

MINISTART Softstarter For Heating Pumps PF 9029



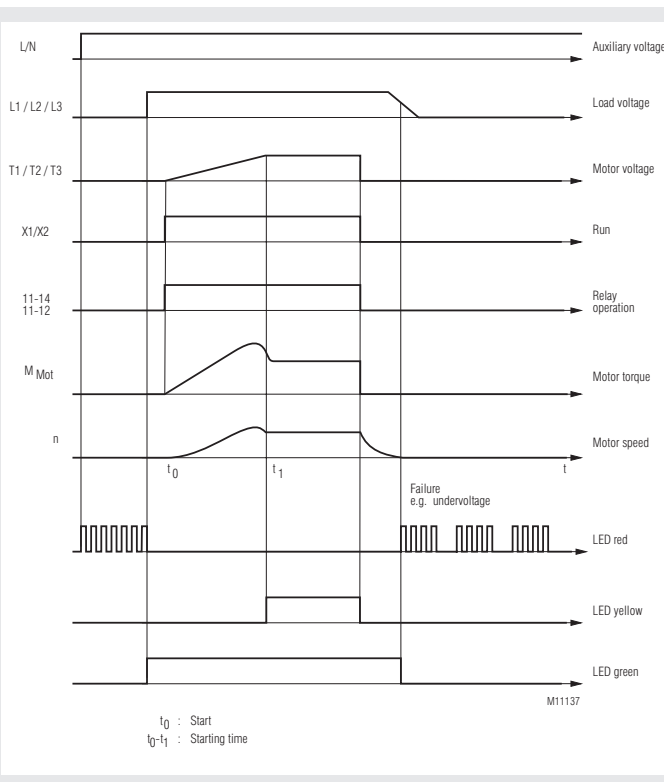
Your Advantages

- 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 starting 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 starting 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



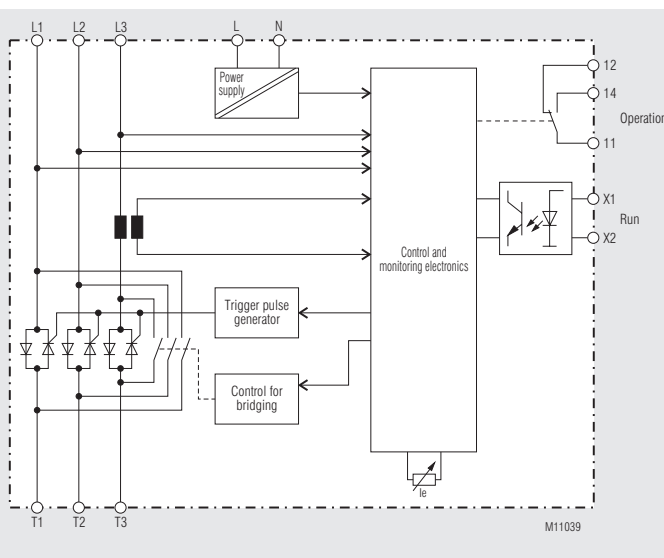
Applications

- 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 semiconductors 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 $50\text{Hz} \pm 5\text{ Hz}$ or $60\text{ Hz} \pm 5\text{ Hz}$ 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 I_{2t} 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 \pm 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 ² s	5500 A ² s	

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
Electrical 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:	$\geq 10^8$ 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 \pm 5 Hz or 60 Hz \pm 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 ² s	
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 \pm 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

Climate resistance:	Amplitude 0.35 mm IEC/EN 60 068-2-6	
Wire connections	frequency 10 ... 55 Hz	
Load terminals:	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
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Mounting torque:

	2.5 Nm
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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
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Weight

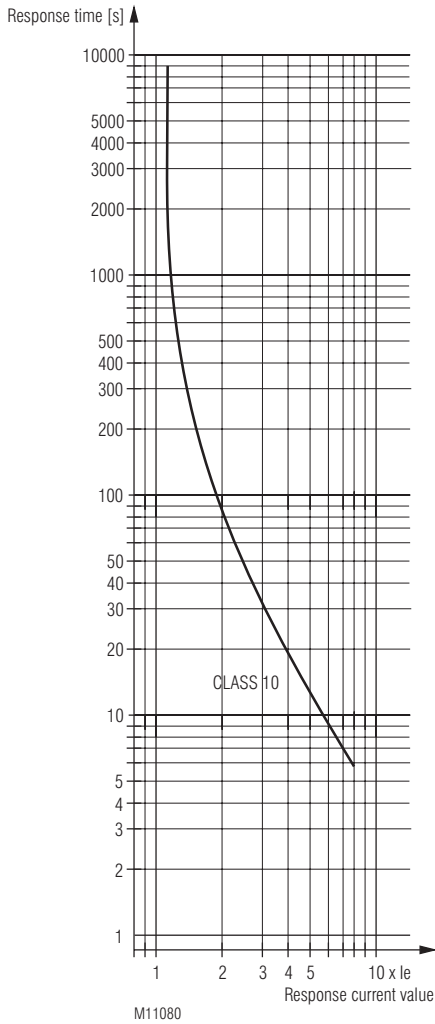
without DIN rail mounting:	500g
with DIN rail mounting:	600g

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



Accessories

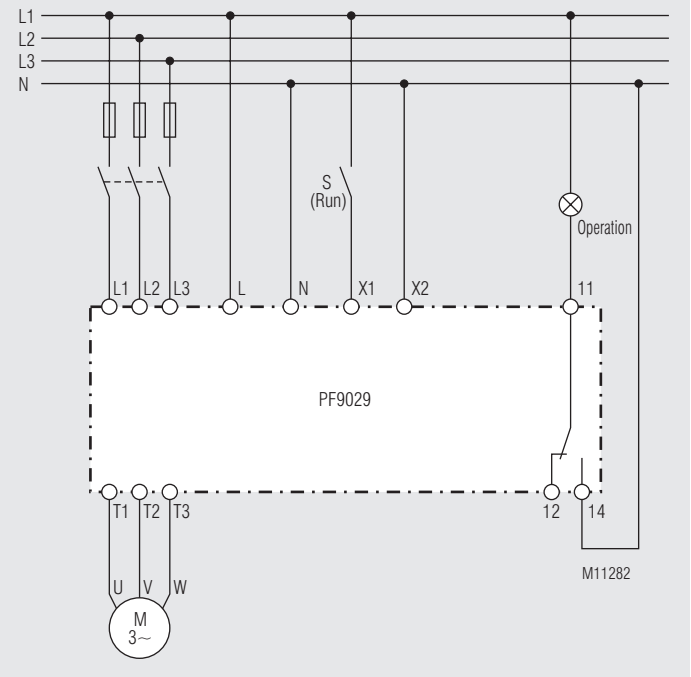
The devices can be mounted on DIN-rail according to IEC/EN 60715 with a fixing plate.

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



Trigger characteristics

Standard Type

PF 9029.11 3 AC 400 V 50 Hz U_H 230 V Hz 25 A

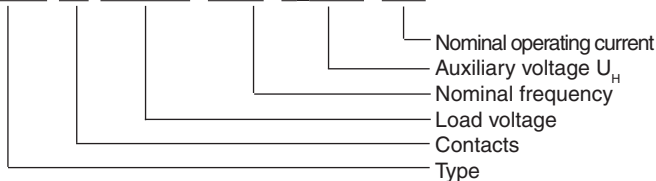
- Article number: 0065815
- Load voltage: 3 AC 400 V
 - Auxiliary voltage U_H: 230 V
 - Nominal operating current I_e: 25 A
 - Setting range I_e: 5 A ... 25 A
 - Width: 67.5 mm

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

Ordering Example

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



Safety Instruction



Dangerous voltage.

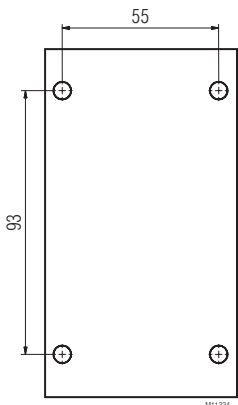
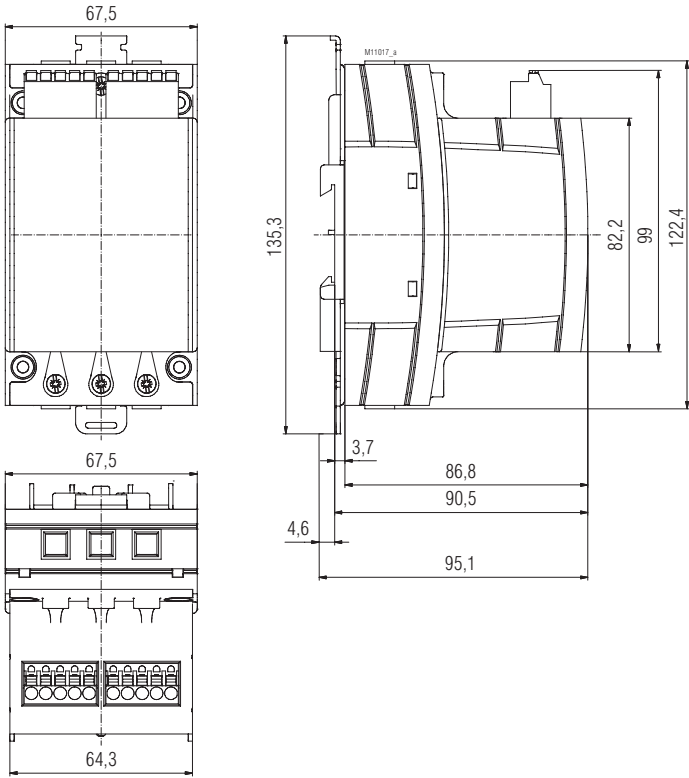
Electric shock will result in death or serious injury.



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.

Dimensions



4x Ø M4 Fastening hole

Drilling pattern