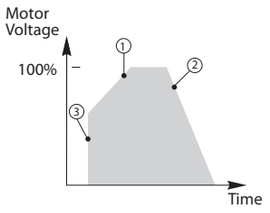
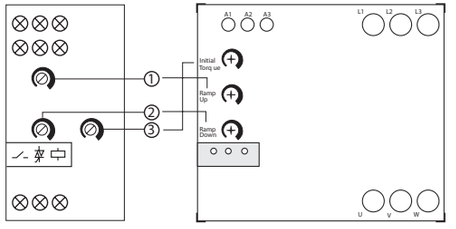
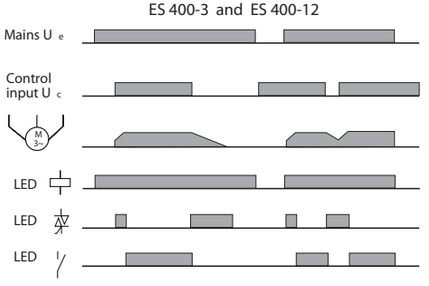
Operation Diagrams

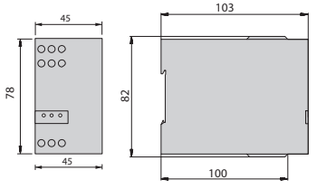




(1) Ramp-up time. Time from zero load voltage to full load voltage.
(2) Ramp-down time. Time from full load voltage to zero load voltage.
(3) Initial torque. % of the nominal torque at the start of the ramp-up function.



Dimensions (mm)



ES 400-3 and 12

Type selection (with recommended manual motor starters)

	Motor full load current (A)										
	0,1 0,16	0,16 0,25	0,25 0,4	0,4 0,63	0,63 1	1 1,6	1,16 2,5	2,5 4	4 6,3	6,3 10	10 16
FANOX Manual motors starters	M-0,16	M-025	M-0,4	M-0,63	M-1	M-1,6	M-2,5	M-4	M-6,3	M-10	M-16
Soft starter	ES 400-3								ES 400-12		

Note: The specifications are subject to change without notice. 10/01

Soft starters

FANOX protection & control

ES

- The best solution for a soft start/stop for 3 phase inductive motors up to 5,3kW (400V).
- Potencial-free control input.
- Easy setting with 3 independent potenciometers
  - -Ramp-up time
  - -Ramp-down time
  - -Initial torque
- Internal heatsink and bypass relay incorporated.
- Compact housing for DIN rail assembly.

Mode of Operation

An electronic circuit comprising semiconductor components starts the motor without the use of contacts.

Neither switching sparks nor contact erosion occur.

Only when the motor nominal voltage is reached the power semiconductor devices are bypassed by relay contacts. Thanks to this technology, the ES motor controllers are substantially longer lasting than conventional contactors.

Easy to install and control. The ES control can take place either from outside by means of a control signal, eg, a programmable controller, or directly via the power supply of the motor to be controlled.

Type selection

	Nominal current	Nominal voltage	Motor rating kW	Motor rating HP	Weight	Code No.
ES 400-3	3 A	400 Vac	1,1	1,5	270 gr	41803
ES 400-12	12 A	±15%	5,5	7,5	270 gr	41812

Input Specifications (Control Input)

Control voltage U c A1-A2: A1-A3:	 24 - 110 VAC/DC ±15%, 12 mA 110 - 480 VAC ±15%, 5 mA
Rated insulation voltage	630 V rms Overvoltage cat. III (IEC 664)
Dielectric strenght Dielectric voltage Rated impulse withstand volt.	 2 kV (rms) 4 kV (1,2/50 µs)

Output Specifications

Utilization category	CA 53b integral bypassing of semiconductors
Overload current profile (overload relay trip class)	ES 400-3: 6/13 ES 400-12: 6/13

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Supply Specifications

Power supply	Overvoltage Cat. III (IEC 664)
Rated operational volt. (U_e) trought terminals L1-L2-L3	(IEC 38) 400 Vac rms ±15% 50/60 Hz -5/+5 Hz
Voltage interruption	≤40 ms
Dielectric voltage	2 kV (rms)
Rated impulse withstand volt.	4 kV (1,2/50 µs)
Rated operational power supplied from	5 VA L1-L2

Semiconductor Data

Rated operational current	I^2t for fusing t = 1 - 10 ms	I_{TSM}	dI/dt
3 A	72 A ^{2}s	120 Ap	50 A/ µs
12 A	610 A ^{2}s	350 Ap	50 A/ µs

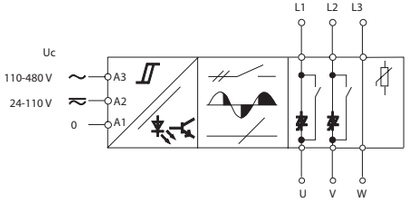
General Specifications

Accuracy Ramp-up	≤ 0,5 s on min. 5,5-7,5 s on max.(ES400-3 and 12)
Ramp-down	≤ 0,5 s on min. 6 -10 s on max.(ES400-3 and 12)
Initial torque	±15% on max. (ES 400-3 and 12) < 5% on min.
EMC Inmunity	Electromagnetic Compatibility acc. to EN 50 082-2
Environment Degree of protection Pollution degree Operating temperature Storage temperature	 IP 20 3 -20 a +50 °C (-4 to +122 °F) -50 a +85 °C (-58 to +185 °F)
ES 400-3 y ES-400-12 Control and Line screw terminals Minimum Max. tightening torque	 2,5 mm ^{2} , AVG 14 0,5 mm ^{2} , AWG 20 0,6 Nm
Line screw terminals	10 mm ^{2} , or 2 x 6 mm ^{2} AWG 6 or 2 x AWG 10
Minimum Max. tightening torque	1 mm ^{2} , AWG 16 2 Nm

Mode of Operation

This motor controller is intended to be used to soft start/stop 3 phase squirrel cage induction motors and thereby reduce the stress or wear on gear and belt/chain drives and to give smooth operation of machines. Soft starting and/or stopping is achieved by controlling the motor voltage.
During running operation the semiconductor is bypassed by an internal electromechanical relay

Functional Diagram



Display Information

	ES400-3	ES400-12
Power Supply	green	green
Ramp	yelow	yelow
Bypass relay on	yelow	yelow

Settings

	ES400-3	ES400-12
Initial torque (% of nominal torque)	0-85%	0-85%
Ramp-up time	0,5-5 s	0,5-5 s
Ramp-down time	0,5-5 s	0,5-5 s

Applications

Changing from Direct ON Line start to soft start (Line controlled soft start) (Fig. 1)

Changing a Direct On Line start into a soft start is very simple with the ES soft starting relay:

1) Cut the cable to the motor and insert the ES relay.
2) Connect control input to two of the incoming lines. Set initial torque to minimum and ramp up and down to maximum.
3) Power up again, adjust the start torque so the motor starts turning immediatly after power is applied, and adjust ramp time to the appropriate value.

When C1 is operated, the motor controller will perform soft start of the motor. When C1 is switched off, the motor will stop, the motor controller will reset and after 0.5 s a new soft-start can be performed.

Please note that the controller does not insulate the motor from the mains. Contactor C1 is therefore needed as a service switch for the motor

Soft start and soft stop (Fig. 2)

When S1 is closed, soft start of the motor will be performed according to the setting of the ramp-up potentiometer and the setting of the initial torque potentiometer. When S1 is opened, soft stop will be performed according to the setting of the ramp-down potentiometer.

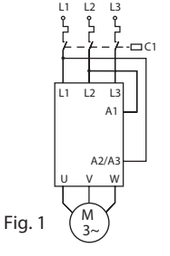


Fig. 1

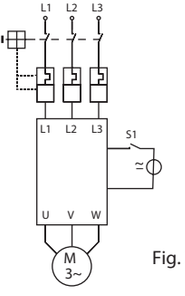


Fig. 2

Fusing Considerations

The motor controller provides by-passing of the semiconductors during running operation. Therefore the semiconductors can only be damaged by short-circuit currents during ramp-up and ramp-down function.

A 3-phase induction motor with correctly installed and adjusted overload protection does not short totally between lines or directly to earth as some other types of loads, e.g. heater bands. In a failing motor there will always be some part of the winding to limit the fault current. If the motor is installed in an environment where the supply to the motor cannot be damaged, the short-circuit protection can be considered to be acceptable if the controller is protected by a 3-pole thermal-magnetic overload relay.

If the risk of short-circuit of the motor cable, the soft starter or the load exists, then the soft starter must be protected by ultrafast fuses, e.g. for a 3 A type: Ferraz 660 gRB 10-10, for an 12 A type: Ferraz 660 gRB 10-25. Fuseholder type PST 10.

Time between rampings

To prevent the semiconductors from overheating, a certain time between ramping should be allowed. The time between rampings depends on the motor current during ramping and ramp time.

ES 400-3

	Ramp time		
I_{ramp} (A)	1	2	5
18	15s	30s	15min
15	12s	20s	60s
12	10s	20s	50s
9	8s	12s	30s
6	5s	9s	25s
3	2s	5s	20s
1,5	1s	2s	5s

ES 400-12

	Ramp time		
I_{ramp} (A)	1	2	5
72	2,5min	5min	40min
60	1,5min	3min	13min
48	50s	1,5min	5min
36	30s	1min	3min
24	15s	40s	15min
12	10s	20s	50s
6	5s	9s	20s

Note: Table is valid for ambient temperature 25°C. For higher ambient temperature add 5% per°C to values in the tables.The more shaded areas in the tables are for blocked rotor. Do not repeat rampings with blocked rotor.