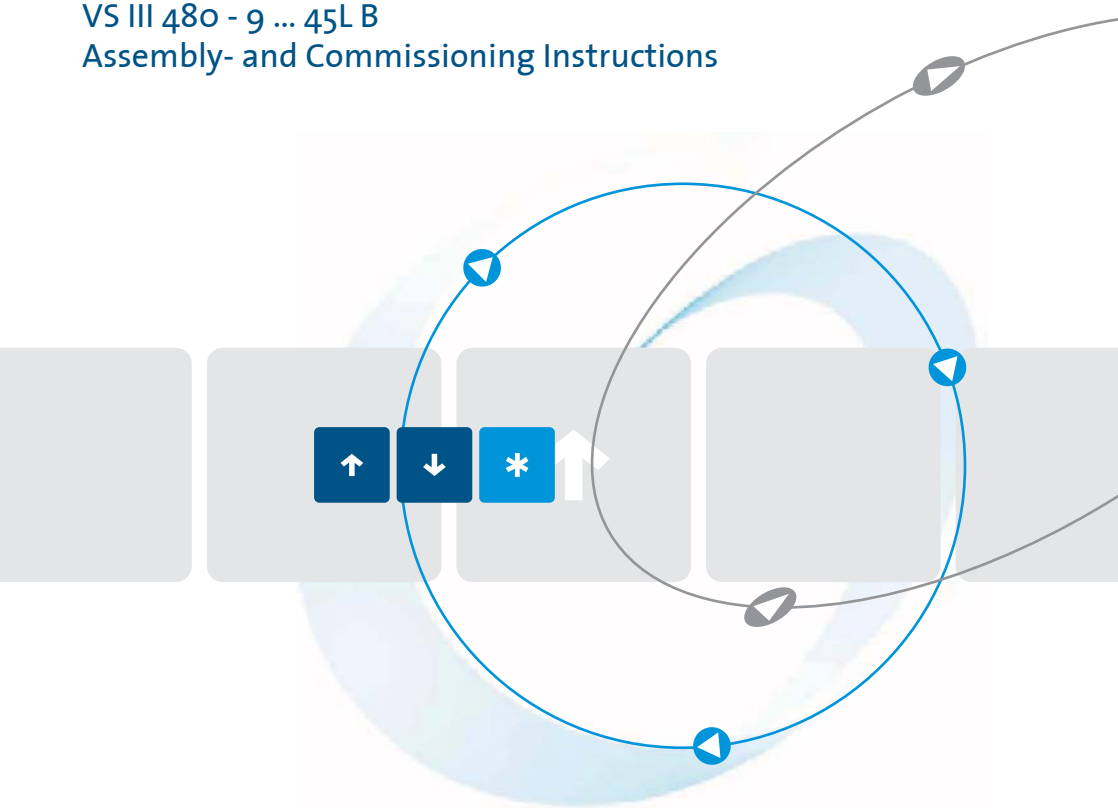
PETER electronic

Soft Starters
VS III 480 - 9 ... 45L B
Assembly- and Commissioning Instructions



Quality is our Drive.

as per 01/19 1S510.10001

Table of Contents **Page**

These commissioning instructions were prepared with great care. Nevertheless, PETER electronic GmbH & Co. KG does not assume liability for damage resulting from mistakes possibly contained in this manual. Technical changes that serve to improve the product are subject to change without notice.

Disposal Instructions

Equipment containing electrical components may not be disposed of together with domestic waste. It must be collected separately as electrical and electronic waste according to local and currently valid legislation.

Notes and symbols used in these instructions

Note: Notes explain the advantages of certain adjustments or settings and help you to make use of the device in the best possible way.

Warning notices: Read them carefully and follow them strictly!

Warning notices are indicated in order to protect you against danger or to help you to prevent the device from being damaged.

Caution: Danger to life through electric shock!

When you see this sign, always make sure that the device is de-energized and secured against unintentional energizing.

1. Safety notes

The described devices are electrical equipment for use in industrial electrical power installations. An impermissible removal of the covers during operation can cause serious damage to your health, since these devices contain live parts with high voltages.

Adjustment work may only be performed by trained staff observing the safety regulations. Assembly and mounting work may only be carried out with the equipment deenergized.

Make sure that all drive components are properly earthed.

Please read these commissioning instructions carefully before putting the device into operation.

Besides, the user must ensure that the devices and associated components are fitted and connected in accordance with the appliable local, legal and technical regulations. The VDE-regulations VDE 0100, VDE 0110 (EN 60664), VDE 0160 (EN 50178) , VDE 0113 (EN 60204, EN 61310),VDE 0660 (EN 50274) plus the appropriate regulations of the TÜV (Technical Control Association) and the trade associations apply in Germany.

The user must ensure that the drive turns into a safe operating state following a device failure, in the event of maloperation, or if the control unit has failed etc..

Caution: Even if the motor is at rest, it is **not** physically separated from the mains.

2. Conformity

In industrial linguistic usage the drive controllers of the type series VersiStart III...L B are called "devices", however, in the sense of the "law on the safety of equipment", the "EMC-law" or the "EC-machinery directive" they are not devices or machines ready for use or connection but they are components. It is only possible to define their final function, when these components are integrated into the design and construction of the user.

To be able to use the devices to their intended purpose, it requires power supply networks according to DIN EN 50160 (IEC38).

The user takes the responsibility that the user's design and construction comply with the applicable legal provision.

The commissioning is strictly forbidden as long as the conformity of the final product with the guidelines 2006/42/EC (Machinery directive) and 2006/95/EC (Low voltage directive) is not proved.

3. General description

With VersiStart III...L B soft starters in current control operating mode (setting with potentiometer xIe), the motor voltage is in three phases (1L1/3L2/5L3) controlled by generalized phase control and thus enables current-controlled starting. For this, the motor voltage is increased via a ramp function until the adjusted starting current is reached. With this starting current, the drive is further accelerated until the motor current decreases to approx. nominal current. Now, the power semiconductors are bridged by the built-in bypass relays.

By applying a control voltage of 230VAC to the terminals X7/X8, the soft starter is started.

The devices require connecting a control supply voltage of 230VAC to the terminals X1 and X2.

The soft starters feature an integrated thermal motor and device protection function. The motor current is measured in one phase and a thermal image of the motor and device is developed.

When the thermal capacity of the motor or device is reached, the device will be switched off and remains in fault mode until it is reset.

The devices are suitable for an operation of 3-phase motors in star or delta connection.

4. Usage to the intended purpose

The devices of the VersiStart III...L B-series are electrical equipment for use in industrial electrical power installations. They are designed for application in machines, in order to reduce the starting torque and starting current peaks as well as the tripping torque of drives with three-phase induction motors.

5. EC Declaration of Conformity

PETER electronic

EC Declaration of Conformity CE

The manufacturer / company placing the product on the market
(authorized representatives of the manufacturer / companies placing the product on the market that are established within the Community)

Name / Address: PETER electronic GmbH & Co.KG
Bruckäcker 9
92348 Berg

hereby declares that the following product (device, component, unit) in the version as supplied

Product designation:	**Soft starters**
Series / type designation:	VS III 480 - 9L B/ -16L B/ -25L B/ -37L B/ -45L B
Article number:	2S511...
Year of manufacture:	2013

complies with the provisions of the following EU-directives:

2014/30/EU	Electromagnetic compatibility
2014/35/EU	Electrical equipment designed for use within certain voltage limits
2011/65/EU	The restriction of the use of certain hazardous substances in electrical and electronic equipment

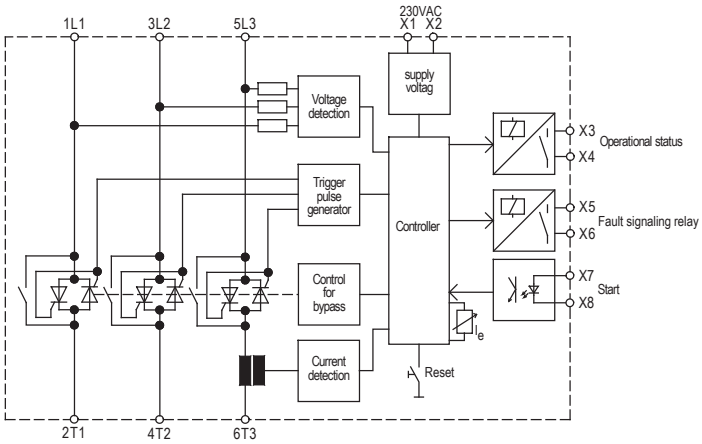
The following harmonized standards have been applied:

EN 60947-1:2007+A1:2012	Low-voltage switchgear and controlgear General rules
EN 60947-4-2:2012	Low-voltage switchgear and controlgear Contactors and motor-starters - AC semiconductor motor controllers and starters

This EC Declaration of Conformity is no longer valid, if the product is modified or changed without our agreement.
This declaration is issued under the sole responsibility of the signatory.

Berg, 18.04.2016 (place, date)
Dr. Thomas Stiller, Managing director (signatory and function of the signatory)
(signature)

6. Block diagram



7. Commissioning

The device is to be put into operation in 3 steps:

1. Mounting
2. Connection and
3. Parameter setting

Please mind the permissible max. starting currents (siehe “Technical data” on page 15) .

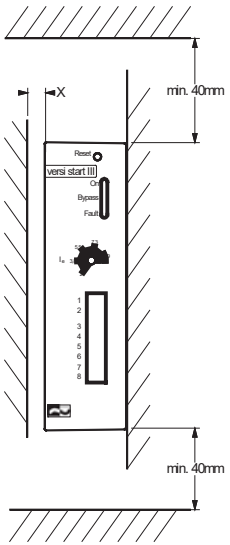
7.1 Mounting instructions

Caution: Danger to life through electric shock!

The following conditions are to be complied with in order to ensure safe and reliable operation of the VersiStart III...L B:

1. The device series VersiStart III...L B is to be used under category III overvoltage conditions.
2. The device must be used only in an environment of pollution degree 2 or better, in compliance with DIN EN 60644-1/IEC664.
3. The device has to be installed into a housing (min. degree of protection: IP54). Make sure that the waste heat generated by the soft starter can be dissipated through the housing.
4. The device must be operated without being exposed to contamination by water, oil, carbon deposits, dust, etc.

Place the device vertically on a perpendicular mounting plate with the motor terminals pointing downwards. The device is to be snap-mounted onto a 35mm top-hat rail according to DIN EN 50022. Make sure that no additional heat sources such as equipment with high heat loss, heating resistors or the like are arranged beneath the device.



Clearance X

Under normal drive conditions, the devices can be mounted side by side.

In the case of applications requiring high starting frequencies and/or high-inertia starting, the devices should be mounted with a distance of approx. 10mm in between them, in order to ensure good ventilation of the heat sink.

Warning:

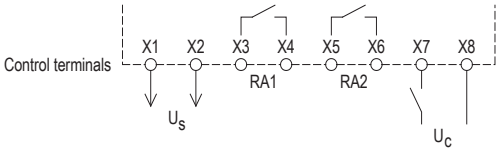
To avoid heat concentrations, a distance of at least 40mm is to be kept between cable duct and device.

7.2 Connection

Power section (see also connection diagram)

Terminal 1L1:	Mains voltage L1
Terminal 3L2:	Mains voltage L2
Terminal 5L3:	Mains voltage L3
Earth connection ⏚	PE
Terminal 2T1:	Motor terminal U
Terminal 4T2:	Motor terminal V
Terminal 6T3:	Motor terminal W

Control section



U_S and U_C see point 12 „Technical data“.

The input resistance of the control inputs is 80kOhms. To control them, it is necessary to use switching contacts enabling reliable switching of the lower control currents (e.g., AgNi+Au)!

When the contact on the terminals X7 and X8 is closed, the motor will accelerate at the adjusted current limit. If the contact is open, the motor will slow down with the adjusted deceleration time ramp.

Caution: Danger to life through electric shock!

The motor is **not** physically separated from the supply mains.

Adjusting the control type

The type series VersiStart III may be controlled as follows:

Control by voltage U_C 24V … 230VAC/DC between terminals X7 and X8.

Control supply voltage U_S only in the case of wide-voltage devices (option B)

Between the terminals X1 and X2 an auxiliary voltage of 230VAC ±10%/150mA is to be injected.

7.3 Parameter settings

Parameter	Potenti-ometer	Setting range
Rated motor current	I_e	depends on power rating up to 100% of nominal device current (see page 16 „Current settings“)

Default setting of potentiometers

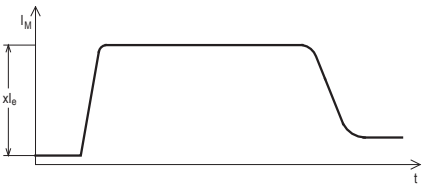
Potentiometer I_e (rated motor current) = to max. value

8. Starting and stopping

First of all, the device should be adapted to the rated current of the motor (see rating plate). For this, appropriately adjust the rated motor current with the potentiometer I_e.

By applying the control voltage to the terminals X7 and X8, soft start is initiated. At the current limit, the motor accelerates to full speed. Then, the power semiconductors are bridged by the bypass relays and the motor is directly run by mains power supply.

By switching the control voltage off, the motor will be disconnected from the mains and coasts to stop.



Caution: Danger to life through electric shock!

Even if the motor is at rest, it is **not** physically separated from the supply mains.

Warning!

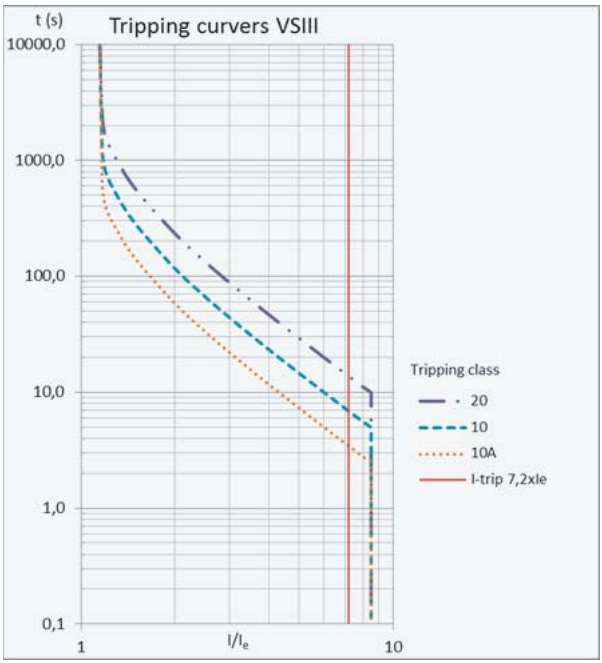
Make sure not to exceed the indicated switching frequency! After every start, it is necessary to give the power semiconductors sufficient time to cool down. If the time interval between starts is too short, there is the danger of destroying the power semiconductors!
Operation in bypassed condition allows the power semiconductors to cool down, too!

9. Thermal overload protection

The type series VersiStart III...L B features an integrated thermal overload protection function both for the motor and the device. A current sensor measures the motor current and calculates a thermal image of motor and device. If the set threshold value is exceeded, the device switches into fault mode. The fault condition is indicated by the red and yellow LED on the device front panel. After such a thermal overload switching has taken place, the device and/or motor must be given sufficient time to cool down. Only then may the device be switched back into operating mode with the reset key. In this connection, however, the thermal memory will not be reset, i.e., if the cooling off period is too short, the device will very soon again switch off due to overload.

By default, the tripping class is set to 10.

The tripping value for the device is factory-set and corresponds with the thermal capacity of the device.



10. LED indicators

On the device front panel there are 3 light-emitting diodes that indicate the following operational states:

LED	Operational status
Green	Device is connected to mains voltage
Yellow	Start completed, device bypassed
Red	Fault
Red Yellow - flashing	Fault, the flashing frequency indicates the root cause of the fault (see chapter 11.1, page 12)
Yellow - flashing with increasing or decreasing frequency	Soft start / Soft stop

Two signaling relays are available on the control terminals X3 / X4 (RA 1) and X5 / X6 (RA 2). The following operational states are signaled:

RA 1 **Operational state**

The signaling contact RA 1 closes at the beginning of soft start and opens at the end of soft stop.

RA 2 **Fault**

Under normal operating conditions the signaling contact RA 2 is closed; it only opens if a fault occurs.

11. Fault

The device series VersiStart III...L B monitors various fault conditions. If a fault is detected, the device indicates the fault via the red LED and by a flashing of the yellow LED (flashes at constant frequency). In case of a fault, the signaling relay RA 2 will be opened. The various fault conditions are indicated via different flashing frequencies of the yellow LED.

11.1 Fault description

Fault	LED	Operational status
1	Yellow LED flashes 1x with a short pause	Undervoltage of electronics supply
2	Yellow LED flashes 2x with a short pause	Heat sink temperature too high/device thermally overloaded
3	Yellow LED flashes 3x with a short pause	Timeout Current control
4	Yellow LED flashes 4x with a short pause	Phase / Trigger failure in phase 1
5	Yellow LED flashes 5x with a short pause	Phase / Trigger failure in phase 2
6	Yellow LED flashes 6x with a short pause	Phase / Trigger failure in phase 3
7	Yellow LED flashes 7x with a short pause	Wrong phase sequence
8	Yellow LED flashes 8x with a short pause	Failure mains frequency-> The Mains frequency has gone beyond the specified range± 5%. or Failure Mains zero crossings -> Mains or motor circuit is defective
9	Yellow LED flashes 9x with a short pause	Overcurrent I-Motor > 4 x I_e in bypass mode
10	Yellow LED flashes 10x with a short pause	Motor current less than 12.5% rated device current
11	2x double flash of yellow LED with a short pause	Overtemperature Device
12	3x double flash of yellow LED with a short pause	Overtemperature Motor
13	4x double flash of yellow LED with a short pause	Mains undervoltage
14	5x double flash of yellow LED with a short pause	Mains overvoltage
15	6x double flash of yellow LED with a short pause	Mains voltage Off
16	Constantly flashing yellow LED	Manual trip

11.2 Fault remedy

In case of a fault, please proceed as follows:

Fault 1:	Defect in the internal control electronics or connected motor too small (see technical data: min. motor load). Send the device to the producer to have it checked.
Fault 2:	Check the starting frequency and the starting current, and also observe the max. ambient temperature. Give the device and/or the motor enough time to cool down. Heat dissipation can be improved by forced cooling, with of a fan mounted underneath the device.
Fault 3:	The motor does not reach final speed with the adjusted max. starting current. Increase the value of the starting current with the "I" potentiometer.
	**Caution!** After a timeout cutoff, always allow the device to cool down, as an immediate restart may destroy the device.
Fault 4-6:	Power supply failed, motor lead interrupted, power semiconductor(s) defective, motor defective. Check motor and wiring. Send the device to the producer to have it inspected.
Fault 7:	At the supply voltage terminals L1, L2, L3 the wrong phase sequence (left-hand rotary field) is applied. Connect phase sequence L1, L2, and L3 for clockwise rotating field.
Fault 8:	As soon as the mains frequency is beyond this range an ongoing operation is impossible. or Mains supply or motor wiring interrupted, power semiconductor(s) defective, check fuses and wiring. Send the device to the producer to have it inspected.
Fault 9:	Motor current exceeds 4 x I_e in bypass mode e. g. Motor is blocked, or short-circuit in the motor circuit or overload. Check the motor circuit and load conditions.
Fault 10:	Motor is too small or phase failure.
Fault 11:	Device is thermally overloaded. Starting current is too high and/or starting time is too long. Starting frequency is too high.
Fault 12:	Motor is thermally overloaded. Motor load is too high.
Fault 13:	Mains voltage is below the permissible limit value.
Fault 14:	Mains voltage is above the permissible limit value.
Fault 15:	Mains voltage is not applied.

11.3 Manual trip

If the device is in stop mode and the reset button is pressed for 5s or longer the VersiStart III...L B will trip. The red LED is now illuminated and the yellow LED flashes continuously and shows a manual trip (to test trip mode of soft starter).

11.4 Resetting of faults

If a fault occurs, the device will go into failure mode (indicated by the red LED on the device front panel).

To put the device back into operating mode, the following options can be carried out.

1. Reset by pressing the Reset-key on the device front panel. Before the reset, however, the starting signal needs to be turned off. As a result of the reset, the device will be newly initialized. The thermal memory will not be deleted.
2. By switching the supply voltage Off and On, the device is put into its initial state. The thermal memory will be deleted by this, too.

Warning:

The cause of the fault must at any rate be identified and remedied by trained expert personnel. Only then may the device be put into operation again.

12. Technical data

Type designation	VS III 480-...L B				
	9	**16**	**25**	**37**	**45**
Rated device current I_e	9A	16A	25A	37A	45A
Rated operational voltage U_e	200V - 480V ±10% 50/60Hz				
Control supply voltage U_S only with Option B	230V ±10% AC 50/60Hz				
Motor rating at U_e 400V	4kW	7,5kW	11kW	18,5kW	22kW
Motor rating at U_e 400V IE3 Motors	3kW	5.5kW	7.5kW	15kW	18.5kW
Switch. frequency/hour at 2,5xI_N and t_{an}=5s 2,5xI_N and t_{an}=1s	10 40	6 24	4 16	3 12	2 8
Utilization category	9A:AC-53b:6-3:357	16A:AC-53b:6-3:597	25A:AC-53b:6-3:867	37A:AC-53b:6-3:1197	45A:AC-53b:6-3:1797
max. Power dissipation - in operation related to max. starting frequency - Standby	9W 5W	9W 5W	9W 5W	9W 5W	9W 5W
I^2t - Power semiconductors in A^2s	390	720	4000	9100	16200
min. Motor load	20% of the device rated current				
Starting time	0,6s				
Starting voltage	80%				
Stopping time	0,25s				
Restart time	200ms				
Input resistance Control inputs	80kOhm				
Control voltage U_c	24 ... 230VAC/DC				
Contact rating of Relay outputs RA1 / RA2	2A / 250VAC / 30VDC				
Installation class	3				
Overvoltage category / Pollution degree: Control and auxiliary circuit Main circuit	 II / 2 III (TT / TN-systems) / 2				
Rated impulse strength U_{imp}: Control and auxiliary circuit Main circuit	 2,5kV 4kV				
Rated insulation voltage U_i: Control and auxiliary circuit Main circuit	 250V 500V				
max. Cross-sectional area for connection solid/stranded: Control terminals Power terminals	 1,5mm² 6mm²			 1,5mm² 16mm²	

max. Tightening torque: Control- / Power terminals	Spring-loaded terminals				
Ambient / Storage temperature	0°C ... 45°C up to an altitude of 1000m / -25°C ... 75°C				
Power reduction[1)]	above 45°C - 2% per 1°C up to max. 60°C and installation altitudes above 1000m -1% per 100m				
Degree of protection	IP 20				
Weight	950g				
Overload relays					
Current settings	2...9A	5...16A	12,5...25A	15...37A	22,5...45A
Tripping classes	10				
Number of poles	1				
Relay version	electronic				
Reset	manual				

[1)] The reductions refer to the rated power.

Note: Please pay attention and consider for the operation of IE3 motors while dimensioning of softstarters the resulting higher starting currents.
For the use of IE3 motors we highly recommend to dimension and design the needed softstarters one size higher.

13. Dimensioning rules

13.1 Dimensioning of fuses for device protection

Pre-fuses F can be dimensioned according to the following instructions:

Basically, two types of fuse protection are available for the user:

1. Fusing according to coordination type "1",DIN EN 60947-4-2.
   After a short circuit, the VersiStart III...L B device is allowed to be inoperative and repair work is possible.
2. Fusing according to coordination type "2",DIN EN 60947-4-2.
   After a short circuit, the device must be suitable for further use. However, there is the danger that the contacts of the bypass or braking relays weld. Therefore, if possible, these contacts are to be checked prior to reconnecting these contacts to the mains supply. If this check cannot be carried out by the user, the device has to be returned to the producer in order to have it checked.

The following dimensioning information refers to the below operating conditions:

- Use of standard asynchronous motors
- Standard starting and stopping times
- Switching frequencies not exceeding the values specified in the data sheet

Fusing according to coordination type "1"

As pre-fuses we recommend to use fuses of the utilization category gG.

If such fuses are also used to provide line protection, the conductor cross section is to be appropriately coordinated!

Short-circuit protection according to EN 60947-4-2

Rated device current (ttechnical data)	Device type	**Fuse value in the case of coordination type 1**	Fuse type (recommendation)
9A	VS III 480-9L B	20A	500V NH00gG
16A	VS III 480-16L B	32A	500V NH00gG
25A	VS III 480-25L B	40A	500V NH00gG
37A	VS III 480-37L B	63A	500V NH00gG
45A	VS III 480-45L B	63A	500V NH00gG

Fusing according to coordination type "2":

The power semiconductors are to be protected by semiconductor protection fuses of the utilization category aR or gR. aR fuses do not guarantee line protection, additional line protection fuses (utilization category gG) must be used.

To protect the semiconductors it is necessary to select fuses having cut-off-I^2t-values which are approx. 10-15% below the threshold-I^2t-value of the power semiconductor (see technical data). In this connection, the fuse rating of the selected fuse should not be smaller than the starting current to be expected.

Notes:

1. PETER electronic does not prescribe the use of semiconductor protection fuses. However, for some UL- or CSA-listed devices there are exceptions which are indicated in the relevant commissioning instructions.
2. On the basis of the I^2t-value of the power semiconductors, the starting time and possibly the max. starting current, the fuse supplier is able to select a suitable type. Due to the great variety of producers, sizes and types, PETER electronic does not recommend any particular fuses.
3. If the value of the fuse or the cutoff-I^2t-value is selected too small, it may happen that the semiconductor fuse reacts during the starting phase or during soft stop.

14. Installation guideline

The devices are to be installed into a switchbox or switchgear cabinet according to point 7. It must be ensured that the switchbox/switchgear cabinet is capable of dissipating the occurring power loss (see techn. data).

14.1 Connection

The device is to be installed according to the attached connection diagram. For other connections please consult PETER electronic GmbH & Co. KG.

14.1.1 Earthing

The electrical earthing provided ensures a low impedance connection between all metallic surfaces. Apart from providing a degree of electrical safety and isolation, the earthing also has the beneficial effect that the flow of RF currents can be directed through the structure of the equipment rather than through sensitive circuits, where it could be disruptive. It is for this reason that it is vitally important to provide separate earth conductors for each part of the installation which are all connected to a common star point.

14.1.2 Cabling

To avoid EMI couplings into the electronics and the disturbances they involve, it must be ensured that the control cables are laid separately in separate cable ducts and as far as possible away from the power cables. If control cables need to cross power cables, they have to be laid at an angle of 90° (Figure 1).

When connecting shielded cables, make sure that the unshielded cable ends are as short as possible. The large-surface shield bonding must necessarily be located at the end of the shielding but may also be established in a suitable place - at a distance of some centimeters (Figure 2).

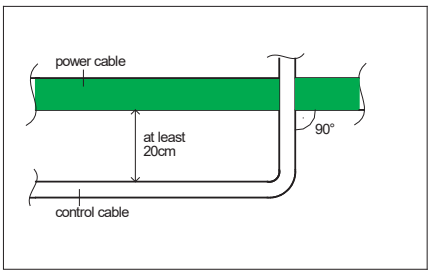


Figure 1

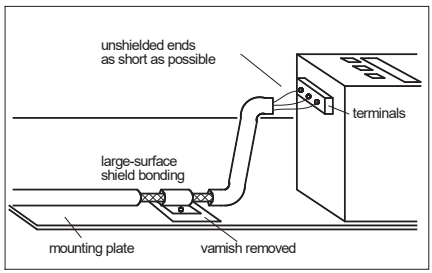


Figure 2

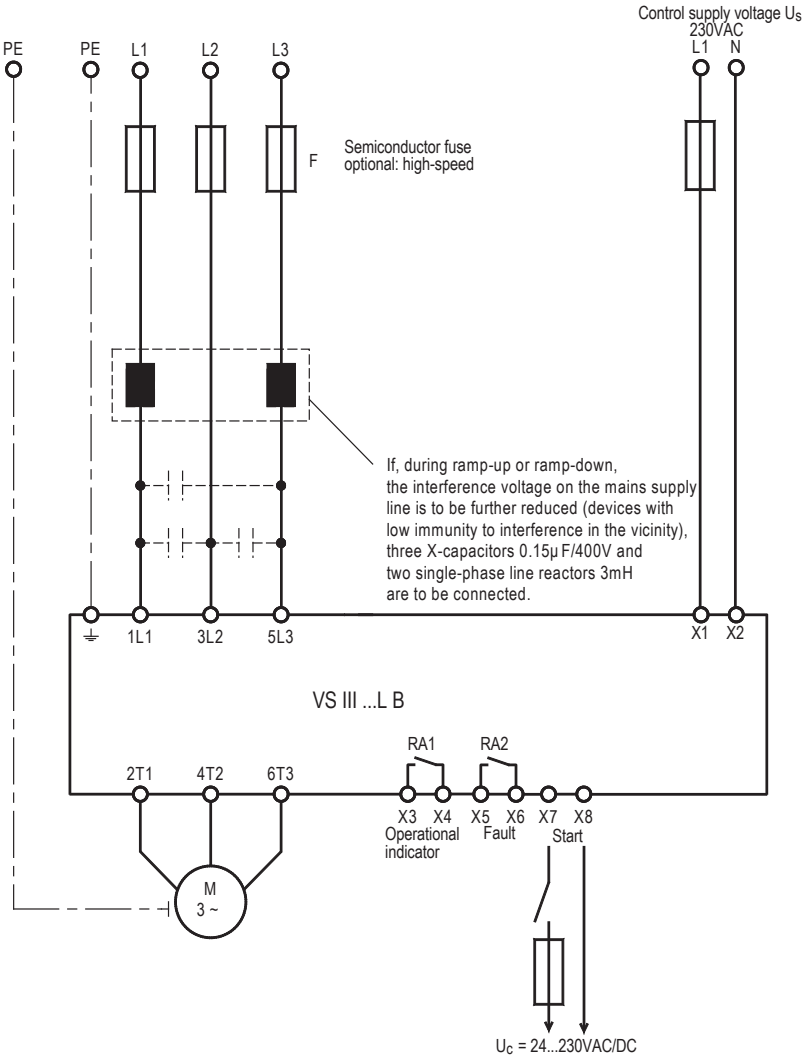
Caution!

The protective conductor connection to the motor must not be laid in shielded motor cables, but is to be separately laid with an appropriate cross-sectional area. The individual earthing systems, power earth, protective earth, digital earth, and analog earth conductors should be laid separately by using a suitable star-point wiring.

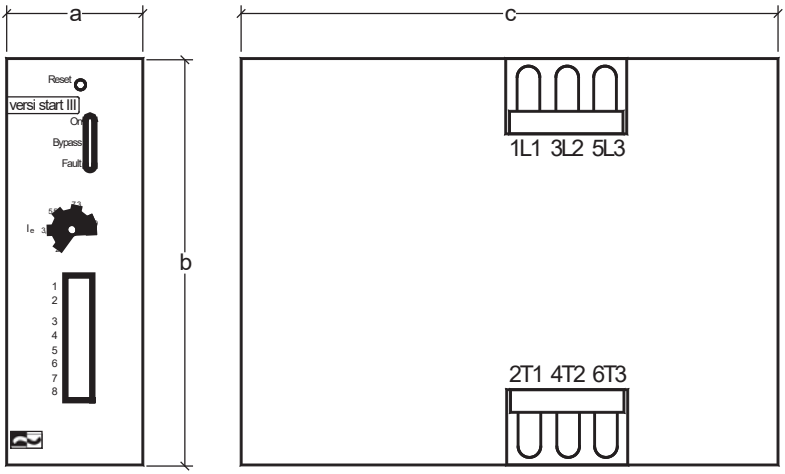
Note: Further connection diagrams for special circuit arrangements are available on our homepage at **www.peter-electronic.com**.

Note: Prior to putting the VersiStart III...L B into operation, the wiring is to be checked.

14.2 General connection diagram



15. Dimensions



Mounting dimensions	a	b	c
VS III ... - 9…45L B	45	147	158

All dimensions indicated in mm.

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