MINISTART
Softstarter And Softstop Device
GF 9016

Translation of the original instructions

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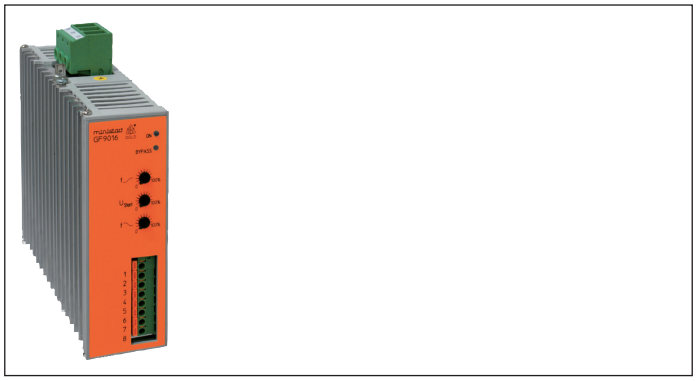
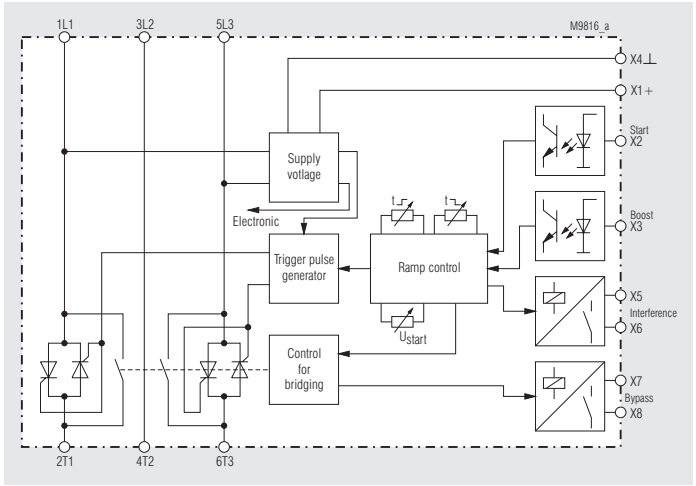


Product Description

The softstarter and softstop device GF 9016 is a electronic control unit for the smooth starting and stopping of three-phase asynchronous machines. 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



Your Advantage

- 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

Features

- 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
- Up to 15 kW: Width 45 mm
  Up to 22 kW: Width 52.5 mm

Approvals and Markings

CE UKCA

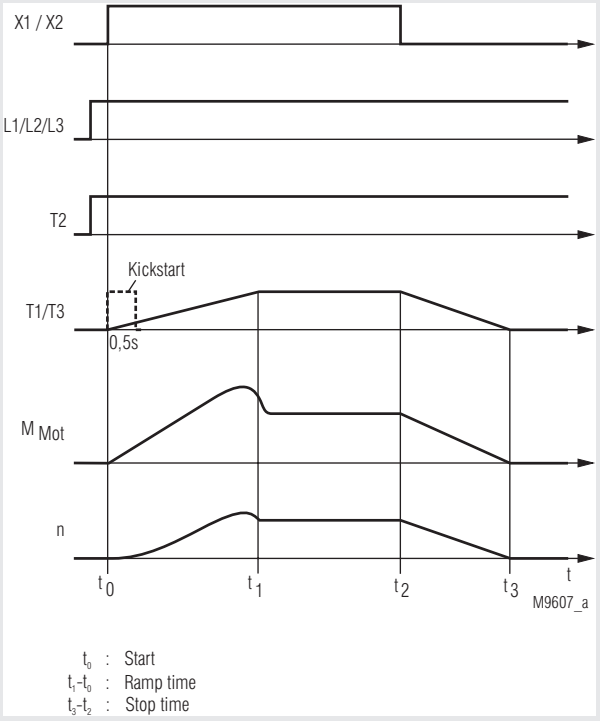
Applications

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

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

Function Diagram



t_0 : Start
t_1-t_0 : Ramp time
t_3-t_2 : Stop time

Indication

LED green: Indicates the ready-to-operate state of the control unit
LED yellow: Lights up after completion of start-up
flashes with rising or falling speed at softstart / softstop
flashes with same frequency at error (see table)

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 unterneath 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.

Warning:

- To avoid heat accumulation, keep a distance of at least 40 mm between the cable duct and the unit.
- If the ramp-up time is set too short, the internal bypass contacts close **before** the motor has reached the rated speed. This can cause damage to the bypass relays.
- Make sure that the specified switching frequency is not exceeded! After each start, the power semiconductors must be given sufficient time to cool down. Starting processes in short succession can destroy the power semiconductors! Operation in bridged state also allows the power semiconductors to cool down!

Technical Data

Nominal voltage:	3 AC 400 V ± 15 % (others on request)				
Nominal frequency:	50 / 60 Hz				
Rated current:	17	25	32	45	A
Nominal motor power at P_N at 400 V:	7.5	11	15	22	kW
Min. motor power:	Approx. 0.2 P_N				
Start torque:	40 ... 80 %				
Ramp time:	0.5 ... 10 s				
Deceleration time:	0.25 ... 10 s				
Recovery time:	200 ms				
Switching frequency:	60	40	30	10	$^1/_h$
I^2t-Power semiconduct. fuse:	4000	4000	9100	16200	
Backup value for coordination type 1:	35	50	50	63	A

Coordination type!
Coordination type 1 according to IEC 60947-4-1: The engine control unit is defective following a short circuit and must be replaced.

Usage category:
17A: AC-53b:3-5:55
25A: AC-53b:3-5:85
32A: AC-53b:3-5:115
45A: AC-53b:3-5:355

Rated insulation voltage: 600 V

Control inputs
Control voltage: 10 ... 24 V DC
Control input current: 1 ... 2.4 mA

Indicator output

Contacts: 1 changeover contact
Switching capacity to AC 15
NO contact: 3 A / AC 230 V IEC/EN 60947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60947-5-1
Electrical life to AC 15 at 3 A, AC 230 V: 2 x 10^5 switching cycles
Permissible switching frequency: Max. 1800 switching cycles / h
Short circuit strength max. fuse rating: 4 A gG / gL IEC/EN 60947-5-1
Mechanical life: ≥ 10^8 switching cycles

General Data

Temperature range
Operation: 0 ... + 45 °C
Storage: - 25 ... + 70 °C
Relative air humidity: < 95%, no condensation at 40 °C
Altitude: ≤ 2000 m
Power reduction
at > 45°C: - 2 % up to max. 60 °C
For instal. heights over 1000 m: - 2 % 100 m each
Overvoltage caregory / polluiton degree: III / 2
Insulation class:
Main circuit: 6 kV
Control and auxiliary circuit: 2.5 kV

Technical Data

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^2
Control terminals:	1.5 mm^2 cage clamp terminals				
Fixing torque:	1.2 ... 1.5	1.2 ... 1.5	1.5 ... 1.7	1.5 ... 1.7	Nm
Mounting:	DIN-rail mounting			IEC/EN 60715	
Weight:	1.0	1.0	1.0	1.0	kg

Dimensions

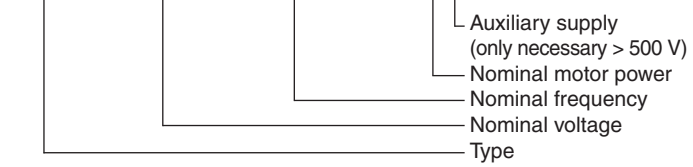
Width x height x depth (incl. terminals)
7.5 / 11 / 15 kW: 45 x 173 x 158 mm
22 kW: 52.5 x 178 x 158 mm

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



Control Input

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.

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_{start}	Starting voltage	Fully anti-clockwise
t ⌐	Ramp-up time	Fully clockwise
t ¬	Deceleration time	Fully clockwise

Set-up Procedure

Softstart:

1. Switch on the unit and motor and select start-up via control input X1/X2 (close). Turn trimmer "M_{an}" clockwise until the motor starts immediately after switching on.
2. Select the acceleration time briefly by turning "t_{an}" counterclockwise to keep the additional thermal load low.

- **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.

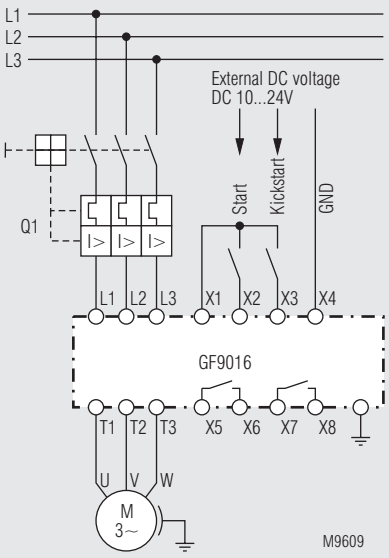
Softstop:

- During the soft coasting phase, the unit must remain switched on at the three-phase mains.
- Select the run-down via the control input X1/X2 (open).
- Adjust the t_{ab} trimmer until the desired run-down time is reached.

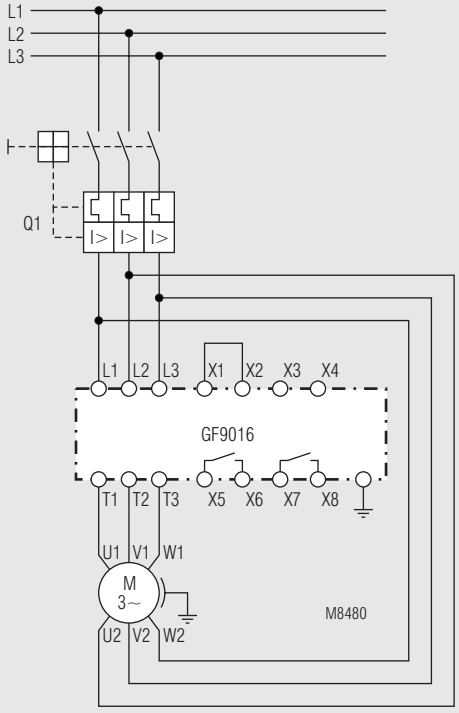
Safety Notes

- 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.
- These units are reset by switching the control supply voltage off and on.
- The protective conductor connection to the motor must not be laid in shielded motor cables, but separately with an appropriate cross-section. The individual earthing systems, power earth, protective earth, digital earth and analogue earth should be laid separately by suitable neutral point wiring.

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