



Frequency Converter.

Quick Guide function for

SpeedControl 1045

ACIM



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## Product description

SpeedControl E 1045 is a frequency converter for control of standard asynchronous motors with 3 phase or single-phase supply. SpeedControl E 1045 is supplied in an IP54 sturdy metal housing for demanding environments. The compact construction offers many mounting options. The construction is not equipped with active cooling, the sound level is very low and the frequency converter is maintenance free. Discrete light grey color for reduction of heat absorption.

For information on Modbus control of the frequency converter, see LS Controls home page.  
<http://www.lscontrol.com>

## Technical specifications

	E1045-370W	E1045-750W	E1045-1500W
<b>Supply voltage</b>	U <sub>in</sub> = 230VAC ±10% - 50Hz	U <sub>in</sub> = 230VAC ±10% - 50Hz	U <sub>in</sub> = 230VAC ±10% - 50Hz
<b>Supply current</b>	Max. I <sub>in</sub> = 4A	Max. I <sub>in</sub> = 6.3A	Max. I <sub>in</sub> = 10A
<b>Supply power</b>	Max. 370W	Max. 750W	Max. 1500W
<b>Motor voltage</b>	3 x AC - 0 – U <sub>in</sub>	3 x AC - 0 – U <sub>in</sub>	3 x AC - 0 – U <sub>in</sub>
<b>Motor current</b>	Max. 2,4A*	Max. 4,0A*	Max. 7,0A*
<b>Motor frequency</b>	0 – 100Hz	0 – 100Hz	0 – 100Hz
<b>16Vdc output</b>	100mA	100mA	100mA
<b>10Vdc output</b>	30mA	30mA	30mA
<b>0 – 10V input</b>	0 – 10V, R <sub>i</sub> = 7 kOhm.	0 – 10V, R <sub>i</sub> = 7 kOhm.	0 – 10V, R <sub>i</sub> = 7 kOhm.
<b>Alarm Relay</b>	Max. 30Vdc/3A & 230VAC/3A	Max. 30Vdc/3A & 230VAC/3A	Max. 30Vdc/3A & 230VAC/3A
<b>Temperature</b>	0 – 40°C	0 – 40°C	0 – 40°C
<b>Modbus A</b>	Net plus	Net plus	Net plus
<b>Modbus B</b>	Net minus	Net minus	Net minus
<b>Modbus C</b>	Net GND	Net GND	Net GND

\* The motor current measuring is optimized for most precise reading around maximum motor current.

## EMC

The SpeedControl E 1045 (IP54) is compliant with below standards for adjustable speed and electrical power drive systems. SpeedControl E 1045 is classified as a Power Drive System (PDS) of "category C2" (EN 61800 – 3).

- EN 61800 – 3:2005 – Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test method.
- EN 61800 – 3/A1:2012 – Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods
- EN 61800 – 5 – 1:2007 – Adjustable speed electrical power drive systems – Part 5-1: Safety requirements - Electrical, thermal and energy

If SpeedControl E 1045 is without housing (IP00), then it does not comply with the standards above.

## Warnings



The components of the power unit of the frequency converter are live when it is connected to mains. Coming into contact with this voltage is extremely dangerous and may cause death or severe injury. The control unit is isolated from the mains potential.



The motor terminals U, V, W are live when the frequency converter is connected to mains, even if the motor is not running.



The control I / O terminals are isolated from the mains potential. However, the relay output terminals may have a dangerous control voltage present even when the frequency converter is disconnected from mains.



The earth leakage current of the frequency converters can exceed 3.5 mA AC. According to standard EN61800-5-1, a reinforced protective ground connection must be ensured.



If the frequency converter is used as part of a machine, the machine manufacturer is responsible for providing the machine with a main switch (EN 60204-1).



If the frequency converter is disconnected from mains while running the motor, it remains live if the motor is energized by the process. In this case the motor functions as a generator feeding energy to the frequency converter.



After disconnecting the frequency converter from mains, wait 5 more minutes before doing any work on frequency converter connections.



The motor can start automatically after a fault situation, if the autoreset function has been activated.



In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.



Intended for use in first environment, that includes domestic premises, it also includes establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purpose.



Note! The frequency converter is only EMC compliant when supplied in IP54 model. If the frequency converter is supplied in IP00 model, the customer will be responsible for EMC compliance.



If the frequency converter is connected to an installation with a residual current device (RCD) protection, the device must be marked with the following: RCD Type B.



The frequency converter is sensitive to ESD (ElectroStatic Discharge). Handle with care. ESD can cause damage to the frequency converter

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## Functions

### Supply

The frequency converter is supplied by 230VAC  $\pm 10\%$ . However it is possible to lower the voltage, but it must be noted, that the power of the motor will be lowered as the main supply voltage decreases. It is not recommended to use a supply less than 190VAC

### Control Voltage

0 – 10 Vdc. Either by potentiometer or by external 0 – 10V signal. Control signal input is located on terminal 6.

### RUN Input

If the RUN input is activated (added to GND from internal supply) the frequency converter will start the motor. The Run input is located on terminal 4.

### DIR Input

If the DIR input is activated the frequency converter will change direction, but only when the motor is at a stand still. The DIR input is located on terminal 3.

### Alarm relay

The relay on the PCB will be activated when the motor is running.

### LSC terminal

This input is designed for a software controlled thermo switch. As default, this input must be shortened with GND. LSC input is located on Terminal 2

### Temperature

The temperature function is set to ensure that if the frequency converter power unit registers an excess temperature it will reduce the motor speed. However, the speed will never be reduced further than the minimum speed. This motor speed reduction will happen slowly. Should the temperature continue to increase, despite the speed reduction, the frequency converter will stop and indicate error.

## Indicator lights

The PCB is equipped with a number of LED lights. LED1 to LED7.

## Modbus LED lights

LED5 (red) and LED6 (green) are modbus LED lights. Please see page "12" for LED positions.

LED6 flashes fast during communication.

LED5 has no function.

## Motor LED lights

LED1 (red) and LED2 (green) are controlled by the circuit regulating the motor.

See section on "Mounting Schematics" for LED positions.

### Start

When the frequency converter is connected to mains, the following pattern is shown:

1. LED1 is off and LED2 is lit constantly => processor initialization.
2. After 5 – 10 seconds, LED1 flashes a number of times to indicate the motor selected by the DIP switches. This also indicates that the motor in question has been initialized in the processor.
3. At last LED1 turns off and LED2 starts flashing.

### Operation

When there are no errors LED2 will be flashing. LED2 flashes when the motor is running and when it is stopped. This indicates that everything is running normally.

### Errors

If an error is detected, the frequency converter will stop the motor, turn on LED1 and turn off LED2.

## HW Stop Function LED lights

LED7 (red) is controlled by the HW Stop function. When it flashes it is indicating that the switch is closed and the HW Stop Function is not blocking the Frequency Converter.

If LED7 (red) is on constantly, it is indicating that the Frequency Converter has been blocked by the HW Stop Function, and that it will not be able to continue until the Supply Voltage has been removed long enough for the Frequency Converter to completely turn off and on again.

## Controller LED lights

LED3 (red) and LED4 (green) are controlled by the interface circuit controlling the I/O's. See page "12" for LED positions.

### Start

When the frequency converter is connected to mains, the following pattern is shown:

1. LED3 turns on and LED4 flashes fast.
2. After 5 – 30 seconds (when the power electronics have been initialized and indicated the motor choice), LED3 will turn off and LED4 will flash slowly.

### Operation

When there are no errors LED4 flashes slowly and LED3 is turned off. This pattern is shown both when the motor is stopped and running. It indicates that everything is running normally.

### Restart

When an error is detected and the frequency converter is waiting to restart, LED3 and LED4 will be flashing at the same frequency. When restart is activated, a new start is initialized.

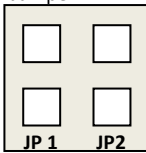
### Errors

If an error is detected, the circuit will indicate the error by flashing LED3 and turn off LED4. At the same time the modbus registers 03x0009 and 03x0010 will be set to a value corresponding to the error. Modbus-register 03x0011 will be set, if the frequency converter is unable to restart and resume operation. The following errors will be indicated by LED3 and the modbus registers 03x0009 and 03x0010:

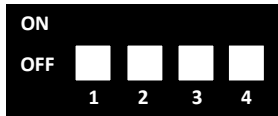
Flash LED3	03x0009 Error code	03x0010 Error code2	Error type Description
1	0	1	Maximum Temperature error. Have not been able to adjust motor, to prevent over temperature.
2	0	2	Motor Start Error. Have not been able to start motor.
3	0	4	Motor current error 1. Current limit exceeded for more than 4 minutes.
4	0	8	Motor current error 2. Current limit x 1,25 exceeded for more than 2 minutes.
5	0	16	Motor current error 3. Current limit x 1,50 exceeded for more than 1 minutes.
6	0	32	Motor current error 4. Current limit x 2,00 exceeded for more than 10 seconds.
7	256	0	Motor gate kill error. High current peak detected.
8	1024	0	Motor phase loss error.
9	2048	0	Motor zero speed error.
10	4096	0	MCE error. This includes: over voltage, undervoltage, regulating error, etc.
11	0	32768	Thermal error. Thermal switch is open or thermister is indicating too high a temperature.
12	0	16384	Modbus Heartbeat Error
13	0	8192	Motor selection error
14			

## DIP-switch and jumper settings for motor

Jumper



DIP-Switch



### JUMPER

JP1: If JP1 is closed, the motor current is set for the smallest motor (e.g. 550W motors = 2,9A)

If JP1 is open, the motor current is set for the largest motor (e.g. 750W motors = 3,8A)

JP2: No function.

370W:	JP1 closed	– smallest motor –	250W motors = 1,7A
	JP1 open	– largest motor –	370W motors = 2,4A
550 - 750W:	JP1 closed	– smallest motor –	550W motors = 2,9A
	JP1 open	– largest motor –	750W motors = 3,8A
1,1 – 1,5kW:	JP1 closed	– smallest motor –	1,1kW motors = 4,9A
	JP1 open	– largest motor –	1,5kW motors = 7,0A

### DIP-Switch

DIP1 = OFF and DIP2 = OFF ----- ramp up time = 5 sec. and ramp down time = 15 sec.

DIP1 = ON and DIP2 = OFF ----- ramp up time = 15 sec. and ramp down time = 30 sec.

DIP1 = OFF and DIP2 = ON ----- ramp up time = 15 sec. and ramp down time = 60 sec.

DIP1 = ON and DIP2 = ON ----- ramp up time = 15 sec. and ramp down time = 120 sec.

DIP3 = OFF and DIP4 = OFF ----- 3 phase motor with parable shaped Hz/voltage curve. See fig. 1.

DIP3 = ON and DIP4 = OFF ----- 3 phase motor with linear shaped Hz/voltage curve. See fig. 2.

DIP3 = OFF and DIP4 = ON ----- 1 phase motor with 50Hz fixed and variable voltage. See fig. 3.

DIP3 = ON and DIP4 = ON ----- 1 phase motor with 40 - 50Hz and variable voltage. See fig. 4.

### Basic settings

Minimum frequency = 10Hz

Maximum frequency = 50Hz

Minimum Voltage on control signal = 1V

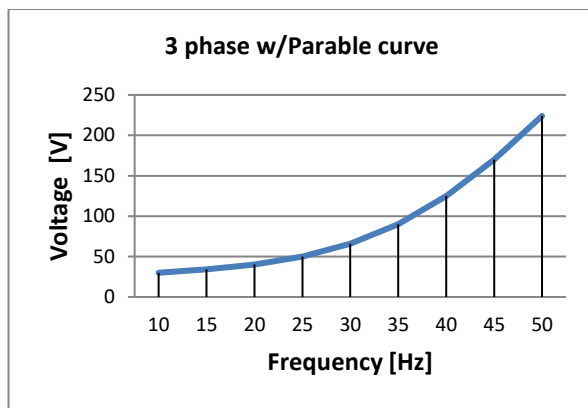
Maximum Voltage on control signal = 10V



## Hz/Volt - curves

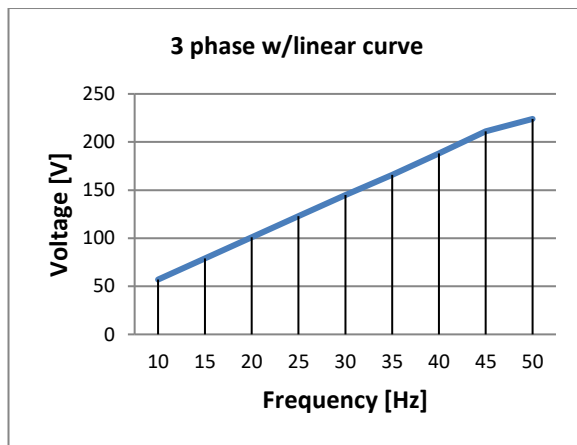
### 3 phase motor with Parable shaped Hz/Voltage curve – Figure 1

Control signal 1 – 10 V controls the frequency from min. to max.



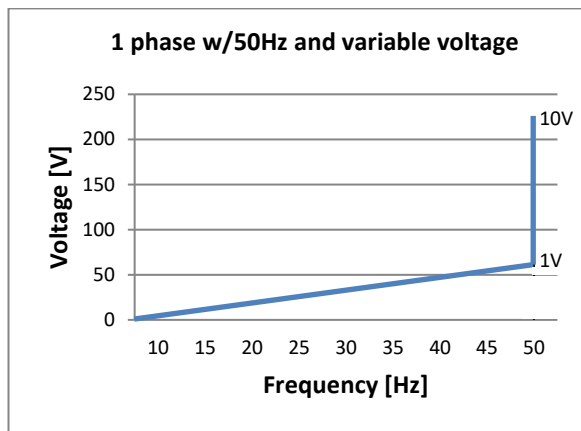
### 3 phase motor w/Linear shaped Hz/Voltage curve – Figure 2

Control signal 1 – 10 V controls the frequency from min. to max.



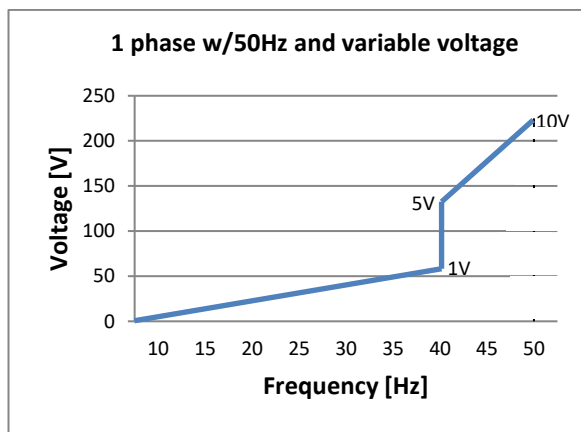
## 1 phase motor with 50 hz and variable voltage – Figure 3

Control signal from 1 to 10V shown below.



## 1 phase motor with 40 - 50 hz and variable voltage – Figure 4

Control signal from 1 to 10V shown below.



## Elektrical / Mechanical installation

### **Important**

A time delay of approx. 5 - 30 sec will occur at start up. If the PCB is dismantled from the metal housing, the warranty will be void. Before handling the frequency converter, it must have been disconnected from supply power for at least 5 minutes.

### **Mounting**

The frequency converter is cooled by passive air circulation. To avoid reduced operation or operation stops due to overheating of the frequency converter, the frequency converter must be mounted vertically on a metal plated wall with the cable glands facing downwards. The frequency converter must be mounted with space around it to ensure sufficient cooling by allowing free circulation of air.

Do not place the frequency converter in a cupboard unless it is well ventilated. The ambient temperature must not exceed 40°C, and the frequency converter must not be exposed to direct sunlight.

### **Supply**

The frequency converter is supplied by mains (230VAC  $\pm 10\%$ ) with minimum 3 x 1.5 mm<sup>2</sup> cable. The distance between supply cable and motor cable must be as long as possible (> 30 cm). If it is necessary to cross the power cable and the motor cable, this must be done at an angle of 90°. The PE-conductor from the motor must be longer than L and N.

Due to relatively high leakage currents in the frequency converter and the motor, the frequency converter and the motor must always be properly grounded in accordance with national and local regulations. The ground conductor should be as short as possible to avoid high frequency radiation.

### **Motor**

The motor is connected to the frequency converter by minimum 4 x 1.5 mm<sup>2</sup> shielded cable. The total cable length must not exceed 20 m, keep it as short as possible. Long cables may cause function failure. The motor cable must be shielded and be mounted correctly in the metal gland to minimize electrical noise from the motor. The PE conductor must be longer than U, V and W. If the motor is rotating in the wrong direction, change the position of two of the motor cables.

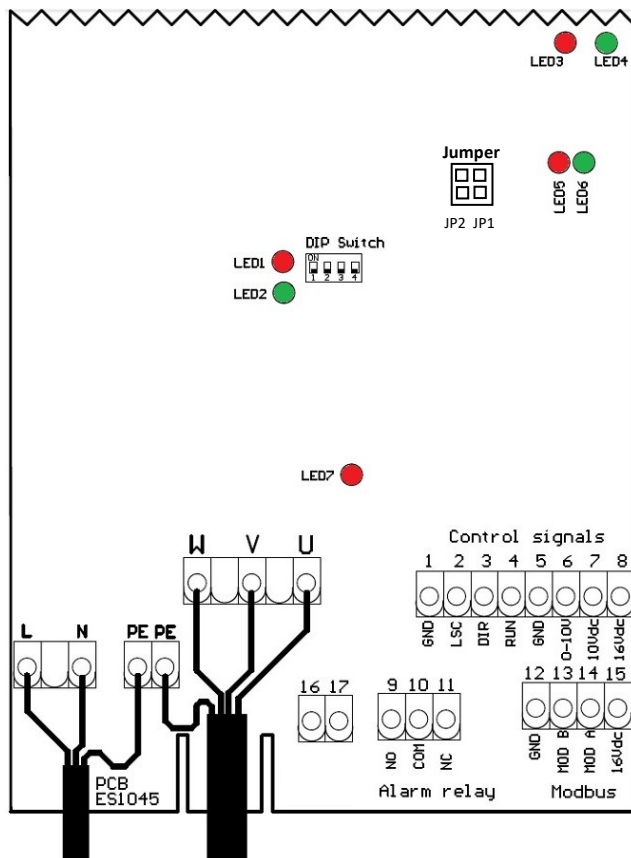
### **Signal cables**

The distance between the signal cable and the motor cable and supply cable must be as long as possible (> 30 cm). If the signal cable crosses the motor cable or the supply cable, it must be done at an angle of 90°. The signal cable must be shielded to GND or PE.

### **Current limits**

The current limits are controlled by Jumper 1. If JP1 is closed, the motor current will be adjusted for operation of 550W motors (2,9A). If JP2 is open, the motor current will be adjusted for operation 750W motors (3,8A).

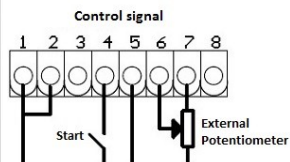
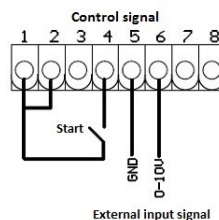
## Mounting schematics



Note:

If LSC is not used for Thermal switch, terminals 1 & 2 must be shortened

If terminals 16 and 17 (HW Stop Switch) are not used, these terminals must be shortened.



Supply Voltage Motor output

Single phase motors are connected between 2 of the 3 phases out of the frequency converter.

Check the place of installation for any special requirements and precautions which must be observed during installation, commissioning or operation. The frequency converter must be supplied through a mains switch with at least 3mm breaker space between all conductors according to IEC364. The fuse installed in the electrical switchboard must be 13A or less for E1045-1500 and 16A or less for E1045-2000. The frequency converter must always be connected to yellow/green grounding conductor (PE) in supply.

If the frequency converter is connected to an installation with a residual current device as an extra protection, the device must be marked with the following marking: RCD Type B.