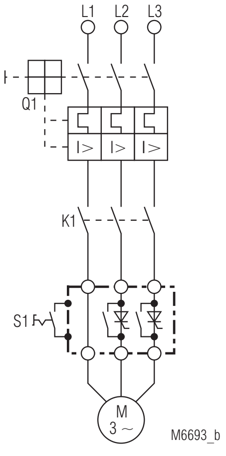


Fig. 2:
2-phase controlled

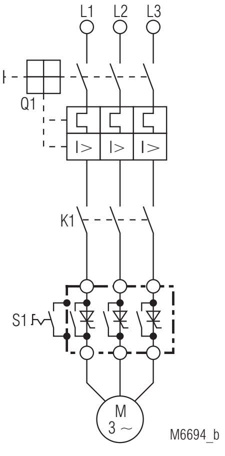


Fig. 3:
3-phase controlled

4. Starting currents of three-phase motors
Furthermore, softstarters are used to reduce the motor starting current by more than 50 %. This is more and more frequently required, not only for weak systems. Weak systems include separate networks, emergency generating sets, dead-end feeders (spurs) or underdimensioned fuses.
However, the starting current can not be reduced with single-phase controlled softstarters because a high current flows in both directly connected phases, which is even higher than with direct-online starter. Therefore, such devices are similar to the KUSA connection that was usual in former times. Instead of a resistor, now the thyristor is arranged in the motor branch. For that reason, single-phase controlled softstarters must always be started using a mains contactor, and therefore they have no softstop function as well. Only two-phase or three-phase controlled devices can also reduce the starting current. Therefore, they are suited as replacement for star-delta motor starters.

5. Starting currents of single-phase motors
The motor current of these motors can also be reduced by means of a softstarter. For this, there are dedicated devices such as the IL 9017. But the single-phase controlled model BA 9010 mainly designed for three-phase motors can also be used. It must be specifically connected (see the data sheet).

6. Installation
Normally, semiconductor fuses are no longer required for equipment protection. The motor protection switch, that is already installed in the most cases, is sufficient.
According to IEC 947.4.2, mains filter and reactor are not required for the EMC conformity during operation because in all DOLD products the power semiconductors are jumpered by an integrated bypass contactor after the soft start.
A mains contactor is only required for single-phase controlled devices and for the model IR 9027 for technical reasons. All remaining products can be started directly online without contactor and only via a potential-free contact.

Attention:
Bear in mind that the motor is still electrically connected to the mains, even if it does not rotate. Therefore, isolate the installation from the power supply using the assigned motor protection switch before any work on the motor or installation.

7. Driving issues
Geared motors with small power rating (up to 0.75 kW) and a very large reduction ratio may not show the desired starting behaviour because the motor works approximately at no load and starts even with small voltage applied.

Drives with a large centrifugal mass and/or strong counter-torque have a so called high-interia starting. Their starting time is longer than normal. This results in a higher heating of motor and equipment. This is critical and therefore the switching frequency must be reduced or a larger motor selected.

For pole-changing motors (e.g. acc. to Dahlander) the softstarter must be rated according to the higher power rating. To start the motor it is useful to adjust the soft coasting time to zero.

8. Example

Task:
Select a suited softstarter that perfectly meets the following requirements:

1. An existing installation is to be modified.
2. Three fan motors (centrifugal mass) with 1.5 kW each have to be simulateously reversed at an interval of 4 minutes.
3. So far, motor reversal was only allowed at standstill. Otherwise the mains and the contactor would be overloaded with too high currents.
4. Now, the coasting time is too long, that means a braking would be desirable.

For questions to the right answer please contact DOLD.

Solution:
BA 9018 / 5.5 kW

Motor Braking Units

Safe braking of three-phase motors
The wish for more safety of industrial machines requires reliable braking devices. However, economic considerations often matter when it comes to their purchasing apart from the safety aspect. By quick stopping of dangerous machine parts braking devices prevent both industrial accidents and also damages to equipment. Therefore, accident prevention rules require them for some machinery and plants, e.g. in the wood and textile industries. Moreover, braking devices help to reduce cost by shortening the deceleration times of machines. Today, mainly three-phase asynchronous motors are used for drive engineering. They can be decelerated both mechanically and also electrically.

Mechanical brakes
The mechanical brake as the most simple and oldest braking device has still a right to exist up to the present day. It is always indispensable when an accidental movement of a de-energized motor must be safely prevented. Moreover it relieves the motor from the heat loss that arises during electrical braking. This advantage becomes particularly important for motors with high switching and braking frequency.

Disadvantages of mechanical braking methods include wearing and vulnerability to failures due to wear and tear as well as abrasion and noise.

Electrical braking
When it comes to electrical braking methods for three-phase asynchronous motors a distinction is made between braking by plugging and d. c. injection braking.

Braking by plugging
In former times, braking by plugging was the most common and most simple electrical braking method. It is initiated by interchanging two mains conductors of the stator winding. This changes the direction of the motor's rotating field and generates a torque working against the direction of rotation and decelerating the motor up to a dead stop. When the motor is not cut off on time by suited means such as a zero-speed switch or frequency relay it accelerates in the reverse direction after its dead stop.

Disadvantages of braking by plugging:
- Relatively high braking torque
- Inconvenient braking torque adjustment via resistors
- High power consumption
- Heavy stress to switching devices

Direct current injection braking
With respect to the losses arising in the rotor, the d. c. injection braking is the more advantageous type of electrical motor braking. For this, via 2 or 3 terminals, direct current is fed into the stator winding that is disconnected from the three-phase system. This causes a stationary field within the motor. The rotation of the rotor makes that an alternating voltage is induced in it. The current resulting from this causes a smooth and strong braking.
In most cases, electronic motor braking devices generate the direct current by a thyristor phase-fired control (**Fig. 1**).
This method has the advantage that the direct voltage can be continuously

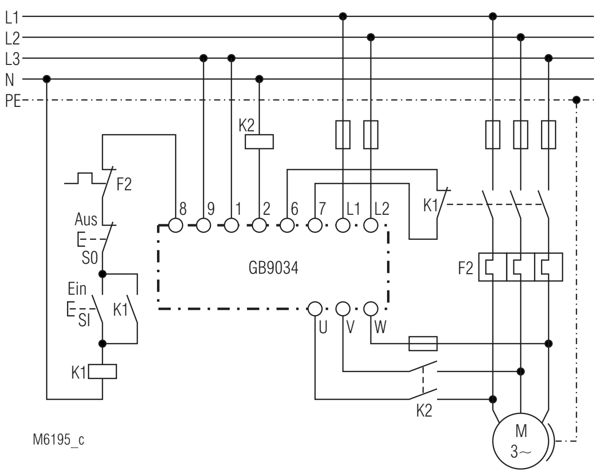


Fig. 1: Schematic diagram for a motor with electronic braking
K1 = mains contactor; K2 = braking contactor

changed by time-shifting the control pulse for the thyristor. Then, the braking current results from the set direct voltage and the resistance of the stator winding through which the braking current flows. The possibility to adjust the braking voltage continuously enables a convenient adjustment of the braking force to the relevant application.
The duration of the braking process can be adjusted by a timer. The braking contactor must cut off the braking current when the motor has just stopped. This avoids an unnecessary thermal stress to the motor. As the stator winding heats up depending on the mode of operation and the winding resistance varies the braking time has to be frequently corrected on the motor braking device. This effect can be eliminated by a zero-speed switch. Independent of the set braking time, the braking contactor drops out when the zero-speed switch signals the motor's dead stop.

Advanced motors are equipped with automatic zero-speed monitors for which no additional sensors are required. Such an automatic zero-speed monitor cuts off the braking current at the dead stop of the motor after a short delay time (< 1 sec.). Additionally, an adjustable braking timer as a safety device is started when the braking process starts. When lapsed it stops the braking process unless the zero-speed monitor has already terminated the braking process.

To protect the power semiconductors against overtemperature also motor braking devices with thermal protection are available. With these devices the braking contactor drops out when the allowed temperature of the power semiconductor is execeeded.

There are two designs of electronic motor braking devices: Typically, devices for smaller power with braking currents up to approx. 25 A have a compact enclosed design. For these devices, the functional modules braking electronic, braking contactor and power part are typically accommodated in a plastic case for DIN rail mounting.

Such a compact design is not possible for motor braking devices for higher power ratings due to the high temperatures in the power section. They are either mounted on a carrier board as open-type assembly or built in a properly sized sheet metal housing.

Functional sequence
For the conventional type of d. c. injection braking the control system of the installation controls the functional sequence. In contrast to this, electronic motor braking devices have an integrated time program providing for the correct sequence of the switching operations. This ensures that mains and braking contactor do not close at the same time. Moreover, this allows a flexible applicability and a reliable function of the braking device. Typically, the function sequence with standard braking devices is as follows:

Once the motor is disconnected from the three-phase system, the braking is initiated after a delay. On the one hand, this braking delay time is used to allow a decay of induction voltages, that are still present after motor disconnection, to a value that is harmless to the power semiconductors. On the other hand, it is used to switch the braking contactor at zero crossing if possible. This considerably reduces contact wearing.

Engineering
To obtain an optimal braking torque the braking current I_B should be higher than the rated motor current by the factor 1.8 to 2. This corresponds to the saturation current, i.e. the magnetic field required for braking reaches its maximum at this current intensity. Higher braking currents only result in a thermal motor overload. The allowed braking current has to be tested using an r.m.s. measuring instrument.

Apart from the braking current, also other criteria are essential for the selection of the correct motor braking device. The selection should be based on the documentation from the relevant manufacturer of the braking device. Selection recommendations included there refer to the max. braking current, duration and frequency of braking operations and to the method of connection of the motor to be decelerated.

To safely prevent thermal motor overload by too frequent braking it is recommended to equip them with thermal protection devices. Thermal motor protection relays are suitable for this. Comfortable motor braking devices have this thermistor motor protection already integrated.

Motor Braking Units

PTC thermistors specifically offered for motor protection are suited as temperature probes. The signal output contact of the thermal monitoring should arranged so that the motor is stopped for safety reasons when the control contact trips, but can not be restarted afterwards until the thermal data allow a restarting.

Softstarters extend the motor service life
To extend the service life of three-phase motors brake devices are often used in combination with softstarters. They allow a more economic design of the driving components and can also be retrofitted in existing installations like brake devices.

Apart from providing both control functions, softstarters with already integrated brake functionality also save a lot of wiring (see **Fig. 2**).

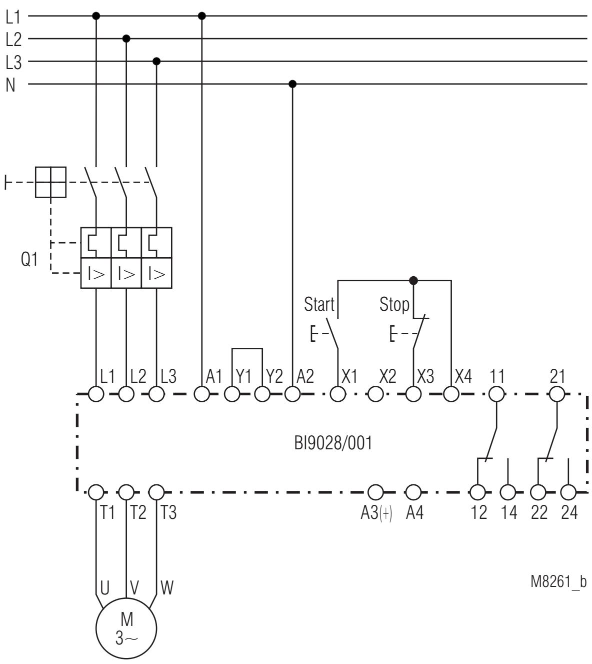


Fig. 2: Schematic diagram for softstart-brake combination

Features of electronic d. c. braking with phase-angle control:

- Continuous adjustment of the braking force and time to the machine's characteristic
- Soft start of the braking effect and thus avoidance of mechanical stresses to bearings, gears or V-belts
- No maintenance needed
- No mechanical wearing
- Easy installation (also later)
- Environmentally compatible

Fields of application
Two reasons require a quick stopping of rotating parts on machinery and plants by brake devices:

1) Prevent industrial accidents by emergency stop or safety braking. Accident prevention rules, e.g. those of the wood working (VBG 7j) and textile industries (VBG 7v) require the use of brake devices.

2) Reduce costs by shortening the coasting times of machines.

Moreover, motor brake devices are used:
- For deceleration of positioning drives
- For braking machines that would reach their resonance frequency when coasting without braking, e.g. shaking troughs
- For lifting and conveying equipment where a run over end positions must be prevented
- For reversal mills, centrifuges and the like

POWERSWITCH
Solid-State Contactor
BF 9250, BH 9250

0231842

BF 9250 up to 10 A

BF 9250 up to 50 A

BF 9250 up to 25 A

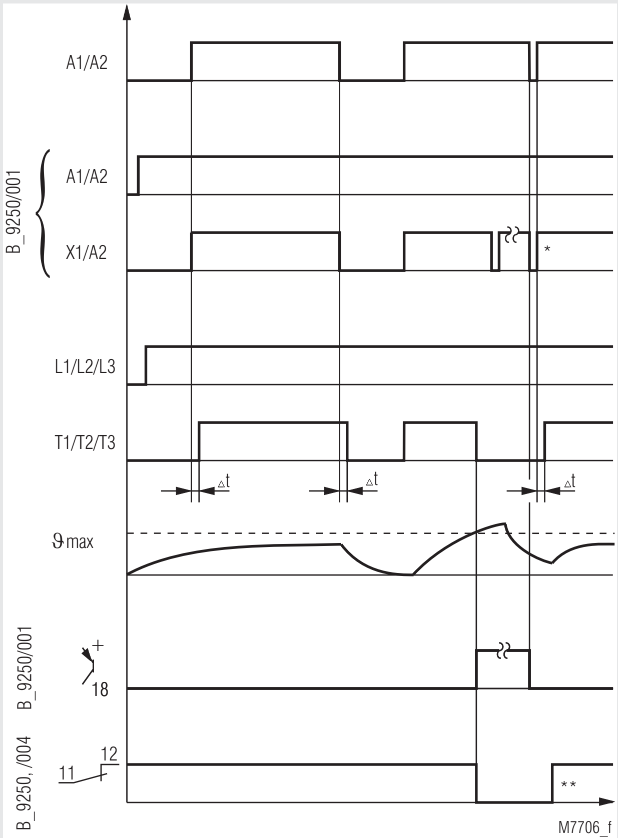
BH 9250 up to 10 A

- According to IEC/EN 60 947-4-2, IEC/EN 60 947-4-3
- 1-, 2- and 3-pole models
- Load current up to 50 A
- For AC load up to 480 V
- Switching at zero crossing
- Protected by varistors
- As option temperature protection of the power semiconductors with monitoring output
- Mounting on DIN-rail
- As option with control input X1 with low current consumption e.g. to be controlled by a PLC
- As option up to 3 separate semiconductor contactors in one unit
- BF 9250: width 22.5 mm, 45 mm and 90 mm
  BH 9250: width 45 mm, 67.5 mm and 112.5 mm

Approvals and Markings

CE | c UL US LISTED Canada / USA

Function Diagram



* The latching function of the overtemperature monitoring is resetted by disconnecting A1/A2 for a short moment

** after the cool down time

Δt = switching delay

Applications

Fast and noiseless switching of:
- heating elements
- motors
- valves
- lighting

Indicators

BF 9250/001, BH 9250/001, BH9250/006

green LED "A1-A2":	on, when voltage on A1/A2
yellow LED "x1":	on, when voltage on X1
red LED "ϑ>":	on, when overtemperature

BF 9250/003

green LED "T_a":	on, when A1 connected
green LED "T_b":	on, when A3 connected
green LED "T_c":	on, when A5 connected

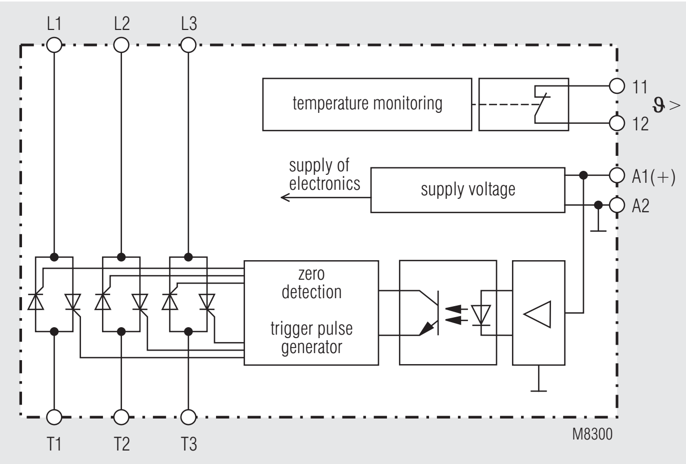
BF 9520/004

green LED "T_a":	on, when A1 connected
green LED "T_b":	on, when A2 connected
green LED "T_c":	on, when A3 connected

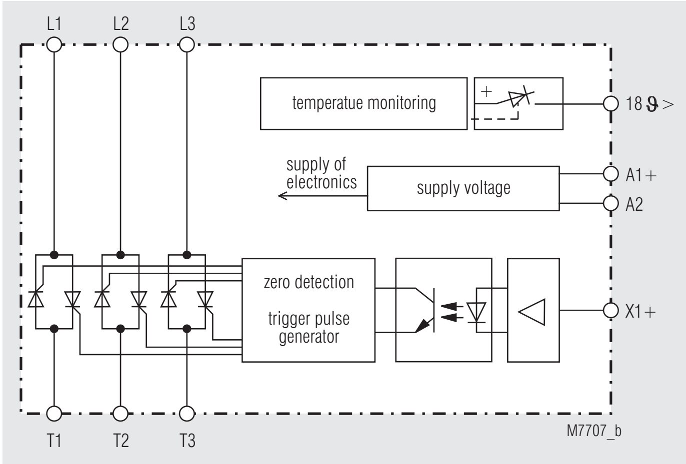
BF 9250

green LED "A1-A2":	on, when voltage on A1

Block Diagrams

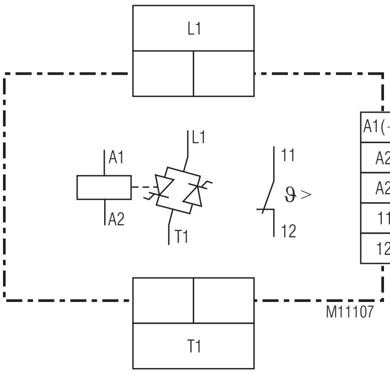


BF 9250, BF 9250/004

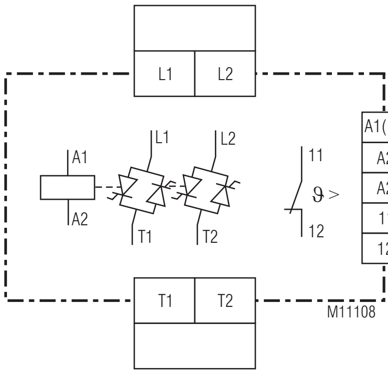


BF 9250/001, BH 9250/001

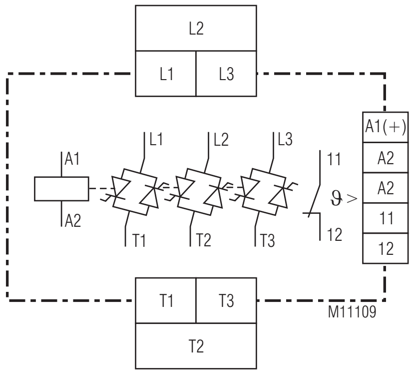
Circuit Diagrams



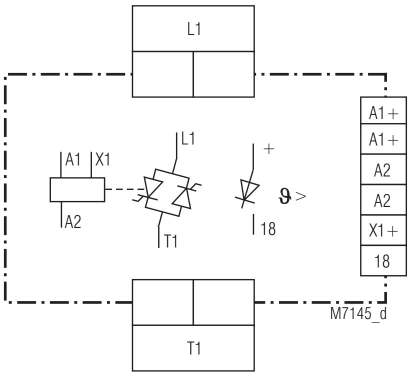
BF 9250.01



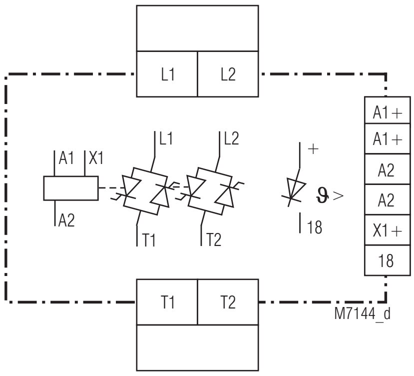
BF 9250.02



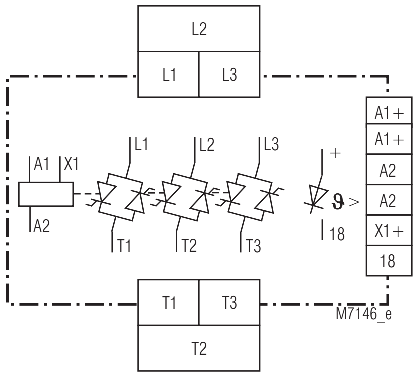
BF 9250.03



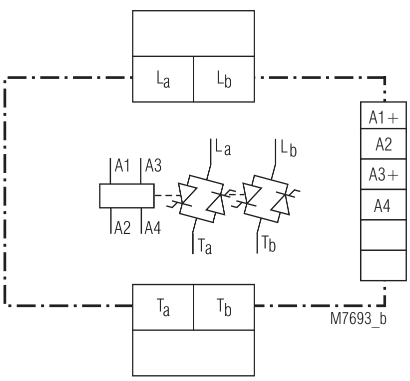
BF 9250.01/001



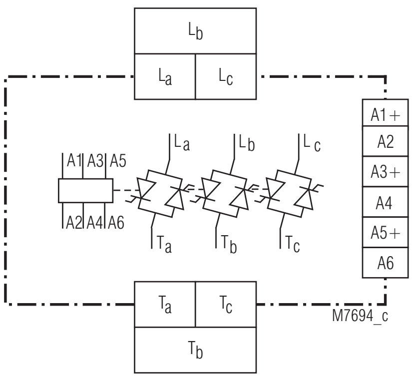
BF 9250.02/001



BF 9250.03/001



BF 9250.92/003

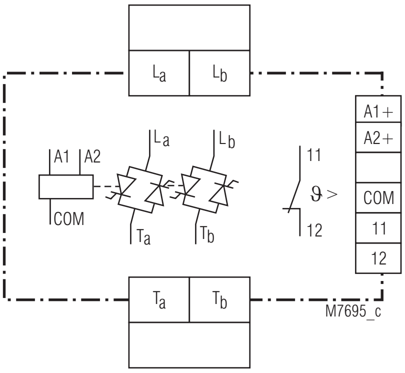


BF 9250.93/003

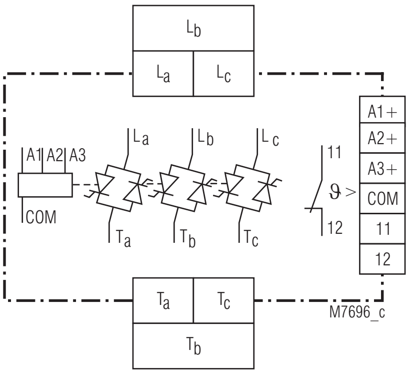
Connection Terminals

Terminal designation	Signal description
A1, A2, A3, A4, A5, A6, COM, X1	Control or operating voltage
18	Indicator output
11, 12	NC contact
L1, L2, L3	Mains connections
T1, T2, T3	Load outputs
T1b, T2b	Load outputs

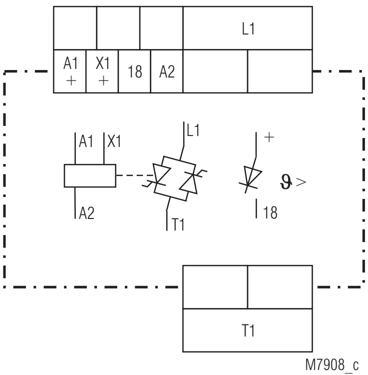
Circuit Diagrams



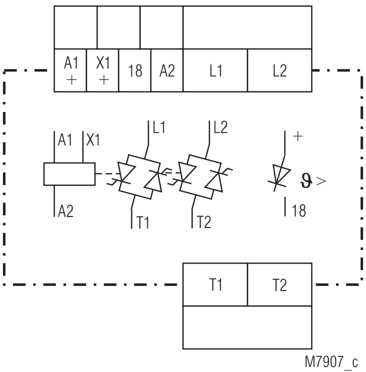
BF 9250.02/004



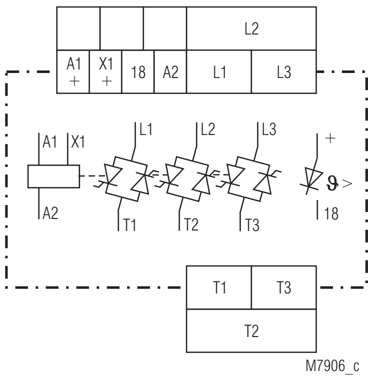
BF 9250.03/004



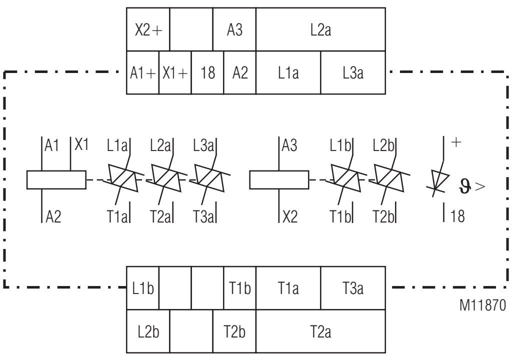
BH 9250.01/001



BH 9250.02/001



BH 9250.03/001



BH 9250.03/006

Technical Data

Input

BF 9250/001, BH 9250/001:
Operation voltage A1/A2: DC 24 V
Voltage tolerance: ± 10 %
Input current: 35 mA
Control voltage X1/A2: DC 3 … 48V
Making voltage: DC 3 V
Switch off voltage: DC 2 V
Start current: 0,5 mA at DC 3 … 10 V
10 mA at DC 10 … 48 V
Start up delay [ms]: ≤ 2 + 1/2 Periode
Release delay [ms]: ≤ 1 + 1/2 Periode

BF 9250/003:
Control voltage A1/A2: DC 24 V, control of T_a
Control voltage A3/A4: DC 24 V, control of T_b
Control voltage A5/A6: DC 24 V, control of T_c
Start up delay [ms]: ≤ 1 + 1/2 Periode
Release delay [ms]: ≤ 1 + 1/2 Periode

BF 9250/004:
Control voltage A1/COM: DC 24 V, control of T_a
Control voltage A2/COM: DC 24 V, control of T_b
Control voltage A3/COM: DC 24 V, control of T_c
Start up delay [ms]: ≤ 1 + 1/2 Periode
Release delay [ms]: ≤ 1 + 1/2 Periode

BF 9250:
Control voltage A1/A2: AC/DC 110 … 230V, AC/DC 24 V
Start up delay [ms]: ≤ 3 + 1/2 Periode
Release delay [ms]: ≤ 35 + 1/2 Periode

BH 9250/006:
Operation voltage A1+/A2: DC 24 V
Control voltage X1+/A2: DC 3 ... 48 V
Control voltage X2+/A3: DC 24 V

Output

Load output T1, T2, T3; T_a, T_b, T_c
Load currents at 100 % duty cycle ED, AC 51:

BF 9250 BH 9250	Ambient temperature	Device without heat sink	Device with small heat sink	Device with large heat sink
1-pole	25°C 40°C	13 A 10 A	30 A 25 A	55 A 50 A
2-pole	25°C 40°C	7 A 6,5 A	17,5 A 15 A	28 A 25 A
3-pole	25°C 40°C	6 A 5 A	14 A 10 A	20 A 15 A

BH 9250.03/006:
Load output T1a, T2a, T3a
AC-51 3 x 3 A
Load output T1b, T2b
AC-51 2 x 1 A
Current reduction over 40°C

BF 9250 BH 9250	Device without heat sink	Device with small heat sink	Device with large heat sink
1-pole	0,2 A / °C	0,4 A / °C	0,6 A / °C
2-pole	0,2 A / °C	0,3 A / °C	0,4 A / °C
3-pole	0,2 A / °C	0,2 A / °C	0,3 A / °C

Min. load current: AC 40 mA
Load voltage range: AC 24 ... 480 V
Frequency range: 50 / 60 Hz
Leakage current in off state at nominal voltage U_N and nominal frequency
(Tj=125°C, max.): 1.0 mA
at load voltage up to: AC 480 V
Peak inverse voltage: ± 1200 Vp

Technical Data

Short circuit current
at t=10 ms
BF 9250.01; .02; .92;
BH 9250.01; .02: 600 A
BF 9250.03; .93;
BH 9250.03: 400 A
Power dissipation: P = 1.2 [V] x I eff. [A] / k [W]
with k as formfactor and
k = 1.1 for sinusoidal current

Semiconductor fuse

BF 9250 BH 9250	I_N	load limit integral of the semi-conductor	Semiconductor fuse Type	Semiconductor fuse Article-No.	Semiconductor fuse Brand
1-pole	10 A 25 A 50 A	1800 A²s 1800 A²s 1800 A²s	fuse 10 x 38 fuse 10 x 38 NH-00	6003434.16 6003434.30 2020920.63	SIBA SIBA SIBA
2-pole	2x6,5 A 2x15 A 2x25 A	1800 A²s 1800 A²s 1800 A²s	fuse 10 x 38 fuse 10 x 38 fuse 10 x 38	6003434.10 6003434.20 6003434.30	SIBA SIBA SIBA
3-pole	3x5 A 3x10 A 3x15 A	800 A²s 800 A²s 800 A²s	fuse 10 x 38 fuse 10 x 38 fuse 10 x 38	6003434.8 6003434.16 6003434.20	SIBA SIBA SIBA

Varistor voltage: AC 510 V

Semiconductor Monitoring Output

Output (Terminal 18)**:** transistor, plus switching
switched auxiliary voltage: DC 24 V
Switching capacity: 100 mA, short circuit proof
Residual voltage: typ. 0.6 V

Output (NC contact 11, 12)
Switching capacity**:** AC 240 V*) / 2.0 A cos φ = 1
AC 240 V*) / 1.0 A cos φ = 0.6 inductive
DC 24 V / 1.0 A

*) max. AC 150 V at variant /004

General Data

Fitting position: cooling ribs vertically
Operating mode: Continuous operation
Temperature range:
Operation: 0 ... 40°C
max. 60°C (with current derating factor see table)
Storage temperature: - 20 ... + 80°C
Clearance and creepage distances
rated impulse voltage / pollution degree 4 kV / 3 IEC 60 664-1
EMC IEC/EN 61 000-6-4, IEC/EN 61 000-6-1
Electrostatic discharge: 8 kVair / 6 kV contact IEC/EN 61 000-4-2
HF-irradiation: 10 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltages
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
Interference suppression: Limit value class A IEC/EN 60 947-4-3
A higher suppression class can be reached by connecting capacitors of 0.47 µF / 600 V AC across the phases or across phase and neutral.

Technical Data

Insulation voltages

Input to Output:	2.5 kV	
Input to semiconductor monitoring output (NC contact)	2.0 kV	
Input to heat sink:	2.5 kV	
Output to Output:	2.5 kV	
Output to heat sink:	2.5 kV	
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 reseistance:	0 / 060 / 04	IEC/EN 60 068-1
Terminal designation	EN 50 005	
Wire connection:	DIN 46 228-1/-2/-3/-4	
Load terminals:	1 x 10 mm² solid 1 x 6 mm² stranded ferruled	
Control terminals and indicator outputs		
BF 9250:	1 x 0.75 mm² stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 1 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3	
BH 9250:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferrueld DIN 46 228-1/-2/-3	
Wire fixing		
Load terminals:	Terminal screws M 4 Box terminal with wire protection	
Control terminals: BF 9250, BF 9250/001, BF 9250/003, BF 9250/004:	cage clamp terminals “Push-In”	
BH 9250:	Plus-minus terminal screws M3,5 box terminals with wire protection	
Mounting:	DIN rail	IEC/EN 60 715

Weight

BF 9250	
Width 22.5 mm:	350 g
Width 45 mm:	580 g
Width 90 mm:	1 050 g
BH 9250	
Width 45 mm:	394 g
Width 67.5 mm:	638 g
Width 112.5 mm:	1 094 g

Dimensions

Width x heigth x depth:

BF 9250:	22.5 x 85 x 120 mm
	45 x 85 x 120 mm
	90 x 85 x 120 mm
BH 9250:	45 x 85 x 120 mm
	67,5 x 85 x 120 mm
	112.5 x 85 x 120 mm

UL-Data according to UL508

Input

Wire connection:	60°C / 75°C copper conductors only
BF 9250:	AWG 28 - 14 Sol/Str
BF 9250/001:	AWG 24 - 14 Sol/Str
BH 9250:	AWG 20 - 12 Sol, 20 - 14 Str. Torque 0.8 Nm

Load circuit

Fixed screw terminal:	75°C copper conductors only AWG 18 - 8 Sol Torque 0.8 Nm or AWG 18 - 10 Str Torque 0.8 Nm (only possible at variants up to 30 A)
Temperature range:	0 ... 40 °C
Frequency range:	50 / 60 Hz
Pollution degree:	2

In the final circuit an overvoltage protector R/CSPD (VZCA2/8) with min. 480V AC, 50/60Hz, VPR=2500V, Type 3 has to be installed.

Info **Technical data that is not stated in the UL-Data, can be found in the technical data section.**

Standard Types

BF 9250.01/001 DC 24 V AC 24 ... 480 V 50/60 Hz 10 A

Article number: 0050515

- 1-pole
- Control input X1: DC 3 ... 48 V
- Auxiliary voltage: DC 24 V
- Load voltage: AC 24 ... 480 V
- Load current: 10 A
- With signal output
- Width: 22,5 mm

BF 9250.03/001 DC 24 V AC 24 ... 480 V 50/60 Hz 3 x 10 A

Article number: 0050520

- 3-pole
- Control input X1: DC 3 ... 48 V
- Auxiliary voltage: DC 24 V
- Load voltage: AC 24 ... 480 V
- Load current: 3 x 10 A
- With signal output
- Width: 45 mm

Variants

BF 9250.0_:	Without low current input X1
BH 9250._ _/001:	With bigger diameter for control wires
BF 9250.92/003, BF 9250.93/003:	2 or 3 power semiconductor controlled by a separate input with galvanic isolation, without temperature monitoring of the semiconductors
BF 9250.02/004, BF 9250.03/004:	2 or 3 power semidconductor controlled by a separate input with common ground with temperature monitoring of the semiconductors signal output not latching without LED display of ϑ.

Odering example for variants

BF 9250 .01 /_ _ _ DC 24 V AC 24 ... 480 V 50/60 Hz 50 A

- Load current
- Frequency range
- Load voltage
- Auxiliary voltage U_H
- Variant, if required
- 1-pole
- Type

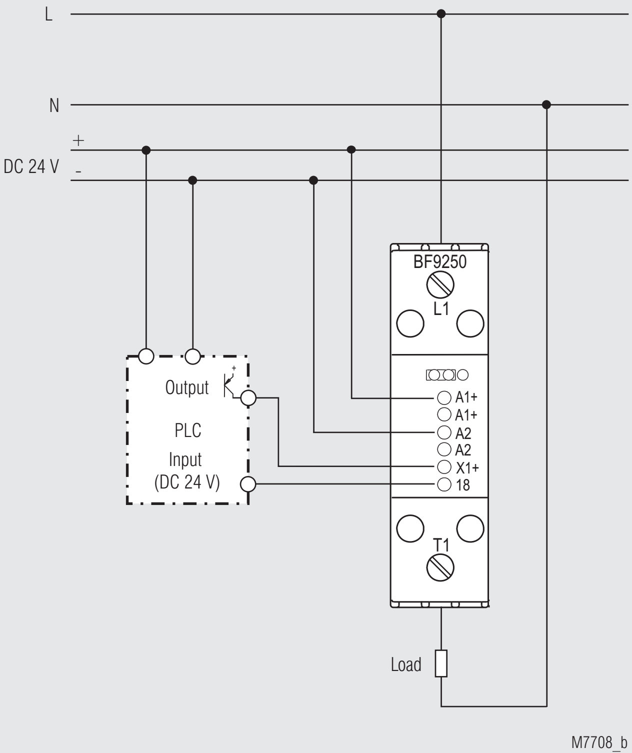
Installation

Recommended distance:
upper / lower side to cable duct: 20 mm

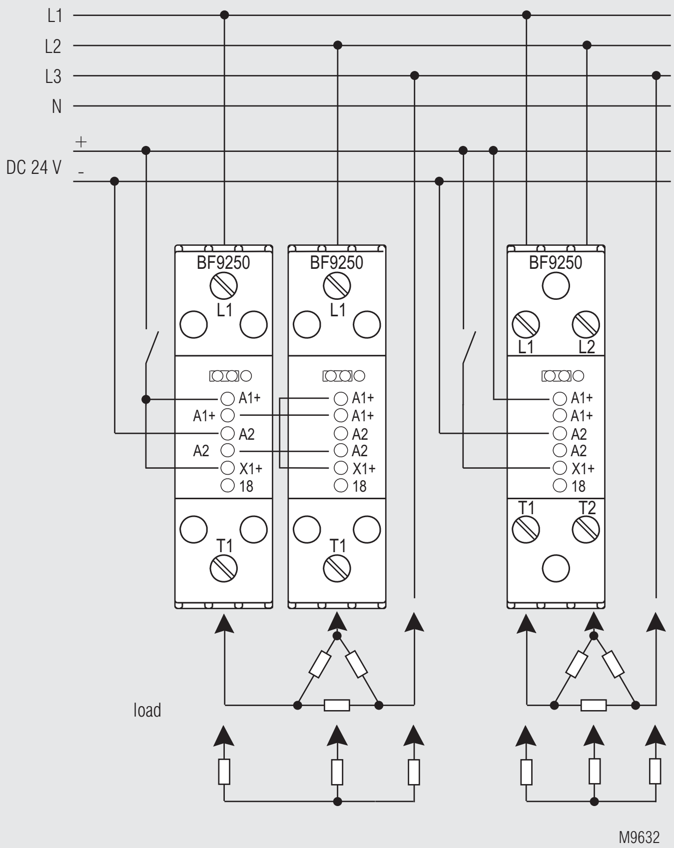
Distance on left and right: 10 mm; with max. load current and 100 % duty cycle

Application Examples

single phase system



3-phase system, 2 phases controlled



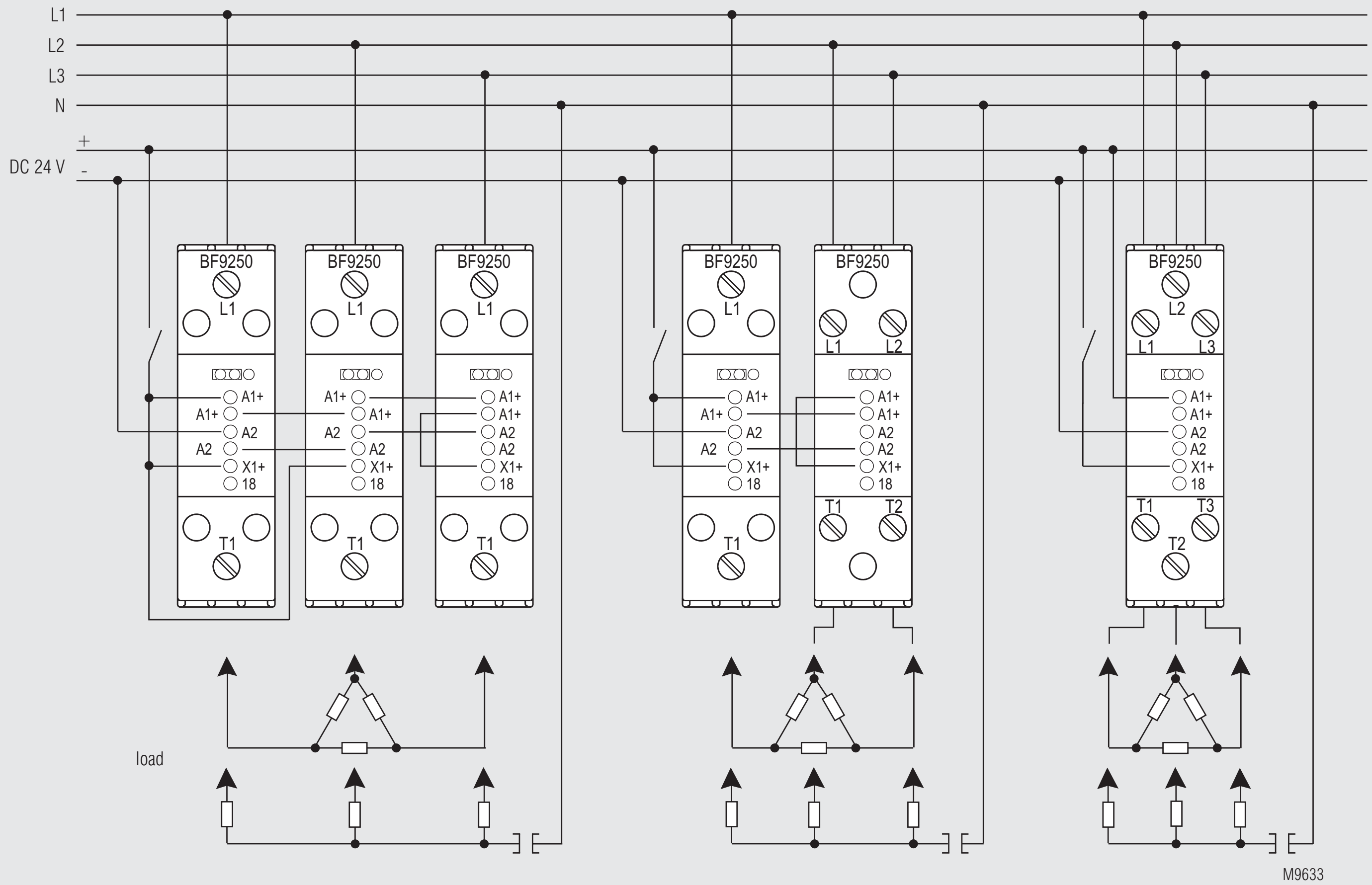
Single phase load switched by 1-pole semiconductor contactor controlled from PLC or Temperature controller output.

3-phase load, switched by 2 single-pole semiconductor contactors (left side) or by 1 2-pole semiconductor contactor (right side)

Width mm	22,5	45	90		22,5	45	90		22,5	45	90
I_L / phase	10 A	25 A	50 A		10 A	25 A	50 A		10 A	25 A	50 A

BF 9250._ _/001

3-phase system, 3-phases controlled

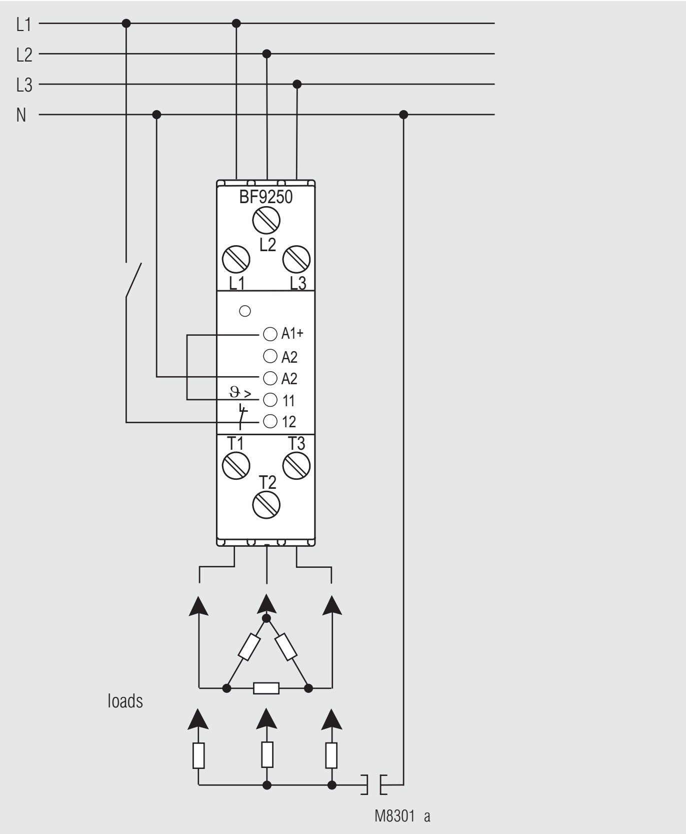


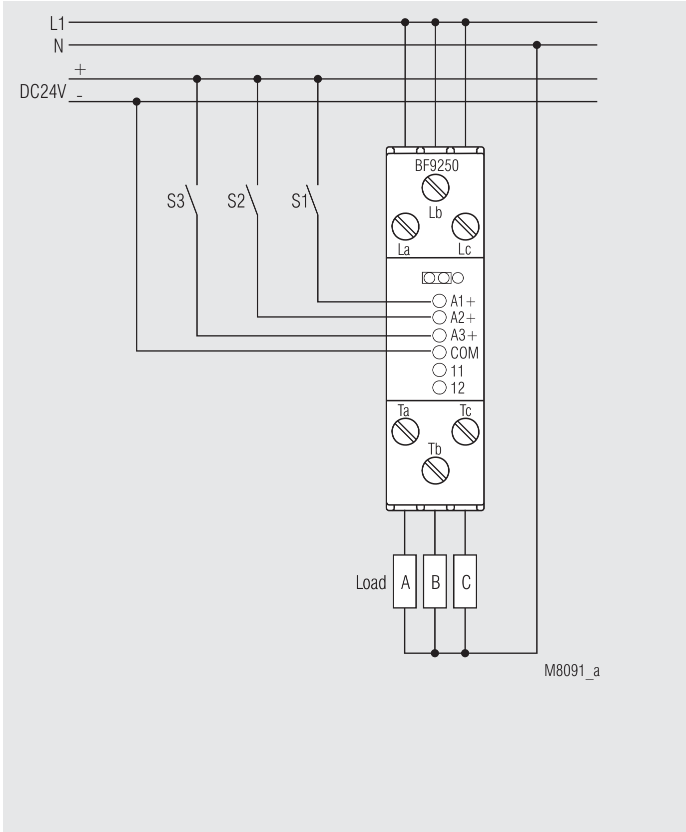
3-phase load switched by 3 single-pole semiconductor contactors

3-phase load switched by 1 3-pole semiconductor contactor

Width mm	22,5	45	90		22,5	45	90		22,5	45	90
I_L / phase	10 A	25 A	50 A		6,5 A	15 A	25 A		5 A	10 A	15 A

BF 9250._ _/001





BF 9250.03
3-phase load, controlled by a 3-pole semiconductor contactor with AC/DC 110-230 V control voltage.

BF 9250.03/004
3 semiconductor contactors in one housing control 3 different loads

POWERSWITCH
Solid-State Contactor
BF 9250/_ _8

DOLD

0255090

BF 9250/008 up to 10 A   BF 9250/008 up to 25 A

- According to IEC/EN 60 947-4-2, IEC/EN 60 947-4-3
- 1-, 2- and 3-pole versions
- Load current up to 50 A at T_U = 40° C
- For AC load up to 530 V
- Switching at zero crossing, optionally immediate switching
- Protected by varistors
- Mounting on DIN-rail
- As option with high I²t of the semiconductor for high switching current (variant /1_8)
- Widths: 22.5 mm, 45 mm and 90 mm

Function Diagram

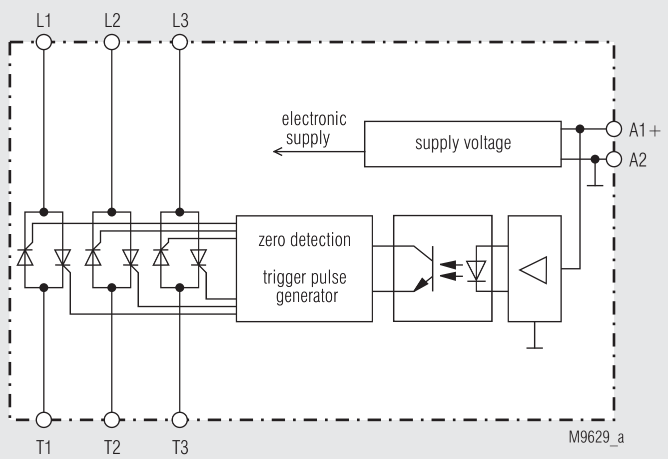
Approvals and Markings

CE | c UL us LISTED
Canada / USA

Applications

Fast and noiseless switching of:
- heating elements
- motors
- valves
- lighting

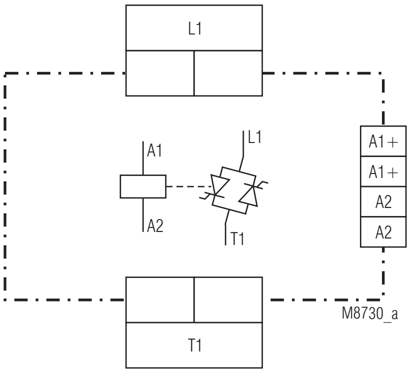
Block Diagram



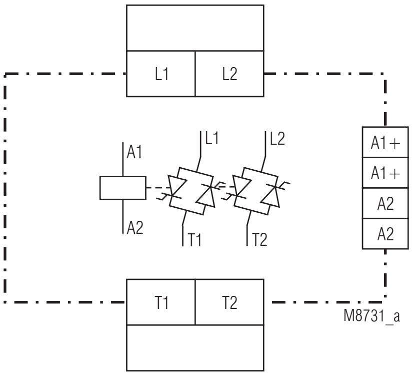
Indicators

LED green: on, when voltage on A1/A2

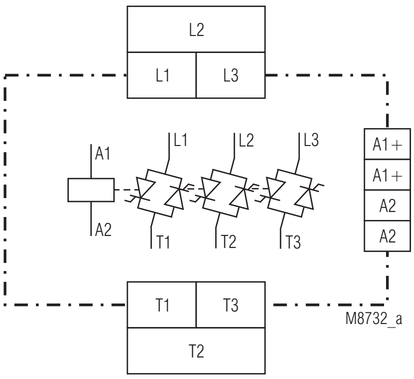
Circuit Diagrams



BF 9250.91/008 (1-pole)



BF 9250.92/008 (2-pole)



BF 9250.93/008 (3-pole)

Connection Terminals

Terminal designation	Signal description
A1 (+), A2	Control or operating voltage
L1, L2, L3	Mains connections
T1, T2, T3	Load output

Technical Data

Input:

Control voltage A1/A2: DC 24 V
Control voltage range:
1-pole: DC 4 ... 32 V
2-pole: DC 7 ... 32 V
3-pole: DC 9 ... 32 V
Start up delay [ms]: ≤ 1 + 1/2 period *⁾
Release delay [ms]: ≤ 1 + 1/2 period *⁾
*⁾ for variant with immediate switching only 1 periode for on and off delay

Output

Load output T1, T2, T3
Load currents at 100 % duty cycle:

		Width		
BF 9250/008	Ambient temperature	22.5 mm	45 mm	90 mm
1-pole	25°C	13 A	30 A	55 A
	40°C	10 A	25 A	50 A
2-pole	25°C	7 A	17.5 A	28 A
	40°C	6.5 A	15 A	25 A
3-pole	25°C	6 A	14 A	20 A
	40°C	5 A	10 A	15 A

Current reduction over 40°C

BF 9250/008	Device without heat sink	Device with small heat sink	Device with large heat sink
1-pole	0.2 A / °C	0.4 A / °C	0.6 A / °C
2-pole	0.2 A / °C	0.3 A / °C	0.4 A / °C
3-pole	0.2 A / °C	0.2 A / °C	0.3 A / °C

Min. load current: AC 40 mA
Load voltage L1, L2, L3: AC 230 V, AC 480 V
Load voltage range:: 24 ... 264 V, AC 24 ... 530 V
Frequency range: 50 / 60 Hz
Leakage current
in off state: approx. 1.0 mA
Peak reverse voltage: ± 1200 Vp
Short circuit current
at t=10 ms
BF 9250.91, BF 9250.92: 600 A
BF 9250.93: 400 A
Power dissipation: P = 1.2 [V] x I eff. [A] / k [W]
with k as formfactor and
k = 1.11 for sinusoidal current

Semiconductor fuse

			Semiconductor fuse		
	I_N	Load limit integral of the semiconductor*⁾	Type	Art.-No.	Brand
1-pole devices	10 A	1800 A²s	fuse 10 x 38	6003434.16	SIBA
	25 A			6003434.30	
	50 A		NH-00	2020920.63	
2-pole devices	2 x 6.5 A	1800 A²s	fuse 10 x 38	6003434.10	
	2 x 15 A			6003434.20	
	2 x 25 A			6003434.30	
3-pole devices	3 x 5 A	800 A²s	fuse 10 x 38	6003434.8	
	3 x 10 A			6003434.16	
	3 x 15 A			6003434.20	

*⁾ up to 18000 A²s: on request

Varistor voltage: AC 510 V

Technical Data

General Data

Mounting position:	cooling ribs vertically	
Operating mode:	Continuous operation	
Temperature range:	0 ... 40°C	
max. temperature:	60°C (with current derating factor) see table	
Storage temperature:	- 20 ... + 80°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree	4 kV / 3	IEC 60 664-1
EMC	IEC/EN 61 000-6-4,	IEC/EN 61 000-6-1
Electrostatic discharge:	8 kVair / 6 kV contact	IEC/EN 61 000-4-2
HF-irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages 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
Interference suppression:	Limit value class A	IEC/EN 60 947-4-3
	A higher suppression class can be reached by connecting capacitors of 0.47 µF / 600 V AC across the phases or across phase and neutral.	
Insulation voltages		
Input to Output:	2.5 kV	
Input to semiconductor monitoring output (NC contact)	2.0 kV	
Input to heat sink:	2.5 kV	
Output to Output:	2.5 kV	
Output to heat sink:	2.5 kV	
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 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection	DIN 46 228-1/-2/-3/-4	
Load terminals:	1 x 10 mm² solid 1 x 6 mm² stranded ferruled	
Control terminals:	1 x 0.75 mm² stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 1 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3	
Wire fixing		
Load terminals:	Terminal screws M 4 Box terminal with wire protection	
Control terminals:	cage clamp terminals	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
Width 22.5 mm:	350 g	
Width 45 mm:	580 g	
Width 90 mm:	1050 g	

Dimensions

Width x heigth x depth:

Dependent of contacts and load current (see table load current):	22.5 x 85 x 120 mm 45 x 85 x 120 mm 90 x 85 x 120 mm

UL-Data according to UL508

Input	
Wire connection	
BF 9250/008:	60°C / 75°C copper conductors only AWG 24 - 14 Sol/Str
Load circuit	
Fixed screw terminal:	75°C copper conductors only AWG 18 - 8 Sol Torque 0.8 Nm or AWG 18 - 10 Str Torque 0.8 Nm (only possible at variants up to 30 A)
Temperature range:	0 ... 40 °C
Frequency range:	50 / 60 Hz
Pollution degree:	2

In the final circuit an overvoltage protector R/CSPD (VZCA2/8) with min. 480V AC, 50/60Hz, VPR=2500V, Type 3 has to be installed.

Info **Technical data that is not stated in the UL-Data, can be found in the technical data section.**

Standard Type

BF 9250.91/008 DC 24 V AC 480 V 50/60 Hz 10 A

Article number: 0056823

- 1-pole
- Control voltage range: DC 4 ... 32 V
- Load voltage range: AC 24 ... 530 V
- Load voltage: 10 A (bei T_U = 40° C)
- with indicator output
- Width: 22.5 mm

Ordering Example

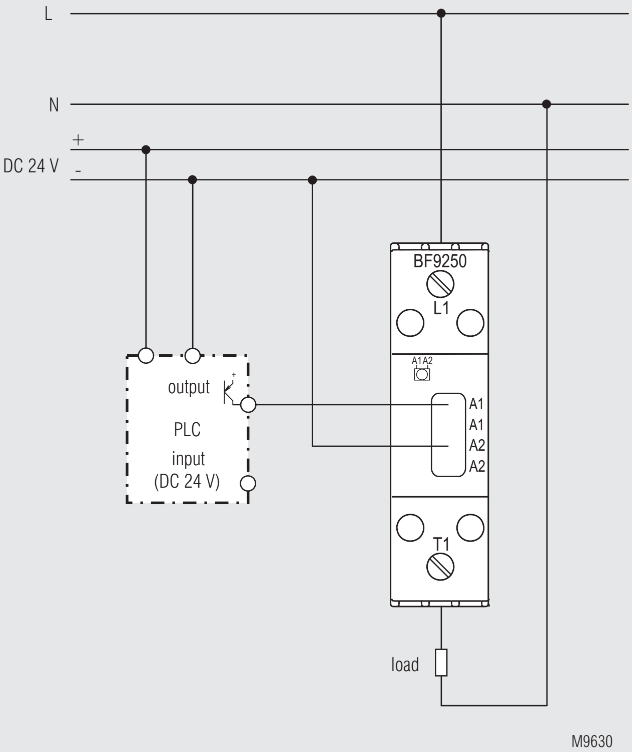
BF 9250 ._ _ /_ _ 8 DC 24 V AC 480 V 50/60 Hz 50 A

- 50 A: Load current
- 50/60 Hz: Frequeny range
- AC 480 V: Load voltage
- DC 24 V: Control voltage
- 0: Switch. at zero crossing / 1: Immediate switching
- 0: Standard / 1: With high I²t
- .91: 1-poles / .92: 2-poles / .93: 3-poles
- BF 9250: Type

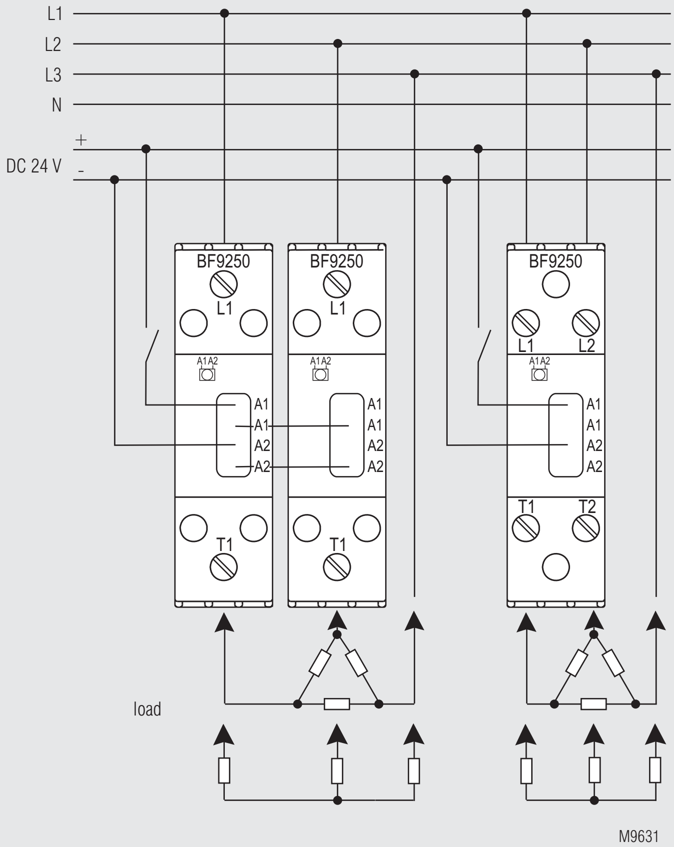
Installation

Recommended distance:
upper / lower side to cable duct: 20 mm
distance on left and right: 10 mm; with max. load current and 100 % duty cycle

single phase system



3-phase system, 2 phases controlled



Single phase load switched by 1-pole semiconductor contactor controlled from PLC or Temperature controller output.

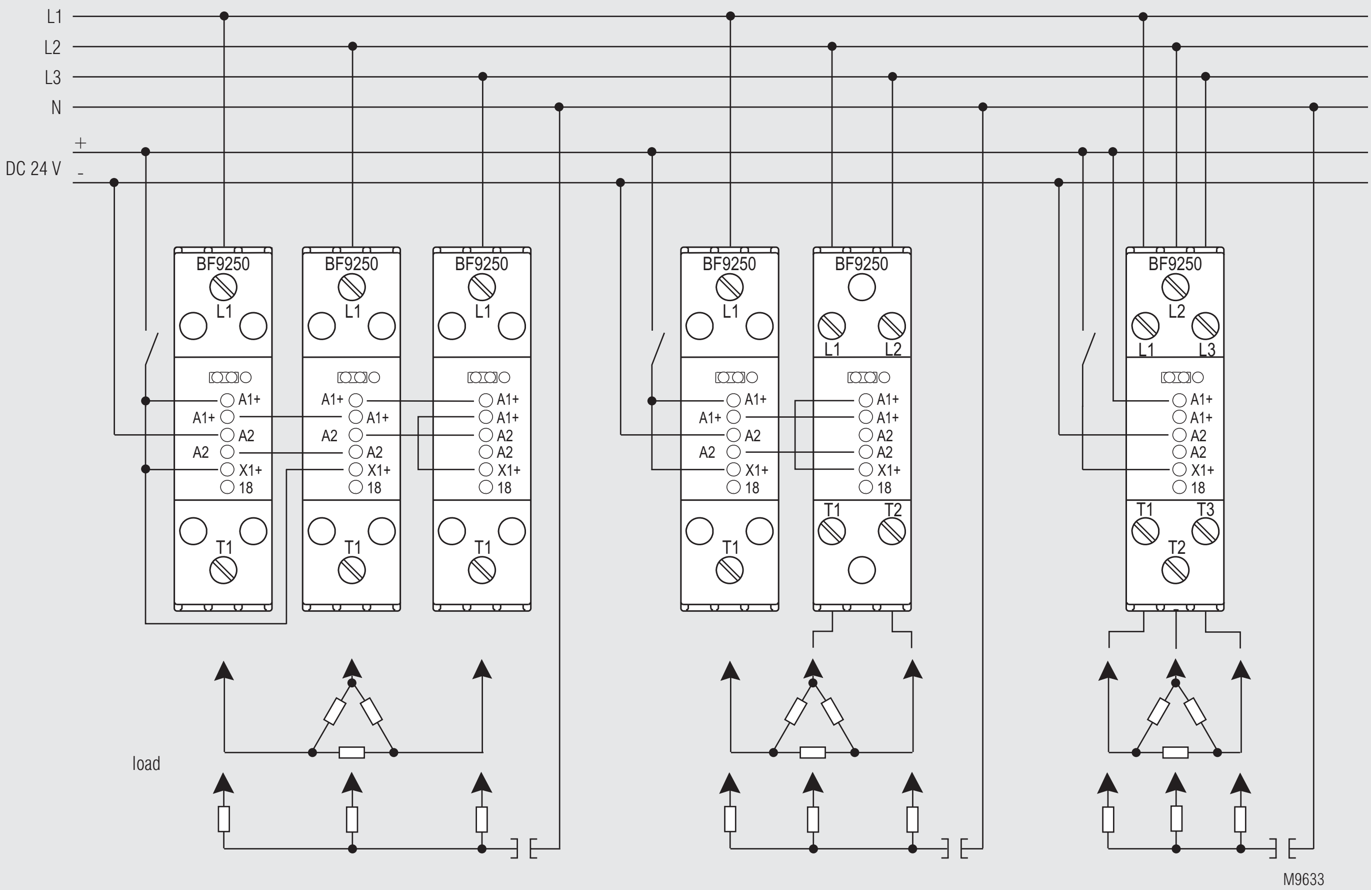
Width mm	22.5	45	90
I_L / phase	10 A	25 A	50 A

3-phase load, switched by 2 single-pole semiconductor contactors (left side) or by 1 2-pole semiconductor contactor (right side)

22.5	45	90
10 A	25 A	50 A

22.5	45	90
6.5 A	15 A	25 A

3-phase system, 3-phases controlled



3-phase load switched by 3 single-pole semiconductor contactors

3-phase load switched by 1 single-pole an 1 2-pole semiconductor contactor

3-phase load switched by 1 3-pole semiconductor contactor

Width mm	22.5	45	90
I_L / phase	10 A	25 A	50 A

22.5	45	90
6.5 A	15 A	25 A

22.5	45	90
5 A	10 A	15 A

Power Electronics

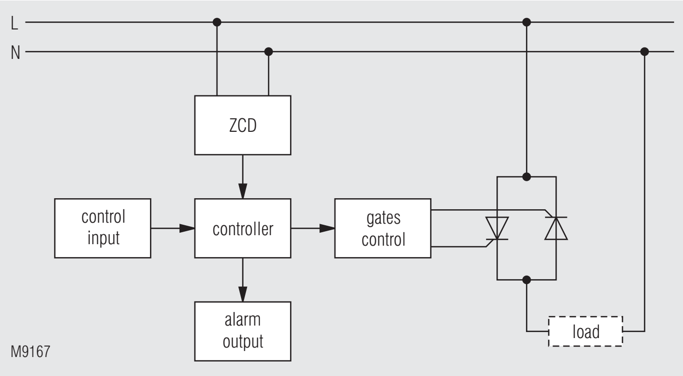
POWERSWITCH
Semiconductor Contactor With Analogue Input For Pulsed Output BF 9250/0_2

DOLD

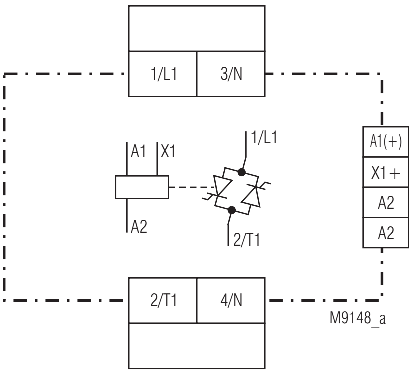
0248829

- Analogue controller for accurate process temperature control
- Burst firing control of heaters
- Control input optional with DC 0 ... 10 V, DC 4 ... 20 mA, 0 ... 10 kΩ
- Reverse action operation possible
- Rated operational voltage range up to 480 V
- Rated operational current is up to AC 50 A
- Zero cross switching
- Protected by varistors
- Temperature protection of the power semiconductors
- LED indications for supply, output status and alarm status
- Alarm indication on mains synchronisation failure
- Alarm indication on control input failure
- Alarm indication on over temperature of power semiconductors
- DIN-rail mountable
- BF 9250/0_2 to 10 A: Width 22.5 mm
  BF 9250/0_2 to 25 A: Width 45 mm
  BF 9250/0_2 to 50 A: Width 90 mm

Block Diagram



Circuit Diagrams



Connection Terminals

Terminal Designation	Signal Designation
A1 (+)	+ / L
A2	- / N
X1	Control input
L1, N	Mains connection
T1, N	Load output

Approvals and Markings

Canada / USA

Applications

- Analogue control for precise temperatur control
- Fast and noiseless switching of heating elements

Indicators

Normal operation
Green LED: ON
Yellow LED: ON according to output status
Red LED: OFF

Mains sychronisation failure alarm
Green LED: Flashing
Yellow LED: OFF
Red LED: Flashing
(This alarm status is not latched)

Control input failure
Green LED: ON
Yellow LED: OFF
Red LED: Flashing
(This alarm status is not latched)

Over temperature of power semiconductors alarm
Green LED: ON
Yellow LED: OFF
Red LED: ON
(This alarm status is latched. Supply on A1+/A2 has to be switched off and back on after a short time to reset this status)

Technical Data

Input

Supply voltage U_H

A1/A2:	AC/DC 24 V
Supply current:	< 26 mA at DC 24 V

Control Input

Current controlled input

Control current range:	DC 0 ... 20 mA or DC 4 ... 20 mA
Allowable input current:	< 35 mA
Over current protection:	YES
Alarm for over current:	YES
Reverse polarity protection:	YES
Voltage drop:	1.02 V at 20 mA

Voltage controlled input

Control voltage range:	DC 0 ... 5 V or DC 0 ... 10 V
Control input current:	< 0.01 mA at DC 10 V

Potentiometer controlled input

Potentiometer value:	10 kΩ ±10 %

Control accuracy

Range:	0 ... 100 %
Step:	1.5625 %

Output

Nominal load voltage:	AC 24 ... 115 V; AC 110 ... 240 V or AC 230 ... 480 V
Load current I_L:	AC 10 A, 25 A, 50 A
Minimum operational current:	AC 40 mA
Operating mode:	Continuous
Current reduction over 40°C	
I_L AC 10 A:	0.2 A / °C
I_L AC 25 A:	0.4 A / °C
I_L AC 50 A:	0.6 A / °C
Freqency range:	45 ... 65 Hz
Varistor voltage:	AC 510 V
Load types:	Resistive
Power loss:	1.2 (V) x I_L (A) approx.
Average power output:	0 ... 100 %
Output power resolution	
at BF 9250/002:	1.5625 %
at BF 9250/042:	5 %
Zero crossing detection:	YES
Off state leakage current at rated voltage and frequency:	1.0 mA (T_j = 125°C max.)
I^2t for fusing t = 1 to 10 ms	
I_L AC 10 A, 25 A:	800 A^2s
I_L AC 50 A:	1800 A^2s
Peak inverse voltage:	±1200 V_P

Note: Higher current capacilities on request

Installation

Recommended distance with max. load current and 100 % duty cycle upper / lower side

to cable duct:	20 mm
left / right:	10 mm

Technical Data

General Data

Maximum humidity:	75 %, no condensation	
Operating temperature:	0 ... 40°C	
Maximum temperature:	60° (using appropriate derating)	
Storage temperature:	- 20 ... + 80°C	
Cooling:	Natural convection	
Junction temperature:	< 125 °C	
Rated withstand voltage input to output:	3500 V	
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Mounting:	DIN rail	IEC/EN 60 715
Wire fixing		
Wire connection		
Load terminals:	1 x 10 mm^2 solid 1 x 6 mm^2 stranded wire with sleeve	
Control terminals:	1 x 0.75 mm^2 stranded wire with sleeve and with insulation 1 x 1.5 mm^2 stranded wire with sleeve and with insulation	
Load terminals:	box terminals	
Control termials:	cage clamps	
Fixing torque:	1.2 Nm	
Weight		
BF 9250/0_2 to 10 A:	350 g	
BF 9250/0_2 to 25 A:	580 g	
BF 9250/0_2 to 50 A:	1094 g	

Dimensions

Width x height x depth

BF 9250/0_2 to 10 A: Width	22,5 x 85 x 120 mm
BF 9250/0_2 to 25 A: Width	45 x 85 x 120 mm
BF 9250/0_2 to 50 A: Width	90 x 85 x 120 mm

UL-Data according to UL508

Input

Wire connection:	60°C / 75°C copper conductors only AWG 24 - 14 Sol/Str

Control input

Current input:	DC 4 ... 20 mA
Voltage input:	DC 0 ... 5 V bzw. DC 0 ... 10 V
Potentiometer input:	10 kOhm ± 10 %

Load circuit

Fixed screw terminal:	75°C copper conductors only AWG 18 - 8 Sol Torque 0.8 Nm or AWG 18 - 10 Str Torque 0.8 Nm (only possible at variants up to 30 A)
Temperature range:	0 ... 40 °C
Frequency range:	50 / 60 Hz
Pollution degree:	2

In the final circuit an overvoltage protector R/CSPD (VZCA2/8) with min. 480V AC, 50/60Hz, VPR=2500V, Type 3 has to be installed.

Info **Technical data that is not stated in the UL-Data, can be found in the technical data section.**

Standard Type

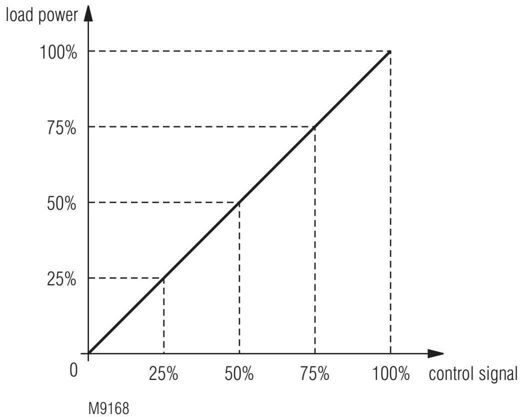
BF 9250.91/042 U_H AC/DC 24 V DC 0 ... 10 V AC 230 ... 480 V AC 10 A

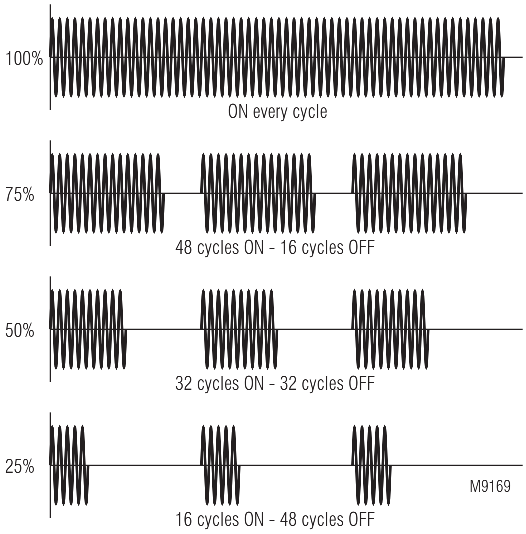
Article number:	0059168
• 1-pole	
• Control input:	DC 0 ... 10 V
• Auxiliary voltage:	AC/DC 24 V
• Load voltage:	AC 230 ... 480 V
• Load current:	AC 10 A
• Width:	22.5 mm

Variants

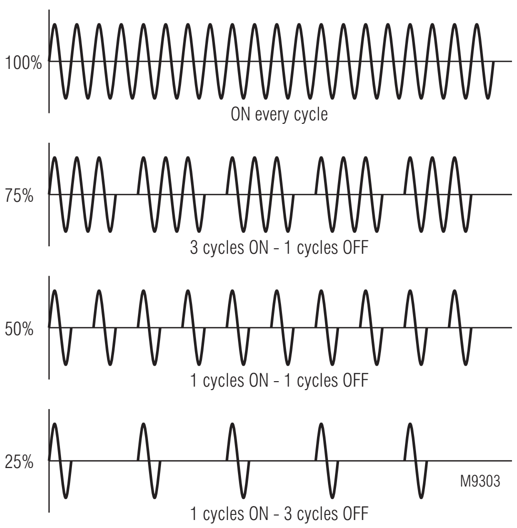
BF 9250/002:	Output control with fixed period of 64 cycles, pulse-space ratio according to input signal
BF 9250/042:	Self optimising, to achieve as short as possible control periods, suitable for infrared lamps

Characteristics

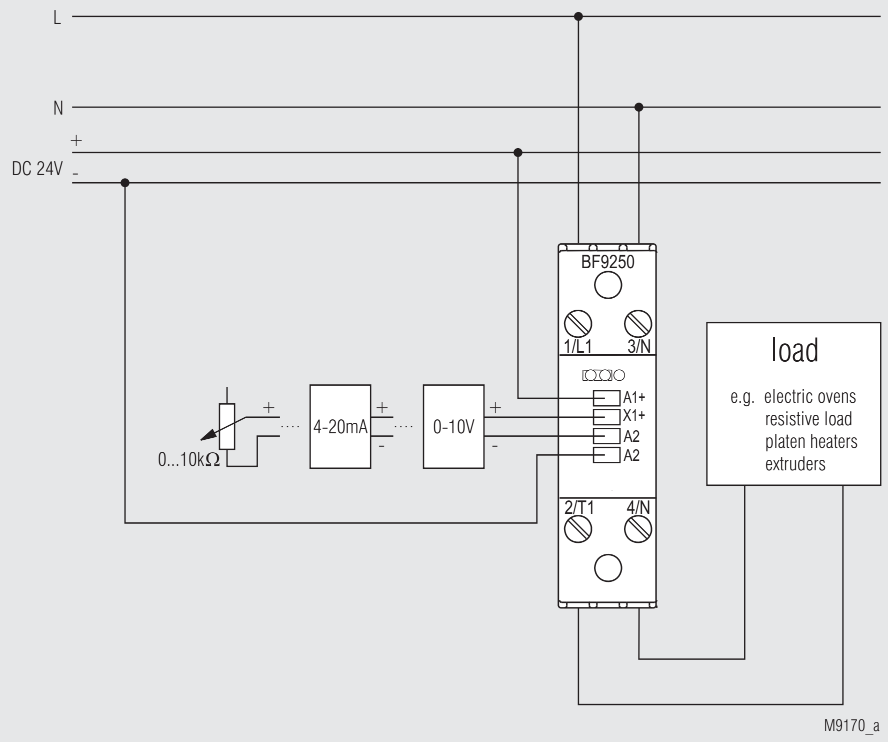




Variant BF 9250/002



Variant BF 9250/042


L
N
+
DC 24V -
BF9250
1/L1
3/N
A1+
X1+
A2
A2
2/T1
4/N
0...10kΩ
4-20mA
0-10V
load
e.g. electric ovens
resistive load
platen heaters
extruders
M9170_a

POWERSWITCH
Solid-State Relay / - Contactor For Resistive Load
PK 9260

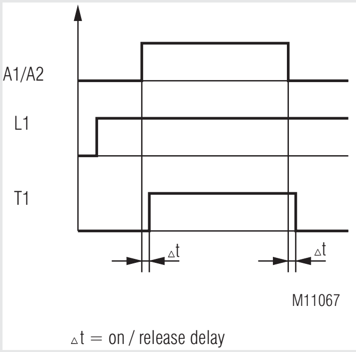
DOLD

0269163

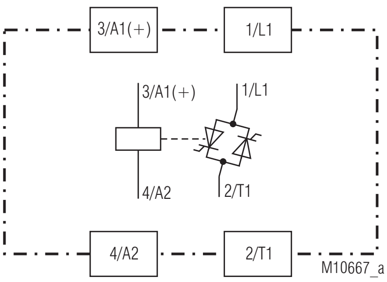
Solid-state relay PK 9260
without heat sink

Solid-state contactor PK 9260
with heat sink 20 A

Function Diagram



Circuit Diagram



Notes

Depending on the application it may be useful to protect the solid-state relay with special superfast semiconductor fuses against shortcircuit.

Without heat sink
The solid-state relay can be mounted on existing cooling surfaces. Depending on the load, sufficient ventilation has to be provided.

With heat sink
For optimised heat dissipation the solid-state relays can be delivered with special dimensioned heat sinks. Depending on the ambient conditions and the load this helps to select the correct solid-state relay and heat sink. The heat sinks can be clipped on DIN-rail.

Your Advantages
- High switching frequency and long life
- Space saving, only 22.5 mm width
- To be mounted on cooling surface with only 2 screws
- With heat sink for DIN-rail mounting
- Silent
- Vibration- and shock resistance

Features
- AC solid-state relay / -contactor
- PK 9260/_ _ _ according to IEC/EN 62314
  PK 9260/_ _ _ / _ _ according to IEC/EN 60947-4-2 and -4-3
- Load current up to 88 A, AC-51
- Switching at zero crossing for resistive loads
- 2 anti-parallel thyristors
- DCB technology (direct bonding method) for excellent heat transmission properties
- As option with:
  - M4 flat terminal or
  - M5 screw terminal for cable lug
- LED status indicator
- Peak reverse voltage up to ± 1600 V
- Insulation voltage 4000 V
- As option with heat sink, for DIN rail mounting

Approvals and Markings

CE

Applications

Solid-state relays switching at zero crossing:

For frequent no-wear and no-noise switching of:

- heating systems
- cooling systems
- valves
- lighting systems

The solid-state relay switches at zero crossing and is suitable for many applications e.g. extrusion machines for plastic and rubber, packaging machines, solder lines, machines in food industry.

Function

The solid-state relay PK 9260 is designed with 2 anti-parallel connected thyristors switching at zero crossing for resistive loads (e.g. heating systems). When connecting the control voltage the output of the solid-state relay is activated at the next zero crossing of the sinusoidal voltage. When disconnecting the control voltage the output is switched off at the next zero crossing of the load current.
The LED shows the state of the control input.

Operation Notes

EMC disturbance during operation has to be reduced by corresponding measures and filters. If several solid-state relays are mounted together sufficient cooling and ventilation has to be provided.

Control Circuit

Control voltage range [V]:	DC 4 ... 32	AC/DC 18 ... 30	AC 100 ... 230
Making voltage [V]:	3.0	10	80
Switch off voltage [V]:	1.0	6.0	25
Max. input current [mA]:	12	25 at 24 V AC	20 at 230 V AC
Start up delay [ms]:	≤ 1.0 + ½ cycle*	≤ 5 + ½ cycle*	≤ 10 + ½ cycle*
Release delay [ms]:	≤ 1.0 + ½ cycle*	≤ 20 + ½ cycle*	≤ 35 + ½ cycle*

*) ½ cycle delay only when switching at 0-crossing, at instantaneous switching the delay = 0

Output

Load voltage AC [V]:	24 ... 230	48 ... 460	48 ...600
Peak reverse voltage [V]:	650	1200	1600
Frequency range [Hz]:	47 ... 63		

Solid-state relays. heat sink see table Load current I_{nenn} [A] / AC-51:	24		32	48	48*	72	72*	88
Solid-state contactor at T_U = 40 °C: Designation heat sink: Load current I_{nenn} [A] / AC-51:	/03 10	/04 20		/05 40		/06 60	/06 60	
Current reduction above T_U = > 40 °C [A / °C]	0,3	0,4		0,6		0,8	0,8	
Max. overload current [A]. t = 10 ms:	≤ 350	≤ 400	≤ 400	≤ 620	≤ 1300*	≤ 1050	≤ 1150	≤ 1150
Load limit integral I^2t [A^2s]:	612	800	800	1920	8500*	5500	6600	6600
Leakage current in off state [mA]	≤ 1,5							
Min. current [mA]	20							
Forward voltage [V] at at nominal current:	1,1	1,2	1,2	1,2	1,1	1,2	1,2	1,2
Off-state voltage [V/µs]:	500	500	1000	1000	1000	1000	1000	1000
Rate of rise of current [A/µs]:	150	150	100	150	150	150	150	150

*) at variant /1_ _ : High I^2t value

Thermal Data - Solid-State Relays -

Solid-state relays without heat sink Load current I_{nenn} [A] / AC-51:	24	32	48	48*	72	72*	88
Thermal resistance Junction ambient [K/W]:	10						
Thermal resistance Junction housing [K/W]:	0,55	0,48	0,36	0,25	0,35	0,25	0,25
Junction temperature [°C]:	≤ 125						

Notes on Sizing for Selection of a Heat Sink

The heat generated by the load current must be dissipated by a suitable heat sink. It is imperative that the junction temperature of the semiconductor is maintained for all potential environmental temperatures of under 125°C. For this reason, it is important to keep the thermal resistance between the base plate of the solid-state relay and the heat sink to a minimum.
To protect the solid-state relay effectively from excess heating, a thermally conducting paste or a graphit gasket (see Accessories) should be applied before installation to the base plate of the heat sink between semiconductor relay and heat sink.
From the table, select a suitable heat sink with the next lowest thermal resistance. Thus, it is ensured that the maximum junction temperature of 125°C is not exceeded. The load current in relation to the environmental temperature can be seen from the table.

a)

Load current (A)	**PK 9260 24 A Thermal resistance (K/W)**					
24.0	3.6	3.2	2.8	2.4	2.0	1.6
21.6	4.1	3.7	3.2	2.8	2.3	1.9
19.2	4.8	4.3	3.8	3.3	2.8	2.2
16.8	5.5	5.0	4.5	3.9	3.3	2.7
14.4	7.0	6.3	5.5	4.8	4.1	3.4
12.0	8.5	7.8	6.9	6.0	5.2	4.3
9.6	-	-	9.0	7.9	6.8	5.6
7.2	-	-	-	-	9.5	7.9
4.8	-	-	-	-	-	-
2.4	-	-	-	-	-	-
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

b)

Load current (A)	PK 9260 32 A Thermal resistance (K/W)					
32.0	2.0	1.9	1.6	1.3	1.1	0.8
28.8	2.5	2.2	1.9	1.6	1.3	1.0
25.6	3.0	2.7	2.3	2.0	1.6	1.3
22.4	3.7	3.3	2.8	2.4	2.0	1.6
19.2	4.5	4.0	3.5	3.1	2.6	2.1
16.0	5.8	5.2	4.5	3.9	3.3	2.7
12.8	7.6	6.8	6.1	5.3	4.5	3.7
9.6	-	9.7	8.6	7.5	6.4	5.3
6.4	-	-	-	-	-	8.5
3.2	-	-	-	-	-	-
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

c)

Load current (A)	PK 9260 48 A / 48 A Hi I²t Thermal resistance (K/W)					
48.0	1.3	1.2	1.0	0.8	0.6	0.5
43.2	1.6	1.4	1.2	1.0	0.8	0.6
38.4	1.9	1.7	1.5	1.2	1.0	0.8
33.6	2.4	2.1	1.8	1.6	1.3	1.0
28.8	3.0	2.6	2.3	2.0	1.6	1.33
24.0	3.8	3.4	3.0	2.6	2.2	1.8
19.2	5.1	4.6	4.0	3.5	3.0	2.4
14.4	7.2	6.5	5.8	5.0	4.3	3.6
9.6	-	-	9.3	8.1	7.0	5.8
4.8	-	-	-	-	-	-
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

d)

Load current (A)	PH 9260 72 A Thermal resistance (K/W)					
72.0	0.7	0.6	0.5	0.4	0.3	-
64.8	0.9	0.8	0.7	0.5	0.4	0.3
57.6	1.1	1.0	0.8	0.7	0.5	0.4
50.4	1.5	1.3	1.1	0.9	0.7	0.5
43.2	1.9	1.6	1.4	1.2	1.0	0.7
36.0	2.4	2.2	1.9	1.6	1.3	1.1
28.8	3.3	3.0	2.6	2.2	1.9	1.5
21.6	4.8	4.3	3.8	3.3	2.8	2.3
14.4	7.8	7.0	6.2	5.5	4.7	3.9
7.2	-	-	-	-	-	8.6
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

e)

Load current (A)	PK 9260 88 A Thermal resistance (K/W)					
88.0	0.6	0.5	0.4	0.3	-	-
79.2	0.7	0.6	0.5	0.4	0.3	-
70.4	0.9	0.8	0.7	0.6	0.4	0.3
61.6	1.2	1.0	0.9	0.7	0.6	0.4
52.8	1.5	1.3	1.1	1.0	0.8	0.6
44.0	2.0	1.8	1.5	1.3	1.1	0.9
35.2	2.7	2.4	2.1	1.8	1.5	1.2
26.4	3.9	3.5	3.1	2.7	2.3	1.9
17.6	6.3	5.7	5.0	4.4	3.8	3.1
8.8	-	-	-	9.7	8.3	7.0
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

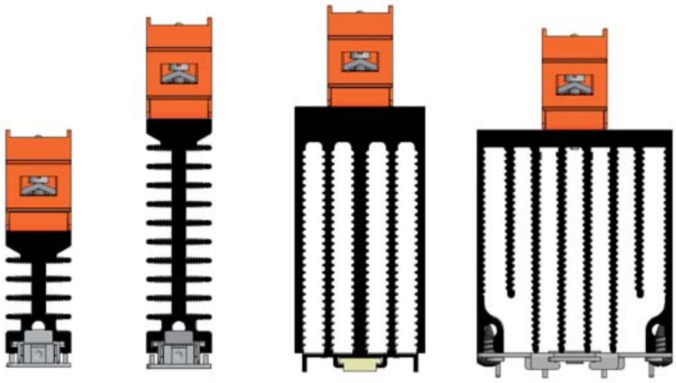
Solid-state with optimised heat sink

We recommend the following combination of solid-state relay and heat-sink depending on the load current and an ambient temperature of 40° C.

If the solid-state relays are used at ambient temperature above 40°C the load current has to be reduced according to the current reduction (A/°C see table).

Example:

Operation at T_U = 45°C; heat sink for 10 A with 0.3 A / °C
Current reduction: 5°C x 0.3 A / °C = 1.5 A
Max. load current: 10 A - 1.5 A = 8.5 A



/03 10 A　/04 20 A　/05 40 A　/06 60 A

General Technical Data

Operating mode:	Continuous operation (Current reduction above 40 °C)	
Temperature range		
operation:	- 25 ... 60° C	
storage:	- 25 ... 85° C	
Relative air humidity:	< 95 % non-condensing at 40 °C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	6 kV / 2	IEC/EN 60 664-1
EMC:	IEC/EN 61 000-6-4,	IEC/EN 61 000-4-1
Electrostatic discharge (ESD):	8 kV air / 6 kV contact	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages		
Control circuit between A1 / A2:	1 kV	IEC/EN 61 000-4-5
between output and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class A	IEC/EN 60 947-4-3
Degree of protection:	IP 10	IEC/EN 60 529
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz, IEC/EN 60-068-2-6	
Housing material:	PBT/PC flame resistant; UL 94 V0	
Base plate:	Aluminum, copper nickle-plated	
Mounting screws:	M4 x 20 mm	
Mounting torque:	2.5 Nm	
Connections load circuit /_ _ 0:	Mounting screws M4 Pozidrive 1 PT	
Mounting torque:	2.5 Nm	
Wire cross section:	2 x 1.5 ... 2.5 mm² solid or 2 x 2.5 ... 6 mm² solid oder 2 x 1.0 ... 2.5 mm² stranded wire with sleeve 2 x 2.5 ... 6 mm² stranded wire with sleeve 1 x 10 mm² stranded wire with sleeve	
Connections load circuit /_ _ 1:	Mounting screws M5	
Mounting torque:	2.5 Nm	
cable lug (DIN 46234):	5 - 2.5; 5 - 6; 5 - 10; 5 - 16; 5 - 25	
Connections control circuit:	Mounting screws M3 Pozidrive 2 PT	
Mounting torque:	0.6 Nm	
Wire cross section:	1 x 0.5 ... 2.5 mm² solid or 2 x 0.5 ... 1.0 mm² solid or 1 x 0.5 ... 2.5 mm² stranded wire with sleeve	
Nominal insulation voltage		
Control circuit – load circuit:	4 $kV_{eff.}$	
Load circuit – base plate:	4 $kV_{eff.}$	
Overvoltage category:	III	
Weight		
without heat sink:	approx. 80 g	
with heat sink Load current		
10 A:	approx. 225 g	
20 A:	approx. 305 g	
40 A:	approx. 575 g	
60 A:	approx. 785 g	

Dimensions

Width x height x depth

without heat sink

with screw terminals:	22.5 x 85 x 50 mm
with cable lug terminals:	22.5 x 139 x 50 mm

with heat sink

Load current

10 A:	22,5 x 99 x 92 mm
20 A:	22,5 x 99 x 131 mm
40 A:	45 x 105 x 135 mm
60 A:	67,5 x 136 x 127 mm

Standard Type

PK 9260.91 AC 48 ... 460 V 24 A DC 4 ... 32 V

Article number:	0064884
• Load voltage:	AC 48 ... 460 V
• Load current:	24 A
• Control voltage:	DC 4 ... 32 V
• Width:	22.5 mm

Variants

PK 9260 .91 / _ _ _ / 0 _

- 0 Without heat sink
- 3 With heat sink 10 A
- 4 With heat sink 20 A
- 5 With heat sink 40 A
- 6 With heat sink 60 A

- 0 M4 flat terminal
- 1 M5 screw terminal (cable lug)
- 2 M5 cable lug terminal (cable lug)

- 0 Switching at zero crossing
- 1 Instantaneous switching

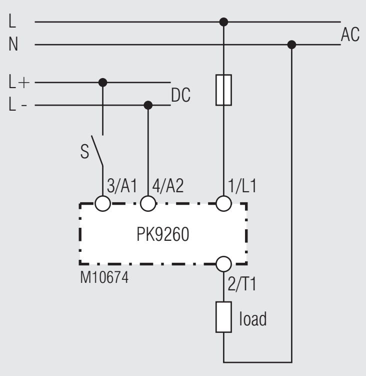
- 0 Standard
- 1 With high I²t-value

Ordering example for variants

PK 9260.91 /1 0 0 /04 AC 48 ...460 V 20 A DC 4 ... 32 V

Control voltage
Load current
Load voltage
with heat sink 20 A
M4 flat terminal
Switching at zero crossing
With high I²t-value
Type

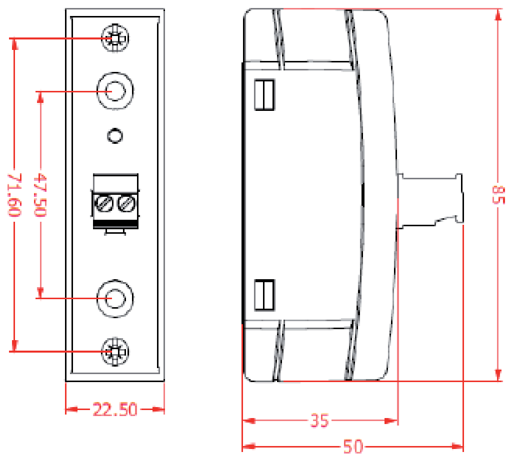
Connection Example



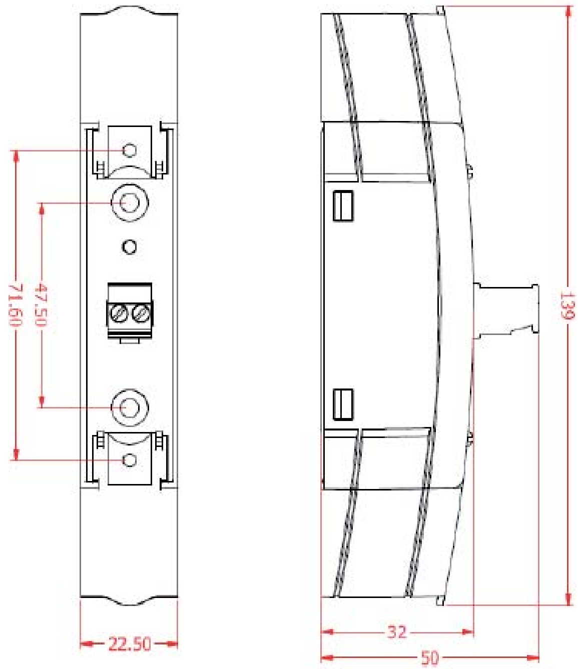
single-phase

Connection Example

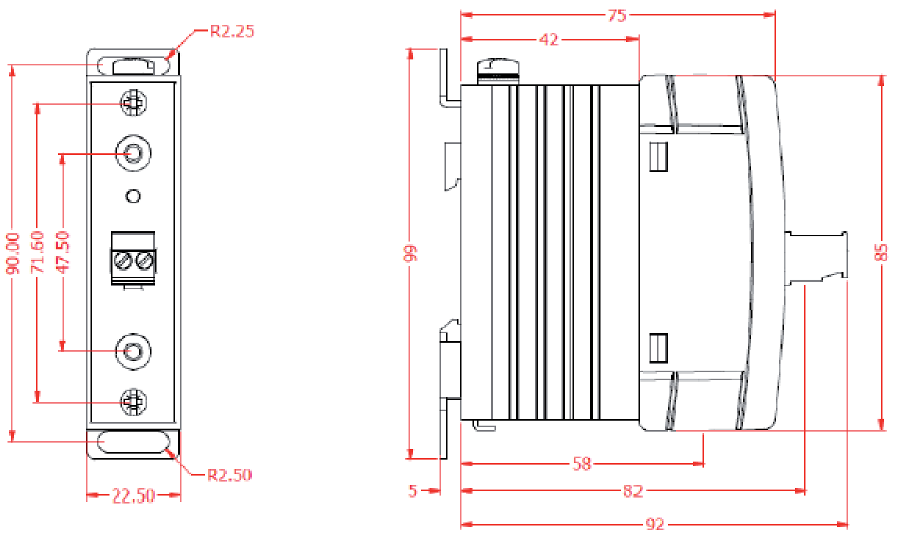
Flat terminals
PK 9260.91/_ _0



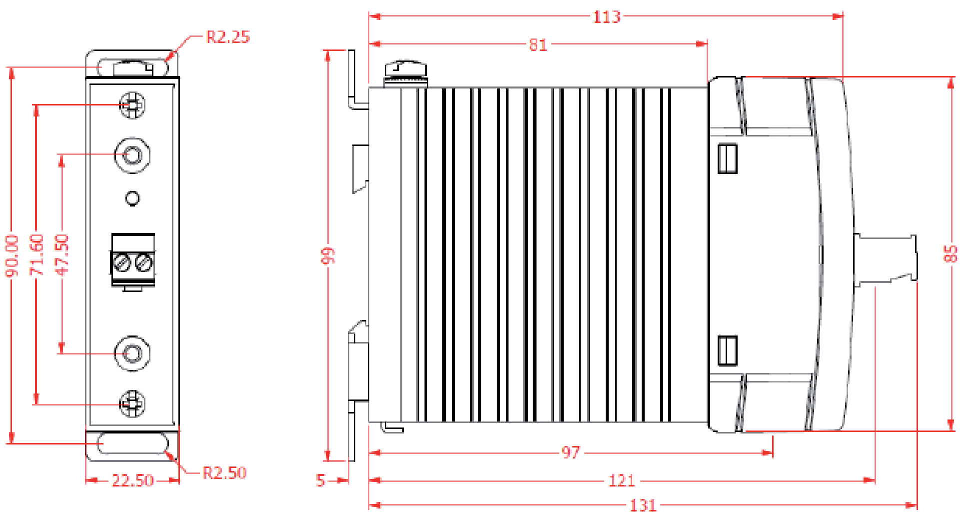
Screw terminals / cable lug terminals
PK 9260.91/_ _1



PK 9260.91/_ _0 /03

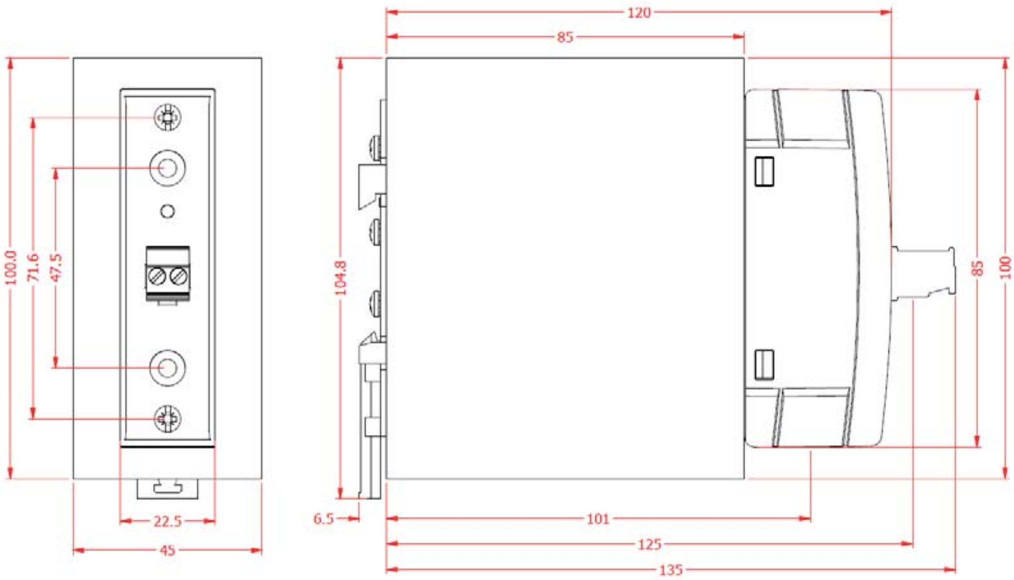


PK 9260.91/_ _0 /04

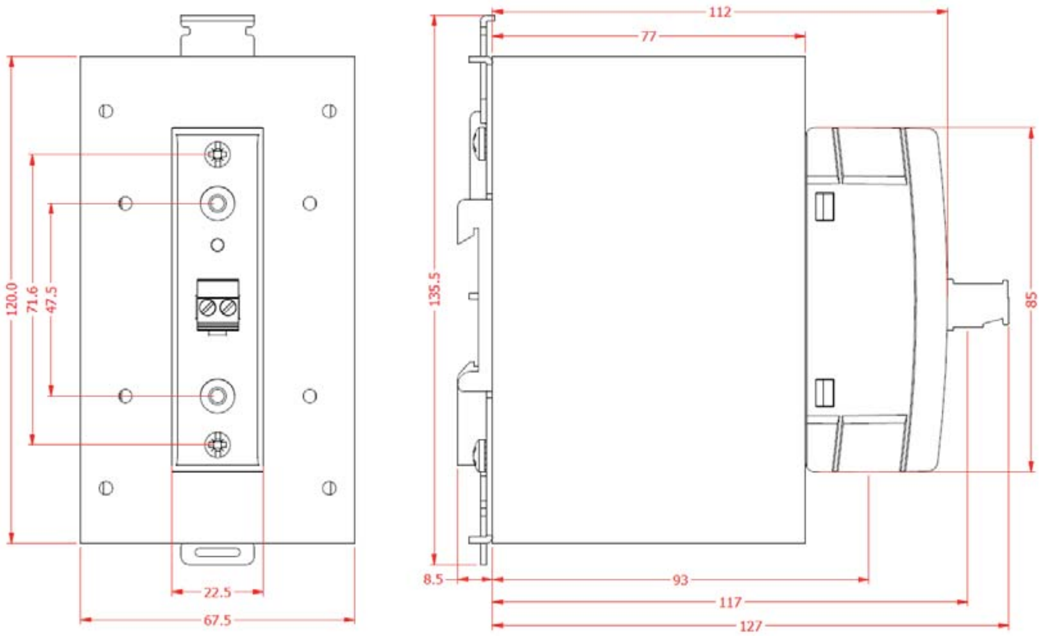


Connection Example

PK 9260.91/_ _0 /05



PK 9260.91/_ _0 /06



POWERSWITCH
Semiconductor Contactor With Current Monitoring
BH 9251

0238194

BH 9251 up to 10 A

BH 9251 up to 20 A

BH 9251 up to 40 A

- According to IEC/EN 60 947-1, IEC/EN 60 947-4-2
- Switching at zero crossing
- To switch single-phase AC load up to 400 V
- Compensates voltage fluctuations of ± 20 %
- Load current up to 40 A
- Monitors:
  - Undercurrent
  - Overcurrent
  - Interrupted load circuit
  - monitors temperature to protect the power semiconductor
- De-energized on fault
- One relay output with changeover contact
- LED Indicators
- No auxiliary supply
- Galvanically separated control input X1-X2 with wide voltage range
- Adjustable current response value
- With integrated heat sink
- DIN-rail mounting
- 45 mm, 67.5 mm and 112.5 mm width

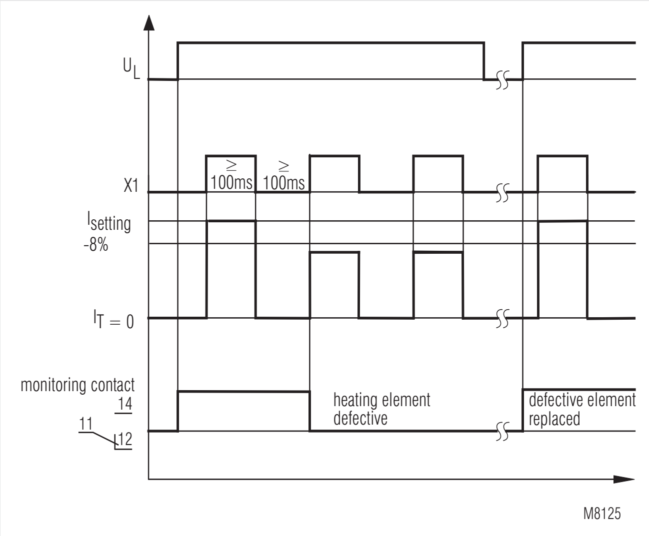
Additional Information About This Topic

- Data sheet BF 9250, Semiconductor contactor

Approvals and Markings

CE

Function Diagram



Applications

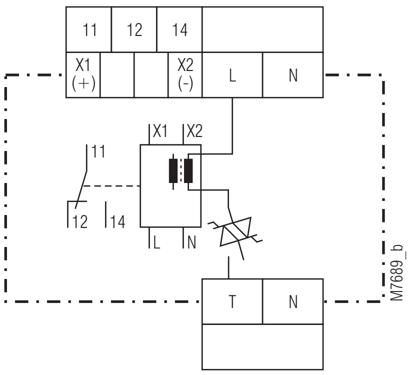
To monitor max. 12 parallel connected heating elements in packaging machines, plastic moulding machines, blister packaging machines etc.

Number-/load of heating elements to be connected to BH 9251, at load voltage AC 230 V

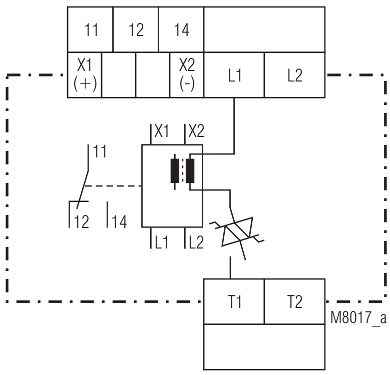
BH 9251				
Load current up to:	5 A	10 A	20 A	40 A
Max. total load of heating elements:	1150 W	2300 W	4600 W	9200 W
Max. no. of heating elements: Load of one element:	12 95 W	12 190 W	12 380 W	12 760 W

Monitors:
- Failure of a heating element ≥ 190 W / 380 W / 760 W
- Broken wire detection
- Short circuits between windings of a heating element

Circuit Diagrams



for AC 230 V



for AC 400 V
Star-connection

Function

Voltage compensation:
The unit includes voltage compensation of ± 20 %. Only fault caused by defective heating elements are detected. Current changes caused by voltage fluctuations are ignored.

Failure of one heating element:
If the current decreases from the adjusted value by 8 % of the total value the monitoring output switches off. The failure of one heating element ≥ 190 W will be detected. The control input X1-X2 has to be closed at least 100 ms to allow current sensing.

Broken wire detection in the load circuit:
A broken line in the load circuit is monitored. The output relay switches off.

Overcurrent in the load circuit:
If the current increases from the adjusted value by 10 % of the total value the monitoring output switches off. The semiconductor remains active. If the overcurrent decreases to normal current the output relay switches on again. With this function shorts between windings inside the heating elements are detected.
At an overcurrent ≥ 30% of the total value the output relay switches off together with the semiconductor. This state will be stored. By switching the voltage off and on at L the semiconductor comes on again if there is no overcurrent. The monitoring output closes. This function is used to protect the device agains overload.

Temperature monitoring:
The temperature detection gets active when the temperature on the semiconductor is to high. The output relay switches off together with the power semiconductor. It the temperature goes back to normal monitoring output and the semiconductor are switched on again. The time disconnection depends on the ambient temperature.

Indicators

green LED, continuous light:	Voltage connected, load current and setting value are identical
green LED, flashing:	Voltage connected, load current and setting value are not identical
yellow LED X1, continuous light:	Control input X1, X2 active
red LED > ϑ, flashing:	Temperature detection active.
> I, continuous light:	Overcurrent ≥ 10 %
red LED < I, continuous light:	Failure of one heating element or broken wire in load circuit

Technical Data

Input

Nominal voltage U_N:

L - N:	AC 230 V / 48 V
L1 - L2:	AC 400 V on request
Voltage range:	0.8 ... 1.2 U_N
Nominal consumption:	0.8 W / 3.2 VA
Nominal frequency:	50 / 60 Hz
Control input X1-X2:	galvanically separated
Input voltage:	AC/DC 9,6 ... 270 V
Input current:	approx. 1 mA
Impulse length:	≥ 100 ms

Current Sensing

Measuring range:	1 ... 10 A / 2 ... 20 A / 4 ... 40 A
Measuring accuracy:	1 % of end scale value
Setting accuracy:	± 2.5 % of end scale value
Repeat accuracy:	< ± 1 %
Adjustment of current value:	infinite within measuring range
Response value for overcurrent:	≥ 10 % of end scale value, fixed
Response value for undercurrent:	- 8 % of end scale value, fixed
Voltage compensation:	± 20 %
Sample time:	≤ 100 ms

Technical Data

Output

Load output I_T

Load current	Width		
	45 mm	67.5 mm	112.5 mm
AC-51:	10 A	20 A	40 A

Values at Tu = 40 °C und 100 % ED

Current reduction			
40°C	0.2 A / °C	0.4 A / °C	0.6 A / °C

Load voltage:	230 V ± 20 %
Cut-off voltage:	1200 Vp
Leakage current:	< 1 mA
Switching delay:	< 100 ms
Semiconductor fuse	
BH 9251, 10 A + 20 A:	800 A^2 s
BH 9251, 40 A:	1800 A^2 s

Monitoring output

Contacts:		
BH 9251.11	1 changeover contact	
Thermal continuous current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC:	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 switching cycles	IEC/EN 60 947-5-1
Short circuit strength max. fuse rating:	4 A gL	IEC/EN 60 947-5-1

General Data

Operating mode:	Continuous operation	
Temperature range:	0 ... + 40°C	
max. temperature:	60 °C (with current reduction)	
Storage temperature:	- 20 ... + 80°C	
Clearance and creepage distances		
rated impulse voltage / Pollution degree		
L, N - X1, X2		
L, N - 11, 12, 14:	4 kV / 2	IEC 60 664-1
X1, X2 - 11, 12, 14:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge votages 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
Interference suppression:	Limit value class B	EN 55 011
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 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection		
Load terminals:	1 x 10 mm^2 solid, or 1 x 6 mm^2 stranded ferruled	
Control terminals:	2 x 1.5 mm^2 stranded ferruled	
Mounting:	DIN rail	IEC/60 715
Weight:		
Width:		
45 mm	400 g	

Dimensions

Width x height x depth:	45 x 84 x 121 mm	(10 A)
	67.5 x 84 x 121 mm	(20 A)
	112.5 x 84 x 121 mm	(40 A)

Standard Type

BH 9251.11 AC 230 V 50/60 Hz 10 A
Article number: 0052267
- Nominal voltage: AC 230 V
- Load current: 10 A
- Width: 45 mm

Ordering Example

BH 9251 .11 AC 230 V 50 / 60 HZ 10 A

- 10 A — Load current
- 50 / 60 HZ — Nominal frequency
- AC 230 V — Nominal voltage
- .11 — Contacts
- BH 9251 — Type

Notes for Installation

Suggested distance:
between relay and cable duct: 20 mm
to neighbour device: 10 mm; at max. load current and 100 duty cycle

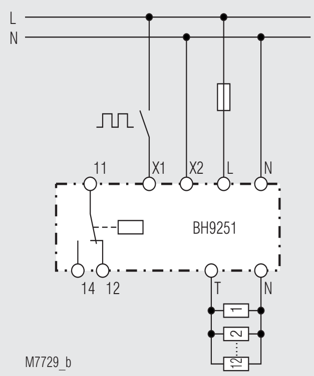
Set-up Procedure

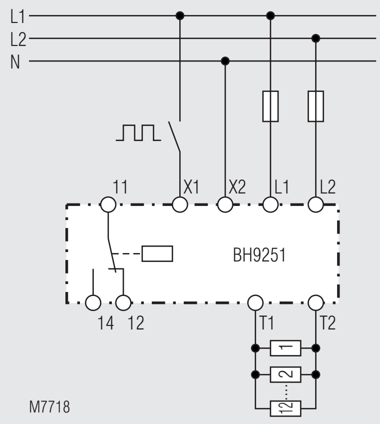
1.) Switch on heating elements by activating control input X1.
2.) When the potentiometer is in left hand position the red LED >I must be on because the unit detects an overcurrent. At the same time the green LED is flashing. Turning the potentiometer slowly clockwise the red LED >I goes of and contact 11-14 closes. The green LED is still flashing.
When the potentiometer is turned further clockwise the LED will change from flashing to continuous light. At this point the window indicating the correct current is reached. Turning further clockwise will make the LED flash again. The width of the window is ± 2.5 % of the setting range. To adjust the unit to the optimum setting the potentiometer should be set in the middle between the 2 points where the green LED starts flashing. At this point the actual current flowing and the setting value are identical. Current changes of > ± 2.5 % will make the green LED flash again. An undercurrent of 8 % will make the red LED <I light up and an overcurrent of 10 % will turn the red LED >I on.
The settings can be done also while the voltage is fluctuating within 20 % from the nominal voltage as changes in these limits are compensated.
3.) Simulating the failure of one heating element by disconnecting the element. The output relay switches off and the LED <I goes on.

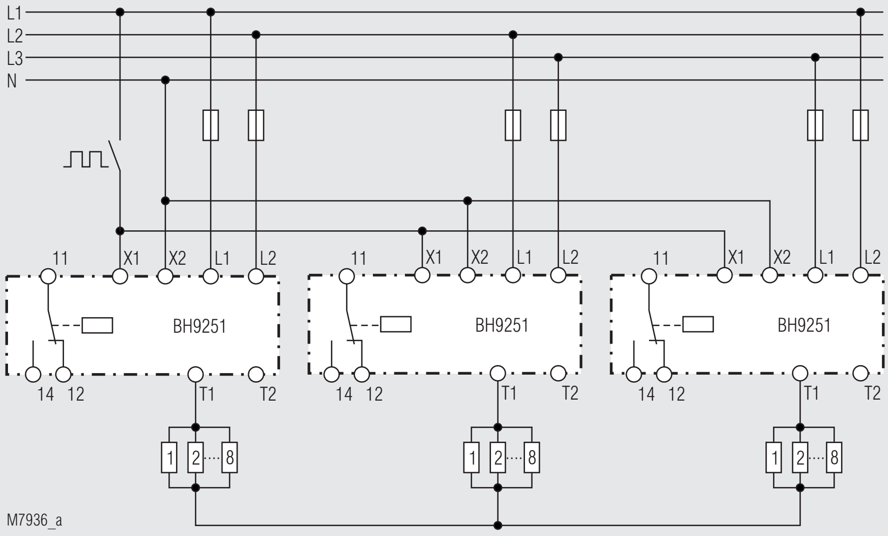
Safety Notes

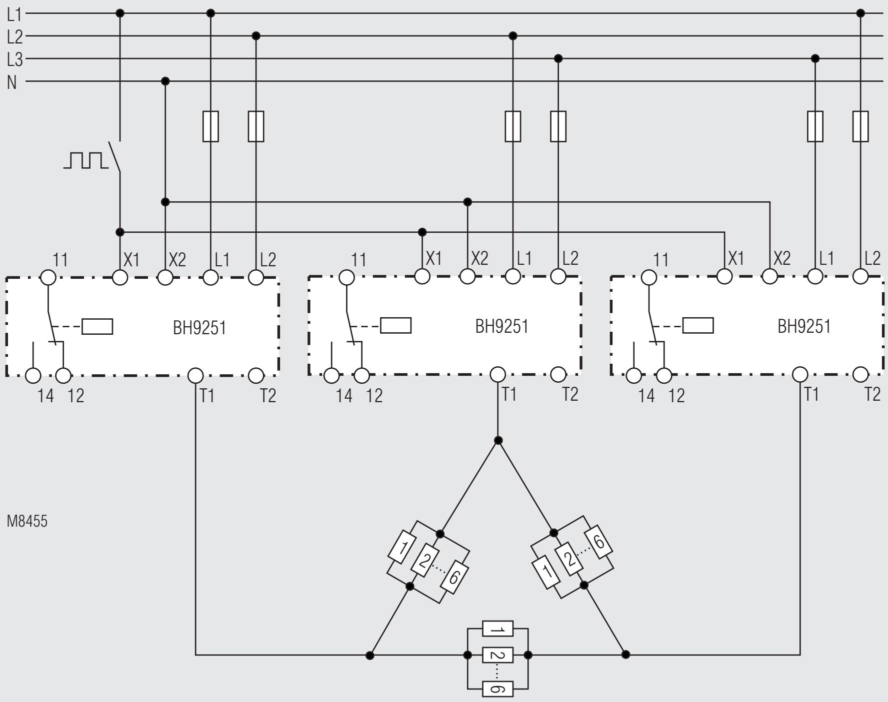
- Failures in the circuit must only be removed when the unit is disconnected.
- The user has to make sure, that the units and the corresponding components are connected and operated according to the local, legal and technical standards (e.g. TÜV, BG, VDE).
- Adjustment must only be done by educated personnel according to the appropriate safety standards. For work in the circuit and on the product the unit must be disconnected form the mains.

Application Examples






L1
L2
L3
N
11
X1
X2
L1
L2
BH9251
14
12
T1
T2
1
2
8
M7936_a


L1
L2
L3
N
11
X1
X2
L1
L2
BH9251
14
12
T1
T2
M8455
1
2
6

POWERSWITCH
Solid-State Relay / - Contactor
PH 9260

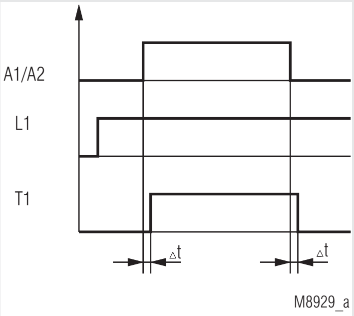
0247349

Solid-state relay
PH 9260.91

Solid-state contactor
PH 9260.91/000/01

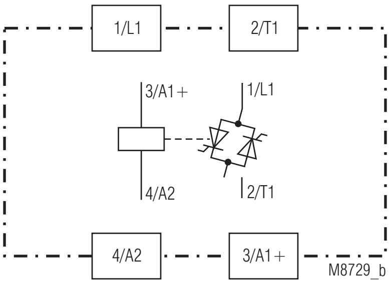
- AC solid-state relay / -contactor
- According to IEC/EN 60947-4-3
- Load current up to 125 A, AC 51 with I^2t up to 18000 A^2s
- Switching at zero crossing
- As option switching at voltage maximum
- 2 anti-parallel thyristors
- DCB technology (direct bonding method) for excellent heat transmission properties
- Touch protection IP20
- Box terminals
- LED status indicator
- Peak reverse voltage 1200 V or 1600 V
- Insulation voltage 4000 V
- As option with overtemperature protection
- As option with reduced HF-emission
- As option with heat sink, for DIN rail mounting
- Width: 45 mm

Function Diagram



Δt = max. 20ms; zero crossing control

Circuit Diagram



PH 9260.91

Connection Terminals

Terminal designation	Signal description
A1(+), A2	Control input
L1	Mains connections
T1	Load output

Approvals and Markings

Canada / USA

Applications

Solid-state relays switching at zero crossing:

For frequent no-wear and no-noise switching of
- heating systems
- motors
- valves
- lighting systems

The solid-state relay switches at zero crossing and is suitable for many applications e.g. extrusion machines for plastic and rubber, packaging machines, solder lines, machines in food industry.

Solid-state relays switching at voltage maximum:

he solid-state relay PH 9260/020 switching at voltage maximum is suitable to switch transformers. The usual high inrush current does not occur.

Function

The solid-state relay PH 9260 is designed whith 2 anti-parallel connected thyristors switching at zero crossing.

When connecting the control voltage the output of the solid-state relay is activated at the next zero crossing of the sinusoidal voltage. When dis-connecting the control voltage the output is switched off at the next zero crossing of the load courrent.

The LED shows the state of the control input.

As option the solid-state relay is available with heatsink to be mounted on DIN rail. This provides optimum heat transmission.

Notes

Overtemperature protection

Optionally, the solid-state relay has an overtemperature protection to mo-nitor the temperature of the heat sink. To this end, a thermal release switch (NC contact) can be inserted into the respective pocket at the bottom of the solid-state relay. As soon as the temperature of the heat sink exceeds for example 100°C, the thermal release switch. For thermal protection of the solid-state relay, a thermal release switch of UCHIYA type UP62 – 100 can be installed.

Technical Data

Output

Load voltage AC [V]:

PH 9260:	24 ... 240, 48 ... 480, 48 ... 600			
PH 9260/020:	100 ... 240, 200 ... 480			
Frequency range [Hz]:	47 ... 63			
Load current [A], AC-51: PH 9260, PH 9260/020:	25	50	100[1)]	125[1)]
Load current [A], AC-56a: PH 9260/020:	10 -	20 30[3)]	- -	- -
Load limit integral I^2t [A^2s]:	800	1800 6600[2)]	6600	18000
Max. overload current [A] t = 10 ms:	400	600 1150[2]	1150	1900
Periodic overload current t = 1 s [A]:	40	120 150[2)]	150	200
Min. current [mA]:	20			
On-state voltage at nominal current [V]:	1.2	1.4	1.4	1.3
Rate of rise of off-state voltage [V/µs]:	500	500	1000	1000
Rate of rise of current [A/µs]:	100	100	100	150
Temperature Data				
Thermal resistance junction - housing [K/W]:	0.6	0.5	0.3	0.3
Thermal resistance housing - ambient [K/W]:	12	12	12	12
Junction temperature [°C]:	≤ 125			

1) Only for pulse operation: Please make sure, that the mean value of the current does not exceed 50 A on these devices.

2) Variant PH 9260.91/1_ _

3) Variant PH 9260.91/120

Control Circuit

	DC	AC/DC	AC/DC
Control voltage range [V]:	4 ... 32	18 ... 36	100 ... 240
Max. nominal input current [mA]: PH 9260:	12	25 (AC) 12 (DC)	5 bei 240 V AC (regulated)
Max. nominal input current [mA]: PH 9260/020:	20	-	-

Turn-on delay [ms]:	5 + 1/2 cycle
Turn-off delay [ms]	
at AC/DC 18 ...36 V:	20 + 1/2 cycle
at AC/DC 85 ... 265 V:	30 + 1/2 cycle

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:		
operation:	- 20 ... 40° C	
storage:	- 20 ... 80° C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	6 kV / 3	IEC/EN 60 664-1
EMC:	IEC/EN 61 000-6-4,	IEC/EN 61 000-4-1
Electrostatic discharge (ESD):	8 kV air / 6 kV contact	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages 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
Interference suppression:	Limit value class A*) *) The device is designed for the usage under industrial conditions (Class A, EN 55011) When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.	
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
Housing material:	Fiberglass reinforced polycarbonate Flame resistant: UL 94 V0	
Base plate:	Aluminum, copper nickle-plated	
Potting compound:	Polyurethane	
Mounting screws:	M5 x 8 mm	
Fixing torque:	2.5 Nm	
Connections control circuit:	Mounting screws M3 Pozidrive 2 PT	
Fixing torque:	0.5 Nm	
Wire cross section:	1.5 mm^2 wire	
Connections load circuit:	Mounting screws M4 Pozidrive 1 PT	
Fixing torque:	1.2 Nm	
Wire cross section:	10 mm^2 wire	
Nominal insulation voltage		
Control circuit – load circuit:	4 $kV_{eff.}$	
Load circuit – base plate:	4 $kV_{eff.}$	
Overvoltage category:	II	
Weight		
without heat sink:	approx. 120 g	
PH 9260.91/_ _ _ /01:	approx. 550 g	
PH 9260.91/_ _ _ /02:	approx. 670 g	

Dimensions

Width x height x depth	
without heat sink:	45 x 58 x 32 mm
PH 9260.91/_ _ _ /01:	45 x 80 x 124 mm
PH 9260.91/_ _ _ /02:	45 x 100 x 124 mm

UL-Data

Control voltage:	DC 4 ... 32 V, Class 2 or current / voltage limiting acc. to UL 508
Load type:	Resistive
Wire connection:	Copper conductors only
3A1+ / 4A2:	AWG 18 - 14 Torque 0.5 Nm (4.4 lb-in)
1L1 / 2T1:	AWG 16 - 8 Torque 1.2 Nm (10.6 lb-in)

The load current printed on the device applies to an ambient temperature of 40 °C (104 °F).

Technical data that is not stated in the UL-Data, can be found in the technical data section.

Technical Data

Contents of Article Numbers

Type		PH 9260							
Variant (Designation)		Standard	PH 9260/000/01 with heat sink	Standard	PH 9260/000/02 with heat sink	PH 9260/100 (I^2t = 6600 A^2s)	PH 9260/100/02 (I^2t = 6600 A^2s with heat sink)	Standard	Standard
Load current		25 A	25 A	50 A	50 A[3)]	50 A	50 A[3)]	100 A	125 A
Load voltage	Control voltage								
24 ... 240 V AC	4 ... 32 V DC	0056651	0056953	0056652	0056954	0057699	0058195	0056821	0059736
	18 ... 36 V AC/DC	0063505	0063676	*	*	*	*	*	*
	100 ... 240 V AC/DC	0061422	0058255	0059749	0058256	*	*	0059631	*
48 ... 480 V AC	4 ... 32 V DC	0056653	0056955	0056654	0056956	0057700	0058196	0056822	0059737
	18 ... 36 V AC/DC	*	*	*	*	*	*	*	*
	100 ... 240 V AC/DC	0059690	0061943	0059691	0059074	*	*	0063193	*
48 ... 600 V AC	4 ... 32 V DC	0058676	*	*	0059980	0058678	*	0058677	*
	18 ... 36 V AC/DC	*	*	0058958	*	0058960	*	*	*
	100 ... 240 V AC/DC	*	*	0058959	*	0058961	*	*	*

At devices without heatsink the necessary heatsink has to be chosen according to the dimensioning notes.

* On request

Units with UL-Approval

3) for stepping operation with 80 % ED

Standard Type

PH 9260.91 AC 48 ... 480 V 50 A DC 4 ... 32 V
Article number: 0056654
- Load voltage: AC 48 ... 480 V
- Load current: 50 A
- Control voltage: DC 4 ... 32 V
- Width: 45 mm

Variants

PH 9260 .91 / _ _ _ / 0 _

- 0 Without heat sink
- 1 With heat sink 1.5 K / W
- 2 With heat sink 0.95 K / W

- 0 Standard
- 1 Low-Noise-Version with reduced HF-emission (Leakage current in off state: 18 mA at AC 480 V)

- 0 Switching at zero crossing
- 2 Switching at voltage maximum

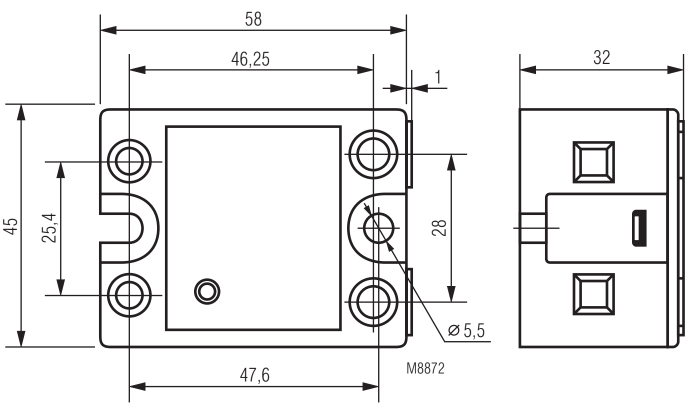
- 0 Standard
- 1 With heigh I^2t-value

Ordering example for variants

PH 9260.91 /101/02 AC 48 ...480 V 50 A DC 4 ... 32 V

Control voltage
Load current
Load voltage
With heat sink 0.95 K / W
Low-Noise-version (on request)
With height I^2t-Wert
Type

Dimensions



Accessories

PH 9260-0-12: Graphite foil 55 x 40 x 0.25 mm to be fitted between device and heat sink, for better heat transmission
Article number: 0058395

For the 100 A- and 125 A-variants we recommend a 25 mm² adapter terminal type 802/115S, Brand FTG.

Selection of a Heat Sink

Load current (A)	PH 9260 25 A Thermal resistance (K/W)					
25.0	2.8	2.5	2.1	1.8	1.5	1.1
22.5	3.2	2.8	2.5	2.1	1.7	1.3
20.0	3.7	3.3	2.8	2.4	2.0	1.6
17.5	4.3	3.8	3.4	2.8	2.4	1.9
15.0	5.1	4.6	4.0	3.5	2.9	2.4
12.5	6.3	5.6	5.0	4.3	3.6	2.8
10.0	8.0	7.2	6.4	5.6	4.7	3.9
7.5	11.0	9.9	8.7	7.6	6.5	5.4
5.0	16.8	15.0	13.5	12.0	10.0	8.5
2.5	-	-	-	-	21.0	17.6
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

Load current (A)	PH 9260 50 A Thermal resistance (K/W)					
50	0.9	0.7	0.6	0.4	0.3	-
45	1.0	0.9	0.7	0.5	0.4	0.2
40	1.2	1.0	0.9	0.7	0.5	0.3
35	1.5	1.3	1.0	0.9	0.7	0.5
30	1.9	1.6	1.4	1.1	0.9	0.7
25	2.4	2.0	1.8	1.5	1.2	0.9
20	3.0	2.7	2.4	2.0	1.9	1.3
15	4.4	3.9	3.4	2.9	2.5	2.0
10	6.9	6.0	5.4	4.7	4.0	3.3
5	14.0	12.9	11.5	10.0	8.6	7.2
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

Load current (A)	PH 9260 100 A Thermal resistance (K/W)					
100	0.43	0.35	0.25	0.2	-	-
90	0.56	0.46	0.35	0.28	0.2	-
80	0.7	0.6	0.5	0.4	0.3	0.2
70	0.9	0.8	0.65	0.55	0.4	0.3
60	1.2	1.0	0.9	0.75	0.6	0.46
50	1.6	1.4	1.2	1.0	0.85	0.6
40	2.3	2.0	1.8	1.5	1.2	1.0
30	3.4	3.0	2.5	2.2	2.0	1.5
20	5.6	5.0	4.5	3.9	3.3	2.7
10	12.0	11.0	10.0	9.0	7.6	6.0
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

Load current (A)	PH 9260 125 A Thermal resistance (K/W)					
125	0.5	0.4	0.3	0.2	0.1	0.1
112.5	0.6	0.5	0.4	0.3	0.2	0.1
100	0.7	0.6	0.5	0.4	0.3	0.2
87.5	0.9	0.8	0.7	0.5	0.4	0.3
75	1.0	1.0	0.9	0.7	0.6	0.5
62.5	1.5	1.4	1.1	1.0	0.8	0.7
50	2.0	1.8	1.6	1.3	1.1	0.9
37.5	3.0	2.6	2.3	2.0	1.7	1.4
25	4.7	4.2	3.5	3.0	2.8	2.3
12.5	10.2	9.0	8.0	7.0	6.0	5.0
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

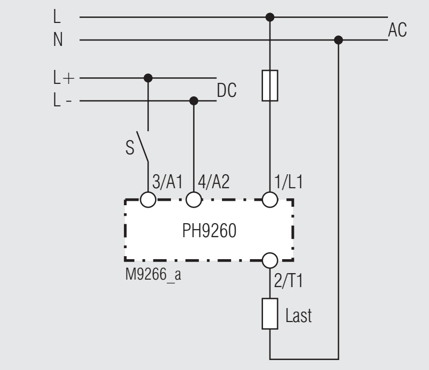
Notes on Sizing for Selection of a Heat Sink

The heat generated by the load current must be dissipated by a suitable heat sink. It is imperative that the junction temperature of the solid-state is maintained for all potential environmental temperatures of under 125°C. For this reason, it is important to keep the thermal resistance between the base plate of the solid-state relay and the heat sink to a minimum.

To protect the solid-state relay effectively from excess heating, a thermally conducting paste should be applied before installation to the base plate of the heat sink between solid-state relay and heat sink.

From the tables below, select a suitable heat sink with the next lowest thermal resistance. Thus, it is ensured that the maximum junction temperature of 125°C is not exceeded. The load current in relation to the environmental temperature can be seen from the table.

Application Examples



Installation Instructions

General Information

The service life and long-time reliability of a solid-state relay depends on its installation and use. Load type, load current, switching frequency, mains voltage and ambient temperature must be taken into account during the project design. To ensure the reliable operation of the devices, an exact analysis of the application and a calculation of the heat sink must be conducted in advance. Solid-state relays constantly produce heat during operation. The ambient conditions therefore require special attention. The choice of the correct heat sink is especially important since the constant overtemperature significantly reduces the service life of the devices. The use of a temperature switch is recommended if neither the load conditions nor the ambient temperatures are known. This switch is available as accessory and is inserted in a pocket on the bottom side.
Attention: The load output is not electrically separated from the mains even if no drive is present

Overload protection (Fig. 1)
The solid-state relay must be protected against short circuit by a separate solid-state fuse of coordination type 2. Choosing the I2t value (switch-off integral) of the fuse half as large as the I2t value of the solid-state is recommended.

Overvoltage protection (Fig. 1)
Although the solid-state relays can withstand high peak voltages, it is better to switch an external varistor parallel to the load output. This is particularly recommended when switching inductive loads. The varistor voltage must be selected appropriate for the mains voltage. A wrong selection can create hazardous situations. As an option, the varistor is factory-installed.

Assembly on the heat sink (Fig. 2, Fig. 3)
A small amount of silicon-containing heat transfer compound is to be applied to the base plate to ensure a good thermal bond between solid-state relay and heat sink. As an alternative, a graphite foil can be placed between solid-state relay and heat sink.

Attention!
Heat transfer compounds without silicon should not be used, since they may attack the plastic of the housing .

The solid-state relay is mounted to the heat sink using two M5x8 screws and matching washers. Both screws should be tightened in alternating fashion until a torque of 1 Nm is reached. After approx. one hour the screws need to be tightened further with a final torque of 2.5 Nm. This ensures that all excess heat transfer compound is squeezed out or that the graphite foil can well adapt to the contours of the surfaces.

Installation of the complete unit (Fig. 4)
The fins of the heat sink must be aligned in a manner allowing the unobstructed circulation of air. Without external fan, the fins must be aligned vertically to support natural convection.

Connection

	Control terminals	Load terminals
Screw:	M3 Pozidrive	M4 Pozidrive
Tightening torque:	0,5 Nm	1,2 Nm
Wire gauge:	1,5 mm²	10 mm²

Attention! When using pneumatic or electric power screwdrivers, their torque limit must be set correctly.

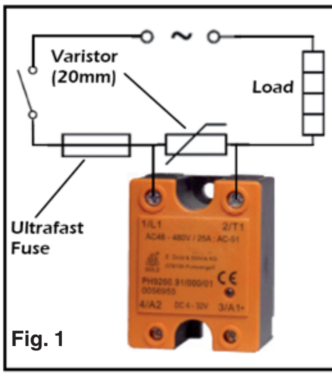


Fig. 1


Fig. 2

Fig. 3

Fig. 4

Power Electronics

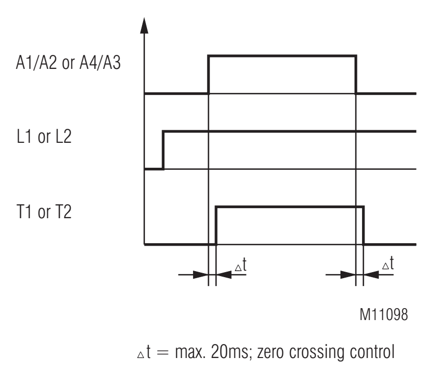
POWERSWITCH
Solid-State Relay / - Contactor, 2-poles
PH 9260.92

0269447

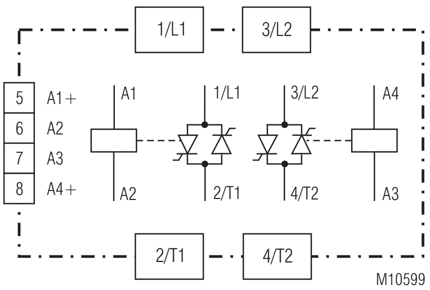
Solid-state relay
PH 9260.92

Solid-state contactor
PH 9260.92/000/0_

Function Diagram



Circuit Diagram



PH 9260.92

Connection Terminals

Terminal destinations	Signal description
A1+, A2; A4+, A3	Control inputs
L1, L2	Mains connections
T1, T2	Load outputs

Your Advantages
- Free from wearing, noiseless, economic
- Excellent EMC- performance, because of switching at zero crossing
- Separate control of both poles
- Available with heatsink to be mounted on DIN rail
- Easy connection via cage clamp terminals

Features
- AC solid-state relay / -contactor
- According to IEC/EN 60947-4-3
- As option load current up to 2 x 32 A or 2 x 48 A
- As option with hight I^2t up to 6600 A^2s
- Load voltages up to AC 480 V
- 2 anti-parallel thyristors for each pole
- DCB technology (direct bonding method) for excellent heat transmission propertie
- Touch protection IP20
- Box terminals for load connections
- LED status indicator for both poles
- Peak reverse voltage up to ± 1200 V
- Insulation voltage 4000 V
- Width 45 mm

Approvals and Markings

CE

Applications

Solid state relays switching at zero crossing:

For frequent no-wear and no-noise switching of

- heating systems
- motors
- valves
- lighting systems

The solid-state relay switches at zero crossing and is suitable for many applications e.g. extrusion machines for plastic and rubber, packaging machines, solder lines, machines in food industry.

Function

The solid-state relay PH 9260 is designed whith 2 anti-parallel connected thyristors switching at zero crossing.

When connecting the control voltage the output of the solid-state relay is activated at the next zero crossing of the sinusoidal voltage. When disconnecting the control voltage the output is switched off at the next zero crossing of the load courrent.

The LED shows the state of the control input.

As option the solid-state relay is available with heatsink to be mounted on DIN rail. This provides optimum heat transmission.

Technical Data

Output

Load voltage AC [V]	24 ... 240, 48 ... 480	
Frequency range [Hz]:	47 ... 63	
Load current [A], AC-51:	32	48
Load limit integral I2t [A2s]:	800 6600*)	1800 6600*)
Max. Overload current [A] t = 10 ms:	400 1150*)	600 1150*)
Periodic overload current t = 1 s [A]:	40 150*)	120 150*)
Min. current [mA]:	20	
On-state voltage at nominal current [V]:	1.2	1.4
Rate of rise of off-state voltage [V/µs]:	500	500
Rate of rise of current [A/µs]:	100	100
Thermische Daten		
Thermal resistance junction - housing [K/W]:	0.6	0.5
Thermal resistance housing - ambient [K/W]:	12	12
Junction temperature [°C]:	≤ 125	

*) Variant PH 9260.92/100

Control Circuit

Control voltage range [V]:	DC 18 ... 30
max. input current [mA]:	15
Turn-on delay [ms]:	0.5 ... 10.5
Turn-off delay [ms]:	0.5 ... 10.5

General Data

Operating mode:	Continuous operation	
Temperature range:		
operation:	- 20 ... 40° C	
storage:	- 20 ... 80° C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	6 kV / 3	IEC/EN 60 664-1
EMC:	IEC/EN 61 000-6-4,	IEC/EN 61 000-4-1
Electrostatic discharge (ESD):	8 kV air	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages 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
Interference suppression:	Limit value class A*) *) The device is designed for the usage under industrial conditions (Class A, EN 55011) When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.	
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	
Housing material:	Fiberglass reinforced polycarbonate Flame resistant; UL 94 V0	
Base plate:	Aluminum, copper nickle-plated	
Potting compound:	Polyurethane	
Mounting screws:	M5 x 8 mm	
Fixing torque:	2,5 Nm	
Connections control circuit:	cage clamp terminals	
Wire cross section:	0.2 ... 1,5 mm^2 wire	

Technical Data

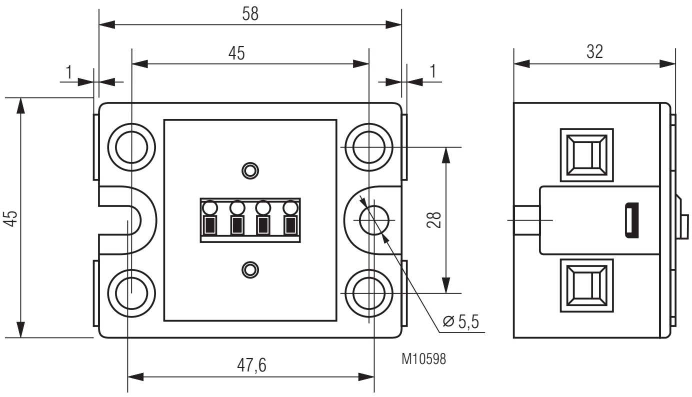
Connections load circuit:	Mounting screws M4 Pozidrive 2 PT
Fixing torque:	1,2 Nm
Wire cross section:	10 mm^2 wire
Nominal insulation voltage	
Control circuit - load circuit:	4 kV$_{eff.}$
Load circuit - base plate:	4 kV$_{eff.}$
Control circuit A1/A2 - A3/A4:	250 V$_{eff.}$
Overvoltage category:	II
Weight	
without heat sink:	approx. 107 g
PH 9260.92/_ _ _ /01:	approx. 537 g
PH 9260.92/_ _ _ /02:	approx. 657 g

Dimensions

Width x height x depth

without heat sink::	45 x 60 x 35 mm
PH 9260.92/_ _ _ /01:	45 x 80 x 127 mm
PH 9260.92/_ _ _ /02:	45 x 100 x 127 mm

Dimensions



Accessories

PH 9260-0-12: Graphite foil 55 x 40 x 0.25 mm to be fitted between device and heat sink, for better heat transmission
Article number: 0058395

Standard Type

PH 9260.92 AC 48 ... 480 V 2 x 48 A DC 18 ... 30 V

Article number:	0064252
• Load voltage:	AC 48 ... 480 V
• Load current:	2 x 48A
• Control voltage:	DC 18 ... 30 V
• Width:	45 mm

Varianten

PH 9260 .92 / _ 0 0 / 0 _

- 0 Without heat sink
- 1 With heat sink 1.5 K / W
- 2 With heat sink 0.95 K / W
- 0 Standard
- 0 Switching at zero crossing
- 0 Standard
- 1 With heigh I^2t-value

Ordering example for variants

PH 9260.92 /100/02 AC 48 ...480 V 2 x 48 A DC 18 ... 30 V

- Control voltage
- Load current
- Load voltage
- With heat sink 0.95 K / W
- With height I^2t-value
- Type

Notes on Sizing for Selection of a Heat Sink

The heat generated by the load current must be dissipated by a suitable heat sink. It is imperative that the junction temperature of the semiconductor is maintained for all potential environmental temperatures of under 125°C. For this reason, it is important to keep the thermal resistance between the base plate of the solid-state relay and the heat sink to a minimum.

To protect the solid-state relay effectively from excess heating, a thermally conducting paste should be applied before installation to the base plate of the heat sink between solid-state relay and heat sink.

From the tables below, select a suitable heat sink with the next lowest thermal resistance. Thus, it is ensured that the maximum junction temperature of 125°C is not exceeded. The load current in relation to the environmental temperature can be seen from the table.

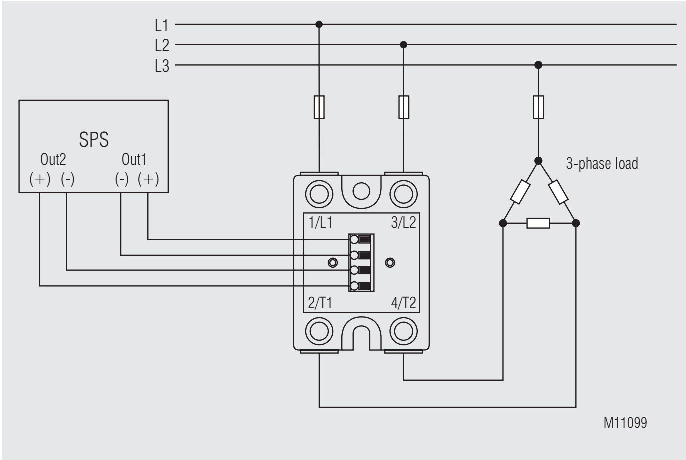
Selection of a Heat Sink

Load current (A)	Version for 2 x 32 A Thermal resistance (K/W)					
64	0.9	0.8	0.6	0.55	0.4	0.3
56	1.1	0.9	0.8	0.65	0.55	0.4
48	1.3	1.1	1.0	0.85	0.6	0.5
40	1.6	1.4	1.2	1.1	0.9	0.7
32	2.1	1.9	1.6	1.4	1.2	0.9
26	2.7	2.4	2.1	1.8	1.5	1.2
16	4.7	4.2	2.7	3.2	2.7	2.2
8	10.0	8.5	7.8	6.8	5.9	5.0
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

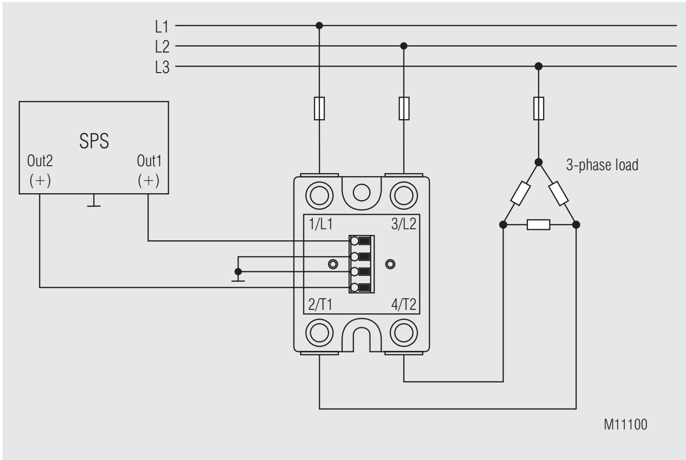
Load current (A)	Version for 2 x 48 A Thermal resistance (K/W)					
96	0.6	0.5	0.4	0.35	0.25	0.15
84	0.7	0.6	0.55	0.45	0.35	0.25
72	0.9	0.8	0.65	0.55	0.45	0.35
60	1.1	1.0	0.85	0.75	0.6	0.45
48	1.5	1.3	1.1	1.0	0.8	0.65
36	2.1	1.9	1.6	1.44	1.2	0.9
24	3.3	3.0	2.6	2.3	1.9	1.6
12	7.0	6.0	5.5	4.9	4.0	3.5
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

Load current (A)	Version fo 2 x 48 A at I^2t = 6600 A^2s Thermal resistance (K/W)					
96	0.8	0.7	0.6	0.5	0.4	0.3
84	0.9	0.8	0.7	0.61	0.5	0.4
72	1.1	1.0	0.85	0.75	0.6	0.45
60	1.4	1.2	1.1	0.9	0.75	0.6
48	1.8	1.6	1.4	1.2	1.0	0.8
36	2.5	2.2	1.9	1.65	1.4	1.2
24	3.5	3.4	3.0	2.6	2.2	1.85
12	7.5	7.0	6.0	5.5	4.5	4.0
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

Application Examples



Ansteuerung durch galvanisch getrennte Ausgänge.



Ansteuerung durch Ausgänge mit gemeinsamer Masse.

POWERSWITCH
Solid-State Relay / - Contactor With Analogue Input For Pulse Package Control PH 9260/042

0276748

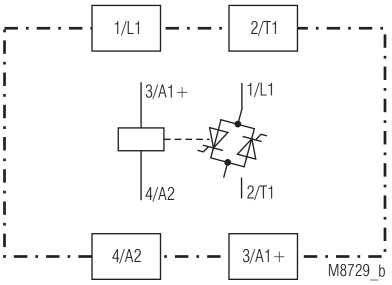
Solid-state relay
PH 9260.91/_42

Solid-state contactor
PH 9260.91/_42/0_

Your advantages
- Self-optimized impulse distribution with minimized cycle times
- Allows for precise temperature regulation
- Switching at zero crossing, providing outstanding EMC properties
- Protection from thermal overload with optional excess temperature protection

Features
- AC solid-state relay / -contactor for pulse package control of heating systems
- Control input DC 4 … 20 mA
- According to IEC/EN 60947-4-2
- Nominal voltage AC 48 ... 480 V
- Load current 25A, 50 A, AC-51
- LED status indicator for control and failure
- Box terminals
- Degree of protection IP20
- As option with heat sink, for DIN rail mounting
- Width: 45 mm

Circuit Diagram



PH 9260.91/_42

Connection terminals

Terminal designation	Signal designation
A1 (+), A2	Analogue control input
L1	Control input
A1	Load output

Approvals and Markings

CE

Applications

The zero crossing solid-state relay switches with 4 ... 20 mA analogue input for pulse package control is ideal for the control of heating elements and infrared lamps. It allows for precise temperature regulation, and offers a wide variety of potential applications with fast and noiseless switching, e.g. extrusion machines for plastic and rubber, at thermoforming machines, packaging machines or machines in food industry.

Functions

The solid-state relay PH 9260/042 is designed whith 2 anti-parallel connected thyristors switching at zero crossing. The output of the solid-state relay is activated at the next zero crossing of the sinusoidal voltage. When disconnecting the control signal the output is switched off at the next zero crossing of the load current.

The on/off switching ratio of the output is set proportional to the control current. The control voltage range of 4 to 20 mA is converted into an on/off switching ration of 0 to 100%. Two LEDs indicate the device status.

As option the solid-state relay is available with heatsink to be mounted on DIN rail. This provides optimum heat transmission.

Indication

yellow LED „A1-A2“:	Operating voltage and control current available. The flashing cycle corresponds to the on/off switching ratio specified by the control current. At a control current < 4 mA or > 25 mA, activation does not occur and the LED does not illuminate.
red LED „Alarm“:	
- flashes slowly:	at control current < 4 mA
- flashes fast:	at control current > 21 mA

Notes

Overtemperature protection
Optionally, the solid-state relay has an overtemperature protection to monitor the temperature of the heat sink. To this end, a thermal release switch (NC contact) can be inserted into the respective pocket at the bottom of the solid-state relay. As soon as the temperature of the heat sink exceeds for example 100°C, the thermal release switch. For thermal protection of the solid-state relay, a thermal release switch of UCHIYA type UP62 – 100 can be installed.

Technical Data

Control Input

Operation voltage A1/A2:	max. 35 V DC
Burden voltage:	max. 8 V (< 400 Ω at 20 mA)
Current range:	DC 4 ... 20 mA
Overcurrent protection:	limit to 35 mA
Resolution:	5 %

Output

Load voltage AC [V]	48 ... 480	
Frequency range [Hz]:	47 ... 63	
Load current [A], AC-51:	25	50
Load limit integral I^2t [A^2s]:	800 6600[1)]	1800 6600[1)]
Max. overload current [A] t = 10 ms:	400 1150[1)]	600 1150[1)]
Periodic overload current t = 1 s [A]:	40 150[1)]	120 150[1)]
Min. current [mA]	20	
On-state voltage at nominal current [V]:	1.2	1.4
Peak reverse voltage [V]:	1200	
On-state voltage [V/µs]:	500	
Rate of rise of current [A/µs]:	100	
Temperature Data		
Thermal resistance junction - housing [K/W]:	0.6	0.5
Thermal resistance housing - ambient [K/W]:	12	
Junction temperature [°C]:	≤ 125	

[1]) Variant PH 9260.91/142

General Data

Operating mode: Continuous operation
Temperature range:
operation: - 20 ... 40° C
storage: - 20 ... 80° C
Clearance and creepage distances
rated impulse voltage / pollution degree: 6 kV / 3 IEC/EN 60 664-1
EMC: IEC/EN 61 000-6-4, IEC/EN 61 000-4-1
Electrostatic discharge (ESD): 8 kV air / 4 kV contact IEC/EN 61 000-4-2
HF irradiation: 10 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltages
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
Interference suppression: Limit value class A*)
*) The device is designed for the usage under industrial conditions (Class A, EN 55011)
When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated.
To avoid this, appropriate measures have to be taken.
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
Housing material: Fiberglass reinforced polycarbonate
Flame resistant: UL 94 V0
Base plate: Aluminum, copper nickle-plated
Potting compound: Polyurethane
Mounting screws: M5 x 8 mm
Fixing torque: 2.5 Nm
Connections control circuit: Mounting screws M3 Pozidrive 2 PT
Fixing torque: 0.5 Nm

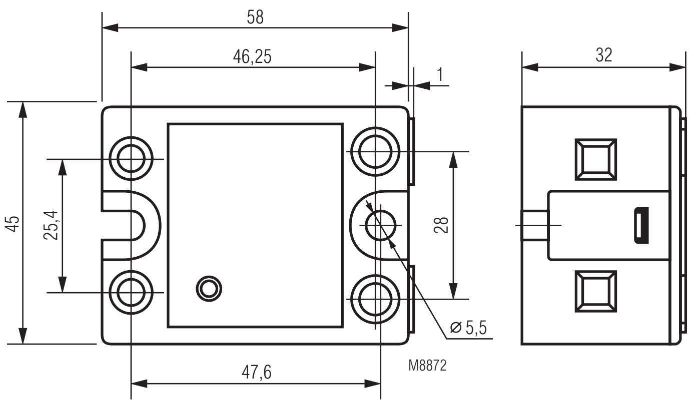
Technical Data

Wire cross section: 1.5 mm² wire
Connections load circuit: Mounting screws M4 Pozidrive 1 PT
Fixing torque: 1.2 Nm
Wire cross section: 10 mm² wire
Nominal insulation voltage
Control circuit – load circuit: 4 $kV_{eff.}$
Load circuit – base plate: 4 $kV_{eff.}$
Overvoltage category: II
Weight
without heat sink: approx. 100 g
PH 9260.91/_ _ _ /01: approx. 530 g
PH 9260.91/_ _ _ /02: approx. 650 g

Dimensions

Width x height x depth
without heat sink: 45 x 59 x 32 mm
PH 9260.91/_ _ _ /01: 45 x 80 x 124 mm
PH 9260.91/_ _ _ /02: 45 x 100 x 124 mm

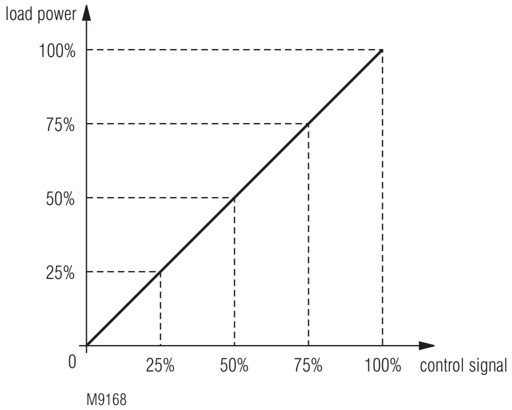
Dimensions



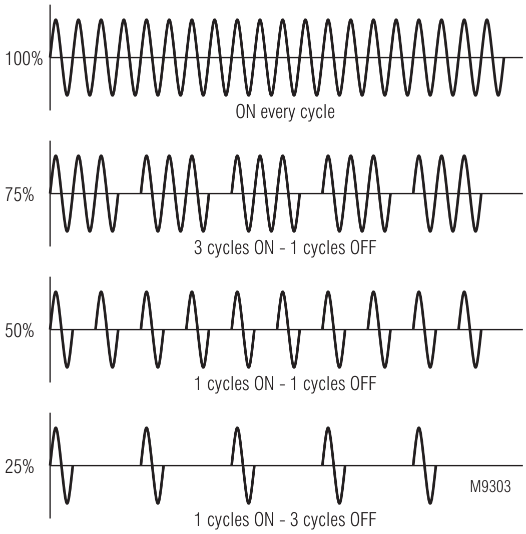
Accessories

PH 9260-0-12: Graphite foil 55 x 40 x 0.25 mm
to be fitted between device and heat sink, for better heat transmission
Article number: 0058395

Characteristics



Control characteristic



Cycle diagram with selfoptimizing puls packaging

Standard Type

PH 9260.91/042 AC 48 ... 480 V 50 A DC 4 ... 20 mA
Article number: 0062777
- Load voltage: AC 48 ... 480 V
- Load current: 50 A
- Control current: DC 4 ... 20 mA
- Width: 45 mm

Variants

PH 9260 .91 / _ 42 / 0 _

0 without heat sink
1 with heat sink 1,5 K / W
2 with heat sink 0,95 K / W

0 Standard
1 With height I²t-value

Type

Ordering example for variants

PH 9260.91 /142 / 02 AC 48 ...480 V 50 A DC 4 ... 20 mA

Control voltage
Load current
Load voltage
With heat sink 0.95 K / W
With heigh I²t-value
Type

Notes on Sizing for Selection of a Heat Sink

The heat generated by the load current must be dissipated by a suitable heat sink. It is imperative that the junction temperature of the semiconductor is maintained for all potential environmental temperatures of under 125°C. For this reason, it is important to keep the thermal resistance between the base plate of the solid-state relay and the heat sink to a minimum.

To protect the solid-state relay effectively from excess heating, a thermally conducting paste should be applied before installation to the base plate of the heat sink between solid-state relay and heat sink.

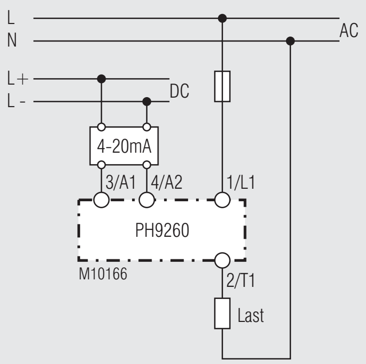
From the tables below, select a suitable heat sink with the next lowest thermal resistance. Thus, it is ensured that the maximum junction temperature of 125°C is not exceeded. The load current in relation to the environmental temperature can be seen from the table.

Selection of a Heat Sink

Load current (A)	PH 9260 25 A Thermal resistance (K/W)					
25.0	2.8	2.5	2.1	1.8	1.5	1.1
22.5	3.2	2.8	2.5	2.1	1.7	1.3
20.0	3.7	3.3	2.8	2.4	2.0	1.6
17.5	4.3	3.8	3.4	2.8	2.4	1.9
15.0	5.1	4.6	4.0	3.5	2.9	2.4
12.5	6.3	5.6	5.0	4.3	3.6	2.8
10.0	8.0	7.2	6.4	5.6	4.7	3.9
7.5	11.0	9.9	8.7	7.6	6.5	5.4
5.0	16.8	15.0	13.5	12.0	10.0	8.5
2.5	-	-	-	-	21.0	17.6
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

Load current (A)	PH 9260 50 A Thermal resistance (K/W)					
50	0.9	0.7	0.6	0.4	0.3	-
45	1.0	0.9	0.7	0.5	0.4	0.2
40	1.2	1.0	0.9	0.7	0.5	0.3
35	1.5	1.3	1.0	0.9	0.7	0.5
30	1.9	1.6	1.4	1.1	0.9	0.7
25	2.4	2.0	1.8	1.5	1.2	0.9
20	3.0	2.7	2.4	2.0	1.9	1.3
15	4.4	3.9	3.4	2.9	2.5	2.0
10	6.9	6.0	5.4	4.7	4.0	3.3
5	14.0	12.9	11.5	10.0	8.6	7.2
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

Application Example



POWERSWITCH
Solid-state Relay / - Contactor
With Load Circuit Monitoring PH 9270

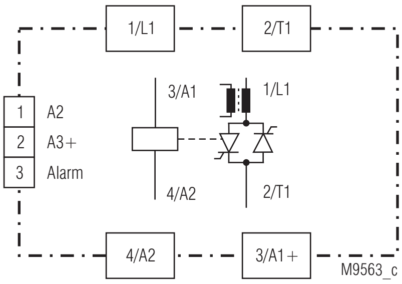
0255163

Solid-state relay
PH 9270.91

Solid-state contactor
PH 9270.91/000/02

- AC solid-state relay /-contactor
- With integrated load circuit monitoring
- Settable load limit value
- According to IEC/EN 60947-4-3
- Load current 40 A, AC 51
- Switching at zero crossing
- 2 anti-parallel thyristors
- DCB technology (direct bonding method) for excellent heat transmission properties
- Two-colours LED status indicator
- Touch protection IP20
- PLC compatible alarm output (PNP; NPN on request)
- As option closed circuit operation or open circuit operation
- As option with optimized heat sink, for DIN rail mounting
- Width 45 mm

Circuit Diagram



PH 9270.91

Approvals and Markings

AE68

Connection Terminals

Terminal designation	Signal description
A1+, A2	Control input
A3+, A2	Operating voltage, load circuit monitoring
Alarm	Solid-state outputs
L1	Network
T1	Load output

Indication

The LED „A1/A2" shows the state of the control input
yellow: controlled semiconductor relays
off: not controlled semiconductor relays

The LED „Alarm" shows the state of the unit
green: no failure
red: failure (thyristor defective with open or short circuit, open load, current value to high or to low or supply voltage < 100 V AC)
off: no auxiliary voltage (A3+/A2)

Notes

Overtemperature protection
Optionally, the solid-state relay has an overtemperature protection to monitor the temperature of the heat sink. For this purpose, a thermal switch (NC contact) can be inserted into the respective pocket at the bottom of the solid-state relay. As soon as the temperature of the heat sink exceeds for example 100°C, the thermal switch opens. For thermal protection of the solid-state relay, a thermal switch of *UCHIYA* type UP62 – 100 can beinstalled.

Applications

For high frequency wear free and noiseless switching of
- heating systems
- motors
- valves*
- lighting systems

The semiconductor switches at zero crossing. The integrated load monitoring provides fast fault finding e.g. broken load elements (part load failure), broken load circuit, overcurrent, missing load voltage, blown fuse and thyristor faults.
The PH 9270 is suitable for many applications e. g. extrusion machines for plastic and rubber, packaging machines, solder lines, machines in food industry.

* On overcurrent monitoring a start up delay must be integrated in the control.

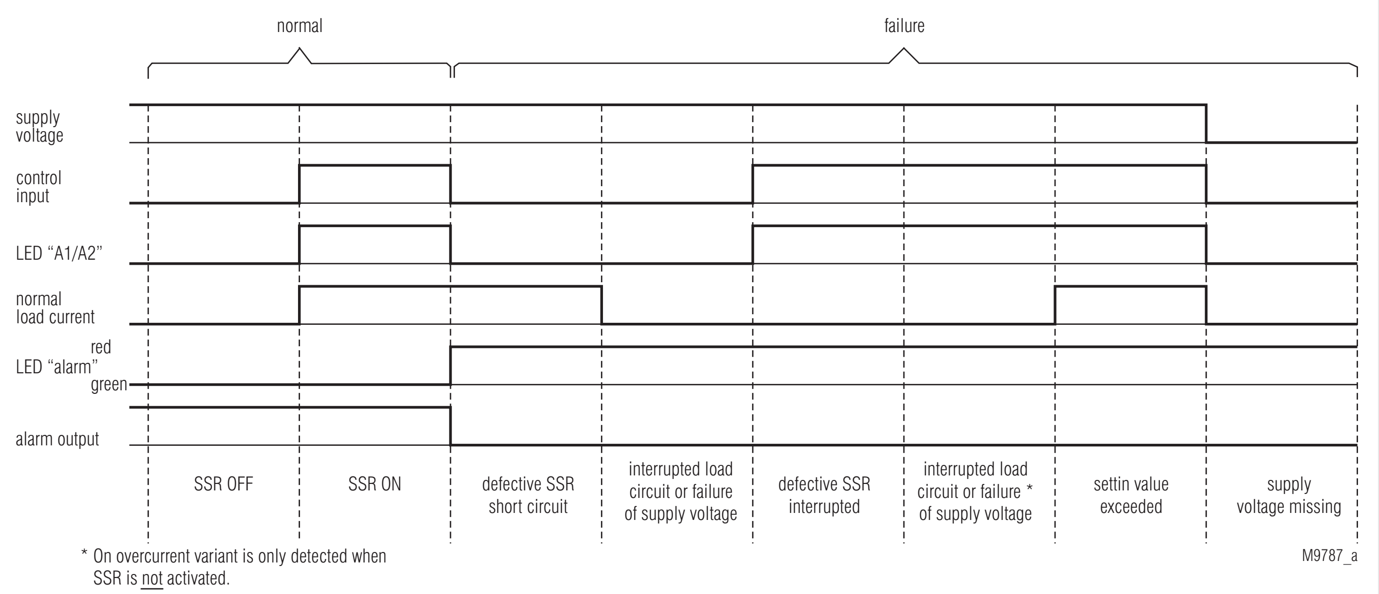
Function

The solid-state relay PH 9270 monitors with applied auxiliary voltage (A3+/A2) the load voltage and the load current. On broken load circuit, deviations of the load current from setting value or defective semiconductor an alarm output is controlled. The failure state is indicated on an 2-color LED (see Function Diagrams).

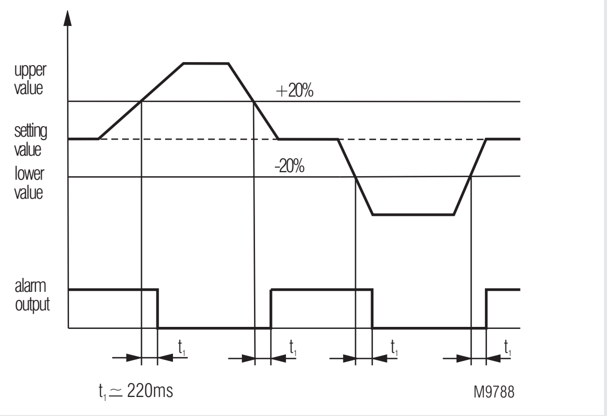
The PH 9270 with 2 antiparallel connected thyristors switches at zero crossing. When connecting the control voltage the semiconductor is switched on with the next zero crossing of the sinusoidal voltage. After disconnecting the control voltage the semiconductor switches off with the next zero crossing of the load current.

As option the PH 9270 is available with heat sink for DIN rail mounting and immediately "ready to use". In addition the heat dissipation is optimised.

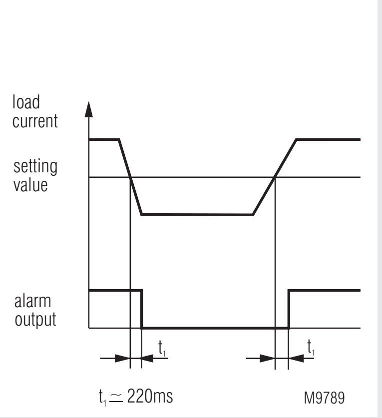
Function Diagram



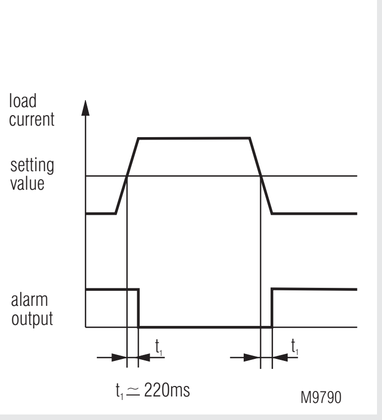
Normal operation and failure status



Over- / Undercurrent detection variant /000



Undercurrent detection variant /001



Overrcurrent detection variant /002

Technical Data

Output

Load voltage AC [V]:	200 ... 480
Frequency range [Hz]:	47 ... 63
Load current [A], (AC 51):	40
Load limit integral I^2t [A^2s]:	1800; 6600*)
Max. overload current [A] t = 10 ms:	600; 1150*)
period. underload current [A] t = 1 s:	120; 150*)
Forward-voltage [V]	
at nominal curren:	1.4
Off-state voltage [V/µs]:	500
Rate of rise of current [A/µs]:	100
Measuring range:	0,5 ... 40 A
Response value:	continously variable
Hysteresis:	2 % of response value
Themperature Data	
Thermal resistance	
junction - housing [K/W]:	0.5
Thermal resistance	
housing - ambient [K/W]:	12
Junction temperature [°C]:	≤ 125

*) variant /1_ _

Alarm Output

Auxiliary supply A3+/A2 [V]:	20 ... 32 (DC)
max. input current [mA]:	15 bei 24 V DC
PNP transistor outputs	
max. output current [mA]:	100
Output voltage	
(open) [V]:	0 (DC)
(closed) [V]:	Auxiliary supply -2 V DC (max.)
Time delay [ms]:	220

Control Circuit

Control voltage A1+/A2 [V]:	20 ... 32 (DC)
Switch off voltage [V]:	0 ... 5 (DC)
max. input current [mA]:	10 at 24 V DC
Turn-on delay [ms]:	5 + 1/2 Periode
Turn-off delay [ms]:	20 + 1/2 Periode

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 20 ... 40° C	
storage:	- 20 ... 80° C	
Clearance and creepage distances:		
rated impulse voltage / pollution degree:	6 kV / 3	IEC/EN 60 664-1
EMC:	IEC/EN 61 000-6-4,	IEC/EN 61 000-4-1
Electrostatic discharge (ESD):	8 kV air / 6 kV contact	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages 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
Interference suppression:	Limit value class A*)	

*) The device is designed for the usage under industrial conditions (Class A, EN 55011)
When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.

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	
Housing material	Fiberglass reinforced polycarbonate Flame resistant: UL 94 V0	
Base plate:	Aluminum, copper nickle-plated	
Potting compound:	Polyurethane	
Mounting screws:	M 5 x 8 mm	

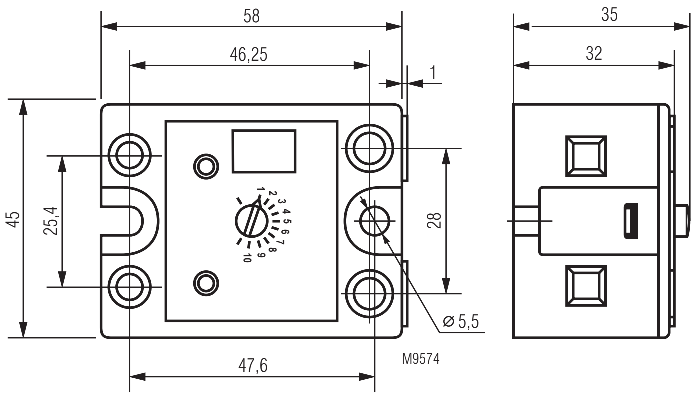
Technical Data

Fixing torque:	2.5 Nm
Connections control input:	Mounting screws M3 Pozidriv 2 PT
Fixing torque:	0.5 Nm
Wire cross section:	1.5 mm² Litze
Connections load circuit:	Mounting screws M4 Pozidriv 1 PT
Fixing torque:	1.2 Nm
Wire cross section:	10 mm² wire
Connections monitoring circuit:	Weidmüller - Omnimate Range connecting pair BL 3.50/03 (included in delivery)
Nominal insulation voltage	
Control circuit – load circuit:	4 $kV_{eff.}$
Load circuit – base plate:	4 $kV_{eff.}$
Overvoltage category:	II
Weight	
without heat sink:	approx. 100 g
PH 9270.91/_ _ _ /01:	approx. 530 g
PH 9270.91/_ _ _ /02:	approx. 650 g

Dimensions

Width x height x depth	
without heat sink:	45 x 58 x 35 mm
PH 9270.91/_ _ _ /01:	45 x 80 x 127 mm
PH 9270.91/_ _ _ /02:	45 x 100 x 127 mm

Dimensions



Accessories

PH 9260-0-12:	Graphite foil 55 x 40 x 0.25 mm to be fitted between device and heat sink, for better heat transmission Article number: 0058395

Standard Type

PH 9270.91 AC 200 ... 480 V	40 A DC 20 ... 32 V
Article number:	0060425
• Load voltage:	AC 200 ... 480 V
• Load current:	40 A
• Auxiliary voltage:	DC 20 ... 32 V
• Alarm output:	PNP, closed circuit operation
• Monitoring:	Under- and overcurrent
• Width:	45 mm

Variants

PH 9270.91 / _ _ _ / 0 _

- 0 = without heat sink
  1 = with heat sink 1.5 K / W
  2 = with heat sink 0.95 K / W

- Control via A1/A2
  0 = with under- and over current monitoring and PNP transistor output with de-energized on trip
  1 = with under current monitoring and PNP transistor output with de-energized on trip
  2 = with over current monitoring and PNP transistor output with de-energized on trip
  5 = with under- and over current monitoring and PNP transistor output with energized on trip
  6 = with under current monitoring and PNP transistor output with energized on trip
  7 = with over current monitoring and PNP transistor output with energized on trip

- 0 = Switching at zero crossing

- 0 = Standard
  1 = With high I^2t-value

Ordering example for variants

PH 9270.91 /1 0 0 / 02 AC 200 ...480 V 40 A DC 20 ... 32 V

- Auxiliary voltage
- Load current
- Load voltage
- With heat sink 0.95 K / W
- with under- and ove current monitoring and PNP semiconductor output with de-energized on trip
- Switching at zero crossing
- With high I^2t-value
- Type

Setting Facilities

Potentiometer to adjust tripping point in the range of 0.5 A up to nominal current.

Setting and Adjustment

Setting for the standard type (over- and undercurrent)

When the SSR is activated to pass the normal load current, start turning the setting knob fully anticlockwise (Alarm LED = Red), then begin to turn it clockwise until the Alarm LED changes to Green. Note the knob setting. Keep turning the knob clockwise until the Alarm LED changes to Red again. Note the knob setting. Take the average of these two settings and set the knob at this value. The SSR is now set up to detect over- and undercurrents of ±20%. The LED should change to Green.

Setting for variant /_01 (undercurrent)

When the SSR is activated to pass the normal load current, start turning the setting knob fully clockwise (Alarm LED = Red), then begin to turn it anticlockwise until the Alarm LED turns Green. The alarm current equals the load current. Note the setting and turn the knob by 10% below the previous setting. The SSR is now set up with the necessary margins to prevent false alarms due to line voltage fluctuations. The LED should remain Green.

Setting for variant /_02 (overcurrent)

When the SSR is activated to pass the normal load current, start turning the setting knob fully anticlockwise (Alarm LED = Red), then begin to turn it clockwise until the Alarm LED turns Green. The alarm current equals the load current. Note the setting and turn the knob by 10% above the previous setting. The SSR is now set up with the necessary margins to prevent false alarms due to line voltage fluctuations. The LED should remain Green.

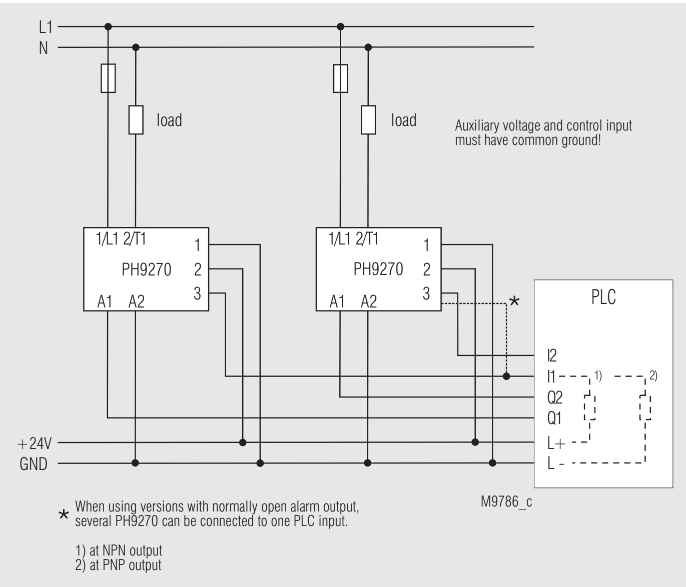
Notes on Sizing for Selection of a Heat Sink

The heat generated by the load current must be dissipated by a suitable heat sink. It is imperative that the junction temperature of the semiconductor is maintained for all potential environmental temperatures of under 125°C. For this reason, it is important to keep the thermal resistance between the base plate of the solid-state relay and the heat sink to a minimum.
To protect the solid-state relay effectively from excess heating, a thermally conducting paste or a graphit gasket (see Accessories) should be applied before installation to the base plate of the heat sink between solid-state relay and heat sink.
From the table below, select a suitable heat sink with the next lowest thermal resistance. Thus, it is ensured that the maximum junction temperature of 125°C is not exceeded. The load current in relation to the environmental temperature can be seen from the table.

Selection of a Heat Sink

Load current (A)	**PH 9270 40 A Thermal resistance (K/W)**					
40	1.2	1.0	0.9	0.7	0.5	0.3
35	1.5	1.3	1.0	0.9	0.7	0.5
30	1.9	1.6	1.4	1.1	0.9	0.7
25	2.4	2.0	1.8	1.5	1.2	0.9
20	3.0	2.7	2.4	2.0	1.7	1.3
15	4.4	3.9	3.4	2.9	2.5	2.0
10	6.9	6.0	5.4	4.7	4.0	3.3
5	14.0	12.9	11.5	10.0	8.6	7.2
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

Application Example



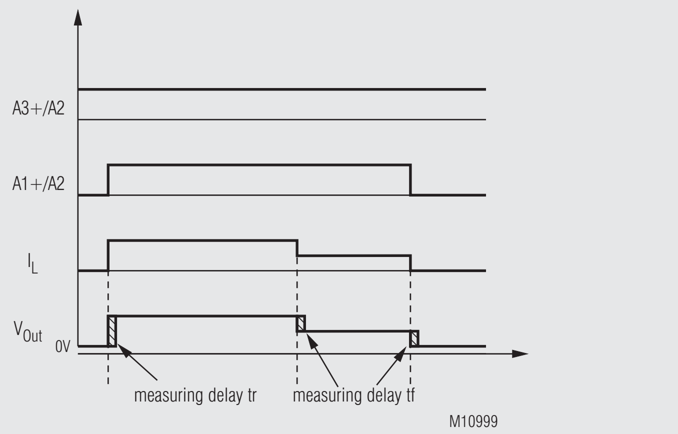
POWERSWITCH
Solid-State Relay / - Contactor
With Load Current Measurement PH 9270/003

0265817

Solid-state relay
PH 9270.91/003

Solid-state contactor
PH 9270.91/003/02

Function Diagram



Your Advantages

- Free from wearing, noiseless, economic
- High productivity by integrated monitoring functions
- Accurate AC / DC measurement up to 45 A
- Analogue output for easy working with signals to PLC or displays
- excellent EMC- performance, because of switching at zero crossing
- As option protection against thermal overload

Features

- AC solid-state relay /-contactor with load current measurement (runs value)
- Analogue output DC 0 ... 10 V
- According to IEC/EN 60947-4-3
- Nominal voltage up to AC 480 V
- Load current up to 45 A, AC-51
- Switching at zero crossing
- DCB technology (direct bonding method) for excellent heat transmission properties
- LED indicator for control
- As option with optimized heat sink, for DIN rail mounting
- Width: 45 mm

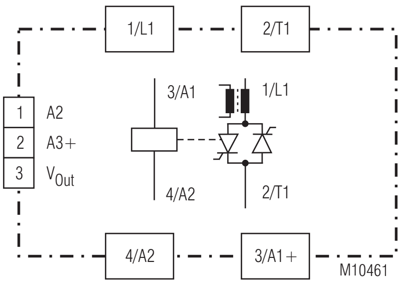
Approvals and Markings

CE

Applications

The solid-state relay switches at zero crossing and with its analogue output 0 ... 10 V. It suitable for heating applications where failures must be detected as early as possible. It allows a continuous monitoring of the load circuit and offers many solutions where fast and silent switching actions are required e.g. in plastic molding and rubber processing machines as well as in thermal forming and packaging machines and also in food industry.

Circuit Diagram



PH 9270.91/003 DC 0 ... 10 V

Function

When voltage is applied to A3+/A2 the solid-state relay PH 9270 monitors continuously the load current and transmits it to a proportional analogue output signal of either 0 ... 10 V. This signal can be easily monitored by a PLC or display module with analogue input.

The PH 9270 with 2 antiparallel connected thyristors switches at zero crossing. When connecting the control voltage the solid-state is switched on with the next zero crossing of the sinusoidal voltage. After disconnecting the control voltage the solid-state switches off with the next zero crossing of the load current.

As option the PH 9270 is available with heat sink for DIN rail mounting and immediately "ready to use". In addition the heat dissipation is optimised.

Connection Terminal

Terminal designation	Signal designation
A1+, A2	Control input
A3+, A2	Auxiliary supply, load current measurement
V_{Out}	Analogue output
L1	Network
T1	Load output

Indication

The LED „A1/A2“ shows the state of the control input
yellow: controlled solid-state relays
off: not controlled solid-state relays

Notes

Overtemperature protection

As option, the solid-state relay has an overtemperature protection to monitor the temperature of the heat sink. For this purpose, a thermal switch (NC contact) can be inserted into the respective pocket at the bottom of the semiconductor relay. As soon as the temperature of the heat sink exceeds for example 100°C, the thermal switch opens. For thermal protection of the solid-state relay, a thermal switch of *UCHIYA* type UP62 – 100 can beinstalled.

Technical Data

Output

Load voltage AC [V]:	24 ... 240, 48 ... 480	
Frequency range [Hz]:	47 ... 63	
Load current measuring range [A], (AC-51):	25	45
Min. load current [A]:	0.02	
Load limit integral I^2t [A^2s]:	1800; 6600*)	
Max. overload current [A] t = 10 ms:	600; 1150*)	
Period. overload current [A] t = 1 s:	120; 150*)	
Forward-voltage [V] at at nominal current:	1.2	1.4
Peak reverse voltage [V]:	800 (24 ... 240 VAC), 1200 (48 ... 480 VAC)	
Off-state voltage [V/µs]:	500	
Rate of rise of current [A/µs]:	100	
Residual current at off state at nominal voltage and nominal frequency [mA]:	≤ 1	
Themperature Data		
Thermal resistance junction - housing [K/W]:	0.6	0.5
Thermal resistance housing - ambient [K/W]:	12	
Junction temperature [°C]:	≤ 125	

*) variant /1_ _

Control Circuit

Control voltage A1+/A2:	20 ... 32 V DC
Max. input current [mA]:	10 at 24 V DC

Analogue output 0 ... 10 V

Operation voltage A3+/A2:	18 ... 32 V DC
Min. input current [mA]:	5 (dependent to load on analogue output)
Output voltage V_{Out}:	10 V equivalent of measuring range (e.g. 25 A)
Min. load resistance [Ω]:	300
Min. measuring current:	1 % of measuring range
Delay of measurement tr [ms]:	< 120
Delay of measurement tf [ms]:	< 300
Measuring accuracy:	± 5 % of measuring range (nominal current)
Max. cable length [m]:	10 (twisted and shielded)

General Data

Operating mode:	Continuous operation	
Temperature range		
operation:	- 20 ... 40° C	
storage:	- 20 ... 80° C	
Clearance and creepage distances:		
rated impulse voltage / pollution degree:	6 kV / 3	IEC/EN 60 664-1
EMC:	IEC/EN 61 000-6-4,	IEC/EN 61 000-4-1
Electrostatic discharge (ESD):	8 kV air / 6 kV contact	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply L1, T1:	1 kV	IEC/EN 61 000-4-5
wires A1, A2 and ground:	1 kV	IEC/EN 61 000-4-5
measuring output and ground:	1 kV	IEC/EN 61 000-4-5
wires L1, T1 and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6

Technical Data

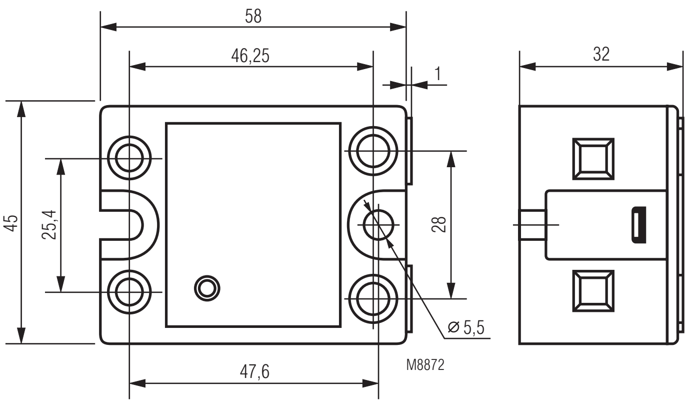
Interference suppression:	Limit value class A*) *) The device is designed for the usage under industrial conditions (Class A, EN 55011) When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.	
Degree 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
Housing material	Fiberglass reinforced polycarbonate Flame resistant: UL 94 V0	
Base plate:	Aluminum, copper nickle-plated	
Potting compound:	Polyurethane	
Mounting screws:	M 5 x 8 mm	
Fixing torque:	2.5 Nm	
Connections control circuit:	Mounting screws M3 Pozidriv 1 PT	
Fixing torque:	0.5 Nm	
Wire cross section:	1.5 mm^2 solid	
Connections load circuit:	Mounting screws M4 Pozidriv 2 PT	
Fixing torque:	1.2 Nm	
Wire cross section:	10 mm^2 solid	
Connections monitoring circuit:	Weidmüller - Omnimate Range connecting pair BL 3.50/03 (included in delivery)	
Nominal insulation voltage		
Control circuit – load circuit:	4 $kV_{eff.}$	
Load circuit – base plate:	4 $kV_{eff.}$	
Overvoltage category:	II	
Weight		
without heat sink:	approx. 110 g	
PH 9270.91/_ _ _ /01:	approx. 540 g	
PH 9270.91/_ _ _ /02:	approx. 650 g	

Dimensions

Width x height x depth

without heat sink:	45 x 59 x 32 mm
PH 9270.91/_ _ _ /01:	45 x 80 x 124 mm
PH 9270.91/_ _ _ /02:	45 x 100 x 124 mm

Dimensions



Accessories

PH 9260-0-12: Graphite foil 55 x 40 x 0.25 mm to be fitted between device and heat sink, for better heat transmission. Article number: 0058395

Notes on Sizing for Selection of a Heat Sink

The heat generated by the load current must be dissipated by a suitable heat sink. It is imperative that the junction temperature of the semiconductor is maintained for all potential environmental temperatures of under 125°C. For this reason, it is important to keep the thermal resistance between the base plate of the semiconductor relay and the heat sink to a minimum.
To protect the solid-state relay effectively from excess heating, a thermally conducting paste or a graphit gasket (see Accessories) should be applied before installation to the base plate of the heat sink between semiconductor relay and heat sink.

From the table below, select a suitable heat sink with the next lowest thermal resistance. Thus, it is ensured that the maximum junction temperature of 125°C is not exceeded. The load current in relation to the environmental temperature can be seen from the table.

Selection of a Heat Sink

Load current (A)	**PH 9270 25 A Thermal resistance (K/W)**					
25.0	2.8	2.5	2.1	1.8	1.5	1.1
22.5	3.2	2.8	2.5	2.1	1.7	1.3
20.0	3.7	3.3	2.8	2.4	2.0	1.6
17.5	4.3	3.8	3.4	2.8	2.4	1.9
15.0	5.1	4.6	4.0	3.5	2.9	2.4
12.5	6.3	5.6	5.0	4.3	3.6	2.8
10.0	8.0	7.2	6.4	5.6	4.7	3.9
7.5	11.0	9.9	8.7	7.6	6.5	5.4
5.0	16.8	15.0	13.5	12.0	10.0	8.5
2.5	-	-	-	-	21.0	17.6
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

Load current (A)	**PH 9270 45 A Thermal resistance (K/W)**					
45	1.0	0.9	0.7	0.5	0.4	0.2
40	1.2	1.0	0.9	0.7	0.5	0.3
35	1.5	1.3	1.0	0.9	0.7	0.5
30	1.9	1.6	1.4	1.1	0.9	0.7
25	2.4	2.0	1.8	1.5	1.2	0.9
20	3.0	2.7	2.4	2.0	1.9	1.3
15	4.4	3.9	3.4	2.9	2.5	2.0
10	6.9	6.0	5.4	4.7	4.0	3.3
5	14.0	12.9	11.5	10.0	8.6	7.2
	20	**30**	**40**	**50**	**60**	**70**
	Ambient-temperature (°C)					

Standard Type

PH 9270.91/003 AC 24 ... 240 V 25 A DC 0 ... 10 V
Article number: 0062432
- Load voltage: AC 24 ... 240 V
- Load current / measuring range: 25 A
- Analogue output: DC 0 ... 10 V
- Width: 45 mm

Variants

PH 9270.91 / _ 0 3 / 0 _

0 = without heat sink
1 = with heat sink 1.5 K / W
2 = with heat sink 0.95 K / W

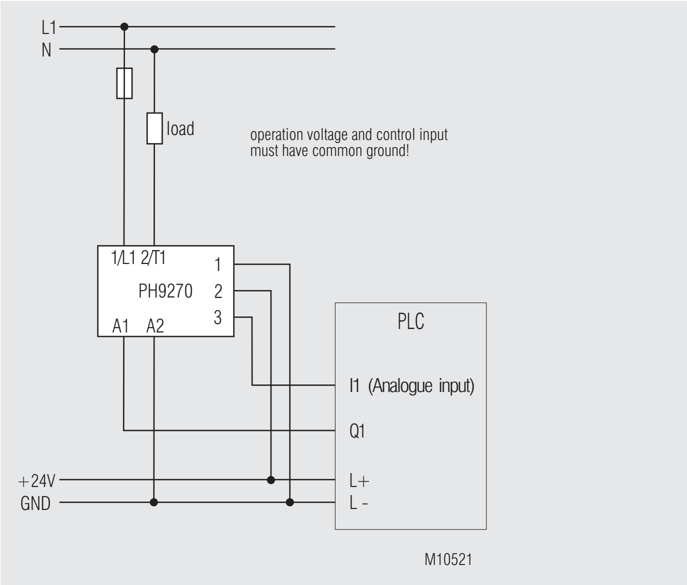
0 Standard
1 With high I^2t-value

Ordering example for variants

PH 9270.91 /103/02 AC 24 ...240 V 25 A DC 0 ... 10 V

Analogue output
Load current
Load voltage
With heat sink 0.95 K / W
With high I^2t-value
Type

Application Example



POWERSWITCH
Solid-State Relay / - Contactor
PI 9260

DOLD

0275015

Solid-state relay
without heat sink

Solid-state contactor
with heat sink 0.75 K/W

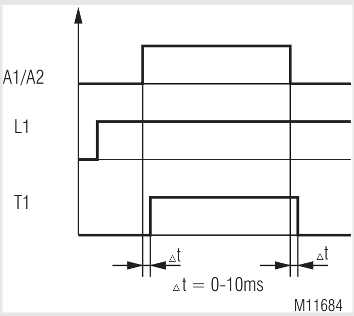
Your Advantages
- High switching frequency and long life
- With heat sink for DIN rail mounting
- Silent vibration and shock resistance
- Providing outstanding EMC properties

Features
- Three Phase AC solid-state contactor
- Meets generally the requirements of IEC/EN 60947-4-3
- Zero cross or immediate switching
- 2 anti-parallel thyristors for each pole
- Direct copper bonded (DCB) technology
- Self-lifting box contact terminals
- Peak reverse voltage up to ±1600Vp
- Wide range AC and DC input control voltage
- Delivered with integrated heat sink for DIN rail mounting
- IP20 Touch protection

Product Description

The solid-state relay PI 9260 was developed for switching resistive and inductive three-phase A.C. current loads, and therefore serves as a replacement for an electronic contactor. Both 2-phase and 3-phase controlled versions are available. The DCB technology (direct copper bonding) ensures very good thermal transmission, so that high load currents are possible. The solid-state relay can be mounted on a variety of cooling surfaces. The device is also available as a ready-to-use version with a pre-dimensioned heat sink. This can simply be snapped onto a wide DIN rail. An LED display signals the status of the control input.

Function Diagram



Approvals and Markings

CE

Applications

Solid state relays switching at zero crossing:

For frequent no-wear and no-noise switching of:
- heating systems
- cooling systems
- valves
- lighting systems

The solid-state relay switches at zero crossing and is suitable for many applications e.g. extrusion machines for plastic and rubber, packaging machines, solder lines, machines in food industry.

Function Notes

EMC disturbance during operation has to be reduced by corresponding measures and filters. If several solid-state relays are mounted together sufficient cooling and ventilation has to be provided.

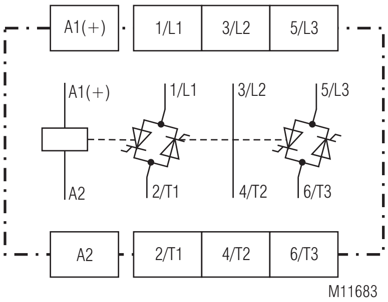
Notes

Depending on the application it may be useful to protect the solid-state relay with special superfast semiconductor fuses against shortcircuit.

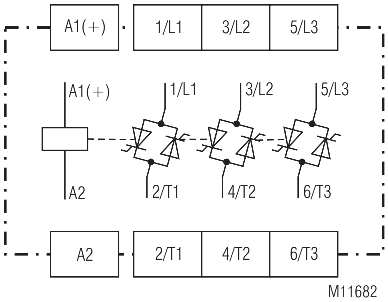
Without heat sink
The solid-state relay can be mounted on existing cooling surfaces. Depending on the load, sufficient ventilation has to be provided.

With heat sink
For optimised heat dissipation the solid-state relay can be delivered with special dimensioned heat sinks. Depending on the ambient conditions and the load this helps to select the correct solid-state relay and heat sink. The heat sinks can be clipped on DIN-rail.

Circuit Diagrams



PI 9260.92



PI 9260.93

Connection Terminals

Terminal Designation	Signal Designation
A1 (+)	+ / L
A2	- / N
L1, L2, L3	Mains connection
T1, T2, T3	Load output

Function

The PI 9260 range of three phase AC solid-state relay, better known as Solid-state relay (SSR) is designed with two anti-parallel thyristors for each pole and mounted on a direct copper bonded (DCB) substrate ensuring a high degree of reliability and robustness. The SSR's triggering circuit can be configured to switch resistive loads or inductive loads. Its fast response, high vibration and shock resistance, high current surge capabilities, low electromagnetic interference together with its inherent long life makes the SSR the obvious choice for many applications. Applications would be for heating and cooling systems, lighting displays, process control, plastic injection machines, motorised valves and many more uses.
Two modes of switching are available for the PI9260 range; the zero-cross switching and instant-on switching (also known as random switching). Zero-cross switching is the preferred mode, because the switching of the relay is synchronised with the mains voltage so that the switching is done at the point where the voltage across the relay is nearly zero. This reduces the electrical switching noise. Due to its low input current requirements the relay can be directly operated from most of the logic systems and computer interfaces. An LED indication shows when the relay is activated.

Two-phase controlled versions – PI 9260.92
In many three-phase applications where the neutral connection is not present in either wye or delta circuits, it is possible to switch on and off loads with only two of the three phases. By means of an internal shunted middle phase, the PI 9260.92 provides all the three phases to the load.
Because only two phases are being switched, the internal power loss is reduced and hence more current can be accommodated for a given heatsink. It has also the advantage of using a smaller heat sink for the same current when compared to a three-switched phase contactor.

Three-phase controlled version PI 9260.93
This version is used in three-phase applications where all phases have to be switched on and off due to system requirements or in applications having wye connected loads with a neutral conductor. Since the SSR dissipates about 1W per ampere of load current, it is of great importance that an effective means of removing heat from the SSR is provided. Proper choice of heat sink is essential to fully utilise the SSR's current capability for a given ambient temperature. A well ventilated cabinet or panel is recommended. If this point is overlooked overheating will result, causing the SSR to lose control or be permanently damaged. The ratings listed below are valid only when the SSR is mounted alone. If more than one SSR is mounted side by side on the DIN rail then the current derating is necessary to keep the working temperature within acceptable limits. As a rule of thumb, 25% current derating is normally adequate. It is recommended that the spacing between two adjacent SSRs should be at least 30 mm.

Control Circuit

	DC	AC
Control voltage range [V]:	10 ... 32	100 ... 230
Min. Pick-up voltage [V]:	8,0	80
Max. Drop out voltage [V]:	3.0	25
Max. input current [mA]:	12	20 at 230 V AC
Response time - turn on [ms]:	≤ 1.0 + ½ cycle*	≤ 10 + ½ cycle*
Response time - turn off [ms]:	≤ 1.0 + ½ cycle*	≤ 35 + ½ cycle*

*) ½ cycle delay only when switching at 0-crossing, at instantaneous switching the delay = 0

Output

Load voltage AC [V]:	24 ... 230	48 ... 480	48 ...600
Peak reverse voltage [V]:	650	1200	1600
Frequency range [Hz]:	47 ... 63		

Maximum Rated Operational current per pole at 40°C [A] AC 51: AC 53a:	20 **5**	30 **8**	50 **12**	60 **15**	60 **20**	60[1)] **30**
Maximum Rated Operational current at 40°C mounted on /06 heat sink[2)] [A] AC 51: AC 53a:	3 x 20 / 2 x 20 **3 x 5 / 2 x 5**	3 x 20 / 2 x 30 **3 x 8 / 2 x 8**	3 x 20 / 2 x 30 **3 x 12 / 2 x 12**	3 x 20 / 2 x 30 **3 x 15 / 2 x 15**	3 x 20 / 2 x 30 **3 x 20 / 2 x 20**	3 x 20 / 2 x 30[1)] **3 x 20 / 2 x 30**
Max. overload current [A]. t = 10 ms:	≤ 300	≤ 400	≤ 620	≤ 1050	≤ 1150	≤ 1900
Load limit integral I^2t [A^2s]:	450	800	1900	5500	6600	18 000
Leakage current in off state [mA]	≤ 1.5					
On-state-voltage [V] at nominal current:	1.0	1.1	1.1	1.1	1.1	1.1
Off-state voltage [V/µs]:	200	1000	1000	1000	1000	1000
Rate of rise of current [A/µs]:	100	100	150	150	150	150

1) Only available in 2 switched-pole versions

2) Current derating factors for heat sink /06 above 40 °C: Three phase controlled versions = 0.32 A/K; Two phase controlled versions = 0.47 A/K

Thermal Data - Solid-state relay -

Thermal resistance junction-ambient [K/W]:	13					
Thermal resistance junction housing [K/W]:	0.6	0.6	0.5	0.35	0.3	0.3
Junction temperature [°C]:	≤ 125					

General Technical Data

Operating mode:	Continuous operation (Current reduction above 40 °C)	
Temperature range		
operation:	- 40 ... 80 °C	
storage:	- 40 ... 80 °C	
Relative air humidity:	< 50 % for < +40 °C and < 90 % for < + 20 °C	
Altitude:	1.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	6 kV / 2	IEC/EN 60 664-1
Over voltage category:	III	
EMC:	IEC/EN 61 000-6-4,	IEC/EN 61 000-4-1
Electrostatic discharge (ESD):	8 kV air / 6 kV contact	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages		
Control circuit between A1 / A2:	1 kV	IEC/EN 61 000-4-5
between output and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class A*)	
	*) The device is designed for the usage under industrial conditions (Class A, EN 55011) When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.	
Degree of protection:	IP 20	IEC/EN 60 529
Vibration resistance:	2 g	IEC/EN 60 068-2-6
Housing material:	PBT/PC flame resistant; UL 94 V0	
Base plate:	Nickel plated aluminium	
Mounting screws:	M4 x 20 mm (with conical and plain washers)	
Fixing torque:	1.8 Nm	
Connections load circuit:	Mounting screws M4 Pozidrive PZ 2	
Fixing torque:	1.2 Nm	
Wire cross section:	2 x 1.5 ... 2.5 mm² solid or 2 x 2.5 ... 6 mm² solid oder 2 x 1.0 ... 2.5 mm² stranded wire with sleeve 2 x 2.5 ... 6 mm² stranded wire with sleeve 1 x 10 mm² stranded wire with sleeve	
Connections control circuit:	Mounting screws M3 Pozidrive PZ 1	
Fixing torque:	0.6 Nm	
Wire cross section:	1 x 0.5 ... 2.5 mm² solid or 2 x 0.5 ... 1.0 mm² solid or 1 x 0.5 ... 2.5 mm² stranded wire with sleeve	
Nominal insulation voltage		
Control circuit – load circuit:	4 $kV_{eff.}$	
Load circuit – base plate:	4 $kV_{eff.}$	
Overvoltage category:	III	
Weight		
PI9260.9X/_ _ _ :	268 g	
PI9260.9X/_ _ _ /06:	970 g	

Dimensions

Width x height x depth: 67,5 x 120 x 50 mm

Standard Type

PI 9260.92/000/06 AC 48 ... 480 V 2 x AC 30 A DC 10 ... 32 V

Article number: 0067462
- Load voltage: AC 48 ... 480 V
- Load current AC-51: 2 x 30 A
- **Load current AC-53a: 2 x 12 A**
- Control voltage: DC 10 ... 32 V
- With heat sink 0.75 K/W
- Width: 67.5 mm

PI 9260.93/000/06 AC 48 ... 480 V 3 x AC 20 A DC 10 ... 32 V

Article number: 0067464
- Load voltage: AC 48 ... 480 V
- Load current AC-51: 3 x 20 A
- **Load current AC-53a: 3 x 12 A**
- Control voltage: DC 10 ... 32 V
- With heat sink 0.75 K/W
- Width: 67.5 mm

Variants

PI 9260 .9_ / _ _ _ / _ _

- 00 Without heat sink
- 06 With heat sink 0.75 K/W
- 16 With heat sink 0.75 K/W and fan kit (on request)

- 0 without temperature protection
- 1 with temperature protection

- 0 Switching at zero crossing
- 1 Immediate switching

- 0 Standard
- 1 With high I²t-value > 6600 A²s
- 2 With high I²t-value > 18000 A²s

- 2 2-poles
- 3 3-poles

Ordering example for variants

PI 9260.93 /1 0 0 /06 AC 48 ...480 V 3 x AC 20 A DC 10 ... 32 V

- Control voltage
- Load current
- Load voltage
- With heat sink 0.75 K/W
- Without temperature protection
- Switching at zero crossing
- With high I²t-value > 6600 A²s
- 3-poles
- Type

Further variants

PI9260.92/200/06 AC 48 ... 480V 2 x AC 30 A AC 100 ... 230 V

Article number:	0067688
Load current AC-51:	2 x 30 A
Load current AC-53a:	**2 x 30 A**

PI9260.93/000/06 AC 48 ... 480V 3 x AC 20 A AC 100 ... 230 V

Article number:	0067687
Load current AC-51:	3 x 20 A
Load current AC-53a:	**3 x 12 A**

PI9260.93/100/06 AC 48 ... 480V 3 x AC 20 A DC 10 ... 32 V

Article number:	0067686
Load current AC-51:	3 x 20 A
Load current AC-53a:	**3 x 20 A**

Other variants on request.

Notes on Sizing for Selection of a Heat Sink

The heat generated by the load current flowing through the SSR has to be removed by a suitably chosen heat sink. It is essential that the junction temperature of the semiconductor is kept below 125 °C for all possible ambient temperatures. It is of paramount importance that the thermal resistance between the SSR base plate and the heat sink is kept to a minimum. A small amount of thermally conductive compound (or a similar interface material) should be applied to the base plate before assembly to the heat sink. The tables shown below can be used as a guide to select a suitable heat sink for various load currents and ambient temperatures situations.

a)

Load current (A)	3 Phase SSR Rating 20A/pole Thermal resistance (K/W)					
20	1.5	1.3	1.1	1.0	0.8	0.6
18	1.7	1.5	1.3	1.1	0.9	0.8
16	2.0	1.7	1.5	1.3	1.1	0.9
14	2.3	2.1	1.8	1.6	1.3	1.1
12	2.8	2.5	2.2	1.9	1.6	1.3
10	3.5	3.2	2.8	2.4	2.1	1.7
8	-	4.1	3.6	3.2	2.7	2.3
6	-	-	-	4.4	3.8	3.2
4	-	-	-	-	-	-
2	-	-	-	-	-	-
	20	30	40	50	60	70
	Ambient temperature (°C)					

b)

Load current (A)	3 Phase SSR Rating 30A/pole Thermal resistance (K/W)					
30	0.7	0.6	0.5	0.4	0.3	0.2
27	0.8	0.7	0.6	0.5	0.4	0.3
24	1.0	0.9	0.8	0.6	0.5	0.4
21	1.2	1.1	0.9	0.8	0.6	0.5
18	1.5	1.4	1.2	1.0	0.8	0.7
15	2.0	1.8	1.5	1.3	1.1	0.9
12	2.7	2.4	2.1	1.8	1.5	1.2
9	3.8	3.4	3.0	2.6	2.2	1.8
6	-	-	-	4.2	3.6	3.0
3	-	-	-	-	-	-
	20	30	40	50	60	70
	Ambient temperature (°C)					

c)

Load current (A)	3 Phase SSR Rating 50A/pole Thermal resistance (K/W)					
50	0.4	0.3	0.2	0.2	0.1	-
45	0.5	0.4	0.3	0.3	0.2	0.1
40	0.6	0.5	0.4	0.4	0.3	0.2
35	0.7	0.6	0.5	0.5	0.4	0.3
30	0.9	0.8	0.7	0.6	0.5	0.4
25	1.2	1.0	0.9	0.8	0.6	0.5
20	1.6	1.4	1.2	1.1	0.9	0.7
15	2.3	2.1	1.8	1.6	1.3	1.1
10	3.7	3.3	2.9	2.5	2.2	1.8
5	-	-	-	-	4.5	4.0
	20	30	40	50	60	70
	Ambient temperature (°C)					

d)

Load current (A)	3 Phase SSR Rating 60A/pole Thermal resistance (K/W)					
60	0.3	0.3	0.2	0.2	0.1	-
52	0.4	0.3	0.3	0.2	0.2	0.1
48	0.5	0.4	0.4	0.3	0.2	0.2
42	0.6	0.5	0.5	0.4	0.3	0.2
36	0.8	0.7	0.6	0.5	0.4	0.3
30	1.0	0.9	0.8	0.7	0.6	0.4
24	1.3	1.2	1.0	0.9	0.7	0.6
18	2.0	1.8	1.6	1.4	1.1	0.9
12	3.0	2.8	2.5	2.2	1.9	1.6
6	-	-	-	-	4.2	3.5
	20	30	40	50	60	70
	Ambient temperature (°C)					

e)

Load current (A)	2 Phase SSR Rating 20A/pole Thermal resistance (K/W)					
20	2.2	1.9	1.7	1.5	1.2	1.0
18	2.5	2.3	2.0	1.7	1.4	1.1
16	3.0	2.6	2.3	2.0	1.7	1.4
14	3.5	3.1	2.8	2.4	2.0	1.7
12	4.3	3.8	3.4	2.9	2.5	2.0
10	5.3	4.7	4.2	3.7	3.1	2.6
8	-	6.2	5.5	4.8	4.1	3.4
6	-	-	-	6.6	5.7	4.8
4	-	-	-	-	-	-
2	-	-	-	-	-	-
	20	30	40	50	60	70
	Ambient temperature (°C)					

f)

Load current (A)	2 Phase SSR Rating 30A/pole Thermal resistance (K/W)					
30	1.0	0.9	0.8	0.6	0.5	0.3
27	1.3	1.0	0.9	0.8	0.6	0.4
24	1.5	1.3	1.1	1.0	0.8	0.6
21	1.9	1.7	1.4	1.2	1.0	0.8
18	2.3	2.1	1.8	1.5	1.3	1.0
15	3.0	2.6	2.3	2.0	1.7	1.4
12	4.0	3.6	3.2	2.7	2.3	1.9
9	5.5	5.1	4.5	3.9	3.3	2.8
6	-	-	-	6.3	5.4	4.5
3	-	-	-	-	-	-
	20	30	40	50	60	70
	Ambient temperature (°C)					

g)

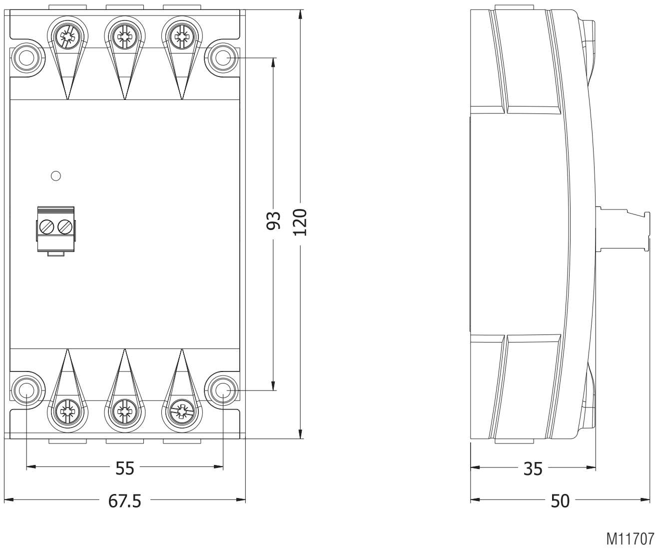
Load current (A)	2 Phase SSR Rating 50A/pole Thermal resistance (K/W)					
50	0.6	0.5	0.4	0.3	0.2	0.1
45	0.7	0.6	0.5	0.4	0.3	0.2
40	0.9	0.8	0.6	0.5	0.4	0.3
35	1.1	1.0	0.8	0.7	0.5	0.4
30	1.4	1.2	1.1	0.9	0.7	0.6
25	1.8	1.6	1.4	1.2	1.0	0.8
20	2.4	2.0	1.9	1.6	1.4	1.0
15	3.5	3.0	2.7	2.4	2.0	1.6
10	5.6	5.0	4.4	3.9	3.3	2.7
5	-	-	-	-	-	6.0
	20	30	40	50	60	70
	Ambient temperature (°C)					

h)

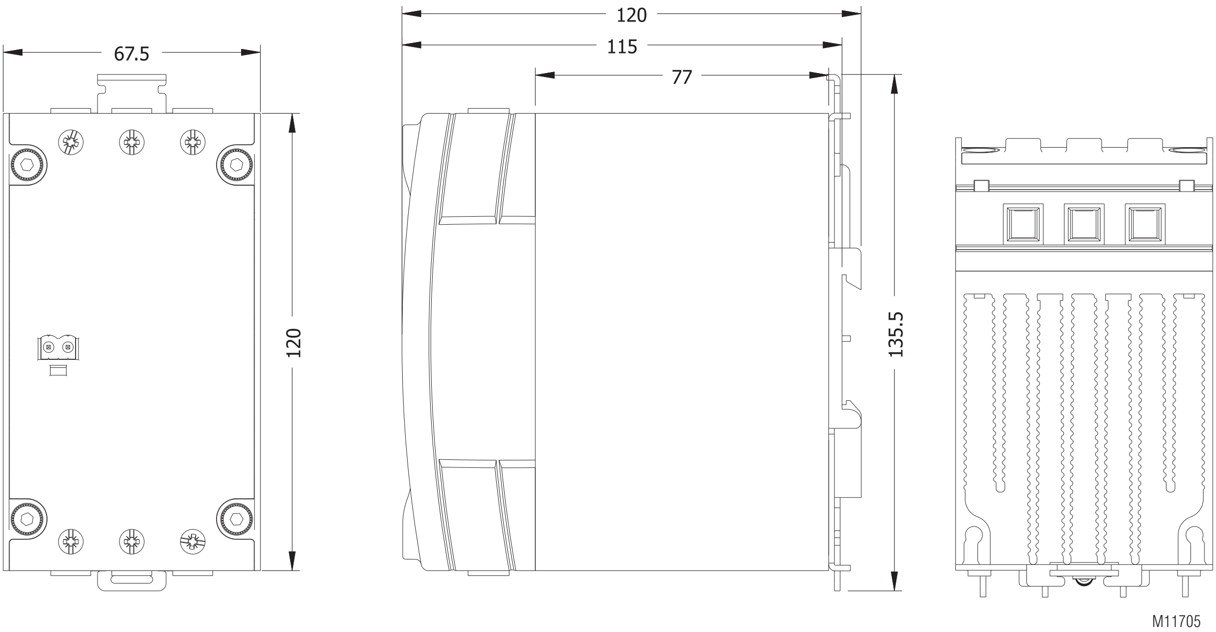
Load current (A)	2 Phase SSR Rating 60A/pole Thermal resistance (K/W)					
60	0.5	0.4	0.4	0.3	0.2	0.1
52	0.6	0.5	0.5	0.4	0.3	0.2
48	0.8	0.7	0.6	0.5	0.4	0.3
42	0.9	0.8	0.7	0.6	0.5	0.4
36	1.2	1.1	0.9	0.8	0.6	0.5
30	1.5	1.4	1.2	1.0	0.9	0.7
24	2.0	1.8	1.5	1.3	1.1	0.9
18	3.0	2.7	2.4	2.1	1.7	1.4
12	4.8	4.3	3.8	3.3	2.9	2.4
6	-	-	-	-	6.3	5.3
	20	30	40	50	60	70
	Ambient temperature (°C)					

Connection Example

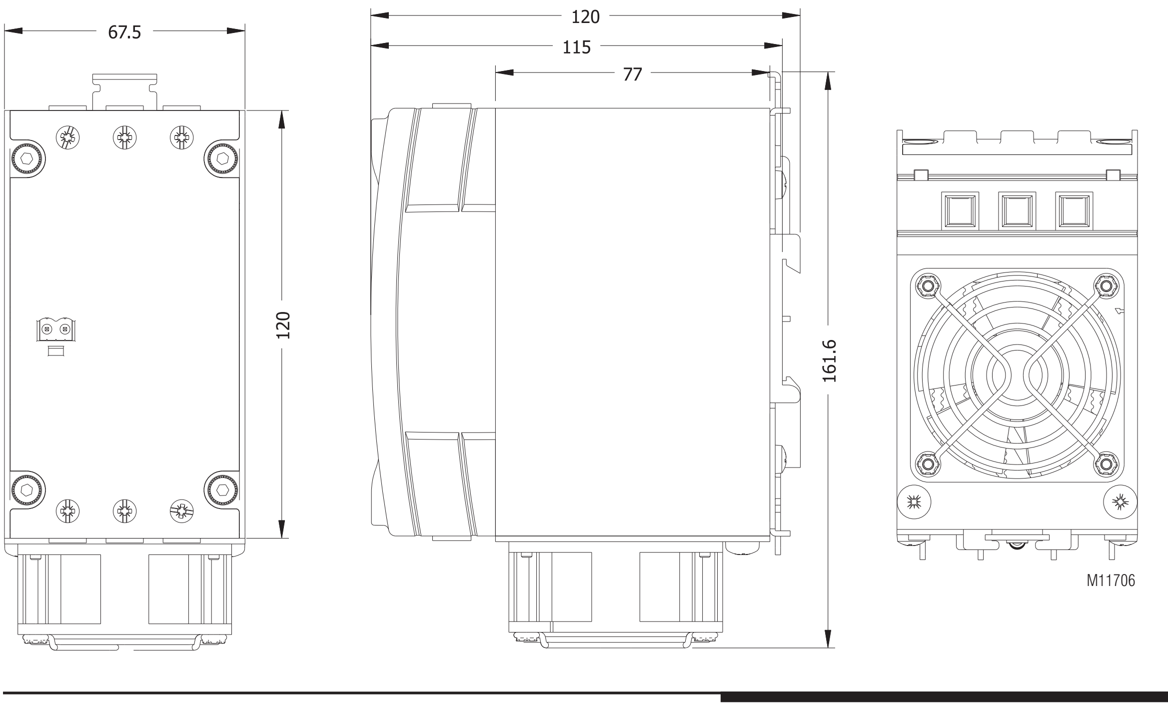
PI9260.93/_ _ _/00



PI9260.93/_ _ _ /06

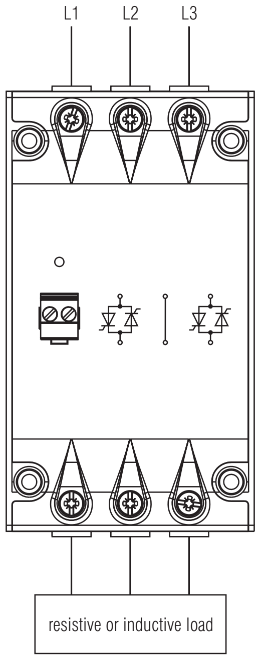


PI9260.93/_ _ _ /16 (on request)

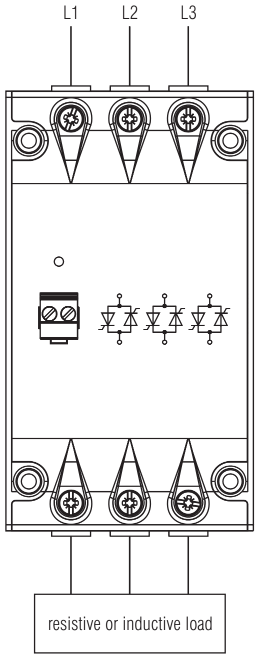


Connection Example

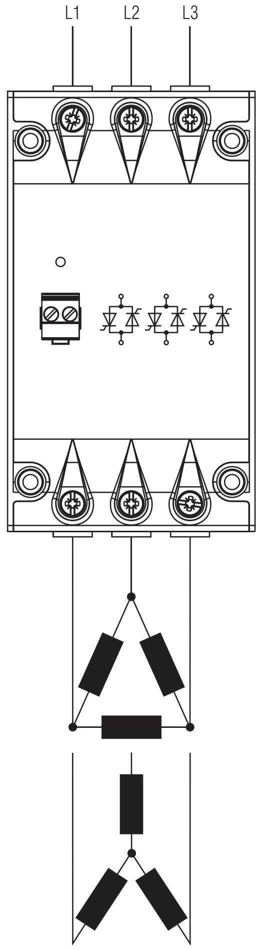
Typical applications



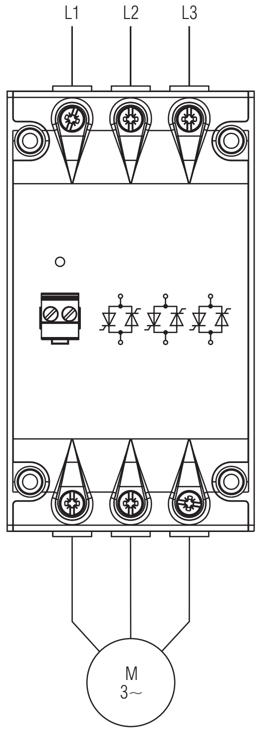
M11708



M11777

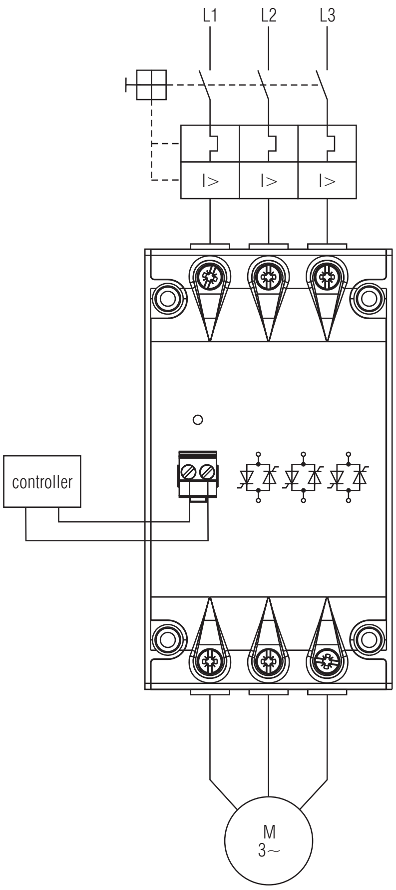


M11778



M11779

Three phase motor application



M11783

Power Electronics

POWERSWITCH
Reversing Contactor
BH 9253

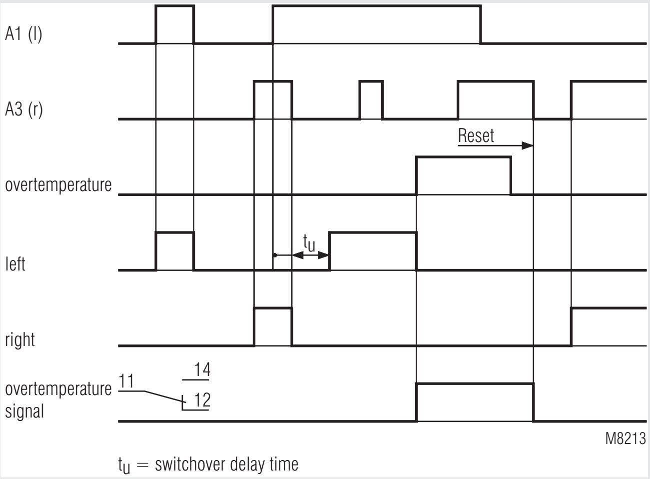
0238830

BH 9253 with
Rated continuous current 4 A

BH 9253 with
Rated continuous current 12 A

- According to IEC/EN 60 947-1, IEC/EN 60 947-4-2
- Switching at zero-crossing
- To reverse 3 phase asynchronuos motors up to 5.5 kW / 400 V (7.5 HP / 460 V)
- Electrical interlocking of both directions
- Temperature monitoring to protect the power semiconductors
- Measured nominal current up to 20 A
- LEDs for status indication
- Galvanic separation between control circuit and power circuit
- 45 mm; 67.5 mm; 112.5 mm width

Function Diagram



Approvals and Markings

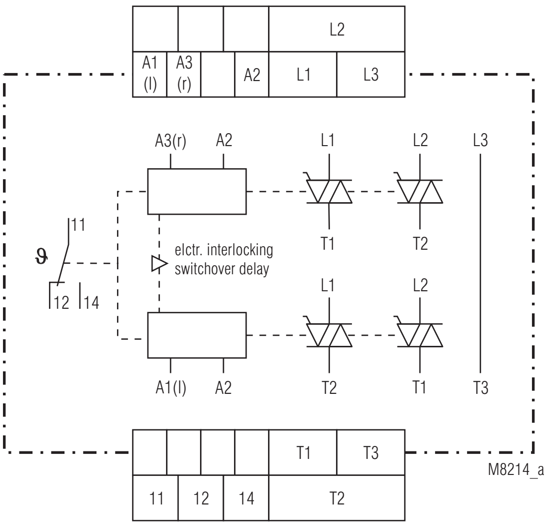
Canada / USA

Function

The reversing contactor BH 9253 is used to reverse the direction of 3-phase asynchronuos motors by switching 2 phases. An electrical interlokking disables the control of both directions at the same time. The reversing contactor has a short on and off delay time. When reversing the phases a switchover delay is guaranteed.

Temperature sensing
To protect the power semiconductors the unit incorporates temperature monitoring. When overtemperature is detected the power semiconductors swith off and an output relay as well as a red LED is activated. This state is stored. When the temperature is back to normal the semiconductors can be activated again by switching off and on the control voltage.

Circuit Diagrams



Indicators

yellow LED "l":	on, when left direction active
yellow LED "r":	on, when right direction active
red LED:	on, when overtemperature

Connection Terminal

Terminal designation	Signal description
A1 (l), A2	Auxiliary voltage, control anti-clockwise
A3 (r), A2	Auxiliary voltage, control clockwise
L1, L2, L3	Mains connection
T1, T2, T3	Motor connection
11, 12, 14	Contacts output relays, active when overtemperature

Technical Data

Input

Nominal voltage

A1,A2 / A3,A2:	AC/DC 24 V; AC 110 ... 127 V, AC 220 ... 240 V, AC 288V AC 400 V (no UL-devices) control voltage A1, A3 has to be connected to the same potential (see appl. example)
Voltage range:	AC: 0.8 ... 1.1 U_N DC: 0.8 ... 1.25 U_N
Nominal consumption	
at AC 230 V:	4 VA, 0.8 W
at DC 24 V:	0.3 W
Nominal frequency:	50 / 60 Hz
Switch on delay:	max. 30 ms
Switch off delay:	typically 25 ms
Switch-over delay t_u:	100 ms (other values on request)
Permissible residual voltage:	30 % U_N

Load Output

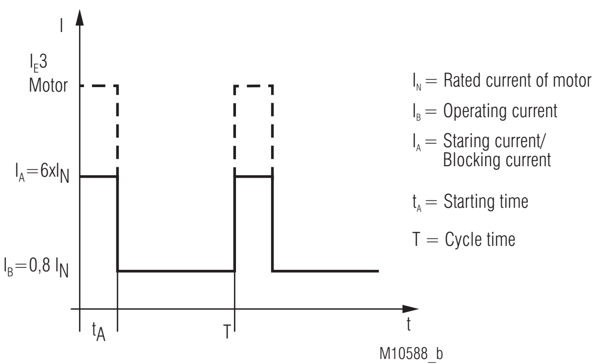
		unit without heat sink	with heat sink width 67.5 mm	with heat sink width 112.5 mm
Rated continuous current I_e [1)]	[A]	4	12	20
Current reduction above 40 °C	[A/°C]	0.1	0.2	0.2
max. motor power at 400 V	[kW]	1.1	4	5.5
Nominal motor current I_N	[A]	2.6	8.5	11.5
max. locked rotor motor current	[A]	15.6	51	69
Example for max. operat. freq. at 100 % duty cycle, 80 % motor load, starting time t_A 2s, starting current I_A= 6 x I_N	[1/h]	250	210	320
Operation mode		AC53a acc. to IEC/EN 60947-4-2		

[1)] The rated continuous current I_e is the max. permissible current of the unit in continuous operation.

Note: The max. permissible operating frequency of the motor can be less. See motor data!

Load voltage range:	AC 24 ... 480 V
Peak inverse voltage:	1 200 Vp
Frequency range:	50 / 60 Hz
Surge current 10 ms:	300 A
Semiconductor fuse:	450 A²s
Varistor voltage:	AC 510 V

Cycle diagram to calculate the operating frequency



Formula for selection of unit and motor

$$I_e \overset{!}{\geq} \frac{1}{T}\left[I_A\, t_A + I_B\,(T-t_A)\right] \quad \text{Device selection}$$

$$I_N^2 \overset{!}{\geq} \frac{1}{T}\left[I_A^2\, t_A + I_B^2\,(T-t_A)\right] \quad \text{Motor selection}$$

I_A: Starting current / Blocking current
Please take into account the motor data.
Modern motors with efficiency class IE3 may have an inrush peek current of 10-12 times of the nominal motor current.

Technical Data

Monitoring Output

Contacts

BH 9253.11:	1 changeover contact	
Thermal current I_{th}:	5 A	
Switching capacity		
at AC 15		
NO:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC:	1 A / AC 230 V	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	4 A gG / gL	IEC/EN 60 947-5-1

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60 °C Current reduction over 40 °C: see table	
Storage:	- 25 ... + 70 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Surge voltages:	5 kV / 0.5 J	
HF-interference:	2.5 kV	
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	1 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 040 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection		
Load terminals:	1 x 10 mm² solid or 1 x 6 mm² stranded ferruled	
Control terminals:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	terminal screws M3.5; box terminals with self-lifting wire protection	
Fixing torque:		
Load terminals:	1.2 Nm	
Control terminals:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:		
BH 9253 with 4 A:	420 g	
BH 9253 with 12 A:	640 g	
BH 9253 with 20 A:	1 040 g	

Dimensions

Width x heigth x depth:

BH 9253 with 4 A:	45 x 84 x 121 mm
BH 9253 with 12 A:	67.5 x 84 x 121 mm
BH 9253 with 20 A:	112.5 x 84 x 121 mm

UL-Data

		unit without heat sink		with heat sink width 67.5 mm		with heat sink width 112.5 mm	
Switching capacity							
Relay NO-contact NC-contact	 [Vac] [Vac]	 230; 3A; GP 230; 1A; GP					
Short circuit current rating	[Arms]	5000					
Ambient conditions		For usage at pollution degree 2; To be used in circuits that allows a max. curent of 5000Arms at 460 V. The device has to be fused with a fuse class RK5 25A.					
Rated continuous current I_e [1)]	[A]	4		12		20	
Ambient temperature	[°C]	40	60	40	60	40	60
max. motor power at 460 V	[HP]	1,5	0,75	5	3	7,5	5
Nominal motor current FLA (Full load current)	[A]	3,0	1,6	7,6	4,8	11	7,6
max. locked rotor motor current LRA	[A]	20	12,5	46	32	63,5	46

[1)] The rated continuous current I_e is the max. permissible current of the unit in continuous operation.

Wire connection
Load terminals
L1, L2, L3, T1, T2, T3: 60°C / 75°C copper conductors only
AWG 18 - 8 Sol Torque 0.8 Nm
AWG 18 - 10 Str Torque 0.8 Nm

Control terminals
A1, A2, A3, 11, 12, 14: 60°C / 75°C copper conductors only
AWG 20 - 12 Sol Torque 0.8 Nm
AWG 20 - 14 Str Torque 0.8 Nm

Technical data that is not stated in the UL-Data, can be found in the technical data section.

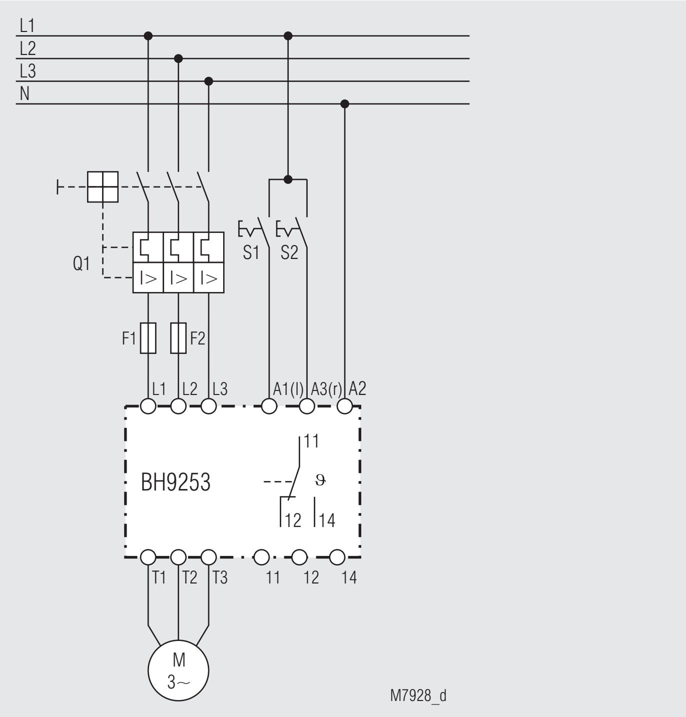
Standard Type

BH 9253.11/61 AC 220 ... 240 V 4 A 100 ms
Article number: 0064657
- Output: 1 changeover contact
- Nominal voltage U_N: AC 220 ... 240 V
- Rated continuous current: 4 A
- Switchover delay: 100 ms
- Width: 45 mm

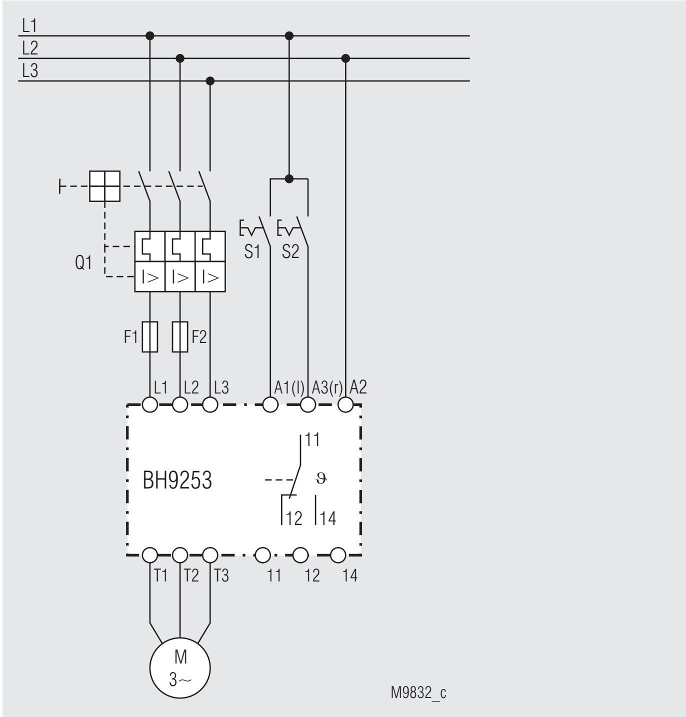
Ordering Example

BH 9253 .11 /61 AC 220...240 V 4 A 100 ms

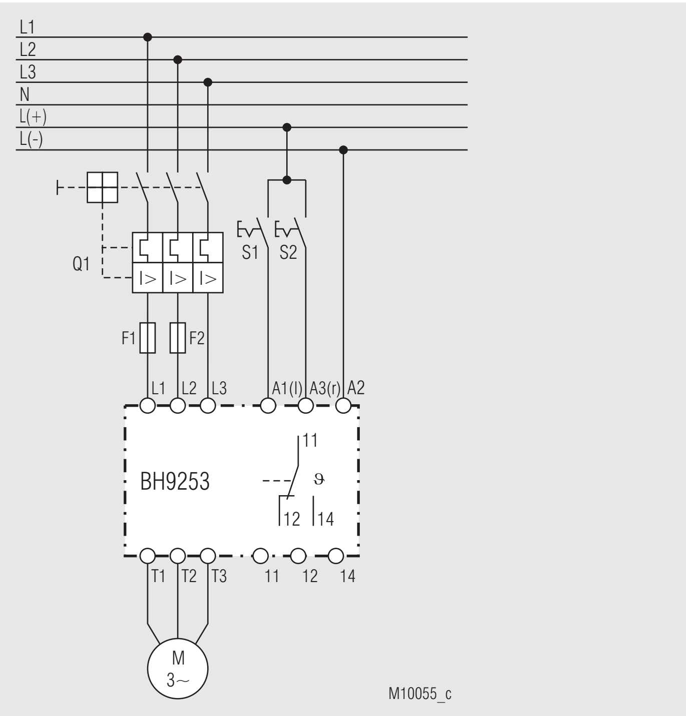
- 100 ms: Switchover delay
- 4 A: Rated continuous current
- AC 220...240 V: Nominal voltage
- /61: UL approval
- .11: Contacts
- BH 9253: Type



230/400 V AC-Mains
AC 230 V control voltage



230/400 V AC-Mains
AC 400 V control voltage



230/400 V AC-Mains
AC/DC 24 V control voltage

ATTENTION!

A1 and A3 has to be connected to the same phase. The common connection is terminal A2.

Connecting a parallel loud between A1 and A2 as well as A3 and A2 is not allowed

POWERSWITCH
Reversing Contactor With Current Monitor
BH 9255

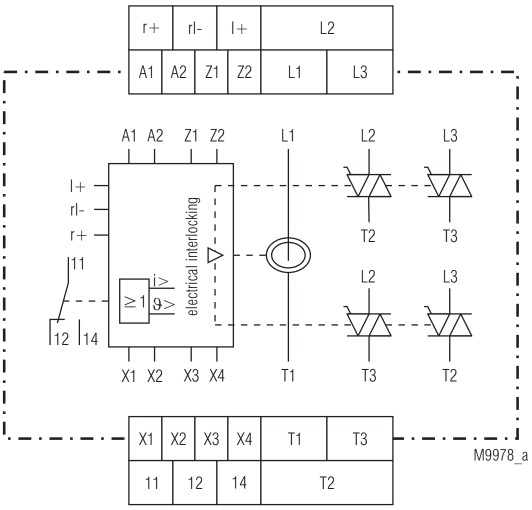

0255168

BH 9255 with
Rated continuous current 4 A

BH 9255 with
Rated continuous current 12 A

- According to IEC/EN 60 947-1, IEC/EN 60 947-4-2
- Switching at zero crossing
- To reverse 3 phase asynchronuos motors up to 5.5 kW / 400 V (7.5 HP / 460 V)
- Electrical interlocking of both directions
- Temperature monitoring to protect the power semiconductors
- Measured nominal current up to 20 A
- LEDs for status indication
- Galvanic separation between control circuit and power circuit
- With current monitor
- 45 mm; 67.5 mm; 112.5 mm width

Circuit Diagrams



Connection Terminal

Terminal designation	Signal description
A1, A2	Auxiliary voltage
r+ / rl-	Control input clockwise
l+ / rl-	Control input anti-clockwise
Z1 / Z2	Parameterization input measuring range via bridge
X1 / X2	Parameterization input switchover delay via bridge
X3 / X4	Parameterization input function via bridge
L1, L2, L3	Mains connection
T1, T2, T3	Motor connection
11, 12, 14	Contacts output relays, enable- / indicator contact

Approvals and Markings

c UL US LISTED
Canada / USA

Function

The reversing contactor BH 9255 is used to reverse the direction of 3-phase asynchronuos motors by switching 2 phases (L1 and L2). An electrical interlocking disables the control of both directions at the same time. The reversing contactor has a short on and off delay time. When reversing the phases a switchover delay is guaranteed.

The motor current is monitored in phase L1. If the current rises above the tripping value the device is able to switch off the motor

Function

Without bridge x3-x4 (plc control)
After connecting the power supply to A1/A2 the enabling contact 11-14 closes. The motor is now started with a positive edge of the signal on control input r+/rl- (clockwise) or l+/rl- (anti-clockwise).

The start up delay runs. If the start up delay is finished and the current is still over the adjusted value the relay contacts switch back to 11-12. This state is stored. It resets by switching off the motor on the control input.

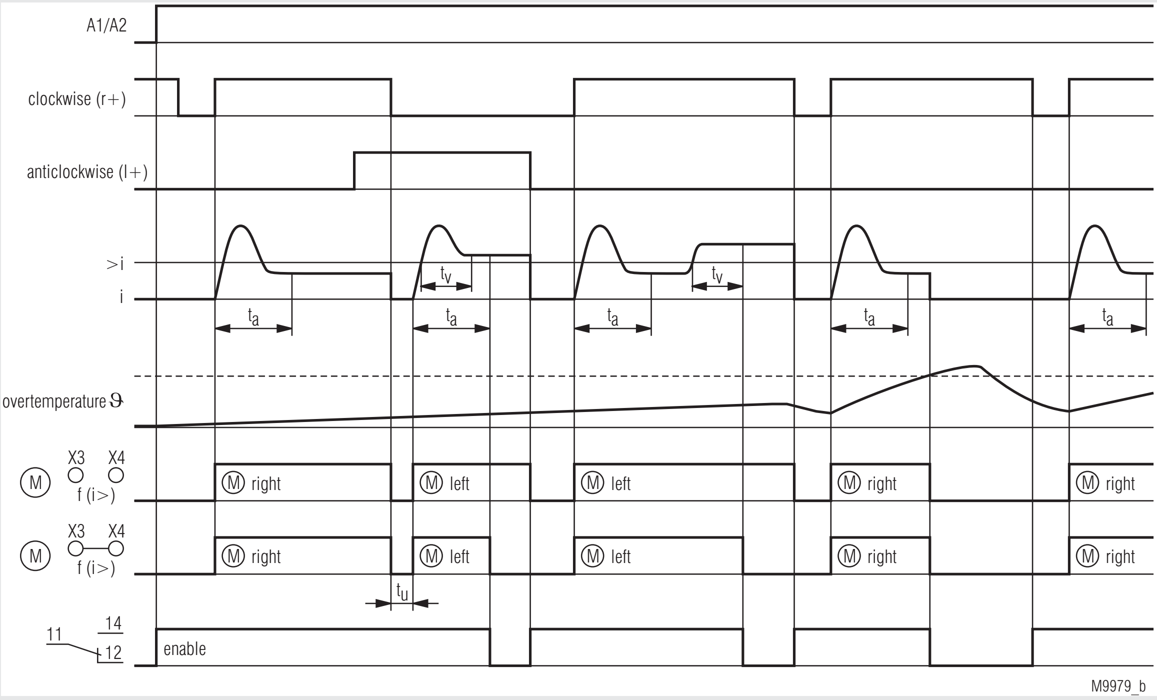
If the motor current rises above the adjusted value during operation the time tv (switching delay) runs down. If the switching delay is finished and the current is still over the adjusted value the relay contacts switch back to 11-12. This state is stored. It resets by switching off the motor on the control input.

With bridge x3-x4 (preferred for manual control)
Same function as without bridge, but in addition to the relay contact 11-12 also the motor is switched off at the same time.

Bridge x1-x2: Switchover delay t_u 20 or 100 ms

Temperature sensing
To protect the power semiconductors the unit incorporates temperature monitoring. When overtemperature is detected e.g. because of reversing to often the power semiconductors swith off and an and the enabling relay switches back in position 11-12. This state is stored. When the temperature is back to normal the semiconductors can be activated again by switching off and on the control voltage.

Function Diagram



Indicators

green LED „ON“	on when auxiliary supply connected flushes if „t_a“ abläuft
yellow LED „r“	on, when right direction active
yellowLED „l“	on, when left direction active
red LED „i>“	on, when overtemperature and flushes during time elaspe of „t_v“
red LED „ϑ>“	on, when overtemperature
both red LEDs „i> + ϑ>“	flushes if a system fault is detected. A motor current is measured and while the semiconductors are off. The motor cannot be started.

Technical Data

Input

Auxiliary voltage U_H:	AC/DC 24 V; AC 110 ... 127 V, AC 230 V, AC 288 V, AC 400 V (no UL-devices)
Voltage range:	AC: 0.8 ... 1.1 U_H DC: 0.8 ... 1.25 U_H
Nominal consumption	
at AC 230 V:	5 VA, 1.1 W
at DC 24 V:	0.6 W
Nominal frequency:	50 / 60 Hz

Control input

r+ /rl / l+:	DC 24 V preferred for plc control (short response time) AC/DC 24 ... 80 V AC/DC 80 ... 230 V

Input	**DC 24 V**	**AC/DC 24 ... 80 V** **AC/DC 80 ... 230 V**
Start up delay:	≤ 10 ms + max. 1 half-wave	≤ 15 ms + max. 1 half-wave
Release delay:	≤ 10 ms + max. 1 half-wave	≤ 60 ms + max. 1 half-wave

Switchover delay t_u:	programmable via bridge on terminals X1 - X2
without bridge:	20 ms
with bridge:	100 ms
Start up delay t_a:	0.1 ... 5 s, adjustable via potentiometer
Switching delay t_v:	0.1 ... 5 s, adjustable via potentiometer
Current measuring range:	2 ranges programmable via bridge on terminals Z1 -Z2

Unit for measured nominal current	4 A	12 A	20 A
without bridge Z1 - Z2:	0.2 ... 2 A	0.4 ... 4 A	0.8 ... 8 A
with bridge Z1 - Z2:	1 ... 10 A	2 ... 20 A	4 ... 40 A
	other measuring ranges on request		

Load Output

		unit without heat sink	with heat sink width 67.5 mm	with heat sink width 112.5 mm
Rated continuous current I_e 1)	[A]	4	12	20
Current reduction above 40 °C	[A/°C]	0.1	0.2	0.2
max. motor power at 400 V	[kW]	1.1	4	5.5
Nominal motor current I_N	[A]	2.6	8.5	11.5
max. locked rotor motor current 2)	[A]	15.6	51	69
Example for max. operat. freq. at 100 % duty cycle, 80 % motor load, starting time t_A 2s, starting current I_A= 6 x I_N	[1/h]	250	210	320
Operation mode		AC53a acc. to IEC/EN 60947-4-2		

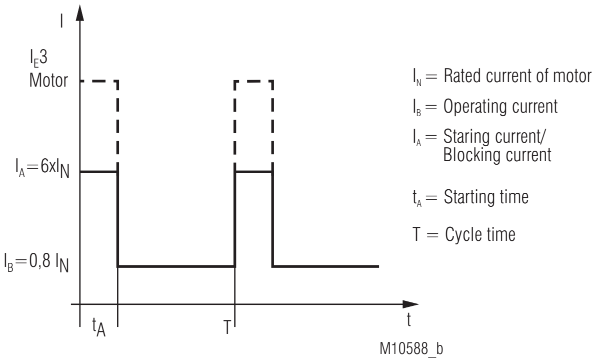
1) The rated continuous current I_e is the max. permissible current of the unit in continuous operation.
2) The max. locked rotor motor or starting current of 100 A for 1 s, 85 A for 2 s and 70 A for 5 s must not be exceeded.
3) At t_A = 1 s

Note: The max. permissible operating frequency of the motor can be less. See motor data!

Load voltage range:	AC 24 ... 480 V
Peak inverse voltage:	1 200 Vp
Frequency range:	50 / 60 Hz
Surge current 10 ms:	350 A
Semiconductor fuse:	610 A^2s
Varistor voltage:	AC 510 V

Technical Data

Cycle diagram to calculate the operating frequency



Formula for selection of unit and motor

$I_e \overset{!}{\geq} \frac{1}{T} \left[I_A t_A + I_B (T-t_A)\right]$ Device selection

$I_N^2 \overset{!}{\geq} \frac{1}{T} \left[I_A^2 t_A + I_B^2 (T-t_A)\right]$ Motor selection

I_A: Starting current / Blocking current
Please take into account the motor data.
Modern motors with efficiency class IE3 may have an inrush peek current of 10-12 times of the nominal motor current.

Monitoring Output

Contacts		
BH 9255.11:	1 changeover contact	
Thermal current I_{th}:	5 A	
Switching capacity		
at AC 15		
NO:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC:	1 A / AC 230 V	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	4 A gG / gL	IEC/EN 60 947-5-1

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60 °C Current reduction over 40 °C: see table	
Storage:	- 25 ... + 70 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Surge voltages:	5 kV / 0.5 J	
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	1 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 040 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	

Technical Data

Wire connection

Load terminals:	1 x 10 mm² solid or 1 x 6 mm² stranded ferruled
Control terminals:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4
Wire fixing:	terminal screws M3.5; box terminals with self-lifting wire protection

Fixing torque:

Load terminals:	1.2 Nm	
Control terminals:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715

Weight:

BH 9255 with 4 A:	460 g
BH 9255 with 12 A:	700 g
BH 9255 with 20 A:	1160 g

Dimensions

Width x heigth x depth:

BH 9255 with 4 A:	45 x 84 x 121 mm
BH 9255 with 12 A:	67.5 x 84 x 121 mm
BH 9255 with 20 A:	112.5 x 84 x 121 mm

UL-Data

		unit without heat sink		with heat sink width 67.5 mm		with heat sink width 112.5 mm	
Switching capacity							
Relay							
NO-contact	[Vac]	230; 3A; GP					
NC-contact	[Vac]	230; 1A; GP					
Short circuit current rating	[Arms]	5000					
Ambient conditions		For usage at pollution degree 2; To be used in circuits that allows a max. curent of 5000Arms at 460 V. The device has to be fused with a fuse class RK5 25A.					
Rated continuous current I_e [1]	[A]	4		12		20	
Ambient temperature	[°C]	40	60	40	60	40	60
max. motor power at 460 V	[HP]	1,5	0,75	5	3	7,5	5
Nominal motor current FLA (Full load current)	[A]	3,0	1,6	7,6	4,8	11	7,6
max. locked rotor motor current LRA	[A]	20	12,5	46	32	63,5	46

[1] The rated continuous current I_e is the max. permissible current of the unit in continuous operation.

Wire connection
Load terminals

L1, L2, L3, T1, T2, T3:	60°C / 75°C copper conductors only AWG 18 - 8 Sol Torque 0.8 Nm AWG 18 - 10 Str Torque 0.8 Nm

Control terminals

A1, A2, A3, 11, 12, 14:	60°C / 75°C copper conductors only AWG 20 - 12 Sol Torque 0.8 Nm AWG 20 - 14 Str Torque 0.8 Nm

Info **Technical data that is not stated in the UL-Data, can be found in the technical data section.**

Standard Type

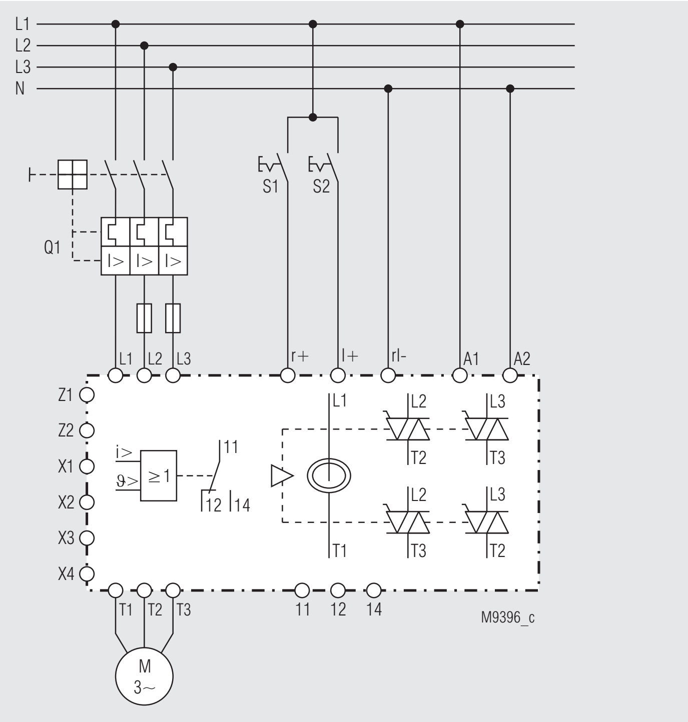
BH 9255.11 /61 AC 230 V 50 / 60 Hz 4 A AC/DC 80 ... 230 V

Artikelnummer:	0064648
• Output:	1 changeover contact
• Auxiliary voltage U_H:	AC 230 V
• Rated continuous current:	4 A
• Control input:	AC/DC 80 ... 230 V
• Width:	45 mm

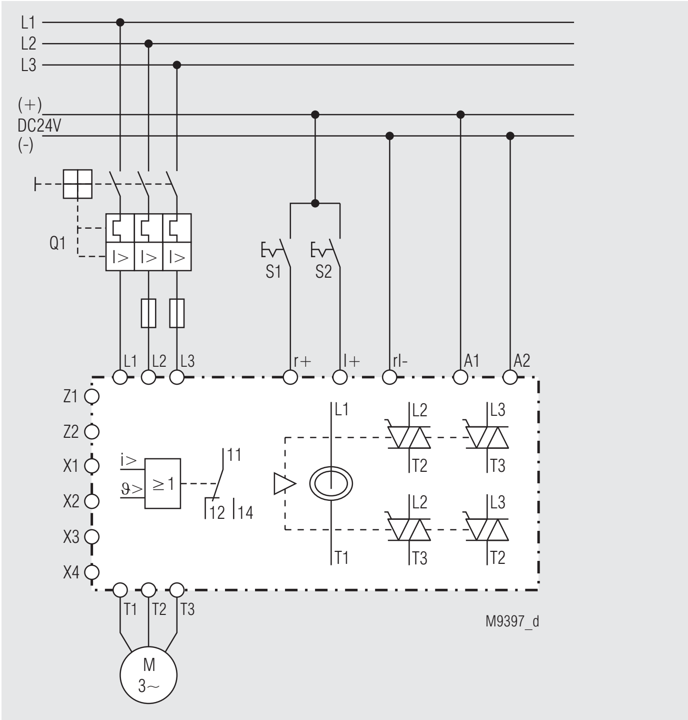
Ordering Example

BH 9255 .11 /61 AC 220...240 V 4 A AC/DC 24 ... 80 V

- Control input (r+, rl-, l+)
- Rated continuous current
- Nom. voltage A1/A2
- UL approval
- Contact
- Type



BH 9255 with A1/A2 = AC 230 V and control input AC/DC 80 ... 230 V



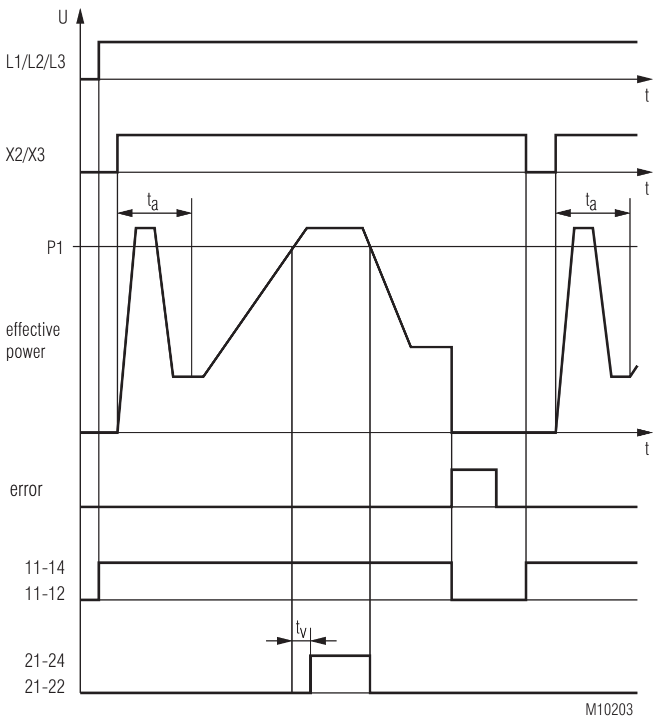
BH 9255 with A1/A2 = AC/DC 24 V and control input AC/DC 24 V or DC 24 V

POWERSWITCH
Reversing Contactor With Softstart And Active Power Monitoring BI 9254

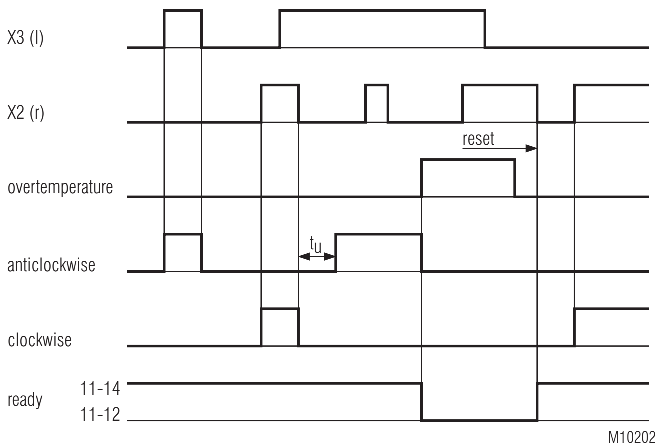
0255167

- According to IEC/EN 60 947-1, IEC/EN 60 947-4-2
- To reverse 3 phase motors
- Electrical interlocking of both directions
- 2-phase softstart
- Active power monitoring after softstart
- Temperature monitoring of power semiconductors
- LED indicator
- Internal auxiliary voltage are made from phase voltage
- Galvanic separation of control circuit and power circuit
- Space and cost saving with 3 functions in one compact unit
- Reducing of wiring and wiring failure
- Width 90 mm

Function Diagrams



P1 = minimum response value
t_a = start up delay
t_V = delay on energisation



t_U = switchover delay time

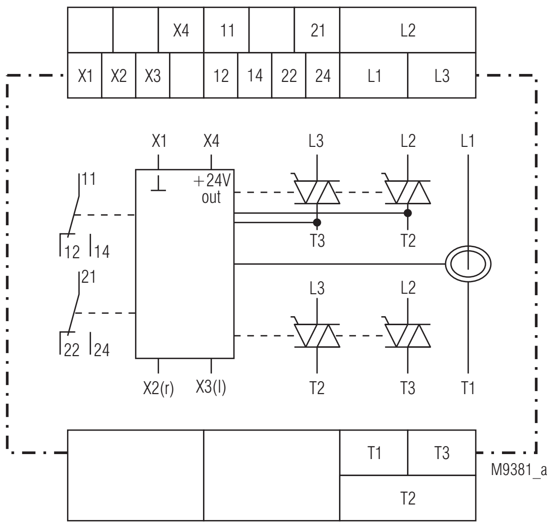
Approvals and Markings

Canada / USA

Applications

- 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 reversing contactor BI 9254 is used to reverse the direction and to monitor the effective power on 3-phase asynchronous motors. An electrical interlock blocks the simultaneous control of both directions. To monitor the effective power correctly the current in the 3 phases has to be symmetric. The monitoring function only gets active after an adjustable start up delay. The 3 phases L1, L2 and L3 are connected continuously to the unit.

Temperature monitoring
To protect the semiconductors their temperature is monitored. If overtemperature is detected, the power semiconductors switch off, the signalling relay 1 de-energises and the red LED flashes Code 1. This state is latched. After the temperature is back to normal the status can be reset by switching the control input on and off.

Softstart
Two phases are controlled by thyristors in order to let the current rise slowly and to limit it. The motor torque reacts accordingly during start-up. This allows to reduce shock and stress for the mechanical parts of the drive. Start-up time and starting torque can be set with potentiometers.

Effective load measuring
After an adjustable start up time, but at the earliest after end of ramp up time, the effective power of the connected motor is monitored. The effective power is defined as $P = U \times I \times \cos\varphi$. The maximum motor load is adjustable with potentiometer. A yellow LED indicates overload, but only as long as the motor is actually in overload state. After an adjustable time delay of 1…10 s a relay contact switches on until the effective load drops again under the adjusted value.

Control inputs
With 2 control inputs left and right rotation is selected. When both inputs are activated the first signal will be accepted as valid. The inputs can be controlled by volt free contacts or with external DC 24 V. With activation of a control input the ramp up time and the start up delay is started again. The unit does not create any extra interlocking times for reversing operation except a short delay that is necessary to control the semiconductors. If one or both control inputs are active when applying auxiliary supply, a failure code “Control input active when unit switched on” is displayed. The Error LED flashes code 6. By disconnecting the control inputs the failure state is reset.

Monitoring relay 1 (contact 11-12-14)
The relay energises as soon as the unit is ready for operation after auxiliary supply is connected. On overtemperature, phase failure or wrong phase sequence the relay de-energises and the power semiconductor switches off.

Monitoring relay 2 (contact 21-22-24)
The relay energises, when after the adjusted time delay the effective power exceeds the setting value (energized on trip). The relay de-energises as soon as the effective power drops below the adjusted value. In the case of any other failure the relay de-energises.

Indication

green LED ON:	permanent on	- supply connected
	flashing	- start up delay active
yellow LED r:	permanent on	- after start clockwise
	flashing	- during start clockwise
yellow LED l:	permanent on	- after start anticlockwise
	flashing	- during start anticlockwise
yellow LED $>P_{max}$:	permanent on	- effective power overload, relay 2 energized
	flashing	- delay active
red LED ERROR:	flashing	- Error
	1*)	- overtemperature on semiconductors
	2*)	- wrong mains freqency
	3*)	- incorrect phase sequence, exchange connections on L1 and L2
	4*)	- phase failure
	5*)	- Temperature monitoring of power semiconductors defect or device temperature < -20 °C
	6*)	- control input energized on power up

1*) - 6*) = Number of flashing pulses in sequence

Setting Facilities

Poti M_{on}:	- starting torque at softstart 20 ... 80 %
Poti t_{on}:	- ramp up time 1 ... 10 s
Poti t_a:	- start up time delay 1 ... 20 s
Poti t_v:	- on delay 1 ... 10 s
Poti P_1:	- response value for max. effective power 0,1 ... 6 kW

The setting of the effective power is infinite adjustable on absolute scale. The most accurate setting is achieved by turning the pot slowly from min to required value without changing the turning direction.

Set-up Procedure

1. Connect motor and device according to application example.
   Turn potentiometer M_{on} fully anticlockwise, potentiometers t_{on}, t_a, t_v and P_{max} fully clockwise.
2. Connect voltage and begin softstart by control of input X2 or X3.
   Turn potentiometer clockwise until motor starts immediately after switching on. This avoids unnecessary heating and humming of the motor.
3. Adjust the stat up time by turning t_{on} to the required value.
   At correct setting, the motor should ramp up continuously to full speed.
4. Adjust the start up time delay with potentiometer t_a, time delay with potentiometer t_v and response value for max. effective power with potentiometer P_{max} to the required value.

Safety Remarks

- Never clear a fault when the device is switched on

Attention: This device can be started by potential-free contact, while connected directly to the mains without contactor (see application example). Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor **must** be disconnected from the mains via the corresponding manual motor starter.

- The user must ensure that the device and the necessary components 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.

Technical Data

Nominal voltage L1/L2/L3: 3 AC 400 V ± 10 %
Nominal frequency: 50 / 60 Hz automatische Erkennung

Load Output

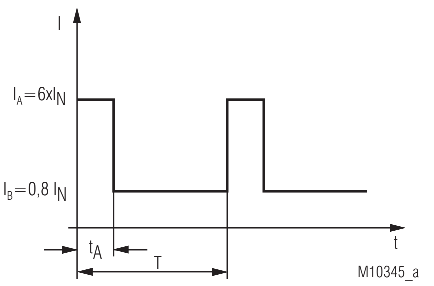
		with heat sink width: 67,5 mm	
Rated continuous current I_e [1]	[A]	12	
Ambient temperature	[°C]	40	60
max. motor power at 400 V	[kW]	5,5	3
Nominal motor current I_N	[A]	11,5	6,6
max. locked rotor motor current [2]	[A]	69	39,6
Example for max. operat. freq. at 100 % duty cycle, 80 % motor load, starting time t_A 2s, starting current I_A= 6 x I_N	[1/h]	84	
Operation mode		AC53a acc. to IEC/EN 60947-4-2	

[1] The rated continuous current I_e is the max. permissible current of the unit in continuous operation.
[2] The max. locked rotor motor or starting current of 100 A for 1 s, 85 A for 2 s and 70 A for 5 s must not be exceeded.

Note: The max. permissible operating frequency of the motor can be less. See motor data!

Peak reverse voltage: 1200 V
Overvoltage limiting: AC 510 V
Surge current 10 ms: 300 A
Semiconductor fuse: e.g. TRS 25R Fa. Ferraz
Leakage current in off state: < 3 x 5 mA
Internal resistance current measuring system: 7 mΩ
Starting voltage: 20 ... 80 %
Ramp up time: 1 ... 10 s
Consumption: 3 W
Interlocking time t_u: 50 ms
Start up delay: max. 25 ms
Release delay: max. 30 ms
Effective power monitoring
Measuring accuracy: ± 4 % max. scale value
Reaction time: 80 ms

Cycle diagram to calculate the operating frequency



t_A = starting time
T = cycle time

Formula for selection of unit and motor

$$I_e \overset{!}{\geq} \frac{1}{T}\left[I_A t_A + I_B (T-t_A)\right]$$ Device selection

$$I_N^2 \overset{!}{\geq} \frac{1}{T}\left[I_A^2 t_A + I_B^2 (T-t_A)\right]$$ Motor selection

Inputs

Control input right, left: DC 24 V "volt free contact"
Rated current: 5 mA
Softstart: DC 10 ... 30 V
Softstop: DC 0 ... 6 V
Connection: polarity protected diode, overvoltage protection
Volt free contakt: NO contact

Technical Data

Indicator Output

Contacts: 2 x 1 change over contacts
Thermal current I_{th}: 5 A
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
Elektrical 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: - 20 ... + 60 °C
Current reduction over 40 °C: see table
Clearance and creepage distances
overvoltage category / contamination level
Motor voltage-heat sink: 6 kV / 2 EN 50 178
Motor voltage-control voltage: 4 kV / 2 EN 50 178
EMC
Electrostatic discharge (ESD): 8 kV (Luftentladung) 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
betwenn wire and ground: 2 kV IEC/EN 61 000-4-5
HF-wire guided: 10 V IEC/EN 61 000-4-6
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: 20 / 055 / 04 IEC/EN 60 068-1
Wire connection
Load terminals: 1 x 10 mm² solid or
1 x 6 mm² stranded wire with sleeve
Control terminals: 1 x 4 mm² solid or
1 x 2,5 mm² stranded ferruled (isolated) or
2 x 1,5 mm² stranded ferruled (isolated) or
2 x 2,5 mm² stranded wire with sleeve
DIN 46 228-1/-2/-3/-4
Wire fixing
Load terminals: Captive plus-minus-terminal screws M4; Box terminals with self-lifting wire protection
Control terminals: Captive plus-minus-terminal screws M3,5; Box terminals with self-lifting wire protection
Mounting: Hutschiene IEC/EN 60 715

Dimensions

Width x height x depth: 90 x 85 x 121 mm

UL-Data

		with heat sink width: 67,5 mm	
Switching capacity Motor (Motor circuit)	[Vac]	400; 3-phase 50/60 Hz	
Relay NO-contact NC-contact	 [Vac] [Vac]	 230; 3A; GP 230; 3A; GP	
Short circuit current rating	[Arms]	5000	
Ambient conditions		For usage at pollution degree 2; To be used in circuits that allows a max. curent of 5000Arms at 460 V. The device has to be fused with a fuse class RK5 25A.	
Rated continuous current I_e [1)]	[A]	12	
Ambient temperature	[°C]	40	60
max. motor power at 400 V	[HP]	3	2
Nominal motor current FLA (Full load current)	[A]	6,1	4,3
max. locked rotor motor current LRA [2)]	[A]	43	34
Example for max. operat. freq. at 100 % duty cycle, 80 % motor load, starting time t_A 2s, starting current $I_A = 6 \times I_N$	[1/h]	245	

[1)] The rated continuous current I_e is the max. permissible current of the unit in continuous operation.
[2)] The max. locked rotor motor or starting current of 100 A for 1 s, 85 A for 2 s and 70 A for 5 s must not be exceeded.

Wire connection

Load terminals: 60°C / 75°C copper conductors only
AWG 18 - 8 Sol Torque 0.8 Nm
AWG 18 - 10 Str Torque 0.8 Nm

Control terminals: 60°C / 75°C copper conductors only
AWG 20 - 12 Sol Torque 0.8 Nm
AWG 20 - 14 Str Torque 0.8 Nm

Info **Technical data that is not stated in the UL-Data, can be found in the technical data section.**

Standard Type

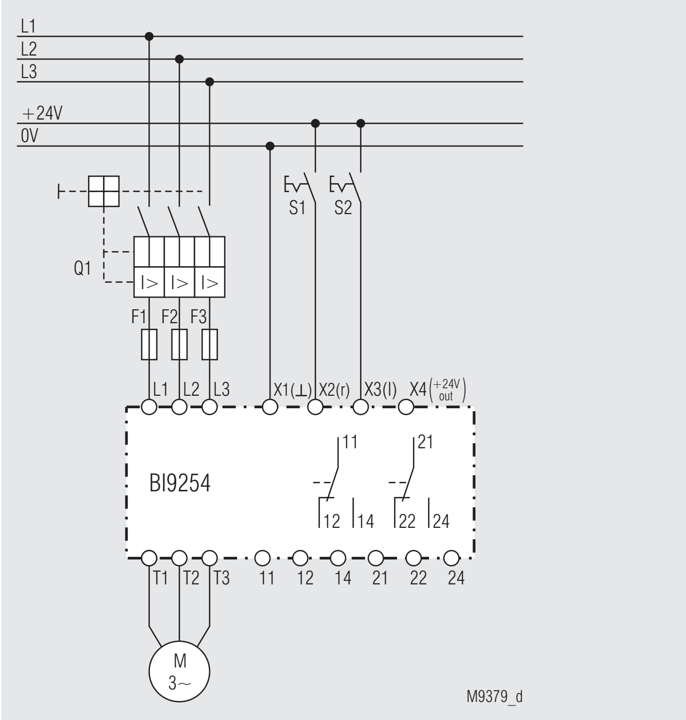
BI 9254.38 3 AC 400 V 50 / 60 Hz 12 A
Article number: 0059430
- Nominal voltage: 3 AC 400 V
- Rated continuous current: 12 A
- Control voltage: DC 24 V or contact
- Width: 90 mm

Order Reference

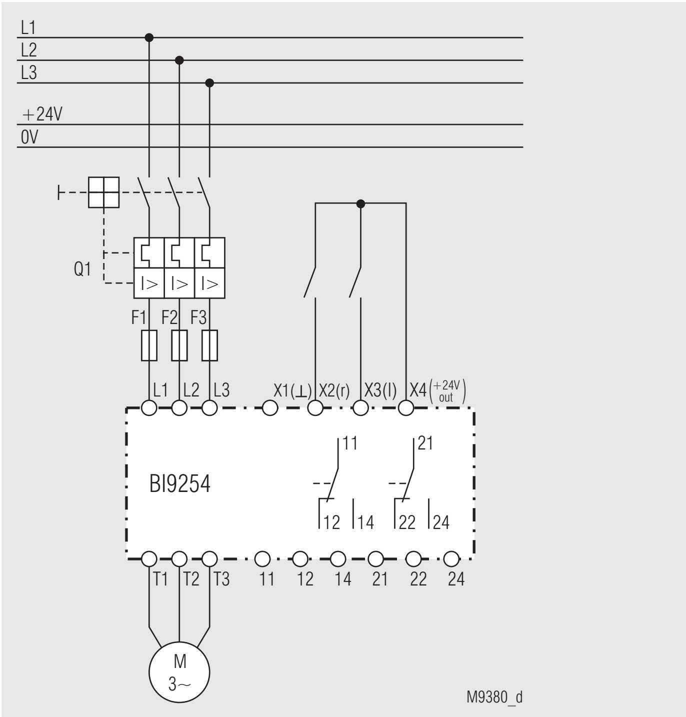
BI 9254 .38 3 AC 400 V 50 / 60 Hz 12 A

- 12 A: Rated continuous current
- 50 / 60 Hz: Nominal frequency
- 3 AC 400 V: Nominal voltage
- .38: Contacts
- BI 9254: Type

Application Examples



BI 9254 with control input DC 24 V



BI 9254 with volt free contact

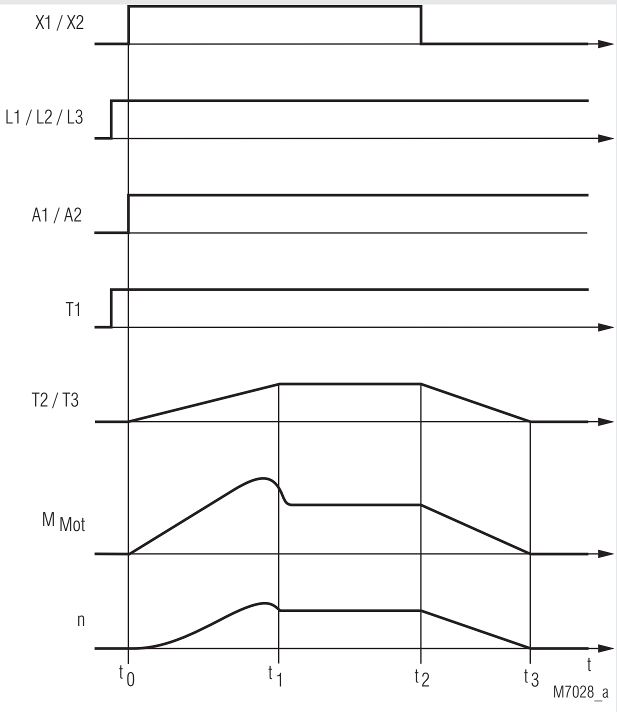
MINISTART
Softstarter With Softstop
UG 9019

0274871

Product Description

The softstart-softstop unit provides smooth starting and stopping of 3-phase asynchronous motors. 2 phases are controlled by power semiconductors in a way that the current can rise continuously. This provides also a continuous rising motor torque. This eliminates mechanical shock while starting. After successful starting the power semiconductors are bridged with internal relay contacts. This reduces internal power dissipation. The softstop function prolongs the stop time of the motor in order to avoid a sudden stop.

Function Diagram



t_0 : start
t_0-t_1 : ramp up time
t_2-t_3 : ramp down time

Your Advantages

- Simple and time-saving commissioning as well as user-friendly operation through setting via potentiometers
- Hybrid relay combines benefits of relay technology with non-wearing semiconductor technologye
- High availablility by
  - Temperature monitoring of semiconductors
  - High withstand voltage up to 1500 V

Features

- According to IEC/EN 60 947-4-2
- 2-phase softstart and softstop of 3-phase motors up to 4 KW
- 4 potentiometer für setting of starting torque, deceleration torque, softstart /-stop
- 3 LEDs for status indication
- Reset button on front
- Connection facility for external reset button
- Relay indicator output for operation
- Galvanic separation between control circuit and power circuit
- Width 22,5 mm

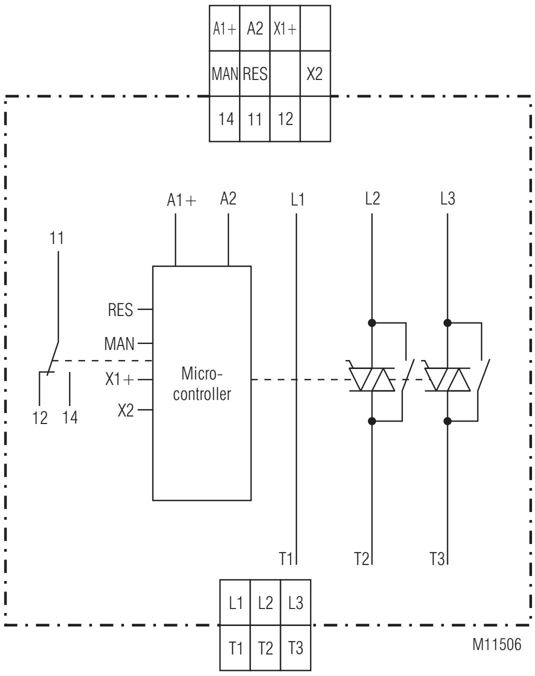
Approvals and Markings

CE c UL US LISTED
Canada / USA

Applications

- Motors with gear, belt or chain drive
- Fans, pumps, conveyor systems, compressors
- Woodworking machines, centrifuges
- Packaging machines, door drives
- Start current limiting on 3 phase motors

Circuit Diagram



Connection Terminals

Terminal designation	Signal description
A1 (+)	Auxiliary voltage + DC 24 V
A2	Auxiliary voltage 0 V
X1+	Control input Start/Stopp
X2	Earth connection control input
MAN	Input for remote reset
RES	Output for remote reset
11, 12, 14	Indicator relay for operation
L1	Phase voltage L1
L2	Phase voltage L2
L3	Phase voltage L3
T1	Motor connection T1
T2	Motor connection T2
T3	Motor connection T3

Function

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 t_{on} and M_{on}.

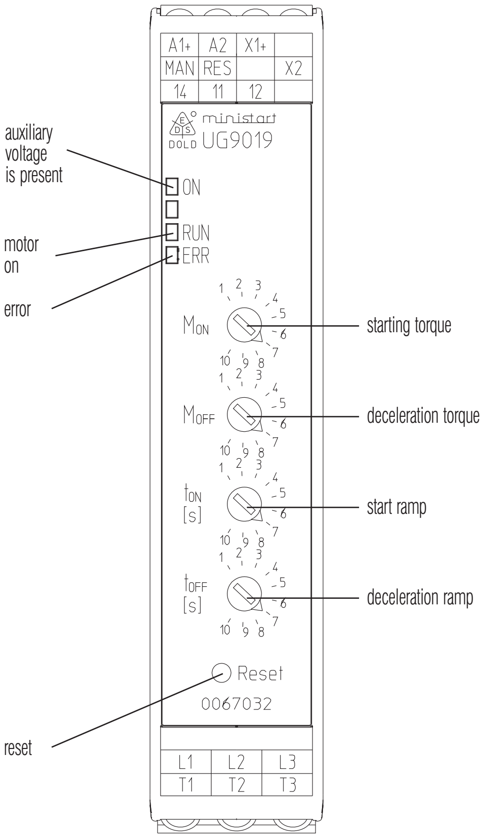
Softstop
The softstop function shall extend the natural running down time of the drive to also prevent jerky stopping.
The deceleration time is set with rotary switch t_{off}, the running-down torque with rotary switch M_{off} .

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.

Control inputs
If a voltage of more than 10 V DC is connected to terminals X1/X2, the device begins with softstart. If the voltage falls lower than DC 8 V the device will softstop.

Signalling output “Ready”
Contact 11/14 is closed if no device fault is present.

Setting



M11801

Setting Facilities

Rotary switch M_{on}:	- Starting torque at softstart 30 ... 80 %
Rotary switch M_{off}:	- Deceleration torque at softstop 80 ... 30 %
Rotary switch t_{on} :	- Start ramp 1 ... 10 s
Rotary switch t_{off} :	- Deceleration ramp 1 ... 10 s

Indication

green LED "ON":	permanent on	- auxiliary supply connected
yellow LED "RUN":	permanent on	- power semiconductors bridged
	flashing	- ramp operation
red LED "ERROR":	flashing	- Error
	1*)	- Overtemperature on semiconductors
	2*)	- Wrong mains freqency
	3*)	- Phase reversal detected
	4*)	- min. 1 phase is missing
	7*)	- Incorrect temperature measurement circuit

1*) - 7*) = 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.

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 requrired current.
3. Connect voltage and starting via input R- or softstop L-.
4. The starting time is set by turning the rotary switch t_{on} 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

Attention !

- 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)
- Adjustmentsmayonlybecarriedoutbyqualifiedspecialiststaffand the applicable safety rules must be observed.
- After a short circuit the softstart-softstop unit is defective and has to be replaced (Assignment type 1).
- Group supply:
- If several softstart-softstop units are protected together, the sum of the motor currents must not exceed 25 A.

Technical Data

Nominal voltage L1/L2/L3:	3 AC 200 ... 480 V ± 10%	
Nominal frequency:	50 / 60 Hz , automatic detection	
Auxiliary voltage:	DC 24 V ± 10%	
Motor power:	max. 4 kW at AC 400 V	
Min. motor power:	50 W	
Operating mode:		
6.9 A (3 kW / 400 V):	AC 53a: 3-5: 100-30	IEC/EN 60947-4-2
9 A (4 kW / 400 V):	AC 53a: 6-2: 100-30	IEC/EN 60947-4-2
Surge current:	200 A (tp = 20 ms)	
Load limit integral:	200 A²s (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	
Consumption:	2 W	
Start up delay for master tick:	max. 100 ms	
Release delay for master tick:	max. 50 ms	
Short circuit strength:		
max. fuse rating:	25 A gG / gL	IEC/EN 60 947-5-1
Assignment type:	1	
Electrcal life:	> 10 x 10^6 switching cycles	

Inputs

Control input X1+/X2:	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")

Indicator Outputs

RES:	DC 24 V, semiconductor, short circuit proof, rated continuous current 0.2 A	
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
Thermal current I_{th}:	5 A	
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	
Test voltage		
Coil - Contact:	4000 V AC	
Open Contact:	1000 V AC	
Short circuit strength		
max. fuse rating:	4 A gG / gL	IEC/EN 60 947-5-1

Technical Data

General Data

Device type:	Hybrid Motor Controller H1B	
Operating mode:	Continuous operation	
Temperature range:		
Operation:	0 ... + 60 °C (see derating curve)	
Storage:	- 25 ... + 75 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 1.000 m	
Clearance and creepage distances		
Rated insulation voltage:	500 V	
overvoltage category / contamination level between control input- , auxiliary voltage and Motor voltage respectively indicator contact:	4 kV / 2	IEC/EN 60 664-1
Overvoltage category:	III	
EMC		
Interference resistance		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 1.0 GHz:	10 V / m	IEC/EN 61 000-4-3
1.0 GHz ... 2.5 GHz:	3 V / m	IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz:	1 V / m	IEC/EN 61 000-4-3
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
Interference emission		
Wire guided:	Limit value class B	IEC/EN 60 947-4-2
Radio irradiation:	Limit value class B	IEC/EN 60 947-4-2
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 / 060 / 04	IEC/EN 60 068-1
Wire connection:		DIN 46 228-1/-2/-3/-4
Screw terminal (fixed):		
Control terminals		
Cross section:	1 x 0.14 ... 2.5 mm² solid or stranded wire with sleeve	
Power terminals		
Cross section:	1 x 0.25 ... 2.5 mm² solid or stranded wire with sleeve	
Insulation of wires or sleeve length:	8 mm	
Fixing torque:	0.5 Nm	
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

UL-Data

Standards:
for all products:
- U.S. National Standard UL508, 17th Edition
- Canadian National Standard - CAN/CSA-22.2 No. 14-13,12th Edition

with restrictions at motor switching power:
- ANSI/UL 60947-1, 3rd Edition (Low-Voltage Switchgear and Controlgear Part1: General rules)
- ANSI/UL 60947-4-2, 1st Edition (Low-Voltage Switchgear and Controlgear Part 4-2: Contactors and Motor-Starters - AC Semiconductor Motor Controllers and Starters)
- CAN/CSA-C22.2 No. 60947-1-07, 1st Edition (Low-Voltage Switchgear and Controlgear - Part1: General rules)
- CSA-C22.2 No. 60947-4-2-14, 1st Edition (Low-Voltage Switchgear and Controlgear - Part 4-2: Contactors and Motor-Starters - AC Semiconductor Motor Controllers and Starters

Motor data:
UL 508, CSA C22.2 No. 14-13
3 AC 200 ... 480 V,
3-phase, 50 / 60 Hz: up to 7.6 FLA, 45.6 LRA at 40 °C
up to 4.8 FLA, 28.8 LRA at 50 °C
up to 2.1 FLA, 12.6 LRA at 60 °C

UL 60947-4-2, CSA 60947-4-2
3 AC 200 ... 300 V,
3-phase, 50 / 60 Hz: up to 7.6 FLA, 45.6 LRA at 40 °C
up to 4.8 FLA, 28.8 LRA at 50 °C
up to 2.1 FLA, 12.6 LRA at 60 °C
3 AC 301 ... 480 V,
3-phase, 50 / 60 Hz: up to 2.1 FLA, 12.6 LRA at 60 °C

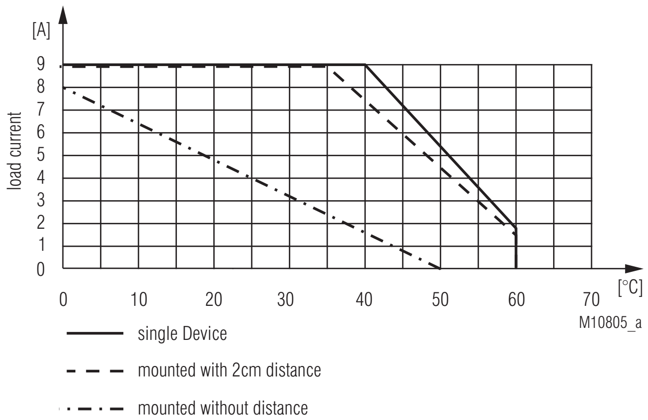
Indicator output relay: 5A 240Vac Resistive

Wire connection: 60°C / 75°C copper conductors only
Connections
A1+, A2, X1+, X2, MAN,
RES, NE, 11, 12, 14: AWG 22 - 14 Sol/Str Torque 3.46 Lb-in (0.39 Nm)
L1, L2, L3, T1, T2, T3: AWG 30 - 12 Str Torque 5-7 Lb-in (0.564-0.79 Nm)

Additional Notes:
- This device is intended for use on supply systems with a maximum voltage from phase to ground of 300V (e.g. for a three phase-four wire system 277/480 V or on a three phase-three wire systems of 240V), rated impulse withstand voltage of max. 4 kV
- Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical Amperes, 480 Volts maximum when protected by class CC, J or RK5 fuse rated maximum 20 A
- For use in pollution degree 2 Environment or equivalent
- The control circuits of this device shall be supplied by an isolated 24 Vdc power supply which output is protected with a fuse rated max. 4 A dc
- For installations according to Canadian National Standard C22.2 No. 14-13 (cUL Mark only) and supply voltages above 400V:
  - Transient surge suppression devices shall be installed on the line side of this equipment and shall be rated 240 V (phase to ground), 415 V (phase to phase), suitable for overvoltage category III, and shall provide protection for a rated impulse withstand voltage peak of 4 kV
  - Transient surge suppression devices shall be installed on the line side of this equipment and shall be rated 277 V (phase to ground), 480 V (phase to phase), suitable for overvoltage category III, and shall provide protection for a rated impulse withstand voltage peak of 4 kV

Info **Technical data that is not stated in the UL-Data, can be found in the technical data section.**

Characteristics



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

Standard Type

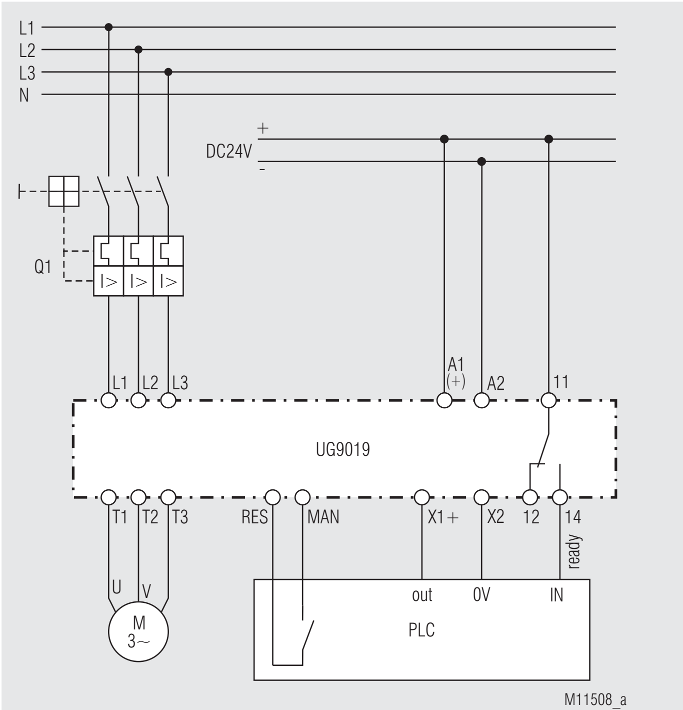
UG 9019.11/110/61 3 AC 200 ... 480 V 9,0 A 1 ... 10 s
Article number: 0067032
- Nominal voltage: 3 AC 200 ... 480 V
- Nominal current: 9,0 A
- Ramp time: 1 ... 10 s
- Width: 22.5 mm

Ordering Example

UG 9019 .11 /110 /61 3 AC 200 ... 480 V 9,0 A 1 ... 10 s

- 1 ... 10 s: Ramp time
- 9,0 A: Nominal current
- 3 AC 200 ... 480 V: Nominal voltage
- /61: UL aproval
- .11: Contacts
- UG 9019: Type

Application Example



Motor control with UG 9019 and PLC

MINISTART
Softstarter
IL 9017, SL 9017

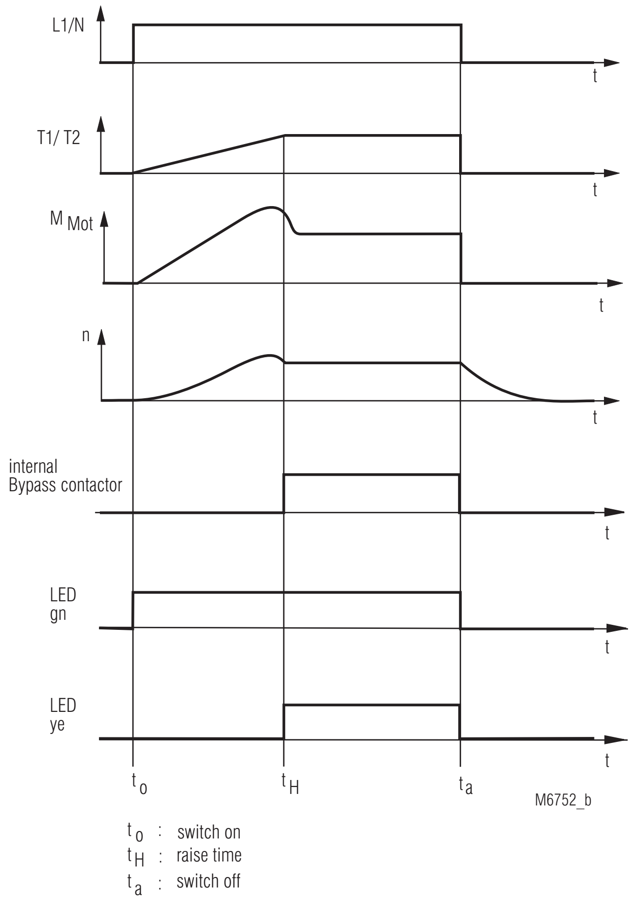
DOLD

0224305

IL 9017 SL 9017

- Increases life of 1-phase squirrel motors and mechanical drives
- Devices available in 2 enclosure version:
  IL 9017: depth 61 mm with terminals at the bottom for installations systems and industrial distribution systems according to DIN 43 880
  SL 9017: depth 100 mm with terminals at the top for cabinets with mounting plate and cable duct
- For single phase motors up to 1.5 kW
- Adjustable ramp time and starting torque
- Semiconductors will be bridged after start up
- LED indication
- Width 35 mm

Function Diagram



Approvals and Markings

CE

Applications

- Drives with gears, belts or chains
- Conveyor belts, fans
- Pumps, compressors

Function

Softstarters are electronic devices designed to enable 1-phase induction motors to start smoothly IL 9017. Slowly ramps up the current, allowing the motor torque to build up slowly. This reduces the mechanical stress on the machine and prevents damage to conveyed material.
When the motor is up to full speed the semiconductors in IL 9017 are bridged to prevent internal power losses and heat build up.

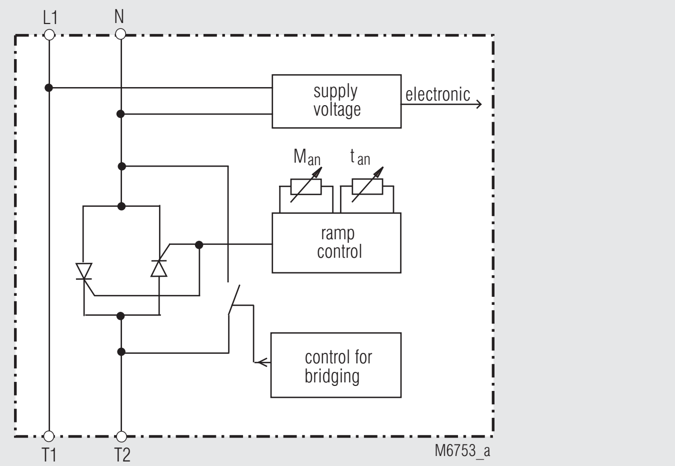
Indication

LED green:	supply connected on softstarter
LED yellow:	softstart is finished

Principle of Operation

Terminal L1 is connected to the mains contactor, terminal N to neutral, the motor is connected to terminals T1, T2. As soon as power is connected to terminal L1, the softstart will commence. Potentiometer "t_{an}" (1 - 10 sec.) adjusts the ramp time (time the motor takes to get to full speed) and potentiometer "M_{an}" adjusts the start voltage (20 - 70 % V_{nom}). When the softstart is complete the internal semiconductor is automatically bridged.

Block Diagram



Notes

The motor load must always be connected as continuous operation of the softstart with no load may cause overheating of the motor and softstart.
It is recommended that the softstart is protected by superfast semiconductor fuses rated as per the current rating of the softstart or motor. However, standard line and motor protection is acceptable, but for high starting frequencies motor winding temperature monitoring is recommended.

Technical Data

Nominal voltage U_N:	AC 230 V -20 % +10 %	
Nominal frequency:	50 / 60 Hz	
Nominal motor power P_N:	1.5 kW	
Min. motor power:	approx. 10 % of rated motor power	
Nominal current:	10 A	
External fuse (optional)		
superfast:	20 A	
Starting voltage:	20 ... 70 %	
Acceleration time		
at starting voltage 20 %:	0.1 ... 10 s	
Recovery time:	200 ms	
Switching frequency:	10/h at 3 x I_r / t_{an} = 10 s, ϑ_U = 20 °C	
Power consumption:	1.4 VA	

General Data

Operating mode:	continuous operation	
Temperature range:	0 ... + 55 °C	
Storage temperature:	- 25 ... + 75 °C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages 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
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
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
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IL 9017:	135 g	
SL 9017:	164 g	

Dimensions

Width x height x depth	
IL 9017:	35 x 90 x 61 mm
SL 9017:	35 x 90 x 100 mm

Standard Type

IL 9017 AC 230 V 1.5 kW	
Article number:	0049323
SL 9017 AC 230 V 1.5 kW	
Article number:	0050603
• Nominal voltage U_N:	AC 230 V
• For motors up to 1.5 kW	
• Width:	35 mm

Ordering Example

IL 9017 AC 230 V 1.5 kW

- 1.5 kW — Nominal motor power
- AC 230 V — Nominal voltage
- IL 9017 — Type

Installation

These units must be mounted on a vertical mounting area with the connections in a vertical plane, i.e. top to bottom. Ensure that no external heat source is placed below the unit and a 40 mm air gap is maintained above and below. Other devices may be directly mounted either side of the unit.

Set-up Procedure

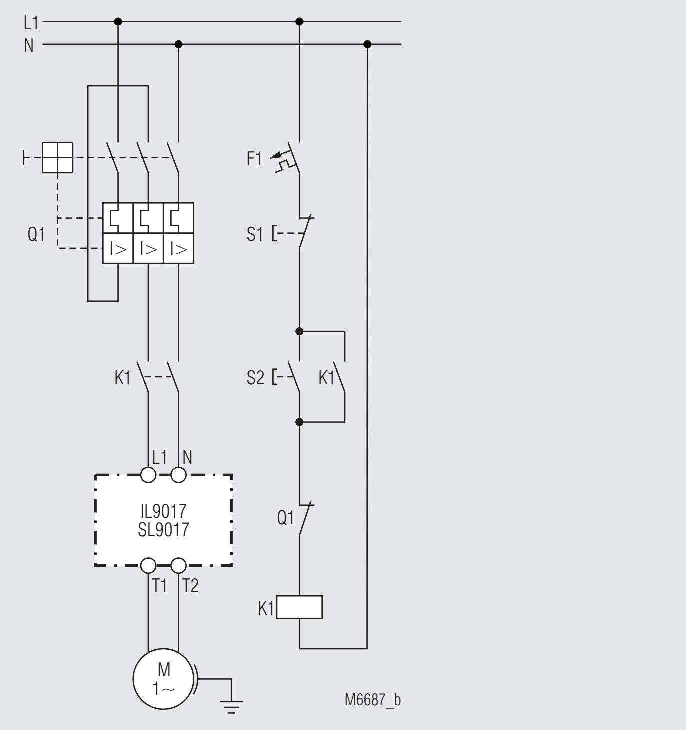
1. Set potentiometer "M_{an}" to minimum (fully anti-clockwise)
   Set potentiometer "t_{an}" to maximum (fully clockwise)
2. Start the motor and turn potentiometer "M_{an}" up until the motor starts to turn without excessive humming. Stop the motor and restart.
3. Adjust potentiometer "t_{an}" to give the desired ramp time.
   Stop and restart the motor, readjusting the potentiometers until the desired starting characteristics are achieved.

- **Attention:** If the ramp-up time is adjusted to short, the internal bridging contact closes before the motor is on full speed.
  This may damage the bridging contactor or bridging relay.

Safety Notes

- Never clear a fault when the device is switched on
- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards.
- Adjustments may only be carried out by qualified specialist staff and the applicable safety rules must be observed.

Application Example

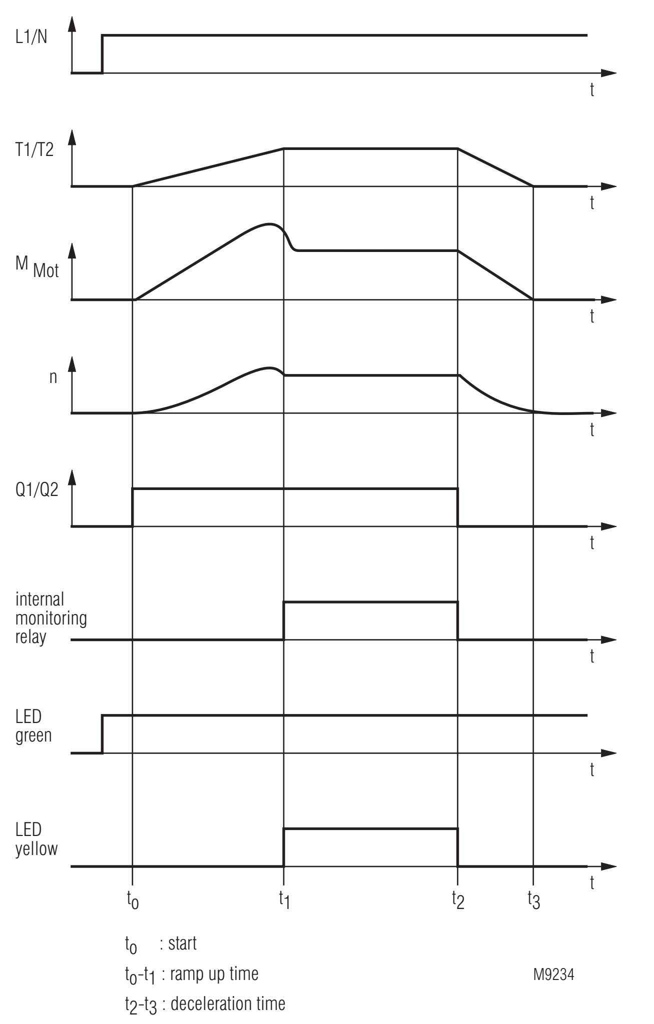


MINISTART
Softstarter With Softstop
IL 9017/300

IL 9017

- Increases life of 1-phase squirrel motors and mechanical drives
- For single phase motors up to 1.5 kW
- Adjustable ramp time/deceleration time and starting torque/ deceleration torque
- Semiconductors will be bridged after start up
- LED indication
- Width 35 mm

Function Diagram



Approvals and Markings

CE

Applications

- Drives with gears, belts or chains
- Conveyor belts, fans
- Pumps, compressors

Function

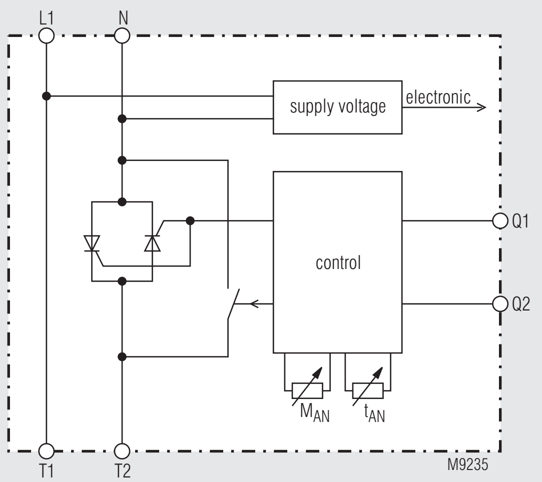
These softstart units are electronic devices designed to enable 1-phase induction motors to start and stop smoothly. By phase control the current is slowly ramped up and down allowing the motor torque to build up and decrease slowly. It provides shock free start and stop of the motor. Sudden changes of the torque as on direct start and stop do not appear any more. This feature allows an economic construction of the mechanical connected elements and prevents demage to conveyed material on conveyor systems.

When the motor is up to full speed the semiconductors in IL 9017 are bridged to prevent internal power losses and heat build up.

Indication

LED green:	softstart active
LED yellow:	softstart is finished, short flashing when mains frequency is outside limits

Block Diagram



Notes

The motor load must always be connected as continuous operation of the softstart with no load may cause overheating of the motor and softstart.
It is recommended that the softstart is protected by superfast semicondutor fuses rated as per the current rating of the softstart or motor. However, standard line and motor protection is acceptable, but for high starting frequencies motor winding temperature monitoring is recommended.

Technical Data

Nominal voltage U_N:	AC 230 V -15 % +10 %	
Nominal frequency:	50 / 60 Hz	
Nominal motor power P_N:	1.5 kW	
Min. motor power:	approx. 10 % of rated motor power	
Nominal current:	10 A	
External fuse (optional) superfast:	20 A	
Starting torque/ deceleration torque:	20 ... 70 %	
ramp-up time/ deceleration time:	0.1 ... 10 s	
Recovery time:	200 ms	
Switching frequency:	10/h at 3 x I_r / t_{an} = 10 s, ϑ_U = 20 °C	
Power consumption:	1.4 VA	

General Data

Operating mode:	continuous operation	
Temperature range:	0 ... + 55 °C	
Storage temperature:	- 25 ... + 75 °C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages 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
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
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
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:	135 g	

Dimensions

Width x height x depth:	35 x 90 x 61 mm

Standard Type

IL 9017/300 AC 230 V 1.5 kW

Article number:	0058831
• Nominal voltage U_N:	AC 230 V
• For motors up to 1.5 kW	
• Width:	35 mm

Adjustment Facilities

Ramp up/deceleration time: With potentiometer $t_{on,off}$ the ramp up and decelertion time can be adjusted within the range 0.1 to 10 s.
Starting and deceleration torque: With potentiometer $M_{on,off}$ the starting torque and the deceleration torque can be adjusted in the range of 20 to 70 % of the max. value.

Set-up Procedure

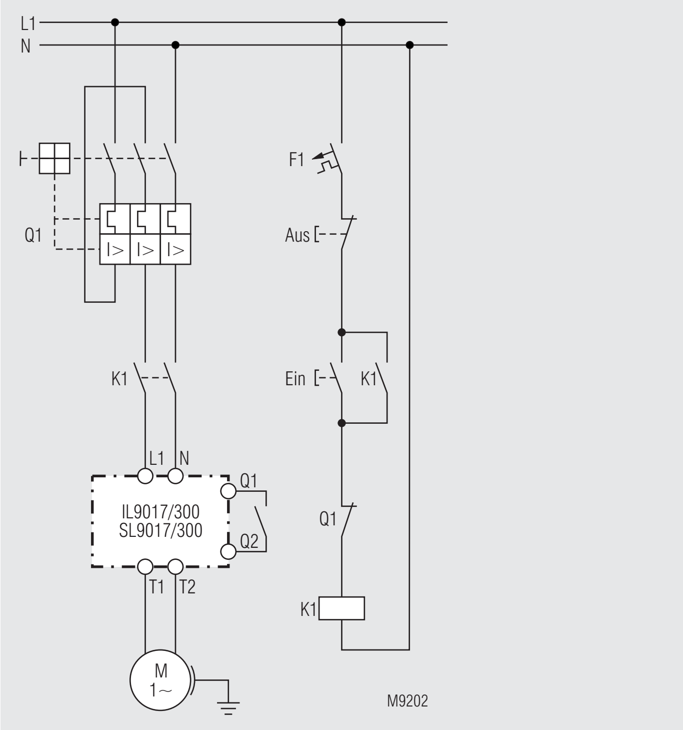
1. Set potentiometer "$M_{on, off}$" fully anti-clockwise
   Set potentiometer "$t_{on, off}$" fully clockwise
2. Start motor by closing contact input Q1-Q2. If the motor does not start, interrupt the process and adjust "$M_{on, off}$" to a higher value. New start.
3. Adjust potentiometer "$t_{on, off}$" to give the desired ramp time.
   Stop and restart the motor, readjusting the potentiometers until the desired starting characteristics are achieved.

Attention: If the ramp-up time is adjusted to short, the internal bridging contact closes before the motor is on full speed. This may damage the bridging relay.
Changes on potentiometer settings are only accepted in the waiting for start status.

Safety instruction

- Never clear a fault when the device is switched on
- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards.
- Adjustments may only be carried out by qualified specialist staff and the applicable safety rules must be observed.

Application Example



MINISTART Softstarter BA 9010, BN 9011

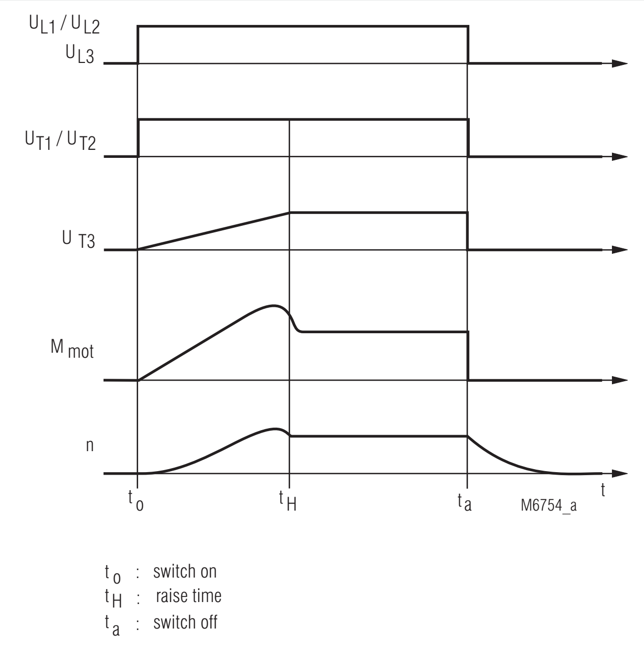
DOLD

0223494

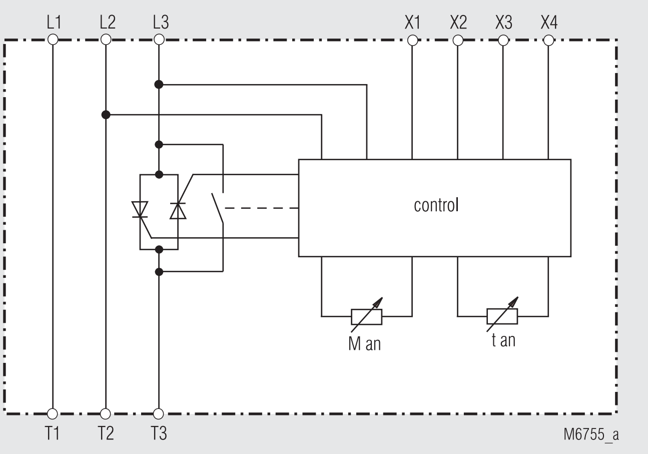
BA 9010 BN 9011

- Increases the life of squirrel cage motors and mechanical drives
- Easily fitted to existing installations
- 1 phase control
- For motors up to 5,5 kW (BA 9010) and to 11 kW (BN 9011)
- Semiconductors bridged after softstart
- Adjustable ramp time and starting torque
- LED indication
- DIN-rail mounting
- BA 9010: width 45 mm
  BN 9011: width 100 mm

Function Diagram



Block Diagram



Approvals and Markings

CE

Applications

- Motor with gears, belt or chain drive
- Fans, pumps, conveyor systems, compressors
- Door drives, packaging machines
- Start current limiting on single phase motors

Function

Softstarters are electronic devices designed to enable 1-phase or 3-phase induction motors to start smoothly. BA 9010 / BN 9011 slowly ramps up the current on one phase, therefore allowing the motor torque to build up slowly. This reduces the mechanical stress on the machine and prevents damage to conveyed material.
When the motor is up to full speed the semiconductors in BA 9010 / BN 9011 are bridged to prevent internal power losses an heat build up.

Indication

LED green	ON	=	power connected
LED yellow	ON	=	softstart complete

Principle of Operation

For direct on line or star delta applications at 400 V, terminals L1, L2, L3 are connected to the mains contactor, terminals X3, X4 should be bridged and the motor connected to terminals T1, T2, T3. As soon as power is connected to terminals L1, L2, L3 the softstart will commence. Potentiometer "t_{an}" (0,5 - 5 sec.) adjusts the ramp time (time the motor takes to get fo full speed) and potentiometer "M_{an}" adjusts the start voltage (0 - 70 % nomV). When the softstart is complete the internal semiconductor is automatically bridged.

Notes

When using BA 9010 / BN 9011 on 230 V 3-phase motors the power rating of the unit must be reduced, i.e. BA 9010 3 kW at 400 V would be rated 1,5 kW at 230 V. To allow softstarting the motor load must always be connected as continuous operation of the softstart with no load may cause overheating of the motor and softstart.
It is recommended that the softstart is protected by superfast semiconductor fuses rated as per the current rating of the softstart or motor. However, standard line and motor protection is acceptable, but for high starting frequencies motor winding temperture monitoring is recommended.

Technical Data

Model:	BA 9010		BN 9011	
Nominal voltage:	3 AC 230 / 400 V			
Voltage range:	160 ... 240 V ± 10 %			
	380 ... 480 V ± 10 %			
Nominal frequency:	50 / 60 Hz			
Nominal motor power P_N at				
400 V:	3 kW	5,5 kW	7,5 kW	11 kW
230 V:	1,5 kW	3 kW	4 kW	5,5 kW
Min. motor power:	approx. 10 % of rated motor power			
Start torque:	0 ... 70 %			
Ramp time:	0,5 ... 5 s			
Recovery time:	200 ms			
Switching frequency:	100/h	80/h	50/h	30/h
Power consumption:	1,5 VA	3,5 VA	3,5 VA	3,5 VA
Operating temperature:	0 ... + 45 °C			
Storing temperature:	- 25 ... + 75 °C			
Protection class:	IP 30		IEC/EN 60 529	
Wire connection:	up to 2,5 mm^2 stranded ferruled			
Mounting:	DIN-rail mounting			
Weigth:	300 g	300 g	500 g	500 g

Dimensions

Width x height x depth:

BA 9010:	45 x 74 x 121 mm
BN 9011:	100 x 74 x 121 mm

Standard Type

BA 9010 3 AC 230 V / 400 V 50/60 Hz 1,5 kW / 3 kW

Article number: 0045241 stock item

- Nominal voltage: 3 AC 230 V / 400 V
- Nominal motor power: 1,5 kW / 3 kW
- Width: 45 mm

Ordering Example

BN 9011 AC 230 / 400 V 50/60 Hz 3 / 5,5 kW

Nominal motor power
Nominal frequency
Nominal voltage
Type

Installation

These units must be mounted on a vertical mounting area with the connections in a vertical plane, i.e. top to bottom. Ensure that no external heat source is placed below the unit and a 40 mm air gap is maintained above and below. Other devices may be directly mounted either side of the unit.

Control Input

To operate the device at AC 230 V it's necessary to bridge the terminals X1, X2. For change pole motor applications the terminals X3, X4 have to be connected via a contact. Otherwise they have to be bridged.

Set-up Procedure

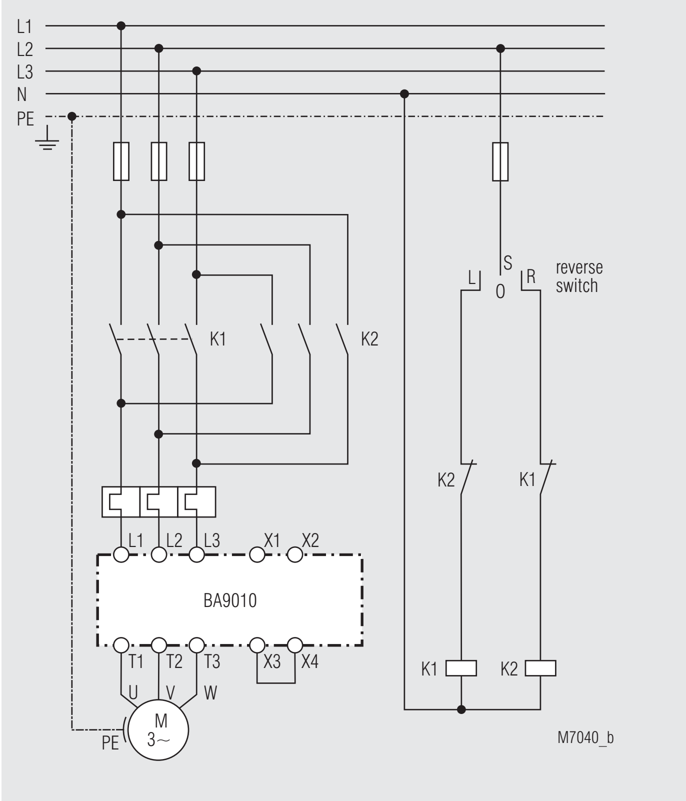
1. Set potentiometer "M_{an}" to minimum (fully anti-clockwise)
   Set potentiometer "t_{an}" to maximum (fully clockwise)
2. Start the motor and turn potentiometer "M_{an}" up until the motor starts to turn without excessive humming. Stop the motor and restart.
3. Adjust potentiometer "t_{an}" to give the desired ramp time.
   Stop and restart the motor, readjusting the potentiometers until the desired starting characteristics are achieved.

- **Attention:** If the ramp-up time is adjusted to short, the internal bridging contact closes before the motor is on full speed.
  This may damage the bridging contactor or bridging relay.

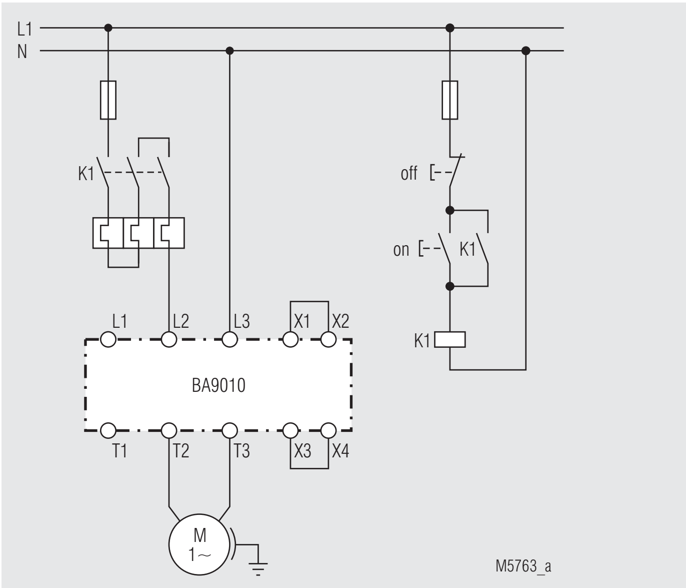
Safety Notes

- Never clear a fault when the device is switched on
- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards.
- Adjustments may only be carried out by qualified specialist staff and the applicable safety rules must be observed.

Application Examples

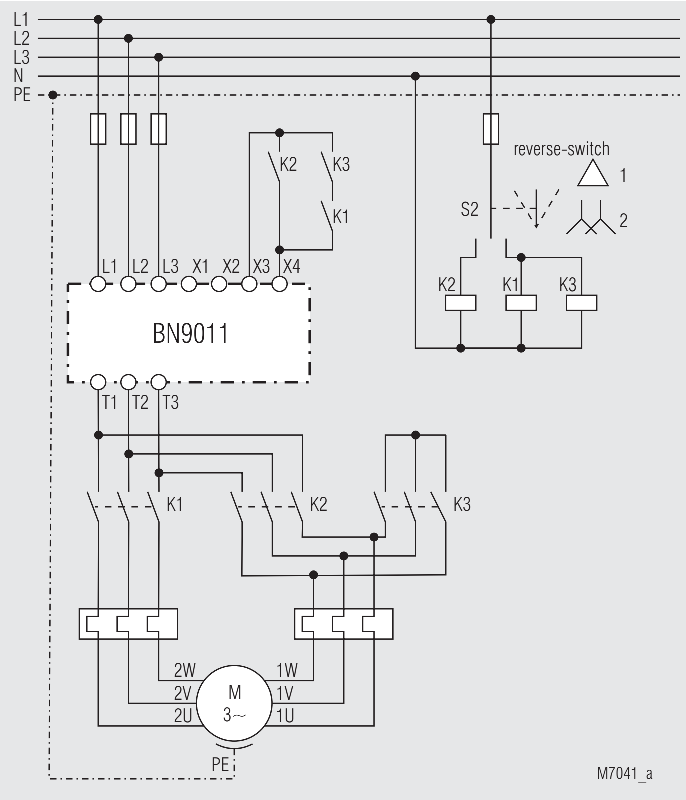


BA 9010 connected to a 3 phase induction motor with reversing



Softstart of a single phase motor on 230 V AC supply

Application Example



BN 9011 connected to a 3 phase multi-pole (Dahlander) motor with reversing

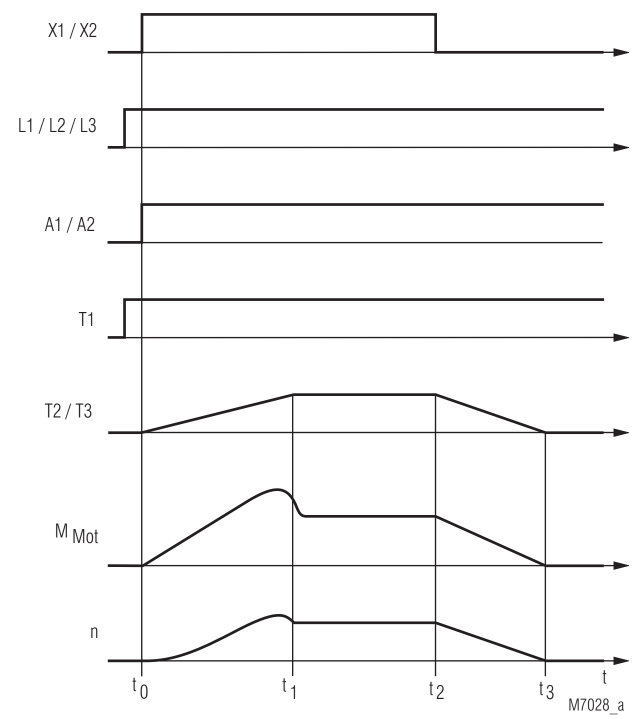
MINISTART
Softstarter With Softstop
BA 9019

DOLD

0223495

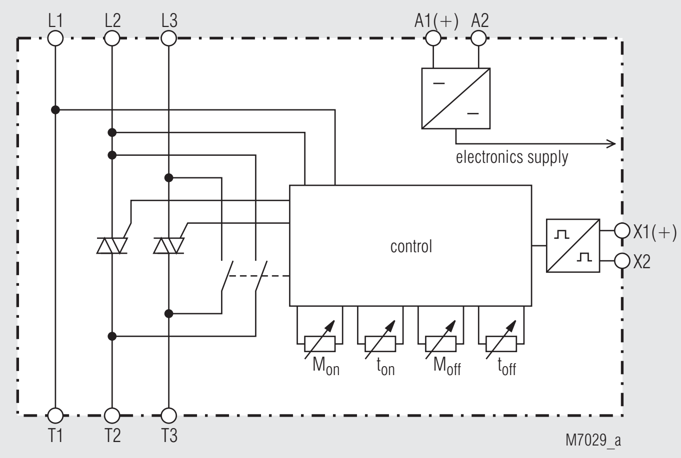
- According to IEC/EN 60 947-4-2
- Softstart and softstop function
- 2-phase motor control
- For motors up to 5.5 kW
- Adjustable ramp time, starting torque and deceleration time
- Wide motor voltage range
- Galvanic separation of control input
- Galvanic separation of auxiliary power supply
- Integrated overtemperature monitoring
- Width: 45 mm

Function Diagram



t_0 : start
t_0-t_1 : ramp up time
t_2-t_3 : ramp down time

Block Diagram



Approvals and Markings

C US
Canada / USA

* see variant

Applications

- Motors with gear, belt or chain drive
- Fans, pumps, conveyor systems, compressors
- Woodworking machines, centrifuges
- Packaging machines, door drives
- Start current limiting on 3 phase motors

Function

Softstarters are electronic devices designed to enable 3-phase induction motors to start smoothly. The BA 9019 slowly ramps up the current on two phases, therefore allowing the motor torque to build up slowly. This reduces the mechanical stress on the machine and prevents damage to conveyed material.
When the motor is up to full speed the semiconcutors in BA 9019 are bridged to prevent internal power losses and heat build up. In addition BA 9019 allows a softstop function prolonging the stop time of the motor, preventing high counter torques from abruptly stopping the motor.

Indication

LED green:	on, when power connected
LED yellow:	on, when power semiconductors bridged
LED red:	on, when temperature monitoring active
BA 9019/100	
LED green:	on, when auxiliary supply connected
LED yellow:	flashing, during ramp up or down
	continuously on, when power semiconductors bridged

Notes

Motor load must always be connected as continuous operation of the soft-start with no load may cause overheating of the motor and softstart.
It is recommended that the softstart is protected by superfast semiconductor fuses rated as per the current rating of the softstart or motor. However, standard line and motor protection is acceptable, but for high starting frequencies motor winding temperature monitoring is recommended.

Technical Data

Nominal voltage L1/L2/L3: 3 AC 200 V -10% ... 460 V +10%
Nominal frequency: 50 / 60Hz

Nominal motor power P_N at		
400 V:	3 kW	5.5 kW
200 V:	1.5 kW	2.2 kW
Rated current:	8 A	12 A
Switching frequency up 3 x I_N, 5 s, ϑ_U = 20 °C:	20 / h	10 / h

Min. motor power: approx. 10 % of rated motor power
Start torque: 50 ... 80 %
Ramp time: 0.5 ... 5 s
Deceleration torque: 30 ... 80 %
Deceleration time: 0.5 ... 5 s
Recovery time: 200 ms
Auxiliary voltage A1 + / A2: DC 24 V ± 20 %
Power consumption: 3 W
Residual ripple: 5 %

Control Input

Voltage range X1/X2: DC: 0 ... 28.8 V
Softstart: > 13 V
Softstop: < 5 V

General Data

Operating mode: Continuous operation
Temperature range:
Operation: 0 ... + 55 °C
Storage: - 25 ... + 75 °C
Relative air humidity: 93 % at 40 °C
Altitude: < 1,000 m
Clearance and creepage distance
Rated insulation voltage: AC 500V
Overvoltage category: III
Rated impuls voltage / pollution degree between auxiliary voltage/control circuit nominal voltage: 4 kV / 2 IEC/EN 60 664-1
EMC
Interference resistance
Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61 000-4-2
HF-irradiation
80 Mhz ... 1.0 Ghz: 10 V / m IEC/EN 61 000-4-3
1.0 GHz ... 2.5 GHz: 3 V / m IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz: 1 V / m IEC/EN 61 000-4-3
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
Interference emission
Wire guided: Limit value class A*) IEC/EN 60 947-4-2
*) The device is designed for the usage under industrial conditions (Class A, EN 55011). When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.
Radio irradiation: Limit value class B IEC/EN 60 947-4-2
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 60 068-1
Climate resistance: 0 / 055 / 04 IEC/EN 60 068-1
Wire connection: 2 x 2.5 mm² solid or 1 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4
Stripping length: 10 mm
Fixing torque: 0.8 Nm
Wire fixing: Flat terminals with self-lifting clamping piece IEC/EN 60 999-1
Mounting: DIN rail
Weight: 300 g

Dimensions

Width x height x depth: 45 x 74 x 121 mm

Standard Type

BA 9019 3 AC 200 ... 460 V 50/60 Hz 3 kW
Article number: 0051284
- Nominal voltage: 3 AC 200 ... 460 V
- Nominal motor power: 3 kW
- Width: 45 mm

Variant

BA 9019/60: with CSA-approval for 3 AC 200 V - 10 % ... 400 V + 10 % 10 A nominal current
BA 9019/100: eceleration time from 0 ... 5 s adjustable

Ordering example for variant

BA 9019 /60 3AC 200 ... 460 V 50/60 Hz 3 kW

Nominal motor power
Nominal frequency
Nominal voltage
Variant, if required
Type

Installation

This units must be mounted on a vertical mounting area with the connections in a vertical plane, i.e. top to bottom.
Ensure that no external heat source is placed below the unit and a 40 mm air gap is maintained above and below. Other devices may be directly mounted either side of the unit.

Control Input

If a voltage of more than 13 V DC is connected to terminals X1/X2, the device begins with softstart. If the voltage falls lower than DC 5 V the device will softstop.

Adjustment Facilities

Potentiometer	Description	Initial setting
M_{on}	Starting voltage	fully anti-clockwise
t_{on}	Ramp-up time	fully clockwise
M_{off}	Deceleration voltage	fully clockwise
t_{off}	Deceleration time	fully clockwise

Set-up Procedure

Set potentiometer "M_{an}" to minimum (fully anti-clockwise).
Set potentiometer "M_{ab}" to maximum (fully clockwise).
Set potentiometer "t_{an}" to maximum (fully clockwise).
Set potentiometer "t_{ab}" to maximum (fully clockwise).
Start the motor and turn potentiometer "M_{an}" up until the motor starts to turn without excessive humming.
Stop the motor and restart.
Adjust potentiometer "t_{an}" to give the desired ramp time.
Stop and restart the motor.
Adjust potentiometer "M_{ab}" until the motor starts to visibly slow down at the initation of the softstop cycle.
Stop and restart the motor.
Adjust potentiometer "t_{ab}" to give the desired deceleration time.
Stop and restart the motor, readjusting the potentiometers until the desired starting/stopping characteristics are achieved.

- **Attention:** If the ramp-up time is adjusted to short, the internal bridging contact closes before the motor is on full speed. This may damage the bridging contactor or bridging relay.

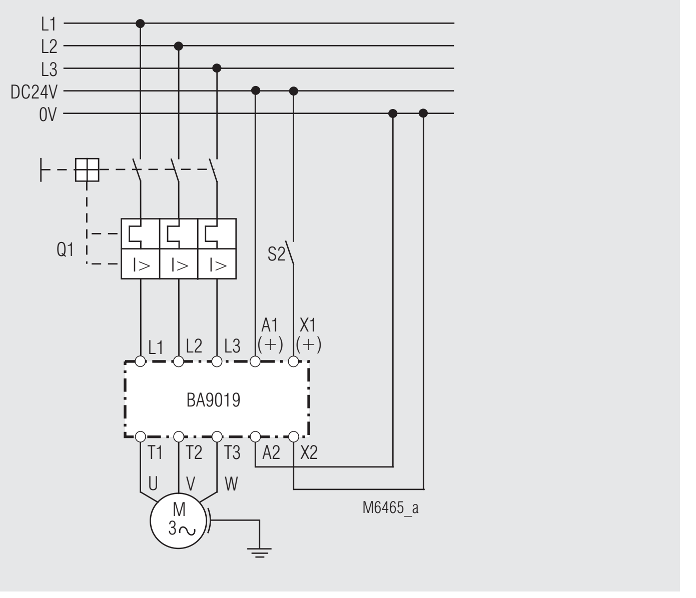
Temperature Monitoring

BA 9019 features overtemperature monitoring of its internal power semiconductors. When the safe running temperature is exceeded the power semiconductors will turn off and a red LED on the front of the unit will illuminate. BA 9019 can be reset after the semiconductors have cooled down by momentarily removing the auxiliary supply voltage.

Safety Notes

- Never clear a fault when the device is switched on
- **Attention:** This device can be started by potential-free contact, while connected directly to the mains without contactor (see application example). Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor **must** be disconnected from the mains via the corresponding manual motor starter.
- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards.
- Adjustments may only be carried out by qualified specialist staff and the applicable safety rules must be observed.

Application Example



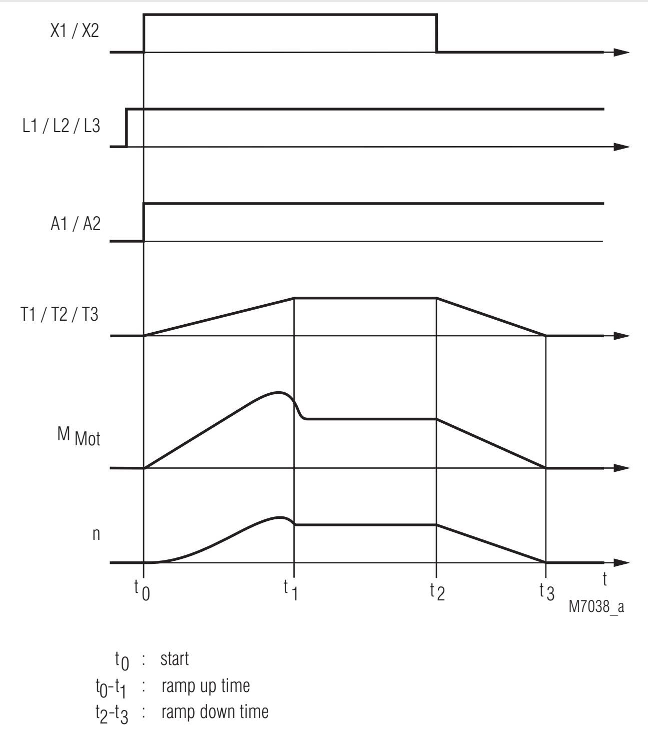
Softstart and softstop

Power Electronics

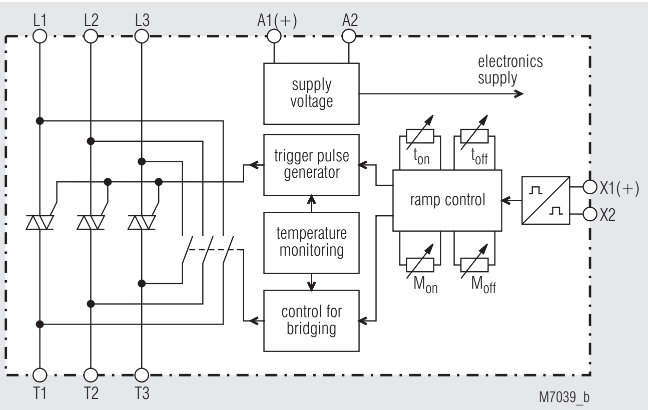
MINISTART
Softstarter With Softstop
BA 9026

- According to IEC/EN 60 947-4-2
- Softstart and softstop function
- 3-phase motor control
- For motors up to 5.5 kW
- Adjustable ramp time, starting torque and deceleration time
- Wide motor voltage range
- Galvanic separation of control input
- Galvanic separation of auxiliary power supply
- Integrated overtemperature monitoring
- 45 mm Baubreite

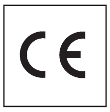
Function Diagram



Block Diagram



Approvals and Markings



Applications

- Motor with gear, belt or chain drive
- Fans, pumps, conveyor systems, compressors
- Packaging machines, door-drives
- Start current limiting on 3-phase motors
- Reduces on off current on transformers and P.S.U's

Function

Softstarts are electronic devices designed to enable 1-phase or 3-phase induction motors to start smoothly. The BA 9026 slowly ramps up the current on three phases, therefore allowing the motor torque to build up slowly. This reduces the mechanical stress or the machine and prevents damage to conveyed material.
When the motor is up to full speed the semiconductors in BA 9026 are bridged to prevent internal power losses and heat build up to addition BA 9026 allows a softstop function prolonging the stop time of the motor preventing high counter torques from abruptly stopping the motor.

Indication

LED green	ON	=	power connected
LED yellow	ON	=	power semiconductors bridged
LED red	ON	=	overtemperature

Principle of Operation

For direct on line or star delta applications, terminals L1, L2, L3 are connected to the mains contactor, with the motor connected to terminals T1, T2, T3. A 24V DC auxiliary supply is connected to terminals A1, A2 and a 24V DC control signal connected to terminals X1-X2.
When power is connected to terminals L1, L2, L3 and 24V DC is presentat terminals X1-X2, the softstart will commence. Potentiometer“t_{an}“ (0.5 - 5 s) adjusts the ramp time (time motor takes to get to full speed)and potentiometer „M_{an}“ adjusts the start voltage
(50-80% nomV).
When the softstart is complete the internal semiconductors are auto-matically bridged. When 24 V DC is removed from terminals X1-X2, the softstop function willcommence for the deceleration time period set on potentiometer“t_{ab}“ (0.5 - 5 s) and deceleration voltage level set on potentiometer“M_{ab}“ (30-80% nomV).

Notes

Motor load must always be connected as continuous operation of the softstart with no load may cause overheating of the motor and softstart.
It is recomended that the softstart is protected by superfast semiconductor fuses rated as per the current rating of the softstart of motor. However, standard line and motor protection is acceptable, but for high starting frequencies motor winding temperature monitoring is recommended.

Technical Data

Nominal voltage:	AC 200 ... 460 V	
Nominal frequency:	50 / 60Hz	
Nominal motor power P_N at		
400 V:	3 kW	5.5 kW
200 V:	1.5 kW	2.2 kW
Rated current:	8 A	12 A
Switching frequency:		
3 x I_r, t_{acc} = 5 s, J_v = 20 °	20/h	10/h
Min. motor power:	approx. 10 % of rated motor power	
Start torque:	50 ... 80 %	
Ramp time:	0.5 ... 5 s	
Deceleration time:	0.5 ... 5 s	
Recovery time:	200 ms	
Auxiliary voltage A1/A2:	DC 24 V ± 20 %	
Power consumption:	3 W	
Residual ripple:	5 %	

Control Input

Voltage range X1+/X2:	DC: 0 ... 28.8 V
Softstart:	> 13 V
Softstop:	< 5 V

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	0 ... + 55 °C	
Storage:	- 25 ... + 75 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 1,000 m	
Clearance and creepage distance		
Rated insulation voltage:	AC 500V	
Overvoltage category:	III	
Rated impuls voltage / pollution degree between auxiliary voltage/control circuit nominal voltage:	4 kV / 2	IEC/EN 60 664-1
EMC		
Interference resistance		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 Mhz ... 1.0 Ghz:	10 V / m	IEC/EN 61 000-4-3
1.0 GHz ... 2.5 GHz:	3 V / m	IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz:	1 V / m	IEC/EN 61 000-4-3
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
Interference emission		
Wire guided:	Limit value class B	IEC/EN 60 947-4-2
Radio irradiation:	Limit value class B	IEC/EN 60 947-4-2
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 60 068-1
Climate resistance:	0 / 055 / 04	IEC/EN 60 068-1
Wire connection:	2 x 2.5 mm² solid or 1 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Stripping length:	10 mm	
Fixing torque:	0.8 Nm	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting::	DIN rail	
Weight:	300 g	

Dimensions

Width x height x depth: 45 x 74 x 121 mm

Standard Type

BA 9026 3 AC 200 ... 460 V 50/60 Hz 3 kW

Article number:	0046450
• Nominal voltage:	3 AC 200 V
• Nominal motor power:	3 kW
• Width:	45 mm

Variant

Ordering example for variant

BA 9026 3 AC 200 ... 460 V 50/60 Hz 3 kW

- 3 kW — Nominal motor power
- 50/60 Hz — Nominal frequency
- 3 AC 200 ... 460 V — Nominal voltage
- BA 9026 — Type

Installation

This units must be mounted on a vertical mounting are a with the connections in a vertical plane, i.e. top to bottom.
Ensure that no external heat source is placed below the unit and a 40 mm air gap is maintained above and below. Other devices may be directly mounted either side of the unit.

Control Input

If a voltage of more than 13 V DC is connected to terminals X1/X2, the device begins with softstart. If the voltage falls lower than DC 5 V the device will softstop.

Set-up Procedure

Set potentiometer „M_{an}“ to minimum (fully anti-clockwise).
Set potentiometer „M_{ab}“ to maximum (fully clockwise).
Set potentiometer „t_{an}“ to maximum (fully clockwise).
Set potentiometer „t_{ab}“ to maximum (fully clockwise).
Start the motor and turn potentiometer „M_{an}“ up until the motor starts toturn without excessive humming.
Stop the motor and restart.
Adjust potentiometer „t_{an}“ to give the desired ramp time.
Stop and restart the motor.
Adjust potentiometer „M_{ab}“ until the motor starts to visibly slow down atthe initiation of the softstop cycle.
Stop and restart the motor.
Adjust potentiometer „t_{ab}“ to give the desired deceleration time.
Stop and restart the motor, readjusting the potentiometers until the desired starting/stopping characteristics are achieved.

- **Attention:** If the ramp-up time is adjusted to short, the internal bridging contact closes before the motor is on full speed.
This may damage the bridging contactor or bridging relay.

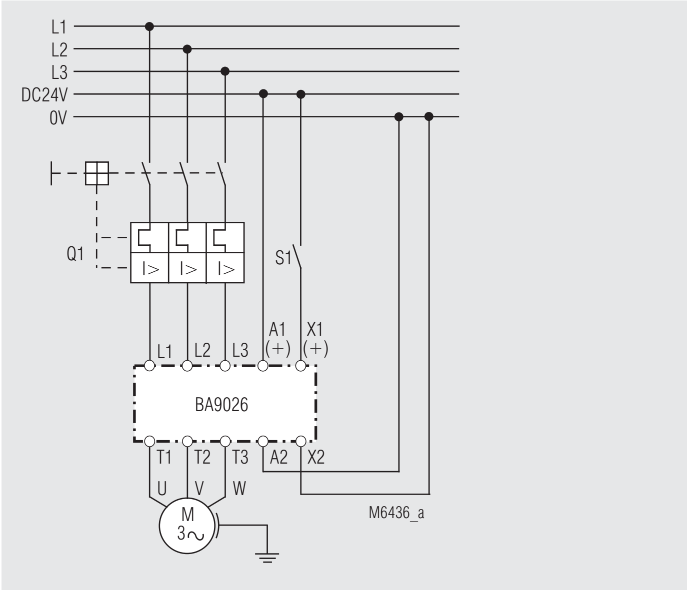
Temperature Monitoring

BA 9026 features overtemperature monitoring of its internal power semiconductors. When the safe running temperature is exceeded the power semiconductors will turn off and a red LED on the front of the unit will illuminate. BA 9026 can be reset after the semiconductors have cooled down by momentarily removing the auxiliary supply voltage.

Safety Notes

- Never clear a fault when the device is switched on
- **Attention:** This device can be started by potential-free contact, while connected directly to the mains without contactor (see application example). Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor must be disconnected from the mains via the corresponding manual motor starter.
- The user must ensure that the device and the necessary componentsare mounted and connected according to the locally applicableregulations and technical standards.
- Adjustments may only be carried out by qualified specialist staff and the applicable safety rules must be observed.

Connection Example



Softstart and softstop

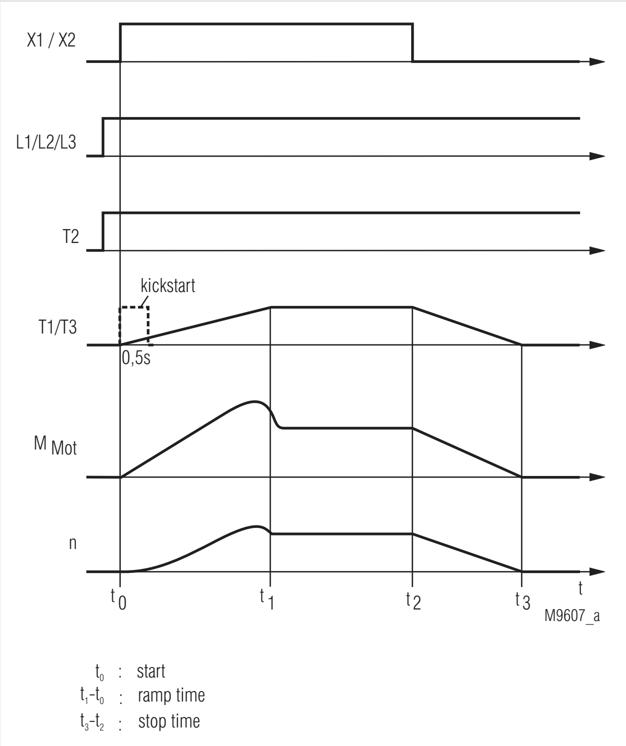
MINISTART
Softstarter And Softstop Device
GF 9016

DOLD

0254730

- For soft and shockfree start of your asynchronous motors
- Less wearing and longer life for your motors and components
- Space saving and easy fitting
- Reduce load from supply mains by reducing of starting current
- According to IEC/EN 60 947-4-2
- Softstart with softstop
- For motors up to 37 kW
- 2-phase control
- Adjustable start up and deceleration time als well as starting voltage, optionally with kickstart
- Without auxiliary voltage
- W3 connection is possible
- As option current control on softstart
- Up to 15 kW: width 45 mm
  Up to 22 kW: width 52.5 mm

Function Diagram



Approvals and Markings

CE

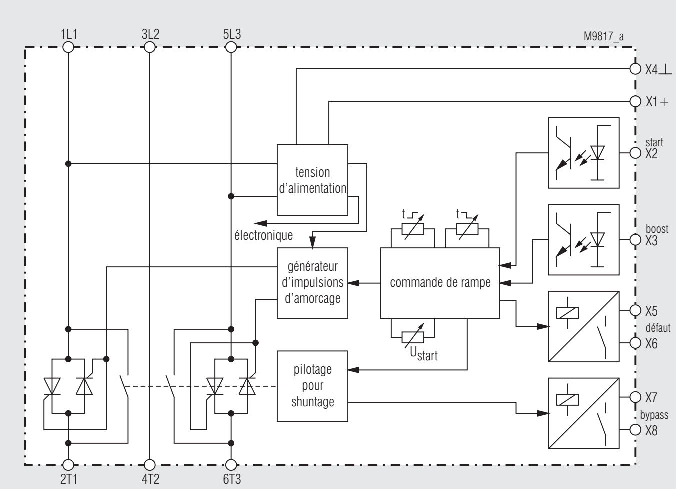
Applications

- Motors with gear, belt or chain drive
- Fans, pumps, conveyor systems, compresseors
- Packaging machines, door drives
- Start current limiting on 3 phase motors

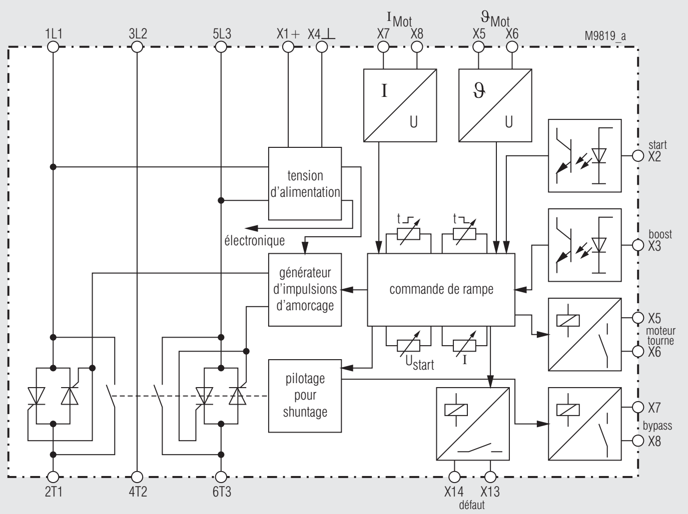
Function

Softstarters are electronic devices designed to enable 1-phase or 3-phase induction motors to start smoothly. The GF 9016 slowly ramps up the current on two phases, therefore allowing the motor torque to build up slowly. This reduces the mechanical stress on the machine and prevents damage to conveyed material.
When the motor is up to full speed the power semiconductors in GF 9016 are bridged to prevent internal power losses and heat build up. In addition GF 9016 allows a softstop function prolonging the stop time of the motor, preventing high counter torques from abruptly stopping the motor.

Block Diagram



up to 22 kW



25 to 37 kW

Indication

LED green ON = power connected
LED yellow ON = power semiconductors bridged
flashes with rising or falling speed at softstart - softstop
flashes with same frequency at error (see table)
LED red: On, when failure detected (only on devices ≥ 25 kW

Failure codes up to 22 kW-devices

Fault	LED yellow	Operating state
1	yellow LED flashes 2 x times with short space	device overloaded / heat sink temperature to high
2	yellow LED flashes 3 x times with short space	failure in electronics
3	yellow LED flashes 4 x times with short space	firing error in phase 1
4	yellow LED flashes 5 x times with short space	firing error in phase 3
5	yellow LED flashes 6 x times with short space	error in motor phase/ power semicond. defective in phase 1
6	yellow LED flashes 7 x times with short space	error in motor phase/ power semicond. defective in phase 3
7	yellow LED flashes 8 x times with short space	general synchronising error

Failure codes from 25 kW-devices

Fault	LED yellow	Operating state
0	yellow LED flashes 1 x times with short space	low supply voltage
1	yellow LED flashes 2 x times with short space	device overloaded / heat sink temp. to high; motor overtemperat.
2	yellow LED flashes 3 x times with short space	current control time out
3	yellow LED flashes 4 x times with short space	phase failure 1
4	yellow LED flashes 5 x times with short space	phase failure 2
5	yellow LED flashes 6 x times with short space	phase failure 3
6	yellow LED flashes 7 x times with short space	frequency failure
7	yellow LED flashes 8 x times with short space	firing error in phase 1
8	yellow LED flashes 10 x times with short space	firing error in phase 3
9	yellow LED flashes 11 x times with short space	mains failure

Motor load must always be connected as continuous operation of the softstart with no load may cause overheating of the motor and softstart.
It is recommended that the softstart is protected by superfast semiconductor fuses rated as per the current rating of the softstart or motor. However, standard line and motor protection is acceptable, but for high starting frequencies motor winding temperature monitoring is recommended.

Technical Data

Nominal voltage: 3 AC 400 V ± 15 % (others on request)
Nominal frequency: 50/60 Hz

Rated current:	16	25	32	45	50	65	75	A
Nominal motor power at P_N at 400 V:	7.5	11	15	22	25	30	37	kW

Min. motor power: approx. 0.2 P_N
Start torque: 40 ... 80 %
Ramp time: 0.5 ... 10 s
Deceleration time: 0.5 ... 10 s
Staring current: 200 ... 500 % with connected current transformer
Recovery time: 200 ms

Switching frequency:	60	45	35	10	35	25	30	$^1/_h$
I^2t-Power semiconductor fuse	4900	4900	6050	6600	6600	11200	25300	A^2s

General Data

Temperature range: 0 ... + 45°C
Storage temperature: - 25 ... + 70°C
Overvoltage carегory / polluiton degree: III / 2
Insulation class: 3
Peak voltage resistance: 4 kV
Degree of protection: IP 20 IEC/EN 60 529
Wire connection
Load terminals up to 22 kW: plug in screw terminal

Stranded wire:	6	6	16	16	25	25	25	mm^2

Control terminals:
up to 22 kW: 1.5 mm^2 cage clamp terminals
to 25 kW: 2.5 mm^2 screw terminal
Mounting: DIN-rail mounting IEC/EN 60 715

Weight:	1.0	1.0	1.0	1.0	1.5	1.5	2.2	kg

Dimensions

Width x height x depth (incl. terminals)
7,5 / 11 / 15 kW: 45 x 173 x 158 mm
22 kW: 52.5 x 178 x 158 mm
25 / 30 kW: 103 x 230 x 125 mm
37 kW: 103 x 230 x 140 mm

Standard Type

GF 9016 3 AC 400 V 50/60 Hz 7.5 kW
- Nominal voltage: 3 AC 400 V
- Nominal motor power: 7.5 kW
- Width: 45 mm

Ordering Example

GF 9016 3 AC 400 V 50/60 Hz 7.5 kW AC 230 V

- AC 230 V: Auxiliary supply (only necessary > 500 V)
- 7.5 kW: Nominal motor power
- 50/60 Hz: Nominal frequency
- 3 AC 400 V: Nominal voltage
- GF 9016: Type

Accessories

A current transformer for current control on softstart is included in delivery.

Control Input

Up to 22 kW
Connect conact to X1, X2 and select softstart (close contact) or softstop (open contact). As option the unit can also be started by an external control voltage of DC 10-24 V. This has to be connected to terminals X2, X3, X4 connecting means starting up,disconnection stopping. On terminal X3 a kickstart function can be activated. This is useful on motors that have a high starting load as e.g. mills, breakers, conveyors. Kickstart takes 0.5 sec at fully switched thyristors.

From 25 kW
X5, X6: Connection for notor thermistor, must be linked, when not used
X7, X8: Connection for current transformerm with current control
Input is only active, if a current transformer is connected

Indicator Outputs

Up to 22kW
X5, X6: error at phase failure, frequency variation, thyristor failure, overtemperature of the unit, disconnected motor. Reset by switching the unit off and on.
X7, X8: softstart finished, semiconductors bridged.

≥ 25 kW
X9, X10: motor runs, device on operation
X11, X12: end of softstart, semiconductor bridged
X13, X14: interference (common alarm)

Adjustment Facilities

Potentiometer	Description	Initial setting
U_{start}	Starting voltage	fully anti-clockwise
t ⟋	Ramp-up time	fully clockwise
t ⟍	Deceleration time	fully clockwise
I (only for 25 kW)	current controlled start	fully anti-clockwise

Set-up Procedure

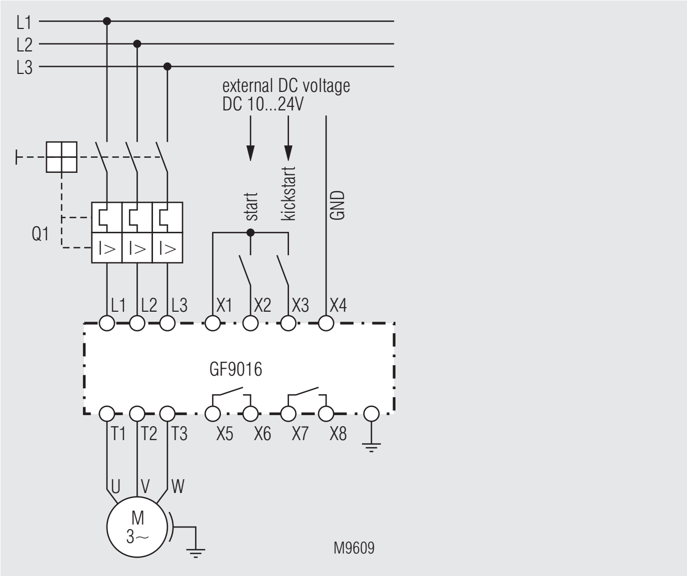
Set potentiometer "U_{start}" to minimum (fully anti-clockwise).
Set potentiometer "t ⟋" to maximum (fully clockwise).
Set potentiometer "t ⟍" to mid position.
Start the motor and turn potentiometer "U_{start}" up until the motor starts to turn without excessive humming.
Stop the motor and restart.
Adjust potentiometer "t ⟋" to give the desired ramp time.
Stop and restart the motor.
Adjust potentiometer "t ⟍" to give the desired deceleration time.
Stop and restart the motor, readjusting the potentiometers until the desired starting/stopping characteristics are achieved.

- **Attention:** If the ramp-up time is adjusted to short, the internal bridging contact closes before the motor is on full speed.
This may damage the bridging contactor or bridging relay.

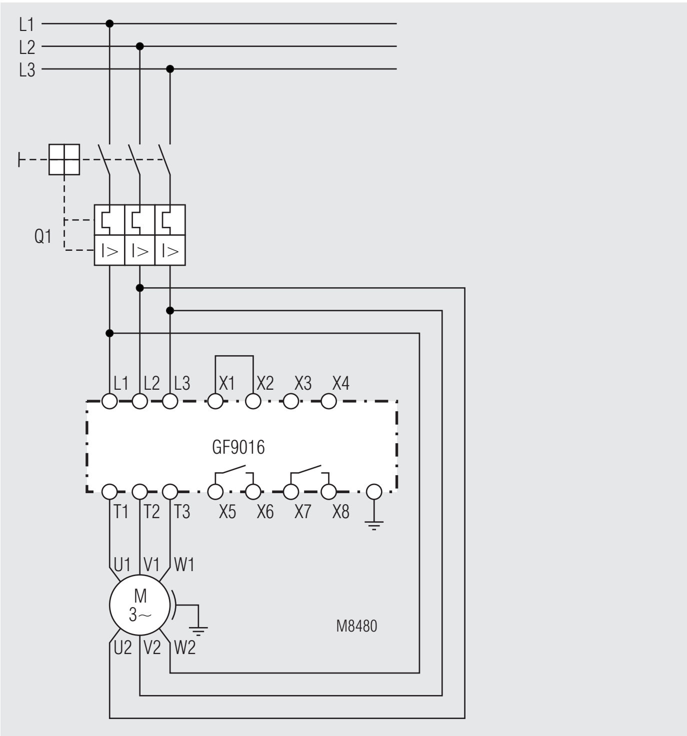
Safety Notes

- Never clear a fault when the device is switched on
- **Attention:** This device can be started by potential-free contact, while connected directly to the mains without contactor (see application example). Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor ***must*** be disconnected from the mains via the corresponding manual motor starter.
- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards.
- Adjustments may only be carried out by qualified specialist staff and the applicable safety rules must be observed.

Application Examples

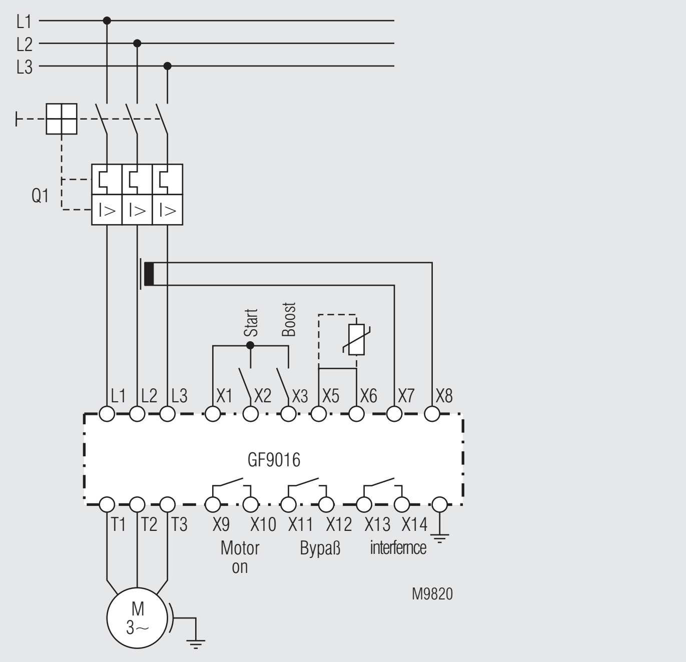


Softstart with softstop



Softstart in a $\sqrt{3}$-circuit up to 22 kW
Start only by connecting the mains voltage, terminals X1-X2 bridget

Application Example



Softstart and softstop function from 25 kW withcontrolled current on start up.

MINISTART
Softstarter
UH 9018

0273638

Your Advantages
- Protection of the drive unit
- Integrated bridging contactor (Bypass)
- Easy operation
- Comprehensive diagnostic via LED-flashing codes possible

Features
- Softstart with softstop
- For motors from 1.5 kW to 7.5 kW
- 2-phase control
- Adjustable ramp time, starting torque and starting voltage
- Kickstart-(Boost-)function
- DIN-rail mounting
- Width: 45 mm

Product Description

The softstarter UH 9018 is an electronic device designed to enable 1-phase or 3-phase induction motors to start smoothly. The devices slowly ramps up the current on two phases, therefore allowing the motor torque to build up slowly.This reduces the mechanical stress on the machine and prevents damage to conveyed material. These features allow cost saving constructions of mechanical gear.
When the motor is up to full speed the power semiconductors in UH 9018 are bridged to prevent internal power losses and heat build up. In addition UH 9018 allows a softstop function prolonging the stop time of the motor, preventing high counter torques from abruptly stopping the motor.

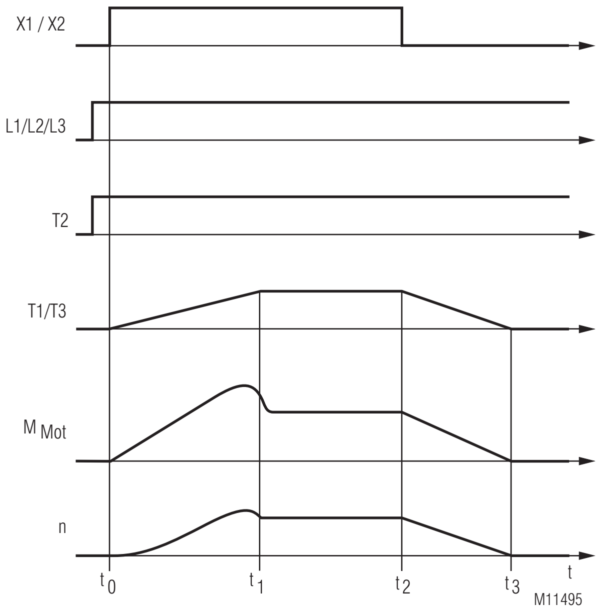
Approvals and Markings

CE

Applications

- Motors with gear, belt or chain drive
- Fans, pumps, conveyor systems, compresseors
- Woodworking machines, centrifuges
- Packaging machines, door drives
- Start current limiting on 3 phase motors

Function Diagram



t_0 : start
t_0-t_1 : ramp time
t_2-t_3 : stop time

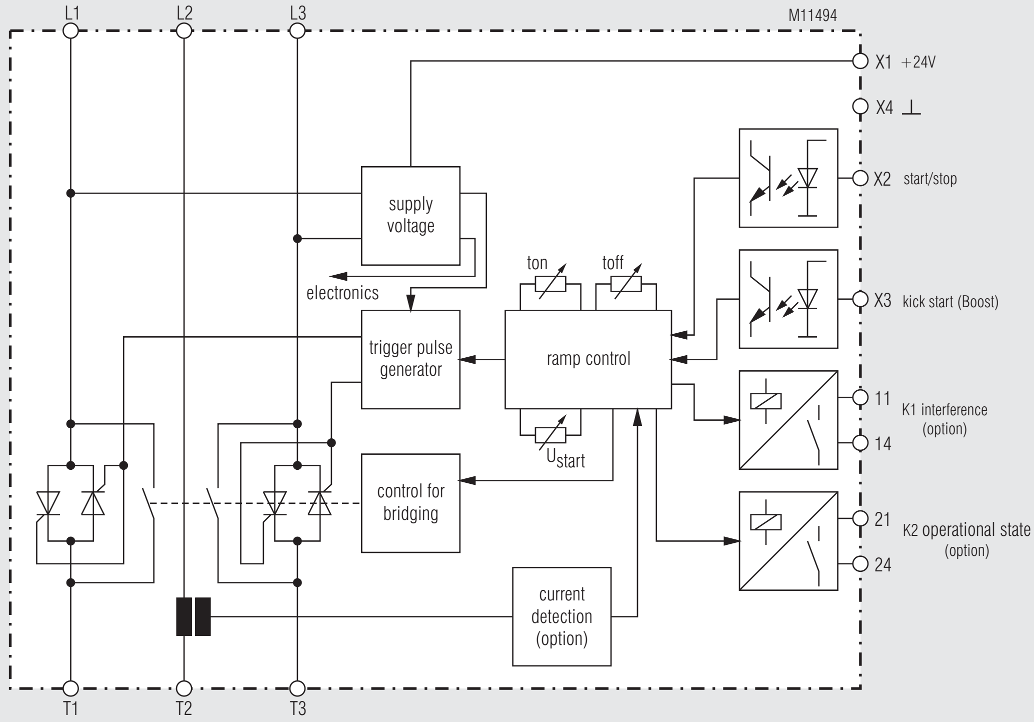
Indication

green LED:	power connected
yellow LED: top	flashes with rising or falling speed at softstart-softs- top
	flashes with same frequency at error

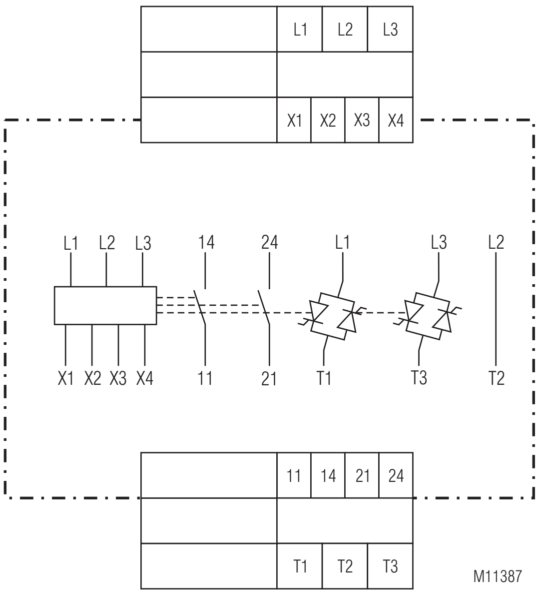
Notes

The motor load must always be connected as continuous operation of the softstart with no load may cause overheating of the motor and softstart. It is recommended that the softstart is protected by superfast semicondutor fuses rated as per the current rating of the softstart or motor. However, standard line and motor protection is acceptable, but for high starting frequencies motor winding temperature monitoring is recommended.

Block Diagram



Circuit Diagram



Connection Terminals

UH9018/_ 0 _ :

Terminal designation	Signal description
L1, L2, L3	Connection nominal voltage (L1, L2, L3)
T1, T2, T3	Connection Motor (U, V, W)
X1, X2	Control input (Start/Stop)
X1, X3	Control input (Kickstart (Boost))
X4	Earth connection
11, 14	Indicator relay K1, NO contact (error)
21, 24	Indicator relay K2, NO contact (operating condition)

UH9018/_ 1 _ :

Terminal designation	Signal description
L1, L2, L3	Connection nominal voltage (L1, L2, L3)
T1, T2, T3	Connection Motor (U, V, W)
X1, X2	Control input (Start/Stop)
X3, X4	Connection for Motor PTC
11, 14	Indicator relay K1, NO contact (error)
21, 24	Indicator relay K2, NO contact (operating condition)

Technical Data

Nominal voltage:	3 AC 400 V ± 10 % Special voltages: 230 V; 480 V; Wide voltage input 200 ... 480 V only with external voltage DC 24 V on X1 / X4
Nominal frequency:	50/60 Hz
Rated current:	3.5; 6.5; 12; 16 A
Nominal motor power at P_N at 400 V:	1.5; 3; 5.5; 7.5 kW
Min. motor power:	approx. 0.2 P_N
Staring voltage (at devices with voltage ramp):	40 ... 80 % U_N
Setting range current limit (at devices with current control):	2 ... 5 I_N
Setting range starting time (at devices with voltage ramp):	0.5 ... 10 s
Deceleration time:	0.25 ... 10 s
Setting range of the gradient of current rise (at devices with current control):	0 ... 100 %
Recovery time:	300 ms
Switching frequency at 3 x I_N and t_{on} = 5 s:	150/h; 70/h; 30/h; 15/h
Semiconductor fuse I^2t-value:	390 A^2s; 720 A^2s; 4000 A^2s; 4000 A^2s;

General Data

Temperature range:	0 ... + 45°C	
Storage temperature:	- 25 ... + 70°C	
Altitude:	up to 1.000 m	
Degree of protection:	IP 20	
Climate resistance:	25 / 075 / 04	IEC/EN 60 068-1
Wire connection		
Load terminals:	up to 2.5 mm^2	
Control terminals:	1 x 1,5 mm^2 solid	
Mounting:	DIN-rail mounting	
Weight:	400 g	

Dimensions

Width x height x depth: 45 x 107 x 121 mm

Standard Types

UH 9018 3 AC 400 V 50/60 Hz 1.5 kW
Article number: 0066471
- Nominal voltage: 3 AC 400 V
- Nominal motor power: 1.5 kW
- Width: 45 mm
- With Kickstart- (Boost-) function
- With voltage ramp
- Starting time: 0.5 ... 10 s
- Deceleration time: 0.25 ... 10 s
- Starting voltage: 40 ... 80 % U_N

UH 9018/100 3 AC 400 V 50/60 Hz 7.5 kW
Article number: 0066472
- Nominal voltage: 3 AC 400 V
- Nominal motor power: 7.5 kW
- Width: 45 mm
- With Kickstart- (Boost-) function
- With heat sink PTC
- With 2 Indicator relays: K1 (11, 14): Alarm
K2 (21, 24): Operating condition
- With current control
- Adjustment of the gradient of current rise: 0 ... 100 %
- Current limit: 2 ... 5 x I_N
- Deceleration time: 0.25 ... 10 s

Ordering example

UH 9018 /_ _ _ 3 AC 400 V 50/60 Hz 1.5 kW

- 1.5 kW – Nominal motor power
- 50/60 Hz – Nominal frequency
- 3 AC 400 V – Nominal voltage
- /_ _ _ – Variant, if required
- UH 9018 – Type

Control Inputs

As described in Principles of operation UH 9018 are normally controlled by a voltfree contact on terminals X1-X2
However, if external DC voltage control is desired UH 9018 can be set at the factory to accept a DC control voltage of 10 ... 42 V DC at terminals X2, X4 .

When the voltfree contact across terminals X1 and X2 is closed, the soft-start function will commence. When the contact is opened, the softstop function will commence.

The motor can be started with a boost (variants UH 9018/_0_) with the help of a potential-free contact on X1, X3. Thereby at the beginning of the soft starting, the motor voltage increases for a short impulse (500ms) to 85% of the nominal voltage. This function effects an increased breakaway torque in the drive and makes possible the starting of the drives with a high holding torque at standstill. Afterwards, the soft starting continues with the adjusted voltage ramp.
Optionally, the boost function can be started also with external control voltage of DC 10 ... 24 V on X3, X4.
The device variants UH 9018/_1_ do not have a boost function. A motor PTC can be connected there to the control terminals X3, X4 for monitoring the motor temperature.

Setting facilities

Devices with voltage ramp UH 9018/0_ _:

Potentiometer	Description	Initial setting
U_{start}	starting voltage	fully anti-clockwise
t_{on}	ramp up time	middle of scale
t_{off}	deceleration time	fully anti-clockwise

Devices with current control UH 9018/1_ _:

Potentiometer	Description	Initial setting
$x\ I_N$	Current limit	middle of scale
t_{int}	gradient of current rise	middle of scale
t_{off}	deceleration time	fully anti-clockwise

Set up Procedure

Softstart with voltage ramp:

1. Start the motor via control input X1/X2 and turn potentiometer "U_{start}" up until the motor starts to turn without excessive humming

2. Adjust potentiometer "t_{on}" to give desired ramp time.

Attention: If the ramp-up time is adjusted to short, the internal bridging contact closes before the motor is on full speed.
This may damage the bridging contactor or bridging relay.

Softstart with current control:
The motor is accelerated to the motor nominal speed at the preset current limit of 2 … 5 xI_N. To this purpose, the desired start-up current is set with the potentiometer xI_N with respect to the nominal speed of the device. The gradient of the increase of the current can be adjusted with the potentiometer tint and thus the control characteristics and the motor acceleration can be adapted to the drive. The motor current is measured in the uncontrolled phase L2/T2 which in the case of two-phase-controlled soft-start devices, for technical reasons, conducts the highest current. The preset current limit is related to the motor current in phase L2/T2. The current in the two other motor phases is lower by about 35 %.

Attention: If the current limit is set too low, the motor will not accelerate to full speed and will remain in a state of intermediate speed. After a certain time, the device will interrupt the starting process and will change to fault mode in order not to overload the device and the motor. What is important in the selection of the current limit is to pay attention to the changes in the load, e.g. with the time (mechanical change, wear, ...) or also the thermal changes, etc. The adjustment must be such that also in the worst-case scenario the drive can accelerate to full speed without problems.

Softstop:
- During softstop the device has to be connected to the voltage.
- Select softstop by opening control input X1/X2.
- Adjust t_{off} until the required stopping time is achieved.

Fault

The UH 9018 monitors different fault states. If a fault is recognised, the device signalises the error by blinking of the yellow LED at a constant frequency. When there is a fault, the signal relay K1 is opened. The different error states are indicated by different blinking sequences of the yellow LED.

Fault Description

Fault	yellow LED flasches	operating condition
1	1 x time with short space	undervoltage Electronic power supply
2	2 x times with short space	heat sink temperature to high Device thermally overloaded or motor overtemperature (at connected motor-PTC) variant / _1_
3	3 x times with short space	current control time out
4	4 x times with short space	Zero crossings error Network or motor circuit is faulty
5	5 x times with short space	phase failure in phase 1
6	6 x times with short space	phase failure in phase 2
7	7 x times with short space	phase failure in phase 3
8	8 x times with short space	firing error in phase 1
9	10 x times with short space	firing error in phase 3
10	11 x times with short space	failure in electronics

Troubleshooting

In the case of a fault it is proceeded as follows:

Fault 1: Defect in the internal control electronics. The device must be checked by the manufacturer.

Fault 2: Check the starting frequency and the starting current or the maximum ambient temperature. Leave the device to cool off. The dissipation of the heat can be improved by forced cooling-off with a fan installed under the device.

Fault 3: The motor does not reach the end speed with the preset maximum starting current. The value of the starting current can be increased with the potentiometer xI_N.

Attention!
After a performed disconnection due to a timeout, the device and the motor must be given a chance to cool off. An immediate start-up can lead to destruction.

Fault 4-7: The power supply is missing, the motor circuit is interrupted, the power semiconductor is defective, the motor is defective; check the motor and the wiring. Send the device to be checked by the manufacturer.

Fault 8-9: Check the motor wiring or defective thyristor module. Send the device to be checked by the manufacturer.

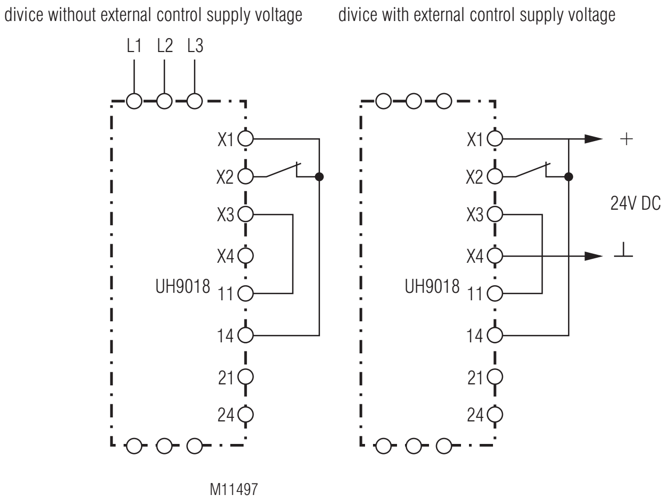
Fault 10: Send the device to be checked by the manufacturer.

Resetting the fault

There are two possibilities for resetting a device fault.

1. As default, the resetting of the fault message takes place by turning off and then on the power supply.
2. The device can be programmed in such a way that a fault reset is possible by a new start-up (opening and then closing the start input). To this purpose, the following approach must be observed.

   First the device must be wired according to the following connection diagrams:



   Then the power supply is turned on. After a short time, the yellow LED starts blinking with different frequency depending on the preset reset mode.

   low flasher frequency: Fault reset by turning on and off of the power supply voltage (standard setting)
   high flasher frequency: Fault reset by restarting

   By opening and closing the start input, the reset mode is changed and the yellow LED starts blinking with the corresponding blinking frequency. The new mode is permanently stored.

Now the power supply can be again turned off and the device is incorporated in the application.

Warning message!

In any case, the cause of the fault must be determined and corrected by trained personnel. Only then the device can be put again into operation.

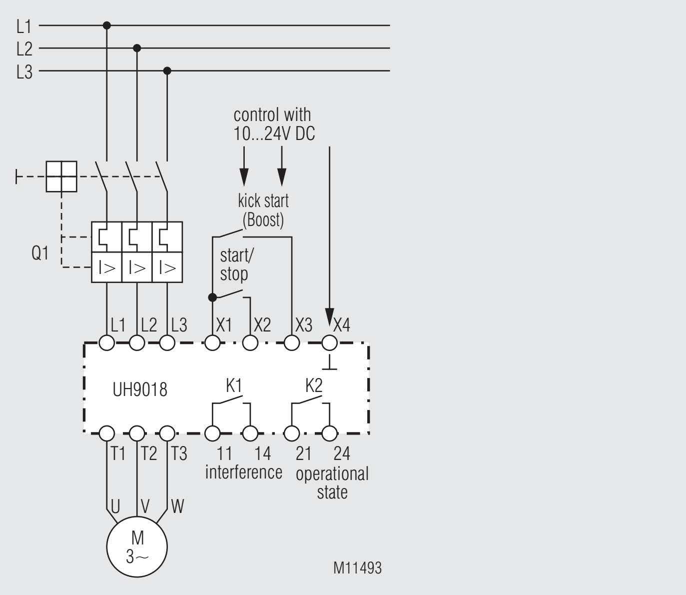
Monitoring Output

Indicator relay K1 (11, 14): Fault:
Contact are closed

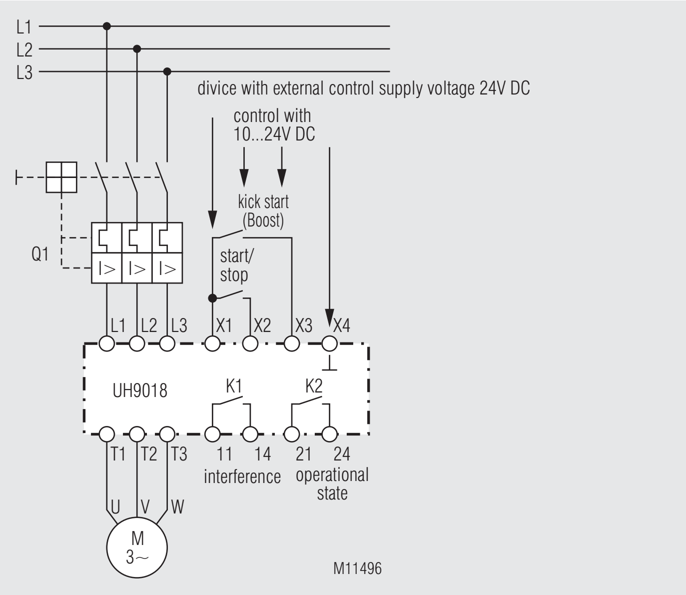
Indicator relay K2 (21, 24): Bypass:
After the end of the start ramp, energizes the bypass relay

Safety Note

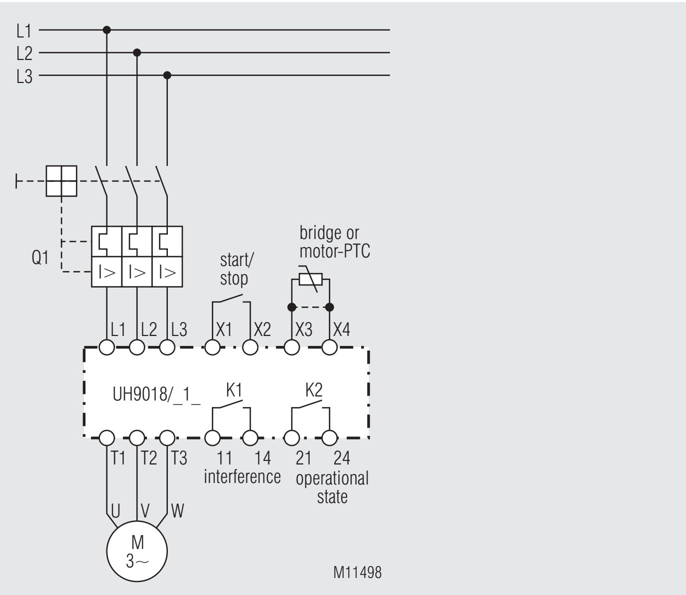
- Never clear a fault when the device is switched on.
- **Attention:** This device can be started by potential-free contact or control with DC 10 ... 24 V while connected directly to the mains without contactor (see application example).
  Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor must be disconnected from the mains via the corresponding manual motor starter.
- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards.
- Adjustments may only be carried out by qualified specialist staff and the applicable safety rules must be observed.



Softstart- and softstop function
(Devices without external control voltage)



Softstart- and softstop function
(Devices with external control voltage))



Softstart- and softstop function at UH 9018/_1_

MINISTART
Softstarter For Heating Pumps
PF 9029

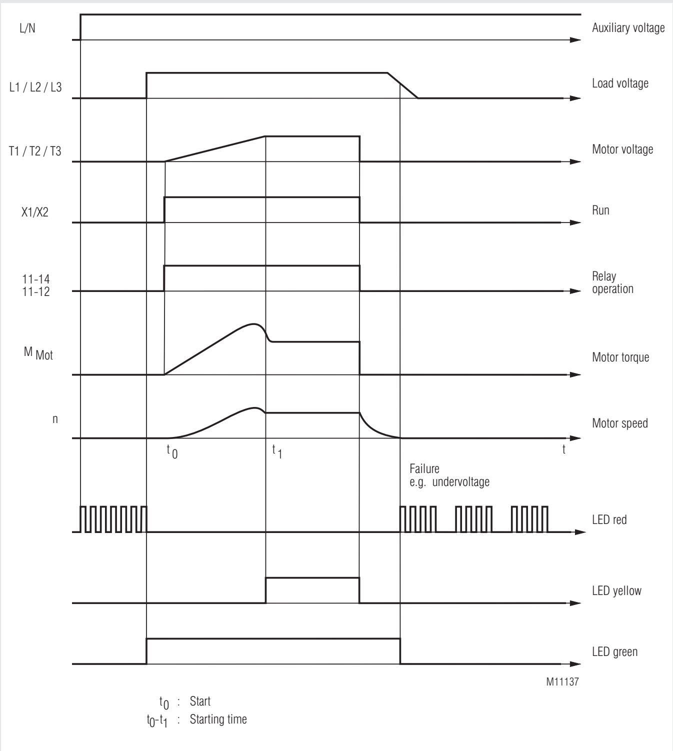
DOLD

0269343

Your Advantages
- For starting current limitation in heat pumps to provide stable mains conditions
- Only one small device 67.5 mm for softstart, motor protection, voltage- and phase sequence monitoring
- Soft start and minimized staring current
- Extended service life of AC - motors and mechanical drive system
- Motor power up to 18,5 kW
- Short ramp up time
  25 A: < 200 ms
  36 A: < 300 ms
- Energy saving by bridging of the semiconductors after softstart
- Symmetrical staring current

Features
- According to IEC/EN 60 947-4-2
- 3-phase controlled with integrated bypass relays
- Phase sequence monitoring
- Undervoltage monitoring
- Overvoltage monitoring
- Blocked motor monitoring in bypass mode
- Integrated motor protection to class 10 acc. to IEC/EN 60947-4-2
- Starting current limitation
- Thyristor monitoring
- Detection of missing load
- Automatic frequency detection of supply voltage
- Temperature monitoring of power semiconductors

Function diagram



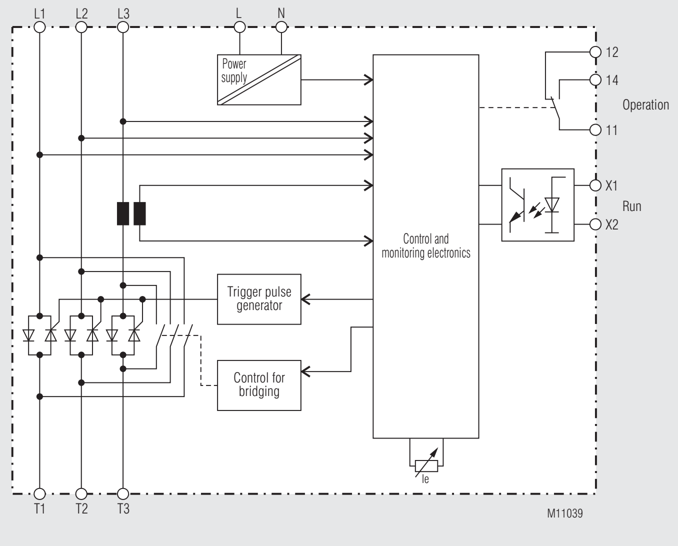
Approvals and Markings

CE

Applications
- Softstarter for compressor motors

Product Description
The PF 9029 from the MINISTART-family is a robust electronic control unit for soft starting of compressor motors with integrated monitoring functions. After successful starting the semicon-ductors are bridged by relays to minimize the power dissipation of the units.

Block Diagram



Function Notes
Variation of speed is not possible with this device.

Device Description

Failure Mode
The softstarter is monitoring different parameters. If failure is detected the unit switches off. In failure mode a red LED with flash code signals the fault. The failure mode can be reset by pressing the reset button or by disconnecting the power supply.

Undervoltage monitoring
To make sure the motor is operated with the correct voltage the voltage is monitored. The voltage is not monitored in ramp up mode. If the voltage drops below 330 V for longer than 1 s the unit switches to failure mode.

Overvoltage detection
To make sure the motor is operated with the correct voltage the voltage is monitored. The voltage is not monitored in ramp up mode. If the voltage rises above 470 V for longer than 1 s the unit switches to failure mode.

Phase sequence monitoring
The phase sequence monitoring function monitors clockwise phase sequence of the 3-phase system. An anti-clockwise sequence forces the unit to failure mode.

Shortcircuited Thyristor
Before each softstart the power-semiconductors are tested for short circuit A detected short circuit forces the unit to failure mode. For short circuit test the motor must be connected.

Motor not connected
Before each softstart it is tested that the motor is correctly connected to the unit. This test avoids that the motor starts on 2 phases and gets faulty. Wrong connection forces the unit to failure mode.

Overtemperature
The temperature of the semiconductors is measured by NTC sensor. Overtemperature forces the unit into failure mode.

Frequency detection
To achieve a correct function the actual frequency has to be known. The frequency is monitored after power on or reset. If the frequency is outside the limits 50Hz ± 5 Hz or 60 Hz ± 5 Hz the unit switches to failure mode.

Blocking protection
In Bypass mode a blocking of the motor is detected by current monitoring. If the current exceeds 4 times the nominal current of the motor, the unit recognizes motor blocking. The unit switches to failure mode.

Overload protection
The unit incorporates an electronic overload protection, which is realized by monitoring the current in one phase. Overload protection class 10 is a fix setting. The response current can be adjusted with a potentiometer by adjusting the motor rated current. When the I2t value is overridden the unit switches into failure mode. The I^2t value is reset with the reset function.

Note: At loss of the auxiliary supply the actual I^2t -value is stored. At restart the I^2t -value is recalled and used for operation independent how long the motor was cooling down.

Limitation of starting current
By starting current limitation the peak current can be limited. The load on the supply network is lower. The time limit of the current is monitored and if the starting time exceeds the limit of 5 s a failure signal is indicated. The current limit is fixed to 2.5 times the motor nominal current.

Indication

The device status is indicated with different coloured LEDs and flash code

LED green:	Device ready
LED yellow:	On, when bridging relay active
LED red:	Flashes if error (see flash codes)

Control Elements

Potentiometer I_e: Nominal current for overload protection and starting current limitation.

Note: The potentiometer setting is only read when connecting the power supply or on reset at failure mode.

Reset-button: Reset of failure mode after failure is removed and confirming potentiometer setting.

Control Circuit

The control input works with a voltage of AC/DC 20 ... 300 V.

After reset or disconnecting the power supply the unit initiates a softstart, if voltage is connected to control input.

Outputs

One output relay is available.
The monitoring contact “operation” closes when the start signal is connected. It opens after the signal is disconnected or when an error occurs.

Auxiliary Supply

To monitor phase failure on all 3 phases an external auxiliary supply of AC 230 V is necessary.

Fault Indication by Flashing Code

During normal operation failure messages may occur. The messages are indicated by a flashing sequence of the red LED0

Flashes *)	Fault	Possible cause	Troubleshooting
1 x fast	Motor voltage is missing	Defective fuse, faulty wiring	Check fuses and wiring
1	Device temperature to high	Duty cycle exceeded	Reduce operating time, use heat sink if possible
2	Mains frequency out of tolerance	Wrong frequency	Device is not suitable for actual frequency. Contact manufacturer
3	Phase sequence incorrect	Load voltage incorrect. Clockwise phase sequence is mandatory for correct function	Check wiring, change 2 phases
4	Undervoltage detected	Load voltage under 330V	Check load voltage
5	Overload detected	Motor overloaded	Reduce operating time, Motor rough-running? Adjust nominal current
6	Motor blocked in Bypass-Mode	Motor stalled in operation	Check motor
7	Thyristor short-circuit	Faulty thyristor detected	Device has to be repaired
9	Motor connected incorrectly	One or more wires to the motor are interrupted	Check wiring to motor
10	Temperature sensor defective	Interruption or short circuit in temperature sensor of power semiconductors	Device has to be repaired
*) No.: Number of flash pulses in a series			

Technical Data

Auxiliary supply:	AC 230 V ± 10%	
Overvoltage protection:	Varistor AC 275 V	
Starting voltage:	3 AC 220 V	
Ramp up time:	0.2 s	0.3 s
Undervoltage protection:	3 AC 330 V, for more than 1s	
Overvoltage protection:	3 AC 470 V, for more than 1s	
Resolution of voltage measurement:	AC 1.5 V	
Nominal consumption:	4 VA	
Short circuit detection	5 ... 25 A	10 ... 36 A
Mode 1:	35 A gL / gG	50 A gG / gL
Mode 2:	5510 A^2s	5500 A^2s

Control Input

Control voltage:	AC/DC 20 ... 300 V
Control input current:	0.2 mA ... 3.1 mA
Start up delay:	10 ... 50 ms
Release delay:	200 ms

Indicator output

Contacts:	1 changeover contact	
Switching capacity to AC 15		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electriscal life to AC 15 at 3 A, AC 230 V:	2 x 10^5 switching cycles	
Permissible switching frequency:	max. 1 800 switching cycles / h	
Short circuit strength max. fuse rating:	4 A gG / gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 10^8 switching cycle	

Output / Load Circuit

Load circuit		
Nominal operating voltage L1-L3:	3 AC 340 ... 460 V	
Peak reverse voltage:	1200 V	
Overvoltage protection:	Varistor 510 V	
Nominal frequency:	50 Hz ± 5 Hz or 60 Hz ± 5Hz	
Nominal operating current I_e:	25 A (AC-53b)	36 A
Setting range I_e:	5 A ... 25 A	10 A ... 36 A
Stoßstrom:	1050 A (tp = 10 ms)	
Load limit integral:	5500 A^2s	
Resolution current measurement:	0.1 A	0.2 A
Usage category	I_e: AC-53b: 2.5 - 0.5: 60	
Number of starts per hour:	10	
Overload protection:	Class 10	
Blocking protection, response value:	4 x I_e , for longer than 1 s in bypass mode	
Current limiting:	2.5 x I_e ± 10% during ramp up	

General Data

Temperature range		
operation:	0 .... + 50 °C	
storage:	- 20 °C ... +75 °C	
Relative air humidity:	< 95%, no condensation at 40°C	
Altitude:	< 1.000 m	
Clearance and Creepage distances rated impulse voltage / pollution degree		
Mains-/Motor voltage- heat sink:	6 kV / 2	IEC/EN 60 947-4-2
Mains-/Motor voltage - control voltage:	6 kV / 2	IEC/EN 60 947-4-2
Mains-/Motor voltage- indicator relay:	6 kV / 2	IEC/EN 60 947-4-2
Overvoltage category:	III	
EMC		
Interference resistance		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 1.0 GHz:	10 V / m	IEC/EN 61 000-4-3
1.0 GHz ... 2.5 GHz:	3 V / m	IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz:	1 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4

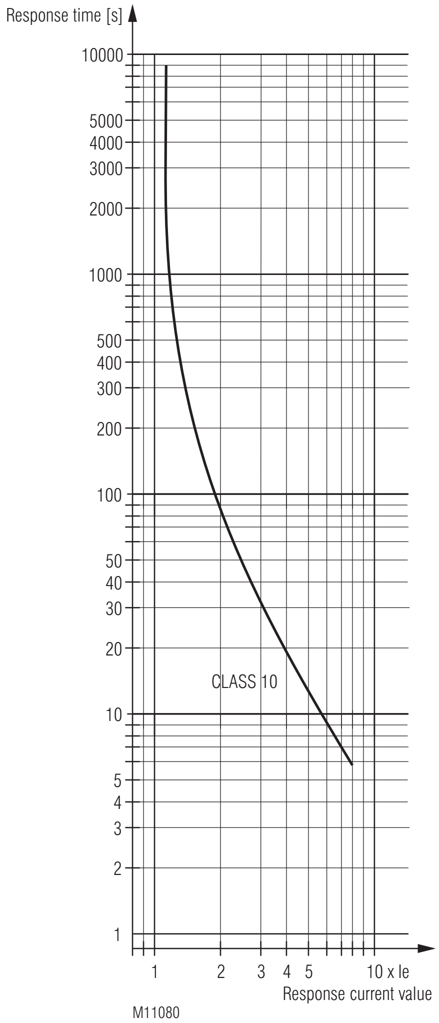
Technical Data

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
Interference emission		
Wire guided:	Limit value class B	IEC/EN 60 947-4-2
Radio irradiation:	Limit value class B	IEC/EN 60 947-4-2
Harmonics in bypass mode:		IEC/EN 61 000-3-11
Degree of Protection		
Enclosure:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with V0 behaviour acc. to UL subject 94	
Vibration resistance	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	0 / 050 / 04	IEC/EN 60 068-1
Wire connections		
Load terminals:	Box terminals with self-lifting wire protection Captive M4 Pozidriv-terminal screws 0,5 ... 16 mm^2 solid 0,5 ... 16 mm^2 mit stranded wire with sleeve DIN 46228/1 0,5 ... 16 mm^2 stranded ferruled (isolated) DIN 46228/4 21 - 6 AWG	
Insulation of wires or sleeve length:	12 mm - 13 mm	
Mounting torque:	2.5 Nm	
Control terminals	pluggable terminal blocks with cage clamp terminals 0.2 - 2.5 mm^2 solid 0.2 - 2.5 mm^2 ferruled 0.2 - 2.5 mm^2 stranded wire with sleeve DIN 46228/1 0.2 - 2.5 mm^2 stranded ferruled (isolated) 26 - 12 AWG	
Insulation of wires or sleeve length:	8 mm	
Weight		
without DIN rail mounting:	500g	
with DIN rail mounting:	600g	

Dimensions

Width x height x depth	
without DIN rail mounting:	67.5 mm x 122.5 mm x 86.5 mm
with DIN rail mounting:	67.5 mm x 140 mm x 95.5 mm

Characteristics



Trigger characteristics

Accessories

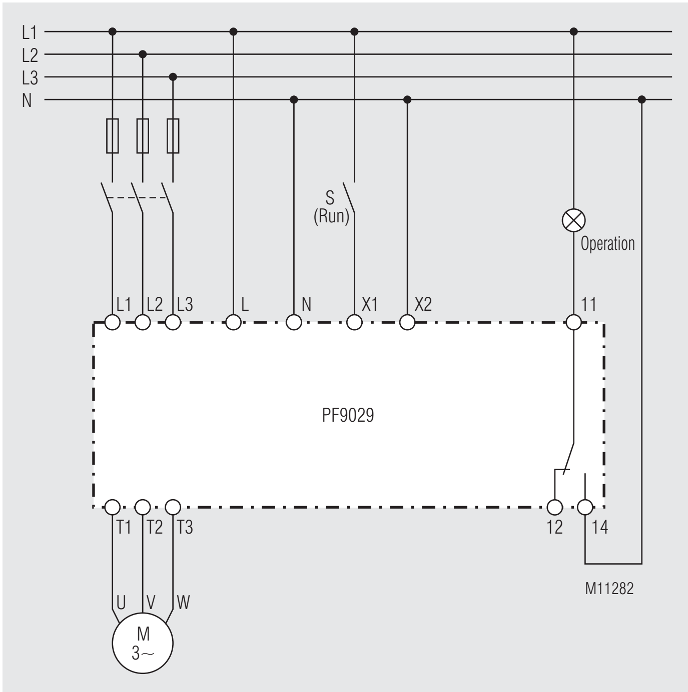
The devices can be mounted on DIN-rail according to IEC/EN 60715 with a fixing plate.

Type: KX4840-20
Article number: 0066204

Operation

1. Connect unit as shown in wiring example
2. Adjust Potentiometer setting „I_e" to nominal motor current.

Connection Example



Standard Type

PF 9029.11 3 AC 400 V 50 Hz U_H 230 V Hz 25 A
Article number: 0065815
- Load voltage: 3 AC 400 V
- Auxiliary voltage U_H: 230 V
- Nominal operating current I_e: 25 A
- Setting range I_e: 5 A ... 25 A
- Width: 67.5 mm

PF 9029.11 3 AC 400 V 50 Hz U_H 230 V Hz 36 A
Article number: 0067298
- Load voltage: 3 AC 400 V
- Auxiliary voltage U_H: 230 V
- Nominal operating current I_e: 36 A
- Setting range I_e: 10 A ... 36 A
- Width: 67.5 mm

Safety Instruction

Dangerous voltage.
Electric shock will result in death or serious injury.

Disconnect all power supplies before servicing equipment.

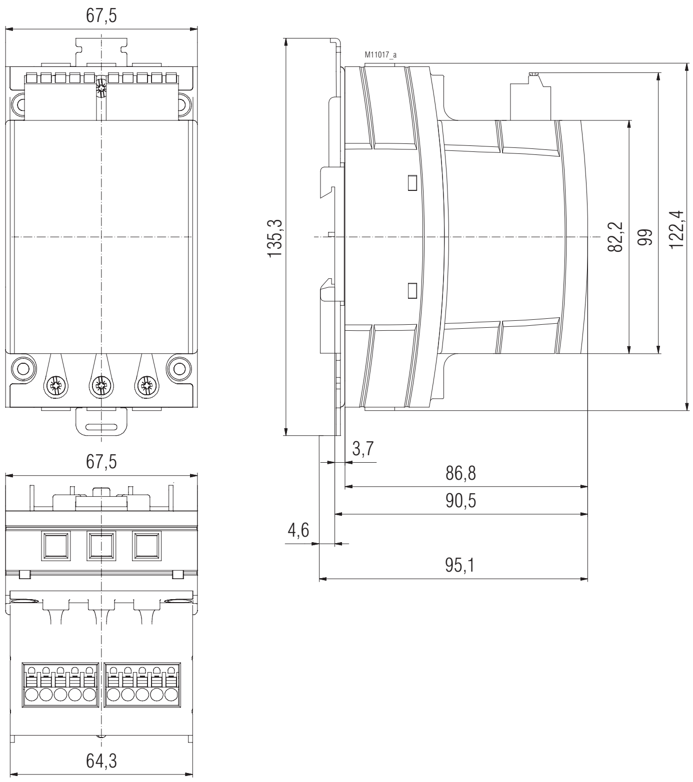
- Never clear a fault when the device is switched on
- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards
- Adjustments may only be carried out by qualified specialist staff and the applicable safety rules must be observed.
- Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor must be disconnected from the mains.

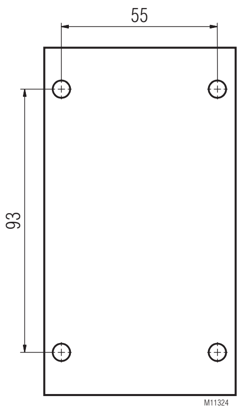
Ordering Example

PF 9029 .11 AC 400 V 50 Hz U_H 230 V 25 A

- 25 A: Nominal operating current
- U_H 230 V: Auxiliary voltage U_H
- 50 Hz: Nominal frequency
- AC 400 V: Load voltage
- .11: Contacts
- PF 9029: Type

Dimensions





4x ∅ M4 Fastening hole

Drilling pattern

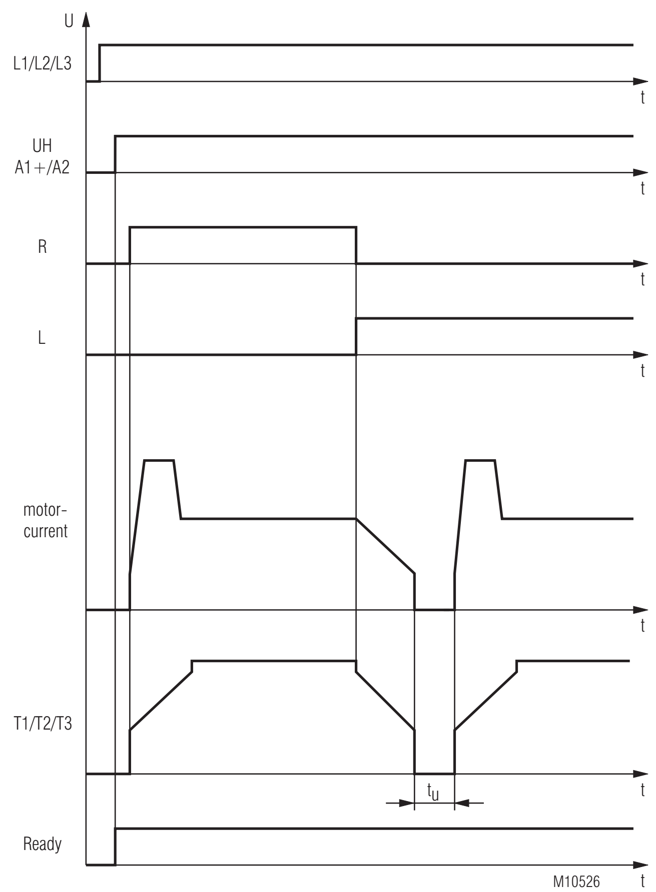
MINISTART
Softstart / Softstop With Reverse Function
RP 9210/300

0255172

Product description

The softstart/softstop devices with reversing function are mainly used for soft reversing of motors. The softart/sofstop function reduces the innertia when reversing, giving less stress to the mechanical components. Less wearing and lower maintenance cost are the result. The parameters for ramp up time and ramp down time as well as start and stop innertia are set via potentiometers. A thermistor or thermal switch can be connected to monitor the motor temperature. Non-wearing reversing by hybrid-technology.

Function Diagram



M10526

t_u = switchover delay time

Your advantages
- 3 functions in one unit
- Easy setup
- No EMC-filter necessary

Features
- According to EN 60 947-4-2
- For controlling of 3-phase motors up to 750 W
- With 2-phase softstart and softstop
- Temperature monitoring of the motors with PTC or thermal switch
- 3 potentiometer for adjustment of softstart, softstop and starting - deceleration time
- 3 LED-indicators
- Reversing with relays, softstart and softstop with thyristors
- 2 x 24 V-inputs for clockwise rotation, anticlockwise rotation
- short circuit proof for 24 V monitoring output
- galvanic separation of control circuit and power circuit
- Width 72 mm

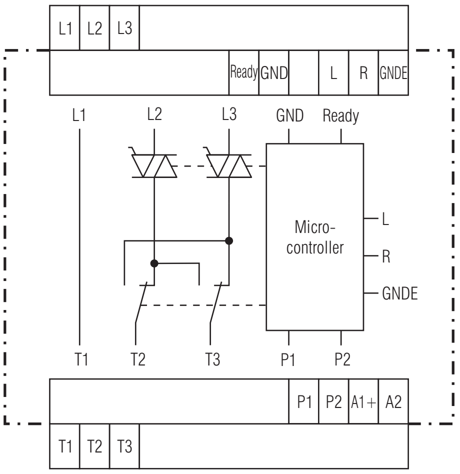
Approvals and Markings

CE

Application

- Conveyors
- Packaging machines
- Door and gate drives

Circuit Diagram



M10525_a

Connection Terminals

Terminal designation	Signal description
A1(+), A2	Auxiliary voltage DC
L1, L2, L3	Load voltage AC
T1, T2, T3	Motor connection
L, R	Control inputs direction of rotation
GNDE	Earth connection control inputs
Ready	Indicator output DC
GND	Earth Indicator output
P1	Thermo sensor
P2	Thermo sensor

Function

The Softstart unit RP 9210/300 includes the functions softstart, softstop and reversing. The reversing is done with relays.

Temperature monitoring
To protect the motor the temperature can be monitored by PTC or thermal switch. When overtemperature is detected the power semiconductors as well as the ready output switch off. The green Ready-LED flashes code 1.
This failure state is stored. After the motor cooled down a reset can be made by temporarily disconnecting the power supply to the unit.

Softstart, Softstop
The unit ramps up or down the current on two phases, therefore allowing the motor torque to build up or to be reduced slowly. This reduces the mechanical stress on the machine and prevents damage to conveyed material. The starting e.g. deceleration time is adjustable by potentiometer.

Control inputs
Right and left rotation is selected via 2 control inputs. If both inputs are activated the one that came first has priority. When the control signal is disconnected the motor is braked for the adjusted braking time. Now the sense of rotation is inverted and the motor is softstarted in the opposite direction.

Monitoring output Ready
If no failure is indicated this short circuit proof output is on +24V.

Indication

green LED-Ready ON:	continuous	-	supply connected
	flashes	-	with failure code
yellow LED R:	continuous	-	Motor turns right
	flashes	-	softstarting or braking at right rotation
yellow LED L:	continuous	-	Motor turns left
	flashes	-	softstarting or braking at left rotation
Failure codes			
	1*)	-	Motor overtemperature
	2*)	-	Wrong freqency
	3*)	-	Phase reversal
	4*)	-	Phase failure
	5*)	-	Motor overcurrent

1*) - 5*) = Number of flashing pulses in sequence

Setting facilities

Potentiometer t_{on}:	-	Ramp up time 1 ... 10 s
Potentiometer t_{BR}:	-	Braking delay time 1 ... 10 s
Potentiometer I_{max}:	-	motor current control 0 ... 3.0 A eff.

Set-up Procedure

1. Connect motor and device according to application example. The 3 phases must be connected in correct sequence, wrong phase sequence will lead to failure (see failure code)
2. If the motor temperature sensor is not required the inputs P1 and P2 must be bridged. Turn potentiometer t_{on} and t_{off} fully clockwise, potentiometer $M_{on, off}$ fully anticlockwise.
3. Power up the unit and begin softstart via inputs R or L
4. Turn potentiometer $M_{on, off}$ fully clockwise, up to motor starts
5. Adjust the start up time by turning ton to the required value. At correct setting, the motor should ramp up continuously to full speed.
6. Adjust the deceleration time to the required value.

Safety Notes

- Never clear a fault when the device is switched on

Attention: This device can be started by potential-free contact, while connected directly to the mains without contactor (see application example). Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor **must** be disconnected from the mains via the corresponding manual motor starter.

- The user must ensure that the device and the necessary components 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.
- Installation and maintenance must only be carried out when the supply is disconnected.
- There is no galvanic separation between auxiliary supply (A1, A2) and measuring circuit (P1, P2). Necessary insulation measures have to be provided according to the application.

Technical Data

Nominal voltage L1/L2/L3:	3 AC 200 ... 400 V ± 10 %
Nominal frequency:	50 / 60 Hz auto detection
Auxiliary voltage A1, A2:	24 V DC ± 10 %
Nominal motor power:	750 W at AC 400 V
Min. motor power:	25 W
Measured thermical current[1]:	1.5 A
Operation mode:	1.5 A: AC 53a: 6-2: 100-30 acc. to IEC/EN 60 947-4-2
Measured nominal current:	1.5 A

[1] The measured thermical current is the arithmetic mean of starting and measured nominal current of the motor in a turn cycle.

Current reduction from 40°C:	0.05 A / °C
Surge current (T_{vj} = 45°C):	65 A (t_p = 20 ms)
Load limit integral:	21 A^2s (t_p = 10 ms)
Peak reverse voltage:	1000 V
Overvoltage limiting:	460 V
Leakage current in off state:	< 3 x 0.5 mA
Starting/deceleration voltage:	30 ... 80 %
Ramp up time:	1 ... 10 s
Declaration ramp:	1 ... 10 s
Consumption	1 W
Switchover delay:	150 ms
Start up delay:	max. 25 ms
Release delay:	max. 30 ms

Input

Control input	
right, left:	DC 24 V
Nominal current:	5 mA
Softstart:	DC 15 ... 30 V
Softstop:	DC 0 ... 5 V
Connection:	polarity protected diode
Motor temperature sensor:	PTC-Sensor acc. to DIN 44 081 / 082
Response value:	4.3 ... 5.1 kΩ
Bimetal switch	
Switching current:	approx. 0.5 mA
Switching voltage:	max. 5 V

Indicator Output

Semiconductor,	
short circuit proof:	DC 24 V
Thermal current I_{th}:	0.5 A

General Data

Nominal operating mode:	Continuous operation	
Temperature range:	0 ... 55 °C	
Clearance and creepage distance		
rated impulse voltage / pollution degree		
Motor voltage - control voltage:	2.5 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
Radio interference:		IEC/EN 60 947-4-2
Radio interference voltage:		IEC/EN 60 947-4-2
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Vibration resistance:	amplitude 0.35 mm frequency10 ... 55 Hz,IEC/EN 60 068-2-6	

Technical Data

Climate resistance:	0 / 055 / 04	IEC/EN 60 068-1
Wire connection		
fixed screw terminal (S),	0.2 ... 4 mm² solid or 0.2 ... 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	captive Plus-minus terminal screws M3.5 box terminals with wire protection	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	185 g	

Dimensions

Width x height x depth: 72 x 90 x 72 mm

Standard type

RP 9210/300 3 AC 400 V 50 / 60 Hz 750 W
Article number: 0062931
- Nominal motor power at AC 400 V: 750 W
- Control input: right, left
- With softstart, softstop and reversing
- Width: 72 mm

Variants

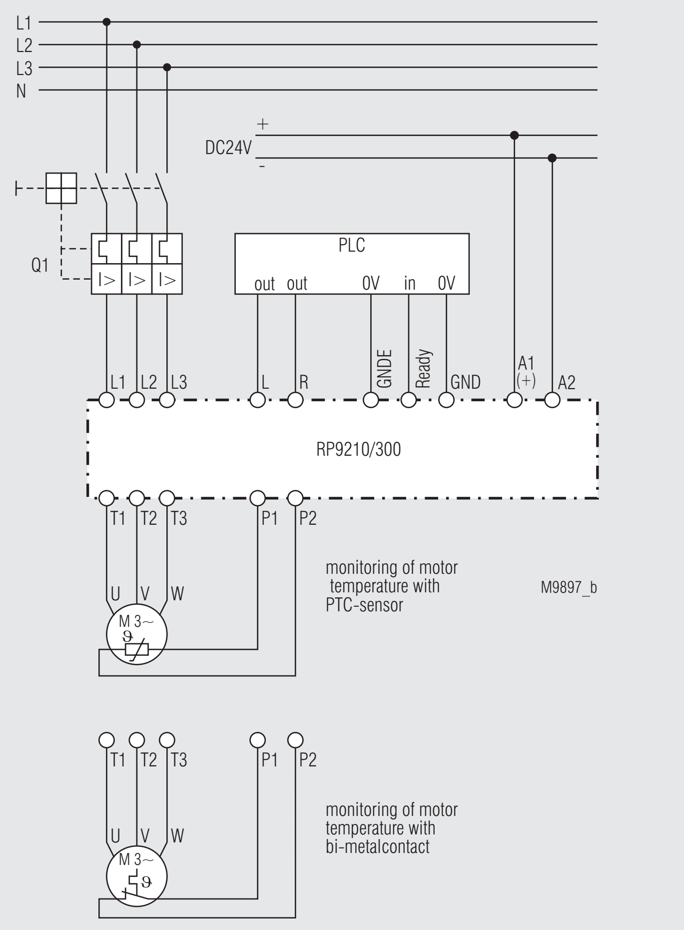
RP 9210/100:	with softstart, without softstop without reversing
RP 9210/200:	with softstart, with softstop, without reversing

Ordering example for variants

RP 9210 /_ _ _ 3 AC 400 V 50 / 60 Hz 750 W

Nominal motor power
Nominal frequency
Nominal voltage
Variant, if required
Type

Application Example



MINISTART
Softstarter
BI 9025, BL 9025

0231843

BI 9025 up to 15 kW

BL 9025 up to 11 kW

- Softstart and softstop function
- 2-phase control
- For motors up to 15 kW at 3 AC 400 V
- Acceleration and deceleration time resp. starting and switch-off torque are separately adjustable
- Wide input voltage range of the power semiconductors
- Galvanic isolation of control input with wide voltage range up to AC/DC 480 V control input
- 3 auxiliary voltages at the device up to AC 230 V
- Integrated overtemperature monitoring
- LED indication
- According to EN 60 947-4-2
- 90 mm width

Additional Information About This Topic

For motors up to 5.5 kW we recommend the softstarter BA 9018 or BA 9019.

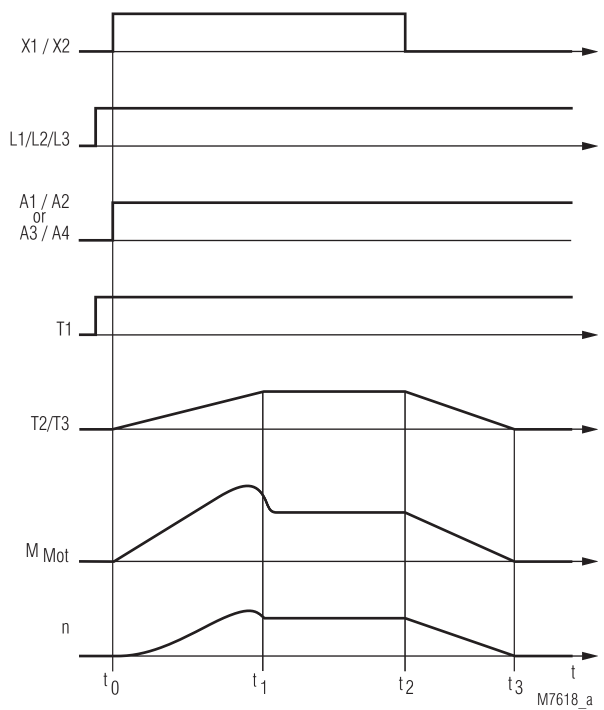
Approvals and Markings

CE

Applications

- Motor with gear, belt or chain drive
- Fans, pumps, conveyor systems, compressors
- Packaging machines, door-drives
- Start current limiting on 3-phase motors

Function Diagram

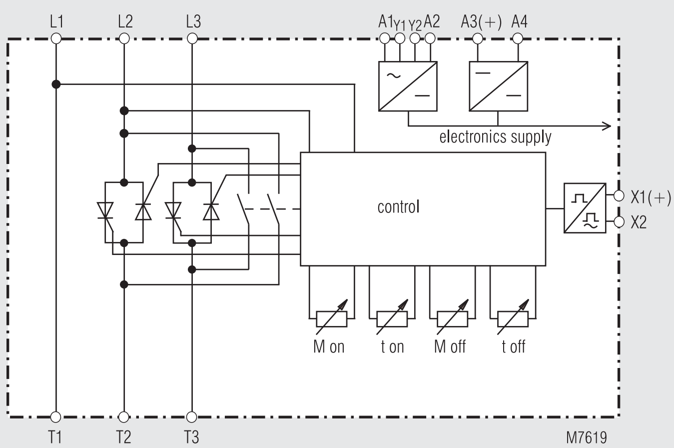


t_0 : start
t_0-t_1 : ramp up time
t_2-t_3 : ramp down time

Function

Softstarters are electronic devices designed to enable 1-phase or 3-phase induction motors to start smoothly. The devices slowly ramps up the current on two phases, therefore allowing the motor torque to build up slowly. This reduces the mechanical stress on the machine and prevents damage to conveyed material.
When the motor is up to full speed the semiconcutors in the device are bridged to prevent internal power losses and heat build up. In addition the device allows a softstop function prolonging the stop time of the motor, preventing high counter torques from abruptly stopping the motor.

Block Diagram



Indication

green LED:	on, when supply connected
yellow LED:	- on, when semiconductors bridged - flashing during ramp up or down
red LED:	Continuously on: Temperature fault Flashing: Attention: Phase reversal

Notes

Variation of speed is not possible with this device. Without load a softstart cannot be achieved. It is recommended that the softstart is protected by superfast semiconductor fuses rated as per the current rating of the softstart or motor. However, standard line and motor protection is acceptable, but for high starting frequencies motor winding temperature monitoring is recommended.
The softstarter must not be operated with capacitive load e.g. power factor compensation on the output.

Technical Data

Nominal voltage: 3 AC 200 V - 15 % ... 480 V + 15 %
Nominal frequency: 50 / 60 Hz

	BI 9025	BL 9025
Width:	90 mm	90 mm
Nominal motor power P_N at		
480 V:	18.5 kW	15 kW
400 V:	**15 kW**	**11 kW**
200 V:	7.5 kW	5.5 kW
Nominal current I_N	32 A	25 A
Switching frequency at 3 x I_N, 10 s, ϑ_U = 45°C:	30 / h	10 / h
Time between 2 starts	min.110 s	min. 350 s

Min. motor power: approx. 0.1 P_N
Start torque: 30 ... 80 %
Ramp time: 1 ... 10 s
Deceleration torque: 30 ... 80 %
Deceleration time: 1 ... 20 s
Recovery time: 200 ms
Auxiliary voltage:
A1/A2, AC 115 V +10%, -15%: bridge A1 - Y1
bridge A2 - Y2
A1/A2, AC 230 V +10%, -15%: bridge Y1 - Y2
A3/A4, DC 24 V +10%, -15%: polarity protected
Power consumption: 3 W
Residual ripple: 5 %
Semiconductor fuse: 50 A superfast

Control Input

Voltage range X1/X2: AC/DC 24 - 480 V
Softstart: > 20 V
Softstop: < 5 V

General Data

Temperature range: 0 ... + 40°C
It is possible to operate the unit at 40°C ... 60°C, the number of starts per hour must then be reduced by 1.5 % / °C temperature increase.
Storage temperature: - 25 ... + 75°C
Usage category: according to EN 60 947-4-2, AC-53 b
Clearance and creepage distances
rated impulse voltage / pollution degree
Control voltage to auxiliary voltage, motor voltage: 6 kV / 2 IEC 60 664-1
Auxiliary voltage to motor voltage: 4 kV / 2 IEC 60 664-1

Technical Data

EMC

Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wire for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5

Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Vibration resistance: Amplitude 0.35 mm IEC/EN 60 068-1
frequency: 10 ... 55 Hz
Climate resistance: 0 / 055 / 04 IEC/EN 60 068-1
Wire connection
Load terminals: 1 x 10 mm² solid
1 x 6 mm² stranded ferruled
Control terminals: 1 x 4 mm² solid or
1 x 2.5 mm² stranded ferruled (isolated) or
2 x 1.5 mm² stranded ferruled (isolated)
DIN 46 228-1/-2/-3/-4 or
2 x 2.5 mm² stranded ferruled
DIN 46 228-1/-2/-3
Wire fixing
Load terminals: Plus-minus terminal screws M4
box terminals with wire protection
Control terminals: Plus-minus terminal screws M3.5
box terminals with wire protection
Mounting: DIN rail mounting IEC/EN 60 715
Weight
BI 9025: 870 g
BL 9025: 835 g

Dimensions

Width x height x depth: 90 x 85 x 121 mm

Standard Type

BL 9025 3 AC 200 ... 480 V 50/60 Hz 11 kW
Article number: 0050957
- Nominal voltage: 3 AC 200 ... 480 V
- Nominal motor power at AC 400 V: 11 kW
- Width: 90 mm

Odering Example

BI 9025 3 AC 200 ... 480 V 50/60 Hz 15 kW

- 15 kW: Nominal motor power at AC 400 V
- 50/60 Hz: Nominal frequency
- 3 AC 200 ... 480 V: Nominal voltage
- BI 9025: Type

Control Input

If a voltage of more than 20 V is connected to terminals X1/X2, the device begins with softstart. If the voltage falls lower than 5 V the device will softstop.

Adjustment Facilities

Potentiometer	Description	Initial setting
M_{on}	Starting voltage	fully anti-clockwise
t_{on}	Ramp-up time	fully clockwise
M_{off}	Deceleration torque	fully clockwise
t_{off}	Deceleration time	fully clockwise

Set-up Procedure

Set potentiometer "M_{on}" to minimum (fully anti-clockwise).
Set potentiometer "M_{off}" to maximum (fully clockwise).
Set potentiometer "t_{on}" to maximum (fully clockwise).
Set potentiometer "t_{off}" to maximum (fully clockwise).
Start the motor and turn potentiometer "M_{on}" up until the motor starts to turn without excessive humming.
Stop the motor and restart.
Adjust potentiometer "t_{on}" to give the desired ramp time.
Stop and restart the motor.
Adjust potentiometer "M_{off}" until the motor starts to visibly slow down at the initation of the softstop cycle.
Stop and restart the motor.
Adjust potentiometer "t_{off}" to give the desired deceleration time.
Stop and restart the motor, readjusting the potentiometers until the desired starting/stopping characteristics are achieved.
During softstop the device must be connected to the 3-phase system.

- **Attention:** If the ramp-up time is adjusted to short, the internal bridging contact closes before the motor is on full speed.
  This may damage the bridging contactor or bridging relay.

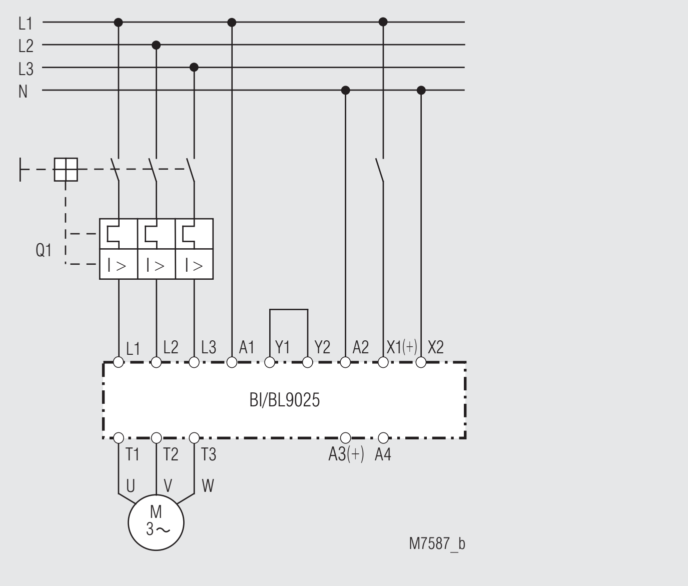
Temperature Monitoring

BH/BL/BI 9025 features overtemperature monitoring of its internal power semiconductors. When the safe running temperature is exceeded the power semiconductors will turn off and a red LED on the front of the unit will illuminate. BI/BL 9025 can be reset after the semiconductors have cooled down by momentarily removing the auxiliary supply voltage. An LED indicates the fault (see fault detection).

Safety Notes

- Never clear a fault when the device is switched on
- **Attention:** This device can be started by potential-free contact, while connected directly to the mains without contactor (see application example). Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor be disconnected from the mains via the corresponding manual motor starter.
- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards.
- Adjustments may only be carried out by qualified specialist staff and the applicable safety rules must be observed.

Connection Example



Softstart and softstop
Phase: 3 AC 400 V

MINISTART
Softstarter With DC-Brake
BI 9028

0239392

BI 9028 up to 7.5 kW

BI 9028 bis 15 kW

Your Advantages
- Softstart and brake in one unit
- Easy wiring
- Space saving

Features
- According to IEC/EN 60 947-4-2
- 2-phase motor control
- For motors up to 15 kW at 3 AC 400 V
- Separate settings for start and brake time, as well as starting and braking torque
- Galvanic isolation of control input with wide voltage range up to AC/DC 230 V
- No external motor or braking contactor necessary
- 3 auxiliary voltages up to 230 V
- monitors undervoltage and phase sequence
- 2 relay outputs for indication of status and fault
- LED-indication
- As option without auxiliary supply
- As option with voltfree contacts for start and stop
- As option with input to detect motor temperature
- BI 9028 up to 7.5 kW: 67.5 mm width
  BI 9028 up to 15 kW: 90 mm width

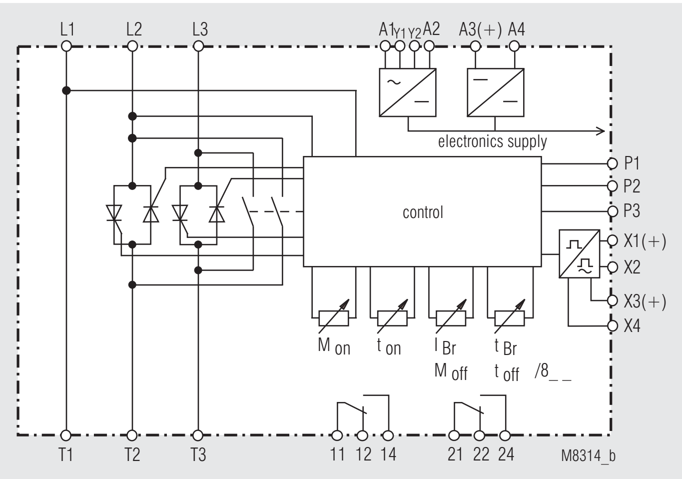
Approvals and Markings

CE

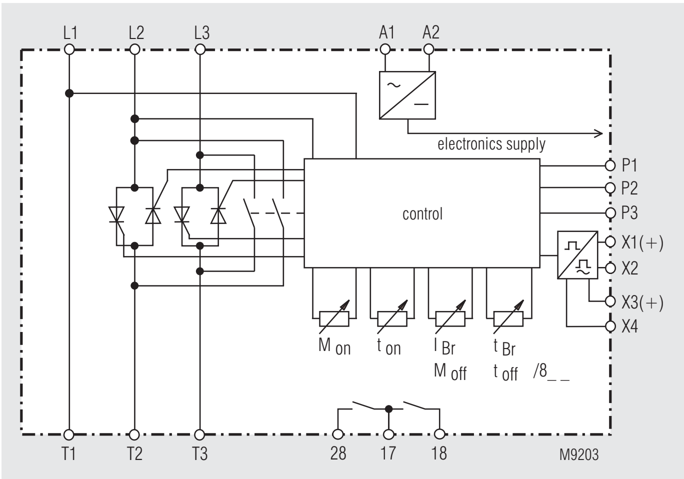
Applications

- Motor with gear, belt or chain drive
- Fans, pumps, conveyor systems, compressors
- Woodworking machines, centrifuges
- Packing machines, door-drives

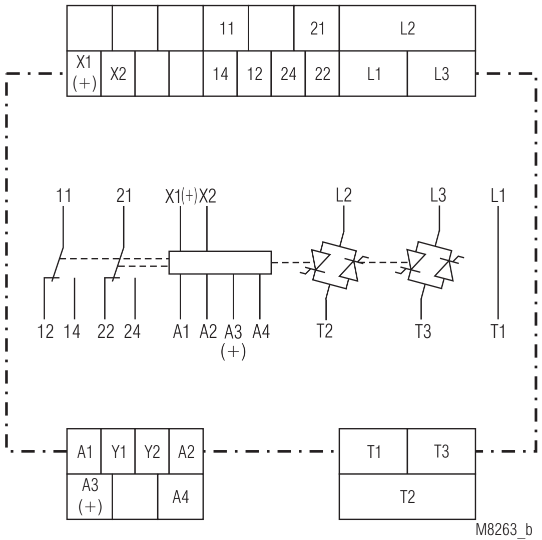
Block Diagrams



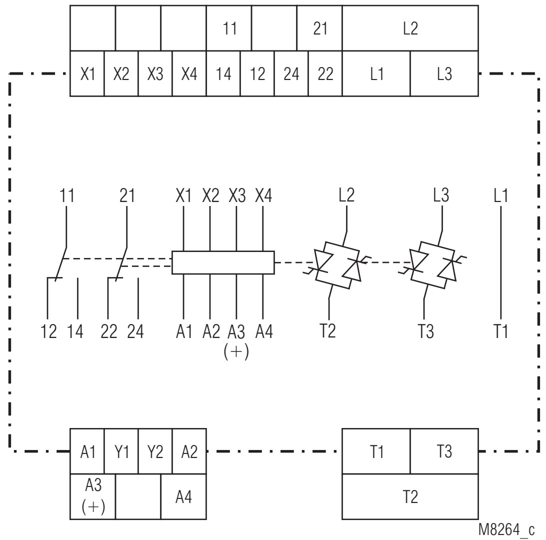
BI 9028 up to 15 kW



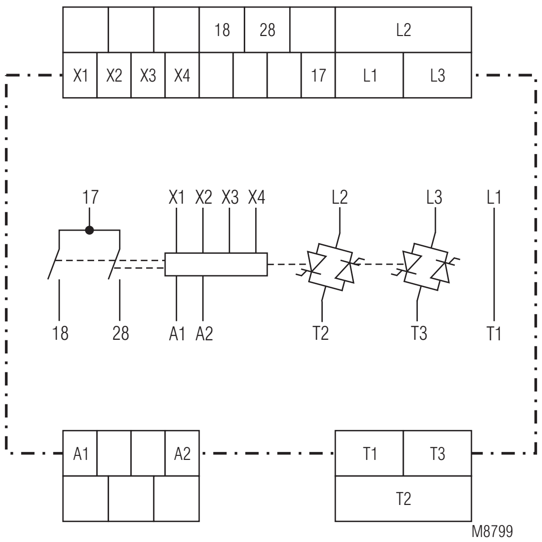
BI 9028 up to 15 kW, U_H = AC 400 V



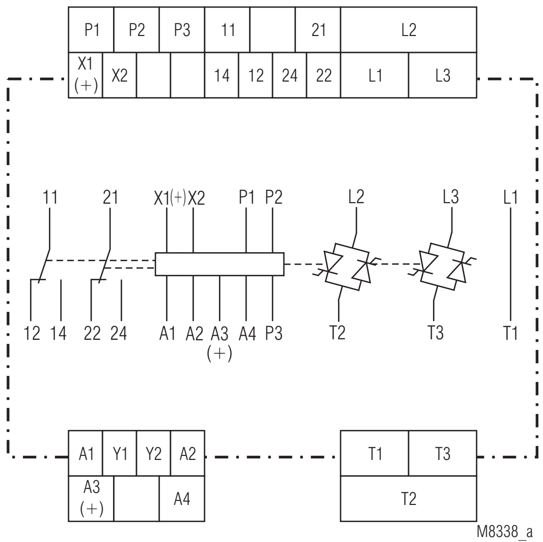
BI 9028.38



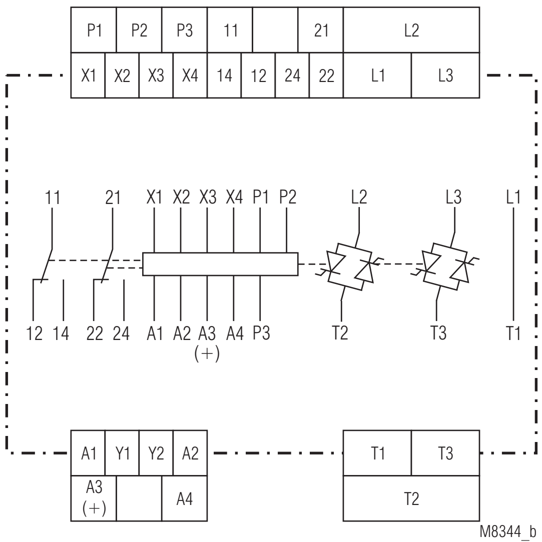
BI 9028.38/001



BI 9028.38/001, UH = AC 400 V



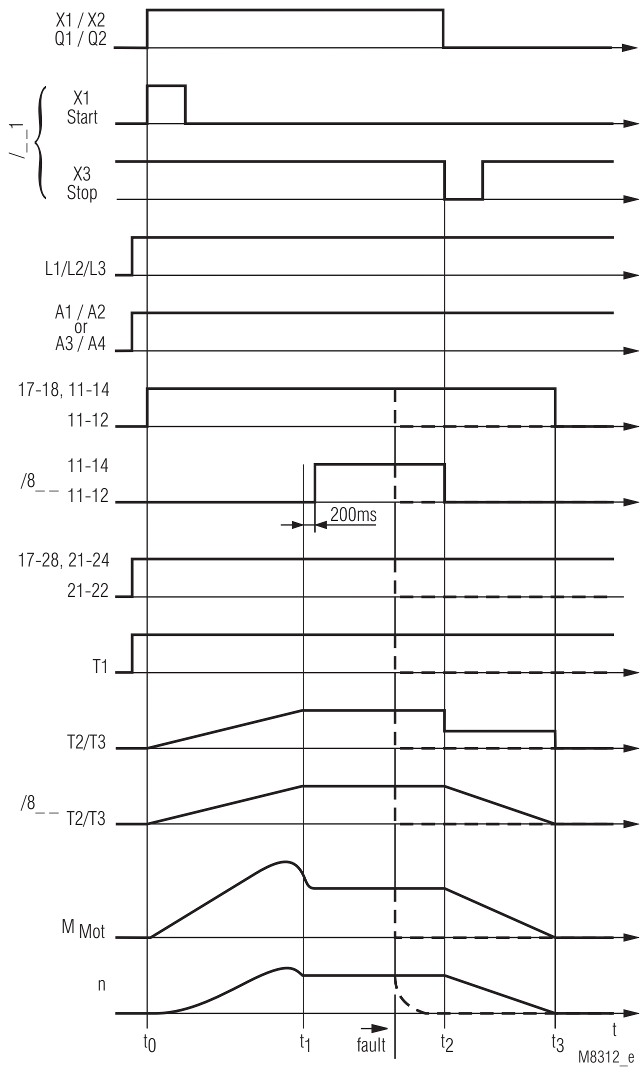
BI 9028.38/010



BI 9028.38/011

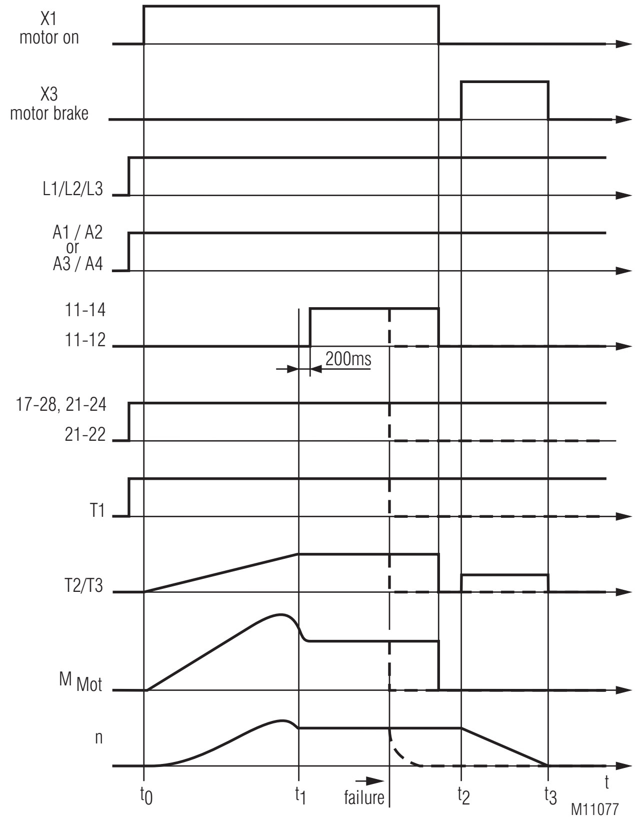
Connection Terminal

Terminal designation	Signal description
X1, X2, X3, X4	Start-, Stopp signal
P1, P2, P3	Thermistor
11, 12, 14	Indicator relay Motor on
21, 22, 24	Indicator relay device ready
A1, A2	Auxiliary voltage main
A3(+), A4	Auxiliary voltage DC 24 V
Y1, Y2	Switching 115 V / 230 V
L1	Phase voltage L1
L2	Phase voltage L2
L3	Phase voltage L3
T1	Motor connection T1
T2	Motor connection T2
T3	Motor connection T3



t_0 : start
t_0-t_1 : ramp up time
t_2-t_3 : braking time
/8_ _ t_2-t_3 : deceleration time

BI 9028.38/_ _1



t_0 : start
t_0-t_1 : softstarttime
t_2-t_3 : brakingdelaytime

BI 9028.38/5_ _

Function

Softstarters are electronic devices designed to enable 1-phase or 3-phase induction motors to start smoothly. The devices slowly ramps up the current on two phases, therefore allowing the motor torque to build up slowly. This reduces the mechanical stress on the machine and prevents damage to conveyed material.
These features allow cost saving constructions of mechanical gear. External motor or brake contactors are not neccessary.

Start/Stop switch
When the motor is on full speed after the starting with start/stop switch S the semiconductors are bridged with internal relay contacts to prevent internal power losses and heat built up.
When stopping the motor via start/stop switch S braking is started. The braking current flows for the adjusted time through the motor windings.
On variant /_ _1 the start and stop function is realised via bush buttons.
On variant /5_ _ the softstart and brake function are separate switching via control input X1, X3.

Monitoring relay 1 (contact 11-12-14 / 17-18)
The relay energises with the start command and de-energises after finish of braking. When a fault occurs the relay de-energises when the semiconductors swith off. The monitoring relay 1 can be used to activate a mechanical holding brake. With the variant BI 9028/8_ _ and BI 9028/5_ _ the relay switches when the semiconductors are bridged.

Monitoring relay 2 (contact 21-22-24 / 17-28)
This relay energises as soon as the unit is ready for operation after connecting it to power. On internal overtemperature, phase failure, wrong phase sequence and overtemperature on the motor (variant BI 9028/_1_) the relay 2 de-energises. The power semiconductors are switched off. The internal temperature monitoring protects the thyristors. The temperature monitoring of the motor (variant BI 9028/_1_) has an input for a bimetallic contact or PTCs. The fault is reset by disconnecting the power supply temporarily after the temperature is down again.
Phase failure and phase sequence monitoring protect motor and plant. The fault is reset by disconnecting the power supply temporarily.

Input P_1 / P_2 / P_3 to monitor the motor temperature on variant BI 9028/_1_
To monitor overtemperature on the motor a bimetallic contact can be connected to P_2 / P_3. When overtemperature is detected the power semiconductors switch off and relay 2 de-energises.
On P_1 / P_2 up to 6 PTC sensors can be connected. On detection of overtemperature, short circuit or broken wire (in sensor circuit) the power semiconductors switch off and relay 1 + 2 de-energise.
The fault is reset by disconnecting the power supply temporarily after the temperature on the motor is down again. After every reset the unit has to be started again via control input or start/stop button.

Indication

green LED:	Continuous light:	when auxiliary supply connected
	Flashing light:	while starting and braking

Monitoring relay 1

yellow LED:	Continuous light:	when contact 11-12-14 / 17-18 switched on

Monitoring relay 2

yellow LED:	Continuous light:	when contact 21-22-24 / 17-28 switched on
	Flashing light:	when contact 21-22-24 / 17-28 switched off
	1*):	overtemperature on thyristor (internal)
	2*):	overtemperature on motor or broken wire in sensor circuit P_1/P_2 , only at variant /01_
	3*):	short circuit on sensor circuit P_1/P_2 , only at variant /01_
	4*):	phase failure
	5*):	incorrect phase sequence, exchange connections on L1 and L2
	6*):	incorrect frequency
	7*):	heat sink temperature sensor defective
	8*):	braking time exceeded

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

Notes

Variation of speed is not possible with this device. Without load a softstart cannot be achieved. It is recommended that the softstart is protected by superfast semiconductor fuses rated as per the current rating of the softstart or motor. However, standard line and motor protection is acceptable, but for high starting frequencies motor winding temperature monitoring is recommended. The softstarter must not be operated with capacitive load e.g. power factor compensation on the output.
The current in the 3 phases is different due to 2-phase control. To avoid false tripping of the motor overload it is recommended to select a suitable overload for this application.
In respect to safety of persons and plant only qualified staff is allowed to work on this device.

Technical Data

Phase / motor
voltage L1/L2/L3
with auxiliary voltage: 3 AC 200 V -10 % ... 480V + 10 %
without auxiliary voltage: 3 AC 200 V ± 10 %
Nominal frequency: 50 / 60 Hz

	Width		
	67.5 mm	90 mm	90 mm
Nominal motor power P_N at 400 V:	7.5 kW	11 kW	15 kW
Switching frequency at 3 x I_N, 5 s, ϑ_U = 20°C:	10 / h	45 / h	30 / h
permissible braking current	35 A	50 A	65 A

Min. motor power:	approx. 0.1 P_N
Start torque:	20 ... 80 %
Ramp time:	1 ... 20 s
Braking time:	1 ... 20 s
Braking delay:	0.5 s
Deceleration torque	
BI 9028/8_ _:	20 ... 80 %
Deceleration time	
BI 9028/8_ _:	1 ... 20 s
Recovery time:	200 ms
Auxiliary voltage:	
Model AC 115/230 V:	
A1/A2, AC 115 V, +10%, -15%:	bridge A1 - Y1 bridge A2 - Y2
A1/A2, AC 230 V,+10%, -15%:	bridge Y1 - Y2
A3(+)/A4, DC 24 V, +10%, -15%:	polarity protected
Model AC 400 V:	
A1/A2, AC 400 V, +10%, -15%:	no bridge
Power consumption:	3 W
Residual ripple max.:	5 %
Short circuit strength	
7.5 kW	
Line protection:	Assignment type 1 acc. to IEC 60947-4-1 max 50 A Typ gG
Semiconductor fuse:	Assignment type 2 acc. to IEC 60947-4-1 max. 1800 A^2s
11 kW	
Line protection:	Assignment type 1 acc. to IEC 60947-4-1 max 63 A Typ gG
Semiconductor fuse:	Assignment type 2 acc. to IEC 60947-4-1 max. 6600 A^2s
15 kW	
Line protection:	Assignment type 1 acc. to IEC 60947-4-1 max. 80 A Typ gG
Semiconductor fuse:	Assignment type 2 acc. to IEC 60947-4-1 max. 6600 A^2s

Inputs

Control input X1/X2	
voltage:	AC/DC 24 - 230 V
Softstart when:	> 20 V
Braking when:	< 5 V
BI 9028/0_1:	
Control input X1/X4, X3/X4:	volt free contact
alternative	
Control input X1/X2, X3/X2	
Voltage:	AC/DC 24 V
Softstart when:	> 15 V
Braking when:	< 5 V
Control input Q1/Q2:	volt free contact
Switching current:	DC 10 mA

Technical Data

Switching voltage:	DC 24 V	
Input P_2 / P_3 for bimetallic contact		
Current:	approx. 1 mA (= switch closed)	
Voltage:	approx. 5 V (= switch open)	
Input P_1 / P_2 for PTC-sensor		
Temperature sensor:	according to DIN 44081/082	
Number of sensors:	1 ... 6 in series	
Response value:	3.2 ... 3.8 kΩ	
Reset value:	1.5 ... 1.8 kΩ	
Load in measuring circuit:	< 5 mW (at R = 1.5 kΩ)	
Broken wire detection:	> 3.1 kΩ	
Measuring voltage:	≤ 2 V (at R = 1.5 kΩ)	
Measuring current:	≤ 1 mA (at R = 1.5 kΩ)	
Voltage, when broken wire in sensor circuit:	DC approx. 5 V	
Current, when short circuit in sensor circuit:	DC approx. 0.5 mA	

Monitoring Output

Contacts		
BI 9028.38:	2 x 1 changeover contacts	
BI 90.28.38 (U_H = AC 400 V):	2 x 1 NO contacts	
Thermal continuous current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contact:	3 A / 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / 230 V	IEC/EN 60 947-5-1
Electrical life:		
to AC 15 at 3 A, AC 230 V:	1 x 10^5 switching cycles	
Short circuit strength max. fuse rating:	4 A gG /gL	IEC/EN 60 947-5-1
Mechanical life:	1 x 10^8 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	0 ... + 45 °C	
Storage:	- 25 ... + 75 °C	
Relative air humidity:	max. 95 %	
Altitude:	< 1,000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree between		
Motor voltage, heat sink:	6 kV / 2	IEC/EN 60 664-1
Control voltage to auxiliary voltage, motor voltage:	4 kV / 2	IEC/EN 60 664-1
Auxiliary to motor voltage:	4 kV / 2	IEC/EN 60 664-1
Overvoltage category:	III	
EMC		
Interference resistance		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:		
80 Mhz ... 1.0 Ghz	10 V / m	IEC/EN 61 000-4-3
1.0 GHz ... 2.5 GHz	3 V / m	IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz	1 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wire 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
Interference emission		
Wire guided:	Limit value class B	IEC/EN 60 947-4-2
Radio irradiation:	Limit value class B	IEC/EN 60 947-4-2
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 / 045 / 04	IEC/EN 60 068-1

Technical Data

Wire connection		
Load terminals:	1 x 10 mm^2 solid 1 x 6 mm^2 stranded ferruled	
Stripping length:	11 mm	
Control terminals:	1 x 4 mm^2 solid or 1 x 2.5 mm^2 stranded ferruled (isolated) or 2 x 1.5 mm^2 stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm^2 stranded ferruled DIN 46 228-1/-2/-3	
Stripping length:	10 mm	
Wire fixing		
Load terminals:	Plus-minus terminal screws M4 box terminals with wire protection	
Control terminals:	Plus-minus terminal screws M4 box terminals with wire protection	
Fixing torque		
Load terminals:	1.2 Nm	
Control terminals:	0.8 Nm	
Mounting:	DIN rail mounting	IEC/EN 60 715
Weight:		
Width 67.5 mm:	630 g	
Width 90 mm:	780 g	

Dimensions

Width x height x depth:	
BI 9028 up to 7.5 kW:	67.5 x 85 x 121 mm
BI 9028 up to 15 kW:	90 x 85 x 121 mm

Standard type

BI 9028.38 3 AC 200 ... 480 V 50/60 Hz 7.5 kW

Article number:	0054984
• Motor voltage:	3 AC 200 ... 480 V
• Nominal motor power at AC 400 V:	7.5 kW
• Control input X1/X2	
• Width:	67.5 mm

Variants

BI 9028.38/_ _1:	volt free contacts for start and stop X1, X2, X3, X4
BI 9028.38/_1_:	input P_1 / P_2 / P_3 to monitor the motor temperature
BI 9028.38/8_ _:	Softstop function instead of brake
BI 9028.38/_ _ 2:	volt free control unit on terminals Q1/Q2
BI 9028.38/5_ _:	softstart and brake function switching via control input X1, X3

Ordering example for variants:

BI 9028.38 /_ _ 3 AC 200 ... 480 V 50/60 Hz 11 kW

Nominal motor power at AC 400 V
Nominal frequency
Phase / motor voltage
Variant, if required
Type

Control Input

With BI 9028 softstart begins by closing switch S and braking starts when opening switch S. When closing S during braking, softstart begins again.

With BI 9028/0_1 softstart begins by pressing the "Start" button (X1). By actuating the "Stop" button (X3) braking is started. Pressing the "Start" button during braking activates the softstart again. If "Start" and "Stop" are activated simultaneously within 0.1 s the stop function has priority.

On BI 9028/_ _2 softstarts begins when closing the contact on Q1/Q2. By opening this contact braking or softstop is started. If Q1/Q2 is permanently closed softstart is started when applying the mains voltage on L1/L2/L3. Start of braking or softstop can only be started by opening Q1/Q2.

With BI9028/5_ _ softstat beginns with activation of input X1. The motor is connected to voltage until the signal is disconnected from the control input. With the signal on control input X3 the braking cycle is started (DC-brake) The braking cycle is finished when the signal on X3 is disconnected or on BI 9028/511 latest 60 seconds after start of the braking cycle the user has to make sure that only one control input is active.

Adjustment Facilities

Potentiometer	Description	Initial setting
M_{on}	Starting voltage	fully anti-clockwise
t_{on}	Ramp-up time	fully clockwise
I_{Br}	Braking current	fully anti-clockwise
t_{Br}	Braking time	fully clockwise
M_{off}	Deceleration voltage time	fully anti-clockwise
t_{off}	Deceleration time	fully clockwise

Set-up Procedure

Softstart:
1. Start the motor via control input X1/X2 and turn potentiometer "M_{on}" up until the motor starts to turn without excessive humming.
2. Adjust potentiometer "t_{on}" to give desired ramp time.
3. On correct setting the motor should accelerate up to nominal speed. If the start takes too long fuses may blow, especially on motors with high inertia.

- **Attention:** If the ramp-up time is adjusted to short, the internal bridging contact closes before the motor is on full speed. This may damage the bridging contactor or bridging relay.

Softstop:
- During softstop the device has to be connected to the voltage.
- Select softstop by opening control input X1/X2; Q1/Q2
- Turn potentiometer M_{off} to the left, until the motor starts visibly to slow down at the initiation of the softstop cycle.
- Adjust t_{off} until the required stopping time is achieved.

Braking:
The braking time t_{Br} and the braking current I_{Br} (max. 2 I_N with star connected and max. 2.8 I_N with delta connected motors, do not exceed max. permissible braking current!) is adjusted on BI 9028. The time has to be adjusted in a way that the current is flowing until the motor is on standstill.
To avoid overload of braking device and motor, the braking current should be checked with a moving iron instrument (see connection diagram).
The procedure für BI 9028/001 is the same.

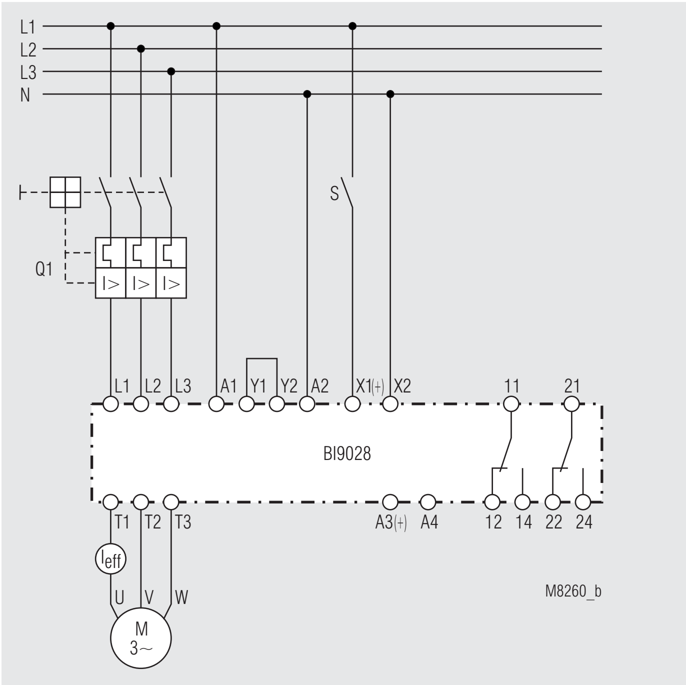
Temperature Monitoring

BI 9028 features overtemperature monitoring of its internal power semiconductors. The unit is therefore protected against overheating during the set up procedure. BI 9028 can be reset after the semiconductors have cooled down by momentarily removing the auxiliary supply voltage.

Safety Notes

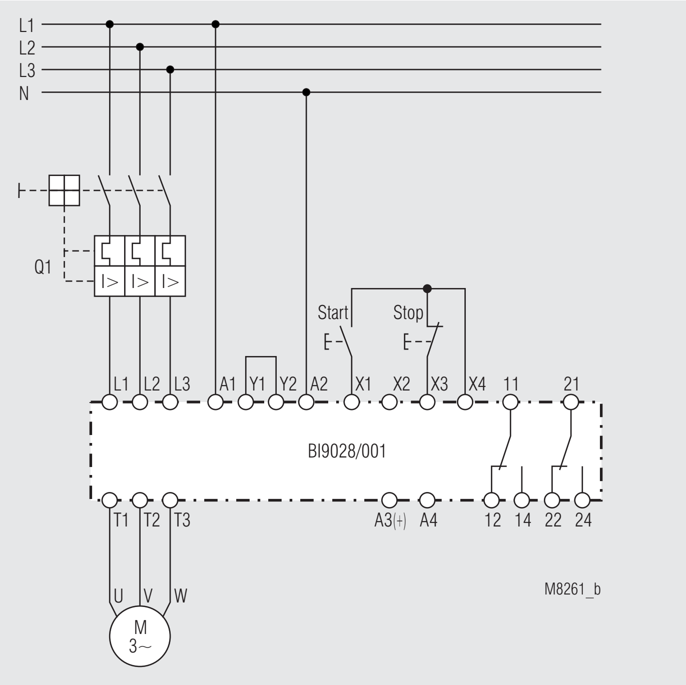
- Never clear a fault when the device is switched on.
- **Attention:** This device can be started by potential-free contact, while connected directly to the mains without contactor (see application example). Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor **must** be disconnected from the mains via the corresponding manual motor starter.
- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards.
- Adjustments may only be carried out by qualified specialist staff and the applicable safety rules must be observed.

Connection Example

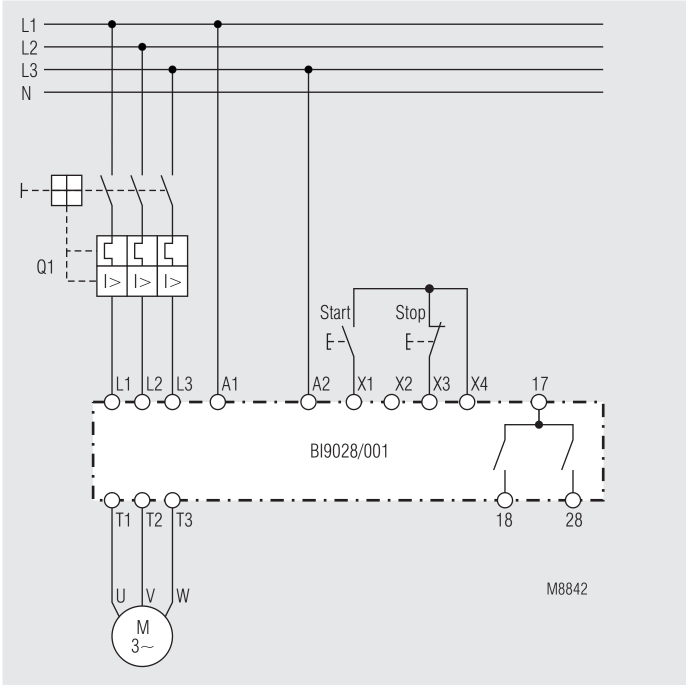


BI 9028 softstart and brake function with switch S

Connection Examples

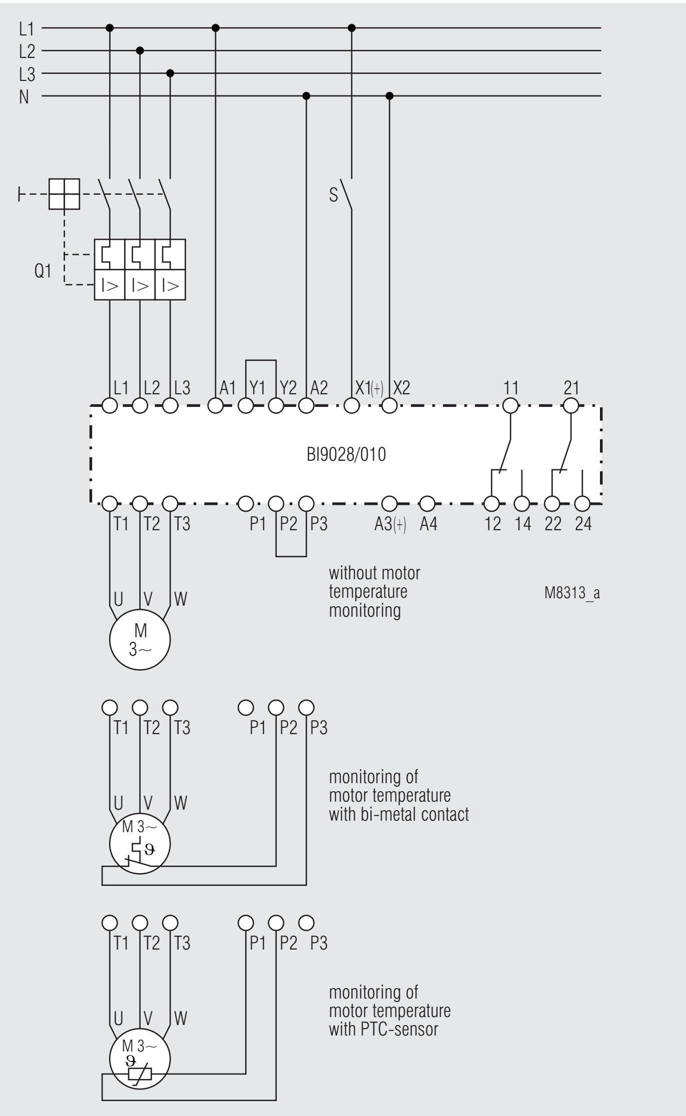


BI 9028/001 softstart with start-button, brake function with stop-button

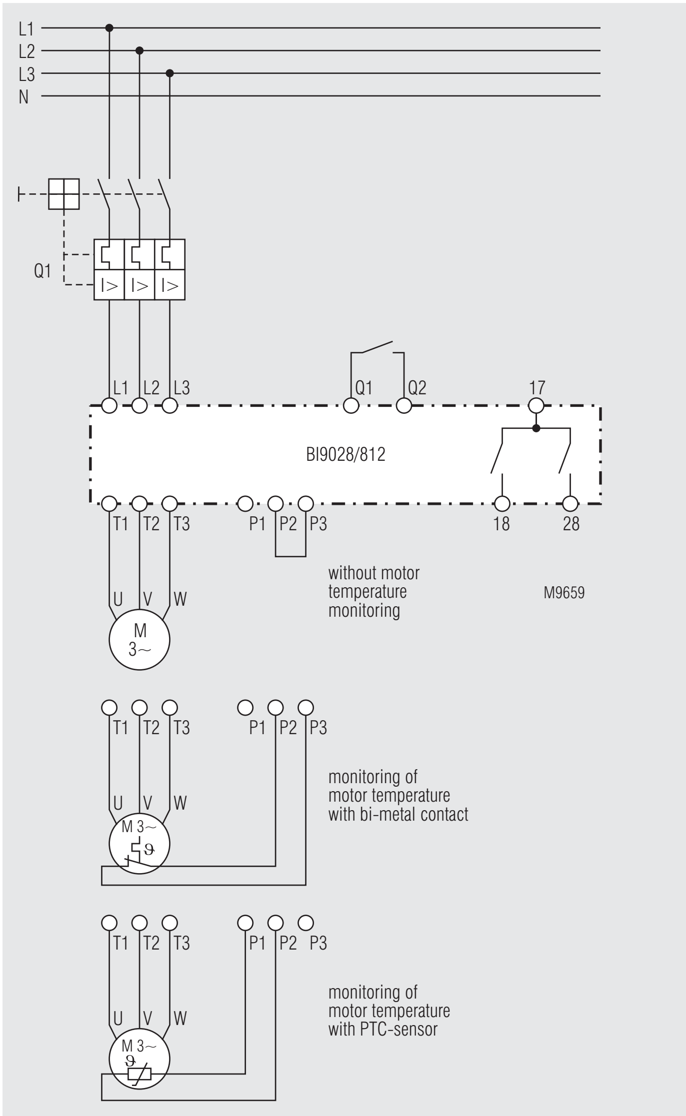


BI 9028/001, U_H = AC 400 V

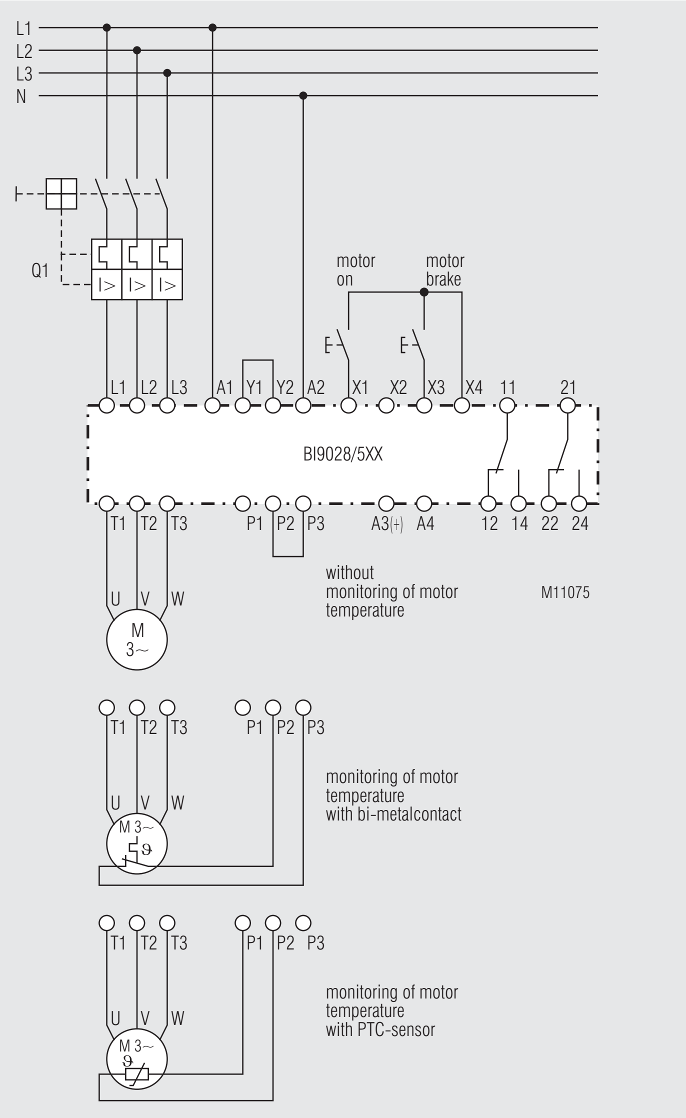
Connection Examples



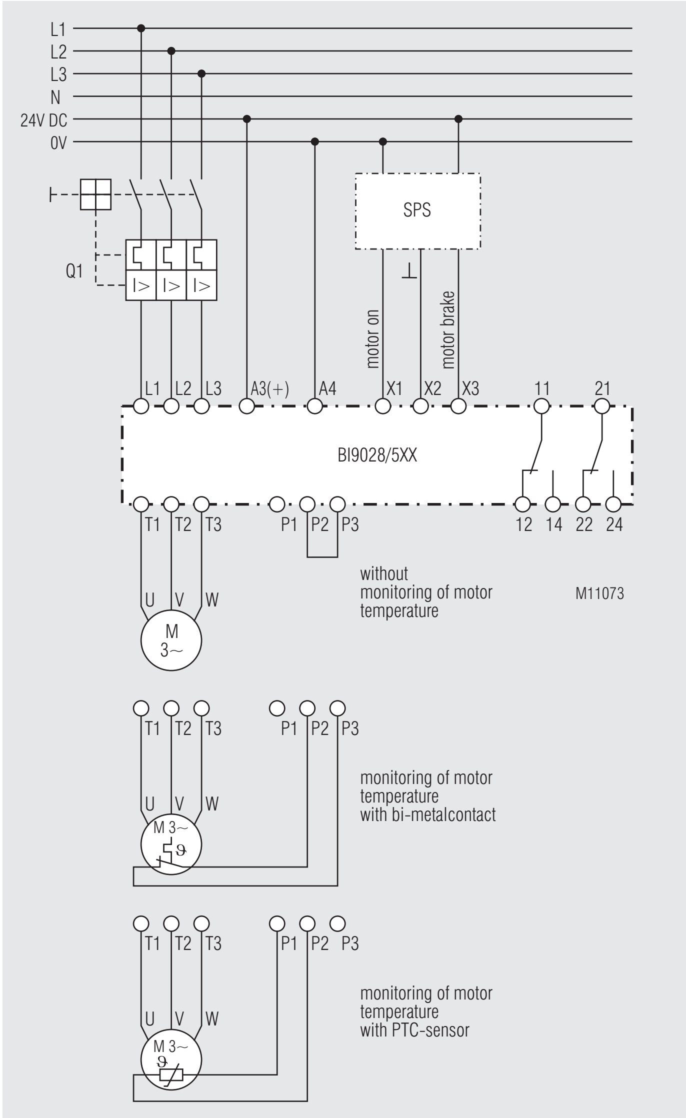
BI 9028/010 softstart and brake function with motor temperature monitoring



BI 9028/010 softstart - softstop with monitoring of motor temperature without auxiliary voltage.



BI 9028/5_ _softstart and brake function switching via separate control inputs, auxiliary voltage U_H = AC 230 V



BI 9028/5_ _ softstart and brake function switching via separate control inputs, auxiliary voltage U_H = DC 24 V

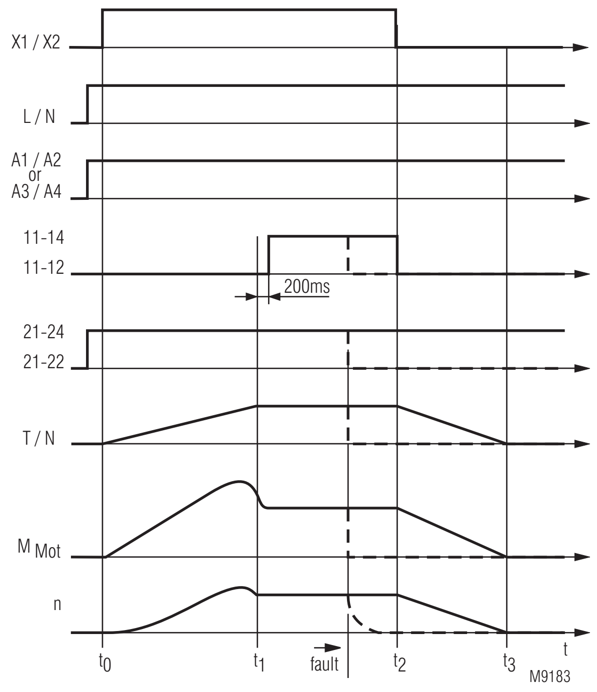
MINISTART
Softstarter For 1-phase Motors
BI 9028/900

DOLD

0249238

- Softstart and softstop function
- According to IEC/EN 60 947-4-2
- 1-phase motor control
- For motors up to 5 kW at AC 230 V
- Separate settings for start and deceleration time, as well as starting and deceleration torque
- Galvanic isolation of control input with wide voltage range up to AC/DC 230 V
- 3 auxiliary voltages up to 230 V
- phase failure detection
- 2 relay outputs for indication of status and fault
- LED-indication
- 90 mm width

Function Diagram



t_0 : start
t_0-t_1 : ramp up time
t_2-t_3 : deceleration time

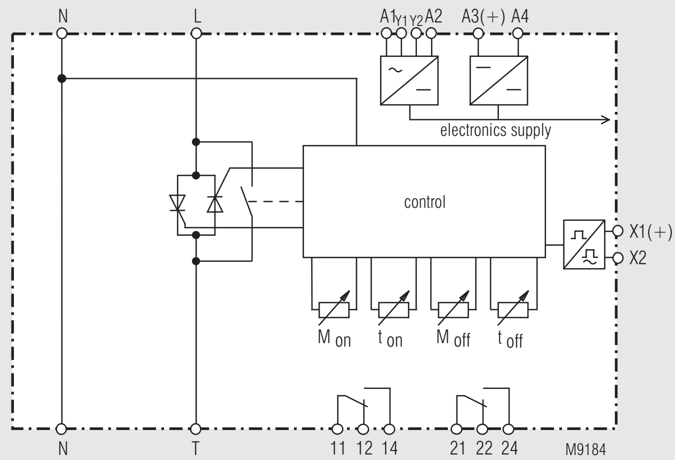
Approvals and Markings

CE

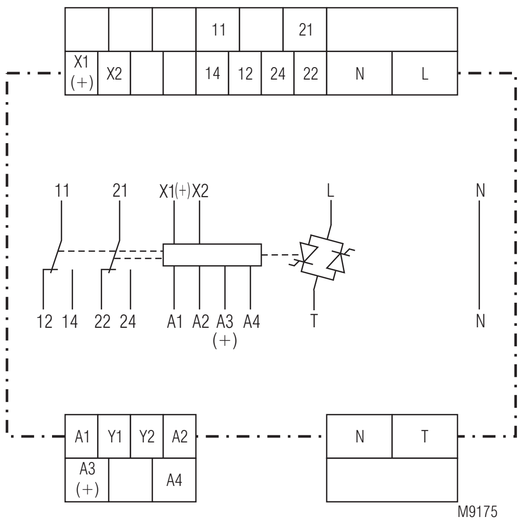
Applications

- Motor with gear, belt or chain drive
- Fans, pumps, conveyor systems, compressors
- Woodworking machines, centrifuges
- Packing machines, door-drives

Block Diagram



Circuit Diagram



Function

Softstarters are electronic devices for smoth start and stop of motors. The device ramps the motor current up and down by phase chopping therefore allowing the motor torque built up and reduce slowly. This reduces mechanical stress on the machine during start and stop. This prevents the connected mechanical equipment against damage caused by mechanical shock of the starting and stopping torque of a direct started motor.
These features allow cost saving constructions of mechanical gear.

Monitoring relay 1 (contact 11-12-14)
The relay indicates the status of the bridged semiconductor.

Monitoring relay 2 (contact 21-22-24)
This relay energises as soon as the unit is ready for operation after connecting it to power. On internal overtemperature, phase failure, or wrong mains frequency the relay 2 de-energises. The power semiconductors are switched off. The internal temperature monitoring protects the thyristors. The fault is reset by disconnecting the power supply temporarily after the temperature is down again.

Indication

green LED:	Continuous light:	when auxiliary supply connected
	Flashing light:	while starting and braking

Monitoring relay 1

yellow LED:	Continuous light:	when contact 11-12-14 switched on

Monitoring relay 2

yellow LED:	Continuous light:	when contact 21-22-24 switched on
	Flashing light:	when contact 21-22-24 switched off
	1*):	overtemperature on thyristor (internal)
	4*):	phase failure in load circuit
	6*):	incorrect frequency

1-6*) = Number of flashing pulses in sequence

Notes

Variation of speed is not possible with this device. Without load a softstart cannot be achieved. It is recommended that the softstart is protected by superfast semiconductor fuses rated as per the current rating of the softstart or motor. However, standard line and motor protection is acceptable, but for high starting frequencies motor winding temperature monitoring is recommended. The softstarter must not be operated with capacitive load e.g. power factor compensation on the output.
In respect to safety of persons and plant only qualified staff is allowed to work on this device.

Technical Data

Phase / motor voltage L1 / N:	1 AC 100 V -10 % ... 480V + 10 %
Nominal frequency:	50 / 60 Hz
Nominal motor power P_N at 230 V:	5 kW
Switching frequency at 3 x I_N, 5 s, ϑ_U = 20°C:	45 / h
Min. motor power:	approx. 0,1 P_N
Starting voltage:	20 ... 80 %
Deceleration voltage:	20 ... 80 %
Ramp time:	0,25 ... 20 s
Deceleration time:	0,25 ... 20 s
Auxiliary voltage:	
Model AC 115/230 V:	
A1/A2, AC 115 V, +10%, -15%:	bridge A1 - Y1 bridge A2 - Y2
A1/A2, AC 230 V,+10%, -15%:	bridge Y1 - Y2
A3(+)/A4, DC 24 V, +10%, -15%:	polarity protected
Power consumption:	2 W
Residual ripple max.:	5 %
Max. semiconductor fuse:	1800 A^2 s

Technical Data

Inputs

Control input X1/X2 voltage:	AC/DC 24 - 230 V
Softstart when:	> 20 V
Stopstart when:	< 5 V

Monitoring Output

Contacts:	2 x 1 changeover contacts	
Thermal continuous current I_{th}:	4 A	
Switching capacity to AC 15		
NO contact:	3 A / 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / 230 V	IEC/EN 60 947-5-1
Electrical life: to AC 15 at 3 A, AC 230 V:	2 x 10^5 switching cycles	
Short circuit strength max. fuse rating:	4 A gL	IEC/EN 60 947-5-1

General Data

Temperature range:	0 ... + 45 °C	
Storage temperature:	- 25 ... + 75 °C	
Clearance and creepage distances rated impulse voltage / pollution degree		
Control voltage to auxiliary voltage, motor voltage:	6 kV / 2	IEC 60 664-1
Auxiliary to motor voltage:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wire for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
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		
Load terminals:	1 x 10 mm^2 solid 1 x 6 mm^2 stranded ferruled	
Control terminals:	1 x 4 mm^2 solid or 1 x 2,5 mm^2 stranded ferruled (isolated) or 2 x 1,5 mm^2 stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 or 2 x 2,5 mm^2 stranded ferruled DIN 46 228-1/-2/-3	
Wire fixing		
Load terminals:	Plus-minus terminal screws M4 box terminals with wire protection	
Control terminals:	Plus-minus terminal screws M3,5 box terminals with wire protection	
Mounting:	DIN rail mounting	IEC/EN 60 715
Weight:	780 g	

Dimensions

Width x height x depth:	90 x 85 x 121 mm

Standard Type

BI 9028.38/900 1 AC 100 ... 480 V 50/60 Hz 5 kW
Article number: 0058687
- Nominal motor power at AC 400 V: 5 kW
- Control input X1/X2
- Width: 90 mm

Control Input

The softstart begins by closing contact S connected to BI 9028/900. By opening contct S the deceleration begins. If contct S closes during deceleration the unit starts to ramp up again.

Adjustment Facilities

Potentiometer	Description	Initial setting
M_{on}	Starting voltage	fully anti-clockwise
t_{on}	Ramp-up time	fully clockwise
M_{off}	Deceleration voltage	fully anti-clockwise
t_{off}	Deceleration time	fully clockwise

Set-up Procedure

Softstart:
1. Start the motor via control input X1/X2 and turn potentiometer "M_{on}" up until the motor starts to turn without excessive humming.
2. Adjust potentiometer "t_{on}" to give desired ramp time.
3. On correct setting the motor should accelerate up to nominal speed. If the start takes too long fuses may blow, especially on motors with high inertia.

- **Attention:** If the ramp-up time is adjusted to short, the internal bridging contact closes before the motor is on full speed. This may damage the bridging contactor or bridging relay.

Softstop:
- During softstop the device has to be connected to the voltage.
- Select softstop by opening control input X1/X2
- Adjust the voltage at which the deceleration stops with Pot. M_{off}.
- Adjust the deceleration time t_{off}.

Temperature Monitoring

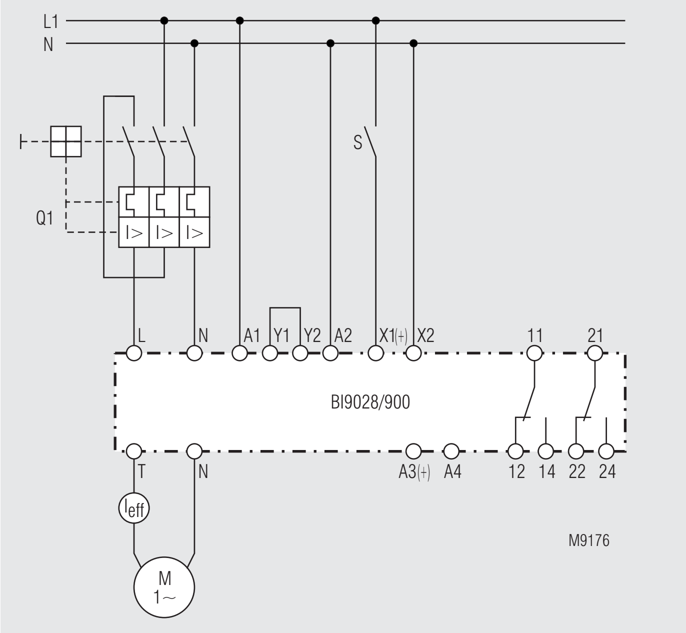
BI 9028/900 features overtemperature monitoring of its internal power semiconductors. The unit is therefore protected against overheating during the set up procedure. BI 9028/900 can be reset after the semiconductors have cooled down by momentarily removing the auxiliary supply voltage.

Safety Notes

- Never clear a fault when the device is switched on.

- **Attention:** This device can be started by potential-free contact, while connected directly to the mains without contactor (see application example). Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor **must** be disconnected from the mains via the corresponding manual motor starter.
- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards.
- Adjustments may only be carried out by qualified specialist staff and the applicable safety rules must be observed.

Connection Example



Softstart and softstop function with switch S

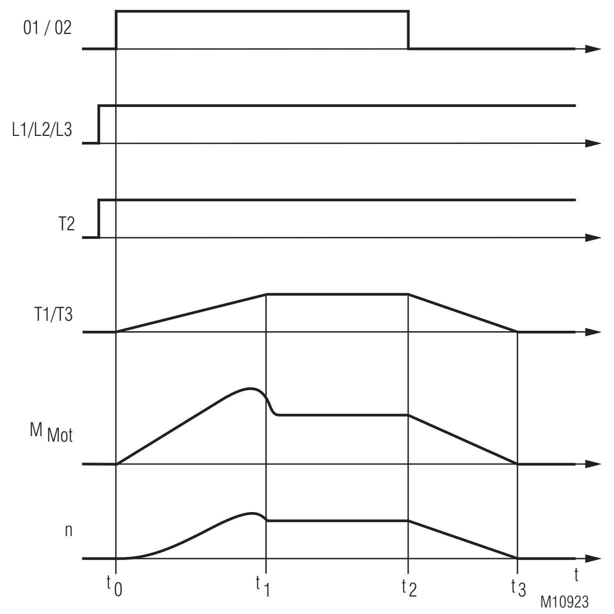
MINISTART
Softstart- / Softstop Device
GI 9014

0269454

GI 9014

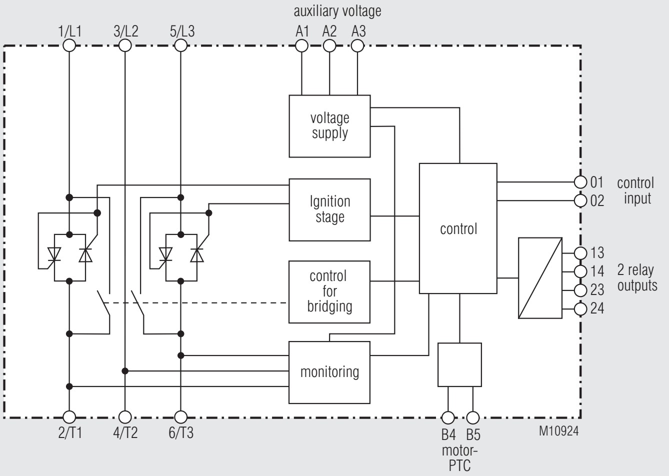
GI 9014 with DeviceNet-module

Function Diagram



t_0 : start
t_1-t_0 : startingtime
t_3-t_2 : decelerationtime

Block Diagram

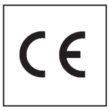


Your Advantages
- Protection of the drive unit
- Space and cost saving because of integrated motor protection:
  - motor overload, phase failure and exceed acceleration time
- Integrated bridging contactor
- Limiting of starting current prevents against mains and equipment overload
- Productivity by shortened stating times on heavy duty stating and high permissible switching frequency
- Individual configuration for every application
- Easy operation
- Comprehensive diagnostic via LED-flashing codes possible

Features
- 2-phase softstarter for asynchronous motors up to 110 kW (400 V)
- Integrated current control time
- Integrated motor protector
- Integrated bridging contactor
- Volt free coltrol input for softstart / -stop
- Connection for motor thermistor
- With two monitoring outputs, one is programmable
- DIN rail mounting with devices up to 30 kW
- Communication interfaces for Profibus, DeviceNet, Modbus and pump controls (optional)
- Start and stop via seperate push buttons or control switch
- Motor voltage range 3 AC 200 ... 440V or 3 AC 200 ... 575V

Adjustable functions:
- Starting time monitoring
- Nominal motor current
- Current ramp
- Current limit
- Softstopp - ramp time
- Motor protection class
- Phase sequence
- Programmable relay output for indicators

Approvals and Markings



Application

- Escalator
- Pumps
- Fans and ventilation systems
- Conveyor systems and elevators
- Compresseors
- Mills, crushers, presses
- ... and for all applicattions with ambitious start-up and deceleration

Indication

LED "On": Indicate the device state
LED "Bypass": Indicate the motor state
flashes with same frequency at error
Failure codes see in operating manual GI 9014

Technical Data

Nominal voltage: 3 AC 200 ... 440 V (+10 % / -15 %)
3 AC 200 ... 575 V (+10 % / -15 %)
Nominal frequency: (at start): 45 ... 66 Hz

Rated current I_N (A):	18	34	42	48	60	75	85	100	140	170	200
Motor power at 400 V (kW):	7,5	15	18,5	22	30	37	45	55	75	90	110
Stromrampe:	2 s, 5 s, 15 s with 150 %; 200 % and 250 % I_N										
Stromgrenze:	250%, 275%, 300%, 325%, 350%, 375%, 400%, 425%, 450% I_N										
Motor protection class:	adjustable										
Deceleration time:	2 s ... 20 s										
operating frequency 4 x I_e and 6 s:	AC 53b 10/h					AC 53b 6/h					
Weight (kg):	2.4					4.3			6.8		

Auxiliary voltage (A1, A2, A3)
optionally: AC 380 to 440 V (+ 10% / - 15%)
and AC 110 to 240V (+ 10% / - 15%)
or AC/DC 24 V (± 20%)
Current consumption
(at operation): < 100 mA
Current consumption
(at starting)
at auxiliary voltage AC 110…440 V: 10 A for 10 ms
at auxiliary voltage AC/DC 24 V: 2 A for 10 ms

Inputs
Start (terminal 01)
NO contact: 150 kΩ at AC 300 V and
5.6 kΩ at DC 24 V
Stop (terminal 02)
NC contact: 150 kΩ at AC 300 V and
5.6 kΩ at DC 24 V
Outputs
Main contactor (terminals 13, 14)
NO contact: 6 A, DC 30 V resistive /
2 A, AC 400 V, AC11
programmable relay
(terminal 23, 24)
NO contact: 6 A, DC 30 V resistive /
2 A, AC 400 V, AC11

General Data

Degree of protection
at 7.5 ... 55 kW: IP 20 IEC/EN 60 529
at 75 ... 110 kW: IP 00 IEC/EN 60 529
IIP 20 with additional finger guard kit
(see accessories)
Temperature range
operation: - 10 °C to + 60 °C
(over +40 °C see derating at Commisioning Instructions)
storage temperature: - 25 ... + 60°C
(to +70 °C for max . 24 h)
Humid: 5% ... 95% relative humid
Rated voltage of insulation: 600 V
Pollution degree: 3
Vibration resistance: Test according to IEC 60068
4 Hz ... 13.2 Hz ± 1 mm Amplitude
13.2 Hz ... 200 Hz: ± 0.7 g
EMC
Electrostatic discharge (ESD): 4 kV (contacts) IEC/EN 61 000-4-2
8 kV (air) IEC/EN 61 000-4-2
Conducted radio frequency
emission: 0.15 MHz to 1000 MHz: 140 dB (µV)

Technical Data

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
Fast transients: 5/50 µs
Voltage dip and
short time interruption: 100 ms (at 40 % nominal voltage)
Harmonics and distortion: IEC 61000-2-4 (class 3), IEC/EN61800-3
Short circuit
Short circuit current
7.5 ... 37 kW: 5 kA
55 ... 110 kW: 10 kA
Heat dissipation:
during start: 3 W/A
during operation: 10 W

Dimensions

Width x height x depth
7.5 / 15 / 18.5 / 22 / 30 kW: 98 x 203 x 165mm
37 / 45 / 55 kW: 145 x 215 x 193 mm
75 / 90 / 110 kW: 202 x 240 x 214 mm

Standard type

GI 9014 3 AC 200 ... 440 V 45 ... 66 Hz 7.5 kW
- Article number: 0062420
- Nominal voltage: 3 AC 200 ... 440 V
- Auxiliary voltage: DC 24 V
- Nominal motor power: 7.5 kW
- Width: 98 mm

Ordering Example

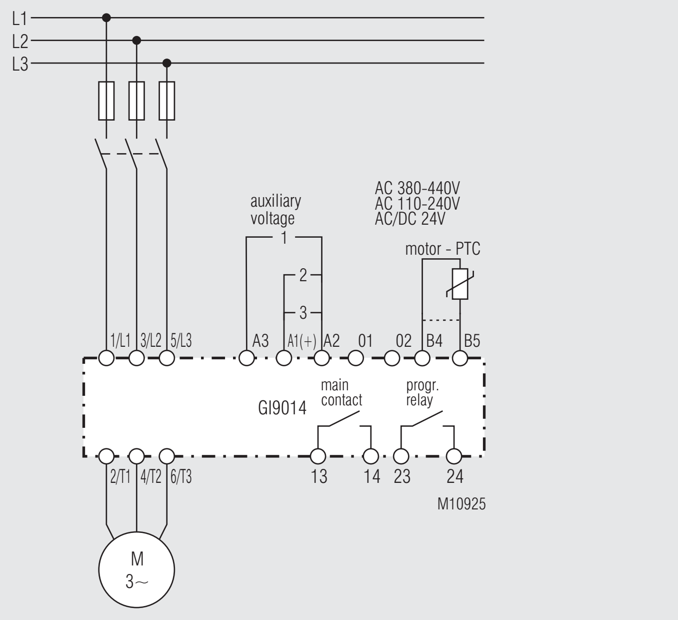
GI 9014 3 AC 200 ... 440 V 45/66 Hz 7,5 kW 3 AC 380 bis 440 V

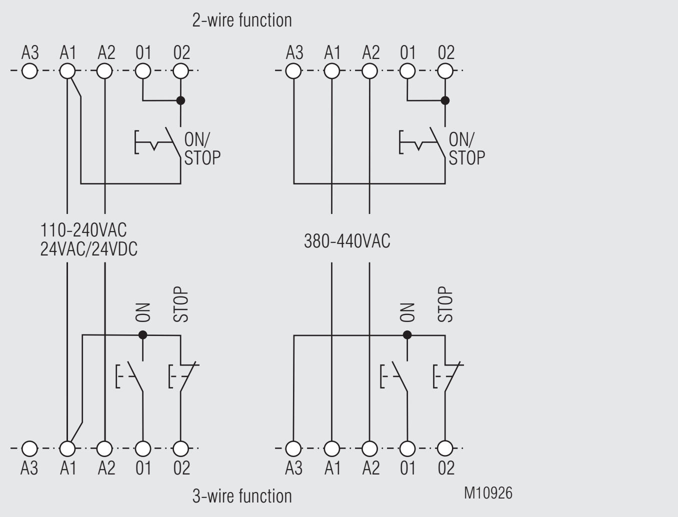
Auxiliary voltage
Nominal motor power
Frequency at start
Nominal motor voltage
Type

Accessories

- GW 5310: Remote control
- GW 5311: Interface for remote control
- GW 5312: DeviceNet-Module
- GW 5313: Modbus-Module
- GW 5314: Profibus-Module
- GW 5316: Finger guard kit and touch protection

Connection Examples

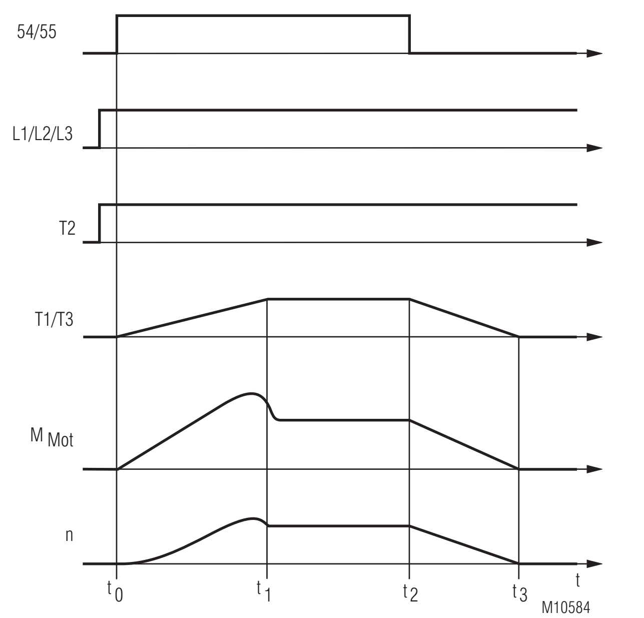




Softstart- / Softstop Device
GI 9015
MINISTART

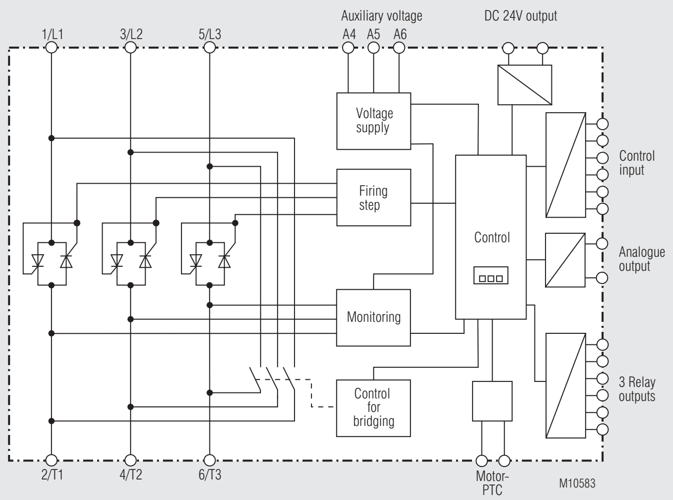
0265519

Function Diagram



t_0 : Start
t_1-t_0 : Startingtime
t_3-t_2 : Decelerationtime

Block Diagram



Your Advantages

- Simple and time saving as well as user friendly operation because of
  - "Adaptive acceleration control" (self learning acceleration control)
  - Graphical LCD display for parameterization and visualisation
- Adjustable bus bars for units from 360 A ... 1600 A for easy connection
- Comprehensive and customer specific motor protection functions because thermal motor modell - external motor protection is not neccessary
- Emergency operation, i.e. in the case of failure a 2-phase control allows motor operation
- Slow motion operation forward and reverse
- DC brake (contact free), therfore no brake contactor neccessary

Features

- 3-phase softstarter for asynchronous motors up to 800 kW (400 V)
- W3 connection up to 1300 kW (400V)
- Nominal current 23 ... 1600 A
- Integrated bridging contactor up to 220 A
- Programmable in- and outputs for fault indication and operation
- Motor-PTC connection possible
- Communication interfaces as option for Profibus, Devicenet or Modbus
- Start and stop via seperate push buttons or control switch

Adjustable functions:

- Emergency operation
- Slow motion operation forward and reverse
- Control input (3 x fixed, 1 x programmable)
- Relay output (3 x programmable)
- 24 V DC output
- Analogue output
- Different softstart / stop modes
- 690 V units on request

Approval and Markings

CE

Application

- Pumps
- Fans and ventilation systems
- Conveyor systems and elevators
- Compresseors
- Mills, crushers, presses
- ... and for all applicattions with ambitious start-up and deceleration

Indication

Graphical LCD display for parameterization and visualisation

Technical Data

Nominal voltage: 3 AC 200 ... 525 V ($\pm$ 10 %)
3 AC 380 ... 690 V ($\pm$ 10 %)
Nominal frequency: (at start): 45 ... 66 Hz

Rated current I_N (A):	23	43	53	76	105	145	170
Motor power at 400 V (kW):	-11	-18.5	-30	-45	-55	-75	-90
I^2T-Power semiconductor fuse (kA^2s):	1.15	8	15	15	125	125	320
Weight (kg):	3.2	3.2	3.2	3.5	4.8	16	16

Rated current I_N (A):	220	255	380	430	650	790	930
Motor power at 400 V (kW):	-110	-132	-200	-250	-310	-400	-500
I^2T-Power semiconductor fuse (kA^2s):	320	320	320	320	1200	2530	4500
Weight (kg):	16	25	50.5	50.5	53.5	53.5	53.5

Rated current I_N (A):	1200	1410	1600
Motor power at 400 V (kW):	600	700	800
I^2T-Power semiconductor fuse (kA^2s):	4500	6480	12500
Weight (kg):	140	140	140

Softstart mode: Constant current, voltage ramp, "Adaptive acceleration control", kick start
Deceleration mode: Softstopp, braking, free wheeling
Operating frequency 3 x I_e and 10 s: AC53b 3.0 - 10:350 10 h
Switching capacity relay output: 10 A / AC 250 V ohmic;
5 A /AC 250V AC15
ambient-temperature: - 10 °C ... + 40 °C (+60 °C Derating)
Auxiliary voltage (A4, A5, A6)
either: AC 110 and 220 V (+ 10% / - 15%; 600 mA)
or**:** AC/DC 24 V ($\pm$ 20%)

Inputs
Nominal value for "active input": DC 24 V, 8 mA
Start (54,55): normally open
Stopp (56,57): normally closed
Reset (58,57): normally closed
programmable input (53,55): NO contact
Motor thermistor (64, 65) response > 3.6 kΩ;
reset < 1.6 kΩ

Outputs
Relay outputs 10 A at AC 250 V ohmic, 5 A at AC 250 V AC15 Lf 0.3
programmable outputs
relay A (13, 14): normally open
relay B (21, 22, 24): change-over
relay C (33, 34): normally open
Analogue output (40, 41): 0 ... 20 mA or 4 ... 20 mA (adjustable)
Max. load: 600 W (DC 12 V at 20 mA)
Accuracy: $\pm$ 5 %
DC 24 V-output (P24, COM) max. load: 200 mA
Accuracy: $\pm$ 10 %

Technical Data

Short circuit capability
Coordination with semiconductor fuses: Typ 2
Coordination with HRC fuses: Typ 1
23 ... 105 A prospective current: 10 kA
145 ... 255 A prospective current: 18 kA
360 ... 930 A prospective current: 85 kA
1200 ... 1600 A prospective current: 100 kA

General Data

Degree of protection
at 23 ... 105 A: IP 20 IEC/EN 60 529
at 145 ... 1600 A: IP 00 IEC/EN 60 529
at 145 ... 220 A: IP 20 with additional finger guard kit (see accessories)

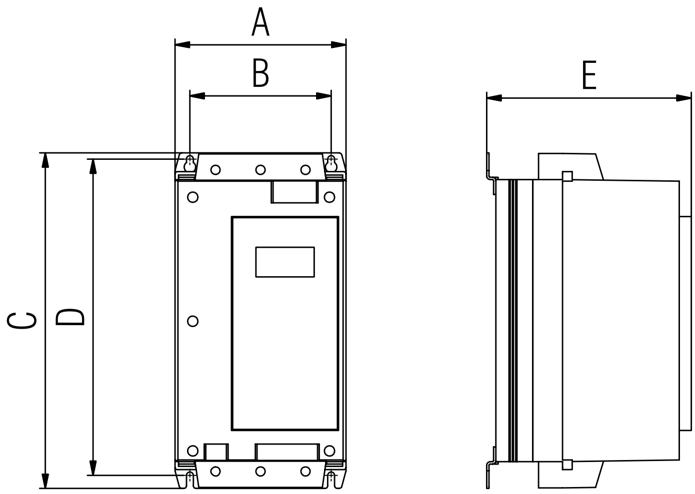
Temperature range
operation: - 10 °C ... + 60 °C
over 40 °C with low nominal value
storage temperature: - 25 ... + 60°C
Altitude: 0 ... 1000 m
over 1000 m with low nominal value
Humid: 5% ... 95% relative humid
Pollution degree: 3
Rated insulation voltage to earth: AC 600 V
rated impulse voltage fuse: 4 kV
Form designation: Bypassed or continuous, semiconductor motor starter form 1

EMC
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
Fast **transients**: 5/50 μs
Voltage dip and short time interruption: 100 ms (at 40 % nominal voltage)
Harmonics and distortion: IEC 61000-2-4 (class 3), IEC/EN61800-3
Short circuit
Short circuit current
7.5 ... 37 kW: 5 kA
55 ... 110 kW: 10 kA
Heat dissipation:
during start: 4,5 Watt / Ampere
during operation
23 ... 53 A: $\leq$ 39 Watt (approx.)
76 ... 105 A: $\leq$ 51 Watt (approx.)
145 ... 220 A: $\leq$ 120 Watt (approx.)
during operation
255 ... 930 A: 4.5 Watts / Ampere (approx.)
1200 ... 1600 A: 4.5 Watts /Ampere (approx.)

Technical Data

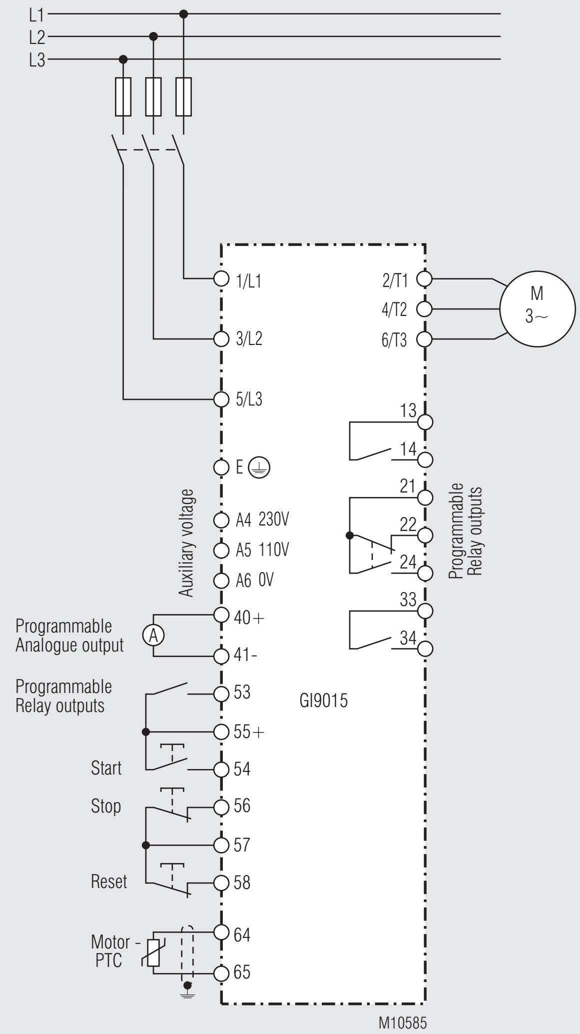
Dimensions

<table>
<tr><th>Unit</th><th>A
mm</th><th>B
mm</th><th>C
mm</th><th>D
mm</th><th>E
mm</th><th>Weight
kg</th></tr>
<tr><td>23 A</td><td rowspan="5">156</td><td rowspan="5">124</td><td rowspan="5">295</td><td rowspan="5">278</td><td rowspan="3">192</td><td rowspan="3">3.2</td></tr>
<tr><td>43 A</td></tr>
<tr><td>53</td></tr>
<tr><td>76</td><td rowspan="2">223</td><td>3.5</td></tr>
<tr><td>105</td><td>4.8</td></tr>
<tr><td>145</td><td rowspan="3">282</td><td rowspan="3">250</td><td rowspan="3">438</td><td rowspan="3">380</td><td rowspan="3">250</td><td rowspan="3">16</td></tr>
<tr><td>170</td></tr>
<tr><td>220</td></tr>
<tr><td>255</td><td>390</td><td>320</td><td>417</td><td>400</td><td>281</td><td>25</td></tr>
<tr><td>380</td><td rowspan="5">430</td><td rowspan="5">320</td><td rowspan="5">545</td><td rowspan="5">522</td><td rowspan="5">302</td><td rowspan="2">50.5</td></tr>
<tr><td>430</td></tr>
<tr><td>650</td><td rowspan="3">53.5</td></tr>
<tr><td>790</td></tr>
<tr><td>930</td></tr>
<tr><td>1200</td><td rowspan="3">574</td><td rowspan="3">500</td><td rowspan="3">750</td><td rowspan="3">727</td><td rowspan="3">361</td><td rowspan="3">140</td></tr>
<tr><td>1410</td></tr>
<tr><td>1600</td></tr>
</table>



M4202_a

Connection Example



Ordering Example

GI 9015 3 AC 200 ... 525 V 105 A AC 110 V and 220 V

- Auxiliary supply
- Rated current I_N
- Nominal voltage
- Type

Accessories

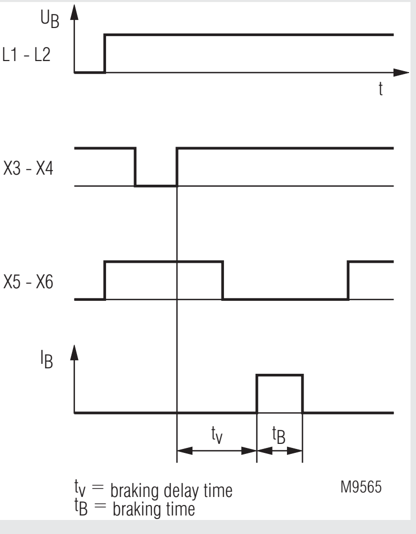
- GW 5312: DeviceNet-Module
- GW 5313: Modbus-Module
- GW 5314: Profibus-Module
- GW 5316: Finger guard kit and touch protection

MINISTOP
Motor Brake Relay
BA 9034N

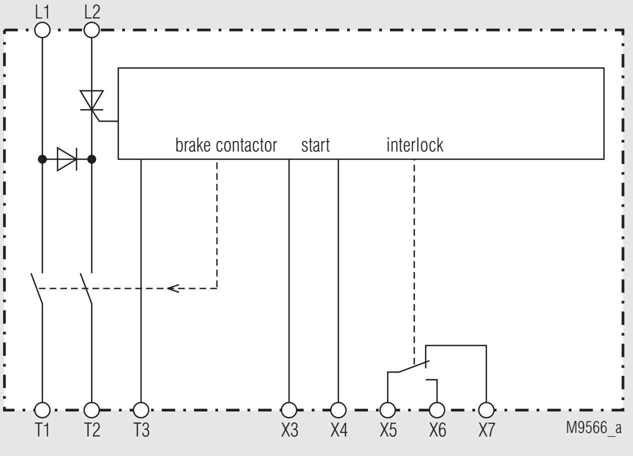
DOLD

0256981

Function Diagram



Block Diagram



Your advantages
- Higher safety level and more economic by short stopping cycle
- Cost saving
- Compact design
- Easily appliance, no need for current measuring instrument

Features
- According to IEC/EN 60947-4-2
- For all single and 3-phase asynchronous motors
- DC-brake with one way rectification up to max. 32 A_{eff}
- Controlled by microcontroller
- Easily fitted to existing installations
- Wear free and maintenance free
- Integrated braking contactor
- DIN-rail mounting
- Adjustable braking current (controlled current)
- With automatic standstill detection
- Variante /100
  - with braking time control
  - without detection of standstill
- Width: 45 mm

Approvals and Markings

CE

Applications

- Saws
- Centrifuges
- Woodworking machines
- Textile machines
- Conveyors

Function

The supply voltage is connected to terminals L1-L2 and the interlock contact X5-X6 closes to enable the motor contactor. A green LED indicates operation. The motor can be started with the start button.
The braking DC-voltage is generated on terminals T_1 and T_2.
The braking sequence is as follows:
Pressing the stop button de-energises the motor contactor. The closing of X3-X4 (contact of the motor contactor) starts the braking. After a safety time the braking contactor closes for the adjusted braking time and the braking current flows through the motor.

Notes

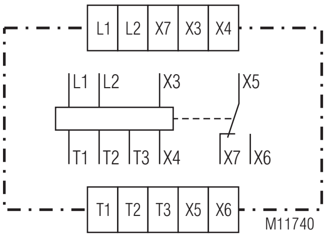
Terminal 3 is the measuring input for standstill detection.
The BA 9034N can be also used without connecting T3. Standstill will be detected by the current measuring. It is important to make sure, that the braking current will flow longer than 2 s before stopping the motor. If the motor stops to early, the standstill will not be detected on the braking current will flow for the maximum braking time.

To have an optimal standstill detection make sure that the braking current is greater than the nominal current of the motor.

If the back-EMF of the motor drops only slowly the unit may have a braking delay of up to 2 s.

On variant /100 the braking current flows for the adjusted time t_B.

Circuit Diagram



Connection Terminals

Terminal designation	Signal description
X3	Start braking, NC contact
X4	Start braking, NC contact
X5, X6	Interlock for monitor contactor
X5, X7	Star-contactor control
L1	Phase voltage L1
L2	Phase voltage L2
T1	Motor connection T1
T2	Motor connection T2
T3	Motor connection T3 (detection of standstill)

Indicators

LED green „RUN“:	- ready:	permanent on
LED red „Error“	- Mains frequency out of tolerance	flashes 1 times
	- Braking current is not present:	flashes 2 times
	- Power semiconductors overheated:	flashes 3 times
	- Synchronisation signal is not present:	flashes 4 times
	- Temperature measuring circuit defective:	flashes 5 times
	- Motor voltage not disconnected:	flashes 6 times
LED yellow „I_B“	- max. braking time 11 s Braking current is present	permanent on
	- max. braking time 31 s Braking current is present	flashes

Technical Data

Nominal Voltage U_N: AC 230 V ± 10 %, AC 400 V ± 10 %
Nominal frequency: 50/60 Hz ± 3 Hz
Permissing braking current: 2 ... 10 A_{eff} , 5 ... 25 A_{eff} , 5 ... 32 A_{eff}
Duty-cycle at max. braking current: 8 %
Braking voltage: DC 10 ... 190 V
Max. braking time: 11 s
Braking delay for fade out of back EMF: auto optimising (0.2 ... 2 s)
Nominal consumption for control circuit: 5 VA
Short circuit strength max. fuse rating
Line protection: 20 A gG / gL IEC/EN 60 947-5-1
Assignment type: 1 IEC/EN 60 947-4-1
Semiconductor fuse: max. 1200 A^2s Typ gR
Assignment type: 2 IEC/EN 60 947-4-1

Output

Contacts: 1 changeover contact 5 A / AC 250 V
Switching capacity to AC 15:
NO contact: 5 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 2 A / AC 230 V IEC/EN 60 947-5-1
Electrical life: 1 x 10^5 switching cycles
Mechanical life: 50 x 10^6 switching cycles

General Data

Operating mode: Continuous operation
Temperature range:
Operation: 0°C ... + 45°C
Storage: - 25°C ... + 75°C
Relative air humidity: 93 % at 45°C
Altitude: < 2,000 m
Clearance and creepage distance
Rated impulse voltage / pollution degree
Relay contacts to supply voltage: 4 kV / 2 IEC 60 664-1
Overvoltage category: III
EMC
Interference resistance
Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61 000-4-2
HF irradiation:
80 MHz ... 1.0 GHz: 10 V / m IEC/EN 61 000-4-3
1.0 GHz ... 2.5 GHz: 3 V / m IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz: 1 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge
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
Irradiation
Interference suppression: Limit value class B EN 55 011
Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm, Frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
Climate resistance: 25 / 075 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection:
Cross section: 2 x 2,5 mm^2 solid or 1 x 1,5 mm^2 stranded ferruled DIN 46 228-1/-2/-3/-4
Stripping length: 10 mm
Wire fixing: Flat terminals with self-lifting clamping piece IEC/EN 60 999-1
Fixing torque: 0.8 Nm
Mounting: DIN rail IEC/EN 60 715
Weight: 600 g

Dimensions

Width x height x depth: 45 x 73 x 122 mm

Standard Type

BA 9034N 25 A AC 400 V 50 / 60 Hz 2 ... 11 s
Article number: 0061337

- Integrated braking contactor
- DIN-rail mounting
- Width: 45 mm

Variant

BA 9034N/100: without standstill monitoring and with potentiometer for setting of braking delay time up to 15 s

Ordering example for variant

BA 9034N /100 25 A AC 400 V 50 / 60 Hz

- Nominal frequency
- Nominal voltage
- Max. braking current
- Variant, if required
- Type

Control Input

If the connection between X3-X4 is opened, the device turns into standby mode. After closing the connection, the device starts with braking.
The device can be started also without control on X3-X4. In this case the braking delay is slightly longer up to 1.5 s.

Monitoring Output

X5, X6: Interlock contact for motor contactor. This contact will be open at system error, this means that the motor cannot be started!
X5, X7: Activation of the star contactor in a star-delta circuit during braking

Adjustment Facilities

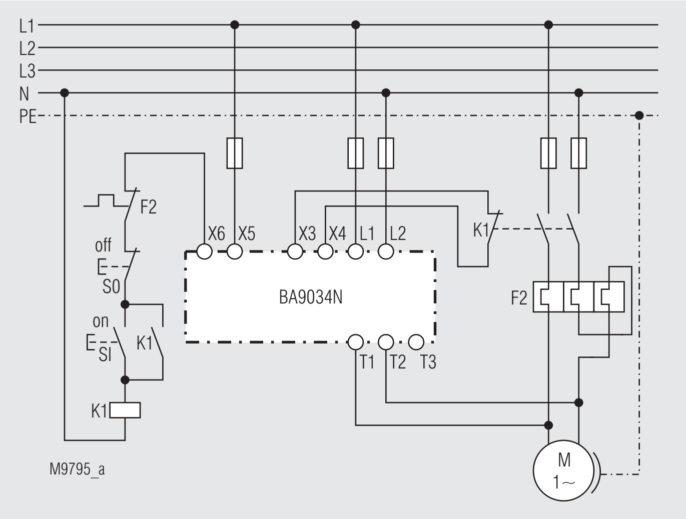
Potentiometer	Description	Initial setting
I_B	Braking current	Fully anti-clockwise

Variant /100:

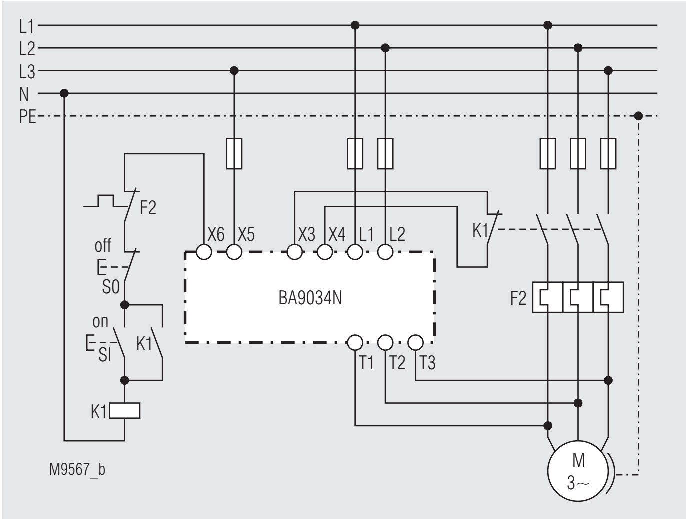
Potentiometer	Description	Initial setting
T_B	Braking delay time	Fully clockwise

The braking current is controlled according to the adjusted value in Ampere.

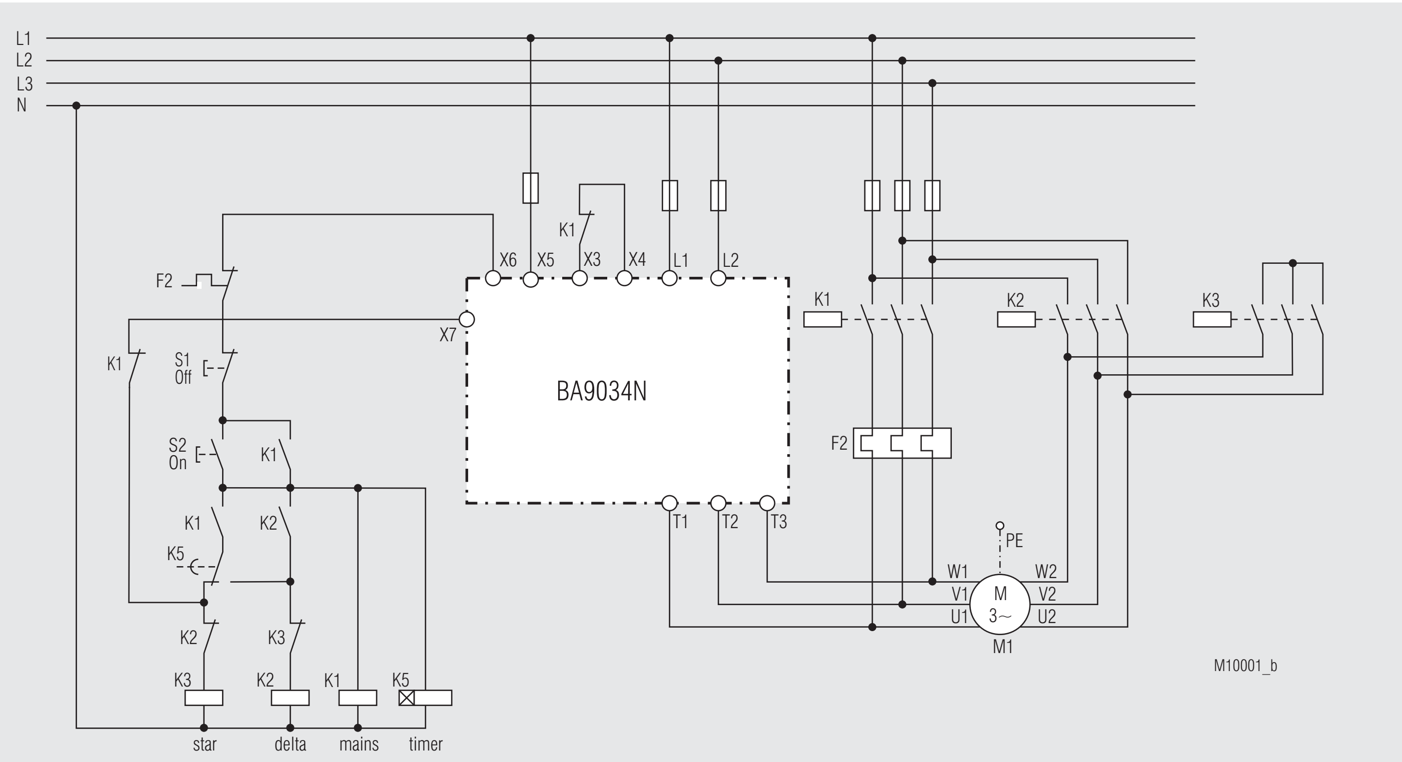
For optimum braking the setting of the current should be max. 1.8 to 2 times the motor current. This corresponds to the saturation current of the magnetic field used to brake the motor. A higher current only overheats the motor. A higher braking efficiency can be obtained by using 2 or more stator windings. The permitted duty cycle is depending on the actual braking current and the ambient temperature.



BA 9034N, single-phase

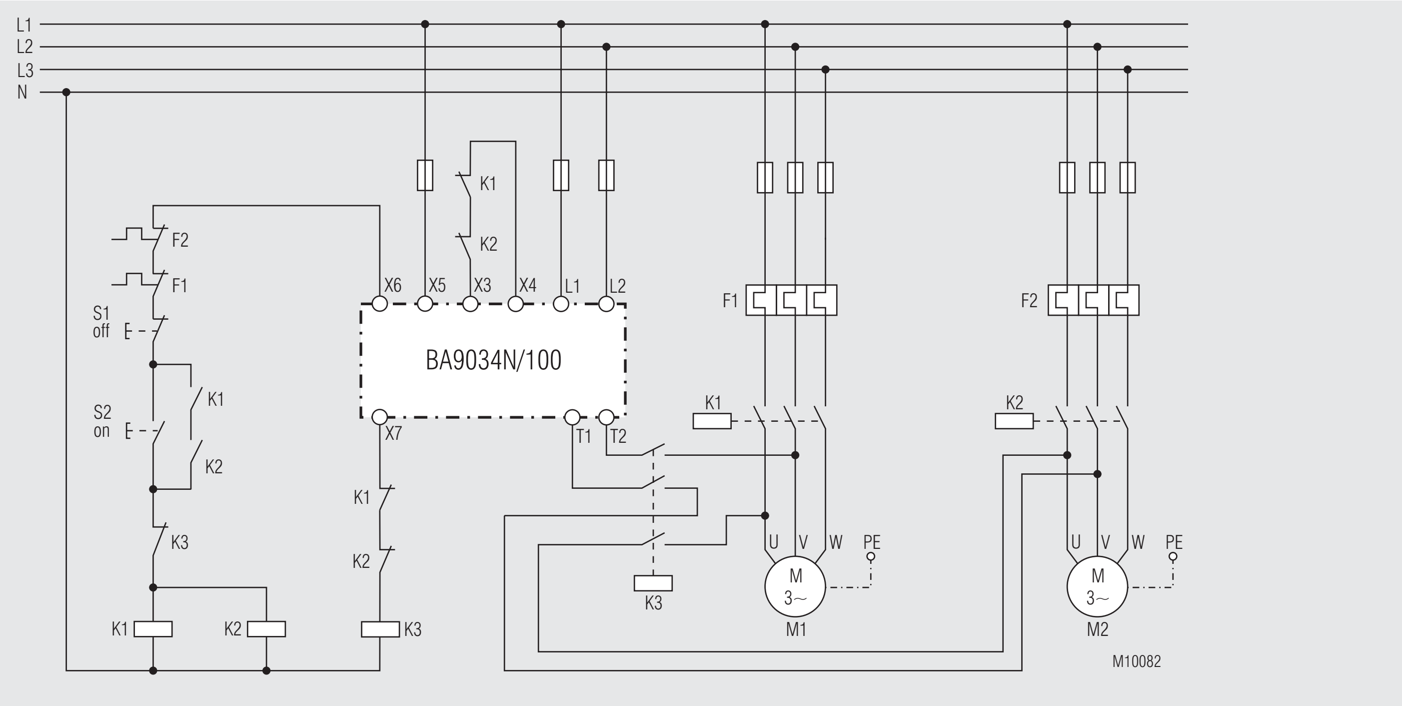


BA 9034N, 3-phase

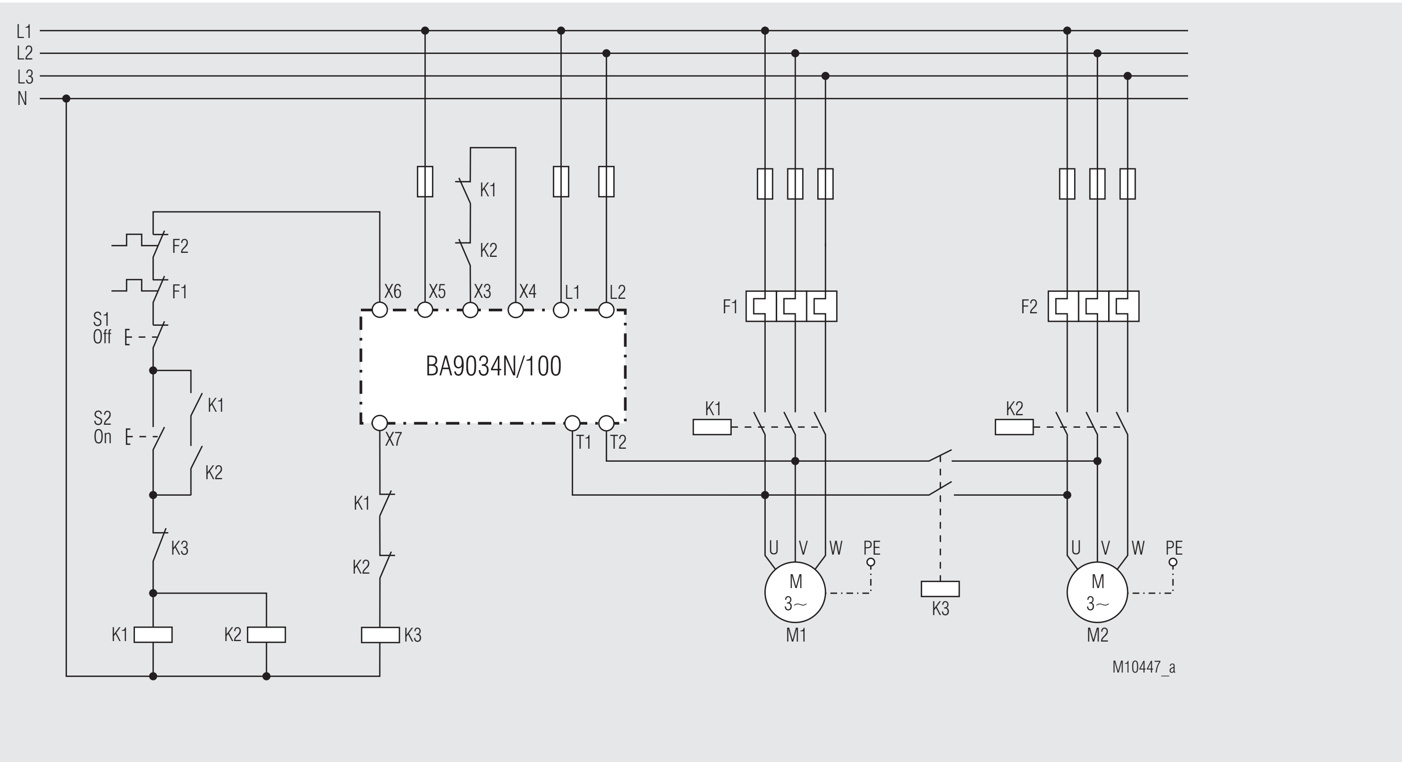


BA 9034N, 3-phase, ⅄Δ-start up

Connection Example



BA 9034N/100 simultaneous braking of 2 motors in serial connection for higher motor loads



BA 9034N/100 simultaneous braking of 2 motors in parallel connection for lower motor loads

Set-up Procedure

- Connect the motor braking relay BA 9034N in accordance to the connection example and make sure to connect the same phases between (L1, L2) and /T1, T2). Make sure that the interlocking contact X5, X6 is wired in series to the coil of the motor contactor so that the motor contactor cannot switch on, while the braking current is flowing

- Set the braking current in the potentiometer scale.
  To avoid overloading of the motor set the current to max. two times the nominal motor current

- The braking time of the BA 9034N cannot be adjusted. Due to the standstill detection it is self-optimizing. If L3 is not connected to T3 standstill detection is provided by measuring the braking current.

- If no standstill is detected, the BA 9034N stops braking after 10 s

Fault Indication by Flashing Code

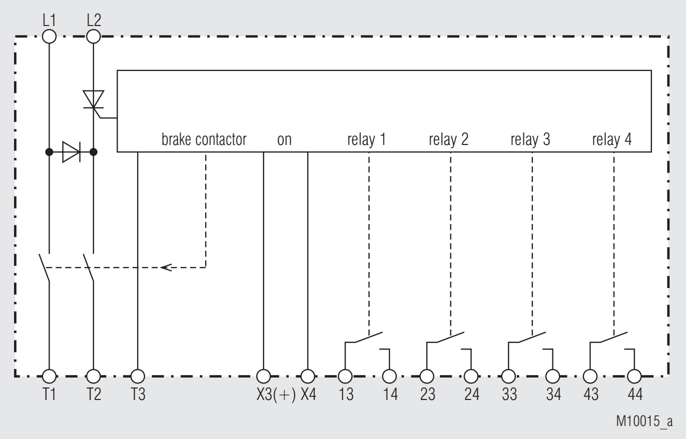
During normal operation failure messages may occur. The messages are indicated by a flashing sequence of the „Error“ LED

Flashes	Fault	Reason	Failure recovery
1 x	Mains frequency out of tolerance	Wrong mains frequency	Device not suitable for the frequency. Contact manufacturer
2 x	Breaking current is not present	Braking current circuit broken	Check the wiring
		Motor coil resistance is too high	Set braking current lower until the error disappears
3 x	Power semiconductors overheated	Permitted duty cycle exceeded	Decrease current and set the braking time longer. Wait till heat sink cools down
4 x	Synchronisa-tions signal is not present	Unit defective	The unit has to repaired
		or temporary interruption of power supply	Switch unit Off and On
5 x	Temperature measuring circuit defective	Unit defective	The unit has to repaired
		or overtemperature on power semiconductors while switching on	Wait till heat sink cools down
6 x	Motor is still connected to voltage while braking should start already	Motor contactor welded	Change motor contactor
		Wiring incorrect	Check wiring
7 x	Braking relay is welded	Unit defective	The unit has to repaired

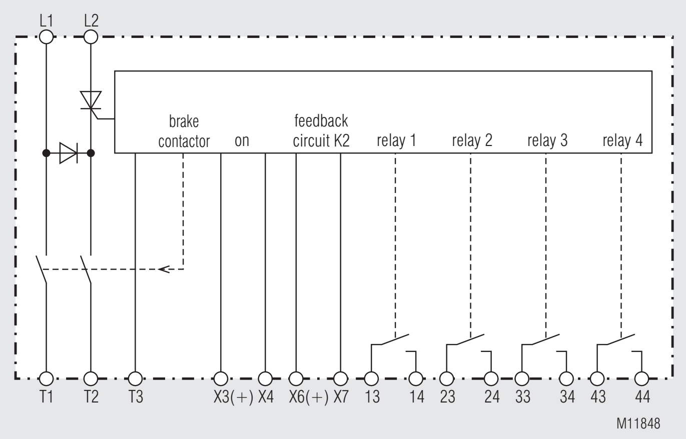
MINISTOP
Motor Brake Relay
BI 9034

0260271

Block Diagrams



BI 9034



BI 9034/800

Your advantages

- Higher safety level and more economic by short stopping cycle
- Cost saving
- Compact design
- Easy to set-up, no need for current measuring instrument

Features

- According to IEC/EN 60947-4-2
- For all single and 3-phase asynchronous motors
- DC-brake with one way rectification up to max. 60 A
- Controlled by microcontroller
- Easily fitted to existing installations
- Wear free and maintenance free
- Integrated braking contactor
- DIN-rail mounting
- Adjustable braking current up to max. 60 A (controlled current)
- With integrated star-delta starting function
- With automatic standstill detection
- Variant /800 with short circuit contactor control for reduced brake delay time
- 90 mm Width

Approvals and Markings

CE

Applications

- Saws
- Centrifuges
- Woodworking machines
- Textile machines
- Conveyors

Function

The supply voltage is connected to terminals L1-L2 and the interlock contact X5-X6 closes to enable the motor contactor. A green LED indicates operation. The motor can be satrted with an ON push button. Depending on the position of the rotary selector switch the motor starts direct on line or with star-delta start. The braking DC-voltage is generated on terminals T_1 and T_2. The braking sequence is as follows:
Pressing the stop button de-energises the motor contactor. The closing of X3-X4 (contact of the motor contactor) starts the braking. After a safety time the braking contactor closes for the adjusted braking time and the braking current flows through the motor.
To reduce the brake delay time there is a variant /800 with a short circuit contactor control. By using a contactor controlled by relay 2, the motor windings are shortcircuited on motor stop. This cuts down the back emf very fast. The braking of the motor can be started faster. The braking cycle is time controlled, no standstill detection.

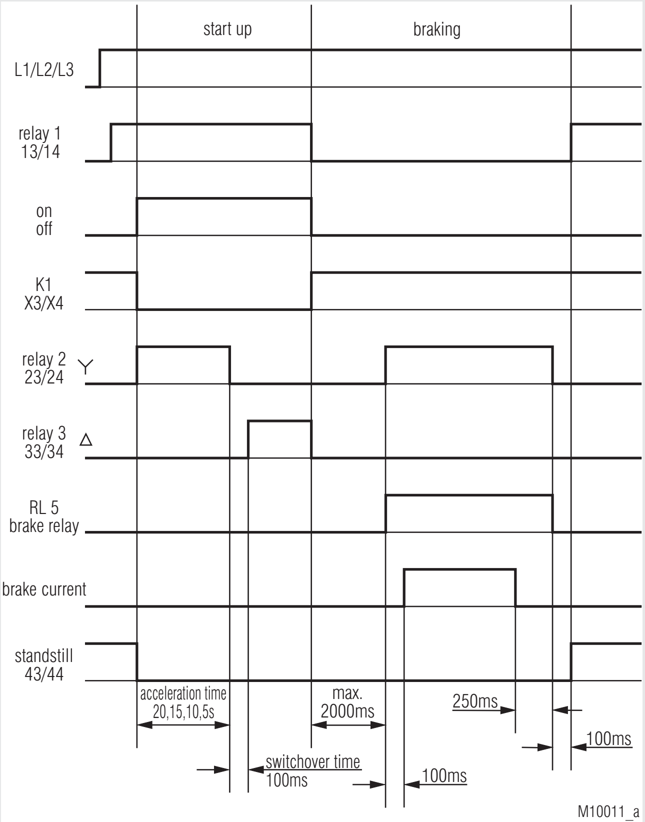
Notes

Terminal 3 is the measuring input for standstill detection.
The BI 9034 can be also used without connecting T3. Standstill will be detected by the current measuring. It is important to make sure, that the braking current will flow longer than 2 s before stopping the motor. If the motor stops to early, the stillstand will not be detected and the braking current will flow for the maximum braking time.

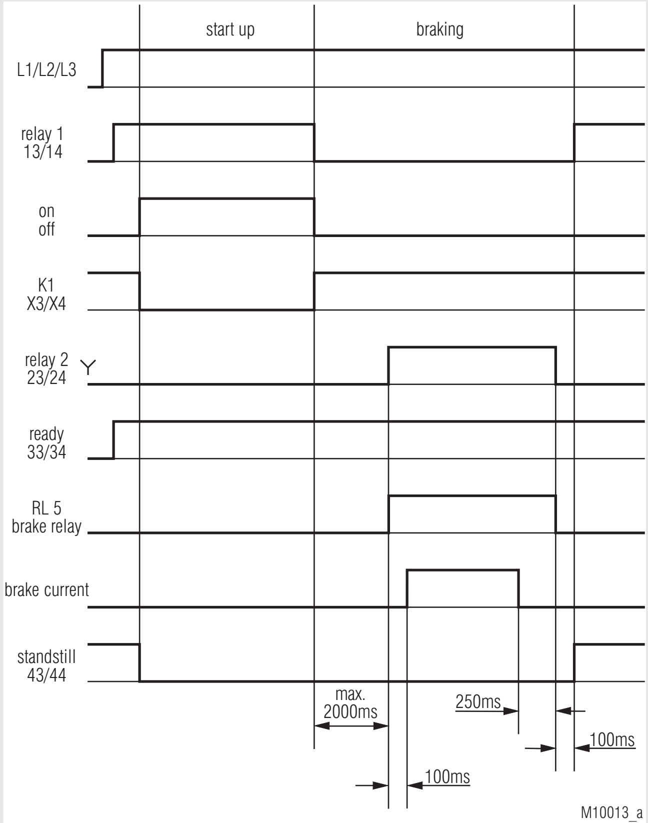
To have an optimum standstill detection make sure that the braking current is higher than the nominal current of the motor.

If the back-EMF of the motor drops only slowly the unit may have a braking delay of up to 2 s.

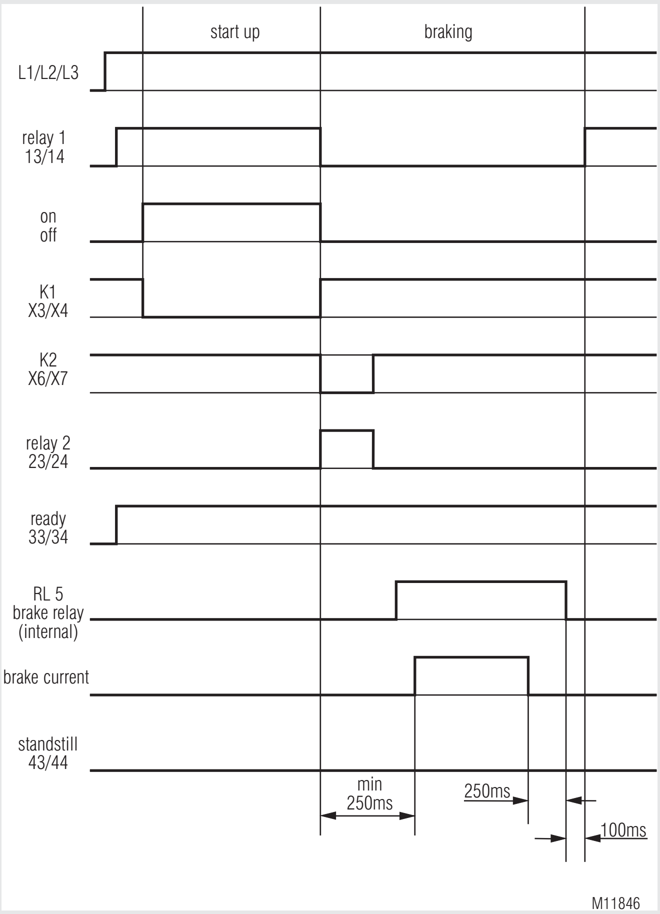
The variant /800 allows to reduce the brake delay time down to 250 ms.



BI 9034 Function 1 ... 4

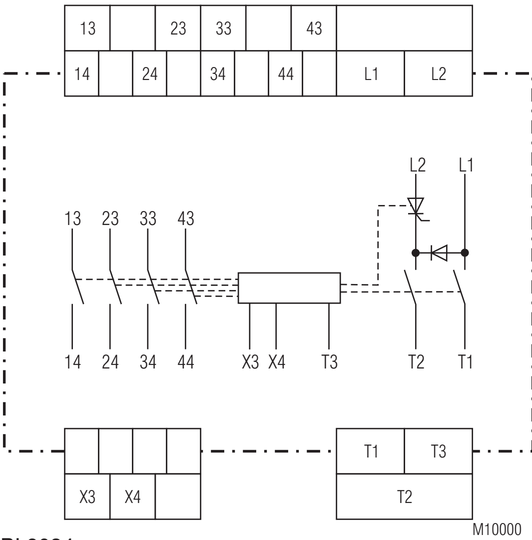


BI 9034 Function 5

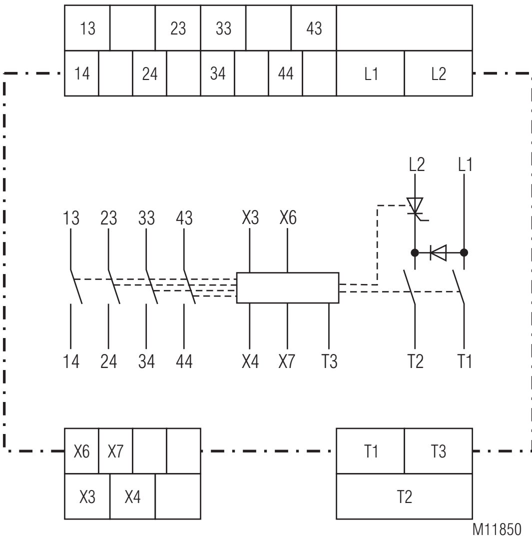


BI 9034/800

Circuit Diagrams



BI 9034



BI 9034/800

Connection Termials

Terminal designation	Signal description
L1	Phase voltage L1
L2	Phase voltage L2
T1	Motor connection T1
T2	Motor connection T2
T3	Motor connection T3 (stand still detection)
X3	(+) Feed back motor contactor
X4	Feed back motor contactor
13, 14	Monitoring relay 1
23, 24	Monitoring relay 2
33, 34	Monitoring relay 3
43, 44	Monitoring relay 4
X6	(+) Feed back short circuit contactor (/800 only)
X7	Feed back short circuit contactor (/800 only)

Indicators

LED green „RUN“:	- ready:	permanent on
LED red „Error“	- Mains frequency out of tolerence	1 flash
	- Braking current is not present:	2 flashes
	- Power semiconductors overheated:	flashes 3 times
	- Synchronisation signal is not present:	flashes 4 times
	- Temperature measuring circuit defective:	flashes 5 times
	- Motor voltage not diconnected:	flashes 6 times
	- Variant /800 only short circuit contactor not de-energized:	flashes 7 times
LED yellow „I_{Br}“	- max. braking time 11 s Braking current is present	permanent on
	- max. braking time 31 s Braking current is present	flashes

Technical Data

Nomial Voltage U_N:	AC 230 V ± 10 %, AC 400 V ± 10 %
Nomial frequency:	50/60 Hz ± 3 Hz
Permissing braking current::	10 ... 60 A $_{eff}$
Duty-cycle at max. braking current:	40 %
I^2t-value of power semiconductors:	6600 A^2 s
Braking voltage:	DC 10 ... 190 V
Braking delay for fade out of back EMF:	
BI 9034:	auto optimising (0.2 ... 2 s)
BI 9034/800:	0.25 s via short circuit contactor
Nominal consumption for control circuit:	5 VA
Fuses	
according to rule 1:	Type gL / 60 A
according to rule 2:	Type gR / I^2t 6600 A^2s

Output

Contacts:	4 NO contacts	2 A / AC 400 V
Switching capacity to AC 15		
NO contact:	3 A / AC 250 V	IEC/EN 60 947-5-1
Electrical life:	10^5 switch. cycles	IEC/EN 60 947-5-1
Mechanical life:	10^6 switch. cycles	IEC/EN 60 947-5-1
Permissible switching frequency:	1800 switcing cycles / h	
Short circuit strength		
max. fuse rating:	4 A gG / gL	IEC/EN 60 947-5-1

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	0 ... + 45 °C	
Storage:	- 25 °C ... + 75 °C	
Altitude:	< 1.000 m	
Clearance and creepage distance		
rated impulse voltage / pollution degree		
Nominal voltage-heat sink:	6 kV / 2	EN 50 178
Relay contacts to supply voltage:	4 kV / 2	IEC 60 664-1
Overvoltage:	III	
EMC		
Störfestigkeit		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:		
80 MHz ... 1.0 GHz:	10 V / m	IEC/EN 61 000-4-3
1.0 GHz ... 2.5 GHz:	3 V / m	IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz:	1 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4

Technical Data

Surge		
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
Interference emission		
Wire guided:	Limit value class A*)	IEC/EN 60 947-4-2
Radio irradiation:	Limit value class A*)	IEC/EN 60 947-4-2
	*) The device is designed for the usage under industrial conditions (Class A, EN 55011). When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.	
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, Frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	25 / 075 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection		
Load terminals:	1 x 10 mm² solid 1 x 6 mm² stranded ferruled A current of 60 A or 80 A is permitted at a.m. duty cycles for 6 mm² wiring	
Control terminals:	1 x 4 mm² solid or 1 x 2.5 stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3	
Wire fixing		
Load terminals:	Plus-minus terminal screws M 4 box terminals with self-lifting clamping piece	
Fixing torque:	1.2 Nm	
Control terminals:	Plus-minus terminal screws M 3,5 box terminals with self-lifting clamping piece	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Rail standard:	EN 50 022	
Weight:	780 g	

Dimensions

Width x height x depth: 90 x 85 x 120 mm

Standard Type

BI 9034 60 A AC 400 V 50 / 60 Hz 2 ... 11 s
Article number: 0062127
- Integrated braking contactor
- DIN-rail mounting
- Width: 90 mm

Ordering Example

BI 9034 60 A AC 400 V 50 / 60 Hz 2 ... 11 s

- 2 ... 11 s — Braking time
- 50 / 60 Hz — Nomial frequency
- AC 400 V — Nominal voltage
- 60 A — Max. braking current
- BI 9034 — Type

Variants on Request

- Second control input e.g. to interrupt braking cycle
- 2 galvanic separated DC 24 V inputs e.g. for control via PLC
- Braking time 1 ... 31 s or to customers specification
- Relay function to customers specification
- Special voltages on request
- Device with time controlled braking cycle, without stand still monitoring, without star-delta-control on request

Control Input

By opening a contact (motor contactor switches on) on terminals X3 (+24vV) and X4 (signal) star-delta starting beginns when function 1...4 is selected. After the adjusted time delay the delta contactor comes on and the brake units waits for the closing of the contact on X3-X4 (stop button is pressed). After closing of this contact the braking cycle starts.

The variant /800 has an extra input X6 (+24V) and X7 (signal) to give feed back from the short circuit contactor K2. The braking cycle is only started when the feed back circuit after operation of the short circuit contactor is closed again.

Monitoring Output

13, 14:	Interlock contact for motor contactor.
23, 24:	Control of star contactor of a star delta starter during start and braking.
33, 34	a) Control of delta contactor when function 1...4 is selected b) ready signal when function 5 is selected
43, 44	Standstill signal, resets on motor start or in case of a failure.

Variante /800

13, 14:	Interlocking for motor contactor
23, 24:	Control of short circuit contactor
33, 44:	Ready signal
43, 44:	No function

On device failure all contacts open

Adjustment Facilities

BI 9034:

Potentiometer	Description	Grundeinstellung
I_{Br}	Braking current	Fully anti-clockwise
Fkt	Function	Fully anti-clockwise

BI 9034/800:

Potentiometer	Benennung	Grundeinstellung
t_{Br}	Braking time	Fully clockwise

The braking current is controlled according to the adjusted value in Ampere.

For optimum braking the setting of the current should be max. 1.8 to 2 times the motor current. This corresponds to the saturation current of the magnetic field used to brake the motor. A higher current only overheats the motor. A higher braking efficiency can be obtained by using 2 or more stator windings. The permitted duty cycle is depending on the actual braking current and the ambient temperature.

The different functions of the brake unit can be selected with rotary switch Fkt

Fkt 1 ... 4:	Star-Delta-control with internal timing Relay 1 - Motor contactor Relay 2 - Star-contactor Relay 3 - Triangle contactor Relay 4 - Stand still
Acceleration time (star-contactor):	Fkt 1 - 20 s Fkt 2 - 15 s Fkt 3 - 10 s Fkt 4 - 5 s
Fkt 5:	Star-Delta-control with external timing Relay 1 - Motor contactor Relay 2 - Star-contactor Relay 3 - Ready Relay 4 - Stand still

Set-up Procedure

- Connect the motor brake relay BI 9034 in accordance to the connection example and make sure to connect the same phases between (L1, L2) and /T1, T2). Make sure that the interlocking contact 13, 14 is wired in series to the coil of the motor contactor so that the motor contactor cannot switch on, while the braking current is flowing

- Select function with rotary switch Fkt

- Set the braking current on potentiometer I_{Br} (braking time at variant /800). To avoid overloading of the motor set the current to max. two times the nominal motor current

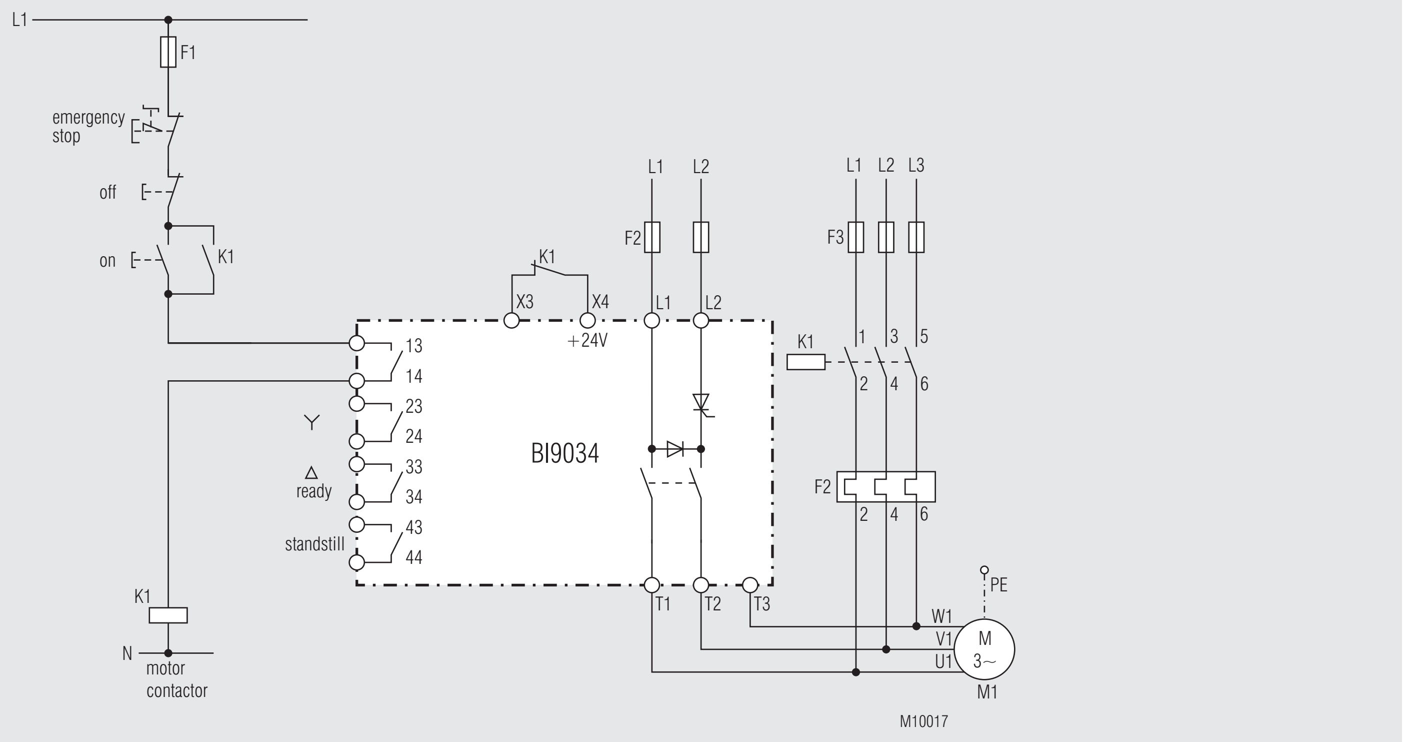
- The braking time of the BI 9034 (exept for BI 9034/800) cannot be adjusted. Due to the standstill detection it is self-optimizing. If L3 is not connected to T3, standstill detection is provided by measuring the braking current.

- If no standstill is detected, the BI 9034 stops braking after 10 s e.g. 30 s

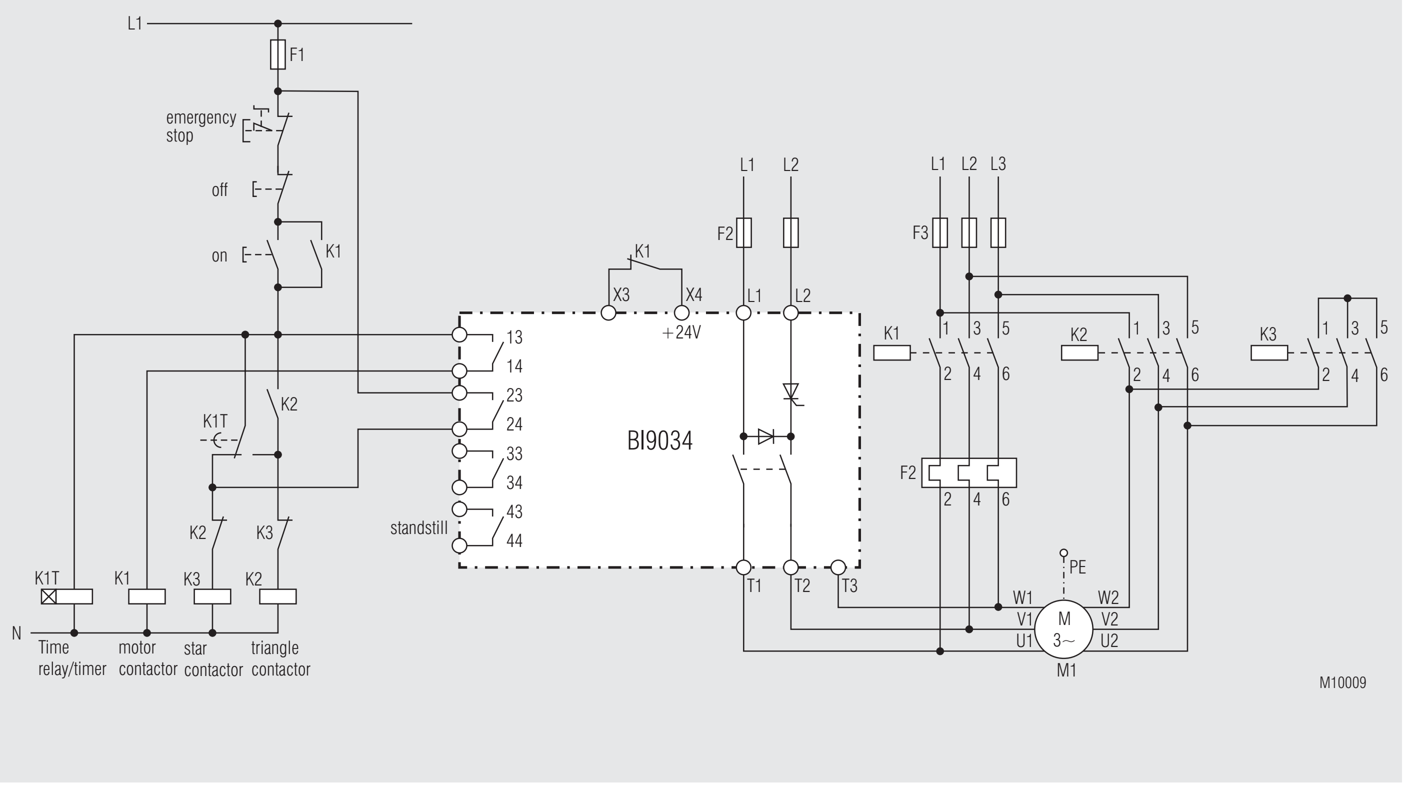
Fault Indication by Flashing Code

During normal operation failure messages may occur. The messages are indicated by a flashing sequence of the „Error“ LED

Flashes	Fault	Reason	Failure recovery
1 x	Mains frequency out of tolerance	Wrong mains frequency	Device not suitable for the frequency. Contact manufacturer
2 x	Breaking current is not present	Braking current circuit broken	Check the wiring
		Motor coil resistance is too high	Set braking current lower until the error disappears
3 x	Power semiconductors overheated	Permitted duty cycle exceeded	Decrease current and set the braking time longer. Wait till heat sink cools down
4 x	Synchronisa-tions signal is not present	Unit defective	The unit has to repaired
		or temporary interruption of power supply	Switch unit Off and On
5 x	Temperature measuring circuit defective	Unit defective	The unit has to repaired
		or overtemperature on power semiconductors while switching on	Wait till heat sink cools down
6 x	Motor is still connected to voltage while braking should start already	Motor contactor welded	Change motor contactor
		Wiring incorrect	Check wiring
7 x	Short circuit contactor not de-energised when braking cycle should be started	Short circuit contactor welded, faulty wiring	Exchange short circuit contactor, check wiring

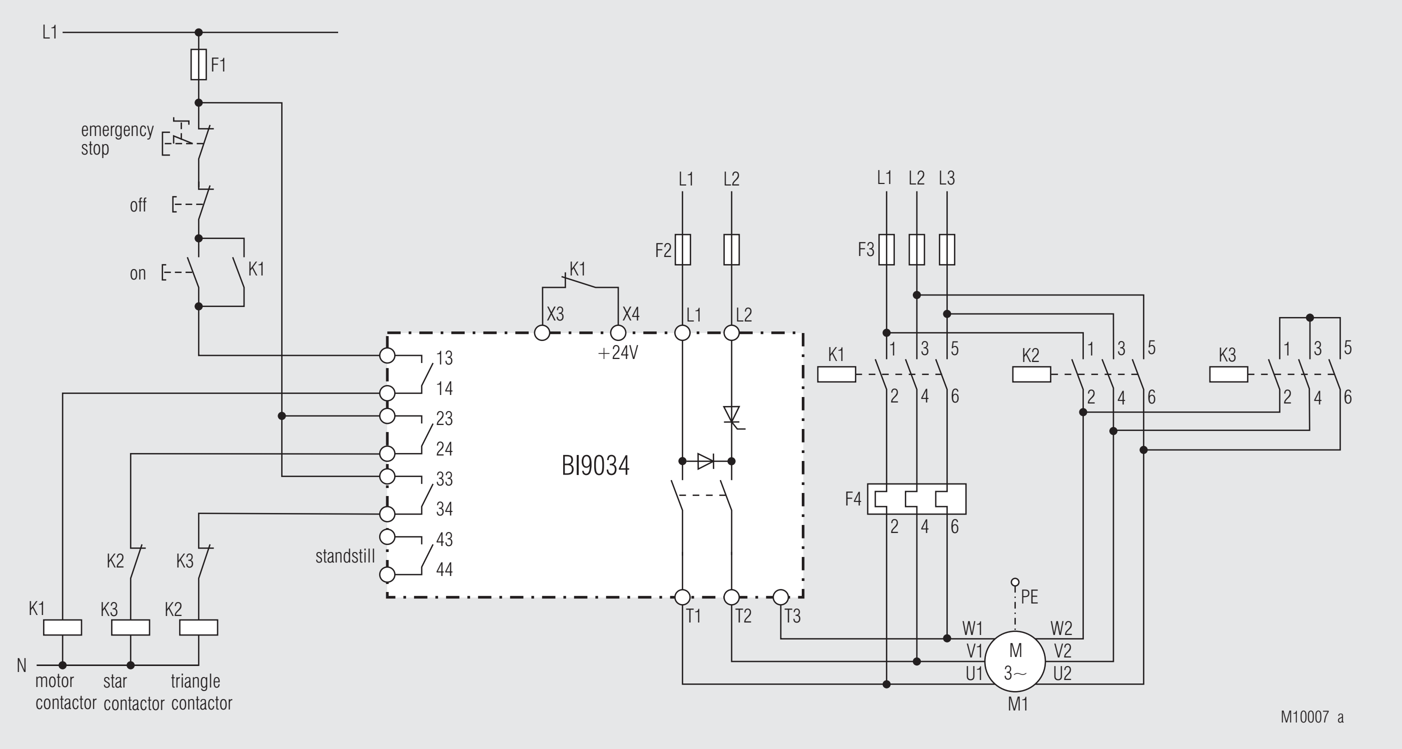


BI 9034 without star-delta-control

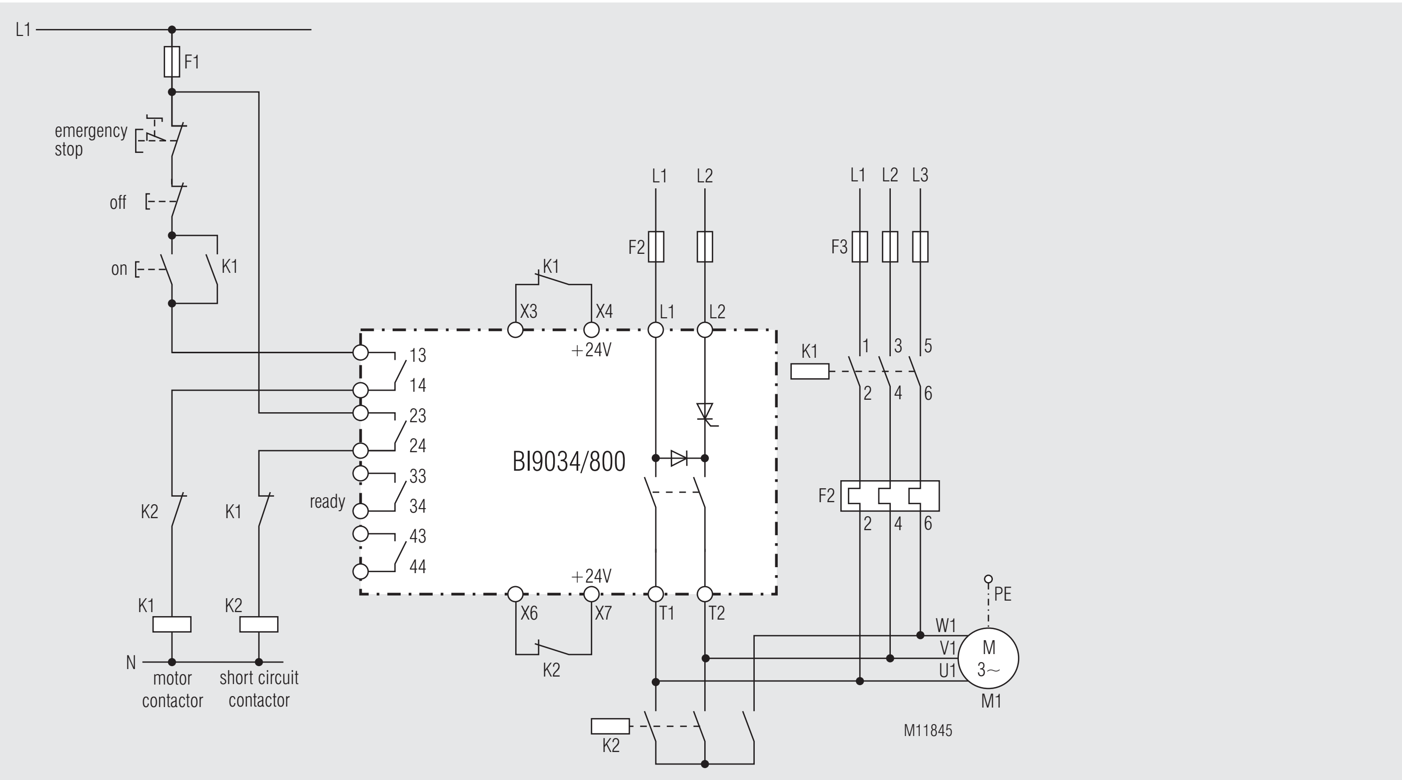


BI 9034 with external star-delta-control

Connection Example



BI 9034 with internal star-delta-control



BI 9034/800 with reduced brake delay time

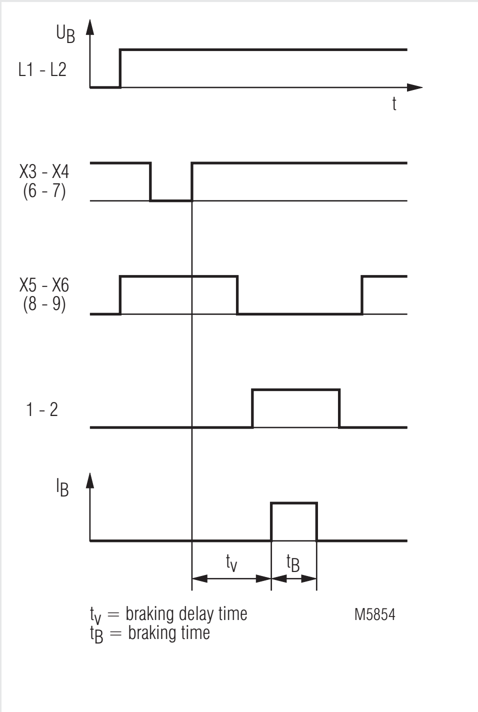
MINISTOP
Motor Brake Relay
BN 9034, GB 9034

DOLD

0245258

- DC brake with one way rectifier up to 600 A
- Can be used on all asynchronous motors
- Easy to fit also into existing control circuits
- Wear and maintenance free
- Integrated braking contactor for devices up to 60 A
- Mounting on 35 mm DIN-rail for 25 A units
- Adjustable braking current
- With automatic standstill monitoring
- as option with start-delta start function
- as option with thermistor motor protection
- as option with wide voltage input
  BN 9034: 200 ... 575 V
  GB 9034: 200 ... 690 V
- width max. 310 mm

Function Diagram



Approvals and Markings

CE

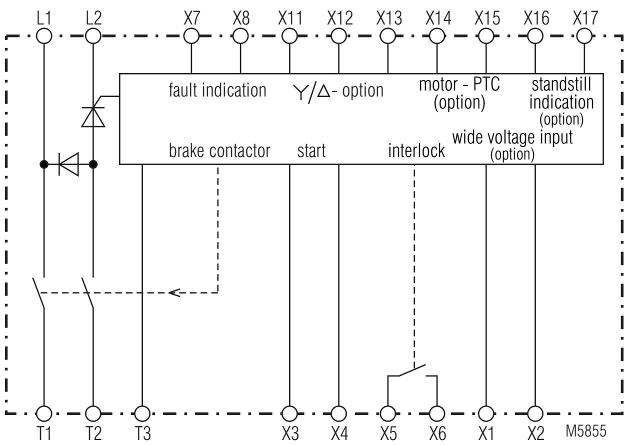
Application

- Saws
- Centrifuges
- Woodworking machines
- Textile machines
- Transportation conveyors

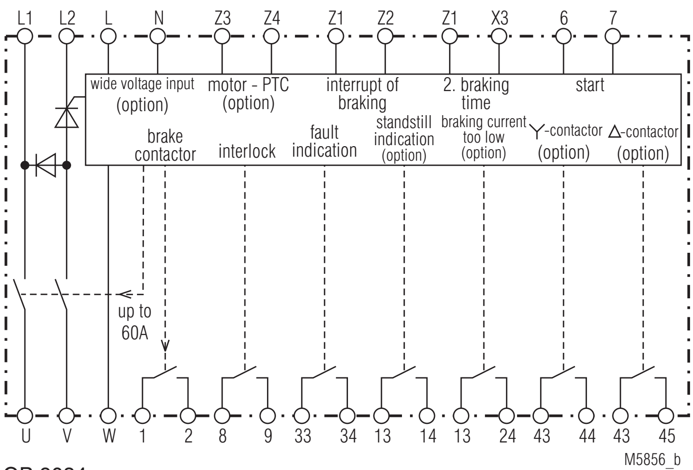
Function

The supply voltage is connected to terminals L1-L2. The interlock contact for the motor contactor closes. The LED „ready“ indicates that the supply voltage is connected. The motor can be started with the start button.
The DC voltage for the motor windings UV is supplied from T1-T2.
The external braking contactor (Devices for > 60 A) is controlled by contact 1-2. This contact is timed in a way, that a safety time is provided between reset of the motor contactor and start of the brake contactor. This is necessary to avoid damage of the semiconductors by induced back EMF voltage.
The timing of the different functions during braking is as follows:
The motor contactor is switched off and disconnects the motor. After elapse of the safety time, the brake contactor is energized and shortly after that the brake current is switched on for the adjusted braking time.

Circuit Diagrams



BN 9034



GB 9034

Indicators BN 9034

LED „ready“:	On, when supply voltage connected flashing, when braking current is adjusted too high.
LED „I“:	On, when braking current is flowing.

Notes

For optimum braking effect, the braking current should be 1,8 ... 2 times the nominal motor current. This current corresponds to the necessary saturation current of the magnetic field needed for braking. Higher currents show not much more effect, but will heat up the motor. A better braking effect is achieved by using more then one motor winding for braking. The permitted braking ration relates to the braking current, the ambient temperature and the brake model.

ATTENTION The terminal W or T3 serves as measuring input for the standstill monitoring, with 2.5 mm² max. cross section. With devices for > 40 A a fuse must be used to protect this connection wire at the point where the wire with smaller cross section is connected to the motor line. The choice of the fuse is suited to the used crossed section and serves the short circuit protection of the line.

Technical Data

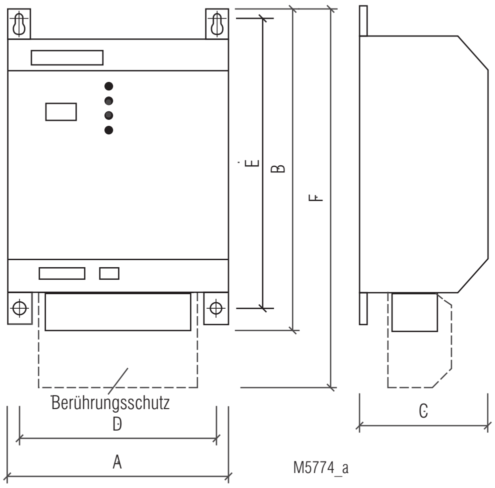
Nominal voltage [U_N]:	AC 400 V ± 10 % others to 600V / 690 V on request						
Nom. frequency [Hz]:	50/60						
	BN 9034	GB 9034					
Motor power [kW] at 400 V:	5.5	7.5	15	22	55	110	160
Max. adjustable braking current [A]:	25	40	60	100	200	400	600
ED at max. braking current [%]:	8	20	20	20	20	20	20
Fuse, superfast [A]:	25	40	60	100	200	400	630
Braking voltage:	DC 0 ... 230 V						
Max. braking time [s]:	15	320					
Back-EMF braking time delay:	selfoptimizing (100 ... 2500 ms)						
Connection diameter							
Box terminal [mm²]:	1.5	16	16	16	35		
Screw terminal:						M12	M12
Power consumption for electronic [VA]:	6						
Contacts:	2 NO contacts 6 A / AC 250 V						
Temperature range [°C]:	0 ... + 45						
Storage temperature [°C]:	- 25 ... + 75						
Degree of protection:	IP 20 (25 A)	IP 20 (40 ... 600 A)					
Mounting:	to 25 A mounting on DIN-rail to 40 A screw fixing M5						
Weight [kg]:	0.8	2.1	2.1	2.1	3.1		

Technical Data

Dimensions:

Width x height x depth

BN 9034:	100 x 73 x 120 mm
GB 9034:	



	A	B	C	D	E	F
40 A	110	242	140	86	226	-
60 A	110	242	140	86	226	-
100 A	110	242	140	86	226	-
200 A	110	255	155	80	226	-
400 A	210	275	165	180	226	340
600 A	310	280	165	280	226	355
Dimensions in mm						

40-100 A	PE	L1	U	L2	V	PE
200 A	PE	L1	U	L2	V	
400 A	PE	L1/U	L2	V		
600 A	L1/U	PE	V	L2		
Wire connection configuration						

Standard Type

BN 9034 25 A AC 400 V 50/60 Hz 15 s
Article number:
- Integrated braking contactor
- Mounting on 35 mm DIN-rail
- Width: 100 mm

Variant

BN 9034 / _ _ _ _

- 1: Thermistor-motor protection input
- 1: Star-delta control
- 1: Output relay for standstill indication
- 1: Wide voltage input (U_N = 200...575 V)

The 4 options can be ordered single or in combinations.

The variant with wide voltage input needs an auxiliary supply of AC 230 V or Ac 24 V.

BN 9034 /_ _ _ _ 25 A AC 400 V 50 / 60 Hz 15 s

- Braking time
- Nominal frequency
- Nominal voltage
- Max. braking current
- Variant, if required
- Type

Inputs BN 9034

Opening the contact on terminal X3 and X4 makes the device ready for braking. When the contact is closed the braking current starts to flow. X14-X15 monitors the motor temperatur (option)

Outputs BN 9034

X5, X6:	Interlock for monitor contactor
X16, X17:	Standstill indication (option)
X7, X8:	Fault indicating output
X11, X12:	Control of Y-contactor (option)
X12, X13:	Control of Δ-contactor (option)

Setting facilities BN 9034

Potentiometer	function	initial setting
I	braking current	left end of scale
t_1	braking time	middle of scale
n_0	standstill level	middle of scale
t_2	2. braking time	left end of scale

Standard Type

GB 9034 100 A AC 400 V 50/60 Hz
Article number: 0056975
- Screw fixing M5
- Width: 110 mm

Variant

GB 9034 / _ _ _ _

- 1: Removable terminals for control signals
- 1: Brake current indicator
- 1: Brake current monitoring, thermistor-motor protection input, star-delta control and output relay for standstill indication
- 1: Wide voltage input (U_N = 200 ... 690 V)

The 4 options can be ordered single or in combinations.

The variant with wide voltage input needs an auxiliary supply of AC 230 V.

GB 9034 / _ _ _ _ 100 A AC 400 V 50 / 60 Hz

- Nominal frequency
- Nominal voltage
- Max. braking current
- Variant, if required
- Type

Inputs GB 9034

Z3, Z4:	Motor PTC
Z1, Z2:	Braking interrupt
Z1, X3:	2. braking time
6,7:	Start of braking

Outputs GB 9034

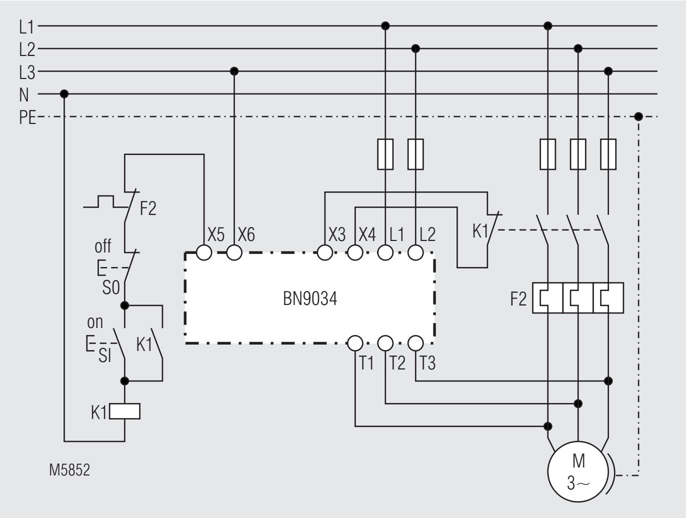
1,2:	External braking contactor
8,9:	Interlock for motor contactor
33,34:	Fault indication output
43,44:	Control of Y-contactor (option)
43,45:	Control of Δ-contactor (option)
13,14	Standstill indication (option)
13,24	Braking current too low (option)

Set-up Procedure

The braking time cannot be set on the unit BN 9034. It is limited by the standstill detection. If the feedback input T3 is not connected to terminal W of the motor the standstill detection is disabled and the internal max. braking time of 15 is valid. The GB 9034 allows to set different braking times and can be used for standstill depending as well as time depending braking function. More details are available in the operating manual.

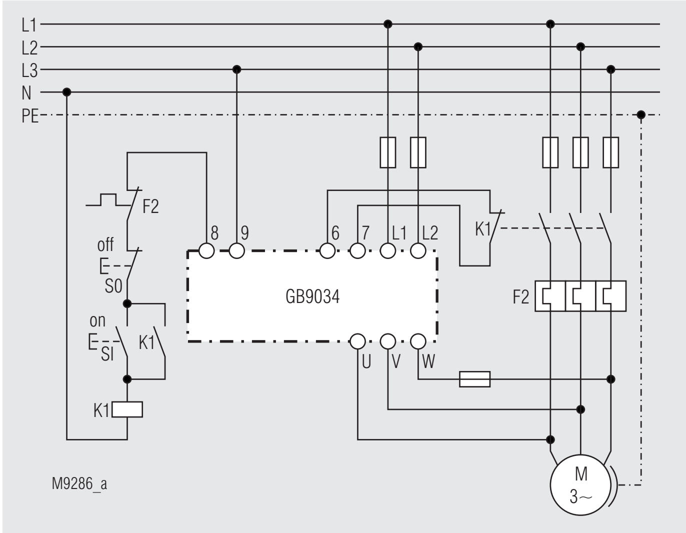
With potentiometer I the braking current can be adjusted. With a current meter (true RMS) the current should be measured so that 2 times the braking current is not exceeded in order not to overheat the motor. The braking device cannot be overloaded, as it limits the current even on full potentiometer setting to the nominal current of the unit. This status is indicated by the flashing „ready“ LED.

Connection Example

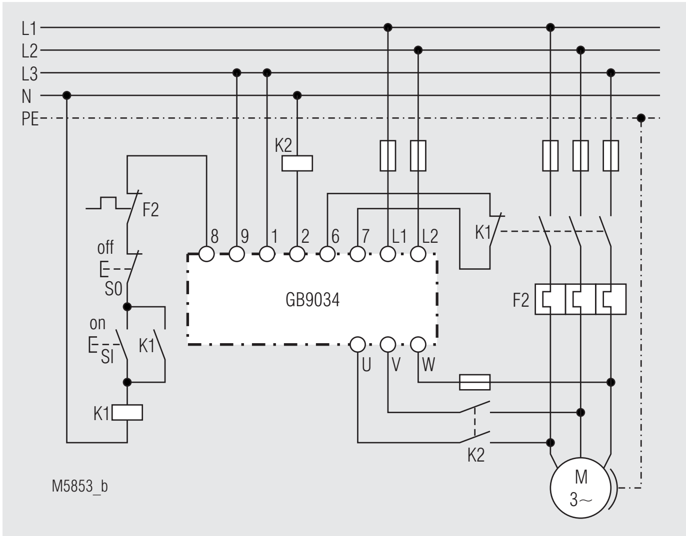


for BN 9034 25 A

Connection Examples



for GB 9034 40 A, 60 A



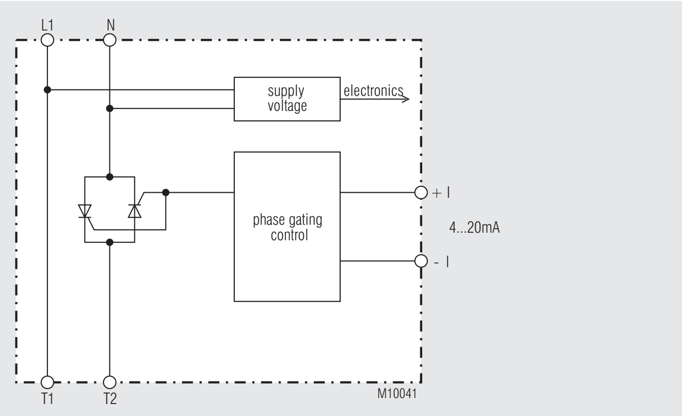
for GB 9034 from 100 A

MINISTART
Phase Controller
IN 9017

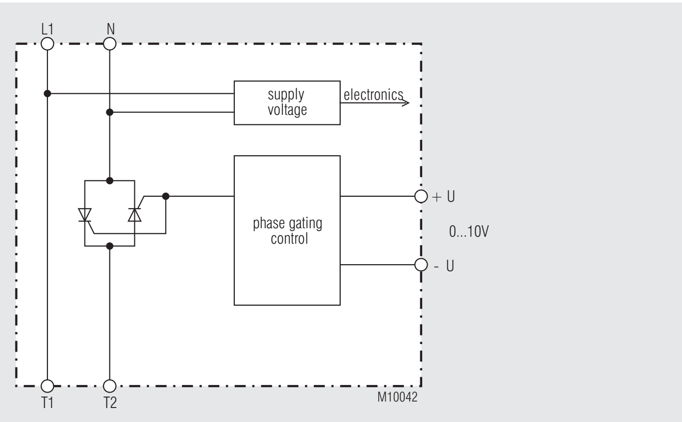
0260595

- Phase controller for resistive and motor load
- for permanent power up to 300 W
- Interference suppression limit value class B
- LED indication
- **Devices available in 3 versions:**
  IN 9017/100: with current interface 4 ... 20 mA and broken wire detection
  IN 9017/200: with voltage interface 0 ... 10 V
  IN 9017/211: with voltage interface 0 ... 10 V, U_{min} adjustable, control input for max. output current
- Width: 53 mm

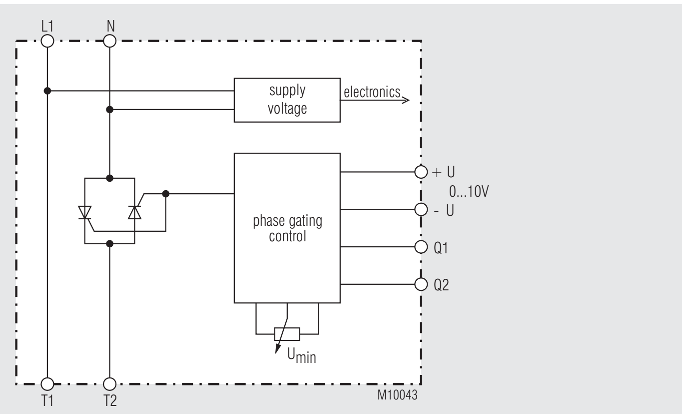
Block Diagrams



IN 9017/100



IN 9017/200



IN 9017/211

Approvals and Markings

CE

Application

- Resistive load
- Infrared heating
- Fan
- Volume compressor

Function

Phase controllers robust electronic units to control the voltage by phase chopping. The Phase chopping angle is adjusted on a control input. (IN 9017/100: 4 ... 20 mA, IN 9017/200: 0 ... 10 V) verstellt.

The variant IN 9017/211 is realised with 0…10V input and voltfree contact input Q1, Q2.
When contact input Q1, Q2 is open the output remains off at 0-3 V. With 3V control voltage the voltage adjusted on potentiometer Umin is switched on. When rising the control voltage continuously up to 10 V on the input, the output voltage increases up to AC 230 V. By closing the contact on Q1,Q2 the the output supplies the max. voltage.

Indication

LED green:	supply voltage is present
LED yellow	
at IN 9017/100:	Permanent on, when control current > 4 mA flashes 1 time, when control current < 4 mA (cable break) flashes 2 times, when mains frequency is outside limits
at IN 9017/200:	Permanent on, when full voltage on motor is present flashes 1 time, when phase gating is active flashes 2 times, when mains frequency is outside limits
at IN 9017/211:	Permanent on, when full voltage on motor is present flashes 1 time, when phase gating is active flashes 2 times, when mains frequency is outside limits flashes 3 times, when setpoint < 3 volt and Q_1, Q_2 are open

Notes

If the power semiconductor should be protected against short circuit or ground fault during operation a superfast fuse needs to be installed (see technical details). If not the standard line protection fuses must be used. The phase controller must not be operated with capacitive load on the output. To provide safety for people and equipment, only trained staff must work on this unit.

Technical Data

Motor voltage

IN 9017/100:	AC 48 V	±10 %
IN 9017/100:	AC 115 V	±10 %
IN 9017/100:	AC 230 V	±10 %
IN 9017/200:	AC 115 V	±10 %
IN 9017/200:	AC 230 V	±10 %
IN 9017/211:	AC 230 V	±10 %

Nominal frequency: 50 / 60 Hz
Nominal load P_N: 300 W at AC 230 V
150 W at AC 115 V
Min. power: approx. 0.1 P_N
Rated current: 1.3 A
Semiconductor fuse (superfast): 20 A

Setting range output voltage

IN 9017/100:	AC 48 V	AC 12 ... 36 V
IN 9017/100:	AC 115 V	AC 29 ... 86 V
IN 9017/100:	AC 230 V	AC 58 ... 172 V
IN 9017/200:	AC 115 V	AC 20 ... 115 V
IN 9017/200:	AC 230 V	AC 40 ... 230 V
IN 9017/211:	AC 230 V	AC U_{min} ... 230 V
	U_{min} AC 80 ... 200 V	

Recovery time: 200 ms
Consumption: 1.4 VA

Control input

IN 9017/100:	4 ... 20 mA	R_i = 82.5 Ω
IN 9017/200:	0 ... 10 V	R_i = 50 kΩ
IN 9017/211:	0 ... 10 V	R_i = 50 kΩ
	Q_1, Q_2, volt free	

General Data

Nominal operating mode:	continuous operation	
Temperature range:	0 ... + 55 °C	
Storage temperature:	- 25 ... + 75 °C	
Clearance and creepage distance		
Rated impulse voltage / pollution degree:	4 kV / 3	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V/m	IEC/EN 61 000-4-3
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
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with VO behaviour according to UL subject 94	
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
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	210 g	

Dimensions

Width x height x depth: 53 x 90 x 61 mm

Standard Types

IN 9017/100 AC 48 V 75 W
Article number:: 0062206

IN 9017/100 AC 115 V 150 W
Article number:: 0058431

IN 9017/100 AC 230 V 300 W
Article number:: 0065838

IN 9017/200 AC 115 V 150 W
Article number:: 0065592

IN 9017/200 AC 230 V 300 W
Article number:: 0058274

IN 9017/211 AC 230 V 300 W
Article number:: 0059425

Set-up Procedure

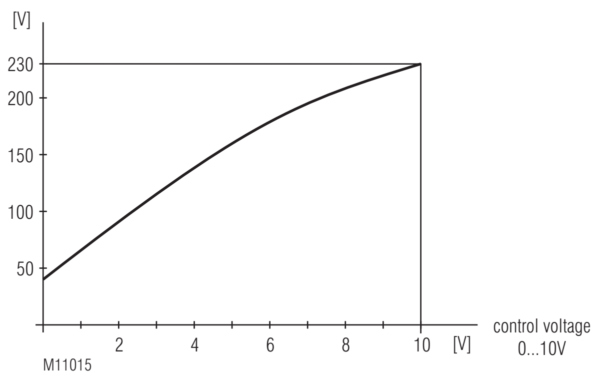
1. Wiring of the component according to connection example
2. Adjust required output voltage

Safety remarks

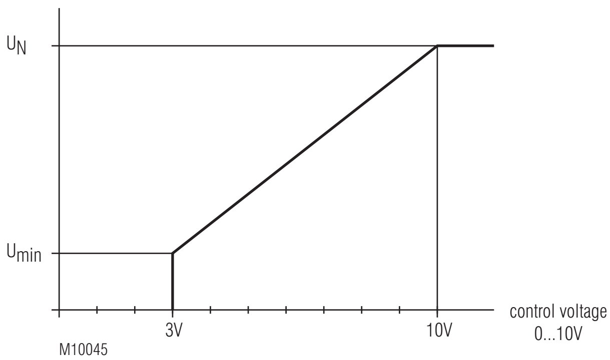
- Never clear fault when the device is switched on
- The user must ensure that the device and the necessary componentsare mounted and connected according to the locally applicable regulations and technical standards.
- After disconnection of the device dangerous voltages may be sensedfor several minutes on the connection terminals caused by filter capacitors.

Attention: This device can be started by potential-free contact, while connected directly to the mains without contactor Please note, that the load is not physically separated from the mains. Because of this the load must be disconnected from the mains via the corresponding manual motor starter.

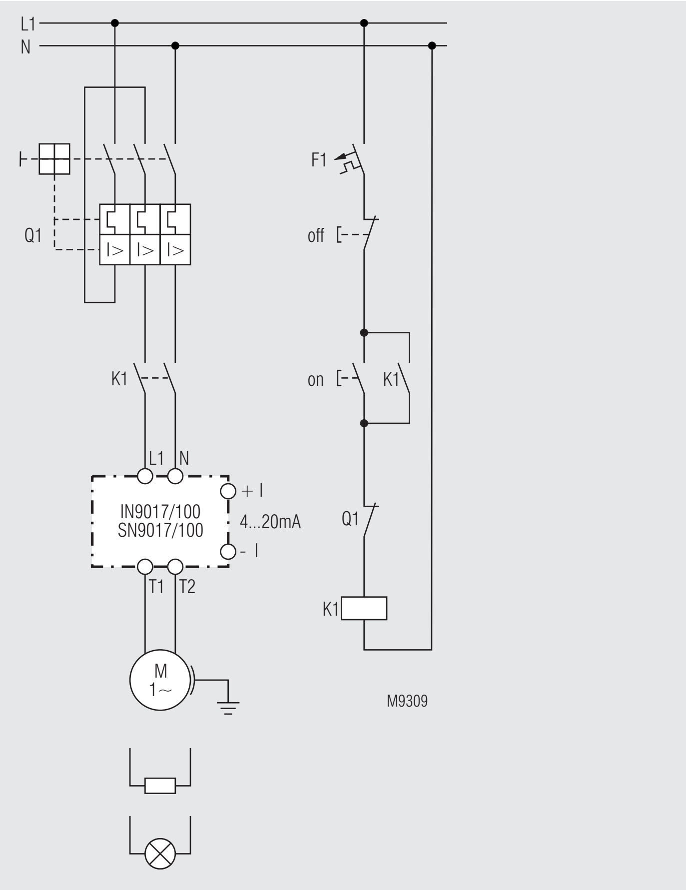
Control Characteristics



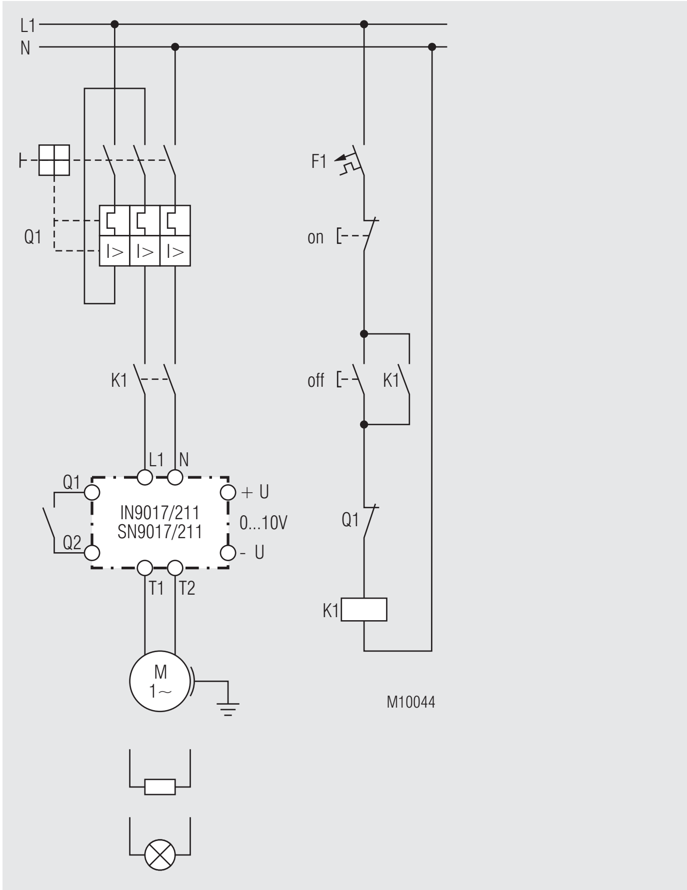
IN 9017/200 AC 230 V



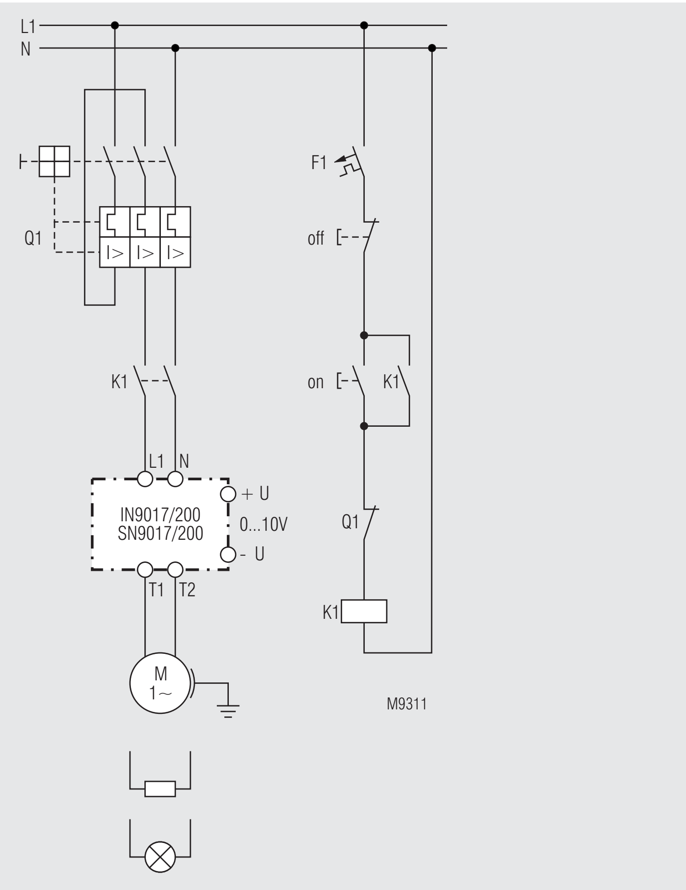
IN 9017/211



IN 9017/100



IN 9017/211



IN 9017/200

Speed Controller, 1-phase
SX 9240.01

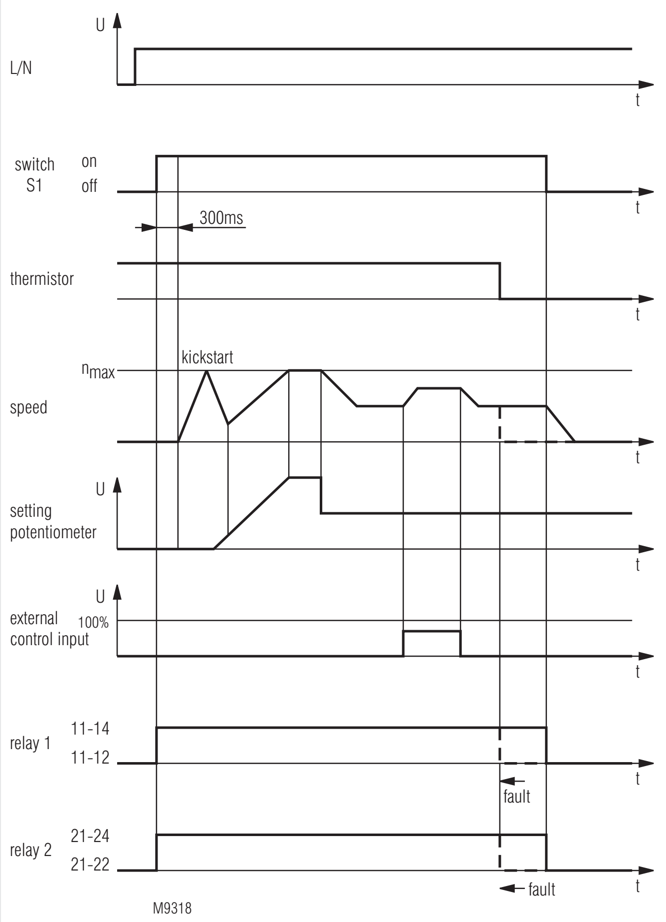
DOLD

0251352

SX 9240.01/01005; 5 A   SX 9240.01/02005; 11,5 A

- According to IEC/EN 60 947-1, IEC/EN 60 947-4-2
- For speed control of 3-phase asynchronous motors up to 5.5 kW
- Speed adjustment by potentiometer on the front
- Additional galvanic separated control input for external speed control 0 ... 10 V
- U_{min} and U_{max} setting accessable behind screw cover
- Large motor voltage range
- Integrated temperature monitoring
- Fullfills the EMC requirement according to IEC/EN 61 000-6-4 limit class B, therefore **screened wires are not necessary** between motor and controller
- 2 changeover monitoring contacts
- LED indicators for alarm and status
- Connection for thermistor to monitor temperature
- 100 mm and 122 mm width

Function Diagram



Approvals and Markings

CE

Application

- Speed control of fans and pumps.

Speed control only works if the torque of the driven load rises with a quadratic function relative to the speed. Usually this is given with fans and pumps.

Function

Speed controllers are electronic devices designed to enable the speed control of 3-phase induction motors. The SX 9240 is a phase chopper device based on a thyristor circuit. The control input "Kickstart", bridge X7-X8, allows to ramp up the motor voltage to nominal value after start. After that the voltage is ramped down again to the required value with corresponding speed. The speed adjustment is made by a potentiometer on the front or by an external 0 ... 10 V input. The adjustment with the higher setting will take the control of the voltage/speed.

Temperature sensing
The temperature of the power semiconductors are monitored. If the permitted highest temperature is exceeded, motor, relay 1 and relay 2 are switched off. The red LED flashes code 1. This Alarm can only be reset after cooling down the device and temporarily cutting the auxiliary supply of the unit.

Motor temperature monitoring
A thermistor can be connected to terminals X 9 - X 10. If the permitted motor temperature is exceeded the motor, relay 1 and relay 2 are switched off. The red LED flashes code 4. The unit remains in fault status until the failure is removed and the power supply is switched off and on again. If no thermistor is connected, X 9 - X 10 must be bridged.

Adjustment of U_{min} and U_{max}
With the potentiometers U_{min} and U_{max} the speed setting can be limited to a certain minimum and a maximum speed. The potentiometers are accessible behind a screw cover on the front of the unit.
On 230 V units the minimum voltage can be adjusted between 25 V_{rms} and 140 V_{rms} and the maximum voltage between 140 V_{rms} and 230 V_{rms}.

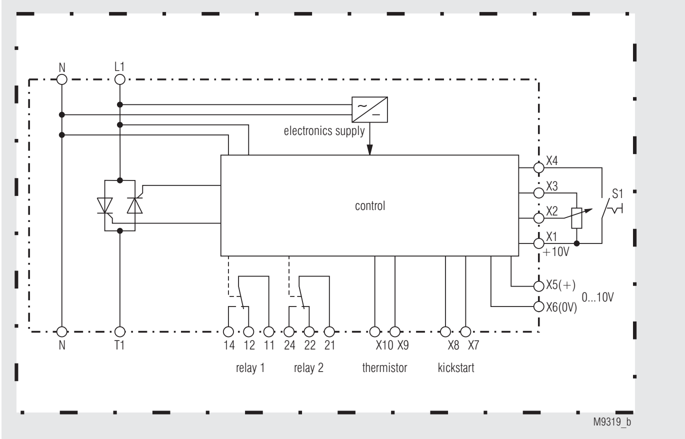
Function

ON-OFF switch
The ON-OFF switch is not edge triggered. If the switch is in position ON, the motor will start after the voltage is connected.

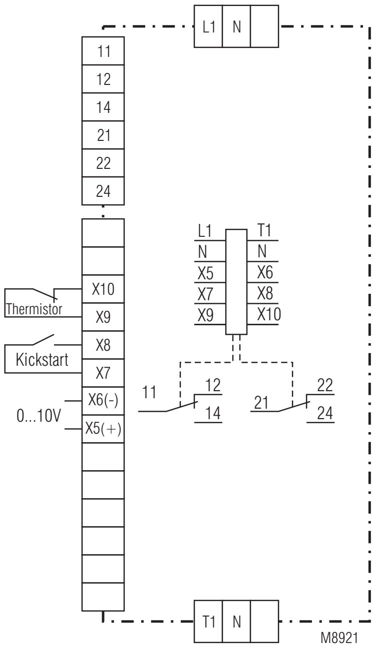
Frequency test
When the unit is connected to voltage, the frequency is measured. If the frequency is out of the permitted limits 50/60 Hz ± 10 %, relay 1 and relay 2 are switched off. The red LED flashes code 2. The unit remains in fault status until the failure is removed and the power supply is switched off and on again.

Relay function
Relay 1 (11-12-14): Energises when the unit is switched on and de-energises when the unit is switched off or goes into failure mode.
Relay 2 (21-22-24): Energises when the unit is switched on and de-energises when the unit is switched off or goes into failure mode.

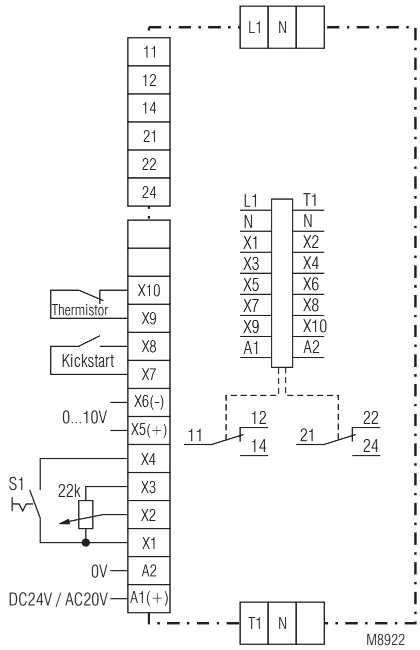
Block Diagram



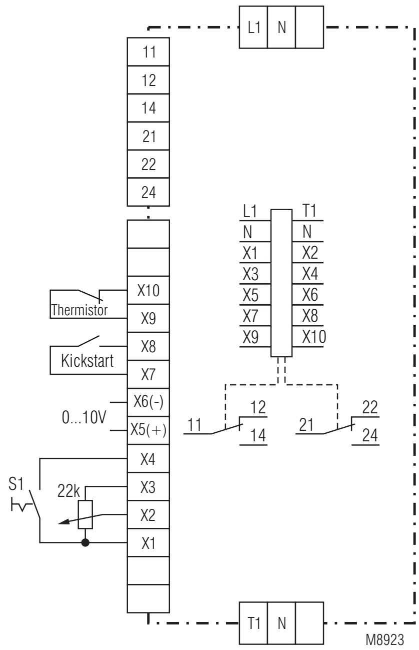
Connection Diagrams



SX 9240.01/0_005



SX 9240.01/2_ 015



SX 9240.01/2_ 005

Indication

green LED: On, when supply connected
yellow LED: On, when motor connected to supply voltage
flashing code 1: voltage is ramping up
red LED: flashing code 1: power semiconductors overheated
flashing code 2: wrong mains frequency
flashing code 4: motor overtemperature

Notes

Motor noise
When the motor is running on low speed resonance can cause noise that may be disturbing.

Notes

Protection against short circuit
It is recommended to use superfast semiconductor fuses to protect the speed controller in the case of short circuits on the output side.

Thermal protection
The speed controllers are designed to operate motors up to the nominal load. To protect the motor against thermal overload a thermal overload device, a motor protection device or thermistor motor protection is required.

To select the right motor the following instructions must be observed: Between 0.6 and 1.0 of the nominal speed the current could be rise up to 50 % higher than the nominal current. This effect is caused by the voltage control. To avoid overheating of the motor it must be declassified. I.e. a 3.3 kW motor can only loaded up to 2.2 kW. In spite of this measure a higher temperature cannot be avoided. Because of this the motor should be of isolation class F or H. In addition the windings should be monitored by means of a thermal contact or thermistor for overtemperature.

Technical Data

Phase / motor voltage:
L - N: AC 230 V ± 10 %
Nominal frequency: 50 / 60 Hz
Motor power

Type	SX 9240.01/01005	SX 9240.01/02005
heat sink	without	22,5 mm
power loss	5 W	12 W
Nominal current at ϑu = 40 °C:	5,0 A	11,5 A
switching cycle	continuous operation	continuous operation

Min. motor power: 0.2 A
Ramp up time after Kickstart: 7.5 s
Hold time after Kickstart: 1 s
Ramp down time after Kickstart: max. 7.5 s
Kickstart voltage: AC 230 V
Power consumption: 1.2 W

Technical Data

Relay contacts

Thermal continuous current I_{th}:	5 A	
Switching capacity		
to AC 15		
NO contacts:	3 A / 230 V	IEC/EN 60 947-5-1
NC contacts:	1 A / 230 V	IEC/EN 60 947-5-1
Semiconductor fuse:	1800 A^2 s	
External control input:	0 ... + 10 V	
Input impedance:	20 kΩ	
Reference voltage:	10 V / 15 mA	
Setting potentiometer:	22 kΩ	
Input impedance:	20 kΩ	
Thermistor input		
NC contact, switching voltage:	24 V	
Input inpedance:	50 kΩ	
Ramp time:	approx. 5 sec from min. speed to max. speed or max. speed to min. speed	
Variation of motor voltage		
at AC 230 V:	25 V_{eff} ... 230 V_{eff}	

General Data

Temperature range: 0 ... + 40°C

(If the temperature (20 ... 60°C) exceeds the a. m. range the nominal current can be increased by 2 % / °C on lower temperature or must be decreased by 2 % / °C on higher temperature.)

Storage temperature:	- 25 ... + 75°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
Control voltage to motor voltage:	4 kV / 2	IEC 60 664-1
Auxiliary voltage to motor voltage:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between wire for power supply:	1 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Radiated interference:	Limit value class B	EN 55 011
Degree of protection:	IP 65	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
Terminal designation:	EN 50 005	
Wire connection		
Load terminals:	4 mm^2 solid, or 2.5 mm^2 stranded	
Control terminals:	1.5 mm^2 stranded	
Relay terminals:	2.5 mm^2 stranded	
Net weight:		
5.0 A:	1280 g	
11.5 A:	1500 g	

Dimensions

Width x height x depth:	
5 A:	100 x 160 x 165 mm
11.5 A:	122 x 160 x 165 mm

Standard Types

SX 9240.01/01005

Article number 0058991

- 1-pole
- for motor currents up to 5 A
- with EMC-filter, Housing, ON/OFF switch and setting potentiometer
- without heat sink
- Control input for 0 ... 10 V
- Thermistor input
- with internal transformer
- 100 mm width

Variants

Ordering example for variants

SX 9240 .01 /_ _ _ _ _

- 0: without specialfunction
- 4: Adjustment potentiometers U_{min}, U_{max}
- 5: Thermistor, adjustment potentiometers U_{min}, U_{max}

- 0: Internal supply AC 230 V
- 1: External supply AC 20 V, DC 24 V

- 0: Control input 0 ... 10 V
- 1: Control input 0 ... 5 V
- 2: Control input 0 ... 20 mA
- 3: Control input 4 ... 20 mA

- 1: 5.0 A
- 2: 11.5 A

- 0: with EMC-filter, housing, ON/OFF switch and setting potentiometer
- 1: without EMC-filter, housing, ON/OFF switch and setting potentiometer
- 2: with EMC-filter, without housing,ON/OFF switch and setting potentiometer
- 3: without EMC-filter, without housing, ON/Off switch and setting potentiometer

1-pole

Type

Set-up Procedure

1.) Open enclosure. Connect device and motor according to circuit diagram.
2.) Remove bridge X8 / X7 when "Kickstart" is not required.
3.) Close enclosure and apply auxiliary voltage.
4.) Start unit with ON/OFF switch.
5.) Turn speed setting potentiometer fully anticlockwise. Adjust U_{min} potentiometer high enough, so that the motor starts. A humming motor at standstill should be avoided inorder not to heat up the motor unnecesarily. Turn speed setting potentiometer fully clockwise. Adjust U_{max} potentiometer until the required max. speed is reached. The motor temperature should be checked on low and medium speed. If necessary the motor must be cooled.

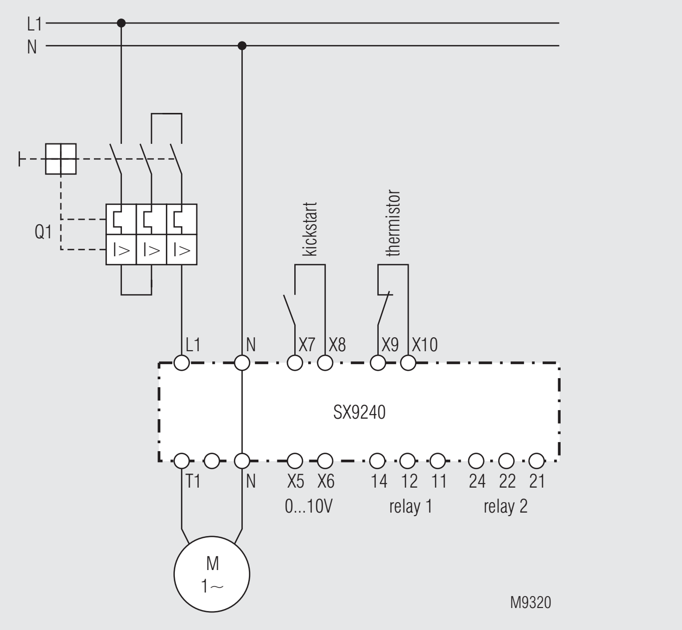
Safety Instructions

- Never clear fault when the device is switched on.

Attention: This device can be started by potential-free contact, while connected directly to the mains without contactor (see application example). Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor **must** be disconnected from the mains via the corresponding manual motor starter.

- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards.
- Adjustments, e.g. adjustment of U_{min}, U_{max} may only be carried out by qualified specialist staff and the applicable safety rules must be observed. Wiring and disconnection work must only be made when the unit is isolated from the mains.
- After disconnection of the device dangerous voltages may be sensed for several minutes on the connection terminals caused by filter capacitors.

Application Example



Speed Controller, 3-phase
SX 9240.03

0239596

SX 9240.03/00005; 2.5 A

SX 9240.03/01005; 5 A

SX 9240.03/02005; 11.5 A

- According to IEC/EN 60 947-1, IEC/EN 60 947-4-2
- For speed control of 3-phase asynchronous motors up to 5.5 kW
- Speed adjustment by potentiometer on the front
- Additional galvanic separated control input for external speed control 0 ... 10 V, 0 ... 20 mA, 4 ... 20 mA
- U_{min} and U_{max} setting accessable behind screw cover
- Large motor voltage range
- Integrated temperature monitoring
- Fullfills the EMC requirement according to IEC/EN 61 000-6-4 limit class B, therefore **screened wires are not necessary** between motor and controller
- 2 changeover monitoring contacts
- LED indicators for alarm and status
- Connection for thermistor to monitor temperature
- 100 mm, 122 mm and 168 mm width

Approvals and Markings

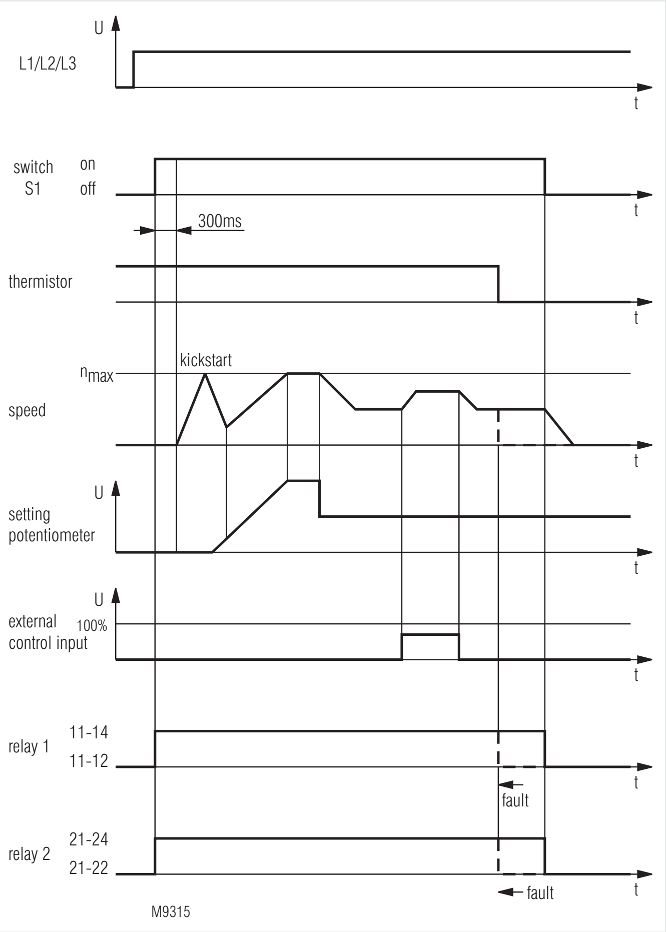
CE

Application

- Speed control of fans and pumps.

Speed control only works if the torque of the driven load rises with a quadratic function relative to the speed. Usually this is given with fans and pumps. Suitable motors: Asynchronous motors designed for voltage control (Rotor material Silumin or similar, isolation class F)

Function Diagram



Function

Speed controllers are electronic devices designed to enable the speed control of 3-phase induction motors. The SX 9240 is a phase chopper device based on a thyristor circuit. The control input "Kickstart", bridge X7-X8, allows to ramp up the motor voltage to nominal value after start. After that the voltage is ramped down again to the required value with corresponding speed. The speed adjustment is made by a potentiometer on the front or by an external 0 ... 10 V input. The adjustment with the higher setting will take the control of the voltage/speed.

Temperature sensing
The temperature of the power semiconductors are monitored. If the permitted highest temperature is exceeded, motor, relay 1 and relay 2 are switched off. The red LED flashes code 1. This Alarm can only be reset after cooling down the device and temporarily cutting the auxiliary supply of the unit.

Motor temperature monitoring
A thermistor can be connected to terminals X 9 - X 10. If the permitted motor temperature is exceeded the motor, relay 1 and relay 2 are switched off. The red LED flashes code 4. The unit remains in fault status until the motor cools down and the power supply is switched off and on again. If no thermistor is connected, X 9 - X 10 must be bridged.

Adjustment of U_{min} and U_{max}
With the potentiometers U_{min} and U_{max} the speed setting can be limited to a certain minimum and a maximum speed. The potentiometers are accessible behind a screw cover on the front of the unit.
On 400 V units the minimum voltage can be adjusted between 110 V_{rms} bis 160 V_{rms} and the maximum voltage between 160 V_{rms} bis 400 V_{rms}.

Phase monitoring L1, L2, L3
The phases L1, L2 and L3 are monitored internally. If one of the 3 phases fails, motor, relay 1 and relay 2 are switched off. The red LED flashes code 3. The unit remains in fault status until the failure is removed and the power supply is switched off and on again. If 2 or 3 phases fail, the unit is no longer supplied. All LEDs go off, the relays de-energise and the motor is switched off.

Function

Phase sequence monitoring

For normal operation a right sequence is necessary. If wrong sequence is detected, the unit goes into failure mode. The red LED flashes code 6. The unit remains in fault status until the failure is removed and the power supply is switched off and on again.

ON-OFF switch

The ON-OFF switch is not edge triggered. If the switch is in position ON, the motor will start after the voltage is connected.

Frequency test

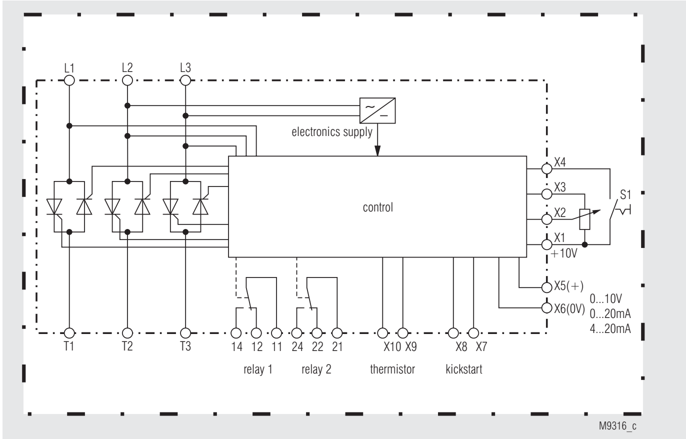
When the unit is connected to voltage, the frequency is measured. If the frequency is out of the permitted limits 50/60 Hz ± 10 %, relay 1 and relay 2 are switched off. The red LED flashes code 2. The unit remains in fault status until the failure is removed and the power supply is switched off and on again.

Relay function

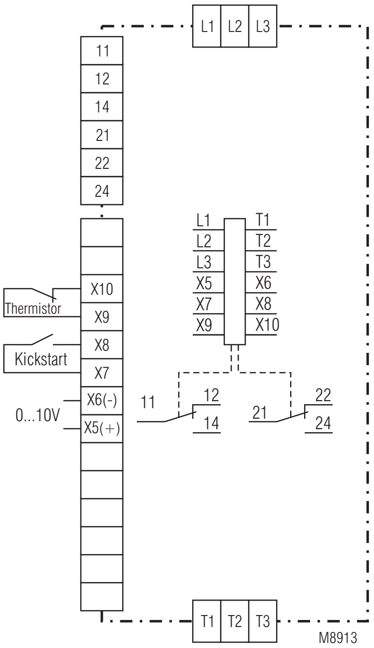
Relay 1 (11-12-14): Energises when the unit is switched on and de-energises when the unit is switched off or goes into failure mode.

Relay 2 (21-22-24): Energises when the unit is switched on and de-energises when the unit is switched off or goes into failure mode.

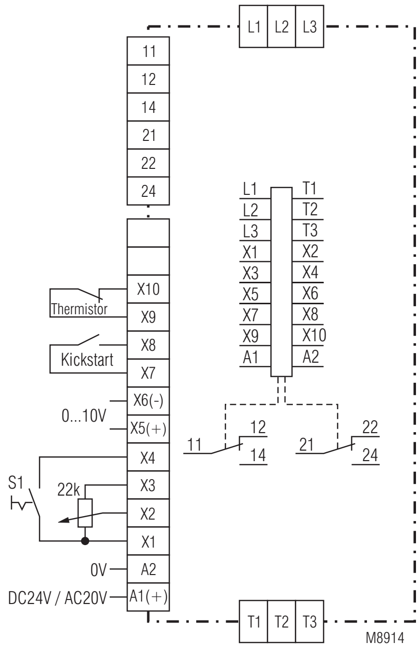
Block Diagram



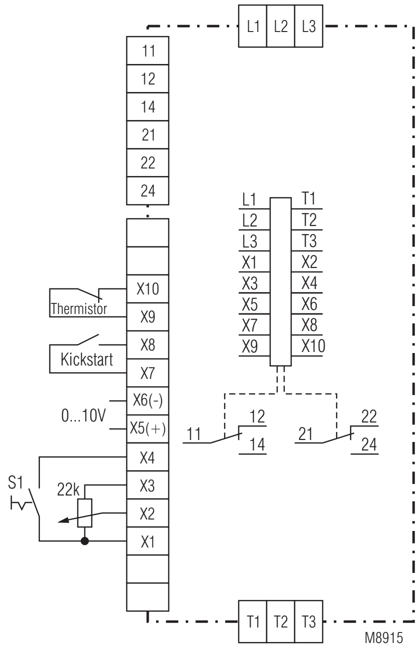
Connection Diagrams



SX 9240.03/0_005



SX 9240.03/2_ 015



SX 9240.03/2_ 005

Indication

green LED: On, when supply connected
yellow LED: On, when motor connected to supply voltage
Flashing, when voltage is ramping up
red LED: flashing code 1: power semiconductors overheated
flashing code 2: wrong mains frequency
flashing code 3: phase failure
flashing code 4: motor overtemperature
flashing code 6: wrong phase sequence

Notes

Protection against short circuit
It is recommended to use superfast semiconductor fuses to protect the speed controller in the case of short circuits on the output side.

Thermal protection
The speed controllers are designed to operate motors up to the nominal load. To protect the motor against thermal overload a thermal overload device, a motor protection device or thermistor motor protection is required.

To select the right motor the following instructions must be observed:
Between 0.6 and 1.0 of the nominal speed the current could be rise up to 50 % higher than the nominal current. This effect is caused by the voltage control. To avoid overheating of the motor it must be declassified. I.e. a 3.3 kW motor can only loaded up to 2.2 kW. In spite of this measure a higher temperature cannot be avoided. Because of this the motor should be of isolation class F or H. In addition the windings should be monitored by means of a thermal contact or thermistor for overtemperature.

Motor noise
When the motor is running on low speed resonance can cause noise that may be disturbing.

Technical Data

Phase / motor voltage:
L1 - L2 - L3: 3 AC 400 V ± 10 %
Nominal frequency: 50 / 60 Hz
Motor power

Type	SX 9240.03/00005	SX 9240.03/01005	SX 9240.03/02005
heat sink	without	22.5 mm	67.5 mm
power loss	10 W	20 W	50 W
Nominal current at ϑu = 40 °C:	2.5 A	5.0 A	11.5 A
Switching cycle	continuous operation	continuous operation	continuous operation

Min. motor power: 0.2 W
Ramp up time after Kickstart: 7.5 s
Hold time after Kickstart: 1 s
Ramp down time after Kickstart: 7.5 s
Kickstart voltage: AC 400 V
Power consumption: 1.2 W
Relay contacts
Thermal continuous current I_{th}: 5 A
Switching capacity
to AC 15
NO contacts: 3 A / 230 V IEC/EN 60 947-5-1
NC contacts: 1 A / 230 V IEC/EN 60 947-5-1
Semiconductor fuse: 25 A superfast

External control input: 0 ... + 10 V, 0 ... 20 mA
Input impedance: 20 kΩ 82,5 Ω

Reference voltage: 10 V / 15 mA
Setting potentiometer: 22 kΩ
Input impedance: 20 kΩ

Thermistor input
NC contact, switching voltage: 24 V
Input inpedance: 50 kΩ

Technical Data

Ramp time: approx. 5 sec from min. speed to max. speed or max. speed to min. speed
Variation of motor voltage at AC 400 V
SX 9240.03/0_005: 110 V_{eff} ... 400 V_{eff}

General Data

Temperature range: 0 ... + 40°C
(If the temperature (20 ... 60°C) exceeds the a. m. range the nominal current can be increased by 2 % / °C on lower temperature or must be decreased by 2 % / °C on higher temperature.)
Storage temperature: - 25 ... + 75°C
Clearance and creepage distances
rated impulse voltage / pollution degree
Control voltage to motor voltage: 4 kV / 2 IEC 60 664-1
Auxiliary voltage to motor voltage: 4 kV / 2 IEC 60 664-1
EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2
HF-irradiation: 10 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltages between wire for power supply: 1 kV IEC/EN 61 000-4-5
Interference suppression: Limit value class B EN 55 011
Radiated interference: Limit value class B EN 55 011
Degree of protection: IP 65 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
Terminal designation: EN 50 005
Wire connection
Load terminals: 4 mm^2 solid, or 2.5 mm^2 stranded
Control terminals: 1.5 mm^2 stranded
Relay terminals: 2.5 mm^2 stranded
Net weight:
2.5 A: 1280g
5.0 A: 1500 g
11.5 A: 1680 g

Dimensions

Width x height x depth:
2.5 A: 100 x 160 x 165 mm
5.0 A: 122 x 160 x 165 mm
11.5 A: 168 x 160 x 165 mm

Standard Types

SX 9240.03/01005
Article number 0059141
- 3-pole
- for motor currents up to 5 A
- with EMC-filter, Housing, ON/OFF switch and setting potentiometer
- with heat sink 22.5 mm
- Control input for 0 ... 10 V
- Thermistor input
- with internal transformer
- 122 mm width

SX 9240.03/02005
Article number 0057511
- 3-pole
- for motor currents up to 11.5 A
- with EMC-filter, Housing, ON/OFF switch and setting potentiometer
- with heat sink 67.5 mm
- Control input for 0 ... 10 V
- Thermistor input
- with internal transformer
- 168 mm width

Variants

Ordering example for variants

SX 9240 .03 /_ _ _ _ _

- 0: without specialfunction
- 4: Adjustment potentiometers U_{min}, U_{max}
- 5: Thermistor, adjustment potentiometers U_{min}, U_{max}

- 0: Internal supply AC 400 V
- 1: External supply AC 20 V, DC 24 V
- 2: Internal supply AC 230 V

- 0: Control input 0 ... 10 V
- 1: Control input 0 ... 5 V
- 2: Control input 0 ... 20 mA
- 3: Control input 4 ... 20 mA

- 0: 2.5 A
- 1: 5.0 A
- 2: 11.5 A

- 0: with EMC-filter, housing, ON/OFF switch and setting potentiometer
- 1: without EMC-filter, housing, ON/OFF switch and setting potentiometer
- 2: with EMC-filter, without housing,ON/OFF switch and setting potentiometer
- 3: without EMC-filter, without housing, ON/Off switch and setting potentiometer

3-pole
Type

Set-up Procedure

1.) Open enclosure. Connect device and motor according to circuit diagram.
2.) Remove bridge X8 / X7 when "Kickstart" is not required.
3.) Close enclosure and apply auxiliary voltage.
4.) Start unit with ON/OFF switch.
5.) Turn speed setting potentiometer fully anticlockwise. Adjust U_{min} potentiometer high enough, so that the motor starts. A humming motor at standstill should be avoided inorder not to heat up the motor unnecesarily. Turn speed setting potentiometer fully clockwise. Adjust U_{max} potentiometer until the required max. speed is reached. The motor temperature should be checked on low and medium speed. If necessary the motor must be cooled.

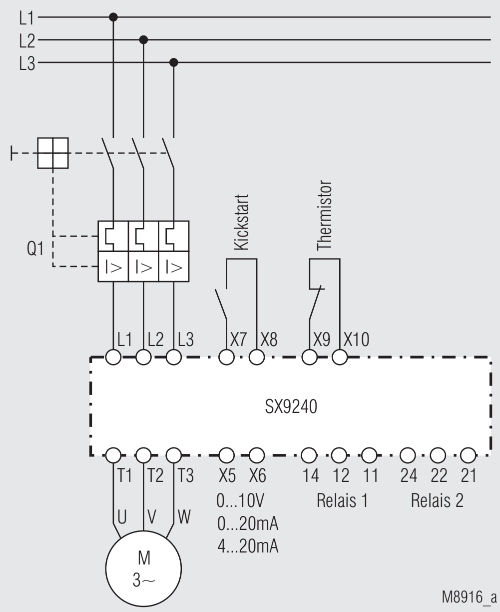
Safety Instructions

- Never clear fault when the device is switched on.

Attention: This device can be started by potential-free contact, while connected directly to the mains without contactor (see application example). Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor **must** be disconnected from the mains via the corresponding manual motor starter.

- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards.
- Adjustments, e.g. adjustment of U_{min}, U_{max} may only be carried out by qualified specialist staff and the applicable safety rules must be observed. Wiring and disconnection work must only be made when the unit is isolated from the mains.
- After disconnection of the device dangerous voltages may be sensed for several minutes on the connection terminals caused by filter capacitors.

Application Example



MINISTART
Smart Motorstarter
UG 9410

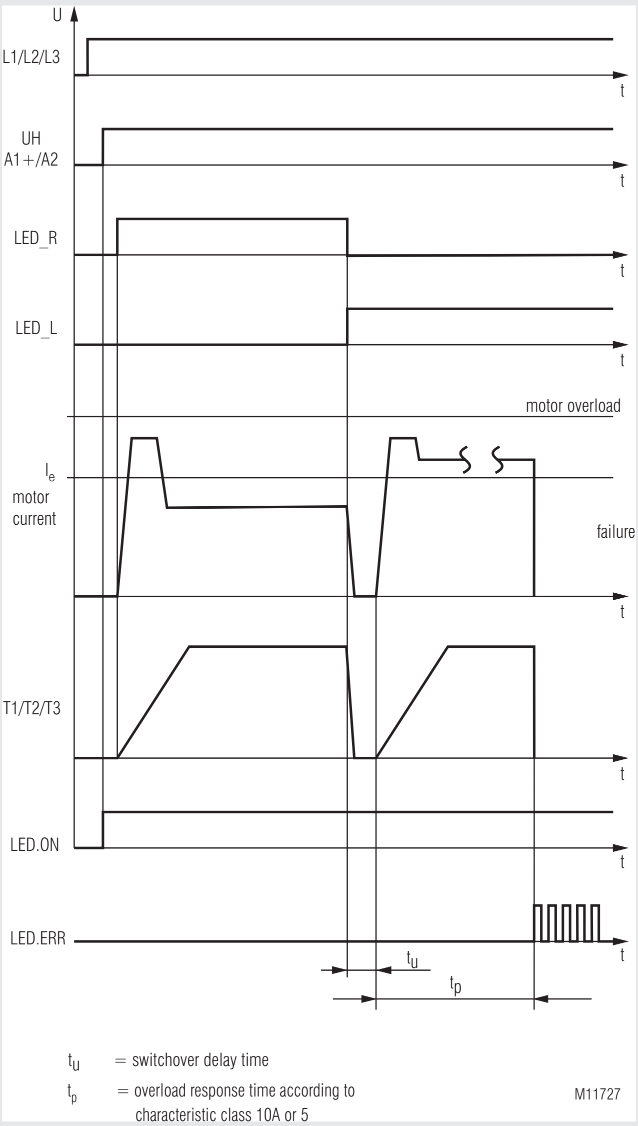
DOLD

0275365

Product Description

The smart motorstarter UG 9410 can be used for softstart, softstop, reversing and protecting 3 phase asynchronous motors. By measuring the line current a thermal model is used to calculate the motor temperature, and in the case of overtemperature the motor is disconnected. In addition also a thermo switch can be used. The reversing is done via relays. The relays are switched without current flow, this provides long service life.

Function Diagram



Your Advantages
- Widely used measuring and automation protocol
- Up to 7 functions in one device
  - Reversing anticlockwise,
  - Reversing clockwise
  - Softstart
  - Softstop
  - Motor protection
  - Phase sequence monitoring
  - Phase failure monitoring
- 80 % less space
- Simple and time-saving commissioning as well as user-friendly
- Operation through parameterization via modbus
- 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
  - Device overload
- Pluggable clamps
- TWIN- connection terminals to loop auxiliary supply and Bus

Features
- According to IEC/EN 60 947-4-2
- Modbus RTU-interface
- To reverse 3 phase motors up to 0.18 kW ... 2.2 kW at 400 V
- 2-phase softstart, softstop
- 3 potentiometer for setting the modbus adress and baud rate
- 5 LEDs for status indication
- Reversing with relays without current, softstart, softstop with thyristor
- Galvanic separation between control circuit and power circuit
- Width: 22.5 mm

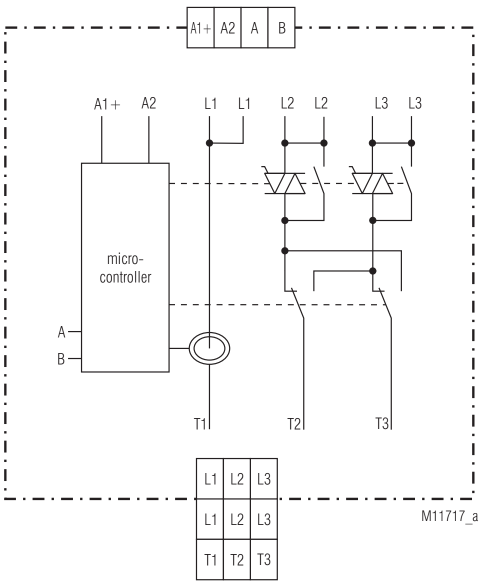
Approvals and Markings

CE

Applications

- 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



Connection Terminals

Terminal designation	Signal description
A1 (+)	Auxiliary voltage + DC 24 V
A2	Auxiliary voltage 0 V
A	Modbus signal A
B	Modbus signal B
L1	Phase voltage L1
L2	Phase voltage L2
L3	Phase voltage L3
T1	Motor connection T1
T2	Motor connection T2
T3	Motor connection T3

Function

Softstart
2 motor phases are controlled using thyristors, so that the motor current rises continuously. The starting torque behaves in the same way. This provides shock free starting and reduces mechanical failures. Starting time- and starting voltage can be adjusted via Modbus.

Softstop
2 motor phases are controlled using thyristors, so that the motor current drops continuously. The motor torque behaves in the same way on run down. This provides shock free stopping and reduces mechanical failures. Stopping time and stopping voltage can be adjusted via Modbus.

Motor protection
The thermal load of the motor is calculated using a thermal model. 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 and motor leading can be acknowledged via Modbus.

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

Phase sequence detection
For correct function of the unit a clockwise phase sequence is required. The phase sequence monitoring feature checks on power up the sequence of the connected voltage and signals on anticlockwise sequence the fault 3. This fault can be cleared via Modbus.

Phase failure monitoring
After connecting the auxiliary supply, the unit checks if all 3 phases are correct. If one or more phases are missing, the unit indicates fault 4. This fault can be reset via Modbus.

Indicators

green LED "On": permanent on - supply connected

red LED "ERR": flashing - Failure code of the device

yellow LED "Bus": flashing - When receiving or transmitting Modbus data

yellow LED "L": permanent on - Motor turns anti-clockwise
flashing - softstart or softstop active on anti-clockwise turn

yellow LED "R": permanent on - Motor turns clockwise
flashing - softstart or softstop active on clockwise turn

Failure code :
1 - Overtemperature on semiconductors
2 - Wrong mains freqency
3 - Phase reversal detected
4 - Phase failure detected
7 - Incorrect temperature measurement circuit
8 - Motor protection has responded
9 - Modubus communication failure
10 - Checksum failure EEPROM

1*) - 10*) = Number of flashing pulses in sequence

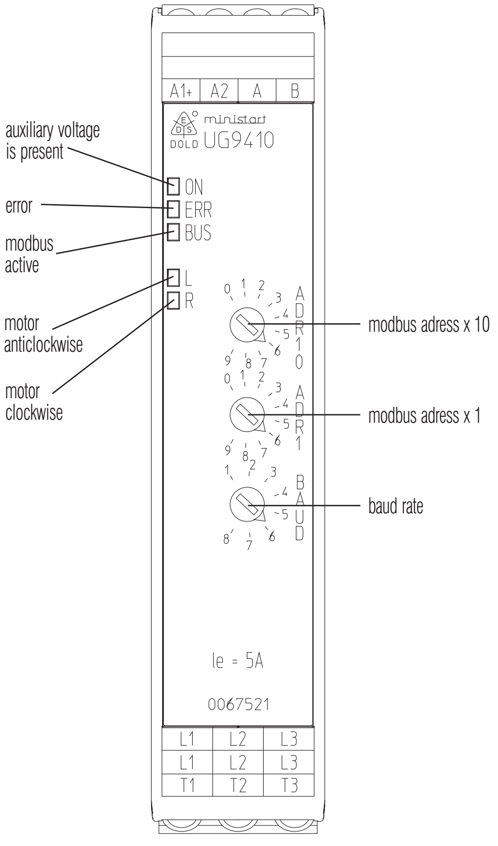
Reset Function

By sending a reset command a reset can be operated via Modbus

Modbus RTU

For communication between motor controller and a supervising control the Modbus RTU protocol according to Specification V 1.1b3 is used.

Setting



M11731_a

Position Potentiometer BAUD	1	2	3	4	5	6	7	8
Baud rate Baud	1200	2400	4800	9600	19200	38400	57600	115200
Response Time	< 50 ms	< 25 ms	< 12 ms	< 10 ms	< 5 ms	< 5 ms	< 5 ms	< 5 ms

Technical Data

Nominal voltage L1/L2/L3: 3 AC 200 ... 480 V ± 10%
Nominal frequency: 50 / 60 Hz , automatic detection
Auxiliary voltage: DC 24 V ± 10%
Motor power: 0.5 A ... 5.0 A adjustable via Modbus
Operating mode
5.0 A: AC 53a: 6-2: 100-30 IEC/EN 60947-4-2
Surge current: 200 A (tp = 20 ms)
Load limit integral: 200 A²s (tp = 10 ms)
Peak reverse voltage: 1500 V
Overvoltage limiting: AC 510 V
Leakage current in off state: < 3 x 0.5 mA
Start / deceleration voltage: 30 ... 80 % adjustable via Modbus
Start / deceleration ramp: 0 ... 10 s adjustable via Modbus
Consumption: 2 W
Switchover delay time: 150 ms
Start up delay for master tick: min. 25 ms
Release delay for master tick: min. 30 ms
Current measurement: AC 0.5 ... 30 A
Measuring accuracy: ± 5% of end of scale value
Measured value update time
at 50 Hz: 100 ms
at 60 Hz: 83 ms
Motor protection
up to 5.0 A: Class 10 A
Electronically, with thermal memory
Reset: manual via Modbus
Short circuit strength
max. fuse rating: 25 A gG / gL IEC/EN 60 947-5-1

General Data

Operating mode: Continuous operation
Operation: 0 ... + 65 °C (see derating curve)
Storage: - 40 ... + 70 °C
Relative air humidity: 93 % at 40 °C
Altitude: < 1.000 m
Clearance and creepage distances
rated impuls voltage / pollution degree
Motor voltage- control voltage: 6 kV / 2 IEC 60 664-1
Motor voltage- Modbus: 6 kV / 2 IEC 60 664-1
Overvoltage category: III
EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2
HF-irradiation
80 MHz ... 1.0 GHz: 10 V / m IEC/EN 61 000-4-3
1.0 GHz ... 2.5 GHz: 3 V / m IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz: 1 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltages
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
Interference emission
Wire guided: Limit value class B IEC/EN 60 947-4-2
Radio irradiation: Limit value class B IEC/EN 60 947-4-2
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 / 065 / 04 IEC/EN 60 068-1
Wire connection: DIN 46 228-1/-2/-3/-4
Removable terminal blocks
Wire connection
Phase voltage and motor
pluggable screw terminal (S): 0.25 ... 2.5 mm² solid or
0.25 ... 2.5 mm² stranded ferruled

Wire connection:
Bus and auxiliary supply
pluggable Twin-cage-clamp-terminal (PT): 0.25 ... 1.5 mm² solid or
0.25 ... 1.5 mm² stranded ferruled

Insulation of wires or
sleeve length: 8 mm
Fixing torque: 0.5 ... 0.6 Nm

Technical Data

Mounting: DIN rail IEC/EN 60 715
Weight: 220 g

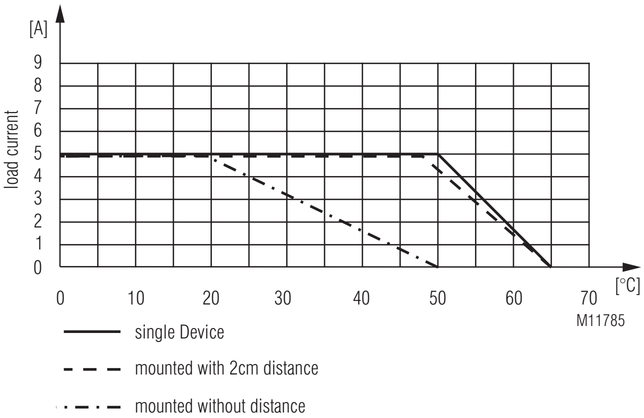
Dimensions

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

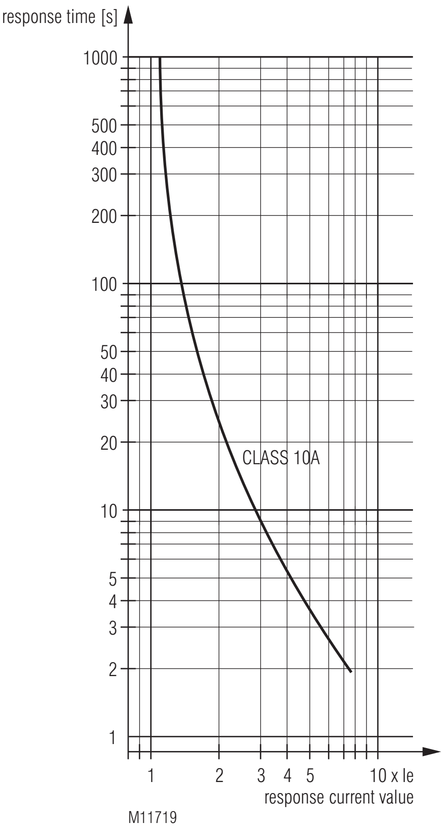
Standard Type

UG 9410PM 3 AC 200 ... 480 V 50/60 Hz 5.0 A
Article number: 0067521
- Nominal voltage: 3 AC 200 ... 480 V
- Nominal motor current: 5.0 A
- Modbus RTU
- Adjustable baud rate
- Width: 22.5 mm

Characteristics



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



Trigger characteristics
Motor overload protection

Setting Facilities

Potentiometer ADR10: - Unit adress x 10

Potentiometer ADR1: - Unit adress x 1

Potentiometer BAUD: - Baud rate

The module address and baud rate is only read after connecting the auxiliary supply!

Group fusing

Several motor starters can be wired in parallel on the supply side. Please make sure, that the total current cannot exceed 16 A. If several starters are use together and require more than 16 A, groups have to be split up for max 16 A.

Set-up Procedure

1. Connect motor and device according to application example. The 3 phases must be connected in correct sequence, wrong phase sequence will lead to failure (see failure code)
2. Setting unit adress and baud rate via potentiometer.
3. Power up the unit.
4. Parametrization via Modbus
5. At correct setting, the motor should ramp up continuously to full speed.

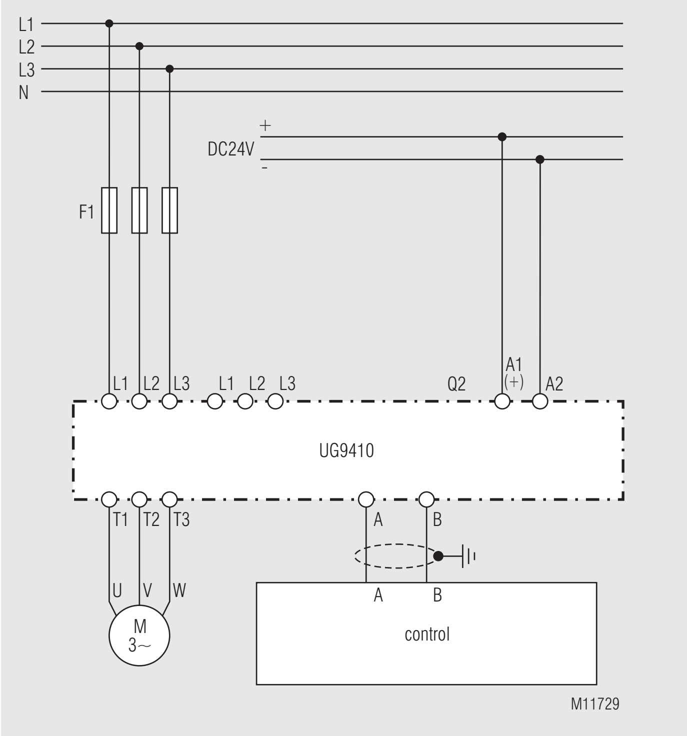
Safety Notes

- Never clear a fault when the device is switched on

Attention: This device can be started directly on the phase voltage without a contactor. Please be aware that the motor is still connected to the supply voltage also when it is not running. Therefore for work on motor and controller the supply has to be disconnected via E-stop.

- 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.
- Touch proof security is only provided when the power connection terminals are plugged into the unit.

Application Example



Motor control with UG 9410 and PLC via Modbus

Bus Interface

Protocol	Modbus Seriell RTU
Adress	1 bis 99
Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
Data bit	8
Stop bit	2
Parity	none

More information about the interface, wiring rules, device identification and communication monitoring can be found in the Modbus user manual.

Function-Codes

At UG 9410 the following function codes are implemented:

Function-Code	Name	Description
0x03	Read Holding Register	Device parameter read word by word
0x04	Read Input Register	Actual values read word by word
0x05	Write Single Coil	Outputs write induvidually
0x06	Write Single Register	Device parameter write word by word
0x10	Write Multiple Register	Device parameter write in blocks

Device configuration

If required the device configuration data can be saved permanently by setting the the Bit "WriteKonfig to EEPROM". The data is copied from the EEPROM to the relevant register when connecting the auxiliary voltage. As the numbers of write cycles of an EEPROM are limited, the writing must not be done in cycles. In addition it is not possible to receive modbus telegrams during a period of 50 ms while writing the EEPROM.

Parameter table

Every slave owns an output- configuration- and actual value table. In these tables it is defined under which address the parameters can be found.

Single Coils (Control signals):

Register-Adress	Protocol-Adresse	Name	Value range	Description	Data type	Access rights
1	0	RunRight	0x0000 0xFF00	Motor turns right off Motor turns right on	BIT	write
2	1	RunLeft	0x0000 0xFF00	Motor turns left off Motor turns left on	BIT	write
3	2	Reset	0x0000 0xFF00	No function Device reset	BIT	write
4	3	WriteKonfig to EEPROM	0x0000 0xFF00	No function Save parameter	BIT	write

Holding Register (Device configuration):

Register-Adress	Protocol-Adresse	Name	Value range	Description	Data type	Access rights
40001	0	Control word 1	0 … 2	Bit 0 = Reset Bit 1 = WriteKonfig to EEPROM	UINT16	write / reading
40002	1	Control word 2	0 … 2	Bit 0 = RunRight Bit 1 = RunLeft	UINT16	write / reading
40003	2	Ie *)	50 … 500	Nominal motor current in 1/100 A	UINT16	write / reading
40004	3	Mon *)	30 … 80	Softstart voltage in % from nominal voltage	UINT16	write / reading
40005	4	Ton *)	0 … 100	Softstart ramp time in 1/10 Sec	UINT16	write / reading
40006	5	Moff *)	80 … 30	Softstop voltage in % from nominal voltage	UINT16	write / reading
40007	6	Toff *)	0 … 100	Softstop ramp time in 1/10 s	UINT16	write / reading
40008	7	Timeout release	0 … 1	0 = Disable 1 = Enable	UINT16	write / reading
40009	8	Timeout	0 …10000	Timeout value in ms	UINT16	write / reading

*) Parameters can be stored permanently in the EEPROM by setting the Bit "WriteKonfig to EEPROM"

Input Register (Device state and measuring values):

Register-Adress	Protocol-Adresse	Name	Value range	Description	Data type	Access rights
30001	0	State word 1 Device failure	0 … 10	0: No failure 1: Overtemperature LT 2: Wrong freqency 3: Phase reversal 4: Phase failure 5: Motor blocked 6: 7: Temperatur circuit fault 8: Motor protection device actuated 9: Communication fault Modbus 10: Checksum failure EEPROM	UINT16	reading
30002	1	State word 2 State of device	0 … 6	0: Device initialize 1: Wait for start 2: Softstart ramp 3: Clockwise On 4: Anti-clockwise On 5: Softstop ramp 6: Device in errormode	UINT16	reading
30003	2	Actual motor current	0 … 3000	Actual motor current in 1/100 A	UINT16	reading
30004	3	Motor load	0 … 100	Motor load in % from rated motor power	UINT16	reading

MINISTART
Smart Motorstarter
UG 9411

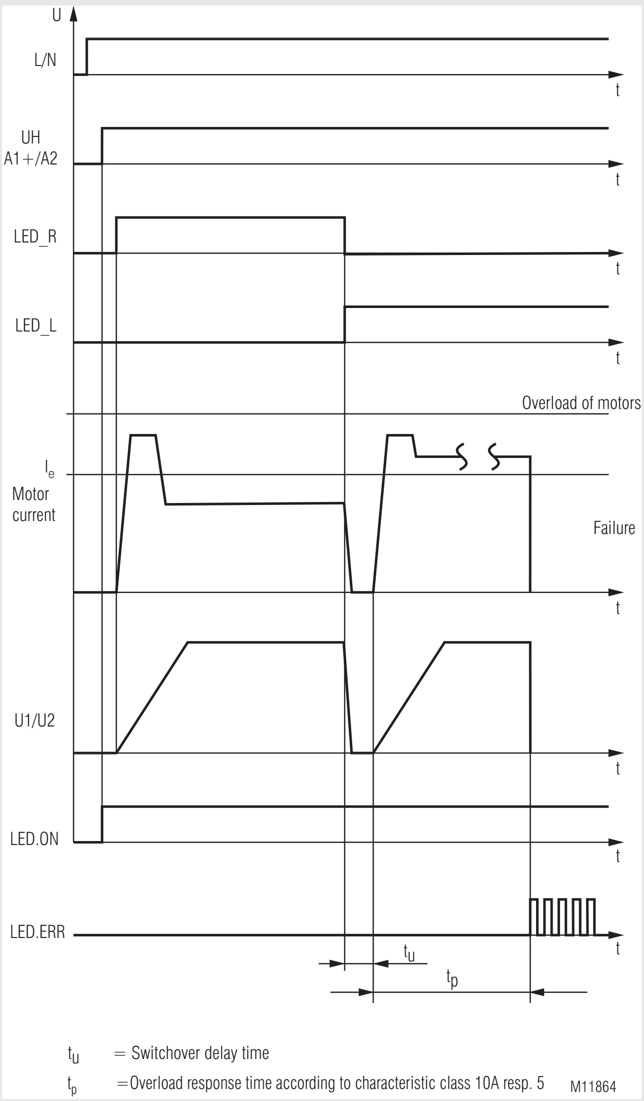
DOLD

0276161

Product Description

The smart motorstarter UG 9411 can be used for softstart, softstop, reversing and protecting 1 phase asynchronous motors. By measuring the line current a thermal model is used to calculate the motor temperature, and in the case of overtemperature the motor is disconnected. In addition also a thermo switch can be used. The reversing is done via relays. The relays are switched without current flow, this provides long service life.

Function Diagram



Your Advantages

- Up to 6 functions in one device
  - Reversing anticlockwise,
  - Reversing clockwise
  - Softstart
  - Softstop
  - Motor protection
  - Phase failure monitoring
- Widely used measuring and automation protocol
- 80 % less space
- Simple and time-saving commissioning as well as user-friendly
- Operation through parameterization via modbus
- 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
  - Device overload
- Pluggable clamps
- TWIN- connection terminals to loop auxiliary supply and Bus

Features

- According to IEC/EN 60 947-4-2
- Modbus RTU-interface
- To reverse 1-phase motors up to 50 ... 180 W or 180 W ... 1.1 kW at 230 V
- 1-phase softstart, softstop
- 3 potentiometer for setting the modbus adress and baud rate
- 5 LEDs for status indication
- Reversing with relays without current, softstart, softstop with thyristor
- Galvanic separation between control circuit and power circuit
- Width: 22.5 mm

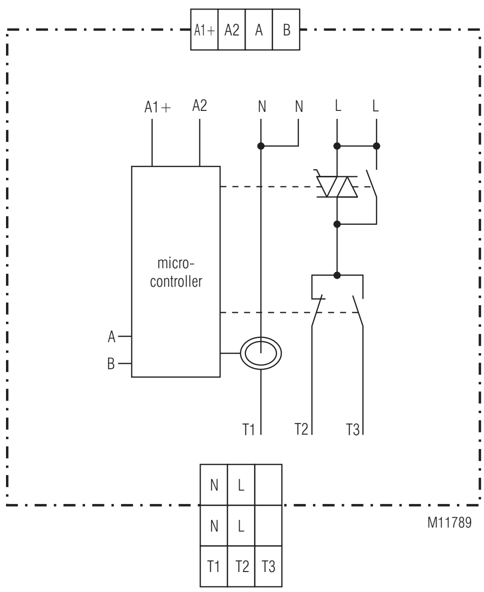
Approvals and Markings

CE

Applications

- 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



Connection Terminals

Terminal designation	Signal description
A1 (+)	Auxiliary voltage + DC 24 V
A2	Auxiliary voltage 0 V
A	Modbus signal A
B	Modbus signal B
L	Phase connection L
N	Neutral
T1	Motor connection T1
T2	Motor connection T2
T3	Motor connection T3

Function

Softstart
The motor phase is controlled using thyristors, so that the motor current rises continuously. The starting torque behaves in the same way. This provides shock free starting and reduces mechanical failures. Starting time- and starting voltage can be adjusted via Modbus.

Softstop
The motor phases is controlled using thyristors, so that the motor current drops continuously. The motor torque behaves in the same way on run down. This provides shock free stopping and reduces mechanical failures. Stopping time and stopping voltage can be adjusted via Modbus.

Motorschutz
Motor protection
The thermal load of the motor is calculated using a thermal model. The current is measured in phase N. 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 and motor leading can be acknowledged via Modbus.

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

Phase failure monitoring
After connecting the auxiliary supply, the unit checks if the phases L / N is correct. If L or L / N phases are missing, the unit indicates fault 4. This fault can be reset via Modbus.

Indicators

green LED "On": permanent on - supply connected

red LED "ERR": flashing - Failure code of the device

yellow LED "Bus": flashing - When receiving or transmitting Modbus data

yellow LED "L": permanent on - Motor turns anti-clockwise
flashing - softstart or softstop active on anti-clockwise turn

yellow LED "R": permanent on - Motor turns clockwise
flashing - softstart or softstop active on clockwise turn

Failure code :
1 - Overtemperature on semiconductors
2 - Wrong mains freqency
4 - Phase failure detected
7 - Incorrect temperature measurement circuit
8 - Motor protection has responded
9 - Modubus communication failure
10 - Checksum failure EEPROM

1*) - 10*) = Number of flashing pulses in sequence

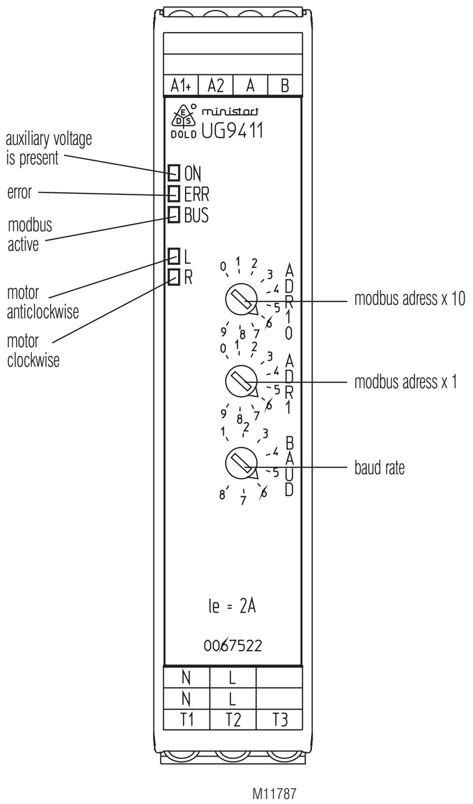
Reset Function

By sending a reset command a reset can be operated via Modbus

Modbus RTU

For communication between motor controller and a supervising control the Modbus RTU protocol according to Specification V 1.1b3 is used.

Setting



Position Potentiometer BAUD	1	2	3	4	5	6	7	8
Baud rate Baud	1200	2400	4800	9600	19200	38400	57600	115200
Response Time	< 50 ms	< 25 ms	< 12 ms	< 10 ms	< 5 ms	< 5 ms	< 5 ms	< 5 ms

Technical Data

Nominal voltage L1/N:	AC 230 V ± 10%	
Nominal frequency:	50 / 60 Hz , automatic detection	
Auxiliary voltage:	DC 24 V ± 10%	
Motor power:	1.5 A ... 7.0 adjustable via Modbus 0.3 A ... 2.0 A adjustable via Modbus	
Operating mode:		
7.0 A:	AC 53a: 4-2: 100-30	IEC/EN 60947-4-2
2.0 A:	AC 53a: 4-2: 100-30	IEC/EN 60947-4-2
Measured nominal current:	7.0 A; 2.0 A	
Surge current:	200 A (tp = 20 ms)	
Load limit integral:	200 A^2s (tp = 10 ms)	
Peak reverse voltage:	1500 V	
Overvoltage limiting:	AC 510 V	
Leakage current in off state:	< 0.5 mA	
Start / deceleration voltage:	30 ... 80 % adjustable via Modbus	
Start / deceleration ramp:	0 ... 10 s adjustable via Modbus	
Consumption:	2 W	
Switchover delay time:	500 ms dependent of I_e	
Switchover delay time:	150 ms	
Start up delay for master tick:	min. 25 ms	
Release delay for master tick:	min. 30 ms	
Current measurement:		
7 A device:	AC 0.5 ... 25 A	
2 A device:	AC 0.2 ... 10 A	
Measuring accuracy:	± 5% of end of scale value	
Measured value update time		
at 50 Hz:	100 ms	
at 60 Hz:	83 ms	
Motor protection		
up to 6.9 A:	Class 10 A	
6.9 to 7.0 A	Class 5	
Electronically, with thermal memory		
Reset:	manual via Modbus	
Short circuit strength		
max. fuse rating:	25 A gG / gL	IEC/EN 60 947-5-1

General Data

Operating mode:	Continuous operation	
Operation:	0 ... + 65 °C (see derating curve)	
Storage:	- 40 ... + 70 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 1.000 m	
Clearance and creepage distances		
rated impuls voltage / pollution degree		
Motor voltage- control voltage:	6 kV / 2	IEC 60 664-1
Motor voltage- Modbus:	6 kV / 2	IEC 60 664-1
Overvoltage category:	III	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 1.0 GHz:	10 V / m	IEC/EN 61 000-4-3
1.0 GHz ... 2.5 GHz:	3 V / m	IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz:	1 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages		
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
Interference emission		
Wire guided:	Limit value class B	IEC/EN 60 947-4-2
Radio irradiation:	Limit value class B	IEC/EN 60 947-4-2
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 / 065 / 04	IEC/EN 60 068-1

Technical Data

Wire connection:		DIN 46 228-1/-2/-3/-4
Removable terminal blocks		
Wire connection		
Phase voltage and motor pluggable screw terminal (S):	0.25 ... 2.5 mm^2 solid or 0.25 ... 2.5 mm^2 stranded ferruled	
Wire connection:		
Bus and auxiliary supply pluggable Twin-cage-clamp-terminal (PT):	0.25 ... 1.5 mm^2 solid or 0.25 ... 1.5 mm^2 stranded ferruled	
Insulation of wires or sleeve length:	8 mm	
Fixing torque:	0.5 ... 0.6 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	220 g	

Dimensions

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

Standard Types

UG 9411PM AC 230 V 50/60 Hz 7.0 A

Article number: 0067523

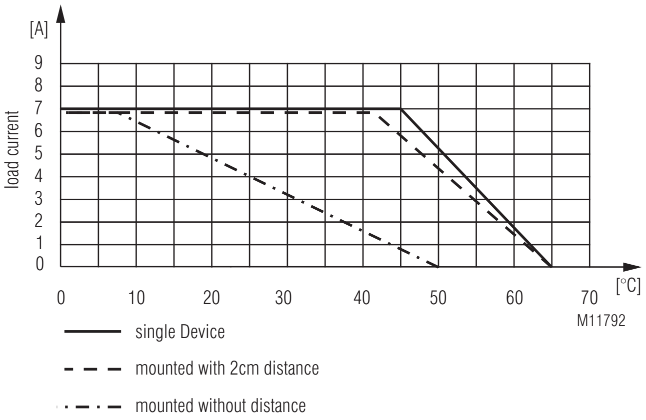
- Nominal voltage: AC 230 V
- Nominal motor current: 7.0 A
- Modbus RTU
- Adjustable baud rate
- Width: 22.5 mm

UG 9411PM AC 230 V 50/60 Hz 2.0 A

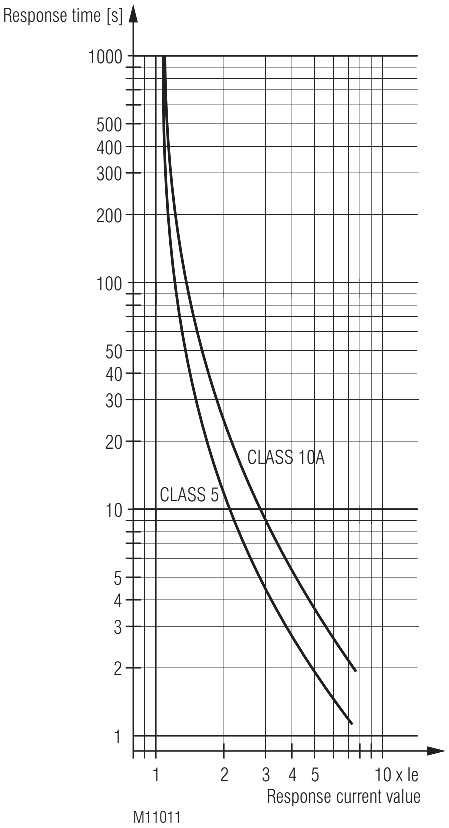
Article number: 0067522

- Nominal voltage: AC 230 V
- Nominal motor current: 2.0 A
- Modbus RTU
- Adjustable baud rate
- Width: 22.5 mm

Characteristics



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



Trigger characteristics
Motor overload protection

Setting Facilities

Potentiometer ADR10: - Unit adress x 10

Potentiometer ADR1: - Unit adress x 1

Potentiometer BAUD: - Baud rate

The module address and baud rate is only read after connecting the auxiliary supply!

Group fusing

Several motor starters can be wired in parallel on the supply side. Please make sure, that the total current cannot exceed 16 A. If several starters are use together and require more than 16 A, groups have to be split up for max 16 A.

Set-up Procedure

1. Connect motor and device according to application example. The 3 phases must be connected in correct sequence, wrong phase sequence will lead to failure (see failure code)
2. Setting unit adress and baud rate via potentiometer.
3. Power up the unit.
4. Parametrization via Modbus
5. At correct setting, the motor should ramp up continuously to full speed.

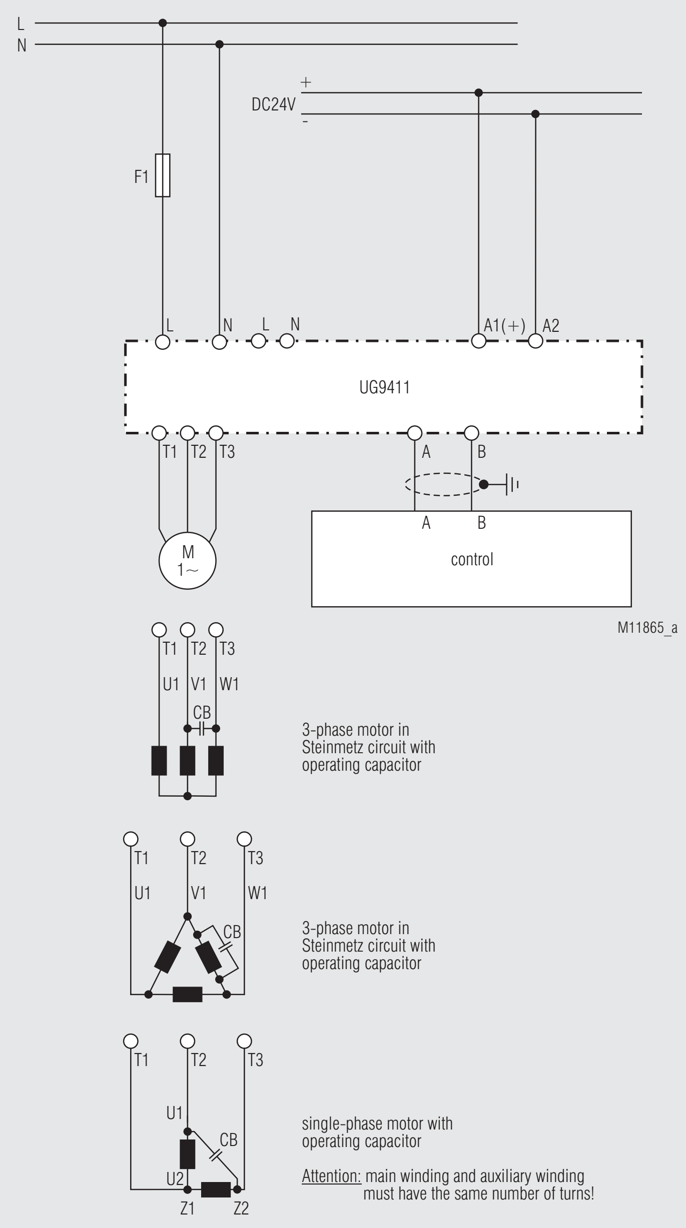
Safety Notes

- Never clear a fault when the device is switched on

Attention: This device can be started directly on the phase voltage without a contactor. Please be aware that the motor is still connected to the supply voltage also when it is not running. Therefore for work on motor and controller the supply has to be disconnected via E-stop.

- 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.
- Touch proof security is only provided when the power connection terminals are plugged into the unit.

Application Example



Motor control with UG 9411 and PLC via Modbus

Bus Interface

Protocol	Modbus Seriell RTU
Adress	1 bis 99
Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud
Data bit	8
Stop bit	2
Parity	none

More information about the interface, wiring rules, device identification and communication monitoring can be found in the Modbus user manual.

Function-Codes

At UG 9411 the following function codes are implemented:

Function-Code	Name	Description
0x03	Read Holding Register	Device parameter read word by word
0x04	Read Input Register	Actual values read word by word
0x05	Write Single Coil	Outputs write induvidually
0x06	Write Single Register	Device parameter write word by word
0x10	Write Multiple Register	Device parameter write in blocks

Device configuration

If required the device configuration data can be saved permanently by setting the the Bit "WriteKonfig to EEPROM". The data is copied from the EEPROM to the relevant register when connecting the auxiliary voltage. As the numbers of write cycles of an EEPROM are limited, the writing must not be done in cycles. In addition it is not possible to receive modbus telegrams during a period of 50 ms while writing the EEPROM.

Parameter table

Every slave owns an output- configuration- and actual value table. In these tables it is defined under which address the parameters can be found.

Single Coils (Control signals):

Register-Adress	Protocol-Adress	Name	Value range	Description	Data type	Access rights
1	0	RunRight	0x0000 0xFF00	Motor turns right off Motor turns right on	BIT	write
2	1	RunLeft	0x0000 0xFF00	Motor turns left off Motor turns left on	BIT	write
3	2	Reset	0x0000 0xFF00	No function Device reset	BIT	write
4	3	WriteKonfig to EEPROM	0x0000 0xFF00	No function Save parameter	BIT	write

Holding Register (Device configuration):

Register-Adress	Protocol-Adress	Name	Value range	Description	Data type	Access rights
40001	0	Control word 1	0 … 2	Bit 0 = Reset Bit 1 = WriteKonfig to EEPROM	UINT16	write / reading
40002	1	Control word 2	0 … 2	Bit 0 = RunRight Bit 1 = RunLeft	UINT16	write / reading
40003	2	Ie Typ 2A Ie Typ 7A *)	30 … 200 150 …700	Nominal motor current in 1/100 A	UINT16	write / reading
40004	3	Mon *)	30 … 80	Softstart voltage in % from nominal voltage	UINT16	write / reading
40005	4	Ton *)	0 … 100	Softstart ramp time in 1/10 s	UINT16	write / reading
40006	5	Moff *)	80 … 30	Softstop voltage in % from nominal voltage	UINT16	write / reading
40007	6	Toff *)	0 … 100	Softstop ramp time in 1/10 s	UINT16	write / reading
40008	7	Timeout release	0 … 1	0 = Disable 1 = Enable	UINT16	write / reading
40009	8	Timeout	0 …10000	Timeout value in ms	UINT16	write / reading

*) Parameters can be stored permanently in the EEPROM by setting the Bit "WriteKonfig to EEPROM"

Input Register (Device state and measuring values):

Register-Adress	Protocol-Adress	Name	Value range	Description	Data type	Access rights
30001	0	State word 1 Device failure	0 … 10	0: No failure 1: Overtemperature LT 2: Wrong freqency 3: Phase reversal 4: Phase failure 5: Motor blocked 6: 7: Temperatur circuit fault 8: Motor protection device actuated 9: Communication fault Modbus 10: Checksum failure EEPROM	UINT16	reading
30002	1	State word 2 State of device	0 … 6	0: Device initialize 1: Wait for start 2: Softstart ramp 3: Clockwise On 4: Anti-clockwise On 5: Softstop ramp 6: Device in errormode	UINT16	reading
30003	2	Actual motor current	0 … 3000	Actual motor current in 1/100 A	UINT16	reading
30004	3	Motor load	0 … 100	Motor load in % from rated motor power	UINT16	reading

MINISTART
Smart Motorstarter
UG 9256

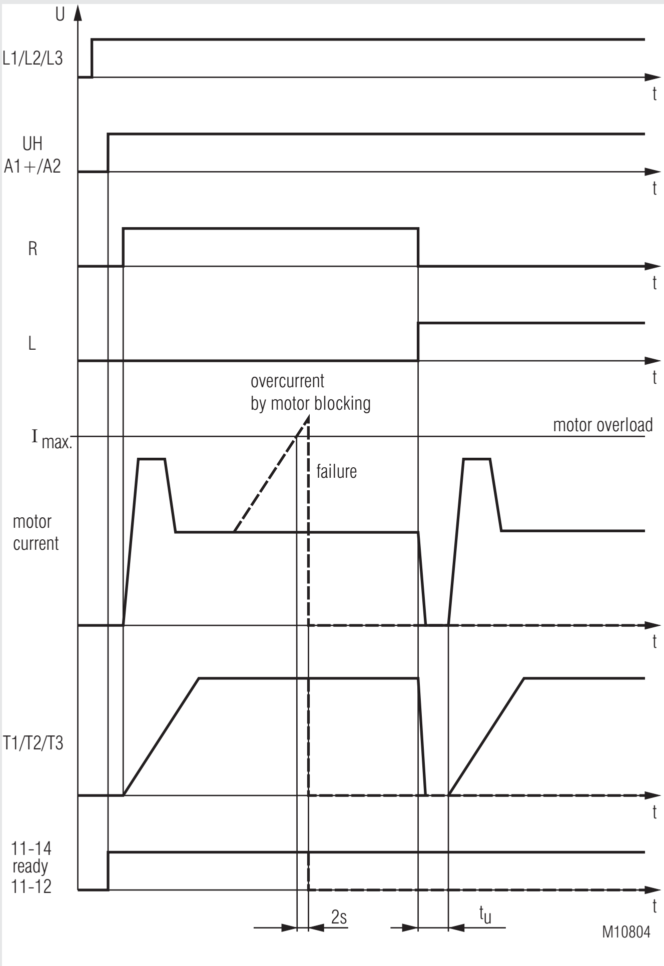
DOLD

0264671

Product Description

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.

Function Diagram



t_U = switchover delay time

t_p = overload response time according to characteristic class 10A or 5 (variants /XX1)

Your Advantages

- Up to 6 function in one unit
  - Reversing anticlockwise
  - Reversing clockwise
  - Softstart
  - Softstop
  - Current monitoring or motor protection
  - Galvanic separation via forcibly guided contacts contact distance min. 0.5 mm
- 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 550 W to 4 kW
- 2-phase softstart
- max. 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
- Width: 22,5 mm

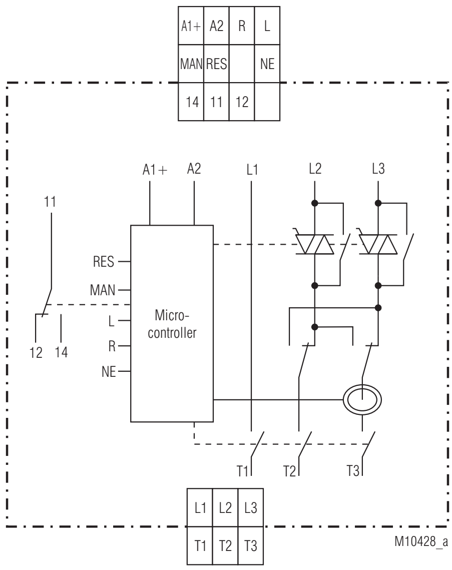
Approvals and Markings

CE c UL US LISTED
Canada / USA

Applications

- 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



Connection Terminals

Terminal designation	Signal description
A1 (+)	Auxiliary voltage + DC 24 V
A2	Auxiliary voltage 0 V
R+	Control input clockwise
L+	Control input anti-clockwise
NE	Earth connection control input
MAN	Input for remote reset
RES	Output for remote reset
11, 12, 14	Indicator relay for operation
L1	Phase voltage L1
L2	Phase voltage L2
L3	Phase voltage L3
T1	Motor connection T1
T2	Motor connection T2
T3	Motor connection T3

Function

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. The nominal motor current can be adjusted via potentiometer I_e. 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 I_{max}. 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 (variant /_0_)
In off state or fault condition the motor terminals are isolated from the mains voltage by a 4 pole. forcibly guided contact relay. The contact opening is min. 0.5 mm.

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*)	- min. 1 phase is missing
	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

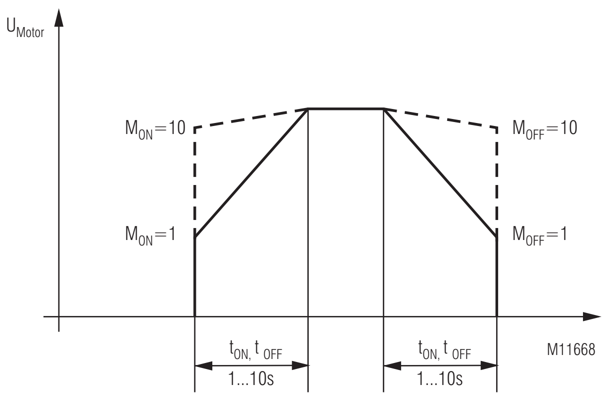
2 options are available to acknowledge the fault

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}



Setting of start / deceleration ramp

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 requrired current.
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.

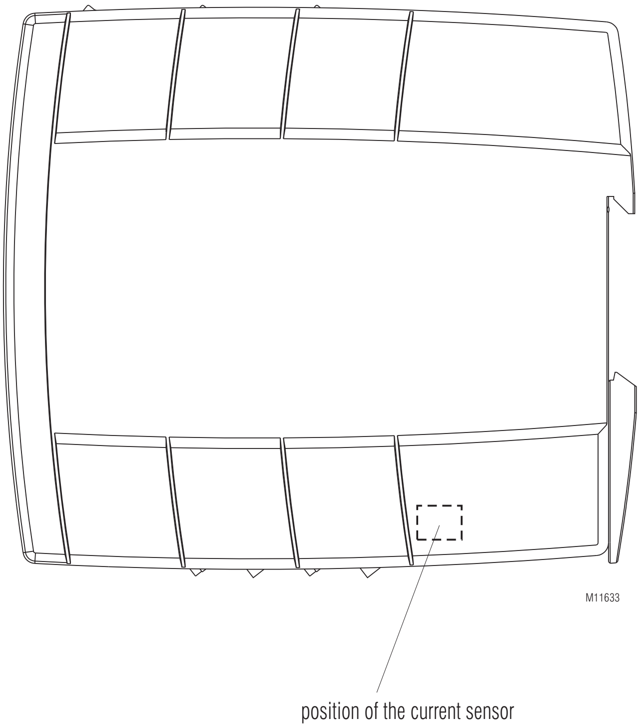
Safety Notes

Attention !

- 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

The phase current in the device is measured with a hall effect sensor. Due to this principle also magnetic fields next to the sensor may have an influence. When designing circuits with this motorstarter components that generate magnetic fields like contactors, transformers, high current wires should not be placed close to the sensor.



Technical Data

Nominal voltage L1/L2/L3:	3 AC 200 ... 480 V ± 10%	
Nominal frequency:	50 / 60 Hz , automatic detection	
Auxiliary voltage:	DC 24 V ± 10%	
Motor power:	4 kW at AC 400 V	
Min. motor power:	25 W	
Operating mode:		
9 A:	AC 51	
9 A:	AC 53a: 6-2: 100-30	IEC/EN 60947-4-2
Surge current:	200 A (tp = 20 ms)	
Load limit integral:	200 A²s (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 _ _; /3_ _:	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 at variant /_ _0	
Nominal motor current I_e:	1.6 A ... 9.0 A at variant /_ _1	
Measuring accuracy:	± 5% of end of scale value	
Measured value update time		
at 50 Hz:	100 ms	
at 60 Hz:	83 ms	
Motor protection		
I_e 1.5 A bis 6.8 A:	Class 10 A	
I_e 6.9 A bis 9.0 A:	Class 5	
Electronically, without thermal memory		
Reset:	manual	
Short circuit strength:		
max. fuse rating:	25 A gG / gL	IEC/EN 60 947-5-1
Assignment type:	1	IEC/EN 60 947-4-1
Electrcal life:	> 10 x 10^6 switching cycles	

Inputs

Control input right, left:	DC 24V
Rated current:	4 mA
Response value ON:	DC 15 V ... 30 V
Response value OFF:	DC 0 V ... 5 V
Connection:	polarity protected diode
Manuel:	DC 24 V (connect button on terminals "MAN" and "RES")

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
Thermal current I_{th}:	5 A	
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 gG / gL	IEC/EN 60 947-5-1

Technical Data

General Data

Device type:	Hybrid Motor Controller H1B	
Operating mode:	Continuous operation	
Temperature range:		
Operation:	0 ... + 60 °C (see derating curve)	
Storage:	- 25 ... + 75 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 1.000 m	
Clearance and creepage distances		
Rated insulation voltage:	500 V	
overvoltage category / contamination level between control input- , auxiliary voltage and Motor voltage respectively indicator contact:	4 kV / 2	IEC/EN 60 664-1
Overvoltage category:	III	
EMC		
Interference resistance		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 1.0 GHz:	10 V / m	IEC/EN 61 000-4-3
1.0 GHz ... 2.5 GHz:	3 V / m	IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz:	1 V / m	IEC/EN 61 000-4-3
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
Interference emission		
Wire guided:	Limit value class B	IEC/EN 60 947-4-2
Radio irradiation:	Limit value class B	IEC/EN 60 947-4-2
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 / 060 / 04	IEC/EN 60 068-1
Wire connection:		DIN 46 228-1/-2/-3/-4
Screw terminal (fixed):		
Control terminals		
Cross section:	1 x 0.14 ... 2.5 mm^2 solid or stranded wire with sleeve	
Power terminals		
Cross section:	1 x 0.25 ... 2.5 mm^2 solid or stranded wire with sleeve	
Insulation of wires or sleeve length:	8 mm	
Fixing torque:	0.5 Nm	
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

UL-Data

Standards:
for all products:
- U.S. National Standard UL508, 17th Edition
- Canadian National Standard - CAN/CSA-22.2 No. 14-13,12th Edition

with restrictions at motor switching power:
- ANSI/UL 60947-1, 3rd Edition (Low-Voltage Switchgear and Controlgear Part1: General rules)
- ANSI/UL 60947-4-2, 1st Edition (Low-Voltage Switchgear and Controlgear Part 4-2: Contactors and Motor-Starters - AC Semiconductor Motor Controllers and Starters)
- CAN/CSA-C22.2 No. 60947-1-07, 1st Edition (Low-Voltage Switchgear and Controlgear - Part1: General rules)
- CSA-C22.2 No. 60947-4-2-14, 1st Edition (Low-Voltage Switchgear and Controlgear - Part 4-2: Contactors and Motor-Starters - AC Semiconductor Motor Controllers and Starters

Motor data:
UL 508, CSA C22.2 No. 14-13

3 AC 200 ... 480 V, 3-phase, 50 / 60 Hz:	up to 7.6 FLA, 45.6 LRA at 40 °C up to 4.8 FLA, 28.8 LRA at 50 °C up to 2.1 FLA, 12.6 LRA at 60 °C

UL 60947-4-2, CSA 60947-4-2

3 AC 200 ... 300 V, 3-phase, 50 / 60 Hz:	up to 7.6 FLA, 45.6 LRA at 40 °C up to 4.8 FLA, 28.8 LRA at 50 °C up to 2.1 FLA, 12.6 LRA at 60 °C
3 AC 301 ... 480 V, 3-phase, 50 / 60 Hz:	up to 2.1 FLA, 12.6 LRA at 60 °C

Motor protection

I_e 1.5 A bis 6.8 A:	Class 10 / 10 A
I_e 6.9 A bis 9.0 A:	Class 5

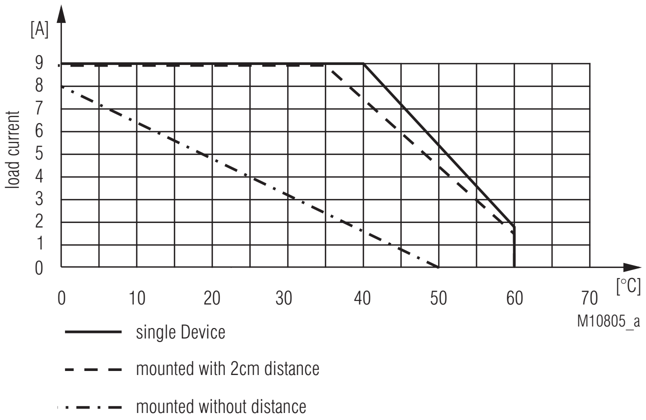
Electronically, without thermal memory

Reset:	manual
Indicator output relay:	5 A 240 V ac Resistive
Wire connection:	60 °C / 75 °C copper conductors only
Connections	
A1+, A2, X1+, X2, MAN, RES, NE, 11, 12, 14:	AWG 22 - 14 Sol/Str Torque 3.46 Lb-in (0.39 Nm)
L1, L2, L3, T1, T2, T3:	AWG 30 - 12 Str Torque 5-7 Lb-in (0.564-0.79 Nm)

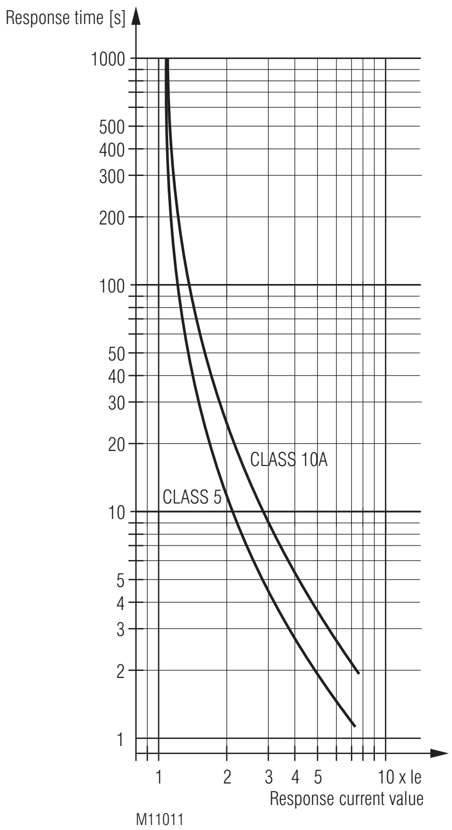
Additional Notes:
- This device is intended for use on supply systems with a maximum voltage from phase to ground of 300 V (e.g. for a three phase-four wire system 277/480 V or on a three phase-three wire systems of 240 V), rated impulse withstand voltage of max. 4 kV
- Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical Amperes, 480 Volts maximum when protected by class CC, J or RK5 fuse rated maximum 20 A
- For use in pollution degree 2 Environment or equivalent
- The control circuits of this device shall be supplied by an isolated 24 Vdc power supply which output is protected with a fuse rated max. 4 A dc
- For installations according to Canadian National Standard C22.2 No. 14-13 (cUL Mark only) and supply voltages above 400V:
  - Transient surge suppression devices shall be installed on the line side of this equipment and shall be rated 240 V (phase to ground), 415 V (phase to phase), suitable for overvoltage category III, and shall provide protection for a rated impulse withstand voltage peak of 4 kV
  - Transient surge suppression devices shall be installed on the line side of this equipment and shall be rated 277 V (phase to ground), 480 V (phase to phase), suitable for overvoltage category III, and shall provide protection for a rated impulse withstand voltage peak of 4 kV

Technical data that is not stated in the UL-Data, can be found in the technical data section.

Characteristics



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



Variant / _ _ 1:
Trigger characteristics
Motor overload protection

Standard Type

UG 9256.11/010/61   3 AC 200 ... 480 V   9,0 A   1 ... 10 s

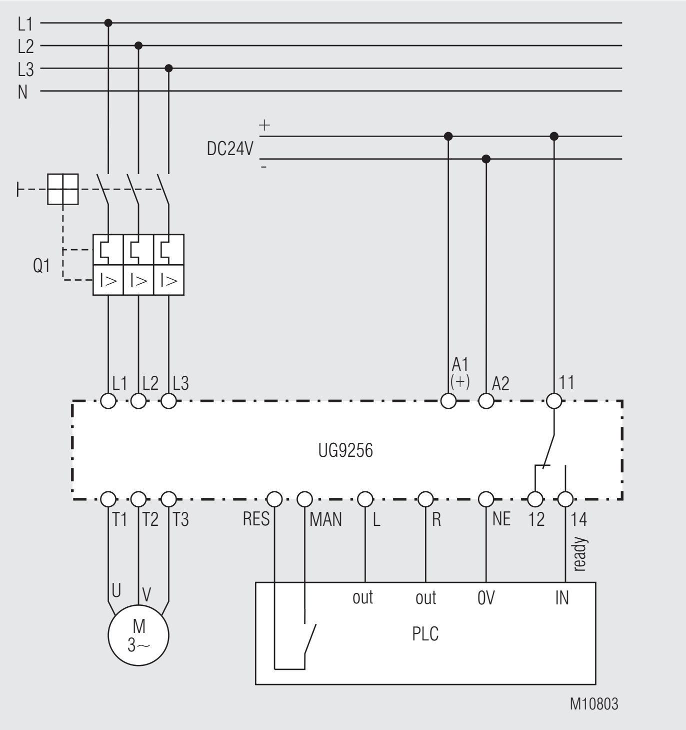
Article number: 0064445
- Nominal voltage: 3 AC 200 ... 480 V
- Nominal current: 9,0 A
- Ramp time: 1 ... 10 s
- Control input R, L
- With softstart
- Without mains isolating
- With overcurrent protection
- Width: 22.5 mm

Ordering Example

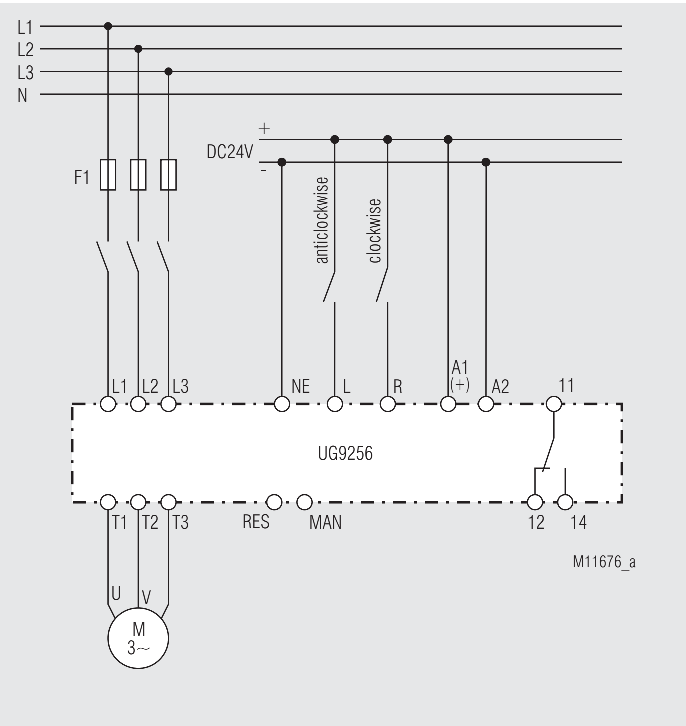
UG 9256.11 / _ _ _ /61 3 AC 200 ... 480 V 9 A 1 ... 10 s

- Ramp time
- Nominal current
- Nominal voltage
- UL approval
- 0 = Overcurrent protection
  1 = Motor protection
- 0 = with mains isolating relay, on when no failure
  1 = without mains isolating relay, on when no failure
  3 = without mains isolating, relay, indicator relay at beginning to softstart on till end of softstop
  4 = with mains isolating relay, indicator relay on while bridging relay on
- 0 = with softstart
  1 = with softstart / softstop
  2 = with softstart / softstop, with ramp off at time potentiometer $t_{on}/_{off}$ 0 ... 0,1 = without ramp
  3 = with softstart, with ramp off at time potentiometer $t_{on}/_{off}$ 0 ... 0,1 = without ramp
  4 = without softstart / softstop
- Type

Application Example



Motor control with UG 9256 and PLC



Motor control with UG 9256 and switch

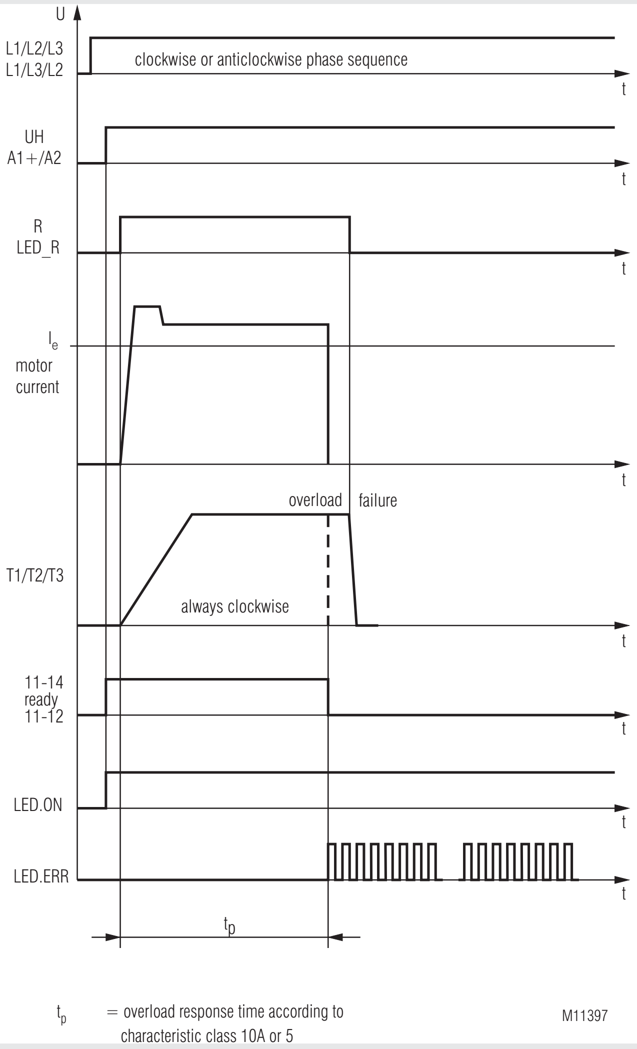
MINISTART
Smart Motorstarter with autom. phase sequence correction
UG 9256/804, UG 9256/807


0273199

Product Description

The smart motorstarter UG 9256/804 and is used to provide always a clockwise phase sequence and to start asynchronous motors. Independent of the the pase sequence on the input it will always provide clockwise sequence on the output to the motor. The unit also protects the motor against phase failure and motor overload. The relays of the reversing circuit switch without current. This provides a long electrical life.

Function diagram



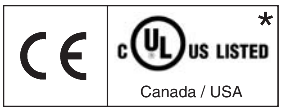
Your Advantages

- Up to 3 functions in one unit
  - Providing clockwise phase sequence at the motor connection terminals
  - Phase failure detection
  - Motorprotection Class 10 A, Class 5
- Galvanic mains separation by forcibly guided contacts contact opening min. 0.5 mm (UG 9256/807)
- 66 % less space
- Simple and time-saving commissioning as well as user-friendly operation through setting via potentiometer on absolute scale
- 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

Features

- According to UL 60 947-4-2
- To reverse the rotary field
- For 3-phase motors with rated motor current from I_e 1,5 A ... 9,0 A
- 1 potentiometer für setting of rated motor current
- 3 LEDs for status indication
- Reversing with relays without current, switching with thyristor
- Galvanic separated 24V-inputs for clockwise
- Reset button on front
- Connection facility for external reset button
- Relay indicator output for operation
- Galvanic separation between control circuit and power circuit
- Galvanic separation of motor terminals from mains voltage in off state or fault condition (UG 9256/807)
- Width 22.5 mm

Approvals and Markings

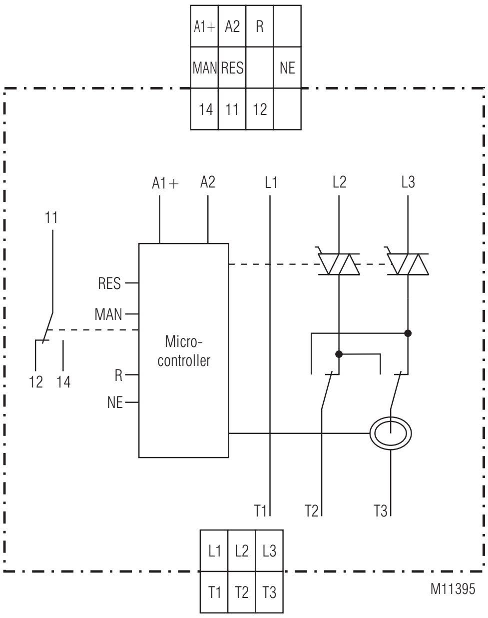


* in preparation

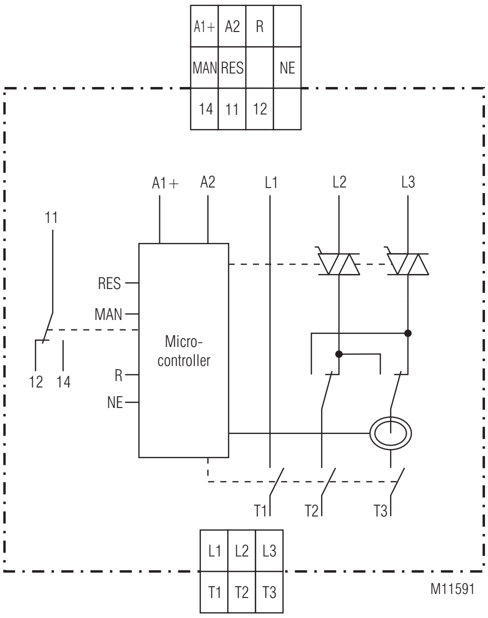
Application

- Conveyor systems with preferred direction of rotation
- Actuating drives in process controls with preferred direction of rotation

Circuit Diagrams



UG 9256/804



UG 9256/807

Connection Terminals

Terminal designation	Signal description
A1 (+)	Auxiliary voltage + DC 24 V
A2	Auxiliary voltage 0 V
R+	Control input clockwise
L+	Control input anti-clockwise
NE	Earth connection control input
MAN	Output for remote reset
RES	Input for remote reset
11, 12, 14	Indicator relay for operation
L1	Phase voltage L1
L2	Phase voltage L2
L3	Phase voltage L3
T1	Motor connection T1
T2	Motor connection T2
T3	Motor connection T3

Functions

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.
Phase failure is detected when he phase is missing for at least 1 second.

Motor connection (UG 9256/807)
In off state or fault condition the motor terminals are isolated from the mains voltage by a 4 pole. forcibly guided contact relay. The contact opening is min. 0.5 mm

Control inputs
Clockwise rotation can be selected via one control input. The reference connection for the control input is the terminal NE. The control input is galvanically separated from the rest of the unit.

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

red LED "ERR": short impulse - Phase reversal detected
red LED "ERR": flashing - Error
1*) - Overtemperature on semiconductors
2*) - Wrong mains freqency
4*) - Icorrect synchronisation signal
6*) - mains isolating energized
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 I_e: - Nom. motor current 1.5 A_{eff} ... 9.0 A_{eff}

Set-up Procedure

1. Connect motor and device according to application example. The unit works with clockwise or anticlockwise phase sequence.
2. Adjust the nominal current of the connected motor with potentiometer Ie
3. Connect devive to power and start motor via control input R.

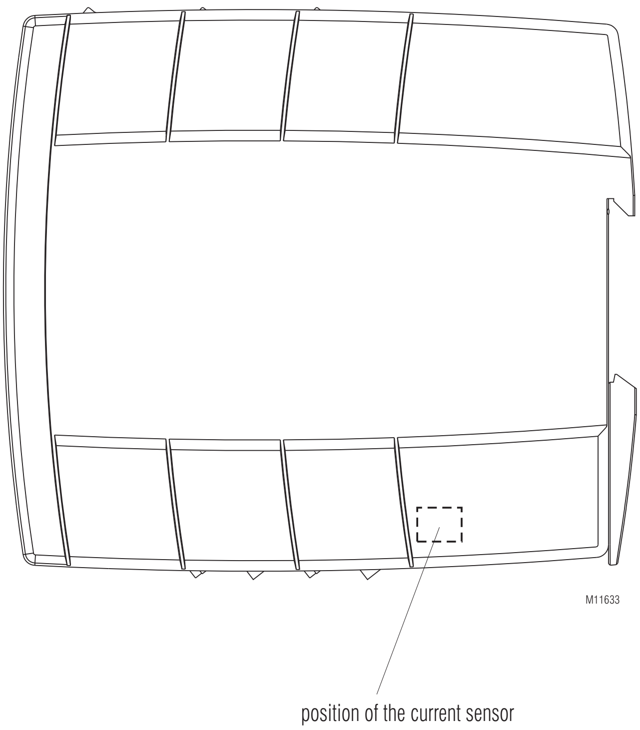
Safety Notes

- 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.

The phase current in the device is measured with a hall effect sensor. Due to this principle also magnetic fields next to the sensor may have an influence. When designing circuits with this motorstarter components that generate magnetic fields like contactors, transformers, high current wires should not be placed close to the sensor.



Technical Data

Nominal voltage L1/L2/L3:	3 AC 200 ... 480 V ± 10%	
Nominal frequency:	50 / 60 Hz , automatic detection	
Auxiliary voltage:	DC 24 V ± 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 cycle.

Surge current:	200 A (tp = 20 ms)	
Load limit integral:	200 A²s (tp = 10 ms)	
Peak reverse voltage:	1500 V	
Overvoltage limiting:	AC 550 V	
Leakage current in off state:	< 3 x 0.5 mA	
Consumption:	2 W	
Start up delay for master tick:	min. 100 ms	
Release delay for master tick:	min. 50 ms	
Overcurrent measuring device:	AC 0.5 ... 50 A	
Measuring accuracy:	± 5% of end of scale value	
Measured value update time		
at 50 Hz:	100 ms	
at 60 Hz:	83 ms	
Motor protection		
I_e 1.5 A to 6.9 A:	Class 10 A	
I_e 6.9 A to 9.0 A:	Class 5	
Short circuit strength:		
max. fuse rating:	25 A gL	IEC/EN 60 947-5-1

Inputs

Control input right:	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")

Indicator Outputs

RES:	DC 24 V, semiconductor, short circuit proof, rated continuous current 0.2 A	
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:	15 x 10^6 switching cycles	
Permissible switching frequency:	1800 switching cycles/h	
Short circuit strength max. fuse rating:	4 A gG / gL	IEC/EN 60 947-5-1

Technical Data

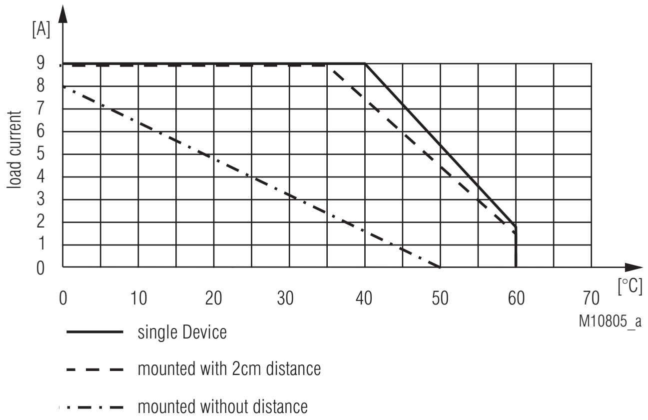
General Data

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	IEC/EN 60 664-1
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
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
RF interference emission:	Limit Class value B	IEC/EN 60947-4-2
Radio interference,	Measurement procedures	EN 55 011
Radio interference voltage,	Measurement procedures	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	
Fixing torque:	0.5 Nm	
Wire fixing:	captive slotted screw	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	220 g	

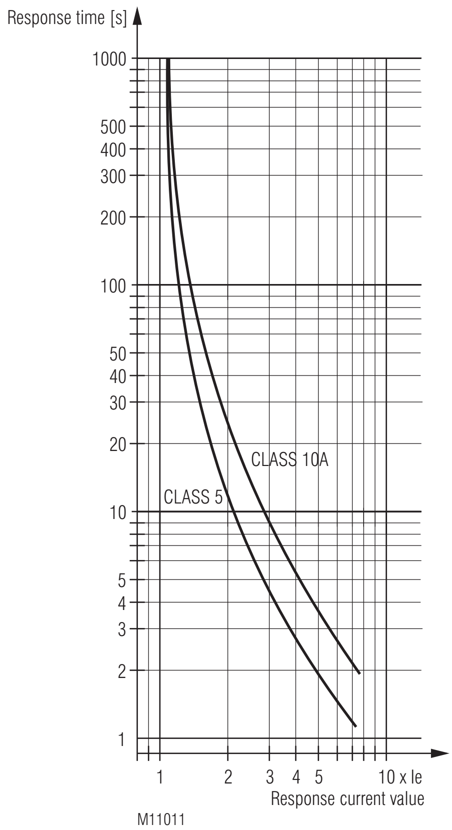
Dimensions

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

Characteristics



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



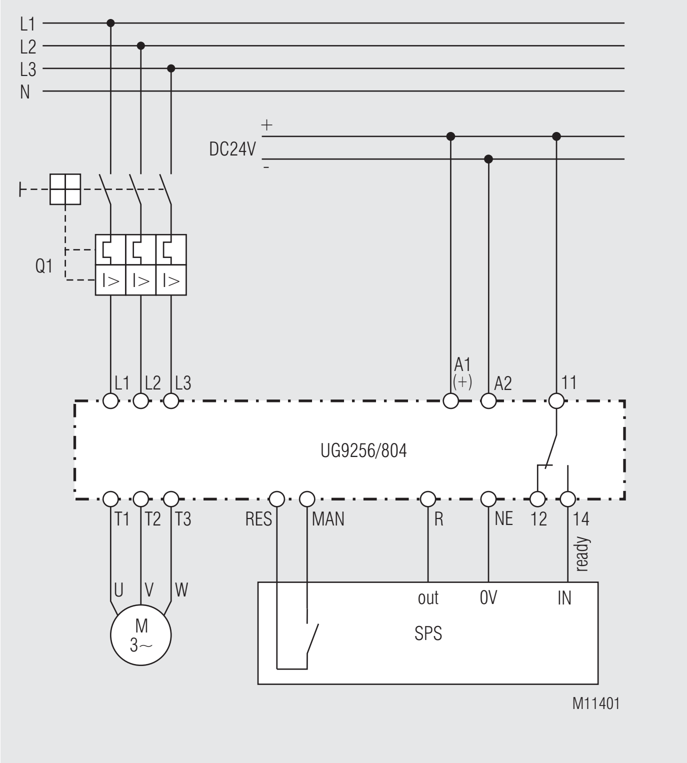
Trigger characteristics
Motor overload protection

Standard Types

UG 9256.11/804/61   3 AC 200 ... 480 V   9.0 A
Article number: 0066450
- Nominal voltage: 3 AC 200 ... 480 V
- Nominal current: 9.0 A
- Control input R
- Width: 22.5 mm

UG 9256.11/807/61   3 AC 200 ... 480 V   9.0 A
Article number: 0067133
- Nominal voltage: 3 AC 200 ... 480 V
- Nominal current: 9.0 A
- Main isolating
- Control input R
- Width: 22.5 mm

Application Example



Motor control with UG 9256/804 and PLC

Type	Function
BA	
BA 7924	Delay module, release delay
BD	
BD 5935	Emergency stop module
BD 5980N	Two-hand safety relay
BD 5987	Emergency stop module
BG	
BG 5551	Diagnostic module for CANopen
BG 5912	Output module with output contacts
BG 5913.08/_0_ _ _	Input module
BG 5913.08/_1 _ _	Input module
BG 5913.08/_2_ _ _	Input module
BG 5913.08/_3_ _ _	Input module
BG 5914.08/_0_ _ _	Input module
BG 5915.08/_1_ _ _	Input module
BG 5924	Emergency stop module
BG 5925	Emergency stop module
BG 5925/900	Light curtain controller
BG 5925/910	Safety-mat switch gear
BG 5925/920	Switch gear for safety switch
BG 5929	Extension module
BG 5933	Two-hand safety relay
BG 7925	Delay module, release delay
BG 7926	Delay module, release delay
BH	
BH 5552	Diagnostic module for CANopen
BH 5902/01MF2	Light curtain controller
BH 5903	Emergency stop module with voltage failure detection
BH 5904/00MF2	Valve monitoring module
BH 5910	Multifunction safety module
BH 5911	Control unit
BH 5913.08/_0_ _ _	Input module
BH 5914.08/_0_ _ _	Input module
BH 5915.08/_1_ _ _	Input module
BH 5922	Emergency stop monitor
BH 5928	Emergency stop module with time delay
BH 5932	Speed or standstill monitor
BH 5933	Two-hand safety relay
BH 7925	Delay module, release delay
BI	
BI 5910	Radio controlled safety module
BI 5928	Emergency stop module with time delay
BI 6910	Radio controlled safety module
BL	
BL 5903	Emergency stop module with voltage failure detection
BL 5922	Emergency stop monitor
BN	
BN 3081	Extension module
BN 5930.48	Emergency stop module
BN 5930.48/203	Emergency stop module
BN 5930.48/204	Emergency stop module
BN 5983	Emergency stop module
BO	
BO 5988	Emergency stop module
HC	
HC 3096N	Interface module
HC 3098	Interface module
HK	
HK 3087N	Interface module
HL	
HL 3094	Interface module
HL 3096N	Interface module
HO	
HO 3094	Interface module
HO 3095	Interface module
IK	
IK 3079	Interface module
IL	
IL 7824	Delay module, release delay
IN	
IN 7824	Delay module, release delay
IP	
IP 3078	Interface module
IP 5924	Emergency stop module

Type	Function
AA	
AA 9050	Speed monitor
AA 9837	Frequency relay
AA 9838	Frequency relay
AA 9943	Undervoltage relay
AD	
AD 5960	Fault annunciator system
AD 5992	Fault annunciator system
AD 5998	Fault annunciator system
AI	
AI 938	Thermistor motor protection relay
AI 941N	Phase sequence relay
AI 942	Asymmetry relay
AK	
AK 9840	Asymmetry relay
BA	
BA 9036	Voltage relay
BA 9037	Voltage relay
BA 9038	Thermistor motor protection relay
BA 9040	Asymmetry relay
BA 9041	Phase sequence relay
BA 9042	Asymmetry relay
BA 9043	Undervoltage relay
BA 9053	Current relay
BA 9054	Voltage relay
BA 9055	Speed monitor
BA 9054/331	Battery symmetry monitor
BA 9054/332	Battery symmetry monitor
BA 9065	Underload monitor (cos φ)
BA 9094	Temperature monitoring relay
BA 9837	Frequency relay
BC	
BC 9190N	Voltage drop detector
BD	
BD 5936	Standstill monitor
BD 9080	Phase monitor
BH	
BH 9097	Motor load monitor
BH 9098	Motor load transmitter
BH 9140	Reverse power monitoring
EH	
EH 5990	Display unit
EH 5991	Display unit
EH 5994	Display unit
EH 5995	Display unit
EH 5996	Text display unit
EH 9997	Fault annunciator system

Type	Function
EP	
EP 5966	Fault annunciator system
EP 5967	Fault annunciator system
IK	
IK 8839	Current monitor
IK 9044	Voltage monitor
IK 9046	Voltage monitor
IK 9055	Speed monitor
IK 9065	Underload monitor (cos φ)
IK 9076	Valve monitor
IK 9094	Temperature monitoring relay
IK 9143	Frequency relay
IK 9144	Standstill monitor
IK 9168	Phase indicator
IK 9169	Phase monitor
IK 9170	Overvoltage relay, 3-phase
IK 9171	Undervoltage relay, 3-phase
IK 9172	Overvoltage relay, single phase
IK 9173	Undervoltage relay, single phase
IK 9178	Phase sequence indicator
IK 9179	Phase sequence monitor /-relay
IK 9270	Overcurrent relay
IK 9271	Undercurrent relay
IK 9272	Overcurrent relay
IK 9273	Undercurrent relay
IL	
IL 5201/20007	Overcurrent relay
IL 5880	Insulation monitor
IL 5881	Insulation monitor
IL 5882	Residual current monitor
IL 5990	Fault annunciator system
IL 5991	Fault annunciator system
IL 8839	Current monitor
IL 9055	Speed monitor
IL 9059	Phase sequence module
IL 9069	Neutral monitor
IL 9071	Undervoltage relay
IL 9075	Fuse monitor
IL 9077	Over- and undervoltage relay
IL 9079	Undervoltage relay to detect auto-reclosing
IL 9086	Phase monitor with thermistor motor protection
IL 9087	Phase monitor
IL 9094	Temperature monitoring relay
IL 9144	Standstill monitor
IL 9151	Level sensing relay
IL 9163	Thermistor motor protection relay

Type	Function
IL 9171	Undervoltage relay, 3-phase
IL 9176	Undervoltage relay, 3-phase with test key
IL 9270	Overcurrent relay
IL 9271	Undercurrent relay
IL 9277	Over- and undercurrent relay
IL 9837	Frequency relay
IN	
IN 5880/710	Insulation monitor
IN 5880/711	Insulation monitor
INFOMASTER B	System overview
IP	
IP 5880	Insulation monitor
IP 5880/711	Insulation monitor
IP 9075	Fuse monitor
IP 9077	Over- and undervoltage relay
IP 9270	Overcurrent relay
IP 9271	Undercurrent relay
IP 9277	Over- and undercurrent relay
IP 9278	Current asymmetry relay with integrated current transformer up to 15 A
IR	
IR 5882	Residual current monitor
LG	
LG 5130	Noise filter
LK	
LK 5894	Insulation monitor
LK 5895	Insulation monitor
LK 5896	Insulation monitor
MH	
MH 5880	Insulation monitor
MH 9055	Speed monitor
MH 9064	Voltage relay
MH 9143	Mains frequency monitor
MH 9300	Multifunction measuring relay
MH 9397	Motor load monitor
MH 9837N	Frequency relay
MH 9837/5_0	Frequency relay
MK	
MK 5130N	Noise filter
MK 5880N	Insulation monitor
MK 9003-ATEX	Thermistor motor protection relay
MK 9040N	Asymmetry relay
MK 9053N	Current relay
MK 9054N	Voltage relay
MK 9055N	Speed monitor
MK 9056N	Phase sequence relay
MK 9064N	Voltage relay
MK 9065	Underload monitor (cos φ)
MK 9143N	Mains frequency monitor
MK 9151N	Level sensing relay
MK 9163N	Thermistor motor protection relay
MK 9163N-ATEX	Thermistor motor protection relay
MK 9300N	Multifunction measuring relay
MK 9397N	Motor load monitor
MK 9837N	Frequency relay
MK 9837N/5_0	Frequency relay
MK 9994	Lamp tester
MK 9995	Lamp tester
ND	
ND 5015	Residual current transformer
ND 5016	Residual current transformer
ND 5017	Residual current transformer
ND 5018	Residual current transformer
ND 5019	Residual current transformer
OA	
OA 9059	Phase sequence module
RK	
RK 9169	Phase monitor
RK 9179	Phase sequence monitor /-relay
RK 9871	Undervoltage relay
RK 9872	Phase monitor
RL	
RL 9836	Voltage relay
RL 9853	Current relay
RL 9854	Voltage relay
RL 9075	Fuse monitor
RL 9877	Phase monitor
RN	
RN 5883	Residual current monitor, type B for AC and DC systems
RN 5897/010	Insulation monitor
RN 5897/300	Insulation monitor
RN 9075	Fuse monitor
RN 9877	Phase monitor

Type	Function
RP	
RP 5812	SMS-Telecontrol module
RP 5888	Insulation monitor
RP 5990	Common alarm annunciator
RP 5991	Common alarm annunciator
RP 5994	New- / First- /Common signal annunciator
RP 5995	New- / First- /Common signal annunciator
RP 9140	Reverse power monitoring
RP 9800	Voltage and frequency monitor
RP 9810	Voltage and frequency monitor acc. to VDE-AR-N 4105
RP 9811	Voltage and frequency monitor
RR	
RR 5886	Locating current injector
RR 5887	Insulation fault locator
SK	
SK 9055	Speed monitor
SK 9065	Underload monitor (cos φ)
SK 9076	Valve monitor
SK 9094	Temperature monitoring relay
SK 9143	Frequency relay
SK 9144	Standstill monitor
SK 9168	Phase indicator
SK 9169	Phase monitor
SK 9170	Overvoltage relay, 3-phase
SK 9171	Undervoltage relay, 3-phase
SK 9172	Overvoltage relay, single phase
SK 9173	Undervoltage relay, single phase
SK 9178	Phase sequence indicator
SK 9179	Phase sequence monitor /-relay
SK 9270	Overcurrent relay
SK 9271	Undercurrent relay
SK 9272	Overcurrent relay
SK 9273	Undercurrent relay
SL	
SL 5201/20007CT	Overcurrent relay
SL 5880	Insulation monitor
SL 5881	Insulation monitor
SL 5882	Residual current monitor
SL 5990	Fault annunciator system
SL 5991	Fault annunciator system
SL 9055	Speed monitor
SL 9059	Phase sequence module
SL 9065	Underload monitor (cos φ)
SL 9069	Neutral monitor
SL 9071	Undervoltage relay
SL 9075	Fuse monitor
SL 9077	Over- and undervoltage relay
SL 9079	Undervoltage relay to detect auto-reclosing
SL 9086	Phase monitor with thermistor motor protection
SL 9087	Phase monitor
SL 9094	Temperature monitoring relay
SL 9144	Standstill monitor
SL 9151	Level sensing relay
SL 9163	Thermistor motor protection relay
SL 9171	Undervoltage relay, 3-phase
SL 9270	Overcurrent relay
SL 9270CT	Overcurrent relay
SL 9271	Undercurrent relay
SL 9271CT	Undercurrent relay
SL 9277	Over- and undercurrent relay
SL 9277CT	Over- and undercurrent relay
SL 9837	Frequency relay
SP	
SP 5880	Insulation monitor
SP 9075	Fuse monitor
SP 9077	Over- and undervoltage relay
SP 9270	Overcurrent relay
SP 9270CT	Overcurrent relay
SP 9271	Undercurrent relay
SP 9271CT	Undercurrent relay
SP 9277	Over- and undercurrent relay
SP 9277CT	Over- and undercurrent relay
SP 9278	Current asymmetry relay with integrated current transformer up to 15 A
SP 9278CT	Current asymmetry relay with integrated current transformer up to 100 A
UG	
UG 9075	Fuse monitor
UH	
UH 5892	Insulation monitor

Type	Function
BA	
BA 9010	Softstarter
BA 9019	Softstarter with softstop
BA 9026	Softstarter with softstop
BA 9034N	Motor brake relay
BF	
BF 9250	Solid-state contactor
BF 9250/_ _8	Solid-state contactor
BF 9250/002	Semiconductor contactor with analogue input for pulsed output
BF 9250/042	Solid-state contactor with burst control
BH	
BH 9250	Solid-state contactor
BH 9251	Semiconductor contactor with current monitoring
BH 9253	Reversing contactor
BH 9255	Reversing contactor with current monitor
BI	
BI 9025	Softstarter
BI 9028	Softstarter with DC-brake
BI 9028/900	Softstarter for 1-phase motors
BI 9034	Motor brake relay
BI 9254	Reversing contactor with softstart and active power monitoring
BL	
BL 9025	Softstarter
BN	
BN 9011	Softstarter
BN 9034	Motor brake relay
GB	
GB 9034	Motor brake relay
GF	
GF 9016	Softstarter and softstop device
GI	
GI 9014	Softstart- / softstop device
GI 9015	Softstart- / softstop device
IL	
IL 9017	Softstarter
IL 9017/300	Softstarter with softstop
IN	
IN 9017	Phase controller

Type	Function
PF	
PF 9029	Softstarter for heating pumps
PH	
PH 9260	Solid-state relay / - contactor
PH 9260.92	Solid-state relay / - contactor
PH 9260/042	Solid-state relay / - contactor with analogue input for pulse package control
PH 9270	Solid-state relay / - contactor with load circuit monitoring
PH 9270/003	Solid-state relay / - contactor with load current measurement
PI	
PI 9260	Solid-state relay / - contactor
PK	
PK 9260	Solid-state relay / - contactor for resistive load
RP	
RP 9210/300	Softstart / softstop with reverse function
SL	
SL 9017	Softstarter
SX	
SX 9240.01	Speed controller 1-phase
SX 9240.03	Speed controller 3-phase
UG	
UG 9019	Softstarter with softstop
UG 9256	Smart motorstarter
UG 9256/804	Smart motorstarter with autom. phase sequence correction
UG 9256/807	Smart motorstarter with autom. phase sequence correction
UG 9410	Smart motorstarter
UG 9411	Smart motorstarter
UH	
UH 9018	Softstarter

Type	Function
AD	
AD 866	Switching Relay
AD 8851	Latching relay
BA	
BA 7632	Stepping relay
BA 7961	Contact protection relay
BD	
BD 3083/100	Interface module
BG	
BG 5595	Switched power supply
CA	
CA 3056	Input-Output interface relay
CB	
CB 3056	Input-Output interface relay
CB 3057	Output interface relay
CC	
CC 3056	Input-Output interface relay
HC	
HC 3093	Interface relay pluggable
HC 3093.__/3__	Interface relay pluggable
HC 3096N	Interface module
HC 3098	Interface module
HK	
HK 3087N	Interface module
HL	
HL 3094	Interface module
HL 3096N	Interface module
HL 3096N.__C/400	Interface module
HO	
HO 3094	Interface module
HO 3095	Interface module

Type	Function
IG	
IG 3051	Input-Output interface relay
IK	
IK 3050	Interface relay
IK 3070	Input-Output interface relay
IK 3076	Input-Output interface relay
IK 3079	Interface module
IK 5121	Protective diode module
IK 8701	Input-Output interface relay / Switching relay
IK 8802	Input-Output interface relay
IL	
IL 5504	CANopen PLC
IL 5507	Output module, analogue
IL 5508	Input module, analogue
IL 8701	Input-Output interface relay / Switching relay
IN	
IN 5509	Input- / Output module, digital
IN 8701	Input-Output interface relay / Switching relay
IP	
IP 3070/022	Output interface relay
IP 3078	Interface module
IP 5502	Input module, digital
IP 5503	Output module, digital
LG	
LG 3096	Interface module
MK	
MK 3046	Interface relay
MK 3096N	Interface module
MK 8804N	Interface relay
MK 8852	Latching relay
ML	
ML 3045	Input-Output interface relay
ML 3059	Input interface relay

Type	Function
RK	
RK 7813	Timer
RK 7814	Timer
RK 7815	Fleeting action relay
RK 7816	Flasher relay
RK 7817	Multifunction relay
SK	
SK 7813	Timer
SK 7814	Timer
SK 7815	Fleeting action relay
SK 7816	Flasher relay
SK 7817N/200	Multifunction relay
SK 7819	Timer
SK 7820	Fleeting action relay
SK 7823	Timer
SK 7854	Cyclic timer
SK 9906	Timer
SK 9962	Timer
SN	
SN 7920	Multifunction relay

Type	Function
IK	
IK 3070/200	Hybrid relay
IK 3071	Input interface relay
IK 5115	Display unit
IK 8701	Switching relay
IK 8702	Remote switch (Impulse relay)
IK 8702/200	Remote switch (Impulse relay)
IK 8715	Priority relay
IK 8717	Remote switch (Impulse relay)
IK 8717/110	Remote switch (Impulse relay)
IK 8800	Remote switch (Impulse relay)
IK 8805	Remote switch f. central switch. op.
IK 8807	Remote switch f. central switch. op.
IK 8810	Staircase lighting time switch
IK 8810/001	Staircase lighting time switch
IK 8810/002	Staircase lighting time switch
IK 8810/003	Staircase lighting time switch
IK 8810/004	Staircase lighting time switch
IK 8810/005	Fan control timer
IK 8813	Energy saving time switch
IK 8814	Light timing switch
IK 8825	Light timing switch
IK 8830	Stepping switch
IK 8832	Buzzer
IK 9078	Mains relay
IK 9171	Undervoltage relay, 3-phase
IL	
IL 7824	Delay module
IL 8701	Switching relay
IL 8800	Remote switch (Impulse relay)
IL 8805	Remote switch f. central switch. op.
IL 8809	Remote switch for central and group switching operation
IL 9171	Undervoltage relay, 3-phase
IN	
IN 7824	Delay module
IN 8701	Switching relay
OA	
OA 8823	Energy saving time switch
OA 8824	Light timing switch
OA 8825	Light timing switch

Type	Function
RK	
RK 8810/001	Staircase lighting time switch
RK 8810/002	Time switch with pre-warning
RK 8810/003	Light timing switch
RK 8810/004	Energy saving time switch
RK 8810/005	Fan control timer
RK 8810/006	Energy saving time switch
RK 8810/100	Staircase lighting time switch
RK 8832	Buzzer
SK	
SK 8702	Remote switch (Impulse relay)
SK 8702/200	Remote switch (Impulse relay)
SK 8832	Buzzer
SK 9078	Mains relay
SK 9171	Undervoltage relay, 3-phase
SL	
SL 9171	Undervoltage relay, 3-phase

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