MINISTART
Softstarter With DC-Brake
BL 9228

0249781

BL 9228 up to 7,5 kW

BL 9228 up to 15 kW

- According to IEC/EN 60 947-4-2
- 2-phase motor control
- For motors up to 15 kW bei 3 AC 400 V
- Separate settings for start and brake time, as well as starting and braking torque
- No braking contactor necessary
- With automatic standstill detection
- Maintenance- and wearfree
- Auxiliary voltages AC 230 V, AC 400 V and DC 24 V
- Monitors undervoltage and phase sequence
- 3 relay outputs for indicaiton of status and fault with LED-indication
- With input to detect motor temperature
- Function test of braking circuit when actuating the On-button
- Monitored braking current
  - safe monitored start
  - protection against unententional start-up
  - safe disconnection of motor contactor after finished braking
- BL 9228 up to 7.5 kW: 90 mm width
  BL 9228 up to 15 kW: 112.5 mm width

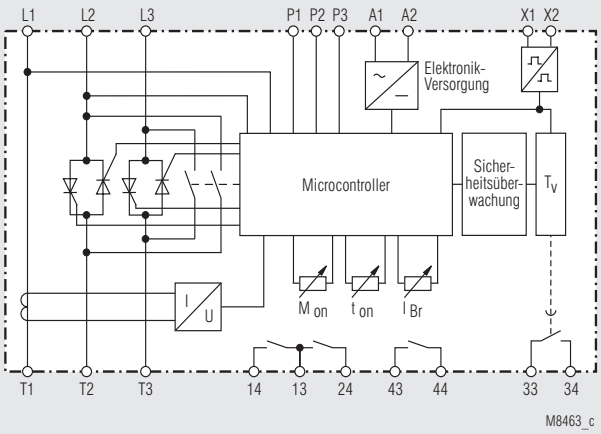
Approvals and Marking

CE

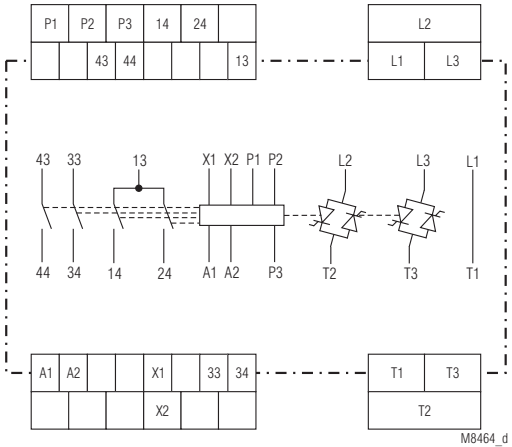
Applications

- 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 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. The braking circuit is tested für correct function at start-up. A negative test interrupts the starting and indicates a fault signal.

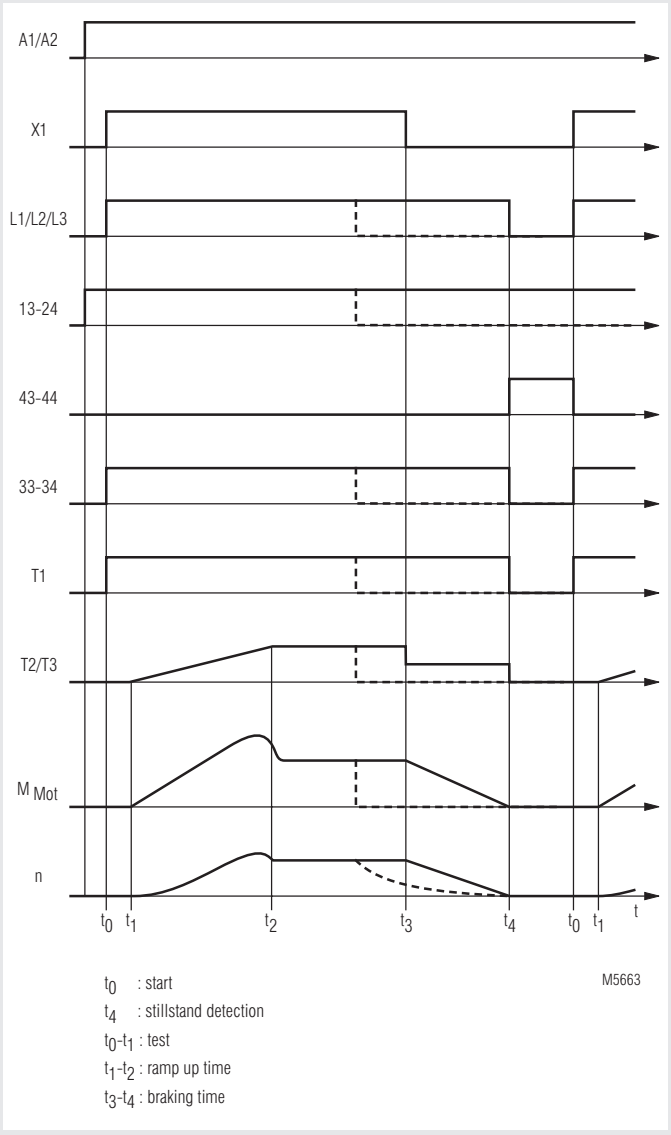
Start/Stop switch
When the motor is on full speed after the starting with start switch the semiconductors are bridged with internal relay contacts to prevent internal power losses and heat built up.
When stopping the motor via start switch braking is started. The braking current flows until detection of the stillstand through the motor windings. If the brake function takes longer than 10 sec, the monitoring relay 1 provides a signal. After 15 sec the brake function will be finished and the motor will be separated from the mains via contactor K1.

Monitoring relay 1 (contact 13-14)
Relay 1 is energized if the brake function takes longer than 10 sec. By restarting of the device this relay is de-energized. However, if the brake function has been longer than 10 sec for the third time, the device is set into an error mode. The red LED flashes code 9. This fault can only be reset by switching on and off the power supply.

Monitoring relay 2 (contact 13-24)
This relay energises as soon as the unit is ready for operation after connecting it to power. If any error occurs the monitoring relay 2 will be de-energized immediately. The power output will be switched off.

Monitoring relay 3 (contact 33-34)
The relay is energized after activating the on-button and is de-energized after indication of the motor standstill at the end of braking.
If standstill is not detected, the relay is de-energized after pushing the off-button and elapse of a safety time. The relay is operating the motor contactor. It is immediately de-energized by any fault indication.

Function Diagram



Function

Monitoring relay 4 (contact 43-44)
This relay is energized when motor standstill is detected. It will be reset by pushing the on-button. The contact can be used for example to lock a safety gate. The monitoring relay 4 is de-energized if an error occurs.

Input P_1 / P_2 / P_3 to monitor the motor temperature
To monitor overtemperature onnb the motor a bimetallic contact can be connected to P_2 / P_3. When overtemperature is detected the power semiconductors switch off and all relays de-energise.
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 all relays de-energise.
The fault is reset by disconnecting the power supply temporarily after the temperature on the motor is down again.

Indication

green LED: Continous light: - when auxiliary supply connected
Flashing light: - while starting and breaking

Monitoring relay 1
yellow LED: Continous light: - when contact 13-14 switched on

Monitoring relay 2
yellow LED: Continous light: - when contact 13-24 switched on

Monitoring relay 3
yellow LED: Continous light: - when contact 33-34 switched on

Indication

Monitoring relay 4 optional
yellow LED: Continous light: - when contact 43-44 switched on
red LED: Flashing light : - Error
1*): - overtemperature on thyristor (internal)
2*): - overtemperature on motor or broken wire in sensor circuit P_1/P_2
3*): - short circuit on sensor circuit P_1/P_2
4*): - phase failure
5*): - incorrect phase sequence, exchange connections on L1 and L2
6*): - incorrect frequency
7*): - incorrect brake circuit
8*): - incorrect safety monitoring
9*): - braking time 3 x higher than 10 s
10*): - incorrect RAM
11*): - incorrect RUN-input (start switch welded)
12*): - device not separated from mains (2 or 3 phases occur before start)
13*): - overcurrent in semiconductors
14*): - brake current to high
15*): - overcurrent at end of ramp up
16*): - Communication error
17*): - Overcurrent on bridging relay
1-17*) = Number of flashing pulses in short sequence

Monitoring Features

- If the motor does not stand still within 10 sec during brake function the monitoring relay 1 will indicate this. The brake function is stopped latest after 15 sec if there is no standstill detection, and the motor is separated from the mains.
  A restart resets the monitoring relay 1. If this error occurs for the third time the device changes into the error mode. The red LED will flash code 9.
- The brake current switches off after 0.5 sec standstill detection.
- On power up the mains frequency, phase sequence and presence of all 3 phases is checked.
- Internal temperature monitoring protects the thyristors. With the function "motor overtemperature" a bimetall switch or PTCs are monitored. By switching on or off of the power supply this fault can be reset after the temperature has dropped.
- Monitoring of phases and phase shift protects the motor or the system. After removing the fault this error can be reset by switching the power supply on and off.
- After connecting the power supply or after braking until restart a check will be done if L1, L2 or L3 of the device are separated from the mains (to ensure that contactor K1 or relay 3 are not welded). It is detected if 2 or 3 phases are connected in a wrong way.
- monitored current to protect the power part and the relays at heavy duti start or blocked motor.

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/L2/L3: 3 AC 200 V -10 % ... 480 V + 10 %
Nominal frequency: 50 / 60 Hz

	Width		
	90 mm	112.5 mm	112.5 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 = 45°C:	10 / h	45 / h	30 / h
permissable braking current:	35 A	50 A	65 A

Min. motor power: 1 kW
Start torque: 20 ... 80 %
Ramp time: 1 ... 20 s
Braking time: 1 ... 15 s
Braking delay: max. 2500 ms
Braking voltage: DC 10 ... 90 V
Start delay: 450 ms
Auxiliary voltage U_H
model DC 24 V: A1/A2, DC 24 V, + 10 %, - 10 %
model AC 230 V: A1/A2, AC 230 V, + 10 %, - 15 %
model AC 400 V: A1/A2, AC 400 V, + 10 %, - 15 %
Power consumption: 2 W
Residual ripple max.: 5 %
max. semiconductor fuse
BL 9228 / 7.5 kW: 1800 A^2s
BL 9228 / 11 kW: 6600 A^2s
BL 9228 / 15 kW: 18050 A^2s

Inputs

Control input X1, X2
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: PTC-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: 4 x 1 NO contacts
Thermal continous current I_{th}: 4 A
Switching capacity
to AC 15
NO contact: 3 A / 400 V IEC/EN 60 947-5-1
Electrical life
to AC 15 at 3 A,
AC 400 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

Temperature range: 0 ... + 45 °C
Storage temperature: - 25 ... + 75 °C
Clearance and creepage distances
rated impuls voltage / pollution degree
Control voltage to auxiliary voltage, motor voltage: 4 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 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
Width 90 mm: 895 g
Width 112.5 mm: 1135 g

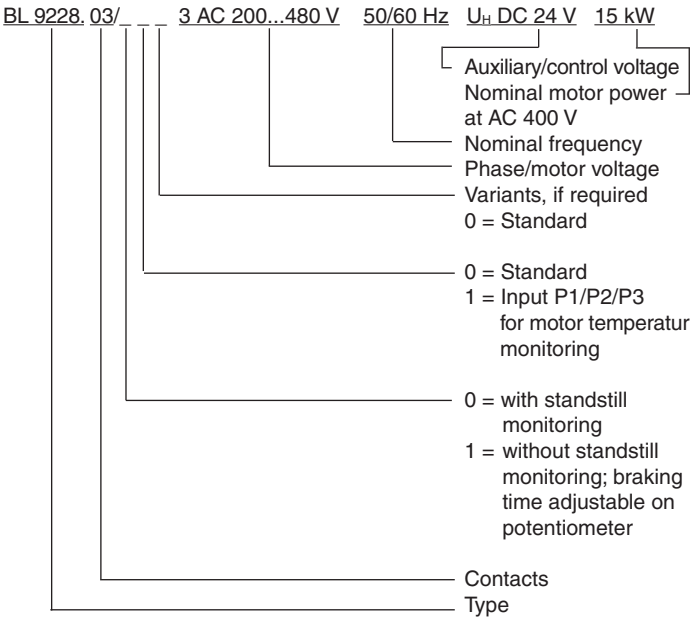
Dimensions

Width x height x depth
BL 9228 up to 7.5 kW: 90 x 85 x 121 mm
BL 9228 up to 15 kW: 112.5 x 85 x 121 mm

Standard Type

BL 9228.03/010 3 AC 200 ... 480 V 50/60 Hz U_H DC 24 V 15 kW
Article number: 0064256
- Nominal motor power at AC 400 V: 15 kW
- Control input X1, X2
- Width: 112.5 mm

Ordering example:



Control Input X1, X2

With BL 9228 soft start begins by pressing the start button. By pressing the stop button braking will start.

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

Set-up Procedure

Soft start:

1. Press start button. 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.

Set-up Procedure

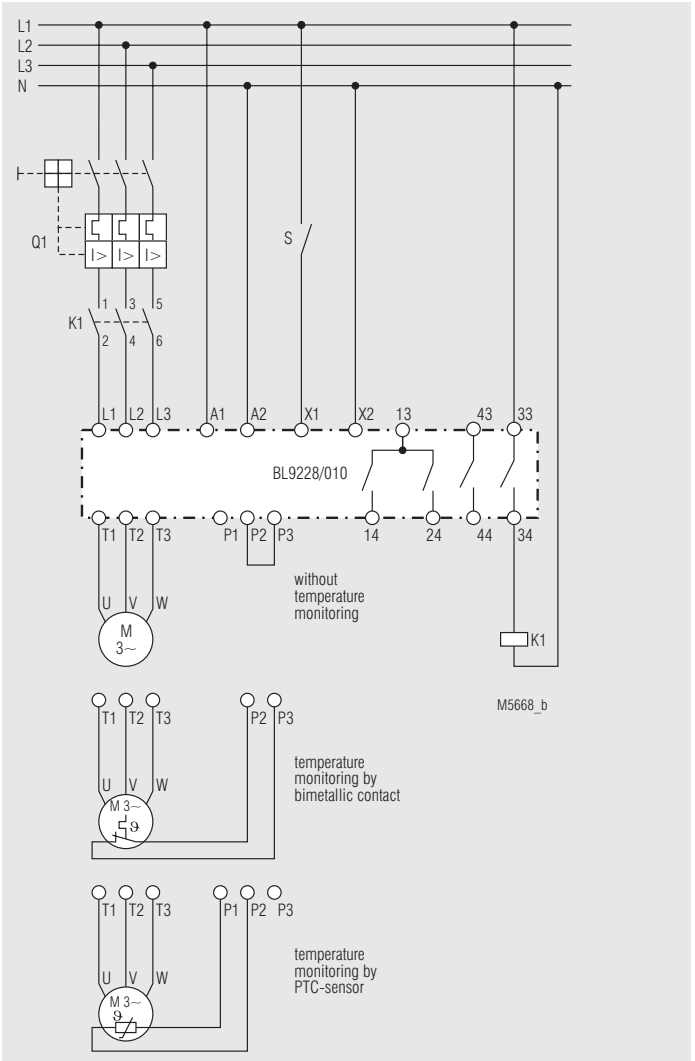
Braking:
Press stop button and adjust with potentiometer "I_{Br}" the braking current to the desired value. Please adjust the braking current high enough so that the brake time is shorter than 10 sec. The brake current should be limited to 1.8 ... 2 x I_N of the motor. If the brake function at 1.8 ... 2 times of rated current has not finshed within 10 sec the load is too high. The next larger motor shoud be used. To avoid an overload of the device and the motor, the brake current should be measured with a moving coil instrument in the motor connecting line T1.

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.

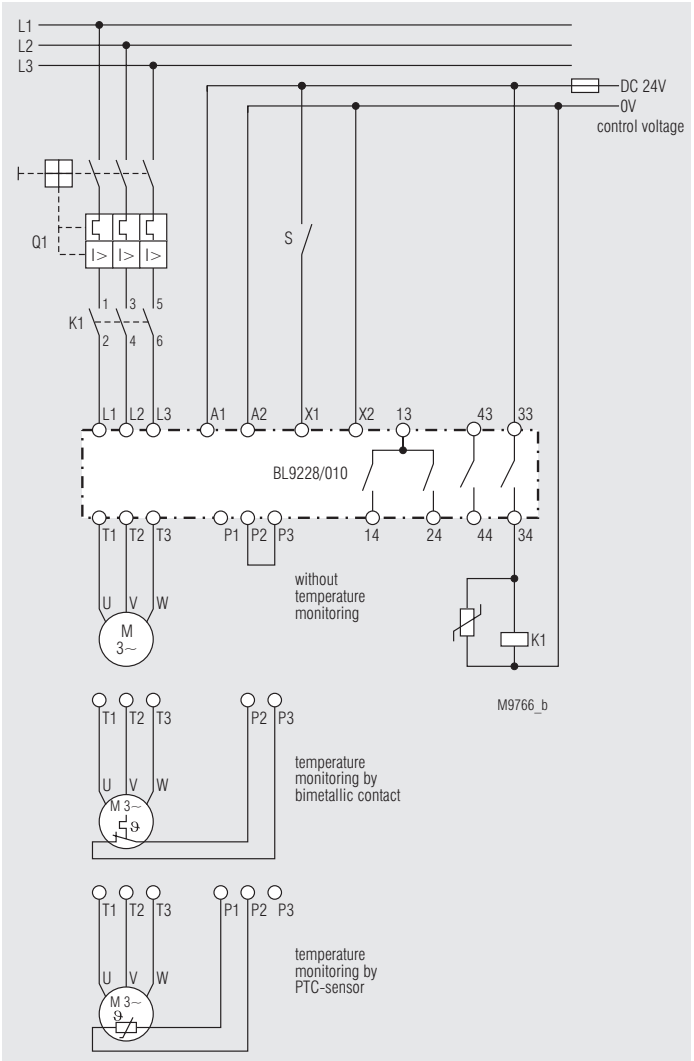
Safety Instructions

- 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.

Connection examples



Auxiliary voltage U_H = AC 400 V or AC 230 V



Auxiliary voltage U_H = DC 24 V

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	Overtemperature on power unit	Permitted duty cycle ex-ceeded	Reduce duty-cycle Wait till heat sink cools down
2 x	Overtemperature on motor or broken wire in thermistor circuit	High duty-cycle on motor or broken wire	Decrease duty-cycle. Repair wiring of temperature sensor
3 x	Short circuit in thermistor circuit	Squeeze conduit, defective soldering point	Check connection wire, repair
4 x	Phase failure	Defective fuse	Change fuse
			Check voltage range
5 x	Decrease phase sequence	Connection L1, L2, L3 incorrect	Correct connetion sequence see application
6 x	Mains frequency is out of tolerance	Wrong mains frequency	Device not suitable for the frequency. Contact manufacturer.
7 x	Broken ciruit	Cable break	Check wiring
		Defective braking relay	The unit has to repaired
9 x	Braking delay time 3 times higher than 10 s	Brake current to small	Setting brake curren higher
		Centrifugal mass for max. brake current to large	Use brake unit with higher ranges
10 x	RAM defective	Defective component	The unit has to repaired

Flashes	Fault	Reason	Failure recovery
13 x	Overcurrent on power semiconductors	Gravitational start	Prolonging ramp up time. Set starting torque lower. Use unit with higher ranges
		Motor blocked	Remove blockage
14 x	Brake current to high	Braking current adjusted over permitted value	Back off potentiometer I_{Br}
15 x	Overcurrent on ramp	Gravitational start, ramp time to short or starting torque to high	Prolonging ramp up time. Set starting torque lower. Use unit with higher ranges
16 x	Communication error	Defective component	The unit has to repaired
17 x	Overcurrent on bridging relay	Motor blockage	Remove blocking