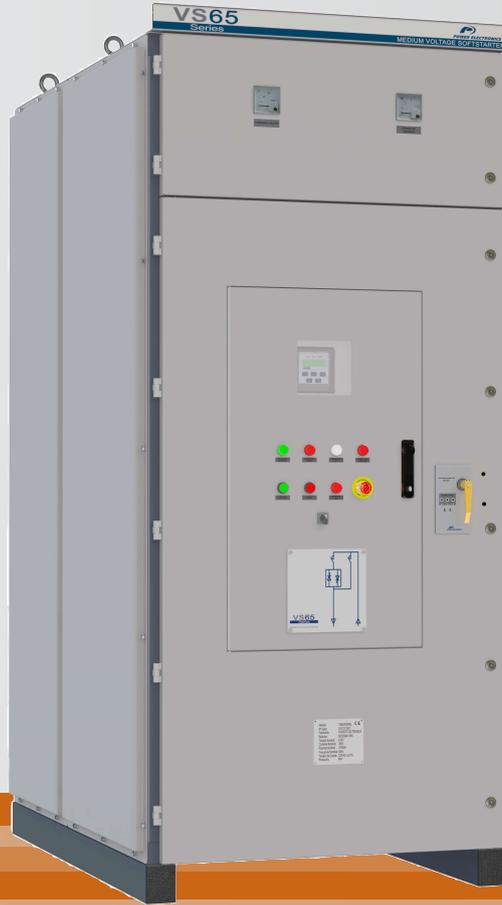


VS65

Series

MEDIUM VOLTAGE SOFT STARTER



Medium Voltage Soft Starter

Hardware and Installation Manual

VS65

Series

MEDIUM VOLTAGE SOFT STARTER

Medium Voltage Soft Starter

Hardware and installation Manual

Edition: July 2012

VS65MTHW01AI Rev. A

SAFETY SYMBOLS

In order to reduce the risk of personal injury, electric shock, fire and damage to equipment, please read carefully and pay attention to the precautions found in this manual.

	ALARM SAFETY WARNING	This symbol indicates the presence of potential hazard, which may result in serious personal injury when instructions are omitted or not followed properly.
	CAUTION	Identifies shock hazards under certain conditions. Particular attention should be given due to the presence of dangerous voltage. Maintenance operations should be carried out by qualified personnel.
		Identifies potential hazards under certain conditions. Read the message and follow the instructions carefully.
		Identifies electric shock hazards under certain conditions. Particular attention should be given due to the presence of dangerous voltage.

July 2012 Edition

This publication could show technical imprecision or misprints. The information here included would be periodically modified and updated, included in later editions. To consult or download the latest information related to this product, please contact our website www.power-electronics.com.

REVISION CONTROL		
DATE	REVISION	DESCRIPTION
12 July 2012	A	First Edition

The equipment and technical documentation is periodically updated. Power electronics reserves the right to modify all or part of the contents within the manual without previous notice.

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SAFETY INSTRUCTIONS

IMPORTANT!

The safety measures shown in the manual are intended to teach the user to use the product properly and as safely as possible to prevent any personal injury or material damage.

 DANGER	 CAUTION	 ALARM
<p>DANGEROUS VOLTAGE</p> <p>The medium voltage soft starters have dangerous voltages when connected to line voltage. Install and maintenance operations should be carried out by qualified personnel only.</p> <p>An improper motor or soft starter installation may cause faults in the equipment, serious injuries including death. Follow carefully the instructions given in the manual, the national electric codes and updated local codes.</p>	<p>SHORT CIRCUIT</p> <p>Medium Voltage soft starters are not tested against short circuits.</p> <p>In case of a severe overload or short circuit, the soft starter should be completely tested to keep the equipment in working order.</p>	<p>GENERAL PROTECTIONS AND EARTH GROUNDING.</p> <p>The installer or user is responsible to provide a proper soft starter earthing system and a complete protections system in accordance with the national electric codes and updated local codes.</p>

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ALARM – SAFETY – CAUTION

Read carefully this manual and follow the instructions before proceeding.

All of the safety instructions would not cover every single potential equipment cause. However, the most common and important ones have been pointed out. The installer should follow the instructions described within the manual, provide quality electric work and localize all of the recommendations and warnings provided before starting the equipment.

Make sure the soft starter is completely disconnected from the power supply and earth grounded before any use or maintenance operation is carried out.

Check the maintenance section before proceeding. In order to prevent electric risks, disconnect the power supply input, earth ground the equipment and remove the control voltages before working in the equipment. Warning and safety labels should be properly placed in terminals, covers and control panels in accordance with local codes. Otherwise, electric shock hazard exists.

Do not connect any kind of power supply to the equipment while the doors are opened.

Totally prohibited to run the soft starter with the doors opened.

Once doors are properly closed, the power supply may be connected to the equipments power supply line. Otherwise, electric shock hazard exists.

Do not open the soft starter doors except for periodic inspections, wiring the unit even when the input voltage is not connected.

Otherwise, you may suffer an electric shock.



ALARM – SAFETY – CAUTION

Power factor compensation capacitors.

The reactive compensation capacitors used to increase the power factor should be connected to the soft starter input terminals and not to the output ones. These capacitors should be connected with an additional contactor as shown in the electric connections section. The connection will be done only when the soft starter is running and it will be disconnected during the acceleration and deceleration ramp.

Otherwise, the soft starter can be damaged.

When working in electric installations always remember to apply the 5 golden rules:

1. Visible cut of all the voltage sources.
 2. Mechanic lock of every single cut elements.
 3. Verify no voltage is present.
 4. Earth ground and short circuit any possible voltage source.
 5. Define and post sign the working area.
-



CAUTION

Handle the equipment with dry hands.

Otherwise, electric shock hazard existence.

Do not use cables with damaged insulation. Do not summit cables to abrasions, excessive stress, heavy loads or pinching.

Otherwise, electric shock hazard existence.

Keep clean the equipment, not allowing lint, paper, wooden chips, dust, metallic chips or other foreign matter (screws, pressure washers...) into the soft starter. Verify this point after the installation.

Otherwise, accident and fire risk existence.

Place the soft starter over non-flammable surface. Keep away from flammable materials.

Otherwise, fire risk existence.

Disconnect and earth ground the soft starter power input when the soft starter is damaged.

Otherwise, fire and secondary accident risk existence.

After applying input voltage or after removing it, the soft starter will remain warm for a couple of minutes.

Otherwise, body injury or skin burn risk existence.

Do not apply voltage to a damaged or soft starter with parts missing even if the installation is complete.

Otherwise, electric shock hazard existence.

Do not exchange the soft starter input and output power connections.

Otherwise, excessive voltage could be found in the logic control circuit.



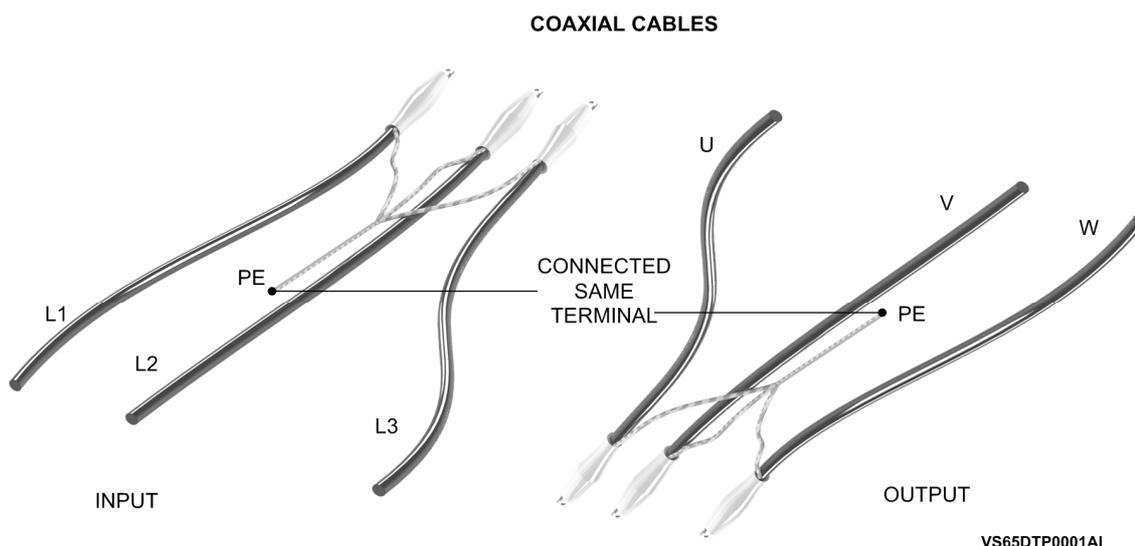
SAFETY

COMMISSIONING

- Before commissioning the soft starter, the user must read carefully this manual and pay particular attention to the connection and start sections.
- Verify all of the parameters and make the necessary settings before starting the equipment. Depending on load and applications, the parameter values can be changed.
- Voltage and current levels applied in terminals as external signs should be in accordance with the manual data. Otherwise, the soft starter could be damaged.

GROUND CONNECTIONS

- Electric shock prevention:
The soft starter locker chassis must be properly earth ground connected to prevent a possible electric shock even when a leakage current flows through the locker. Disconnect all of the voltage supplies before proceeding with maintenance operations within the soft starter or motor. Due to the existence of capacitors in the power section, the equipment will keep dangerous voltage even when the input voltage is disconnected. Use a cable to earth-ground it and discharge the existing voltage.
- Only connect the earth grounding to the soft starter earth plate. Do not use the case or the chassis screw for grounding.
- The earth protection cable must be connected first and disconnected last.
- The motor earth grounding will be connected to the soft starters' one and not to the installations one.
- The installations earth grounding will be connected to the soft starters' one.
- Equipment input cables are medium voltage cables. As shown in the figure, they are coaxial cables, each one including earth. To carry out with a correct connection it is necessary to join every phase's earth and connect it to the soft starters' earth plate.
- The output cables to the motor have the same characteristics. Their earths should also be joined and connected to the soft starters earth plate **IN THE SAME TERMINAL** than the input cables.



- After a short-circuit occurrence, examine the ground connection circuit because it can be damaged and probably some or all the parts need to be replaced.



WARNINGS

RECEPTION

- The VS65 Series soft starters are handled carefully, tested and perfectly packed before delivering.
 - In the event of transport damage, please ensure that you notify the transport agency and Power Electronics: 902 40 20 70 (International + 34 96 136 65 57).
-

UNPACKING

- Verify model and serial number of the soft starter is the same on the box, delivery note and unit.
 - Each soft starter is supplied with an installation manual.
-

RECYCLING

- Packing of the equipments should be recycled. Therefore, it is necessary to separate materials included (plastic, paper, cardboard, Wood....) and deposit them on proper recycling banks.
 - Waste products of electric and electronic devices should be selectively collected for their correct environmental management.
-

SAFETY

- Before starting the soft starter, read this manual completely to gain an understanding of the unit. In case of doubt, please contact Power Electronics (902 40 20 70 / +34 96 136 65 57) or your nearest agent.
 - Wear safety goggles when operating the soft starter with voltage.
 - Handle the equipment in accordance with the soft starters' weight.
 - Proceed with the installation according to the instructions found in this manual.
 - Do not stack the soft starter or place heavy objects on the soft starter.
 - Ensure that the soft starter is correctly installed considering the recommendations within this manual.
 - Do not drop the soft starter or to impact exposure.
 - The VS65 Series soft starters contain static-sensitive printed circuit boards. Use static safety procedures when handling boards.
 - Avoid installing the soft starter in different conditions from those described in the Technical Characteristics section.
-

1. INTRODUCTION

The VS65 Medium Voltage Soft starter has been designed to start, stop, protect and control medium voltage AC motors. The VS65 integrates as standard SCR stacks, Snubber circuit, trigger circuit, line and bypass vacuum contactors, fiber optics interconnections and control board, and a easy user interface, that make the VS65 MV Soft starter the most complete, reliable and safety soft starter.

Additionally, its modular design permits to integrate additional features such as fuses, ground fault monitoring relay, metal-clad systems, circuit breakers, etc.

STANDARD FEATURES

User friendly Alphanumeric Display

Multiple motor protection options: Input phases sequence, High Voltage, Input Low Voltage, Start current limit, Rotor locked, Motor overload (thermal model), Under load, Unbalanced phases , Shearpin current, Maximum number of starts/hour, water hammer control, PTC input.

Complete soft starter protection: SCR overheat, Excessive start time (max 120s), Input phase loss.

Modbus field Bus standard and optional digital and analogue I/O

In Line and Bypass vacuum contactors

Multiple control push buttons and indicators

Multiple starting and stopping modes

Dual setting pre-configuration

Local and remote start and stop

OPTIONAL FEATURES

Overcurrent protection with fuses or Automatic Circuit Breaker

Ground fault monitoring relay

Power Stage and protections Metal-Clad system

IP54 Degree of protection

Communication protocols (Profibus DP, Devicenet, Ethernet, N2 Metasys, others)



Figure 1.1: VS65 soft starter

2. CONFIGURATION TABLE & STANDARD RATINGS

2.1. Configuration table

Example of the selection table module soft starter VS65

CODE: VS6520064CLT

VS65	200		6		4		CL		T		-		-	
VS65 Series	Output current ^[1]		Input voltage		Protection degree		Configuration		Power cable access		Fuses		Metal-Clad	
	200	200 ^a	2	2300V	4	IP41	CL	Fixed line contactor	-	Bottom input and output connection	-	No fuses	-	Without Metal-Clad
	400	400 ^a	3	3000V 3300V	5 ^[3]	IP54	CX	Removable line contactor	T	Top input and bottom output connection	F ^[3]	With fuses	M ^[3]	With Metal-Clad
	4	4160V			C ^[2]	Without line contactor	U	Top input and output connection				
			6	6000V 6600V										
			8	10000V 11000V										
			-	Under request										

Notes:

- [1] Check the rated current of the motor nameplate to guarantee the compatibility with the selected soft starter.
- [2] In these cases it is required an additional input protection cell.
- [3] Consult availability with Power Electronics.

2.2. Standard ratings

MODELS VS65 2.3kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) [1]	(HP)
VS65040 2	40	149	200
VS65050 2	50	186	250
VS65060 2	60	224	300
VS65070 2	70	261	350
VS65090 2	90	298	400
VS65100 2	100	336	450
VS65110 2	110	373	500
VS65130 2	130	447	600
VS65150 2	150	522	700
VS65170 2	170	597	800
VS65190 2	190	671	900
VS65210 2	210	746	1000
VS65270 2	270	932	1250
VS65320 2	320	1119	1500
VS65370 2	370	1305	1750
VS65420 2	420	1491	2000
VS65480 2	480	1678	2250
VS65530 2	530	1864	2500
VS65590 2	590	2051	2750
VS65640 2	640	2237	3000
VS65740 2	740	2610	3500

[1] kW standard motor rated power ($\cos \varphi = 0.88$, 2.3kV)

MODELS VS65 3kV – 3.3kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) [2]	(HP)
VS65040 3	40	200	268
VS65050 3	50	250	335
VS65060 3	60	315	422
VS65070 3	70	355	476
VS65080 3	80	400	536
VS65090 3	90	450	603
VS65100 3	100	500	670
VS65110 3	110	560	751
VS65120 3	120	630	845
VS65140 3	140	710	952
VS65160 3	160	800	1073
VS65180 3	180	900	1207
VS65200 3	200	1000	1341
VS65250 3	250	1250	1676
VS65280 3	280	1400	1877
VS65320 3	320	1600	2145
VS65360 3	360	1800	2413
VS65400 3	400	2000	2681
VS65450 3	450	2240	3003
VS65500 3	500	2500	3352
VS65560 3	560	2800	3754
VS65630 3	630	3150	4223

[2] kW standard motor rated power ($\cos \varphi = 0.88$, 3.3kV)

MODELS VS65 4.16kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW)	(HP) [3]
VS65050 4	50	298	400
VS65055 4	55	336	450
VS65060 4	60	373	500
VS65070 4	70	447	600
VS65080 4	80	522	700
VS65095 4	95	597	800
VS65110 4	110	671	900
VS65120 4	120	746	1000
VS65150 4	150	932	1250
VS65180 4	180	1119	1500
VS65210 4	210	1305	1750
VS65240 4	240	1491	2000
VS65270 4	270	1678	2250
VS65300 4	300	1864	2500
VS65320 4	320	2051	2750
VS65350 4	350	2237	3000
VS65410 4	410	2610	3500
VS65470 4	470	2983	4000
VS65530 4	530	3356	4500
VS65590 4	590	3728	5000
VS65650 4	650	4101	5500
VS65700 4	700	4474	6000

[3] HP standard motor rated power ($\cos \phi = 0.88$, 4.16kV)

MODELS VS65 6kV – 6.6kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) [4]	(HP)
VS65040 6	40	400	536
VS65045 6	45	450	603
VS65050 6	50	500	671
VS65055 6	55	560	751
VS65060 6	60	630	845
VS65070 6	70	710	952
VS65080 6	80	800	1073
VS65090 6	90	900	1207
VS65100 6	100	1000	1341
VS65125 6	125	1250	1676
VS65140 6	140	1400	1877
VS65160 6	160	1600	2146
VS65180 6	180	1800	2414
VS65200 6	200	2000	2682
VS65220 6	220	2240	3004
VS65250 6	250	2500	3353
VS65280 6	280	2800	3755
VS65300 6	300	3150	4224
VS65350 6	350	3550	4761
VS65400 6	400	4000	5364
VS65450 6	450	4500	6035
VS65500 6	500	5000	6705
VS65560 6	560	5600	7510
VS65630 6	630	6300	8449

[4] kW standard motor rated power ($\cos \phi = 0.88$, 6.6kV)

MODELS VS65 10kV – 11kV			
CODE	NOMINAL CURRENT (A)	MOTOR POWER	
		(kW) [5]	(HP)
VS65020 6	20	400	536
VS65025 6	25	450	603
VS65030 6	30	500	671
VS65035 6	35	560	751
VS65040 6	40	630	845
VS65050 6	50	710	952
VS65055 6	55	800	1073
VS65060 6	60	900	1207
VS65075 6	75	1000	1341
VS65085 6	85	1250	1676
VS65095 6	95	1400	1877
VS65110 6	110	1600	2146
VS65120 6	120	1800	2414
VS65135 6	135	2000	2682
VS65150 6	150	2240	3004
VS65170 6	170	2500	3353
VS65190 6	190	2800	3755
VS65210 6	210	3150	4224
VS65240 6	240	3550	4761
VS65270 6	270	4000	5364
VS65300 6	300	4500	6035
VS65340 6	340	5000	6705
VS65380 6	380	5600	7510

[5] kW standard motor rated power ($\cos \phi = 0.88$, 11kV)

3. TECHNICAL CHARACTERISTICS

INPUT	Input voltage	2300VAC, 3000VAC-3300VAC, 4160VAC, 6000VAC-6600VAC, 10000VAC-11000VAC [1]
	Input frequency	47 ~ 62Hz
	Control voltage	230VAC ±10%, 50Hz
OUTPUT	Motor output voltage	2300VAC, 3000VAC-3300VAC, 4160VAC, 6000VAC-6600VAC, 10000VAC-11000VAC
	Output Frequency	47 ~ 62Hz
	Efficiency full load)	> 99.6%, 100% with Bypass
GENERAL DATA	Overload	125% of the continuous rated value 100% to 500% (during 1 ~ 60s configurable)
	Phase sequence	Compatible with any phase sequence
	Transitory over voltage protection	Snubber network
	Cooling system	Natural
	Bypass contactor	Powerful enough to start the motor in direct start mode.
	Metal-Clad (optional)	Power Stage (SCR's) and protections
	Input Protection (optional)	Fuses
ENVIRONMENTAL PROTECTION	Protection degree [1]	IP41, IP54 (optional)
	Work temperature	0°C to +50°C
	Storage temperature	-25°C to +55°C
	Humidity	5% - 95%, Without condensation
	Height [1]	1000m, Without derating
INTERCONNECTION	Digital inputs	5 configurable inputs
	Analogue inputs	2 analogue inputs of 0-20mA or 4-20mA, 0-10V
	Output relays	3 switched relays (non-inductive 10A 250Vac)
	Analogue outputs	1 configurable output 0-20mA or 4-20mA
OPERATION MODES [2]	Starting modes	Current limit starting Current ramp and current limit starting Dynamic torque control Direct starting Initial torque pulse starting
	Stop modes	Inertia stop Stop with voltage ramp
KEYPAD AND CONTROL PUSH BUTTONS	Keypad	Backlit, alphanumeric 2x16 characters
		5 keys: start, stop, access and scroll menu
		Status leds: ON: Green. Turned on indicates there is voltage in the control boards. RUN: Orange. Flashing shows when the motor accelerates or decelerates. When turned on indicates the motor is working. FAULT: Red. Indicates fault.
	Control door buttons	3 push buttons: Start, Stop and emergency stop
		1 starting mode selector
		5 status pilots (running, stopped, ready, power supply, alarm)
	Input module (optional)	7 status pilots (Power supply L1/L2/L3, MV switches status on/off/loaded, control voltage supply)
		3 push buttons: switch status, connection and disconnection 1 MV connection lock selector
	Display information	Current of the three phases
		Line average voltage
Digital inputs and relays status		
Analogue inputs and outputs status		
Power supply and motor frequency		
Power factor		
Developed torque and power		
Fault history (5 last faults)		
Total and partial starts number		
Total and partial operation hours		
Partial motor consumption		

[1] For other voltages consult with Power Electronics.

[2] For other configurations consult with Power Electronics.

GENERAL FEATURES	Colour (Metal Parts)	RAL 7032
	Corrosion Protection	C4 in accordance with ISO 12944-2
	Painting duration	H in accordance with ISO 12944-1
	Input and output holes for cabling	Yes, access from above
COMMUNICATION	Standard Hardware	RS232 / RS485
	Optional Hardware	Ethernet
	Standard Protocol	Modbus-RTU
	Optional Protocol	Profibus DP, Devicenet, Ethernet, N2 Metasys
	Control modes	Local: from keyboard Remote: from the digital and analogic inputs PLC: start / stop
MOTOR PROTECTIONS	Input phases sequence	
	High Voltage	
	Input Low Voltage	
	Start current limit	
	Rotor locked	
	Motor overload (thermal model)	
	Under load	
	Unbalanced phases	
	Shearpin current	
	Maximum number of starts/hour	
SOFT STARTER PROTECTIONS	SCR overheat	
	Excessive start time (max 120s)	
	Input phase loss	
SOFT STARTER SETTINGS	Torque pulse	
	Initial torque	
	Initial torque time	
	Acceleration time	
	Current limit: 1 to 5·In	
	Overload: 0.8 to 1.2·In, Overload curve: 0 to 10	
	Deceleration time / Freewheel stop	
	Slow Speed(1/7 fundamental frequency)	
	Dual setting	
	Number of Starts/hour allowed	
	Torque control	
Water hammer control stop		
REGULATIONS	Certification	CE
	Designed as	EMC Directive (2004/108/CE) EN61000-6-2, -4
	Design and construction	EN62271-1,-200
		EN60071-1,-2

3.1. Topology

The VS65 soft starter is divided in four sections that isolate the medium voltage from the low voltage cabinets. The following image shows where the main soft starter components are placed.

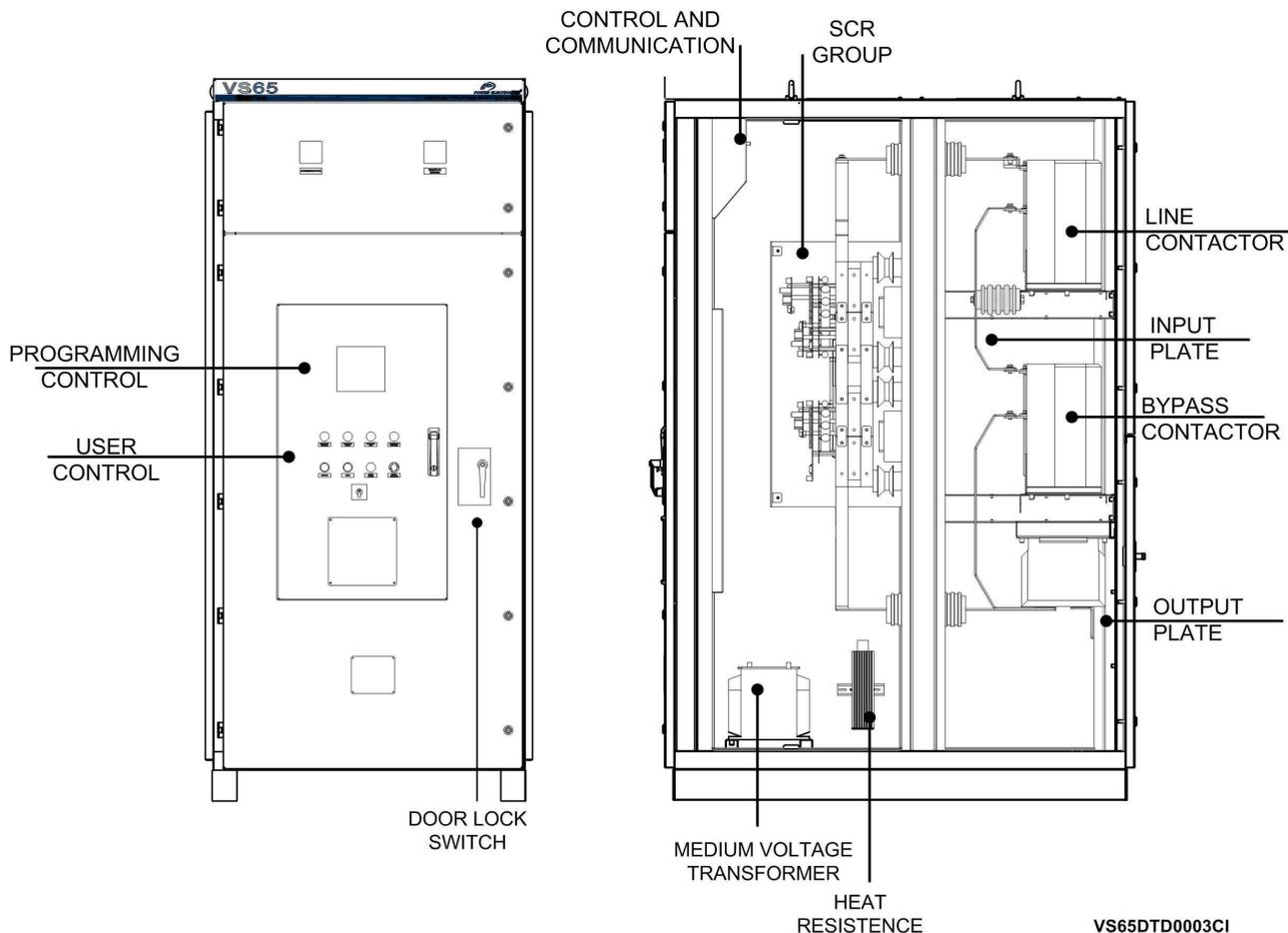


Figure 3.1 Inner view- Main components

o **Power stage with SCR modules.**

Integrated in antiparallel and connected in series among themselves depending on the rated motor voltage.

Voltage	Pairs in series	Total SCR	Inverse Peak Voltage
2300V	1	6	6500V
3300V / 4160V	2	12	13000V
6000V / 6600V	3	18	19500V

o **Snubber Circuit**

The soft starter integrates dynamic voltage balanced circuits that protect and balance the current through the SCR's.

o **Trigger circuit:**

Provides trigger pulses to in order to control the SCR firing. Both the trigger circuit and the SCR are connected to the medium voltage side and separated from the control board and the transformer by fiber optics.

o **Line vacuum Contactor:**

The line contactor isolate the SCR once the motor is started, increasing the thyristor protection and lifetime. It will activate when the run sequence command is received by the equipment. When the soft starter receives the stop command, it will not open the line contactor until the soft starter has stopped the motor. The status of the contactor can be seen through its dedicated window.

Note: When the customer selects the input module option equipped with circuit breaker, the line contactor will not be included in the soft starter because its function will be assumed by the circuit breaker.

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o **Bypass vacuum contactor:**

After the SS starts the motor, the bypass contactor will close allowing the current flow to the motor through the bypass contactor placing the SCR in bypass. When the soft starter receives a stop command, the bypass contactor will open allowing the soft starter to make a soft motor stop.

o **Fuses (Optional)**

The SS could optionally include input overcurrent protection with fuses. Check the maximum interrupting to ensure the compatibility with the connection point.

o **Ground Fault Monitoring Relay (Optional)**

Although the SS integrate as standard a current unbalance protection, it can be equipped with an optional ground fault monitoring relay that fulfills safety installation requirements.

o **User interface**

The VS65 SS integrates as standard multiple door push buttons and pilots (Start, Stop, ready ...) and an alphanumeric display suitable for industrial environments. Additionally, it is available with multiple communication interfaces and analog and digital I/O.

3.2. Operating Principles

The VS65 has a microcontroller as control nucleus which can start and protect the motor. The CPU is able to control and trigger the SCR phase degree. The effective voltage applied to the motor is controlled by controlling the thyristor trigger instant. This way, the torque is smoothly increased until the motor spinning rated speed is reached after the acceleration ramp.

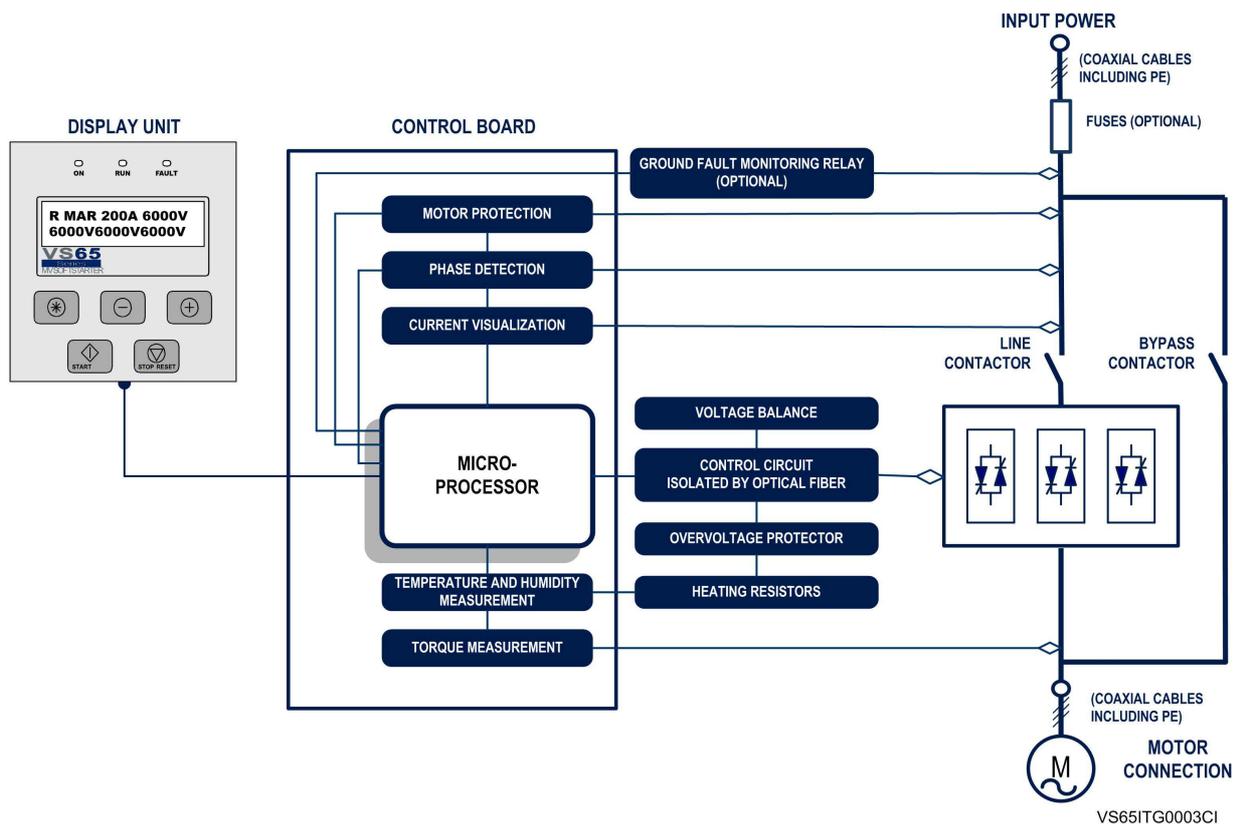


Figure 3.2 Block diagram example

3.3. Connection Diagrams

3.3.1. General Power Connection Diagram

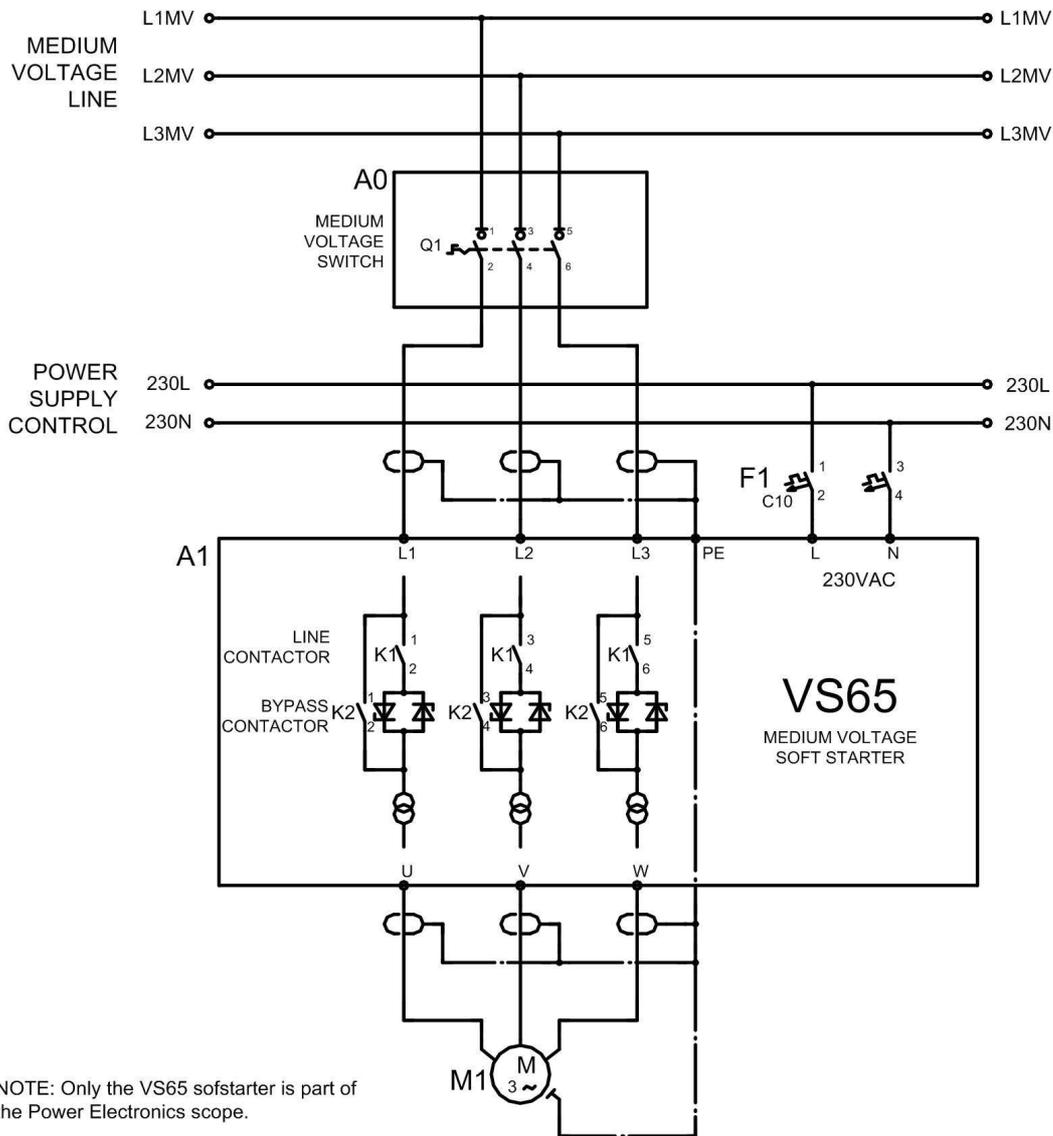


Figure 3.3 General Power Connection diagram

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MEDIUM VOLTAGE SWITCHGEAR

To compliance with IEC-62271-200 The user must connect the soft starter through a medium voltage switchgear equipped with a switch and a ground connection that permits a visible cut between the SS and the MV line. Additionally it must be equipped with a mechanical interlock and padlock to avoid mal-function or unexpected reconections. The installer must ensure that VS65 doors cannot be opened without the protection cell activated and locked.

GROUND FAULT MONITORING

The VS65 SS can optionally be equipped with a ground fault monitoring relay. The installer must ensure the current unbalance threshold to ensure personal safety and fire protection according to the local regulations.

OVER VOLTAGE PROTECTIONS

It is recommended the installation of surge arrester to ground to protect against transient overvoltages. The surge arrester must have rated voltage greater than the drive voltage range to prevent its operation during normal conditions.

3.3.2. General Connection for Reactive Compensation (optional)

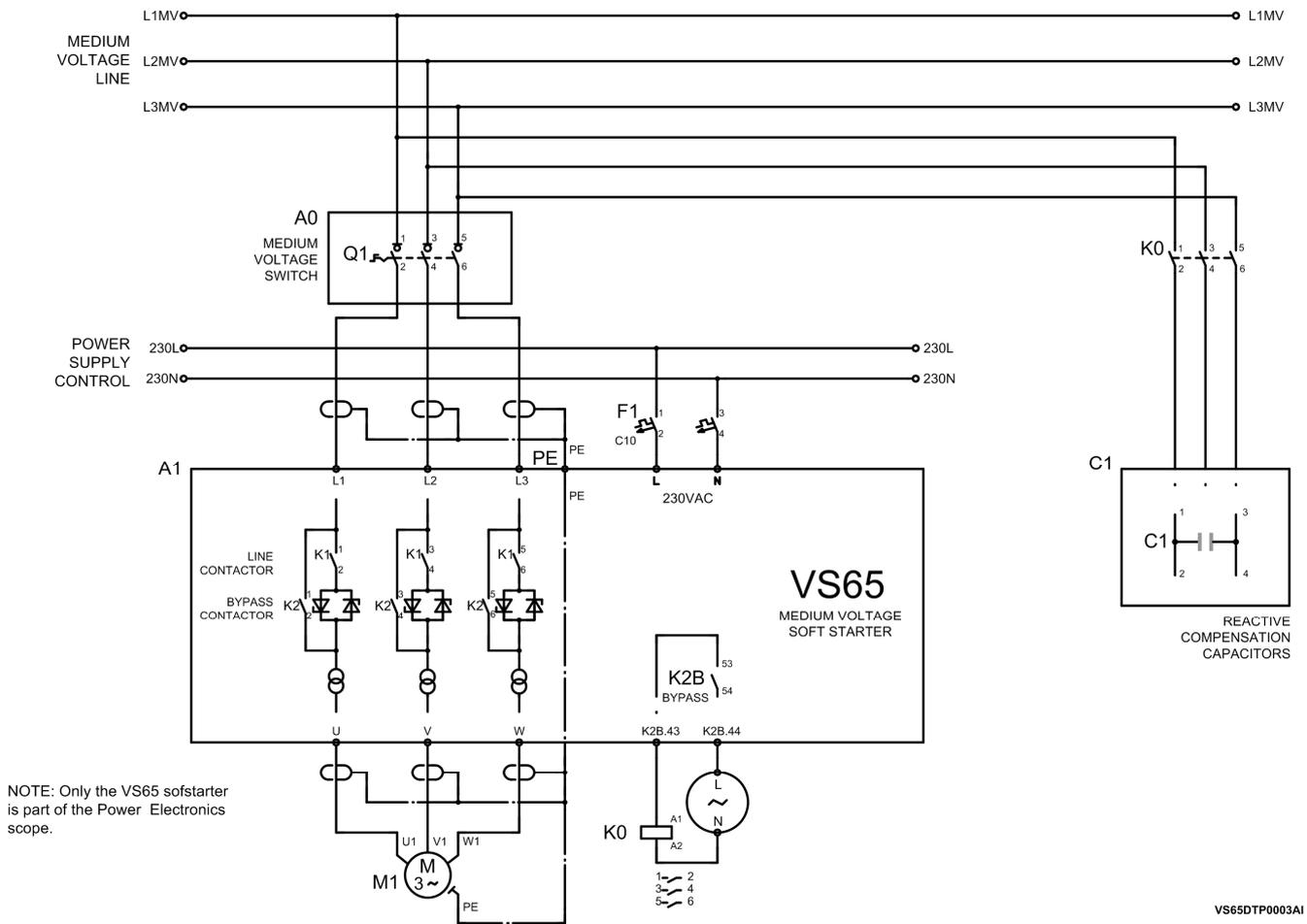


Figure 5.5 Reactive Connection



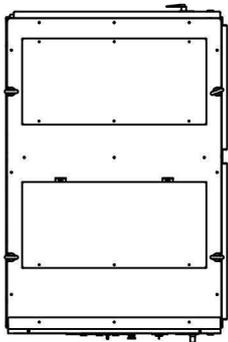
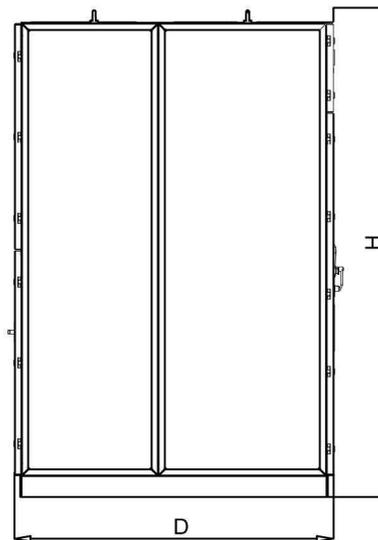
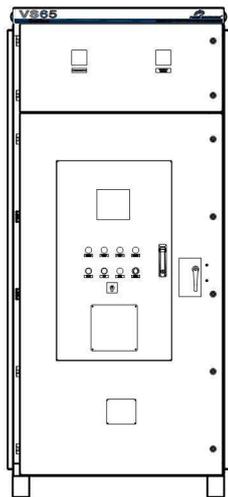
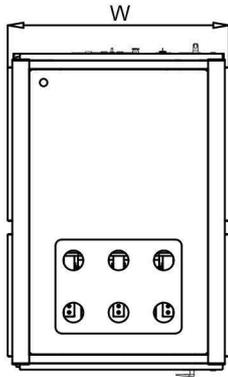
CAUTION

Capacitors must be always connected to the VS65 input and never to the output. The capacitor must be equipped with a contactor (K0) that must be controlled by the bypass relay of the VS65 SS. It will be closed after the soft starting sequence has been completed. In the case of reactive compensation capacitors connection, consult Power Electronics, the bypass relay of the VS65 SS would be installed under request. For further information consult Software and Programming manual.

Otherwise It could cause damage to the equipment and lead to injury to people.

4. DIMENSIONS

CONFIGURATION	DIMENSIONS (mm)			WEIGHT (kg)
	HEIGHT (H)	WIDTH (W)	DEPTH (D)	
CL / C	2300	1050	1520	1100



VS65DTD0001C

Figure 4.1 VS65 general dimensions

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5. HANDLING, TRANSPORTATION AND INSTALLATION

Read carefully the following installations and system commissioning instructions for a correct mechanical and electrical installation.

5.1. Environmental Ratings

An adequate installation should ensure a normal working and lifetime. The VS65 soft starters must be installed in locations under the following conditions:

- Protection degree: IP41
- Working temperature: 0°C to +50°C.
- Humidity: 5~95% without condensation. (Optionally equipped with heating resistors)
- Keep apart from scrap, conductive dust and corrosive gases.
- Height: Up to 1000m (For higher altitude, please contact Power Electronics.)

5.2. Reception and Storage

The VS65 series soft starters are carefully tested and perfectly packed before delivering. In the event of transport damage, please ensure that you notify the transport agency and Power Electronics: 902 40 20 70 (International +34 96 136 65 57) or your nearest agent, within 24hrs from receipt of the goods.

Make sure model and serial number of the Inverter are the same on the box, delivery note and unit.

The storage of the inverter should be sun and moisture protected and with an ambient temperature between -20°C and +50°C.

5.3. Handling and Transportation

The VS65 is transported in vertical position. Do not stack equipments. After the reception, do not store the equipment outside and keep them in a dry and ventilated room.

The equipment is designed to be transported with a forklift truck from above or with a crane from the top eyebolts.



CAUTION

If the maximum tonnage of the transport elements cannot meet the requirement, it could cause damage to the equipment and lead to injury to people.

During transportation and handling the goods should not be exposed to moisture, overturned, inverted, tilted or impacted, the tilting angle should be no more than 30°. Avoid brusque movements and shocks during transportation, especially when lowering.

In case of using a forklift truck, take care about the load distribution, the use of a safety strap or tension belts are recommended.

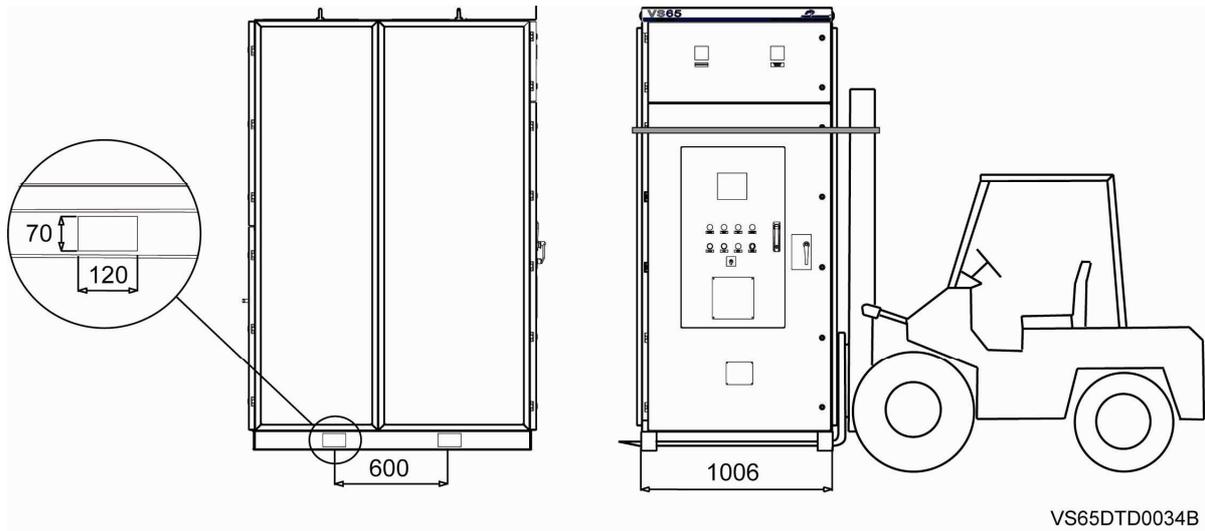


Figure 5.1 VS65 Forklift truck transportation

When lifting the soft starter using a crane, first gradually lift the wires until they become taut. The use of spreaders is recommended. Lift the SS up or down slowly. At the time of placing the SS on the floor, stop lowering it just before reaching the floor and then slowly lower it on the floor to avoid any shock

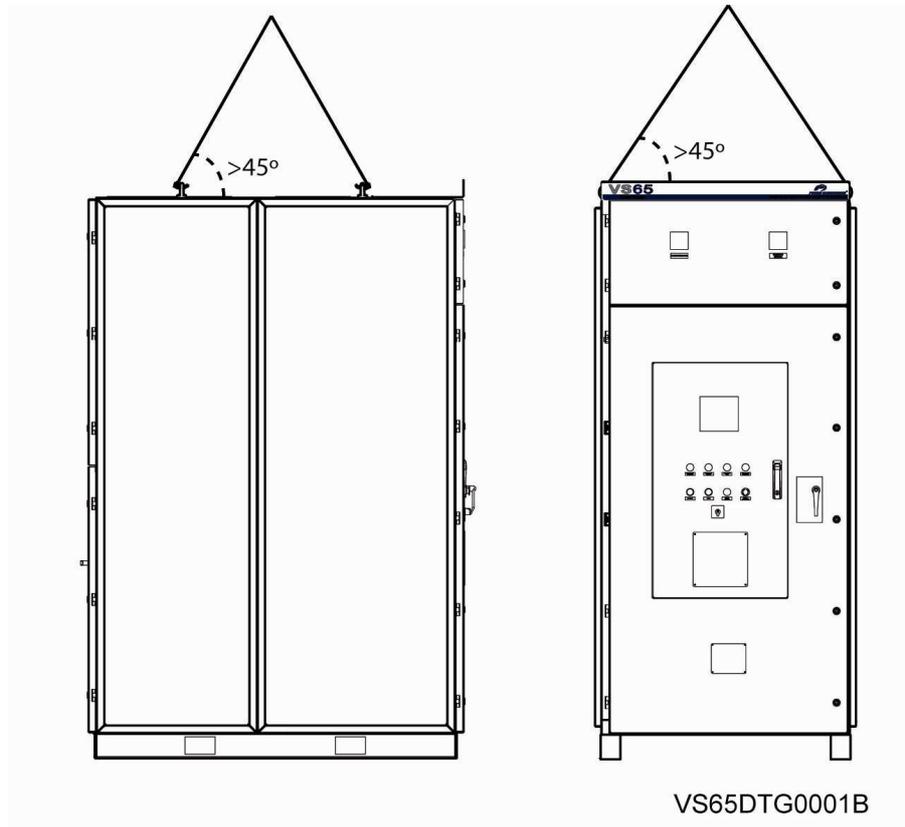


Figure 5.2 VS65 crane transportation

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5.4. Installation requirements

The following figure shows the safety clearance that the user must keep in the installation. It will be necessary to keep a frontal, back and upper distance at least as the one shown in the figure. The equipment can be placed one attached to another without leaving any distance between them.

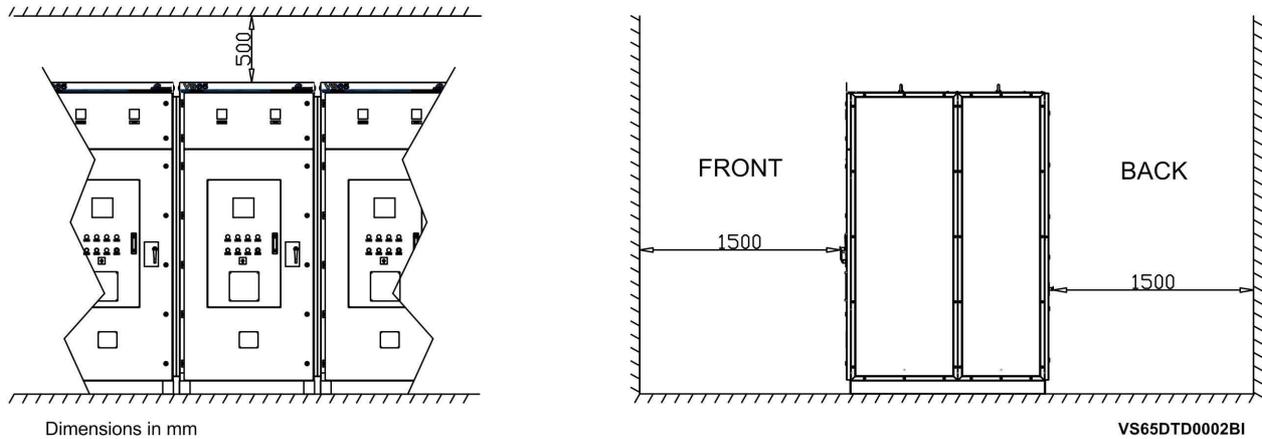


Figure 5.3 Soft starter safety clearances. Frontal and side view.

The foundations must ensure a plain, levelled solid surface to the soft starter's weight. To ensure the degree of protection for the cabinet use the original bottom plates delivered with the unit. With user-defined cable entries, take care of the degree of protection and fire protection.

5.5. EMC Emissions/Immunity and noise levels

The VS65 soft starters are in compliance with EN 61000-6-2,-4; EN 61000-3-4 that defines EMC emissions and immunity levels for control low voltage circuits.

6. WIRING ACCESS AND CONNECTION

6.1. Electrical Protections

6.1.1. Short circuit – Fuses (Optional)

The VS65 soft starter optionally includes input protection fuses. One fuse per phase provides overcurrent protection to the equipment. The main characteristics of these fuses are shown in the next table.

Fuse Rated Current	2.3kV to 3.3kV				
	Power Fuse	Fuse holder	Rated Voltage (kV)	Rated Interrupting Current (kA)	Lowest Interrupting Current
50A	LFL-3G-50B	LFH-6G-D1HB	3.6	40	4In
63A	LFL-3G-60B	LFH-6G-D1HB			
75A	LFL-3G-75B	LFH-6G-D1HB			
100A	LFL-3G-100B	LFH-6G-D1HB			
125A	LFL-3G-125B	LFH-6G-D1HB			
160A	LFL-3G-160B	LFH-6G-D2HB			
200A	LFL-3G-200B	LFH-6G-D2HB			
>200A	Consult with Power Electronics.				

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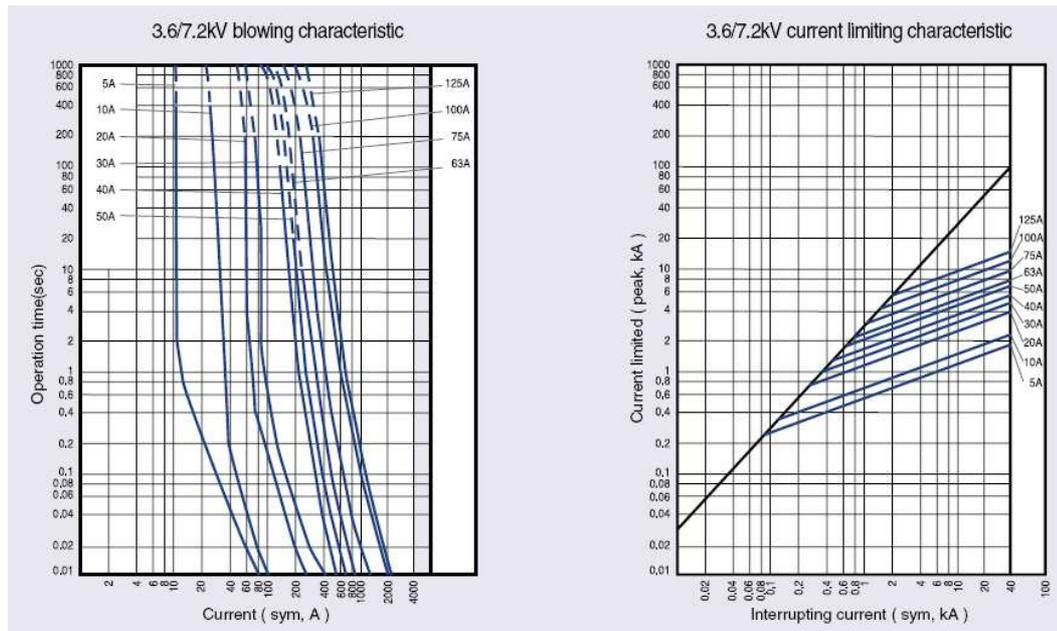


Figure 6.1 Fuse characteristics $I_n < 125A$ (Source: LS System Industries Co.)

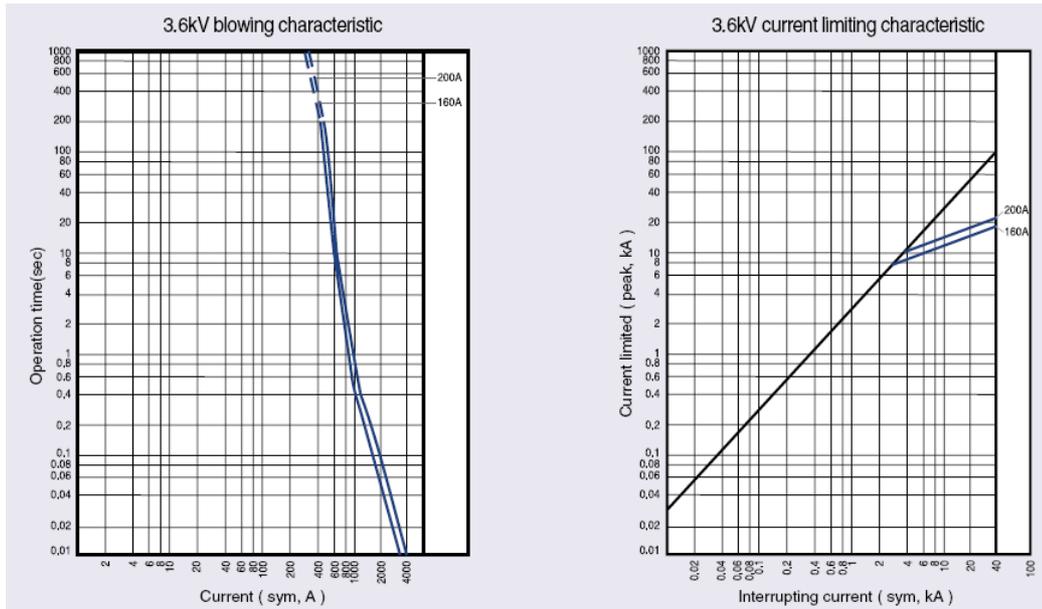


Figure 6.2 Fuse characteristics (160A, 200A) (Source: LS System Industries Co.)

Fuse Rated Current	4.16kV to 6.6kV				
	Power Fuse	Fuse holder	Rated Voltage	Rated Interrupting Current	Lowest Interrupting Current
50A	LFL-6G-50B	LFH-6G-D1HB	7.2kV	40kA	4In
63A	LFL-6G-60B	LFH-6G-D1HB			
75A	LFL-6G-75B	LFH-6G-D1HB			
100A	LFL-6G-100B	LFH-6G-D1HB			
125A	LFL-6G-125B	LFH-6G-D1HB			
160A	LFL-6G-160B	LFH-6G-D2HB			
200A	LFL 6G 200B	LFH-6G-D2HB			
>200A	Consult with Power Electronics.				

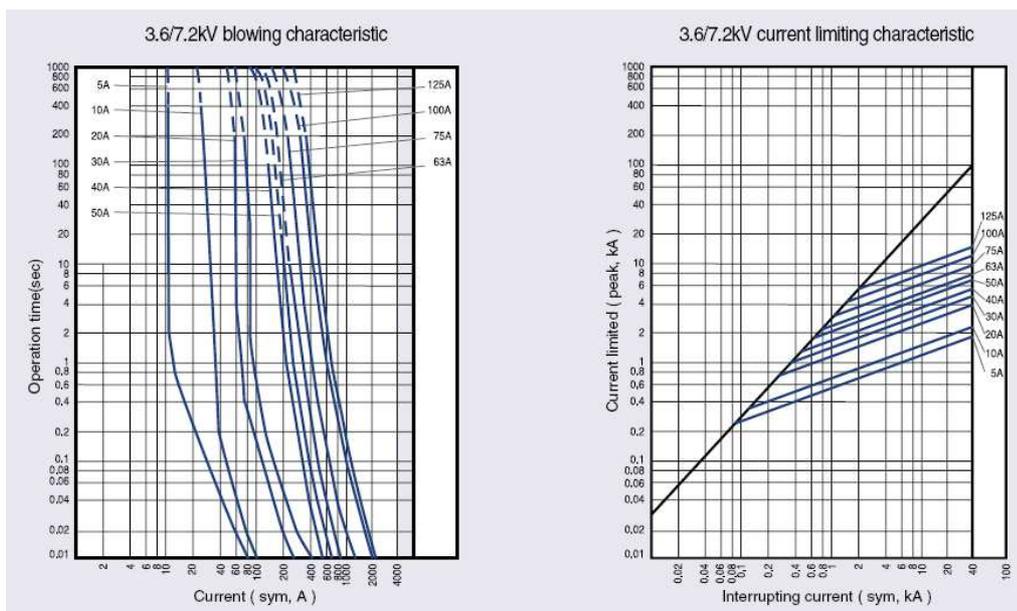


Figure 6.3 Fuse characteristics $I_n \leq 125A$ (Source: LS System Industries Co.)

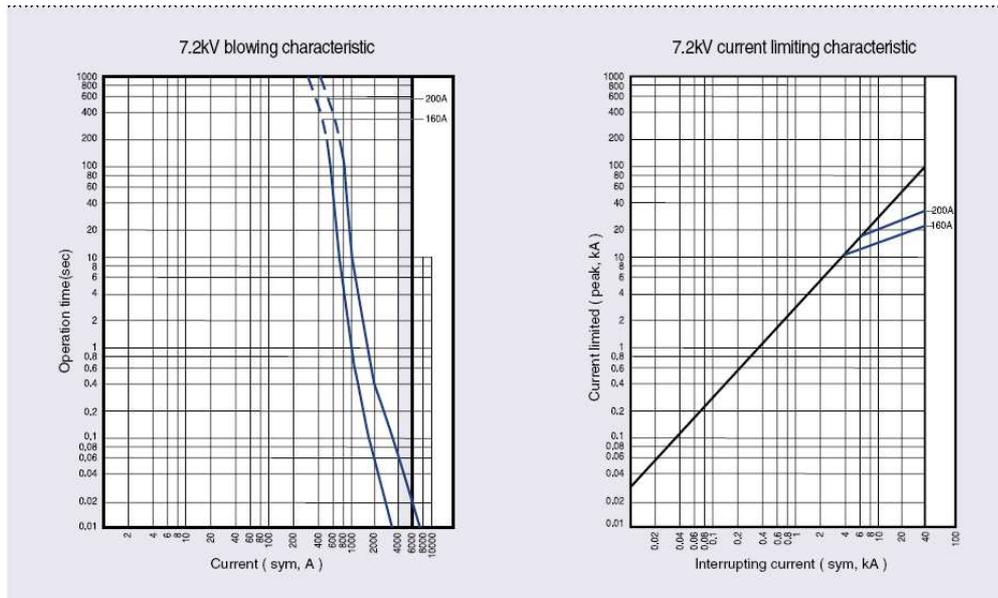


Figure 6.4 Fuse characteristics (160A, 200A)-7.2kV (Source: LS System Industries Co.)

Therefore, it is not recommended to install the soft starter in points where the short-circuit current available is higher than 40kA. If so, install general fuses with a greater breaking capacity and with fastest interrupting capacity.

6.1.2. Ground fault protection relay (Optional)

The VS65 SS integrates as standard a current imbalanced protection with a threshold of 40%. Optionally it can include an electronic earth leakage protection relay. The relay measures the sum of the three phase input currents through the input toroid. When the current imbalance is greater than the configured threshold the soft starter will perform an emergency STOP opening the bypass contactor.



SAFETY

GROUND FAULT MONITORING

The installer must ensure the current imbalance threshold to ensure personal safety and fire protection according to the local regulations.

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6.1.3. Contactors

The VS65 SS with a rated current <400A is equipped with a line vacuum contactor and a bypass vacuum contactor, both are selected according to the rated voltage and the configuration (removable or fix). The contactors enables to performance the starting and stopping sequence, and to interrupt the supply under normal conditions. The following table summarizes the characteristics.

2.3kV to 3.3kV					
Contactor Rated Current	Rated Voltage	Rated Breaking Current	Rated short-time Current	Closing time (ms)	Trip time (ms)
200	3.6kV	4kA	2.4kA-30s, 4kA-10s, 6kA-2s, 6.3kA-1s, 8kA-0.5s, 10kA-0.1s	145	35
400					
>400A	Consult with Power Electronics.				

4.16kV to 6.6kV					
Contactor Rated Current	Rated Voltage	Rated Breaking Current	Rated short-time Current	Closing time (ms)	Trip time (ms)
200	7.2kV	4kA	2.4kA-30s, 4kA-10s, 6kA-2s, 6.3kA-1s, 8kA-0.5s, 10kA-0.1s	145	35
400					
>400A	Consult with Power Electronics.				

6.1.4. General Protections

The VS65 integrate as standard multiple protections such us phase sequence, overload, underload, shearpin current, PTC signal, start limits, and other. Further information about functional operation and configuration can be found in Software and Programming manual.

6.2. Wiring Access

The following figures show the access to the VS65 soft starter power terminals to connect the input power supply and the motor output cables, which is found in the back part of the equipment. As shown in the images below, in the bottom part we find the plate with the necessary cable pass.

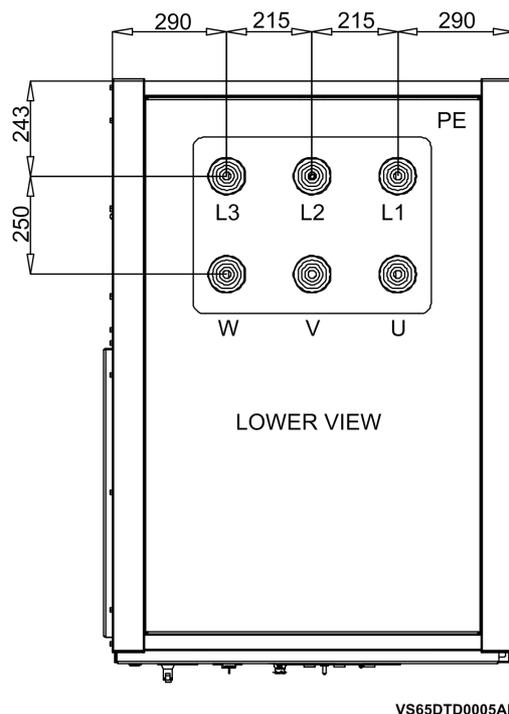


Figure 6.5 Power terminals access from below

The following figures describe the soft starter input and output access terminals.

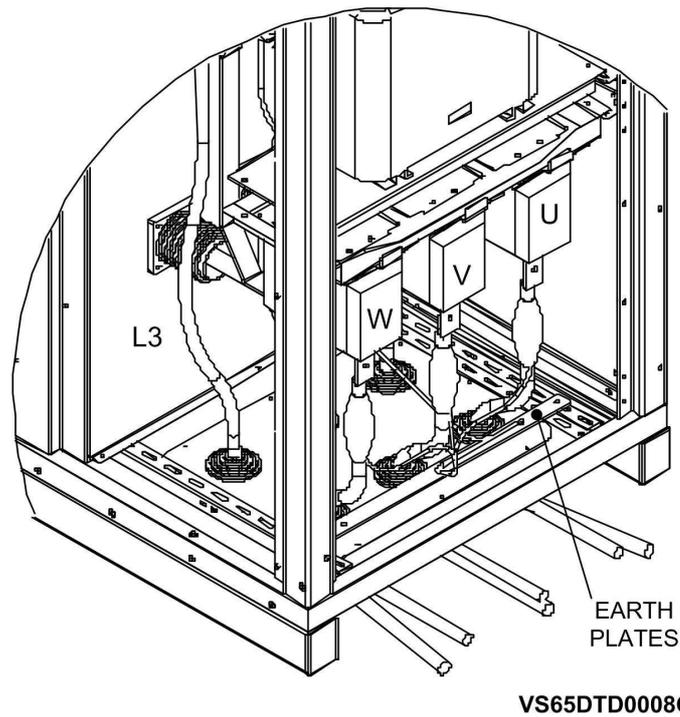


Figure 6.6 Power cables internal wiring

The VS65 is equipped with internal wiring ducts that permit the user to route the different control, signal or data cables, without interferences. The user should pass the control cables from above and route the cables to the user terminals located in the upper cabinet. To enter the cables, a hole will be prepared on the bottom left of the soft starter cabinet.

6.3. Power and PE terminals

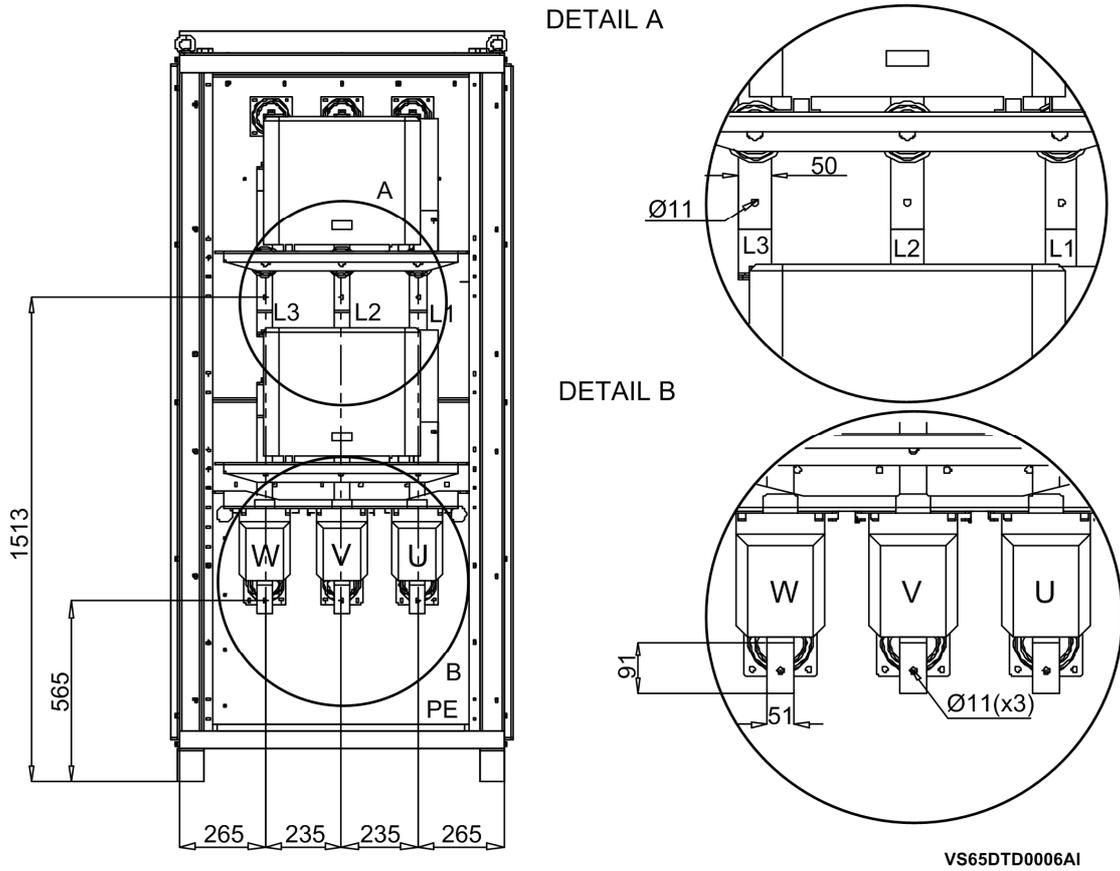
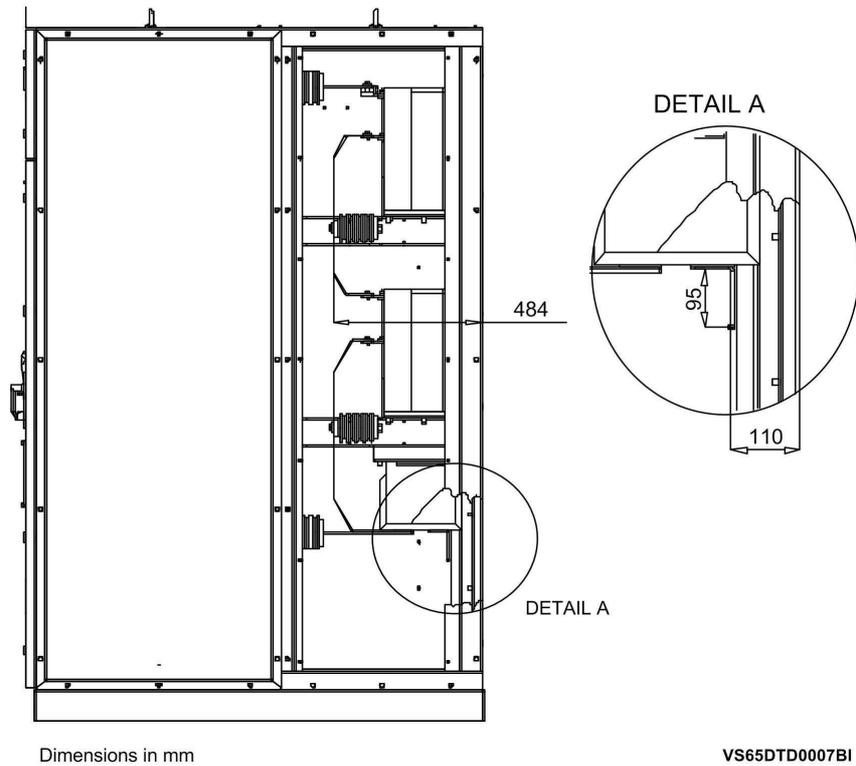


Figure 6.8 Power terminals description



Dimensions in mm

Figure 6.9 Power terminals

6.4. Wiring recommendations



CAUTION

The installation must be done by qualified personal.

Otherwise, the equipment can be damaged and lead to injury to people.

The VS65 series soft starters are built-in an earth busbar. First of all, connect the input and output shields, and the motor earth to the earth busbar of the soft starter (PE).

Connect the three input phases to the L1, L2 y L3 input terminals. Connect the three motor phases to the U, V and W output terminals. These terminals are located on the back part of the soft starter, as it has been described on the previous section.

The copper bars or the cables must satisfy the intensity capacity rule and the isolation voltage.

The cables installation must respect the minimum safety clearance between the plates and the equipment as shown in the following figure.

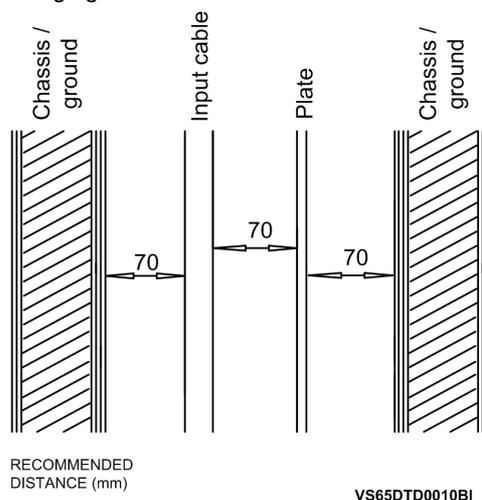


Figure 6.10 Input cables safety distance



CAUTION

In any case the distance between plates and equipment should never be smaller than 60mm

Torque specifications for MV power connections in VS65 soft starter:

Bolt size	Torque at full engagement (Nm)
M10	40
M12	60



CAUTION

Line voltage (input supply) must never be connected to U, V and W terminals. Otherwise, the drive will be damaged.

It is absolutely necessary that the installer guaranties the correct observance of the law and the regulations that are in force in those countries or areas where this device is going to be installed.

For safety reasons it is determinant to measure the grounding resistance of the plant itself. This must be established before the first start up of the plant and with the drive disconnected.

It is responsibility of the installer, to provide the adequate number, type and cross section grounding conductor alongside with the characteristics of the drive used and of the Plant in order to minimize the grounding resistance, that compliance with the local and national regulation.

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6.5. Control Terminals

The user interconnection switch (X4) is located in the frontal upper part of the locker, where the available control signs are found in accordance with the diagram attached.

For other configuration, contact Power Electronics.

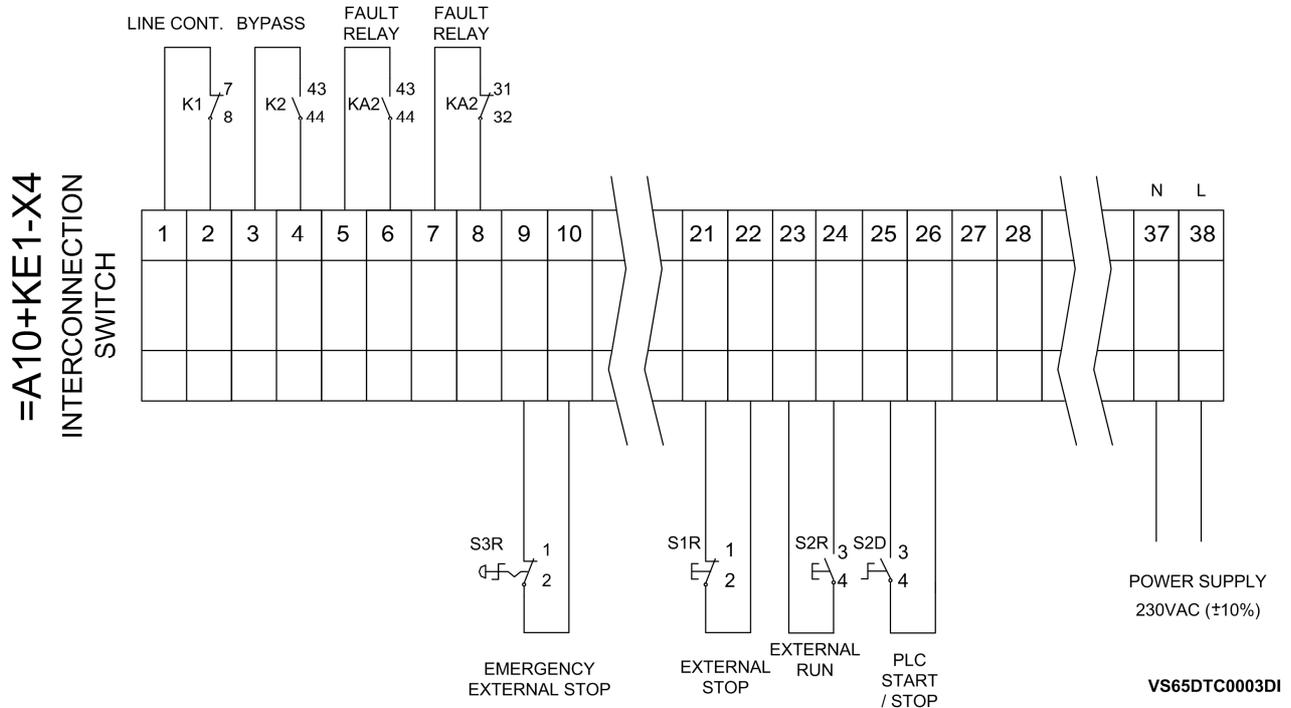


Figure 6.11 Interconnection control boards diagram

On the control voltage terminal block, control wiring is secured in place by 3mm spring terminals. Use a screwdriver whose dimensions are 0.6x3.5mm to open the terminal clamp, and then insert the wire into the terminal cage. Release the clamp by removing the screwdriver. The maximum allowed control cable section is 2.5mm² and the torque must be between 0.4Nm and 0.8Nm.

	TERM.	SIGNAL	DESCRIPTION	
X4	OUTPUT RELAYS	1	K1	Auxiliary contact of the line contactor (NC). It shows the line contactor's status (opened or closed). Potential free. (Max 200mA)
		2		
		3	K2	Auxiliary contact of the bypass contactor (NO). It shows the bypass contactor's status (opened or closed). Potential free. (Max 200mA)
		4		
	5	KA2	(NO) and (NC) Output relay shows if the soft starter is in a failure status. Potential free. (Rated: 6A@250VAC - 6A@28VDC) (Max 200mA).	
	6			
	7			
	DIGITAL INPUTS	8	KA2	
9		EMERGENCY STOP	Door mounted emergency stop pushbutton contact (NC) (Factory Wired do not use).	
10			External emergency stop pushbutton contact (NC)	
21		STOP	Door mounted stop pushbutton contact (NC) (Factory Wired do not use).	
22			External STOP push button.	
23		START	Door mounted start pushbutton contact (NO). Enabled when VS65 door mounted mode selector is in local control mode (Factory wired do not use).	
24	Remote external start pushbutton. Enabled when VS65 door mounted mode selector is in remote control mode.			
32	PLC START/ STOP	PLC Start/Stop Connection (NO). It allows the connection of a Start/Stop digital signal. Enabled when VS65 door mounted mode selector is in remote control mode.		
33				
CPS	37	230Vac - N	Input terminals for control board power supply (230Vac / ± 10%). Other voltage ratings are available on demand. Max Power consumption (Max 1A@24Vdc).	
	38	230Vac - L		

Note:
CPS: Control Power Supply, **UPS:** User Power Supply

6.5.1. Correct control shield bonding

It is recommended to use shielded twisted cable for all the data, signal or control cables that came out from the soft starter, with the properly shield bonding to ground. To ensure an effective shield bundling, VS65 includes optionally EMC shield clamps that ensure a 360° effective shield bundling.

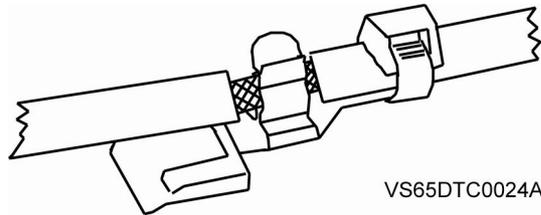


Figure 6.13 EMC terminal block connection detail

Digital signal cables must be grounded at both ends of the cable. It is recommended to use independent shielded cables for digital and analogue signals. When using multiple analogue signals do not use common return for them.

6.6. Direct on-line start



SAFETY

MEDIUM VOLTAGE SWITCHGEAR

To compliance with IEC-62271-200, the user must connect the soft starter through a medium voltage switchgear equipped with a switch and a ground connection that permits a visible cut between the SS and the MV line. Additionally it must be equipped with a mechanical interlock and padlock to avoid mal-function or unexpected reconnections. The installer must ensure that VS65 doors cannot be opened without the protection cell activated and locked.

7. INTERFACE

VS65 integrates multiple pushbuttons, indicators and pilots, suitable for adverse industrial environment. The interfaces are located on the top and lower front doors.

7.1. Upper door pilots and indicators



Figure 7.1 Top door indicators

- **Ammemeter** [MOTOR CURRENT]: It shows the motor current. The relationship between Real current / Measured current is 750 / 5A.
- **Voltmeter** [INPUT VOLTAGE]: It shows the equipment input voltage. The relationship between Real voltage / Measured voltage is 6600 / 110V.

7.2. Alphanumeric Display

DISPLAY UNIT AND CONTROL KEYPAD

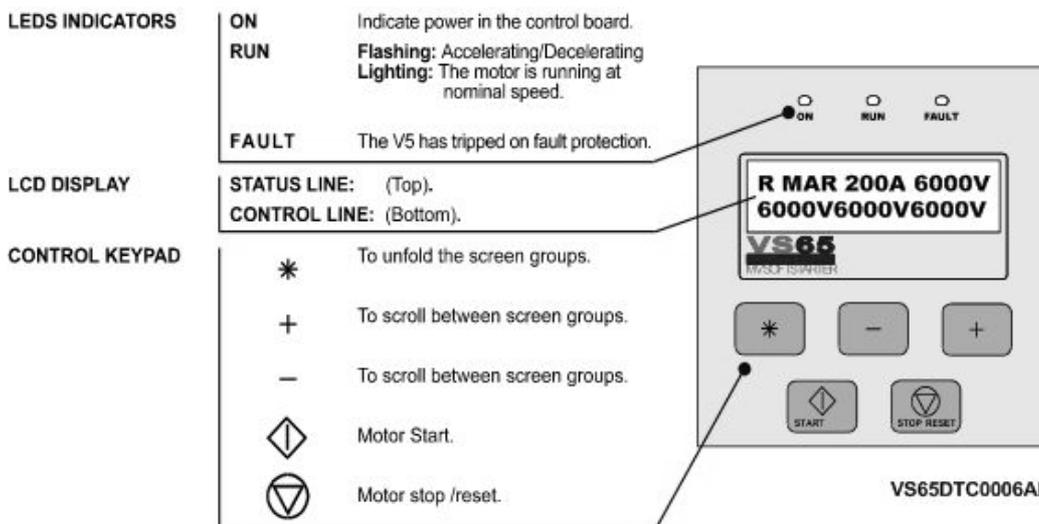


Figure 7.2 Display Unit

For further information consult Software and Programming Manual.

7.3. Lower door pushbuttons and pilots

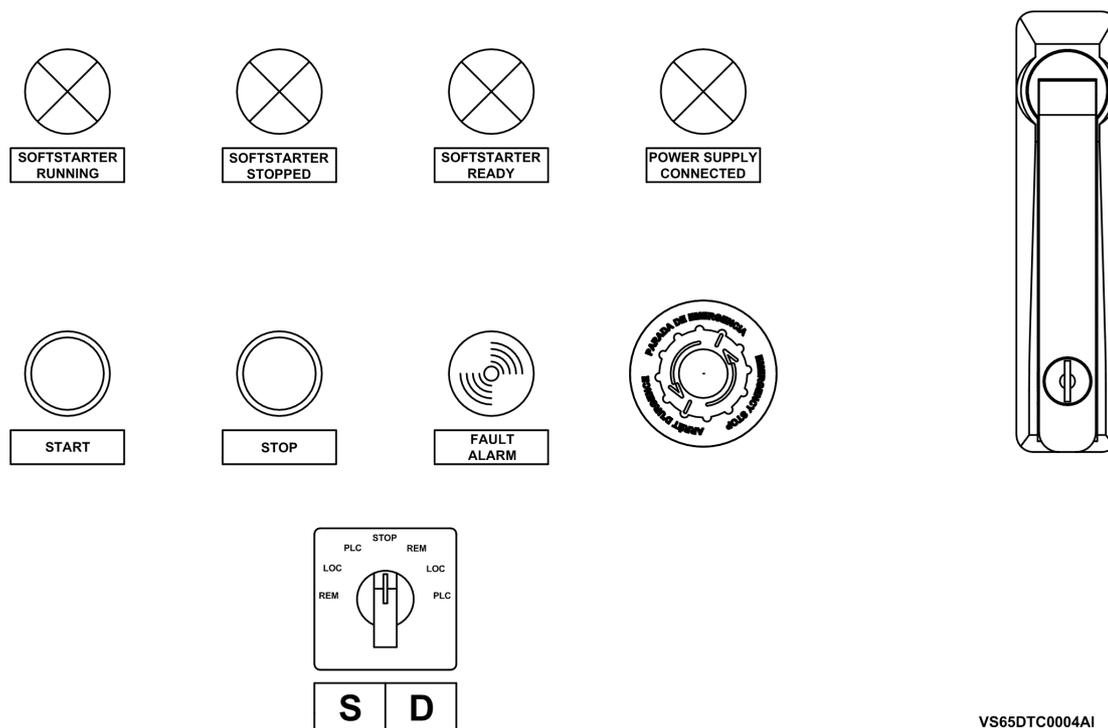


Figure 7.3 Control elements. Pilots and buttons

• **[CONTROL MODE] Selector**

Allows the user to select between the different control modes. The selector has seven positions that permit to select in Soft Start mode (Starting Sequence) or Direct Start Mode (Direct Bypass Connection) from the following control methods:

LABEL	Method description
LOC	Selected LOC, the soft starter will be controlled by the LOCAL door mounted push buttons. The REMOTE and PLC start and stop signals will be disabled; only the REMOTE Emergency STOP will be enabled.
REM	Selected REM, the soft starter will be controlled by the REMOTE start/stop signals. The LOCAL start/stop pushbuttons and PLC start and stop signals will be disabled, only the LOCAL and REMOTE Emergency STOPS will be enabled.
PLC	Selected PLC, the soft starter will be controlled by the PLC start/stop signals. The LOCAL start/stop pushbuttons and REMOTE start/stop signals will be disabled, only the LOCAL and REMOTE Emergency STOPS will be enabled.
STOP	LOCAL, REMOTE and PLC start/stop signals will be disabled. If the VS65 is running, when STOP is selected it will run the stop sequence.

The possible statuses are:

SELECTOR	Soft start (S - Left)	Direct start (D - Right)
STOP	Equipment STOP	
LOC	Local control in soft start	Local control in direct start
REM	Remote control in soft start	Remote control in direct start
PLC	PLC control in soft start	PLC control in direct start

However, it will be possible to access to the VS65 visualization and configuration parameters displayed through the corresponding communication bus. Note that the communication bus will enable the soft starter control whenever the [3. SERIAL COMMS] option has been set, in the parameter [G6.1 CONTROL MODES].

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Down below, from left to right and up to down, the rest of the door elements are described:

PUSHBUTTON / PILOT	DESCRIPTION
[SOFT STARTER READY] Pilot Light	Colour White. When no faults occur, it will turn on indicating the user that the equipment is ready to start.
[SOFT STARTER RUNNING] Pilot Light	Colour Green. Turned on shows the soft starter is running, that means the bypass contactor is connected. The moment the soft starter is not running, the light would turn off.
[SOFT STARTER STOPPED] Pilot Light	Colour Red. Unlike the previous light, when turned on in a continuous way, indicates the soft starter is stopped. Starting the soft starter, it will turn off.
[POWER SUPPLY CONNECTED] Pilot Light	Colour Red. Active when the auxiliary low voltage power supply is connected.
[START] Button	Colour Green. The user can start the soft starter in local mode by pressing this button. To enable it, the user should previously place the control mode selector to the LOC position, either in soft or direct start, whenever the parameter [G6.1CONTROL MODE] has been set as [REMOTE].
[STOP] Button	Colour Red. The user is able to stop the soft starter locally. Unlike the start button, it is always enabled. To enable it, the user should previously place the control mode selector to the LOC position, either in soft or direct start, whenever the parameter [G6.1CONTROL MODE] has been set as [REMOTE].
[FAULT ALARM] Pilot Light	Colour Red. This pilot will turn on when a fault occurs. It emits both an acoustic alarm, by the use of a buzzer and a light alarm, by the use of a blinking red coloured light.
[EMERGENCY STOP] Mushroom Button	Emergency red Stop Pushbutton with a rotator lock to sign the emergency stop. When the motor is running and the button is pressed, the VS65 opens the bypass contactor, stopping the motor by coasting. If the motor is stopped and the button is pressed, the VS65 cannot initialize the start sequence. Once the causes which had caused them to be pressed have disappeared, unlock the button and the VS65 will be ready to start.

7.4. Front and rear doors

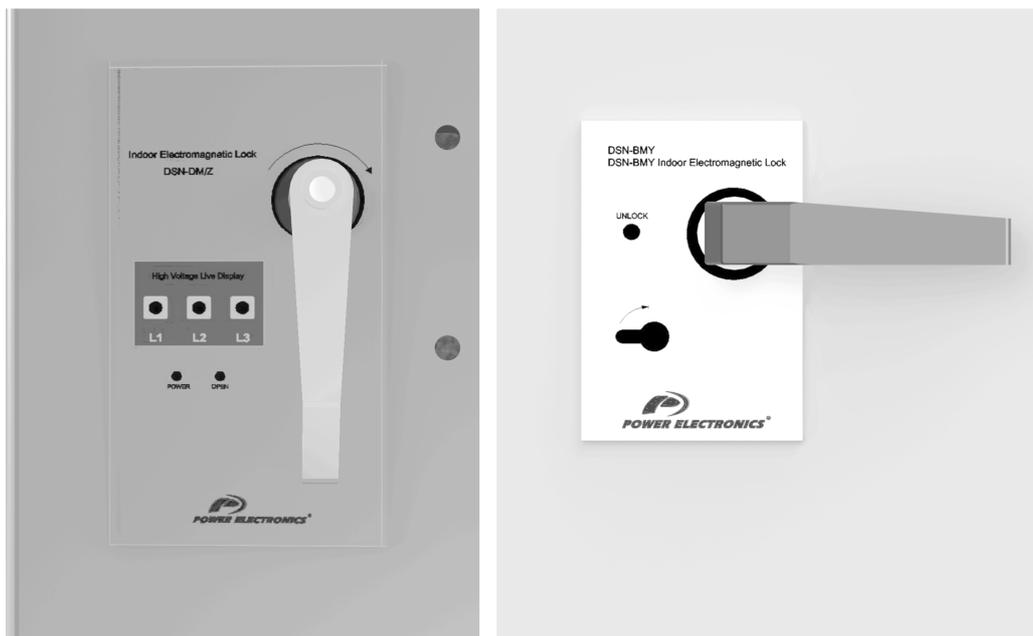
The VS65 SS is divided in 4 independent sections that prevent the user for unexpected access to medium voltage active conductors. Additionally, the SS is equipped with explosion proof cabinet and door locks that minimize the damage for adjoining components in case of explosion.

The soft starter has electromagnetic door opening control designed to avoid medium voltage work risks.

The door opening control is located in the front of the cabinet. This control can only be used when there is not dangerous voltage in the cabinet. "Power" led shows that there is low voltage in the equipment. L1, L2 and L3 leds show that there is medium voltage in the equipment. Push the handle button and turn right to open it. "Open" led will be turned ON while the door is opened.

If the handle is broken or locked, the SS is built in an emergency opening system. The two orifices situated at the right of the handle allow the access to two screws that open the door.

The door opening control of the rear door can only open the equipment if the front door is opened. Push the handle button and turn right to open it.



VS65ITG0004A

Figure 7.4 Electromagnetic door opening control (Interlocks)

8. CONFIGURATION, LOW VOLTAGE TRIAL AND COMMISSIONING

8.1. Before Commissioning Observations

- Check no foreign matter is found inside the equipment.
- Verify the auxiliary power supply is 230VAC $\pm 10\%$.
- Verify the interconnection signs are correct and in accordance with the manual.
- Check the soft starter power supply is connected to the L1, L2, L3 terminals and the motor power supply to U, V, W terminals. Confirm that the triphasic voltage at soft starters input is within the specifications and the motor characteristics plate is in accordance with the equipment installed.

Note: The VS65 are factory configured to: START, STOP, and RESET from keyboard.

- The digital input state can be checked on the screen EDG X 0 0 0 0 F
 X indicates the input is active, **0** means the digital input has not been activated for the moment.
 K indicates that the motor PTC is not active and **F** that the PTC input is active.
- Firstly, control through the digital inputs is disabled by the screen [G6.1 CONTROL MODE=1 LOCAL]. This means the soft starters run and stop is carried out by display and any modification of the digital inputs will have no major consequence than the screen visualization EDG= 0000K.
- Default relay configuration:

Relay 1: Line. Connected during the acceleration ramp and during the deceleration ramp.

Relay 2: Bypass. Connected at the end of the acceleration ramp and disconnected at the beginning of the deceleration ramp.

Relay 3: Fault (Active in case of fault).

8.2. Low voltage Trial



CAUTION

Only qualified personal can make this test.

Otherwise, the equipment can be damaged and you may suffer electric shocks.

After treat all the things explained before, it is necessary to perform a low voltage test to allow the personnel check soft starter's electric configuration safely and in which test makers don't need special tools.

The VS65 is able to start and stop a low voltage three-phase motor, using only a low voltage transformer connected instead of the medium voltage transformer.

This test will be first made in the Power Electronics facilities, where the test conditions can be simulated. After, in the customer installation, it will be necessary to repeat the same test before connecting the soft starter to the medium voltage network. Power Electronics qualified personnel must always make this test.

8.2.1. Material

The following tools are needed to perform the low voltage test:

- A low voltage 400/110VAC, 2kVA for soft starters with a rated voltage of 6000V or more, or a low voltage 400/70VAC, 2kVA for soft starters with a rated voltage of 4160V or less (approximately) three-phase transformer connected in configuration star-star with phase angle 0°. A second alternative could be to use two single-phase transformers with the same characteristics as in the following image.

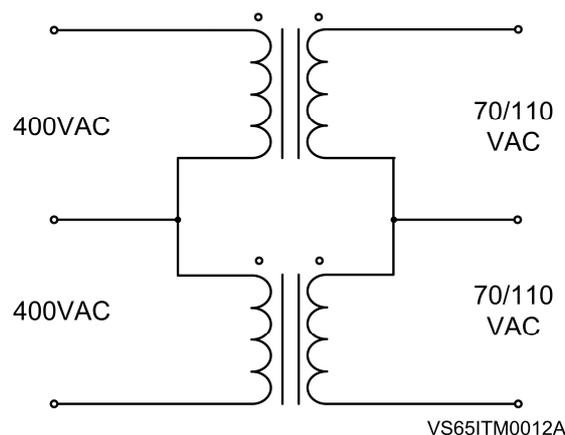


Figure 8.1 Low voltage test transformer

- Three 300k Ω / 6W resistors (one per phase).
- Three test bulbs of 100W and 230VAC with star connection as it is shown in the following figure. The terminals U, V and W will receive 400VAC when the equipment is connected to this voltage and started.

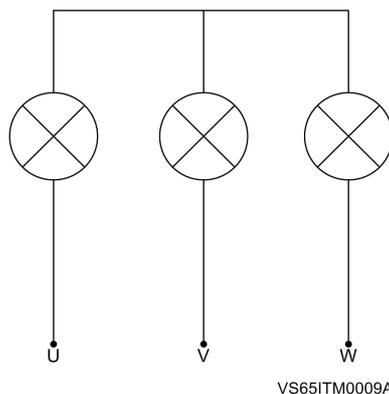


Figure 8.2 Connection of the test bulbs

- One low voltage three-phase motor from 1 to 10CV.

8.2.2. Wiring process before the test

To realize the low voltage test, these instructions should be followed:

- Disconnect the medium voltage transformer cables from the primary and secondary (low and medium voltage cables). This transformer is located next to the thyristors.

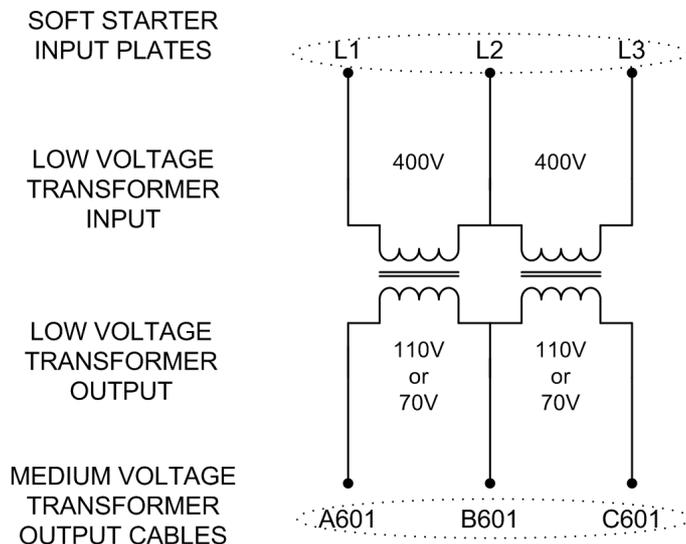


CAUTION

Do not continue with the test without disconnecting the MV transformer cables.

Otherwise, there is death risk.

- Connect then the three-phase 400/110VAC or 400/70VAC transformer (configuration star-star with phase angle 0) instead of the Medium Voltage transformer, its connection is shown in the following drawing. The low voltage transformer's input will be 400VAC when it's connected to the equipment terminals (L1, L2 and L3) and then power supply is provided to the soft starter. The low voltage transformer output will provide 110VAC or 70VAC to the cables A601, B601 and C601. The objective of this method is to work with low voltage instead of medium voltage to make the test safely. To connect the low voltage transformer's cables it's indispensable to consider the phases order, use a phase meter to make this connection easier.



VS65ITM0010BI

Figure 8.3 Connection of the low voltage test transformer

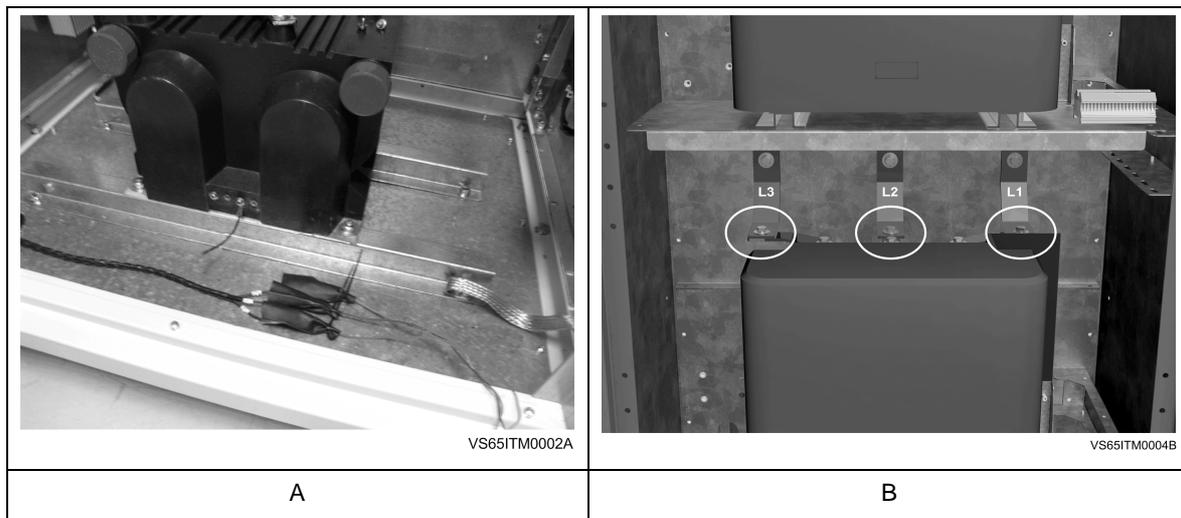


Figure 8.4 (A): Connection of the 70 or 110VAC low voltage transformer's wires and (B): Connection of the 400VAC low voltage transformer's wires

- Provide 230VAC auxiliary power supply to the X4 terminal block, placed in the superior door.

E
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G
L
I
S
H

- 300k Ω resistor should be connected in each phase, making an electrical bridge in the medium voltage resistors, in the input of the first thyristors (terminal block JP2, terminal K) and in the phase output (terminal block JP2, terminal RF).



CAUTION

Make sure that IN EACH PHASE has been connected a 300k Ω resistor.
Otherwise, the equipment can be damaged.

Then the connections will be detailed for an only phase. The same steps should be done in the three phases.

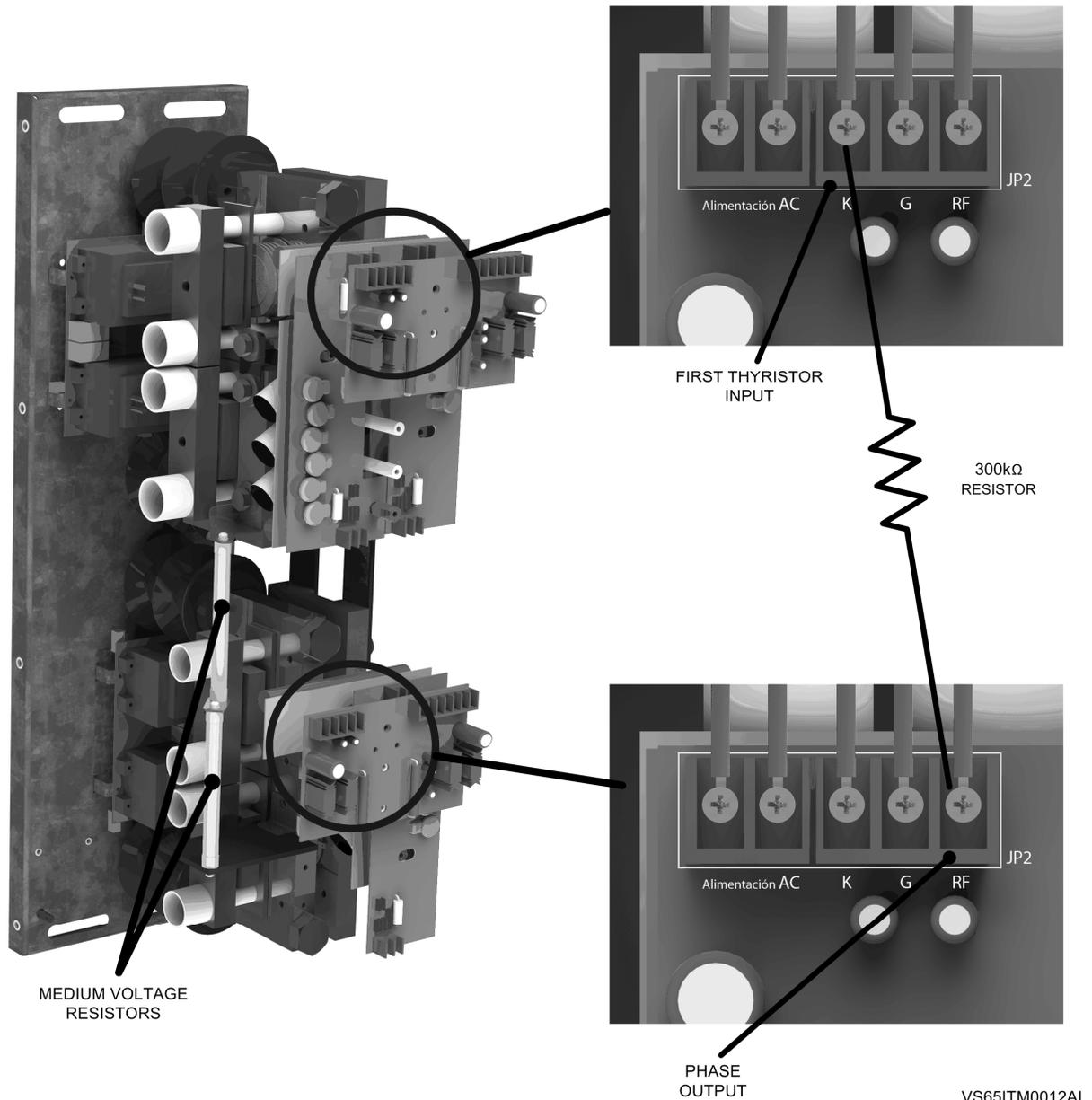
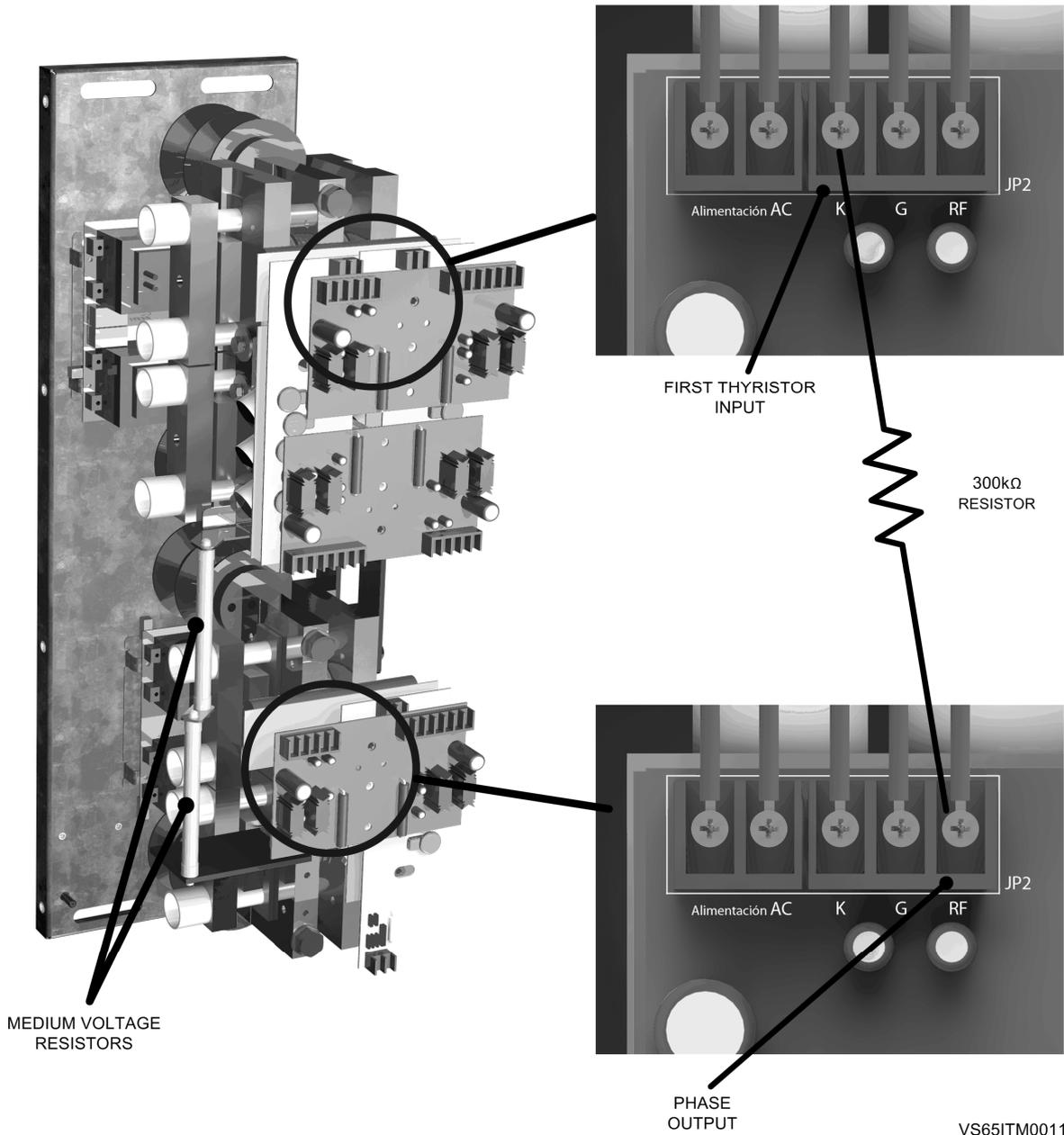


Figure 8.5 Connection of the 300k Ω resistor in the trigger boards per phase in the medium voltage soft starters of 4160V or lower rated voltage



E
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Figure 8.6 Connection of the 300kΩ resistor in the trigger boards per phase in the medium voltage soft starters of 6000V or higher rated voltage

- Connect the soft starter input to 400VAC through the terminals L1, L2 and L3.

8.2.3. Test process

This process consists on two similar tests with different output components during each start.

- Use the three bulbs to realize the first test.
- The three-phase motor from 1 to 10CV should be connected in parallel with the three bulbs to realize the second test.

8.2.4. Test

- Keep pressed the inferior door switch during the test. Otherwise, the soft starter will not start.



CAUTION

When the door is opened and the door switch is pressed the personal protections of the equipment are disabled. These tests must be always made by qualified personal of Power Electronics.

- Turn on the circuit breakers located in the low voltage cabinet. That will turn on the red light "power on".
- Close the superior door and keep the main door opened. Select the soft start mode LOCAL. The display, the electronic board, the white pilot "soft starter ready" and the red pilot "soft starter stopped" will be turned ON.
- Push the green button "start". The soft starter applies a start ramp (the display will show it). It's recommended to make a visual inspection of the trigger boards. Their leds will be enabled showing their correct interconnection and the correct thyristors' trigger. Check that the start is progressive. For example, in the case of the bulbs test, they make a progressive increase of its illumination.
- When the start ramp is finished, the bypass contactor will be enabled and the line contactor will work for 1 second before being disabled. The green pilot "soft starter running" will be turned on, and the red pilot "soft starter stopped" and the white pilot "soft starter ready" will be turned off. The equipment is at this moment working in bypass mode until it has to stop.
- To stop the soft starter, push the red "stop" button. The line contactor will be enabled and the bypass contactor will be working for a second and then disabled.
- During the deceleration ramp, check another time if the trigger boards' leds are turned on like in the start ramp.
- When the deceleration ramp is finished, the green pilot "soft starter running" will be turned off, and the white pilot "soft starter ready" and the red pilot "soft starter stopped" will be turned on.
- After making the two tests, stop pressing the door switch.

8.2.5. Test ending and Medium voltage connection

- Disconnect the low voltage transformer.
- Connect the medium voltage transformer cables as they were at the beginning.
- Disconnect the resistors of 300kΩ of the trigger boards.
- If the tests are correctly performed, the equipment is ready to begin the medium voltage start.
- CLOSE the soft starter doors and verify that all of the safety devices are active and there is no risk present when the motor starts.
- Start the equipment with medium voltage in the required mode.
- Set the display parameter groups G2, G4 and G5 (check the VS65 Programming and Software manual for more information) and the equipment will be ready to start the motor with medium voltage.

8.3. Medium voltage Commissioning

Once the previous points are checked follow the next tasks.

- Verify the properly connection and tightening torque of the VS65 earth terminals, both of the input and output cables shield. Ensure the minimum distance between shields and earth busbars.
- Verify the properly connection and tightening torque of the VS65 output power and of the motor input terminals.
- Verify the properly connection and tightening torque of the VS65 medium voltage input power terminals.
- Check that the VS65 cabinet doors are correctly closed.

With 230Vac (Control power supply) we proceed to configure the parameters to start-up the medium voltage motor unloaded.

Check the VS65 Programming and Software manual for more information.



CAUTION

Only qualified personal can follow the next steps.

Otherwise, the equipment can be damaged and you may suffer electric shocks.

Once the previous points have been checked carefully by qualified personnel, who will have extended knowledge about the medium voltage installations operation, the following tasks will be carried out:

- Connect medium voltage supply.
- Verify the input VS65 voltage in the analogical voltmeter of the upper door and in the display.
- Proceed to select the desired start moving the selector of the main door.
- Start the soft starter.
- Check the start contactor's sequence and that there are not abnormal vibrations or noises in the motor.
- After the start up check the motor parameters, if they are under normal conditions, the commissioning has finished.

9. PREVENTIVE MAINTENANCE

The VS65 series Medium Voltage soft starter is highly reliable and has easy maintenance. Therefore, to ensure a long working life it is recommended to take into account the following instructions:



CAUTION

Make sure the soft starter is completely disconnected from the power supply and earth grounded before any maintenance operation is carried out.

In order to prevent electric risks, disconnect the power supply input, earth ground the equipment and remove the control voltages before working in the equipment. Warning and safety labels should be properly placed in terminals, covers and control panels in accordance with local codes. Otherwise, electric shock hazard exists.

Inspection site	Inspection element	Inspection	Period				Inspection method	Criterion	Instrument of measurement
			Daily	1 year	2 years	3 years			
All	Ambient conditions	Are there dust particles? Are the ambient temperature and the humidity within specification?	o				See "Warnings"	Temperature: -10°C to +40°C Humidity: below 90% non-condensing.	Thermometer, Hygrometer, recorder.
	Module	Are there any abnormal noises or oscillations?	o				Visual and audible.	There are no anomalies.	
	Input power	Is the input power to the main circuit correct?	o				Measure the voltage between terminals L1, L2, L3 and N.		Digital multimeter. Tester.
	Power connections	Are they properly tightened the power connections?		o			Measure the temperature and torque about the power connections.	Check that the temperature is homogeneous between cables and lower than 70°C.	Infrared thermometer or thermographic camera. Torque key.
	Control input power	Is the input power to the control circuit correct?	o				Measure the voltage between terminals L and N.		Digital multimeter. Tester.
	Trigger board power supply	Is the input power to the control circuit correct?	o				Measure the voltage between output terminals.		Digital multimeter. Tester.
Main circuit	All	Is there any lost parts? Components are very hot? The transformer insulation is correct?		o			Visual check. Measure the transformer resistor.	No anomalies. The measure must be higher than 100MΩ.	Ohmmeter.
	Conductor/ Cable	Is the conductor corroded? Is the sheathing of the cable damaged?		o			Visual check.	No anomalies.	
	Terminal	Is any damage visible?		o			Visual check.	No anomalies.	
	Relay	Are their terminals corroded? Switches correctly?		o			Visual and audible.	No anomalies	
	Contactors	Is there any contactor chatter? Is the contact damaged?		o			Visual and audible. Measure the torque about its connections.	No anomaly.	

Inspection site	Inspection element	Inspection	Period				Inspection method	Criterion	Instrument of measurement
			Daily	1 year	2 years	3 years			
Control circuit and protections	Operating check	Is there any imbalance between output voltage phases?		o			Measure voltage between output terminals U, V and W.	Balanced voltage between phases i.e. lower than 8V difference for 400V models.	Digital multimeter / RMS voltage meter.
Display	All	Is the displayed value correct?	o o				Visual check. Check the reading instrument with an external measurement. Clean the screen.	Check the specified values and the control values are equal.	Voltmeter, amperemeter.
Motor	Insulation resistance	Megger check (between terminals of output circuit and ground terminal)			o		Disconnect the cables U, V and W and join them together. Check the resistance between this join and ground.	More than 5MΩ	Megger type 2500V
	All	Is there any noise or abnormal vibrations? Has any unusual smell been perceived?	o				Audible, sensory and visual check. Check if damages have been produced by overheating.	No anomaly.	

DECLARATION OF CONFORMITY CE

The company:

Name: **POWER ELECTRONICS ESPAÑA, S.L.**
Address: C/ Leonardo Da Vinci, 24-26, 46980 Paterna (Valencia) España
Telephone: +34 96 136 65 57
Fax: +34 96 131 82 01

Declares under its own responsibility that the product:

Medium Voltage Soft Starter

Brand: Power Electronics
Model name: VS65 Series

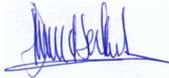
Is in conformity with the following European Directives:

References	Title
2004/108/CE	Electromagnetic Compatibility

References of the harmonized technical norms applied under the Electromagnetic Compatibility Directive:

References	Titles
EN 61000-6-4:2007	Electromagnetic Compatibility (EMC). Part 6-4: Generic norms. Emission norm for industrial environments
EN 61000-6-2:2005	Electromagnetic Compatibility (EMC). Part 6-2: Generic norms. Immunity norms for industrial.

Paterna, December 17th December 2008



David Salvo
Executive Director

ANNEX A: ELECTRIC DIAGRAMS

On the following page the electric diagrams will be attached:



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