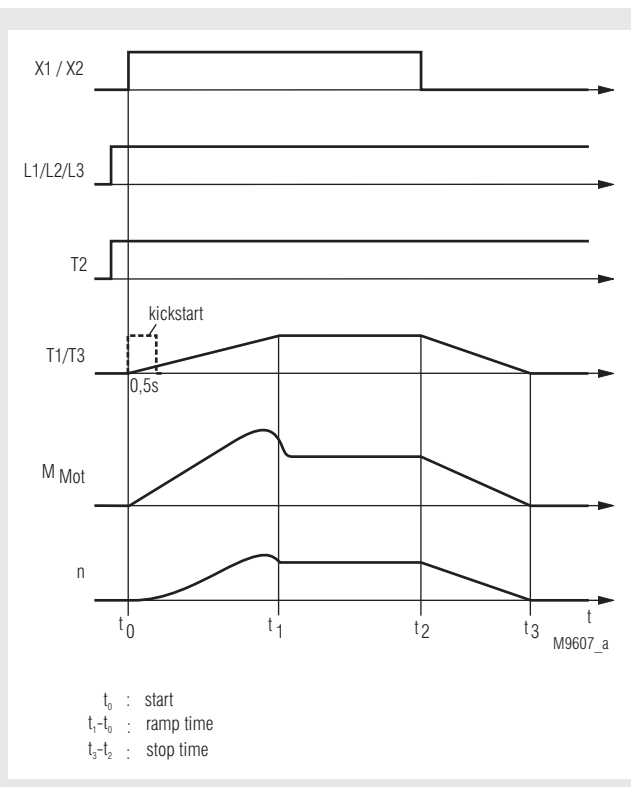


- For soft and shockfree start of your asynchronous motors
- Less wearing and longer life for your motors and components
- Space saving and easy fitting
- Reduce load from supply mains by reducing of starting current
- According to IEC/EN 60947-4-2
- Softstart with softstop
- For motors up to 22 kW
- 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**



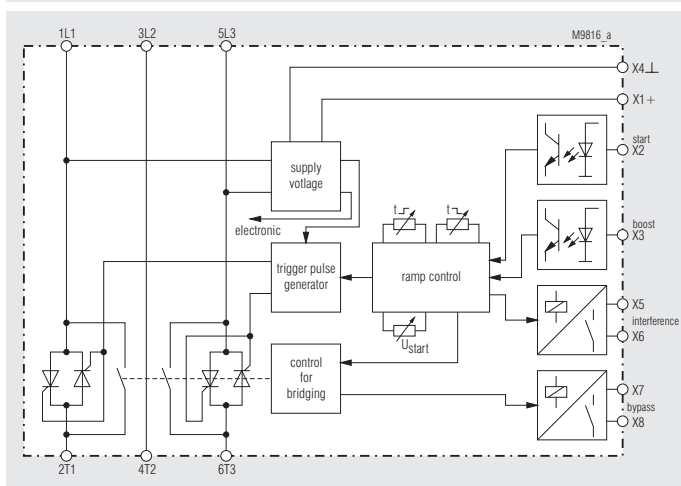
**Applications**

- Motors with gear, belt or chain drive
- Fans, pumps, conveyor systems, compressors
- 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**



**Connection Terminals**

Terminal designation	Signal description
L1, L2, L3	Phase voltage L1, L2, L3
T1, T2, T3	Motor voltage U, V, W
X1	Output + 24V
X1	Input + 24 V at variant with wide voltage
X2	Start / Stop
X3	Kickstart 0,5 s
X4	0 V
X5, X6	Indicator output, fault
X7, X8	Indicator output, device bridged

Indication			
LED green	ON	=	Power connected
LED yellow	ON	=	Power semiconductors bridged
			flashes with rising or falling speed at softstart - soft-stop
			flashes with same frequency at error (see table)
LED red: On, when failure detected (only on devices $\geq 25$ kW)			

#### Failure codes

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

#### Troubleshooting

In case of a fault, please proceed as follows:

##### Fault 1:

Electronics supply or motor too small (see technical data minimum motor load). Send device to the producer to have it checked.

##### Fault 2:

Check the frequency of starts and the starting current and also observe the max. ambient temperature. Give the device and/or the motor enough time between starts to cool down. The heat dissipation can be improved by forced cooling, e.g., by means of a fan mounted underneath the device or by using a motor with a separately driven fan.

##### Fault 3:

Defect in the internal control electronics. Send device to the producer to have it checked.

##### Fault 4/5:

Mains supply is interrupted. Motor lead interrupted, power semiconductor(s) defective, motor defective. Check motor and wiring. Send device to the producer to have it inspected.

##### Fault 6/7:

Mains supply is interrupted. Power semiconductors do not trigger. Motor rating is too small. Check as to whether the motor is suitable for the device rating. Send device to the producer to have it checked.

##### Fault 8:

Mains or motor wiring is interrupted. Power semiconductor(s) defective. Check wiring. Send device to producer to have it inspected

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.

#### Resetting of faults

The fault message can be reset by disconnecting and reconnecting the supply voltage.



#### Warning:

At any rate, the cause of the fault has to be identified and remedied by trained and qualified personnel. Only then must the device be put into operation again.

#### Notes



#### Attention:

Please pay attention and consider for the operation of IE3 motors while dimensioning of softstarters the resulting higher starting currents. For the use of IE3 motors we highly recommend to dimension and design the needed softstarters one size higher.

#### Technical Data

<b>Nominal voltage:</b>	3 AC 400 V $\pm$ 15 % (others on request)				
<b>Nominal frequency:</b>	50/60 Hz				
<b>Rated current:</b>	17	25	32	45	A
<b>Nominal motor power at P<sub>N</sub> at 400 V:</b>	7,5	11	15	22	kW
<b>Min. motor power:</b>	Approx. 0.2 P <sub>N</sub>				
<b>Start torque:</b>	40 ... 80 %				
<b>Ramp time:</b>	0,5 ... 10 s				
<b>Deceleration time:</b>	0,25 ... 10 s				
<b>Recovery time:</b>	200 ms				
<b>Switching frequency:</b>	60	40	30	10	1/h
<b>I<sup>2</sup>t-Power semiconduct. fuse:</b>	4000	4000	9100	16200	
<b>Control inputs</b>					
Control voltage	10 ... 24 V DC				
Control input current:	1 ... 2.4 mA				
<b>Indicator output</b>					
<b>Contacts:</b>	1 changeover contact				
<b>Switching capacity to AC 15</b>					
NO contact:	3 A / AC 230 V	IEC/EN 60947-5-1			
NC contact:	1 A / AC 230 V	IEC/EN 60947-5-1			
<b>Electrical life to AC 15 at 3 A, AC 230 V:</b>	2 x 10 <sup>5</sup> switching cycles				
<b>Permissible switching frequency:</b>	Max. 1 800 switching cycles / h				
<b>Short circuit strength max. fuse rating:</b>	4 A gG / gL	IEC/EN 60947-5-1			
<b>Mechanical life:</b>	$\geq 10^8$ switching cycles				

## Technical Data

### General Data

#### Temperature range:

<b>Operation:</b>	0 ... + 45 °C
<b>Storage:</b>	- 25 ... + 70 °C
<b>Relative air humidity:</b>	< 95%, no condensation at 40 °C
<b>Altitude:</b>	< 1,000 m

#### Power reduction

At > 45 °C:	- 2 % up to max. 60 °C
For instal. heights over 1.000 m:	- 2 % 100 m each

#### Overvoltage category / pollution degree:

III / 2

#### Insulation class:

Main circuit:	6 kV
Control and auxiliary circuit:	2.5 kV

#### EMC

##### Interference resistance

Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61000-4-2
HF-irradiation		
80 MHz ... 1.0 GHz:	10 V / m	IEC/EN 61000-4-3
1.0 GHz ... 2.5 GHz:	3 V / m	IEC/EN 61000-4-3
2.5 GHz ... 2.7 GHz:	1 V / m	IEC/EN 61000-4-3
Fast transients:	2 kV	IEC/EN 61000-4-4
Surge voltage between wires for power supply:	1 kV	IEC/EN 61000-4-5
between wire and ground:	2 kV	IEC/EN 61000-4-5
HF-wire guided:	10 V	IEC/EN 61000-4-6
Voltage dips:		IEC/EN 61000-4-11

##### Interference emission

Wire guided:	Limit value class B	IEC/EN 60947-4-2
Radio irradiation:	Limit value class B	IEC/EN 60947-4-2

#### Degree of Protection:

IP 20

#### Wire connection

Load terminals:	Plug in screw terminal
Stranded wire:	6   6   16   16   mm <sup>2</sup>

#### Control terminals:

1.5 mm<sup>2</sup> cage clamp terminals

<b>Fixing torque:</b>	1.2 ... 1.2 ... 1.5 ... 1.5 ... Nm
	1.5 1.5 1.7 1.7

#### Mounting:

DIN-rail mounting IEC/EN 60715

#### Weight:

1.0 | 1.0 | 1.0 | 1.0 | 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

### 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	
					Auxiliary supply (only necessary > 500 V)
					Nominal motor power
					Nominal frequency
					Nominal voltage
					Type

## Control Input

Connect contact 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.

## Indicator Outputs

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.

## Adjustment Facilities

Potentiometer	Description	Initial setting
U <sub>start</sub>	Starting voltage	fully anti-clockwise
t <sub>r</sub>	Ramp-up time	fully clockwise
t <sub>λ</sub>	Deceleration time	fully clockwise

## Set-up Procedure

Set potentiometer "U<sub>start</sub>" to minimum (fully anti-clockwise).  
 Set potentiometer "t<sub>r</sub>" to maximum (fully clockwise).  
 Set potentiometer "t<sub>λ</sub>" to mid position.  
 Start the motor and turn potentiometer "U<sub>start</sub>" up until the motor starts to turn without excessive humming.  
 Stop the motor and restart.  
 Adjust potentiometer "t<sub>r</sub>" to give the desired ramp time.  
 Stop and restart the motor.  
 Adjust potentiometer "t<sub>λ</sub>" 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.

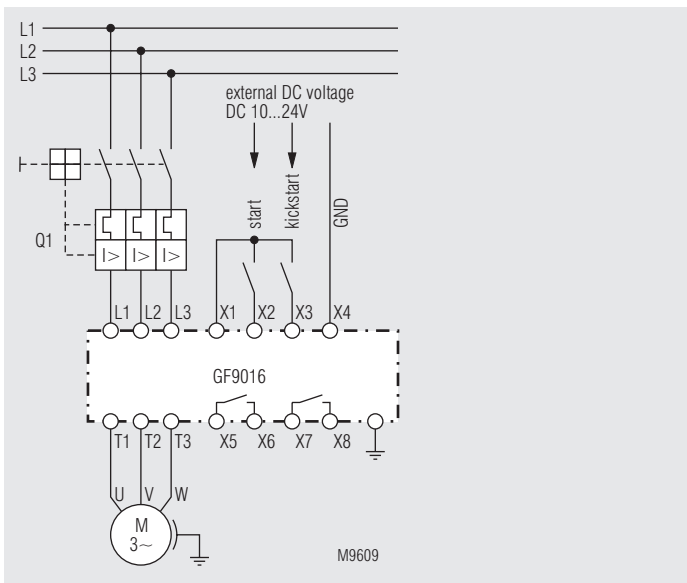


## Safety Notes

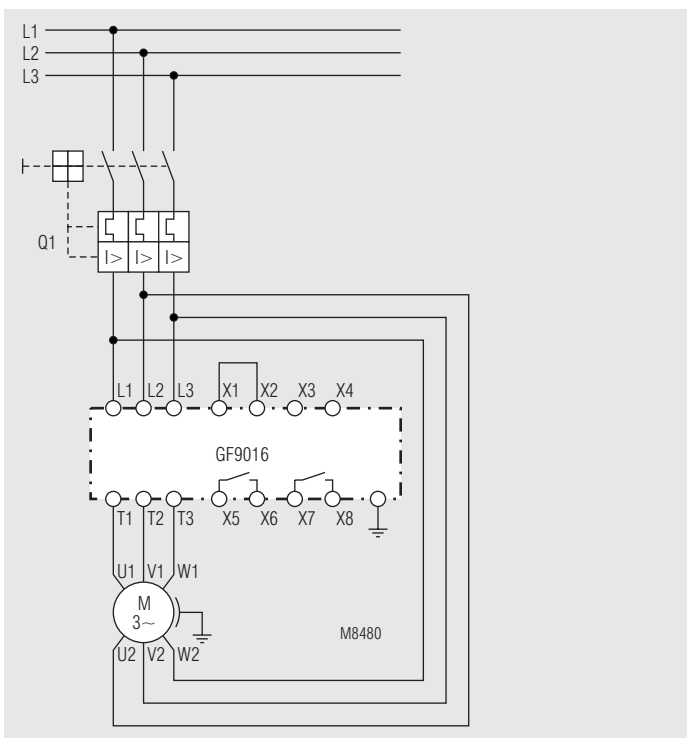
- Never clear a fault when the device is switched on
- **Attention:** This device can be started by potential-free contact, while connected directly to the mains without contactor (see application example). Please note, that even if the motor is at rest, it is not physically separated from the mains. 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 bridged