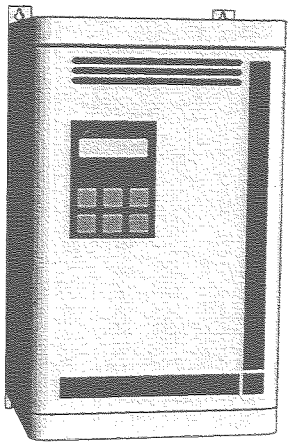


Valid for the following soft starter models:
MSE-017 to MSE-835

MASTERSTART™ MSE SOFT STARTER

INSTRUCTION MANUAL

Document number: 01-0471-01
Document version: r1a
Date of release: 1995-09-01

SAFETY WARNINGS

Safety

The soft starter should be installed in a cabinet or in an electrical control room.

- The device must be installed by trained personnel.
- Always use standard commercial fuses, slow blow e.g. type gL, to protect the wiring and prevent short circuiting. To protect the thyristors against short-circuit currents, superfast semiconductor fuses can be used if prefered. The normal guarantee is valid even if superfast semiconductor fuses are not used.

Operating and maintenance personnel

1 Read the whole Instruction Manual before installing and putting the equipment into operation.

2 During all work (operation, maintenance, repairs, etc.) observe the switch-off procedures given in this instruction as well as any other operating instruction for the driven machine or system. See **Emergency** below.

3 The operator must avoid any working methods which reduce the safety of the device.

4 The operator must do what he can to ensure that no unauthorised person is working on the device.

5 The operator must immediately report any changes to the device which reduce its safety to the user.

6 The user must undertake to operate the device in perfect condition only.

Installation of spare parts

We expressly point out that any spare parts and accessories not supplied by us have also not been tested or approved by us.

Installing and/or using such products can have a negative effect on the characteristics designed for your device. The manufacturer is not liable for damage arising as a result of using non-original parts and accessories.

Emergency

You can switch the device off at any time with a mains switch connected in front of the soft starter (both motor and control voltage must be switched off).

Dismantling and scrapping

The enclosure of the soft starter is made of recyclable material as aluminium, iron and plastic. Legal requirements for disposal and recycling of these materials must be complied with.

The soft starter contains a number of components demanding special treatment, as for example thyristors. The circuit board contain small amounts of tin and lead. Legal requirements for disposal and recycling of these materials must be complied with.

1. SAFETY

The device was manufactured in accordance with EC regulations.

- EN 292, part 1 and 2, 1991. Safety of machines (Basic terms).
- EN 60 204-1 Electrical equipment of machines, part 1, General requirements and VDE 0113.

1.1 Integrated safety systems

The device is fitted with a monitoring system which reacts to:

- Over temperature (operation is stopped).
- Phase failure or thyristor fault.
- If the starting time is exceeded (in the case of Current Limit Start function, Factory Option). Operating too long at current limit.
- Motor Overload (Operation is stopped, in the case of Motor Protection function, Factory Option).

For more details see **Alarm functions, alarm list** on page 43 and **Fault, cause, remedy** on page 44.

The soft starter is fitted with a connection for protective earth ⏚ (PE).

MASTERSTART MSE soft starters are all enclosed IP 20/21.

1.2 Safety measures

These instructions are a constituent part of the device and must be:

- Available to competent personnel at all times.
- Read prior to installation of the device.
- Observed with regard to safety, warnings and information given.

The tasks in these instructions are described so that they can be understood by people trained in electrical engineering. Such personnel must have appropriate tools and testing instruments available. Such personnel must have been trained in safe working methods.

The safety measures laid down in DIN norm VDE 0100 must be guaranteed.

The user must obtain any general and local operating permits and meet any requirements regarding:

- Safety of personnel.
- Product disposal.
- Environmental protection.

NOTE! The safety measures must remain in force at all times. Should questions or uncertainties arise, please contact your local sales outlet.

1.3 Notes to the Instruction Manual

WARNING! Warnings are marked with a warning triangle.

Serial number

The information given in these instructions only applies to the device with the serial number given on the label on the front page.

A plate with the serial number is fixed to the device.

Important

For all enquiries and spare parts orders, please quote the correct name of the device and serial number to ensure that your inquiry or order is dealt with correctly and swiftly.

NOTE! These instructions only apply to the soft starters having the serial number given on the front page, and not for all models.

1.4 How to use the Instruction Manual

This instruction manual tells you how to install and operate the MASTERSTART MSE soft starter. Read the whole Instruction Manual before installing and putting the unit into operation. For simple start-up, read chapters 1. **SAFETY** to 5. QUICK SET-UP.

Once you are familiar with the soft starter, you can operate it from the keyboard by referring to the chapter 6. STARTING/OPERATING THE SOFT STARTER. This chapter describes all the functions and possible setting.

2. INSPECTION AT DELIVERY

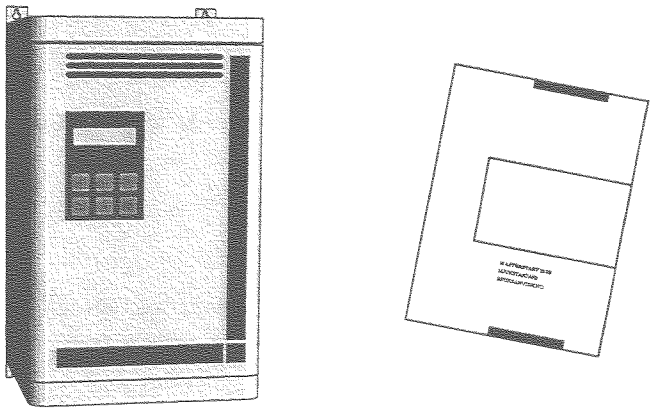


Fig. 1 *Scope of delivery.*

2.1 Transport and packing

The device is packed in a carton or plywood box for delivery. The outer packaging can be returned. The devices are carefully checked and packed before despatch, but transport damage cannot be ruled out.

Check on receipt:

- Check that the goods are complete as listed on the delivery note, see type no. etc. on the rating plate.

Is the packaging damaged?

- Check the goods for damage (visual check).

If you have cause for complaint

If the goods have been damaged in transport:

- Contact the transport company or the supplier immediately.
- Keep the packaging (for inspection by the transport company or for returning the device).

Packaging for returning the device

- Pack the device so that it is shock-resistant.

Intermediate storage

After delivery or after it has been dismounted, the device can be stored before further use in a dry room.

2.2 Unpacking of MSE-170 and larger types

The soft starter is attached to the plywood box/loading stool by screws, and the soft starter must be unpacked as follows:

1 Open only the securing plates at the bottom of the box (bend downwards). Then lift up the box from the loading stool, both top and sides in one piece.

2 Loosen the three (3 pcs) screws on the front cover of the soft starter, down by the lower logo.

3 Push up the front cover about 20 mm so that the front cover can be removed.

4 Remove the two (2 pcs) mounting screws at the bottom of the soft starter.

5 Lift up the soft starter at the bottom about 10 mm and then push backswards about 20 mm so that the soft starter can be removed from the mounting hooks* at the top. The hooks are placed under the bottom plate and cannot be removed until the soft starter is pulled out.

6 Loosen the screws (2 pcs) for the mounting hooks and remove the hooks.

7 The hooks are used as an upper support for mounting the soft starter.

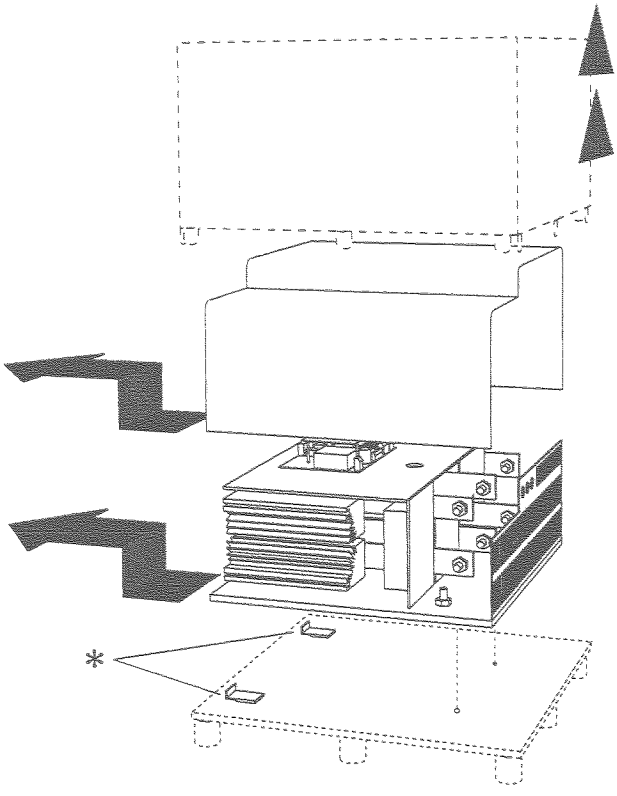


Fig. 2 *Unpacking of MSE-170 and larger models.*

3. DESCRIPTION

The MASTERSTART MSE soft starter is installed directly between the mains contactor and the supply cable to the motor. The mains contactor can be activated by means of an integrated relay (K1).

The soft starter was developed for soft-starting and stopping three-phase motors. After input of appropriate "starting voltage" and "ramp times" and further desired parameters, a microprocessor will calculate all necessary output voltage values. The output voltage has three-phase control.

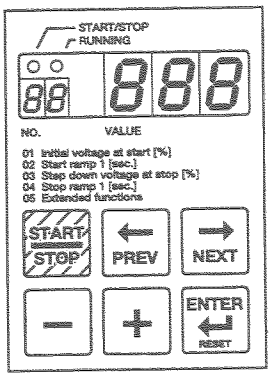
On the front of the soft starter there is a programming and presentation unit (PPU). The PPU is a built-in operator panel with an LED character display and a keyboard. The functions of the unit are organised in a simple "one level" window structure. Controlling the motor i.e. start/stop, is done either from the keyboard, through remote control inputs, or through the serial interface (option).

To get the function and performance expected, a number of parameters have to be set, but there are two ways:

- The "Quick Set-up" for which there are only four parameters to set.
- The more advanced mode where up to 24 parameters can be used for tuning etc.

When using the standard application of the soft starter via "ramp function":

- The motor voltage is controlled from the starting voltage through to full supply voltage and vice versa.
- The starting current of the motor is thus reduced. A typical starting current of a soft starter using the ramp function amounts to about 300-400% of the rated current, compared with 600-800% of rated current at direct-on-line start. The longer the starting ramp time setting, the less starting current is required. As a rule, the starting current is half that required for a direct-on-line start.



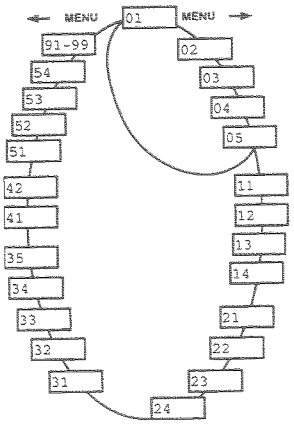


Fig. 3 *The programming and presentation unit and the menu structure.*

Special application

Special ramp functions can be performed as required via the integrated, remote analogue control input, 0-10/2-10 V DC alt. 0-20/4-20 mA DC.

NOTE! To avoid thermal overloads at the motor, consult your sales representative before using this function.

Factory options

A current limit start function can be ordered as a built-in factory option (Current Limit Start version, CL-version). When using the current limit start option the inrush current can be limited to between 150%-500% of the rated current.

In many cases it is convenient to have a complete starter. MASTERSTART MSE can then be delivered with a built-in motor protection function. This function must then be ordered as a built-in factory option (Motor protection version (CL-T-version).

Features

As a further option a serial interface is also available. This option as well as all other accessories and options can be added and delivered separately.

As mentioned above MASTERSTART MSE soft starters offer you several features, but the following functions are also included or available:

- Dual ramp start and stop
- Application "Pump"
- Step down voltage at stop
- Remote analogue control
- Torque booster at start
- Full voltage start (D.O.L)
- DC-brake
- Programmable relay, etc.

Auxiliary relays and displays

The soft starter has three built-in auxiliary relays (K1, K2 and K3) to signal Operation, Full voltage, Control DC-brake contactor etc. and Alarm. The alarm relay is always used as an alarm relay (K3). The other two relays are programmable. On the front of the soft starter there is a built-in LED display showing mains on, status and alarm.

Applications for the soft starter

Typical equipment used with the soft starter is:

- Ventilators, fans
- Pumps
- Conveyor belts
- Compressors
- Presses
- Centrifuges
- Saw mills
- Overhead cranes
- Water and waste water equipment
- Grinders
- Rock crushers
- Mixers

Connection – Minimum wiring

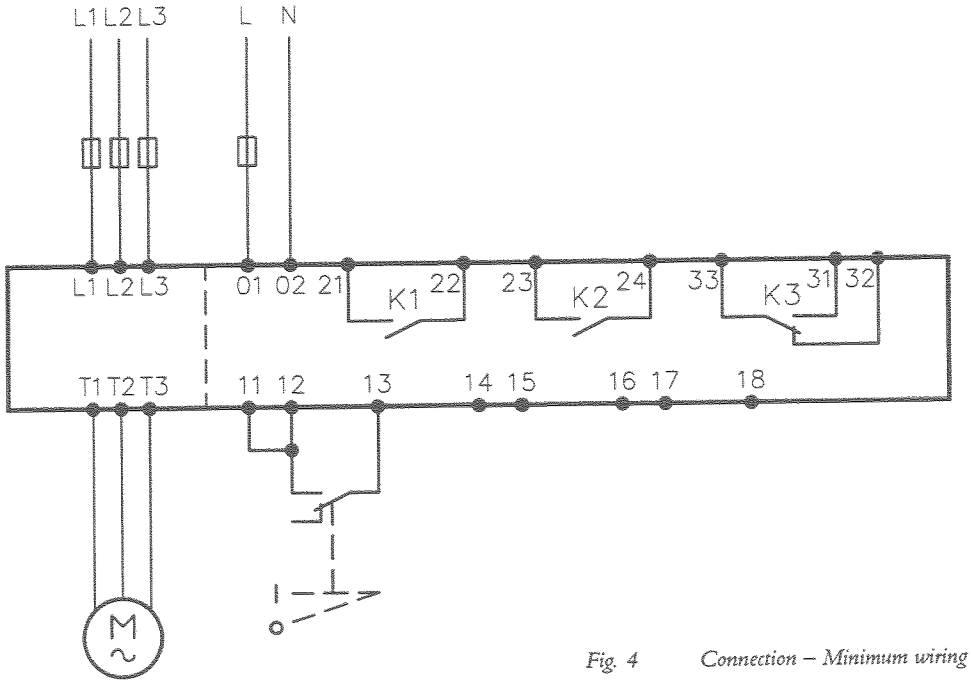


Fig. 4 Connection – Minimum wiring (12 76 002)

NOTE! If general and local regulations permit, you can do without a motor contactor because it is not necessary for starting and stopping the motor.
You must always use normal slow blow fuses, e.g. type gL, to protect the wiring etc.

The figure **Connection – Minimum wiring (12 76 002)** on page 9 shows minimum wiring of the soft starter. Controlling the motor; start/stop, is done either from the keyboard, or through the remote control inputs, terminal 11 - 13:

1 To start/stop the soft starter from the keyboard, check that there is a link between term. 12 and 13 (at delivery).

2 To start/stop from the remote control inputs, term. 11 - 13, remove the link between 12 and 13 and connect according to the figure **Connection – Minimum wiring (12 76 002)** on page 9 (link between 11 and 12, for 2-wire start/stop).
See also chapter **Start/stop/reset** on page 29.

3.1 Function of soft starter - "Factory setting"

Below is a function description of the soft starter (Factory setting) where the basic functions "Quick Set-up" and "Standard Wiring" are used.

The device is started and stopped as shown in Fig. 5.

- The soft starter is connected between the motor contactor and the motor.
- The ramp times are set separately for starting and stopping by means of a built-in operator panel with an LED display, on the front of the soft starter. Start ramp can be set from 1 to 60 s in window 02 and stop ramp from 2 to 120 s in window 04. Step down voltage at stop can be set in window 03, if required. These ramp times always relate to the voltage time ramp and the acceleration and deceleration slope ramp times.
- The soft starter starts the motor when an external potential-free contact has closed (at terminals 12–13, term. 11–12 linked). Start/stop of the motor can also be done from the keyboard. To start/stop from the keyboard, there must be a link between 12 and 13 (at delivery). See also chapter **Start/stop/reset** on page 29.
- The output voltage increases according to the set ramp and the initial voltage (starting voltage), window 01.
- As the voltage increases, the motor shaft starts to rotate.

The output voltage increases until the mains voltage has been reached. The acceleration and stopping times result from the supply of voltage and current, and from the load torque. The starting voltage can be adjusted to suit the motor. To reduce starting time when the load torque is greater, the starting procedure can be optimised by raising the initial voltage. While operating, the microprocessor continuously checks the power and load conditions.

After the external contact (term. 12-13) has been opened, or stop command given from the keyboard, the motor is stopped according to the stop ramp. If a step down voltage value is set the output motor voltage follows the step down ramp. This function is used when a quick, but still soft stop is required.

When starting and stopping, the motor contactor is switched on and off under no-current conditions by the built-in operating relay K1 (see chapter **Standard wiring** on page 19)

The unit has three built-in relays: K1, K2 and K3. Relay K3 is always used as an alarm relay. The other two relays are programmable. Relay K1 and K2 are at delivery (factory setting) programmed as description below.

- The relay K1 is used for indication of operation. K1 closes before start-up and is activated by the external contact, terminal 12–13 or start command from keyboard (see Fig. 5). Normally used for controlling the motor contactor.
- Relay K2 is used for indication of full voltage, closes when the start ramp is finished and remains closed until operation is stopped (term. 12 -13 opened or stop command from keyboard).

The relay K2 can be used to:

- Give a signal when "Full Voltage" is reached.
- Control by-passing of the soft starter during full speed operation, Control DC-brake, sequence start of other equipment etc.

For more details, see **TECHNICAL DATA** on page 48..

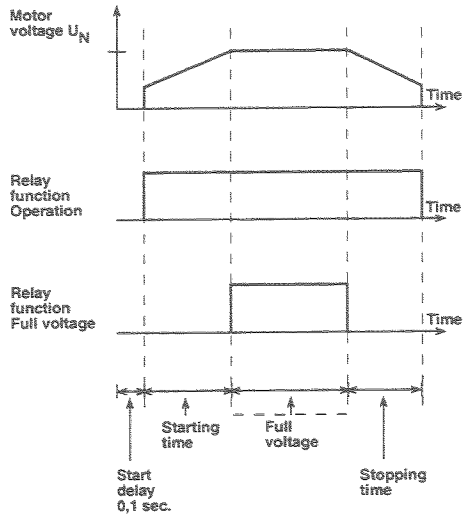


Fig. 5 *Start/stop sequence and relay functions.*

4. MOUNTING/WIRING

Mounting, wiring and setting the device into operation must be carried out by trained personnel (electricians specialised in heavy current technology):

- In accordance with the local safety regulations of the electricity supply company.
- In accordance with DIN VDE 0100 for setting up heavy current plants.

Care must be taken to ensure that personnel do not come into contact with live circuit components.

WARNING! Never operate the soft starter with removed front cover.

4.1 Installation of the soft starter in a cabinet

When installing the soft starter:

- Ensure that the cabinet will be sufficiently ventilated, after the installation.
- Keep the minimum free space, see the tables below.
- Ensure that air can flow freely from the bottom to the top.

NOTE! When installing the soft starter, make sure it does not come into contact with live components. The heat generated must be dispersed via the cooling fins to prevent damage to the thyristors (free circulation of al

MASTERSTART MSE-017 to MSE-835 soft starters are all delivered as enclosed versions with front opening. The units have bottom entry for cables etc. see Fig. 9 and Fig. 10.

MSE-017 to MSE-145

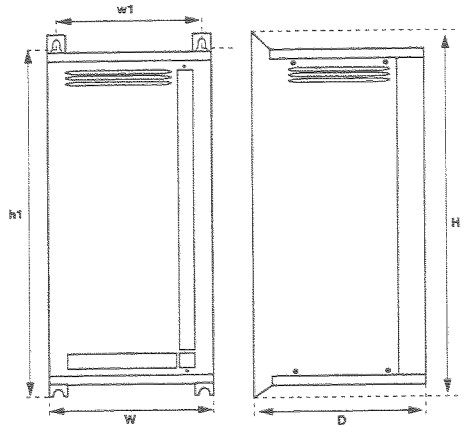


Fig. 6 MSE-017 to MSE-145 dimensions.

Table 1: MSE-017 to MSE-145 dimensions etc.

MSE	Class	Connection	Conv./	Dimension	Hole dist.	Hole dist.	Diam./	Weight
-017	IP 21	Terminal	Convection	360x211x220	181.5	345	6.2/M5	5.9
-030	IP 21	Terminal	Fan	360x211x220	181.5	345	6.2/M5	6.7
-045	IP 21	Terminal	Fan	360x211x220	181.5	345	6.2/M5	6.7
-060	IP 21	Busbars	Fan	460x211x220	181.5	445	6.2/M5	9.1
-075, -085	IP 21	Busbars	Fan	460x211x220	181.5	445	6.2/M5	9.4
-110, -145	IP 21	Busbars	Fan	560x211x220	181.5	545	6.2/M5	12.0

MSE model	Minimum free space (mm):			Connection,terminals or busbars Cu/Al 2)	Tightening torque for bolt (Nm)		
	above 1)	below	at side		Cable	PE-cable	Supply and PE
-017	100	100	0	10/6	1.8	1.8	0.6
-030	100	100	0	16/10	1.8	1.8	0.6
-045	100	100	0	25/16	1.8	1.8	0.6
-060	100	100	0	15x5 (M8)	15	4	0.6
-075,-085	100	100	0	15x5 (M8)	15	4	0.6
-110,-145	100	100	0	20x5 (M10)	20	4	0.6

1) Above: wall-soft starter or soft starter-soft starter
2) Cu-cable: solid/stranded mm² (bolt). Busbars Cu (bolt).

MSE-170 to MSE-835

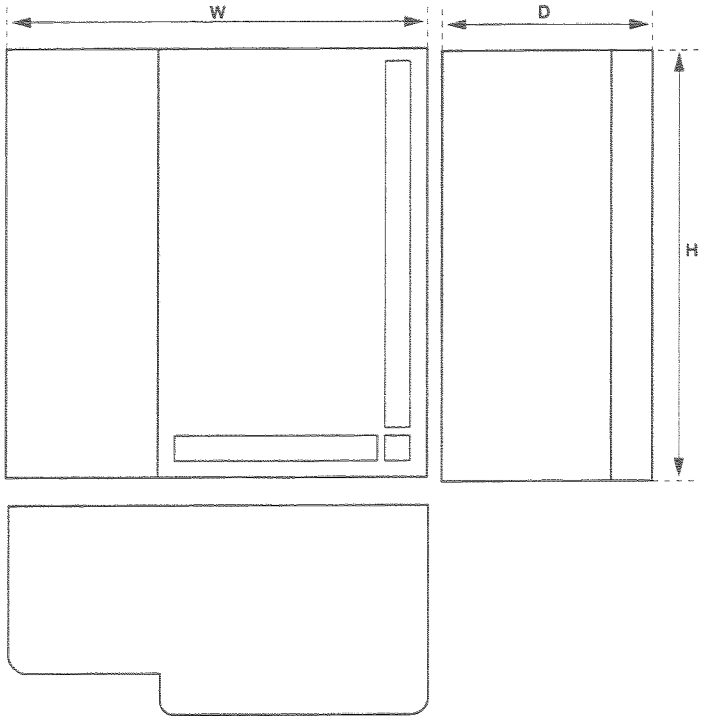
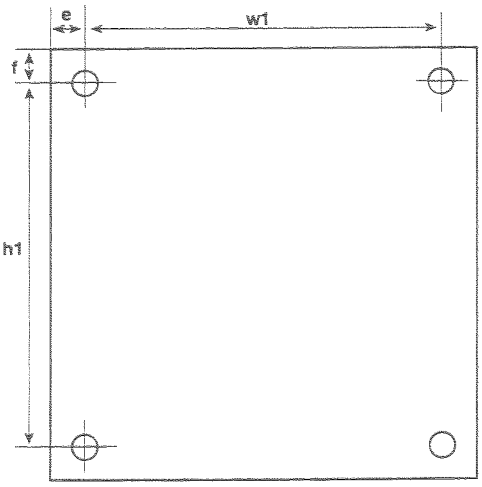


Fig. 7 *MSE-170 to MSE-835. Standard and Current Limit (CL)/ Motor Protection (CL-T) version.*



Hole pattern for screw attachment, MSE-170 to MSE-835. Hole distance (mm).

MSE	e	f
-170 to -450	44	39
-570 to -835	45.5	39

NOTE! The two supplied mounting hooks (see page 7.) is used as upper mounting support (only MSE-170 to MSE-835).

Table 2: MSE-170 to MSE-835 dimensions etc.

MSE model	Class	Connection	Conv./ Fan	Dimension HxWxD (mm)	Hole dist. w1 (mm)	Hole dist. h1 (mm)	Diam./ screw	Weight (kg)
-170, -210, -250	IP 20	Busbars	Fan	447x484x244	400	370	8.5/M8	28
-310	IP 20	Busbars	Fan	532x547x278	460	450	8.5/M8	42
-370, -450	IP 20	Busbars	Fan	532x547x278	460	450	8.5/M8	46
-570	IP 20	Busbars	Fan	687x640x302	550	600	8.5/M8	64
-710	IP 20	Busbars	Fan	687x640x302	550	600	8.5/M8	78
-835	IP 20	Busbars	Fan	687x640x302	550	600	8.5/M8	80

MSE model	Minimum free space (mm):			Connection, terminals or busbars Cu/Al 2)	Tightening torque for bolt (Nm)		
	above 1)	below	at side		Cable	PE-cable	Supply and PE
-170, -210, -250	100	100	0	40x5 (M10)	35	15	0.6
-310	100	100	0	40x8 (M12)	50	15	0.6
-370, -450	100	100	0	40x8 (M12)	50	15	0.6
-570	100	100	0	40x10 (M12)	50	15	0.6
-710	100	100	0	40x10 (M12)	50	15	0.6
-835	100	100	0	40x10 (M12)	50	15	0.6

1) Above: Wall-soft starter or soft starter-soft starter
2) Busbars Al (bolt)

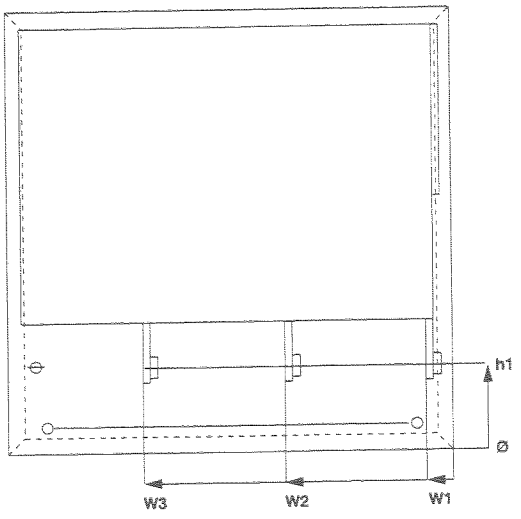


Fig. 8 Busbar distances

Table 3: Busbar distances

MSE model	Dist. h1 (mm)	Dist. w1 (mm)	Dist. w2 (mm)	Dist. w3 (mm)
-170 to -250	79	30	183	336
-310 to -450	104	33	206	379
-570 to -835	129	35	239.5	444

4.2 Connections

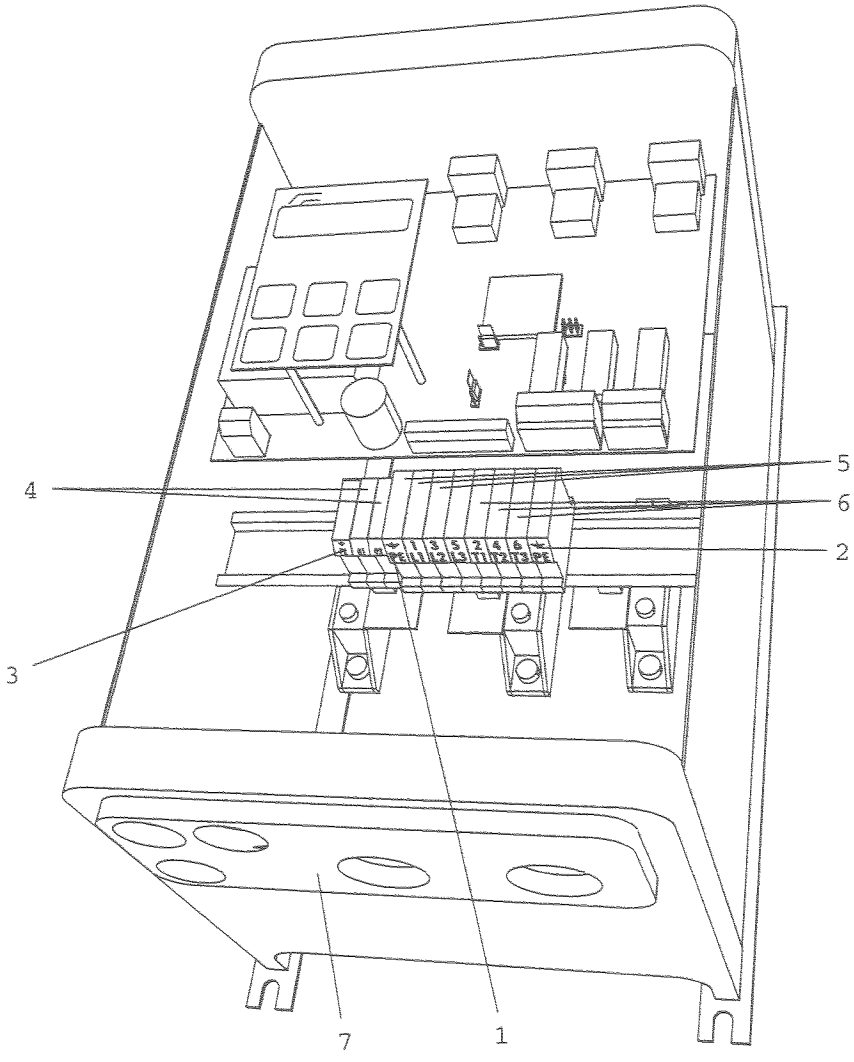


Fig. 9 *Connection of MSE-017, -030 and -045.*

Connection of MSE-017 to MSE-045

Device connections

1. Protective earth, ⏚ (PE), Mains supply
2. Protective earth, ⏚ (PE), Motor
3. Protective earth, ⏚ (PE), Control voltage
4. Control voltage connection **01, 02**
5. Mains supply **L1, L2, L3**
6. Motor power supply **T1, T2, T3**
7. Inlet and outlet for cables, dimensions (mm)

   MSE-017 3x ø 18.6 2x 22.5
   MSE-030 3x ø 18.6 2x 28.5
   MSE-045 3x ø 18.6 2x 37

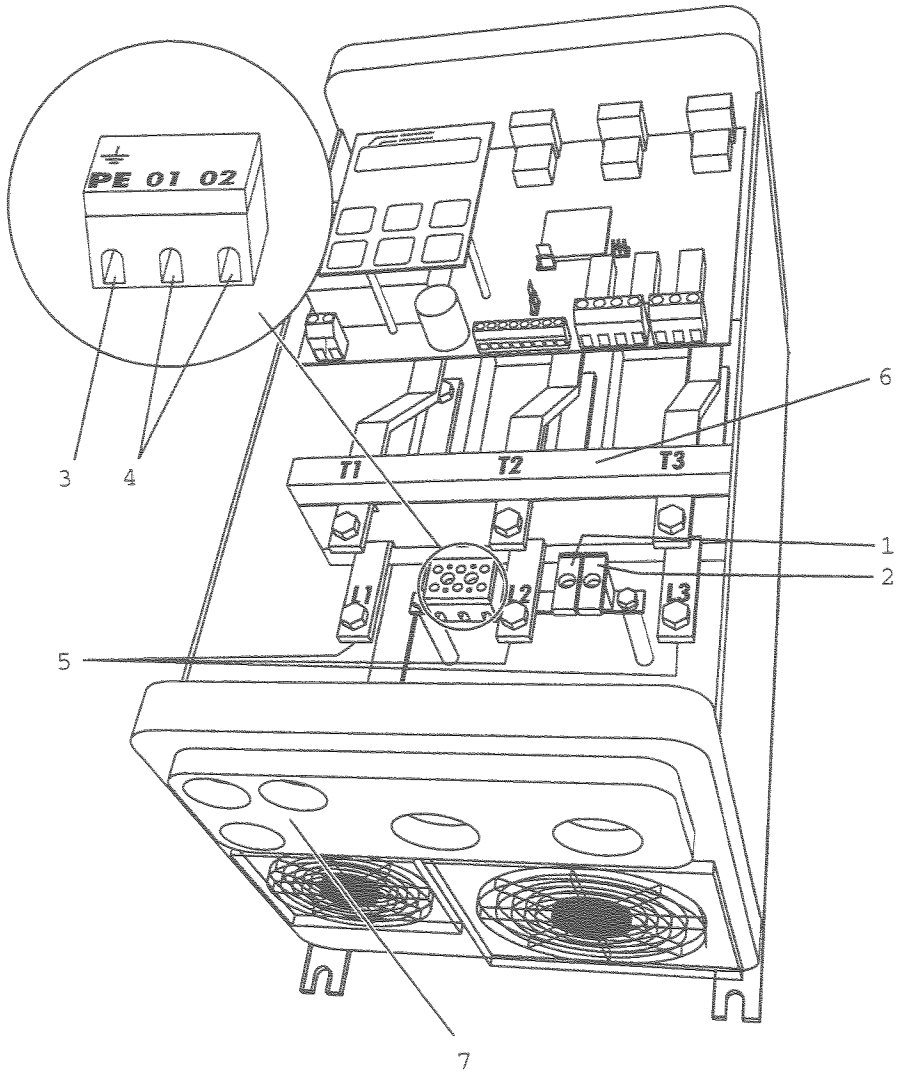


Fig. 10 Connection of MSE-060, -075, -085, -110 and -145.

Connection of MSE-060 to MSE-145

Device connections

1. Protective earth, ⏚ (PE), Mains supply
2. Protective earth, ⏚ (PE), Motor
3. Protective earth, ⏚ (PE), Control voltage
4. Control voltage connection **01, 02**
5. Mains supply **L1, L2, L3**
6. Motor power supply **T1, T2, T3**
7. Inlet and outlet for cables, dimensions (mm)
   MSE-060 to MSE-075 3x ø 18.6 2x 37
   MSE-085 to MSE-145 3x ø 18.6 2x 47

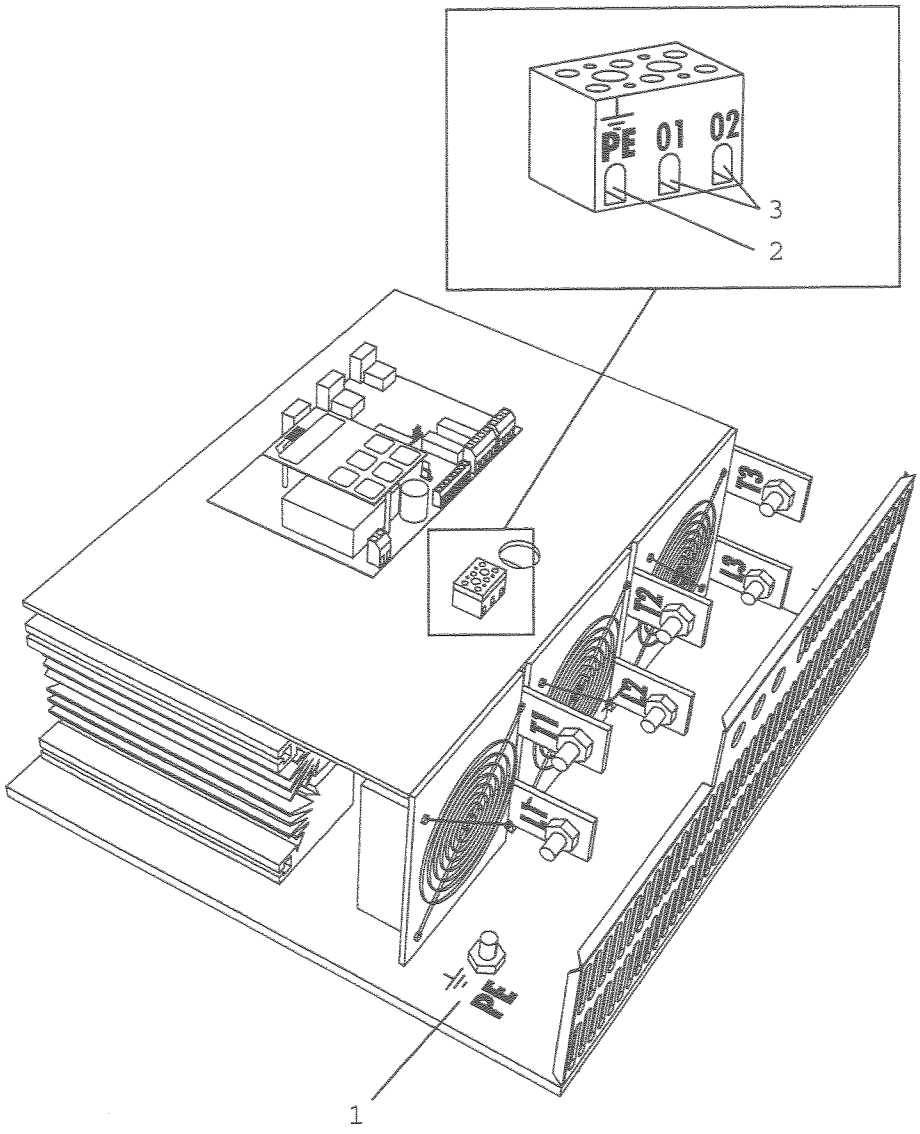


Fig. 11 Connection of MSE-170 to MSE-835.

Connection of MSE-170 to MSE-835

Device connections

1. Protective earth, ⏚ (PE), Mains supply and Motor
2. Protective earth, ⏚ (PE), Control voltage
3. Control voltage connection **01, 02**

Mains supply **L1, L2, L3**

Motor power supply **T1, T2, T3**

Connection and setting on the PCB, control card.

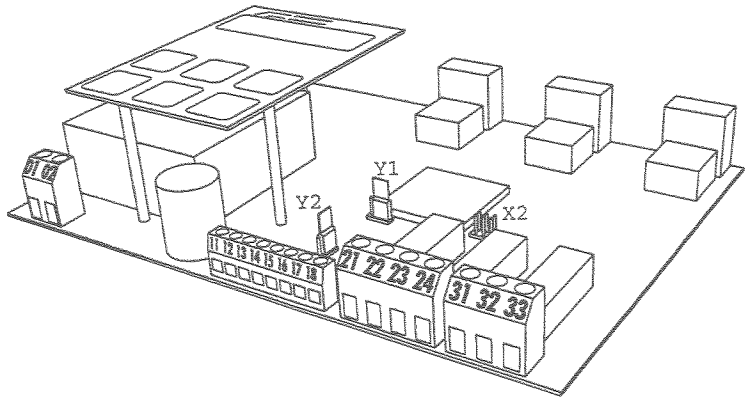


Fig. 12 Connections on the PCB, control card

PCB terminals:

X2 Connection serial interface
Y1 Key board lock,
bridge in the position to the left (1, 2)= locked
bridge in the position to the right (2, 3)= unlocked
Y2 Remote analogue control,
bridge in the upper position (1, 2) = voltage signal
bridge in the lower position (2, 3) = current signal

Terminal	Function	Electrical characteristics
01	Internal connection, supply	200-240 VAC
02		
11 *	Digital inputs for start/stop and reset.	0-3 V –> 0. 8-27 V–> 1. Max. 37 V for 10 sec. Impedance to 0 VDC: 2.2 kΩ.
12 *		
13 *	Supply/control voltage to PCB terminal 11 and 12, 10 kΩ potentiometer, etc.	+12 VDC ±5%. Max. current from +12 VDC: 50mA. Short circuit proof.
14	Remote analogue control, 0-10 V, 2-10 V, 0-20 mA and 4-20 mA.	Impedance to terminal 15 (0 VDC) voltage signal: 100 kΩ, current signal:100 Ω.
15	GND (common)	0 VDC
16	Digital inputs for selection of parameter set.	0-3 V –> 0. 8-27 V–> 1. Max. 37 V for 10 sec. Impedance to 0 VDC: 2.2 kΩ.
17		
18	Supply/control voltage to PCB terminal 16 and 17, 10 kΩ potentiometer, etc.	+12 VDC ±5%. Max. current from +12 VDC = 50mA. Short circuit proof.
21	Programmable relay K1. Factory setting is "Operation" indication by closing terminal 21 - 22.	1-pole closing contact, 250 VAC, 5 A AC1 (100 VDC, 0.5 A).
22		
23	Programmable relay K2. Factory setting is "Full voltage" indication by closing terminal 23-24.	1-pole closing contact, 250 VAC, 5 A AC1 (100 VDC, 0.5 A).
24		
31	Alarm relay K3, closed to 33 at alarm.	1-pole changeover contact, 250 VAC, 5 A AC1 (100 VDC, 0.5 A).
32	Alarm relay K3, opened at alarm.	
33	Alarm relay K3, common terminal.	

* **Start/Stop** and reset (12-13 linked at delivery, this enables start/stop from keyboard. Disconnect the jumper for remote control).

4.3 Standard wiring

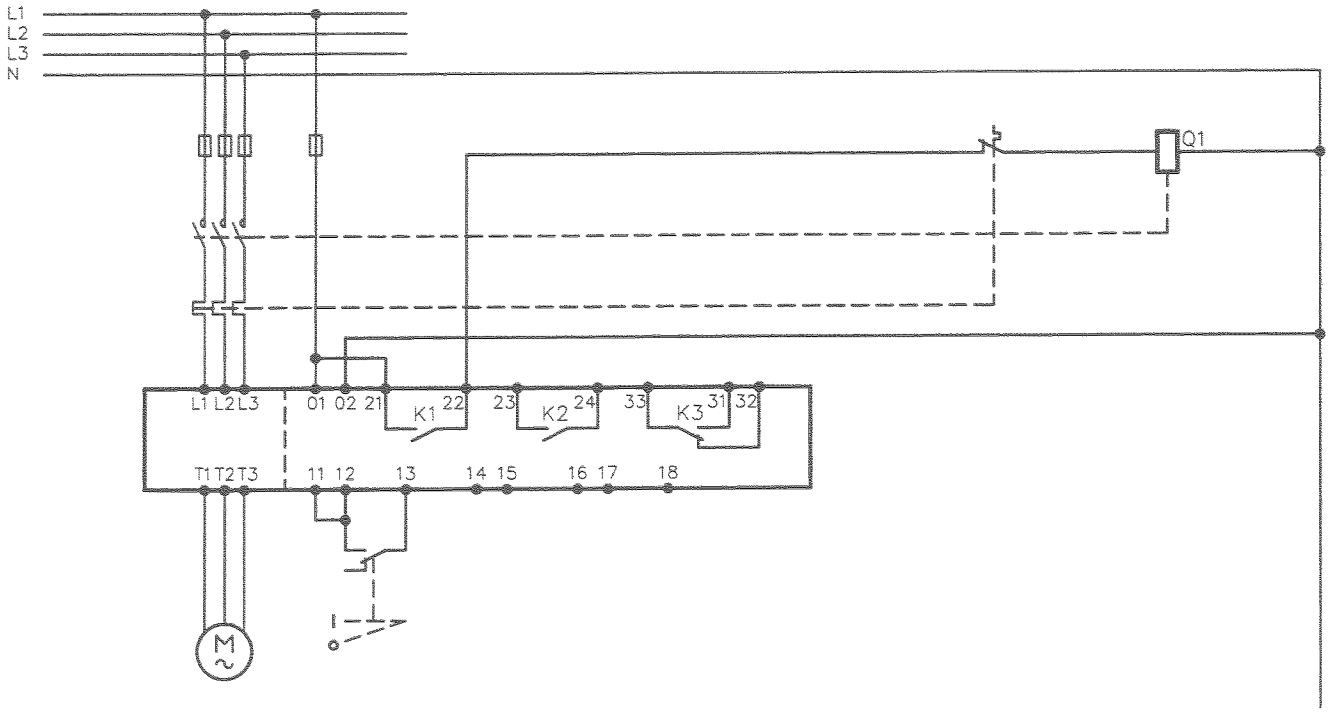


Fig. 13 Wiring circuit, "Standard wiring" (12 76 001)

WARNING! When a pole changing or reversing contactor is used, it is connected between the soft starter output and the motor, see Wiring example on page 21.

The figure above shows the "standard wiring". See **Installation of the soft starter in a cabinet** on page 12 for tightening torque for bolts etc.

1 Connect Protective Earth (PE) to terminal marked ⏚ (PE).

2 Connect the soft starter between the 3-phase mains supply and the motor. On the soft starter the mains side is marked L1, L2 and L3 and the motors-ide with T1, T2 and T3.

3 Connect the motor contactor in front of the soft starter to ensure that the mains and motor can be isolated.

4 Connect the control voltage (normally 230 V) for the control card at terminal 01 and 02.

5 Connect relay K1 (terminals 21 and 22) to the control circuit.

6 Connect PCB terminal 12 and 13 (PCB terminal 11-12 must be linked) to, e.g. a 2-position switch (on/off) or a PLC, etc., to obtain control of soft start/stop.(Terminal12-13mustbelinkedforstart/stopcommandfromkeyboard).

7 Set the two bridges Y1 and Y2, see **PCB terminals:** on page 18.

8 Ensure the installation complies with the appropriate local regulations.

NOTE and WARNING! See next page!

NOTE! If general and local regulations permit, you can do without a motor contactor because it is not necessary for starting and stopping the motor. Always use standard commercial, slow blow fuses, e.g. type gL, to protect the wiring and prevent short circuiting.

To protect the thyristors against short-circuit currents, superfast semiconductor fuses can be used if prefered. The normal guarantee is valid even if superfast semicon-ductor fuses are not used. All signal inputs and outputs are galvanically insulated from the mains supply.

WARNING! Ensure that the front cover is connected to Protective earth ⏚ (PE). This only on model MSE-017 to MSE-145.

4.4 Wiring example

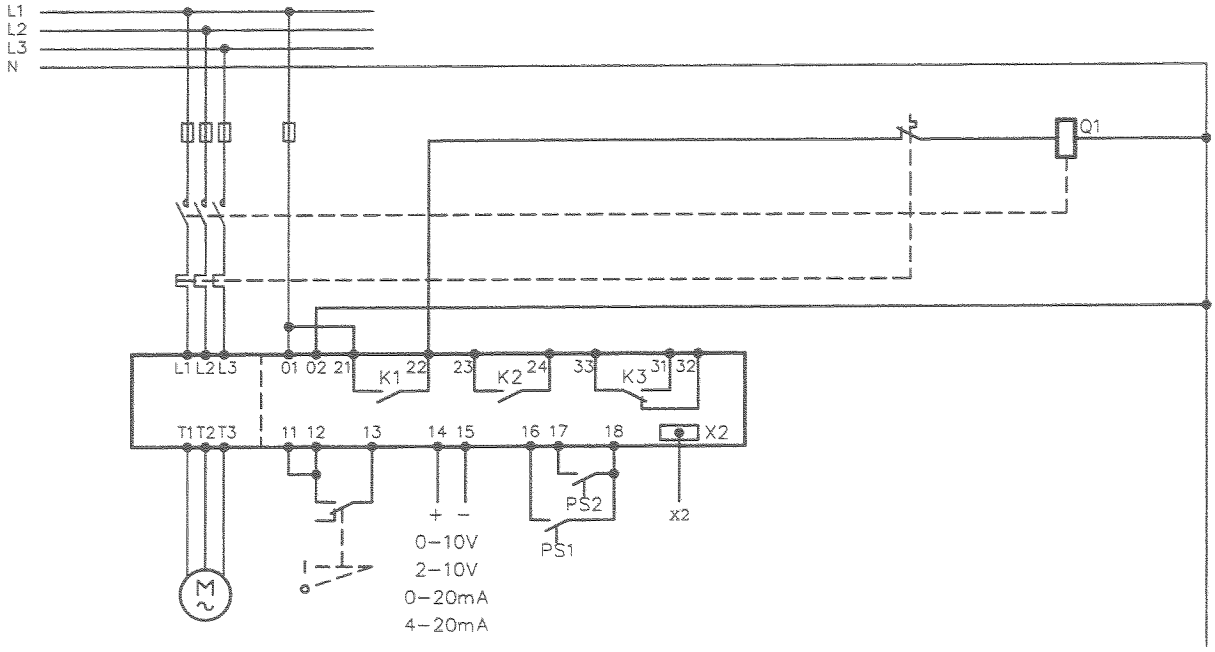


Fig. 14 Analogue control, parameter set and serial interface wiring circuit (12 76 005)

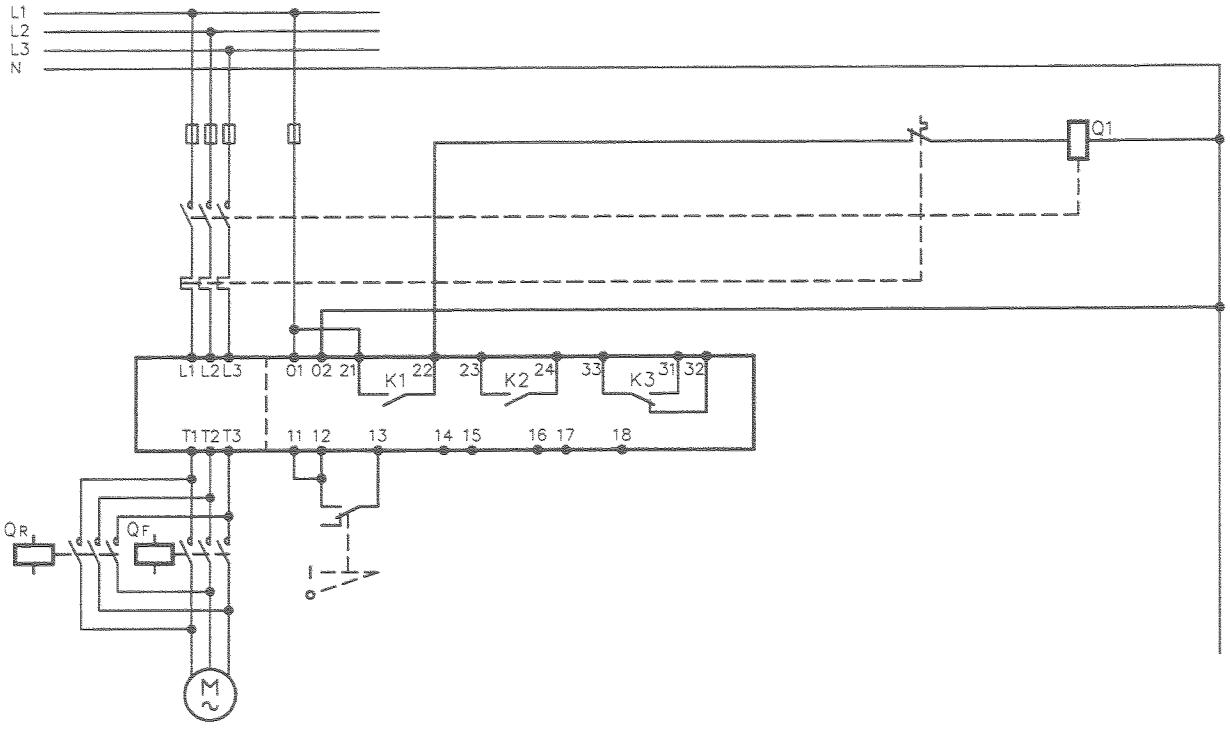


Fig. 15 Forward/reverse wiring circuit (12 76 006)

5. QUICK SET-UP

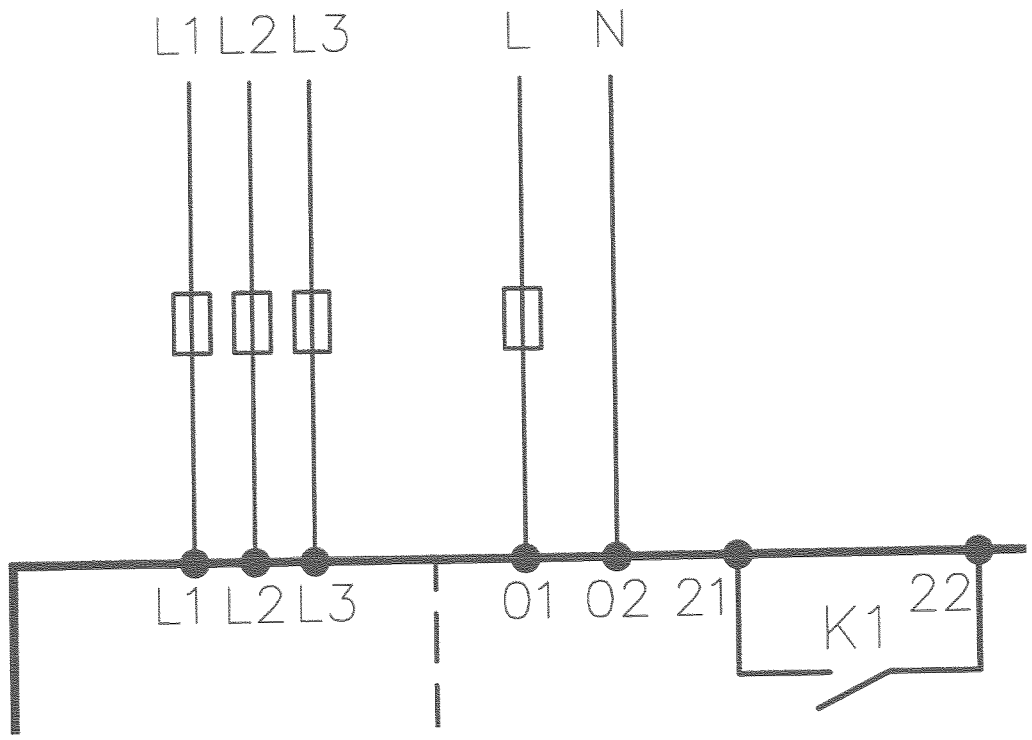


Fig. 16 Minimum wiring without relays and contactors. (12 76 002)

This chapter describes briefly the set-up for simple soft start and soft stop when using the "voltage-ramp" function.

WARNING! Mounting, wiring and setting the device into operation must be carried out properly by trained personnel. Before set-up, make sure that the installation is according to chapter 4. MOUNTING/WIRING and the check list below.

Check list

- Mount the soft starter in accordance with chapter **4. MOUNTING/ WIRING**.
- Consider the power loss at rated current, max. ambient temperature is 40°C (see chapter **9. TECHNICAL DATA**).
- Connect the motorcircuit according to Fig. 13 in chapter **4. MOUNTING/WIRING**.
- Connect the protective earth.
- Connect the control voltage to terminals 01 and 02 (normally 230 V).
- Connect relay K1 (PCB terminals 21 and 22) to the contactor - the soft starter then controls the contactor.
- Connect PCB terminals 11, 12 and 13 to, e.g., a 2-way switch (closing non-return) or a PLC, etc., to obtain control of soft start/soft stop.[1])
- Check that the motor and supply voltage corresponds to values on the soft starter's rating plate.
- The soft starter must be connected in front of a pole changer or a reversing contactor if used.
- Ensure the installation complies with the appropriate local regulations.

1) Terminal 12-13 must be linked for start/stop command from keyboard.

Setting

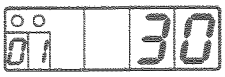
WARNING! Make sure that all safety measures have been taken before switching on the supply.

Switch on the supply (normally 1 x 230 V), all segments in the display and the two LED's will be illuminated for a few seconds. Then the display will show window 01. An illuminated display indicates there is supply voltage on the PCB.

Check that you have mains voltage on the mains contactor or on the thyristors.

The settings are carried out according to following four steps:

1 Estimate the starting-time for the motor/machine.



2 Set the initial voltage in window 01. Normally the factory setting, 30% of U_N, will be satisfactory. Press key "+" to increase the value if necessary, then press key "ENTER ↵ " to confirm the new value. Press key "NEXT →" to go to window 02.

3 Set chosen "ramp up time" at start (1-60 sec.) in window 02. Press key "+" or "-" to change the value. Press key "NEXT →" twice to go to window 04.

4 Set chosen "ramp down time" at stop (2-120 sec.) in window 04. If only soft start is required, set the value to "off".

Starting

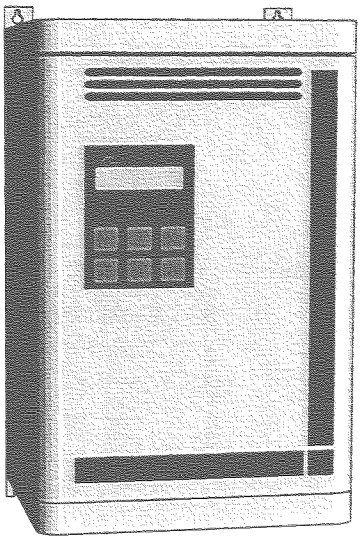
WARNING! Make sure that all safety measures have been taken before starting the motor in order to avoid personal injury.

Start the motor by pressing the "START/STOP" key on the build-in keyboard or through the remote control, PCB terminal 11, 12 and 13. When the start command is given, the mains contactor will be activated by relay K1 (PCB terminal 21 and 22), and the motor then start softly.

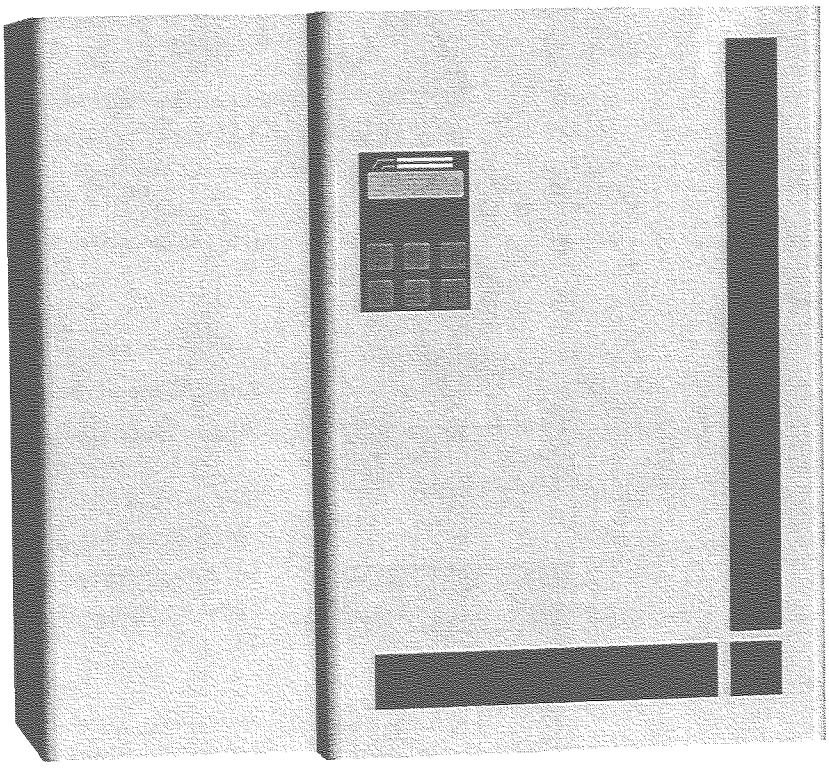
If the initial voltage or the ramp time has to be readjusted, repeat the steps in "Setting" above. When the settings are correct the motor will start slowly and without any snatching movement. The motor will accelerate smoothly to full speed if the correct ramp up time has been set.

NOTE! The rated current must not be exceeded during normal operation. "Real start time" can be longer or shorter than the set values depending on the load conditions during start up. Also the stop time can be longer or shorter than the set stop time.

6. STARTING/OPERATING THE SOFT STARTER



MSE-017 to MSE-145



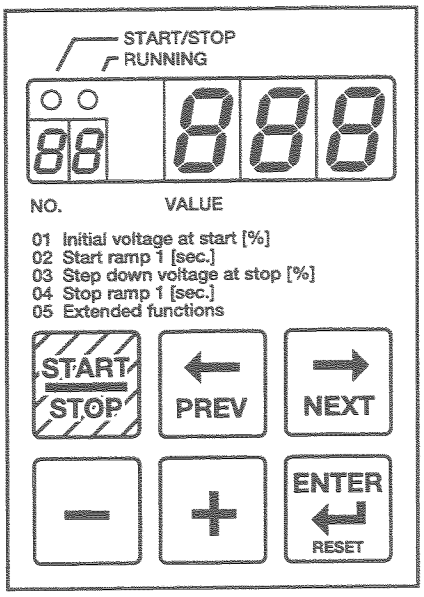
MSE-170 to MSE-835

Fig. 17 *MASTERSTART MSE soft starter models.*

WARNING! Never operate the soft starter with removed front cover.

To obtain the required operation, a number of parameters must be set in the soft starter.

Setting/configuration is done either from the built-in keyboard or by a computer/control system through the serial interface (option). Controlling the motor i.e. start/stop, selection of parameter set, is done either from the keyboard, through the serial interface (option) or through the remote control inputs.



The programming and presentation unit (PPU) is a build-in operator panel with two light emitting diodes, two + three seven-segment LED-displays and a key-board.

The two light emitting diodes indicates start/stop and running motor/machine. When a start command is given either from the PPU, through the serial interface (option) or through the remote control inputs, the start/stop-LED will be illuminated.

At a stop command the start/stop-LED will switch off. When the motor is running, the running-LED is flashing during ramp up and down and is illuminated continuously at full motor voltage.

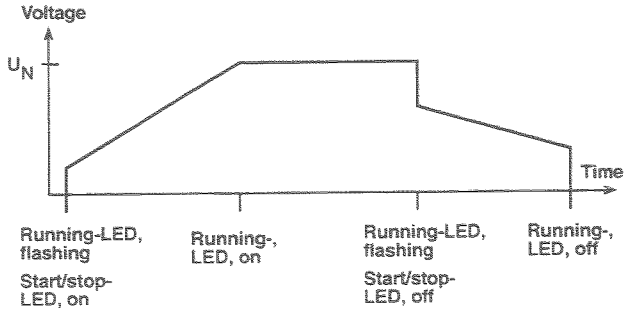
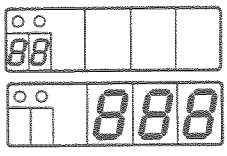


Fig. 18 LED indication at different operation situation.



The two green LED-displays to the left indicates a specific window number.

In each window, (e.g. 01, 02, 03 etc.), is a value, (e.g. "on", "off", 1, 100 etc.), of a parameter chosen.

The value of a parameter is indicated by the three red LED-displays to the right.

The parameters that can be set is e.g. Start/stop ramps, Application "Pump", Current Limit, By-pass, DC-brake etc.

The windows are organised in a simple one level structure with the opportunity to limit the number of windows that are reachable by setting the value in window 05 to "off" (factory setting). With this setting only the basic windows 01, 02, 03, 04 and 05 can be reached.

This to simplify the setting when only voltage start/stop ramps are used.

The Menu structure is shown below.

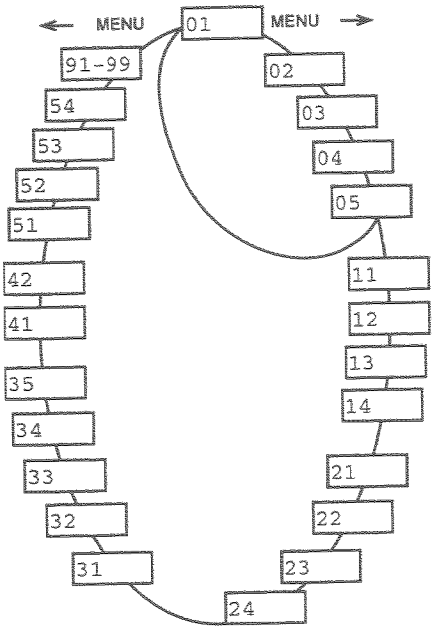


Fig. 19 Menu structure.

The function of the keyboard are based on a few simple rules.

Start/stop motor operation. START STOP

Display previous window. PREV

Display next window. NEXT

Decrease value of setting. −

Increase value of setting. +

Confirm setting just made. Initiate a reset. ENTER RESET

At power up window 01 is shown automatically. Use the "NEXT → " and "PREV ← "keys to move between windows. To scroll through window numbers, press and hold either the "NEXT → " or the "PREV ← " key. The "+" and "–" keys are used to increase respectively decrease the value of setting. The "ENTER ↵ " key conforms the setting just made. The "START/STOP" key is only used to start and stop the motor/machine.

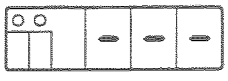
The key board can be locked by a bridge if unauthorised use is to be prohibited. When the keyboard is locked neither setting or controlling can be done e.g. start/stop, but set values can be viewed. The bridge is located on the PCB, see chapter **4.2 Connections**.

The unit has three built-in relays.

- Relay K1 is factory set for controlling the motor contactor, "Operation" function. The relay closes before start-up and is activated by the start/stop-command. Relay K1 can be set to either "Operation" or "Full voltage" function.
- Relay K2 is factory set to "Full voltage" function. Relay K2 can be set to either "Full voltage" or "Operation" function. When DC-brake is chosen the relay K2 is automatically dedicated to control the external DC-brake contactor.
- The alarm relay, K3, is always an alarm relay and activates when a fault occur.

With the "Full voltage" function, the relay that is set to " Full voltage" function (e.g. relay K2"), closes when the starting up ramp is finished and remains closed until the stop ramp starts.
The relay can be used either to:

- Give a signal when the rated voltage is reached.
- Control bypassing of the soft starter.



If an non-possible combination of functions or if e.g. the "START/STOP" key is pressed when the keyboard is locked, the display will view "- - -".
The display will show this for all keys pressed except for "NEXT →" and "PREV ←".

6.1 Description of functions

In the table below you will find all functions/parameters. At delivery your soft starter is programmed according to the column **Factory setting**. These settings are made only as parameter settings and cannot be automatically recalled.

Window number	Function / parameter	Value	Factory setting
01	Initial voltage at start	30 - 90 % of U_N	30
02	Start ramp 1	1 - 60 sec.	10
03	Step down voltage at stop	100–40 % of U_N	100
04	Stop ramp 1	off, 2–120 sec.	off
05	Extended functions	off, on	off
11	Start ramp 2	30–90 % of U_N	60
12	Start ramp 2	off, 1–60 sec.	off
13	Stop ramp 2	100–40 % of U_N	70
14	Stop ramp 2	off, 2–120 sec.	off
21	Current limit, CL	off, 150–500 %	off
22	Application "Pump"	off, on	off
23	Remote analogue control	off, 1, 2	off
24	Full voltage start D.O.L.	off, on	off
31	Torque booster	off, 0.1–2 sec.	off
32	By-pass	off, on	off
33	Power factor control P.F.C.	off, on	off
34	DC-brake	off, 1–10 sec.	off
35	DC-brake	30–100 % of U_N	30
41	Motor protection	off, 50–120	off
42	Scale factor	90–225 % of I_N	x)
51	Programmable relay K1	1, 2	1
52	Programmable relay K2	1, 2, (3)	2
53	Parameter set	0, 1, 2, 3, 4	1
54	Serial interface	off, on	off

x) Depending on size, see chapter **6.15 Motor protection, CL-T version (factory option)**

The functions/parameters are divided in two parts, basic functions and extended functions. The basic functions consist of start/stop ramp, initial voltage at start and step down voltage at stop.

The extended functions are then divided in five groups:

- Dual ramp start and stop, windows 11–14
- Main functions for motor control, windows 21–24
- Additional functions for motor control, windows 31–35
- Motor protection, windows 41–42
- External control function, windows 51–54

NOTE! The four main functions for motor control, windows 21–24, can only be selected one at a time.

Function and combination matrix

In the table below you will find all possible functions and combination of functions you can do with your soft starter.

1 Select function in the horizontal "Function" column. Only one function can be selected in this column, except that Ramp Start and Ramp Stop can be used together.

2 In the vertical column "Additional ..." you will find all possible function that can be used together with your selected function.

Function and combination matrix

Function / Additional function possible	Dual Ramp Start and Stop	Torque Booster at start	Step down voltage at stop	DC-brake	Power Factor Control	Programmable relay	Parameter set	Motor Protection	By-pass	Serial interface
Ramp Start	X	X	X	X	X	X	X	X	X	X
Ramp Stop	X	X	X	X	X	X	X	X	X	X
Current Limit start	1		X	X	X	X	X	X	X	X
Application "Pump"	X	X	X	X	X	X	X	X	X	X
Remote analogue control				X	X	X	X	X	X	X
Full voltage start						X	X	X	X	X
By-pass	X	X	X	X		X	X		–	X

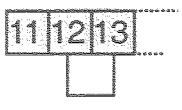
1) Only Dual Ramp at stop

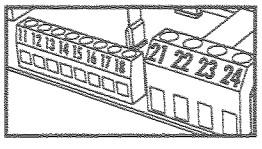
Combination possible = X

6.2 Start/stop/reset

Start/stop of the motor and reset of alarm is done either from the keyboard, through the remote control inputs or through the serial interface (option).

To start and stop from the keyboard, the "START/STOP" key is used.



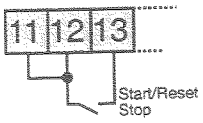


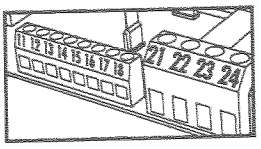
PCB terminals 12 and 13 must be linked to be able to use the "START/STOP" key.

To reset from the keyboard, the "ENTER ↵ /RESET" key is used. A reset can be given both when the motor is running and when the motor is stopped. A reset by the keyboard will not start or stop the motor.

The remote control inputs start/stop/reset (PCB terminals 11, 12 and 13) can be connected for 2-wire or 3-wire control. (PCB terminals 12-13 linked at delivery, this enables start/stop from keyboard. Disconnect the jumper for remote control.

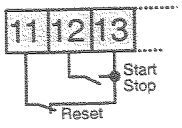
2-wire start/stop with automatic reset at start.

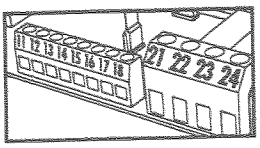




Closing PCB terminals 12 and 13 will give a start command. Opening the terminals will give a stop. If PCB terminals 12 and 13 is closed at power up a start command is given (automatic start at power up). When a start command is given there will automatically be a reset.

2-wire start/stop with separate reset

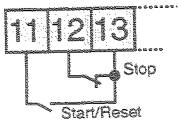


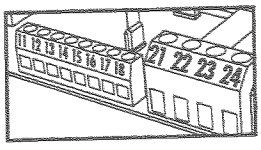


Closing PCB terminals 12 and 13 will give a start and opening the terminals will give a stop. If PCB terminals 12 and 13 are closed at power up a start command is given (automatic start at power up). When PCB terminals 11 and 13 are opened and closed again a reset is given.

A reset can be given both when the motor is running and stopped and doesn't affect the start/stop.

3-wire start/stop with automatic reset at start.





PCB terminal 12 and 13 are normally closed and PCB terminal 11 and 13 are normally open. A start command is given by momentarily closing PCB terminal 11 and 13. To stop, PCB terminal 12 and 13 are momentarily opened.

When a start command is given there will automatically be a reset. There will not be an automatic start at power up.

6.3 Ramp times start/stop, step down voltage at stop

Setting

WARNING! Make sure that all safety measures have been taken before switching on the supply.

Switch on the supply (normally 1 x 230 V), all segments in the display will light up for a few seconds. Then the display will show window 01. An illuminated display indicates there is supply voltage on the PCB.

Check that you have mains voltage on the mains contactor or on the thyristors. When setting the ramp times for starting and stopping, initial voltage at start and step down voltage at stop, proceed as follow.:

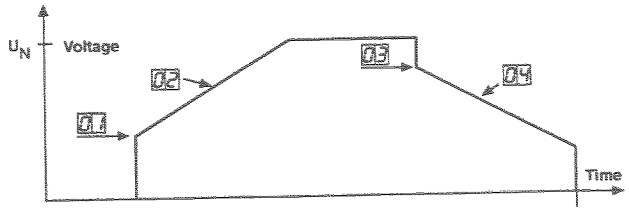
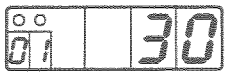
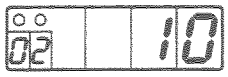


Fig. 20 *Window numbers for start/stop ramps, initial voltage at start and step down voltage at stop.*



1 Determine the starting time for the motor/machine.

2 Set the initial voltage in window 01. Normally the factory setting, 30% of U_N, is a suitable choice.
Press key "+" to increase the value if wanted, then press key "ENTER ↵ "to confirm the new value. Press key "NEXT →"to go to window 02.



3 Set chosen "ramp up time" at start (1-60 sec.) in window 02. Press key "+" or "-" to change the value.

4 Set chosen "ramp down time" at stop (off, 2-120 sec.) in window 04. If only soft start is required, set the parameter to "off".

The time the start ramp slope last can be calculated from the formula below:

$$Tr_{start\ ramp} = \frac{100 - U_{window\ 01}}{70} \times T_{window\ 02}$$

Example:
If the initial voltage, window 01, is set to 30% of U_N. Start ramp 1 in window 02 is set to 10 sec., the start ramp slope last for:

$$Tr_{start\ ramp\ 1} = \frac{100 - 30}{70} \times 10 = 10 \text{ sec.}$$

The ramp slope time is equal to the time set in window 02 when the initial voltage at start, set in window 01 is 30% of U_N. If the initial voltage at start is higher than 30% of U_N, the ramp slope time is shorter than the time set in window 02.

The stop ramp last for the time set in window 04 when initial voltage at stop is 100% of U_N (window 03).

Step down voltage at stop.

Step down voltage at stop can in some application be used to stop quickly but still smoothly. The step down voltage at stop (100-40% of U_N) is set in window 03.

The time the stop ramp slope last can be calculated from the formula below:

$$Tr_{stop\ ramp} = \frac{U_{window\ 03} - 30}{70} \times T_{window\ 04}$$

Example:
If the step down voltage at stop, window 03, is set to 80% of U_N. Stop ramp 1 in window 04 is set to 20 sec., the stop ramp slope last for:

$$Tr_{stop\ ramp\ 1} = \frac{80 - 30}{70} \times 20 \approx 14.3 \text{ sec.}$$

Dual ramp at start and stop.

To achieve even smoother ramps at start and or stop, a dual ramp can be used.

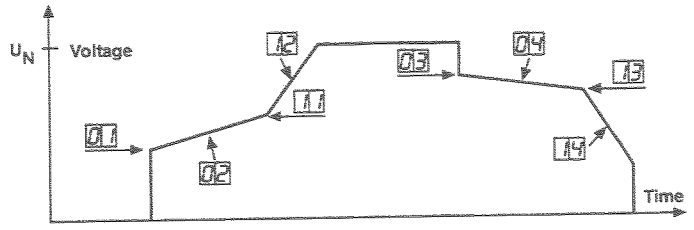


Fig. 21 *Window numbers for dual ramp at start/stop, initial voltage at start and step down-voltage at stop.*

The time ramp slope can be calculated from the formulas below:

$$Tr_{\text{start ramp 1}} = \frac{U_{\text{window 11}} - U_{\text{window 01}}}{70} \times T_{\text{window 02}}$$

$$Tr_{\text{start ramp 2}} = \frac{100 - U_{\text{window 11}}}{70} \times T_{\text{window 12}}$$

$$Tr_{\text{stop ramp 1}} = \frac{U_{\text{window 03}} - U_{\text{window 13}}}{70} \times T_{\text{window 04}}$$

$$Tr_{\text{stop ramp 2}} = \frac{U_{\text{window 13}} - 30}{70} \times T_{\text{window 14}}$$

Example:
If the initial voltage, window 01, is set to 30% of U_N. Start ramp 1 in window 02 is set to 10 sec. Start voltage for start ramp 2, window 11, is set to 60% of U_N. Start ramp 2 in window 12 is set to 5 sec., the start ramp slope last for:

$$Tr_{\text{start ramp 1}} = \frac{60 - 30}{70} \times 10 \approx 4.3 \text{ sec.}$$

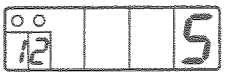
$$Tr_{\text{start ramp 2}} = \frac{100 - 60}{70} \times 5 \approx 2.9 \text{ sec.}$$

The total start ramp time is 4.3 + 2.9 = 7.2 sec.
The total stop ramp time is calculated in the same way by adding "$Tr_{\text{stop ramp 1}}$" with "$Tr_{\text{stop ramp 2}}$".

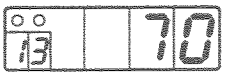
The settings are carried out by beginning with the settings in windows 01, 02, 03 and 04 above and proceed with the following steps:

1 Set window 05 to "on" to be able to reach the extended functions.

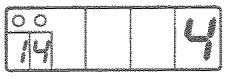
2 Set the start voltage (30-90 %) for start ramp 2 in window 11. The start voltage for start ramp 2 is always higher than the initial voltage at start (window 01)



3 Set the chosen start ramp 2 (off, 1-60 sec.) in window 12.



4 Set the start voltage (100-40 % of U_N) for stop ramp 2 in window 13. The start voltage for stop ramp 2 is always lower than the step down voltage at stop (window 03).



5 Set the chosen stop ramp 2 (off, 2-120 sec.) in window 14.

Starting

WARNING! Make sure that all safety measures have been taken before starting the motor in order to avoid personal injury.

Start the motor by pressing the "START/STOP" key on the built-in keyboard or through the remote control, PCB terminal 11, 12 and 13 (remove the link, PCB terminal 12 -13). When the start command is given, the mains contactor will be activated by relay K1 (PCB terminal 21 and 22), and the motor will then start.

If the voltage levels or the ramp times have to be readjusted, repeat the steps in "Setting". When the settings are correct the motor will start slowly and without any snatching movement. The motor will accelerate smoothly (built-in delay 0.1 sec.) to full speed if the correct ramp up time has been set.

NOTE! The rated current must not be exceeded during normal operation. "Real start time" can be longer or shorter than the set values depending on the load conditions during start up. Also the stop time can be longer or shorter than the set stop time.

6.4 Application "Pump"

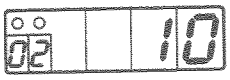
This function is mainly intended to minimise hydraulic shocks to pipelines. Six parameters are automatically set by the microprocessor. Only the start and the stop time must be set.

The function is a combination of the dual ramp start and stop, the initial voltage at start and the step down voltage at stop. It is possible to re-set one or more of the values for further tuning.

The settings are carried out according to following steps.

1 Determine the starting and stopping time for the motor/pump.

2 Set chosen "ramp up time" at start (1-60 sec.) in window 02.



3 Set chosen "ramp down time" at stop (off, 2-120 sec.) in window 04.

4 Set window 05 to "on" to be able to reach the extended functions.

5 The Application "Pump" function is set by setting the parameter in window 22 to "on".

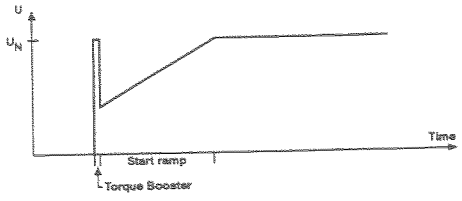
It is possible to re-set one or more of the six values that are set automatically in windows 01, 03, 11, 12, 13 and 14 for further tuning.

NOTE! The values in windows 02 and 04 must be set before the value in window 42 is set to "on". If the value in window 42 is set to "off", the six parameters in windows 01, 03, 11, 12, 13 and 14 are automatically set to there factory settings, see chapter 6.1.

6.5 Torque booster

The Torque Booster enables maximum torque to be obtained by providing a full voltage output during 0.1 - 2 s at start. This enables a soft start of the motor even if the break away torque is high at start. For example in crushing mill applications etc.

When the Torque Booster function has finished, starting continues according to the start ramp. This function can only be used together with Ramp start or the Dual ramp start-function.



The principles of the Torque Booster when starting the motor.

Set chosen time for the Torque booster (off, 0.1 - 2 sec.) in window 31. Make sure window 05 is set to "on" to be able to reach window 31. Re-set the value for further tuning if necessary.

NOTE! Check whether the motor can accelerate the load with "Torque Booster", without any harmful mechanical stress.

6.6 By-pass

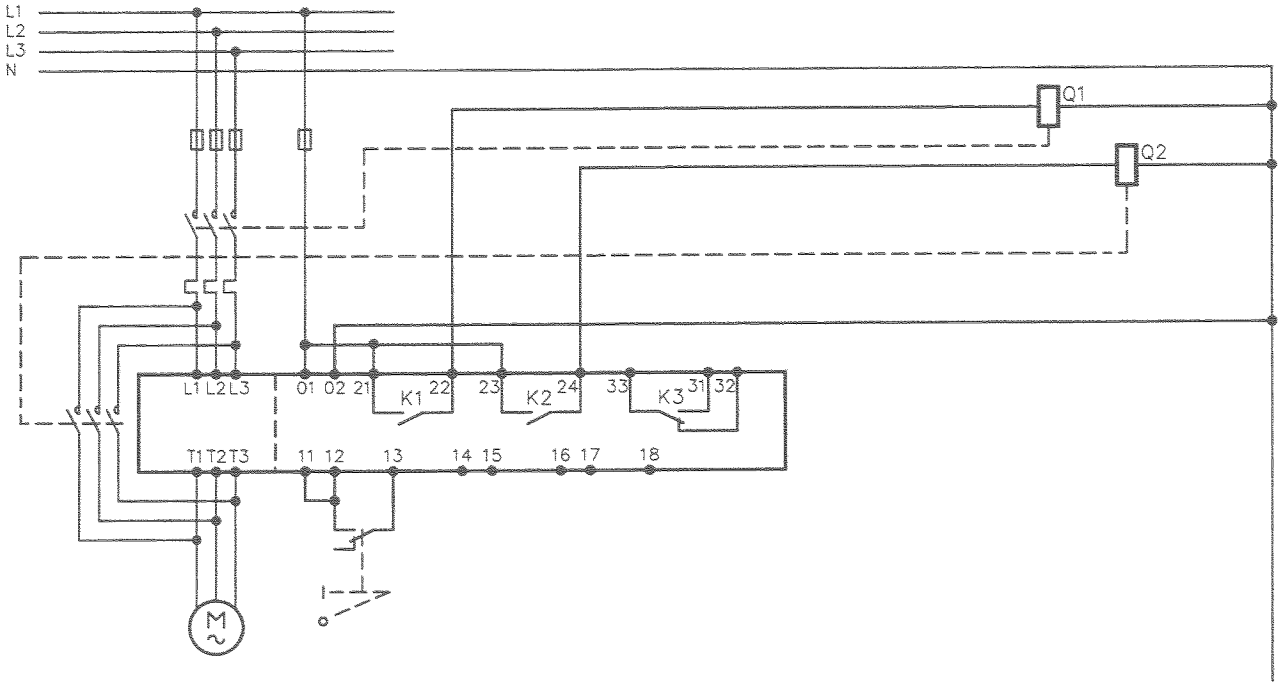
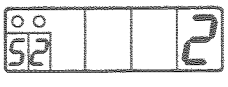


Fig. 22 *By-pass contactor can be used to shunt the motor current during nominal speed. (12 76 003)*

In cases of high ambient temperatures or other reason it may sometimes be necessary to use a by-pass contactor to minimize the power loss at nominal speed (see Technical Data). By using the built-in Full Voltage Relay function an external contactor can be used to By-pass the soft starter when operating at nominal speed.

By-pass contactor can also be used if soft stop is required. Normally a By-pass contactor is not necessary as the device is designed for continuous running conditions. During By-pass operation, the alarms for phase failure and thyristor fault (F1) are eliminated. In case of a CL-T version the Motor Protection will not function when the soft starter is by-passed.

The By-pass function is set by setting the parameter in window 32 to "on". The parameter in window 05, extended function, must first be set to "on".



Check that the parameter in window 52 is set to "2" (Full Voltage Relay function for relay K2).

6.7 DC-brake

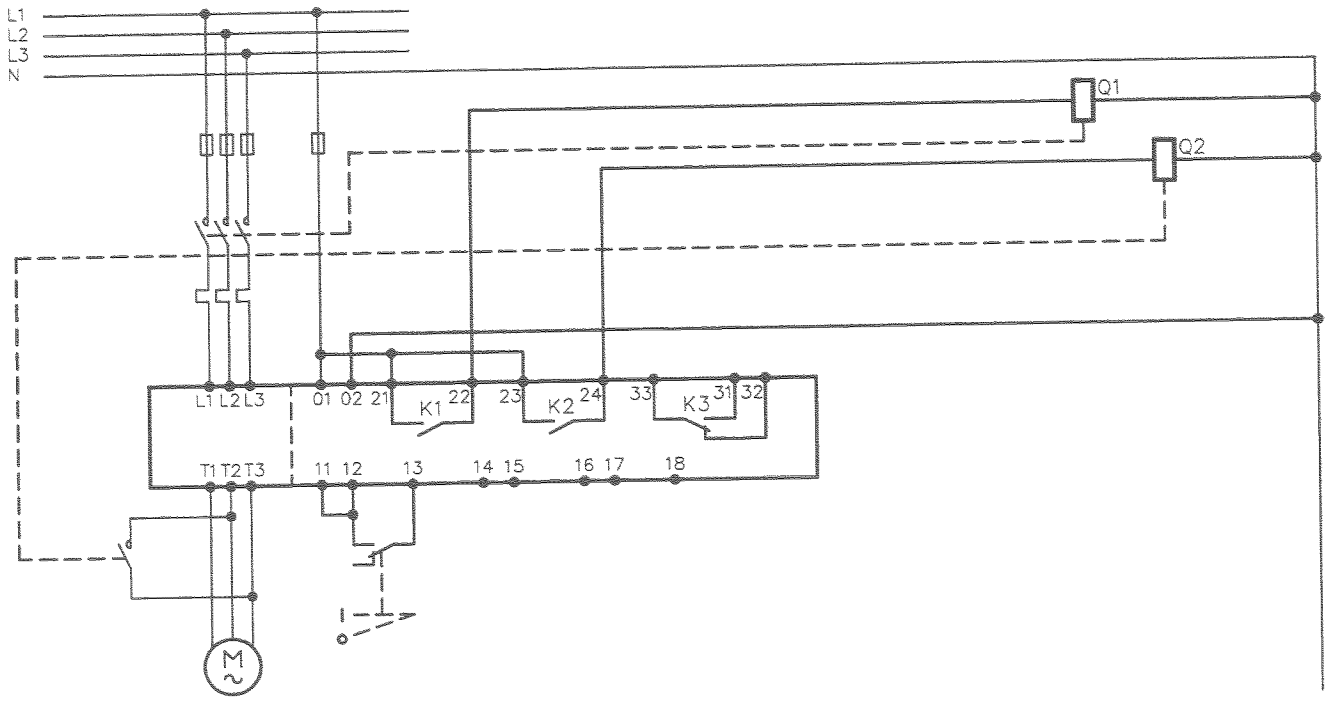


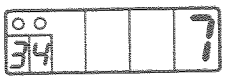
Fig. 23 DC-brake for fast stop of high inertia machines. (12 76 004)

In some applications the stop ramp is not enough, especially if fast braking of high inertia machines is required, i.e. flywheel applications. If the built-in DC-brake function then is chosen the relay K2 will be dedicated to control an external DC-brake contactor. This function can be combined with the ramp stop, but if the ramp time stop is "0" the DC-brake will work when the stop command is given.

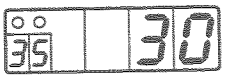
Both time (1–10 s) and voltage (30–100 % of U_N) can be set, this so that the braking stops when the motor has reached standstill. For very high inertia loads, at the end of the max. 10 s the machine freewheels to a standstill.

NOTE! When the DC-brake function is chosen, the time in window 34 is set to 1–10 sec., the relay K2 is dedicated to control the external DC-brake contactor.

Change the factory setting in window 34 from "off" to chosen time (1-10 sec.) by pressing key "+". The parameter in window 05, extended function, must first be set to "on".



Set the voltage (30-100%) for the DC-Brake function to a suitable value in window 35.



WARNING! The thyristors will be short circuit if the DC-brake function is not chosen in window 34 when the external DC-brake contactor is connected. The thyristors will also be short circuit if the external DC-brake contactor is wrongly connected between T1-T2 or T1-T3 instead of correctly connected between T2-T3, see figure above.

6.8 Programmable relay K1 and K2

The soft starter has three built-in auxiliary relays to signal "Operation", "Full voltage" and "Alarm". The alarm relay, K3 (change over contacts), is always used as an alarm relay . The other two relays, K1 and K2 (closing contacts), are programmable.

They can be set to either "Operation" indication or "Full voltage" indication. If DC-brake is chosen the relay K2 will be dedicated to this function.

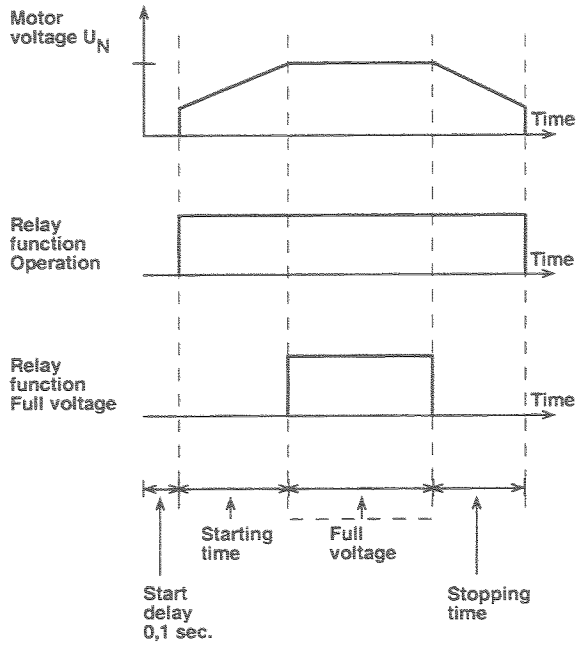
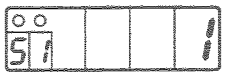
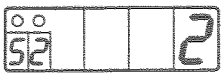


Fig. 24 Start/stop sequence and relay function "Operation" and "Full voltage".

The indication for relay K1 is set in window 51 and the indication for relay K2 is set in window 52. Value "1" indicates "Operation" and "2" indicates "Full voltage".



Set chosen relay indication for relay K1 in window 51, factory setting is "1" (Operation). The value in window 05, extended function, must first be set to "on".



Set chosen relay indication for relay K2 in window 52, factory setting is "2" (Full voltage).

NOTE! When the DC-brake function is chosen, the time in window 34 is set to 1-10 sec., the relay K2 is dedicated to control the external DC-brake contactor. The parameter in window 52 is automatically set to "3" to indicate that relay K2 is set to control the external DC-brake contactor.

6.9 Parameter set

Parameter set, an important function which can be handy when using one soft starter to switch in and start different motors, or working under variable load conditions. For example; starting and stopping conveyor belts with different weight on the goods from time to time.

Four sets of parameters can be controlled either from the keyboard, the remote control inputs or the serial interface (option). Up to 18 different parameters can be set for each Parameter set.

Window numbers for the parameters that can be set in each parameter set:
01, 02, 03, 04, 05
11, 12, 13, 14
21, 22, 23, 24
31, 32, 33, 34, 35

Set chosen Parameter set (0-4) in window 53, factory setting is "1".

Set the parameter in window 53 to"0" for remote control operation.
For keyboard operation, choose selected Parameter set directly in window 53.
Set the parameter to "1" to select Parameter set 1, "2" to select Parameter set 2
.....

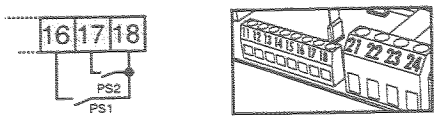


Fig. 25 Connection of remote control inputs.

Selecting a parameter set using the remote control inputs.

Parameter set	PS1 (16–18)	PS2 (17–18)
1	Open	Open
2	Closed	Open
3	Open	Closed
4	Closed	Closed

6.10 Operation with Remote Analogue Control

Soft starting and soft stopping can also be controlled via the Remote Analogue Control (0-10 V, 2-10 V, 0-20 mA and 4-20 mA). This control makes it possible to connect optional ramp generators or regulators.

When the soft starter has been given the start command, the motor voltage is regulated through the remote analogue input.

WARNING! The remote analogue control may not be used for continuous speed regulation of standard motors. With this type of operation the increase in the temperature of the motor must be taken into consideration.

To install the Remote analogue control, proceed as follows:

1 Connect the ramp generator or regulator to terminal 14 (+) and 15 (–).

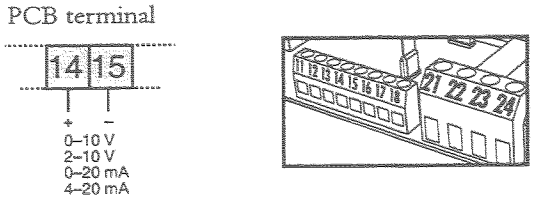


Fig. 26 Wiring for Remote analogue control.

2 Set bridge Y2 on the PCB control card to voltage or current control signal position, see also chapter **4.2 Connections**.

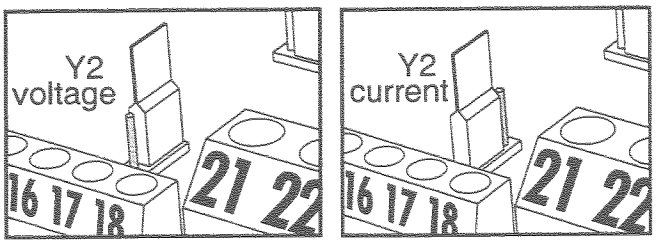
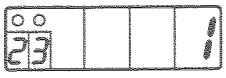


Fig. 27 Setting for Remote voltage or current analogue control.



3 Set the parameter in window 23 to "1" for 0-10V/0-20mA control signal or to "2" for 2-10V/4-20mA control signal. If Remote analogue control is not requested, set the parameter in window 23 to "off".

6.11 Full voltage start, D.O.L.

The motor can be accelerated as if it was connected directly to the mains. For this type of operation:

1 Check whether the motor can accelerate the required load (D.O.L.-start, Direct On Line start).

2 The function is set by setting the value in window 24 to "on". The value in windows 21, 22 and 23 must be "off".

3 Start and stop with terminals 11, 12 and 13 or through the "START/STOP" key on the keyboard.

6.12 Power Factor Control

During operation, the microprocessor continuously monitors the load on the motor. Particularly when idling or when only partially loaded, it is sometimes desirable to improve the power factor. If Power factor control (PFC) is selected, the soft starter reduces the motor voltage when the load is lower. Power consumption is reduced and the degree of efficiency improved.

Choose PFC by setting the parameter in window 33 to "on".

6.13 Control via serial interface (option)

Observe the operating instruction supplied with the option.

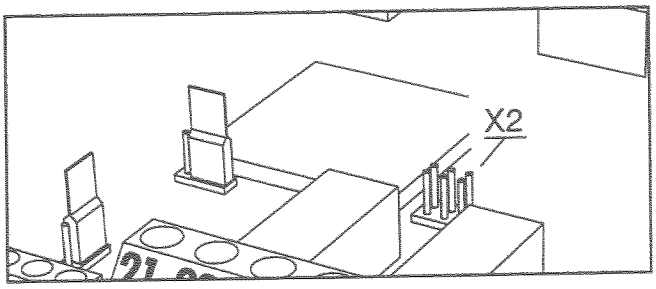
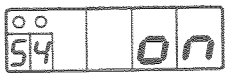


Fig. 28 Wiring for control via serial interface.

This function is selected by setting the value in window 54 to "on".



6.14 Current limit function, CL-version (factory option)

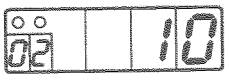
NOTE! Current Limit function is a factory option, make sure that the MASTER START MSE is a CL-version before attempting adjustment.

The Current Limit function is used to limit the current drawn when starting (150-500% of I_N). This means that current limit is only achieved during set start-up time.

The settings are carried out in following three steps:

1 Estimate the starting-time for the motor/machine.

2 Set chosen "Start time" (1-60 sec.) in window 02. Press key "+" and/or "-" to change the value if required, then press key "ENTER ↵ "to confirm the new value.



3 Set the current limit to a suitable value e.g. 300% of I_N in window 21.
Make sure that the value in window 05 is "on".

NOTE! Even though the current limit can be set as low as 150% of the nominal current value, this minimum value cannot be used generally. Consideration must be given to the starting torque and the motor before setting the appropriate current limit.
"Real start time" can be longer or shorter than the set values depending on the load conditions.

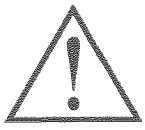
If the starting time is exceeded and the soft starter is still operating at current limit level:

- The display will show "F4".
- The alarm relay, K3, will trip. The relay can be used to interrupt operation e.g. opening the control circuit. If the alarm relay, K3, is not used to interrupt operation the soft starter will allow the motor to take the current it needs to reach full speed.

6.15 Motor protection, CL-T version (factory option)

In many cases it is convenient to have a complete starter. MASTERSTART MSE soft starter can then be delivered with a built-in motor protection function. This means that external motor protection relay can be excluded. The built-in microprocessor continuously calculates the motor temperature based on a thermal model of the motor.

Both slight overload for long time and several over-loads of short duration will result in overload alarm and trip. The overload alarm will also be indicated on the display (F2). For correct function of this factory option; the connected motor must be at least half the size of the soft starter (50-120 % of I_N, MSE).



WARNING! During By-pass operation, the motor protection is not activated, because the current to the motor doesn't flow through the soft starter.
If the control voltage is disconnected (terminals 01 and 02), the soft starter will lose the calculated motor temperature value. When the control voltage is connected again, the soft starter starts to calculate the motor temperature assuming there is a cool motor start.
This means that the motor can be overheated if the control voltage is switched off and on.

The settings are carried out according to following two steps:

1 Calculate the rated current of the motor in % of the nominal current of the soft starter,

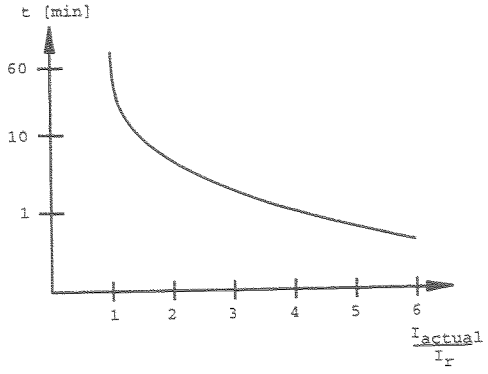
$$\text{e.g.}\ \frac{\text{15 A (rated motor current)}}{\text{17A (MSE-017)}} \times 100\% = 88\%$$

2 Set the calculated value, e.g. 88%, in window 41. Press key "ENTER ↵" to confirm the value.

Trip time at different overload conditions

Actual current/Ir	Trip time
<1.0	Unlimited
1.05	36 min.
1.1	26 min.
1.4	11 min.

Trip time (t) = $-\tau \cdot \ln (1-(I_r/I)^2)$



Trip time vs I_{actual}/I_r characteristics.

The time constant, τ, is set to 15 minutes. I_r is the rated motor current and I is the actual current. E.g. trip time for a motor overloaded 1.4 times.

$$t = -15 \text{ min} \cdot \ln\left[1-\left(\frac{15}{15 \cdot 1,4}\right)^2\right] = 11 \text{ min.}$$

Scale factor

WARNING! The scale factor (90 - 255% of I_N) in window 42 is factory set and should not under any circumstances be changed.

The value of the scale factor depends on the size of the soft starter according to the table below.

Size of MSE	Scale factor
-017	118
-030	100
-045	111
-060	100
-075	107
-085	118
-110	109
-145	103
-170	118
-210	119
-250	100
-310	97
-370	108
-450	111
-570	105
-710	113
-835	96

6.16 Alarm functions, alarm list

The soft starter is fitted with a monitoring system which stops the operation at;

- Over temperature, thyristors
- Motor overload (if the Motor protection function is in operation, CL-T version only)

The alarm relay, K3, will trip at alarm. The relay can be used to interrupt operation e.g. by opening the control circuit at e.g. alarm;

- Thyristor fault/phase failure
- Full speed not reached at set current limit and start time (if the Current limit function is in operation, Cl and CL-T version only)

An alarm is indicated by flashing red figures on the display. The window indication (the green figures) is off.

If the motor is stopped the "running" LED is off, if the motor is running the LED is illuminated. The "start/stop" LED can still be illuminated if a running command has been given.

By pushing the "START/STOP" key the alarm indication will disappear and the command will take action if the alarm is gone, if the cause for the alarm is still there the indication will remain.

If the "ENTER/RESET" key is pressed a reset will take place, if the cause of the alarm is gone and then normal window indication will appear.

Display indication	Protective function	Resetting the alarm	Restart
F1	Thyristor fault/phase failure	Automatic	No stop command is given
F2 (CL-T version)	Motor protection, overload	Cool down the motor and reset	Reset and start
F3	Over temperature thyristors	Cool down the soft starter and reset	Reset and start
F4 (CL and CL-T Version)	Full speed not reached at set current limit and start time	Reset	No stop command is given

Alarm list

The alarm list is generated automatically. It shows the latest nine old alarms (F1-F4). The alarm list can be usefull when tracing a failure in the soft starter or its environment. Press key "NEXT →"or key "PREV ←"to reach the alarm list, window 91 - 99. The alarm list is found between window 54 and 01 in the menu structure. One can go through the alarm list step by step by using the "NEXT →"and "PREV ←"keys.

9 1	Latest old error.
92	Next latest old error.
93 ...	Next next latest old error etc. (max. 9 st)
99	

7. TROUBLESHOOTING

7.1 Fault, cause, remedy

Check that the soft starter has been correctly installed, e.g. terminal screw correctly tightened, no loose wiring, etc.

Observation	Fault indication	Cause	Remedy
The motor does not run	The display is not illuminated	No control voltage	Switch on the control voltage
	F1	Fuse defective	Renew the fuse
		No mains supply	Switch the mains supply on
		Short circuit in thyristors	Check the thyristors. Full Voltage start, D.O.L. can be used to start the motor even if there is short circuit in thyristors, see chapter **6.16 Alarm functions, alarm list**.
	F2 (CL-T version)	Motor protection, overload	Cool down the motor and reset
	F3	Thyristors overheated	– Check ventilation of cabinet. – Check the size of cabinet. – Clean the cooling fins.
	F4 (CL and CL-T version)	Full speed not reached at set current limit and start time	Increase the starting time and/or the current limit level
	The start/stop-LED does not illuminate	No start command is given	E.g. press the "START/STOP" key.
The motor is running but an alarm is given	F1	Short circuit in thyristors	Switch off at suitable opportunity. Check the thyristors. Full Voltage start, D.O.L. can be used to start the motor again even if there is short circuit in thyristors, see chapter **6.16 Alarm functions, alarm list**.
		Failure in one phase.	Check the mains supply.
	F4 (CL and CL-T version)	Full speed not reached at set current limit and start time.	Increase the starting time and/or the current limit level.
The motor jerks etc.	When starting, motor reaches full speed but it jerks or vibrates.	Starting time too short.	Increase starting time.
		Starting voltage incorrectly set.	Adjust starting voltage.
		Motor too small in relation to rated current of soft starter.	Use a smaller model of the soft starter.
		Motor too large in relation to load of soft starter.	Use larger model of soft starter.
		Starting voltage not set correctly	Readjust the start ramp.
			Select the current limit function.
	Starting or stopping time too long, soft stop does not work.	Ramp times not set correctly.	Readjust the start and/or stop ramp time.
		Motor too large or too small in relation to load.	Change to another motor size.

The alarm list is described in chapter 6.16 **Alarm functions, alarm list**.

WARNING! The tasks in these instructions are described so that they can be understood by people trained in electrical engineering/electronics. Such personnel must have appropriate tools available.
Before performing all maintenance and repair work, switch off the electricity supply to the device and observe the safety regulations (both motor and operating voltage).

7.2 Service

Please contact your local MASTERSTART sales outlet or Emotron , see the back cover.

8. MAINTENANCE

In general the soft starter is maintenance-free. There are however some things which should be checked regularly. Especially if the surroundings are dusty the unit should be cleaned regularly.

WARNING! Do not touch parts inside the enclosure of the unit when the control and motor voltage is switched on.

Regular maintenance

- Check that nothing in the soft starter has been damaged by vibration (loose screws or connections).
- Check external wiring, connections and control signals. Tighten terminal screws and busbar bolts if necessary.
- Check that PCB board, thyristors and cooling fin are free from dust. Clean with compressed air if necessary. Make sure the PCB board and thyristors are undamaged.
- Check for signs of overheating (changes in colour on PCB board, oxidation of solder points etc.). Check that the temperature is within permissible limits.
- Check that the cooling fan/s permit free air flow. Clean any external air filters if necessary.

In the event of fault or if a fault cannot be cured by using the fault-tracing table in chapter Troubleshooting, see chapter **Service** on page 45.

9. TECHNICAL DATA

3x200–440 V 50/60 Hz Model		**MSE-017**	**MSE-030**	**MSE-045**	**MSE-060**
Power Data & Order No. Recommended motor size for **400 V** Rated current of device (A) Order No. for Motor Voltage 3x200–440 V	1)	**7.5 kW** 17 01-0501-yz	**15 kW** 30 01-0502-yz	**22 kW** 45 01-0503-yz	**30 kW** 60 01-0504-yz
3x440–500 V 50/60 Hz Model		**MSE-017**	**MSE-030**	**MSE-045**	**MSE-060**
Power Data & Order No. Recommended motor size för **500 V** Rated current of device (A) Order No. for Motor Voltage 3x440–500 V	1)	**11 kW** 17 01-0521-yz	**18.5 kW** 30 01-0522-yz	**30 kW** 45 01-0523-yz	**37 kW** 60 01-0524-yz
Electrical Data Recommended wiring fuse (A) Semi-conductor fuses, if required Power loss at rated motor load (In) Power consumption control card Power consumption fan	2)	25/35/50 80 A 50 W 25 VA –	35/50/80 125 A 90 W 25 VA 25 VA	50/63/125 160 A 140 W 25 VA 25 VA	63/80/160 200 A 180 W 25 VA 25 VA
Starts per hour: In in % and time in sec. at 50 % duty, intermittent S4, at max 40 °C 450 %, 5s 400 %, 10s 350 %, 20s 300 %, 30s 250 %, 60s	3)	 100 65 50 38 28	 100 65 50 38 28	 100 65 50 38 28	 100 65 50 38 28
Mechanical Data Dimensions in mm HxWxD incl. brackets Mounting position (Vertical/Horizontal) Weight (kg) "Connection, Terminals or busbars Cu;" Cu-cable: solid/stranded mm2 (bolt) Cooling system		 325x211x220 360x211x220 Vertical 5.9 10/6 Convection	 325x211x220 360x211x220 Vert. or Horiz. 6.7 16/10 Fan	 325x211x220 360x211x220 Vert. or Horiz. 6.7 25/16 Fan	 425x211x220 460x211x220 Vert. or Horiz. 9.1 15x5 (M8) Fan
General Electrical Data Number of fully controlled phases Voltage tolerance (control and motor) Control card/fan voltage Recommended fuse for control card/fan (A) Frequency Frequency tolerance Switch-on delay Relay contacts	1)	3 +/- 10 % See below Max 10 A 50/60 Hz +/- 10 % 100 ms 3 x 5 A, 250 V AC 1 (1,5A AC 11)			
Type of protection/insulation Type of casing protection Insulation voltage Ui(V) Varistor		IP 21 820 VDC			
Other General Data Ambient temperatures In operation Max. e.g. at 80% IN In storage Relative air humidity Max. altitude		0 - 40 °C 50 °C (-25) - (+70) °C 95%, non-condensing 1000 m			
Norms/Standards, Conform to: EMC, Emission EMC, Immunity Harmonic distorsion		EN 292, EN 60204-1 (VDE 0113) EN 50081-2, CISPR 11 and 14, VDE 0875 curve N EN 50082-1 kat. B, IEC 801-4, IEC 801-2 Max. 5% of basic frequency			

1) yz = Control voltage (y) and Standard (z) alt. Factory Option, see **Order Number** on page 52.
2) Recommended wiring fuse is given for; ramp/ direct/ heavy start (slow blow e.g. gL)
3) For further applications, please contact Emotron or use application / calculation examples. Starts per hour depends on i.e. Average, rated, starting and running current: starting, running and cooling time; ambient temperature etc.

3x200–440 V 50/60 Hz Model	**MSE-075**	**MSE-085**	**MSE-110**	**MSE-145**
Power Data & Order No.				
Recommended motor size for **400 V**	**37 kW**	**45 kW**	**55 kW**	**75 kW**
Rated current of device (A)	75	85	110	145
Order No. for Motor Voltage 3x200–440 V 1)	01-0505-yz	01-0506-yz	01-0507-yz	01-0508-yz
3x440–500 V 50/60 Hz Model	**MSE-075**	**MSE-085**	**MSE-110**	**MSE-145**
Power Data & Order No.				
Recommended motor size for **500 V**	**45 kW**	**55 kW**	**75 kW**	**90 kW**
Rated current of device (A)	75	85	110	145
Order No. for Motor Voltage 3x440–500 V 1)	01-0525-yz	01-0526-yz	01-0527-yz	01-0528-yz
Electrical Data				
Recommended wiring fuse (A) 2)	80/100/200	100/125/250	125/180/315	160/200/400
Semi-conductor fuses, if required	250 A	315 A	350 A	450 A
Power loss at rated motor load (In)	230 W	260 W	330 W	440 W
Power consumption control card	25 VA	25 VA	25 VA	25 VA
Power consumption fan	25 VA	25 VA	25 VA	25 VA
Starts per hour: In in % and time in sec. at 50 % duty, intermittent S4, at max 40 °C 3)				
450 %, 5s	100	100	63	28
400 %, 10s	65	65	41	18
350 %, 20s	50	50	31	14
300 %, 30s	38	38	24	10
250 %, 60s	28	28	18	8
Mechanical Data				
Dimensions in mm HxWxD	424x211x220	424x211x220	525x211x220	525x211x220
incl. brackets	460x211x220	460x211x220	560x211x220	560x211x220
Mounting position (Vertical/Horizontal)	Vert. or Horiz.	Vert. or Horiz.	Vert. or Horiz.	Vert. or Horiz.
Weight (kg)	9.4	9.4	12	12
"Connection, Terminals or busbars Cu;"				
Cu-cable: solid/stranded mm^2 (bolt)	15x5 (M8)	15x5 (M8)	20x5 (M10)	20x5 (M10)
Cooling system	Fan	Fan	Fan	Fan
General Electrical Data				
Number of fully controlled phases	3			
Voltage tolerance (control and motor)	+/- 10%			
Control card/fan voltage 1)	See below			
Recommended fuse for control card/fan (A)	Max 10 A			
Frequency	50/60 Hz			
Frequency tolerance	+/- 10 %			
Switch-on delay	100 ms			
Relay contacts	3 x 5 A, 250 V AC 1 (1,5A AC 11)			
Type of protection/insulation				
Type of casing protection	IP 21			
Insulation voltage Ui(V) Varistor	820 VDC			
Other General Data				
Ambient temperatures				
In operation	0 - 40 °C			
Max. e.g. at 80 % I_N	50 °C			
In storage	(-25) - (+70) °C			
Relative air humidity	95%, non-condensing			
Max. altitude	1000 m			
Norms/Standards, Conform to:				
EMC, Emission	EN 292, EN 60204-1 (VDE 0113)			
EMC, Immunity	EN 50081-2, CISPR 11 and 14, VDE 0875 curve N			
Harmonic distorsion	EN 50082-1 kat. B, IEC 801-4, IEC 801-2			
	Max. 5% of basic frequency			

1) yz = Control voltage (y) and Standard (z) alt. Factory Option, see **Order Number** on page 52.
2) Recommended wiring fuse is given for; ramp/ direct/ heavy start (slow blow e.g. gL)
3) For further applications, please contact Emotron or use application / calculation examples. Starts per hour depends on i.e Average, rated, starting and running current: starting, running and cooling time; ambient temperature etc.

3x200–440 V 50/60 Hz Model	**MSE-170**	**MSE-210**	**MSE-250**	**MSE-310**	**MSE-370**
Power Data & Order No.					
Recommended motor size for **400 V**	**90 kW**	**110 kW**	**132 kW**	**160 kW**	**200 kW**
Rated current of device (A)	170	210	250	310	370
Order No. for Motor Voltage 3x200–440 V 1)	01-0509-yz	01-0510-yz	01-0511-yz	01-0512-yz	01-0513-yz
3x440–500 V 50/60 Hz Model	**MSE-170**	**MSE-210**	**MSE-250**	**MSE-310**	**MSE-370**
Power Data & Order No.					
Recommended motor size för **500 V**	**110 kW**	**132 kW**	**160 kW**	**200 kW**	**250 kW**
Rated current of device (A)	170	210	250	310	370
Order No. for Motor Voltage 3x440–500 V 1)	01-0529-yz	01-0530-yz	01-0531-yz	01-0532-yz	01-0533-yz
Electrical Data					
Recommended wiring fuse (A) 2)	200/200/400	200/200/400	250/250/500	315/315/630	400/400/800
Semi-conductor fuses, if required	700 A	700 A	700 A	800 A	1000 A
Power loss at rated motor load (In)	510 W	630 W	750 W	930 W	1100 W
Power consumption control card	25 VA	25 VA	25 VA	25 VA	25 VA
Power consumption fan	75 VA	75 VA	75 VA	75 VA	75 VA
Starts per hour: In in % and time in sec. at 50 % duty, intermittent S4, at max 40 °C 3)					
450 %, 5s	90	75	50	65	38
400 %, 10s	63	49	32	42	25
350 %, 20s	48	42	25	35	23
300 %, 30s	36	35	20	28	19
250 %, 60s	26	25	15	19	11
Mechanical Data					
Dimensions in mm HxWxD	447x484x244	447x484x244	447x484x244	532x547x278	532x547x278
incl. brackets	Vert. or Horiz.	Vert. or Horiz.	Vert. or Horiz.	Vert. or Horiz.	Vert. or Horiz.
Mounting position (Vertical/Horizontal)	28	28	28	42	46
Weight (kg)	40x5 (M10)	40x5 (M10)	40x5 (M10)	40x8 (M12)	40x8 (M12)
"Connection, Busbars Al (bolt);"	Fan	Fan	Fan	Fan	Fan
Cooling system					
General Electrical Data					
Number of fully controlled phases	3				
Voltage tolerance (control and motor)	+/- 10 %				
Control card/fan voltage 1)	See below				
Recommended fuse for control card/fan (A)	Max 10 A				
Frequency	50/60 Hz				
Frequency tolerance	+/- 10 %				
Switch-on delay	100 ms				
Relay contacts	3 x 5 A, 250 V AC 1 (1,5A AC 11)				
Type of protection/insulation					
Type of casing protection	IP 20				
Insulation voltage Ui(V) Varistor	820 VDC				
Other General Data					
Ambient temperatures					
In operation	0 - 40 °C				
Max. e.g. at 80% I_N	50 °C				
In storage	(-25) - (+70) °C				
Relative air humidity	95%, non-condensing				
Max. altitude	1000 m				
Norms/Standards, Conform to:					
EMC, Emission	EN 292, EN 60204-1 (VDE 0113)				
EMC, Immunity	EN 50081-2, CISPR 11 and 14, VDE 0875 curve N				
Harmonic distorsion	EN 50082-1 kat. B, IEC 801-4, IEC 801-2				
	Max. 5% of basic frequency				

1) yz = Control voltage (y) and Standard (z) alt. Factory Option, see **Order Number** on page 52.
2) Recommended wiring fuse is given for; ramp/ direct/ heavy start (slow blow e.g. gL)
3) For further applications, please contact Emotron or use application / calculation examples. Starts per hour depends on i.e. Average, rated, starting and running current: starting, running and cooling time; ambient temperature etc.

3x200–440 V 50/60 Hz Model		**MSE-450**	**MSE-570**	**MSE-710**	**MSE-835**
Power Data & Order No.					
Recommended motor size for **400 V**		**250 kW**	**315 kW**	**400 kW**	**450 kW**
Rated current of device (A)		450	570	710	835
Order No. for Motor Voltage 3x200–440 V	1)	01-0514-yz	01-0515-yz	01-0515-yz	01-0517-yz
3x440–500 V 50/60 Hz Model		**MSE-450**	**MSE-570**	**MSE-710**	**MSE-835**
Power Data & Order No.					
Recommended motor size för **500 V**		**315 kW**	**400 kW**	**500 kW**	**600 kW**
Rated current of device (A)		450	570	710	835
Order No. for Motor Voltage 3x440–500 V	1)	01-0534-yz	01-0535-yz	01-0536-yz	01-0537-yz
Electrical Data					
Recommended wiring fuse (A)	2)	500/500/1 k	630/630/1 k	800/800/1 k	1 k/1 k/1.2 k
Semi-conductor fuses, if required		1250 A	1250 A	1800 A	2500 A
Power loss at rated motor load (In)		1400 W	1700 W	2100 W	2500 W
Power consumption control card		25 VA	25 VA	25 VA	25 VA
Power consumption fan		75 VA	75 VA	75 VA	75 VA
Starts per hour: In in % and time in sec. at 50 % duty, intermittent S4, at max 40 °C	3)				
450 %, 5s		28	30	25	20
400 %, 10s		18	20	16	13
350 %, 20s		15	17	13	11
300 %, 30s		10	12	9	8
250 %, 60s		8	10	7	6
Mechanical Data					
Dimensions in mm HxWxD		532x547x278	687x640x302	687x640x302	687x640x302
incl. brackets		Vert. or Horiz.	Vert. or Horiz.	Vert. or Horiz.	Vert. or Horiz.
Mounting position (Vertical/Horizontal)		46	64	78	80
Weight (kg)		40x8 (M12)	40x10 (M12)	40x10 (M12)	40x10 (M12)
"Connection, Busbars Al (bolt);"		Fan	Fan	Fan	Fan
Cooling system					
General Electrical Data					
Number of fully controlled phases		3			
Voltage tolerance (control and motor)		+/- 10%			
Control card/fan voltage	1)	See below			
Recommended fuse for control card/fan (A)		Max 10 A			
Frequency		50/60 Hz			
Frequency tolerance		+/- 10 %			
Switch-on delay		100 ms			
Relay contacts		3 x 5 A, 250 V AC 1 (1,5A AC 11)			
Type of protection/insulation					
Type of casing protection		IP 20			
Insulation voltage Ui(V) Varistor		820 VDC			
Other General Data					
Ambient temperatures					
In operation		0 - 40 °C			
Max. e.g. at 80 % I_N		50 °C			
In storage		(-25) - (+70) °C			
Relative air humidity		95%, non-condensing			
Max. altitude		1000 m			
Norms/Standards, Conform to:					
EMC, Emission		EN 292, EN 60204-1 (VDE 0113)			
EMC, Immunity		EN 50081-2, CISPR 11 and 14, VDE 0875 curve N			
Harmonic distorsion		EN 50082-1 kat. B, IEC 801-4, IEC 801-2			
		Max. 5% of basic frequency			

1) yz = Control voltage (y) and Standard (z) alt. Factory Option, see **Order Number** on page 52.
2) Recommended wiring fuse is given for; ramp/ direct/ heavy start (slow blow e.g. gL)
3) For further applications, please contact Emotron or use application / calculation examples. Starts per hour depends on i.e. Average, rated, starting and running current: starting, running and cooling time; ambient temperature etc.

Order Number

The order number consists of four parts e.g. 01-0501-2 0

01	= Basic number
0501	= Model of MSE, 0501= MSE-017 and motor 3x200-440V (0521=MSE-017 and motor 3x440-500 V)
2	= Control voltage (2 = 200 - 240 VAC)
0	= Standard or Factory Option (0 = Standard)

01-xxxx-y z

xxxx	= model, size and motor voltage
y	= 1 control voltage 100 - 120 VAC 2 control voltage 200 - 240 VAC 5 control voltage 380 - 500 VAC
z	= 0 Standard 1 CL, Current Limit 2 CL-T, Current Limit and Motor Protection

Functions of MSE and settings

Start-up

Ramp start	1-60 s
Initial voltage at start (% of U_N)	30-90
Starting torque (% of M_N)	Approx. 10-80
Torque Booster at start	Built in
Full Voltage Start (D.O.L)	Built in

Run-down

Ramp stop	2-120 s
Step down voltage at stop (% of U_N)	100-40
Direct stop	Built in
DC-brake at stop	Built in

Other functions

Dual ramp start and stop	Built in
Application"Pump"	Built in
Remote analogue control	0-10/2-10 V DC alt. 0-20/4-20 mA DC
Supply (+12V), for remote pot. 10k	Built in
By-pass	Built in
Power Factor Control, PFC	Built in
Programmable relay K1 and K2	Built in
Alarm Relay K3	Built in
Parameter set (4 set)	Built in

Option

Serial interface	Optional

Factory Options

Current limit start	Optional (Factory Option, see Note)
Motor protection	Optional (Factory Option, see Note)

NOTE! "Current limit start" and "Motor protection" functions are only available as "Factory Options", CL-version resp. CL-T-version.
In the Motor protection version (CL-T-version) the "current limit start" function is included. See Technical Data Options, or contact your local sales representative.

PCB Terminals

01	Internal connection, supply
02	Internal connection, supply
11, 12, 13	Start/Stop/Reset (12-13 linked at delivery, this enables start/stop from keyboard. Disconnect the jumper for remote control.)
14, 15	Remote analogue control 0-10 V, 2-10 V, 0-20 mA, 4-20 mA Ri voltage = 100 kΩ, Ri current = 100 Ω) (terminals 14 = +, 15 = -)
18	+12 VDC, max. 50 mA available, e.g. pot. 10 kΩ (Term. 14 input, 15 (–) and 18 (+).
16, 17, 18	Parameter set
21, 22	Relay K1
23, 24	Relay K2
31, 32, 33	Relay K3, alarm
X2	Connection serial interface
Y1	Keyboard lock: – bridge in the position to the left = locked – bridge in the position to the right = unlocked
Y2	Remote analogue control. – bridge in the upper position = voltage signal – bridge in the lower position = current signal

NOTE! All signal inputs and outputs are galvanically isolated from the power supply (control and motor voltage).

Status indication

A built-in LED display showing mains on, status and alarm:

– Mains on (control voltage)	Display illuminated
– Start command given	Start/Stop-LED "on"
– Stop command given	Start/Stop-LED "off"
– During ramp up and ramp down	RUNNING-LED is flashing
– Operation (running)	RUNNING-LED "on"

Fault indication

– Thyristor fault/phase failure	Display indication "F1"
– Motor protection, overload	Display indication "F2"
– Over temperature, thyristors	Display indication "F3"
– Full speed not reached at set current limit and start time	Display indication "F4"

Technical Data and Order Number for Options

Type MSE-017to -835 options

Current limit start	**Factory Option**
Order No.	01-xxxx-y1 (See **Factory Options** on page 53)
Motor Protection	**Factory Option**
Order No.	01-xxxx-y2 (See **Factory Options** on page 53)

Serial Interface

Data: Input/output signals, term.	X2
Software, communication protocol	Emotron Standard
Mounting and connection, plug-in on MSE PCB	
Order No.	01-0553-00

Terminal clamp

Data: Single cables, Cu or Al	
Cables	95-300 mm^2
MSE type and Cu cable	-210 to -310
Bolt for connection to busbar	M10
Dimensions in mm	33x84x47 mm
Order No. single	9350
Data: Parallel cables, Cu or Al	
Cables	2x95-300 mm^2
MSE type and Cu cable	-210 to -835
Bolt for connection to busbar	M10
Dimensions in mm	35x87x65
Order No. parallels	9351

Type of protection/enclosure

IP 21 for MSE-017 to MSE-145 and IP 20 for MSE-170 to MSE-835.

NOTE! For more information about order numbers etc. see Order Number on page 52.

Semi-conductor fuses

Always use standard commercial fuses to protect the wiring and prevent short circuiting. To protect the thyristors against short-circuit currents, superfast semiconductor fuses can be used if prefered (e.g. Bussmann type SILCU or similar, see table below).

The normal guarantee is valid even if superfast semiconductor fuses are not used.

Select the Semi-Conductor fuses as follows:

1 Decide on the appropriate Amp.-value (A), if Bussmann fuses are not used, e.g. MSE-017 and 80 A.

2 Check that the I^2t-value is correct acc. to the below table.

The I^2t-value = max.-value recommended by Emotron (400 V).
The Semi-Conductor Fuses-value in Amp. (A) = min.-value recommended by Emotron.

NOTE! Recommended wiring fuse is given for ramp/direct/heavy start (slow blow e.g. gL). Recommended Semi-Conductor fuses: e.g. Bussmann type SILCU.

Type	Thyristor	Semiconductor Fuses I t	(A s)	Motor Standard Fuses
MSE-017	SKKT 42	2,5k	80A	25/35/50A
MSE-030	SKKT 72	9,5k	125A	35/50/80A
MSE-045	SKKT 92	13k	160A	50/63/125A
MSE-060	SKKT 106	18k	200A	63/80/160A
MSE-075	SKKT 132	40k	250A	80/100/200A
MSE-085	SKKT 162	60k	315A	100/125/250A
MSE-110	SKKT 213	100k	350A	125/180/315A
MSE-145	SKKT 253	200k	450A	160/200/400A
MSE-170	N280/281	300k	700A	200/200/400A
MSE-210	N280/281	300k	700A	200/200/400A
MSE-250	N280/281	350k	700A	250/250/500A
MSE-310	N370	700k	800A	315/315/630A
MSE-370	N490	2M	1000A	400/400/800A
MSE-450	N540	3M	1250A	500/500/1000A
MSE-570	N600	4M	1250A	630/630/1000A
MSE-710	N760	5M	1800A	800/800/1000A
MSE-835	N990	10M	2500A	1000/1000/1200A

9.1 Tests in accordance with norm EN 60204

Before leaving the factory, the device was subjected to the following tests:

- Through connection of earthing system;
  a) visual inspection.
  b) check that earthing wire is firmly connected.
- Insulation.
- Voltage.
- Function.

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