Soft-Starter

SSW7000

User's Manual

User's Manual

Series: SSW7000

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The table describes the revisions made to this manual.

Revision	Description	Chapter
1	First edition	-
2	Correction of table 8.1	8
3	Section update 10.3.1 – safe sectioning	10
	D.O.L. starting description – section 10.4	10
4	SSW7000C Description	3, 5, 6 and 9
5	General Revision	1 - 10
6	Inclusion of the 500A and 600A models	3
	PFC description with capacitor discharge adjustment	3
	Change of D.O.L. mode operation	10
7	Inclusion of the 6,9 kV models – SSW7000C	3, 5, 6 and 9

Contents

1 SAFETY INSTRUCTIONS

This manual contains the information necessary for the correct use of the SSW7000.

It has been written to be used by qualified personnel with suitable training or technical qualification for operating this type of equipment.

1.1. SAFETY WARNINGS IN THE MANUAL

The following safety notices are used in the manual:

DANGER!
The procedures recommended in this warning have the purpose of protecting the user against death, serious injuries and considerable material damage.

ATTENTION!
The procedures recommended in this warning have the purpose of avoiding material damage.

NOTE!
The information mentioned in this warning is important for the proper understanding and good operation of the product.

1.2. SAFETY WARNINGS IN THE PRODUCT

The following symbols are attached to the product, serving as safety notices:

High voltages are present

Components sensitive to electrostatic discharge.
Do not touch them

Mandatory connection to the protective earth (PE).

Connection of the shield to the ground.

1.3. PRELIMINARY RECOMMENDATIONS

DANGER!
Only qualified personnel familiar with the SSW7000 soft-starter and associated equipment should plan or implement the installation, start-up and subsequent maintenance of this equipment.

These personnel must follow all the safety instructions included in this manual and/or defined by local regulations.

Failure to comply with these instructions may result in life threatening and/or equipment damage

NOTES!
For the purposes of this manual, qualified personnel are those trained to be able to:

1. Install, ground, energize and operate the SSW7000 according to this manual and the effective legal safety procedures

2. Use protective equipment according to the established standards.

3. Give first aid services.

DANGER!
Always disconnect the input power before touching any electrical component associated to the SSW7000. Follow the SSW7000 disconnection sequence, according to the item 10.4.1 - SSW7000 Disconnection Sequence.

High voltages and rotating parts (fans, if installed) may be present on the SSW7000 even after shut down or power disconnection. Wait at least 3 minutes for the complete discharge of the capacitors and the stopping of the fans.

Always connect the equipment frame to the protective earth (PE) at the suitable connection point.

ATTENTION!
Electronic boards have components sensitive to electrostatic discharges. Do not touch directly on components or connectors. If necessary, touch the grounded metallic frame before or use an adequate grounded wrist strap.

Do not perform any high pot tests with the SSW7000!
If it is necessary, consult WEG.

NOTE!
Soft-starters may interfere with other electronic equipments. In order to minimize these effects, take the precautions recommended in the chapter 5 - Installation and Connection.

NOTE!
Read the user's manual completely before installing or operating the SSW7000.

2 ABOUT THE MANUAL

This manual presents the necessary information for the installation and commissioning, as well as the product main technical characteristics, and how to troubleshoot the SSW7000 most common problems.

This manual must be used together with the SSW7000 programming manual.

ATENÇÃO!

The operation of this equipment requires installation instructions and detailed operation provided in the user's manual, programming manual and communication manuals. The user's manual and the programming manual are supplied in a hard copy together with the soft-starter. The user guides are also provided in a hard copy along with the accessories. The other manuals can be downloaded from the WEG website at - www.weg.net.

In order to obtain more information on the accessories and its operation, refer to the following manuals:

- RS-232/RS-485 Serial Communication Manual.
- Anybus-CC Communication Manual.
- SoftPLC Manual

2.1. TERMS AND DEFINITIONS

2.1.1. Terms and Definitions Used in the Manual

Amp, A: ampere

AC: alternating current.

DC: direct current.

DOL: Direct Online start.

°C: celsius degrees.

HMI: Human-Machine Interface; it is the device that allows the control of the motor, the visualization and the modification of the SSW7000 parameters. It presents keys for commanding the motor, navigation keys and a graphic LCD display.

hp: "Horse Power" = 746 Watts (power measurement unit, normally used to indicate the mechanical power of electric motors).

Hz: hertz.

kg: kilogram= 1000 gramas.

kHz: kilohertz = 1000 hertz.

kV: kilovolts = 1000 volts.

mA: miliampere = 0.001 ampères.

min: minute.

ms: milisecond = 0.001 segundos.

Nm: newton meter; torque measurement unit.

OEM: Original Equipment Manufacturer.

Ω: ohm.

PE: Protective Earth.

PFC: Power Factor Correction.

rms: “Root mean square”; effective value

rpm: revolutions per minute, speed measurement unit.

s: second.

UCBT: Low voltage control unit.

UCMT: Medium voltage control unit.

USB: “Universal Serial BUS”; it is a type of connection in the perspective of the “Plug and Play” concept.

V: volts.

3 ABOUT THE SSW7000

The “Soft-Starter WEG 7000” is a high performance product that allows the starting/stopping control and protection of medium voltage three-phase induction motors, thus preventing mechanical shocks ant the load, current peaks in the supply line and damage to the motor.

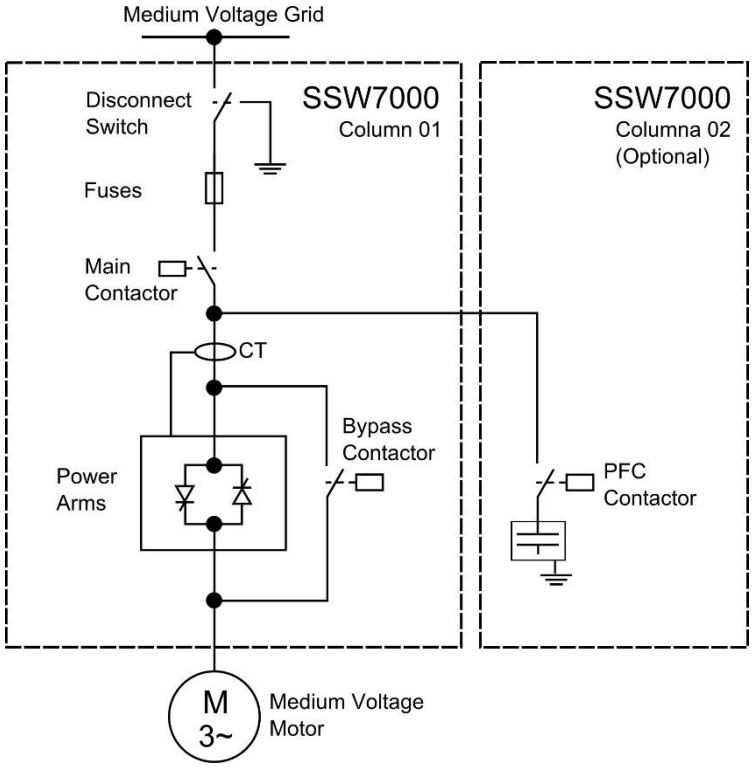


Figure 3.1: General block diagram of SSW7000.

NOTE!
The capacitor bank for power factor correction is provided in an additional column coupled to the SSW7000

3.1. MAIN CHARACTERISTICS

The soft-starter SSW7000 has three panel versions: one IP41 version, one IP54 version and one NEMA version. The NEMA and IP54 are compacts versions – SSW7000C, 36” wide. The operation is the same for all versions. The specific differences among the versions will be detailed in this manual.

3.1.1. Disconnect Switch

The standard SSW7000 panel has a medium voltage input disconnect switch that allows the electrical disconnection of the internal circuit of the SSW7000 from the power supply.

This disconnect switch is interlocked with the cabinet door, so that the door can only be opened when the disconnect switch is also open. When open, the connections on the upper side of the fuses are grounded.

DANGER!
Even with the disconnect switch open, voltage may still be present on the side of medium voltage power supply of the disconnect switch. When maintenance is required on the medium voltage side of the disconnect switch, the medium voltage power supply must be disconnected and grounded in a point before the SSW7000.

DANGER!
The SSW7000 has another power supply for the low voltage control. Make sure there is no voltage before touching any component

3.1.2. Fuses

The standard panel of the SSW7000 features R-type medium voltage fuses against short circuit on the panel, on the motor and on the cables to the motor.

3.1.3. Line Contactor

The standard SSW7000 panel has a line vacuum contactor with utilization category AC-3, which makes it possible to disconnect the SSW7000 power section whenever the motor is deactivated.

The line contactor is driven by the control electronics of SSW7000.

3.1.4. Bypass Contactor

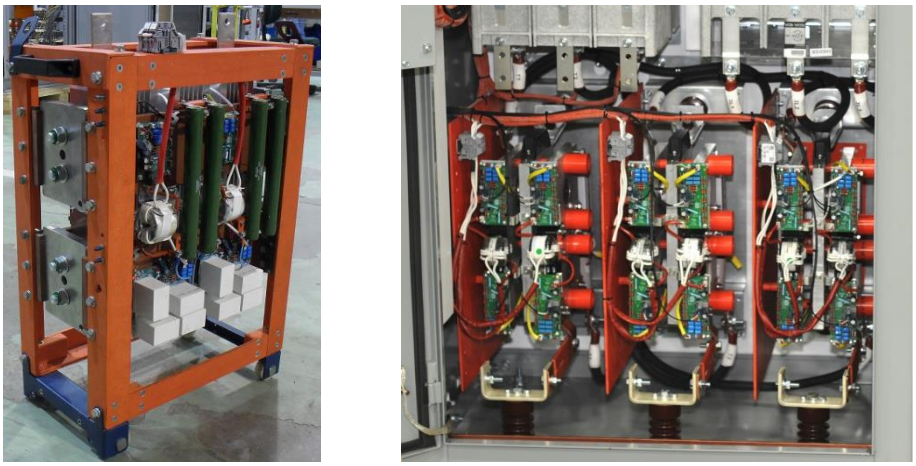
The standard SSW7000 panel has a vacuum contactor with utilization category AC-3, which makes it possible to bypass the power arms after starting the motor. This function allows energy saving by eliminating losses on the SCRs during the motor full operating duty and it also eliminates the necessity of using fans for the operation of the SSW7000 in its rated start operation duty, which is specified in the section 9.1 – Power Data.

This contactor is sized to withstand direct on line starting and the SSW7000 rated current at full load. It also allows the implementation of a direct on line starting logic.

.
The bypass contactor is driven by the control electronics of SSW7000.

3.1.5. Power Arms

The SSW7000 power arms are assembled as modules with wheels that facilitate their installation and replacement during maintenance. For the SSW7000C version, the power arms don't have wheels and are attached to the back of the panel.



(a) SSW7000 (b) SSW7000C

Figure 3.2: Power Arms

Each arm is comprises the SCRs, heatsinks, snubbers, supply transformers and firing boards. The firing commands and the temperature readings are performed through fiber optic cables.

If it is necessary to increase the start duty of the SSW7000, increasing the number of starts per hour, for instance, it is possible to install fans on the power arms. In such case, refer to the manufacturer.

3.1.6. Control

The SSW7000 control is implemented using two electronic control boards, isolated from each other through fiber optic cables.

The C1 (CC11) control board is responsible for all the user access means: HMI, analog and digital inputs and outputs, communication accessories, PT100 input and SoftPLC. It presents the possibility of firmware update either via USB communication or via flash memory.

The C2 (CSM) control board is responsible for the motor control, the firing signals, the voltage and current readings, and the synchronism. It is mounted in the medium voltage compartment and it does not allow direct access to the user. The board firmware can be updated via USB communication.

3.1.7. Motor thermal Protection

Besides the possibility of using overload protection on the motor by means of preset thermal class, the SSW7000 has an eight channel PT100 input accessory (IOE-04 module), which allows monitoring the motor winding and bearing temperatures.

The advantage of this module is the possibility of using the motor overload protection combined with the PT100 temperature measurements. Besides, these temperature measurements are also available on the HMI and through network communication.

The fault and alarm levels of the motor thermal protection through the motor PT100 sensors can be totally programmed. For further details, refer to sections 15.5 - Motor Thermal Protection and 15.6 - Motor Thermal Class Protection, of the programming manual.

3.1.8. Tests

The SSW7000 has a test routine with the purpose of verifying the main panel connections. For more details, refer to the section 7.1- SSW7000 Operation Verification in this manual and to the section 14.2 - Test Mode in the SSW7000 programming manual.

There is also the possibility of performing test with low voltage; however, it becomes necessary to change the voltage reading connections, as well as the SSW7000 parameterization (P0296).

3.1.9. Ground Fault Protection

The SSW7000 has two ground fault detection methods. One by neutral to ground voltage measurement (in the standard panel) for isolated networks, and another by ground fault current measurement (the current transformer is optional).

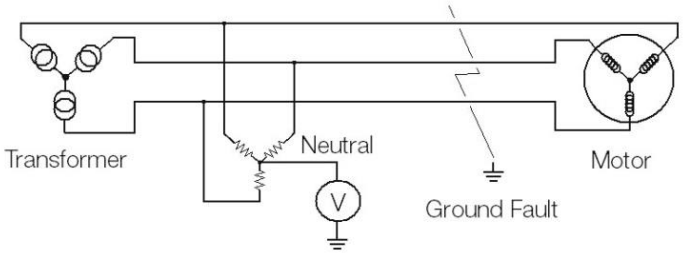


Figure 3.3: Ground fault detection by voltage

NOTE!
The ground fault by voltage detected by the SSW7000 may have occurred in any point of the power supply system from the transformer to the motor.

The ground fault protection by voltage has the advantage that the SSW7000 also detects the ground fault when the ground fault current does not pass through the SSW7000.

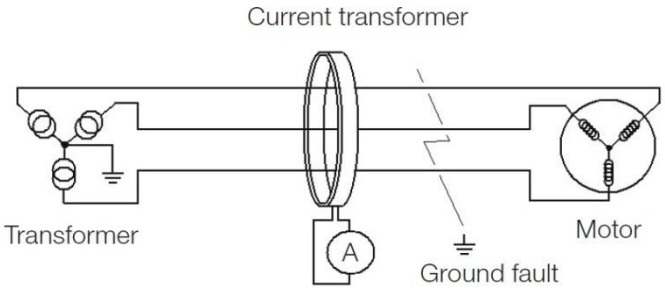


Figure 3.4: Ground fault detection by current.

3.1.10. Command for Power Factor Correction

NOTE!
The capacitor bank for power factor correction is provided in an additional column coupled to the SSW7000

DANGER!
Power factor correction capacitors must never be installed at the SSW7000 output (U / 2T1, V / 4T2 and W / 6T3).

NOTE!
The current carrying capacity of digital outputs DO1, DO2 and DO3 is 1A, as described in 9.2 Control Data.

Control for a SSW7000

The SSW7000 can control the motor power factor correction (PFC) capacitor bank directly through a digital output (DO1, DO2 or DO3) programmed for “PFC Control”. The digital output will then be activated after the motor starts and after the bypass contactor closes, thus preventing the capacitor bank from being activated with the motor turned off or during the motor start or stop.

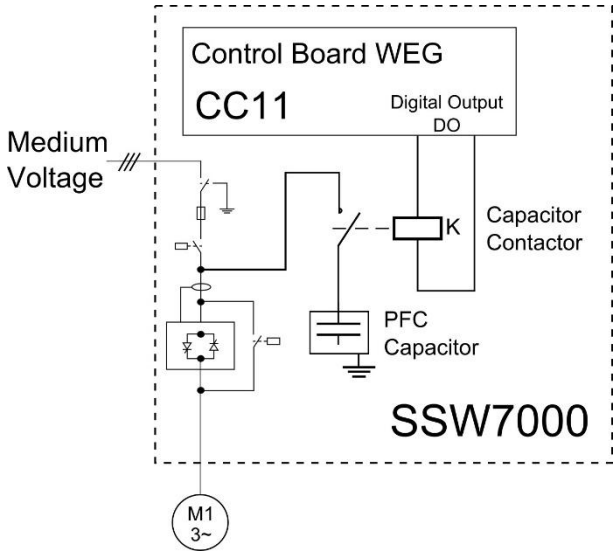


Figure 3.5: Connection to PFC Control for a SSW7000

Control for Multiple SSW7000

Multiple SSW7000 may be connected in parallel, sharing the same power supply transformer.

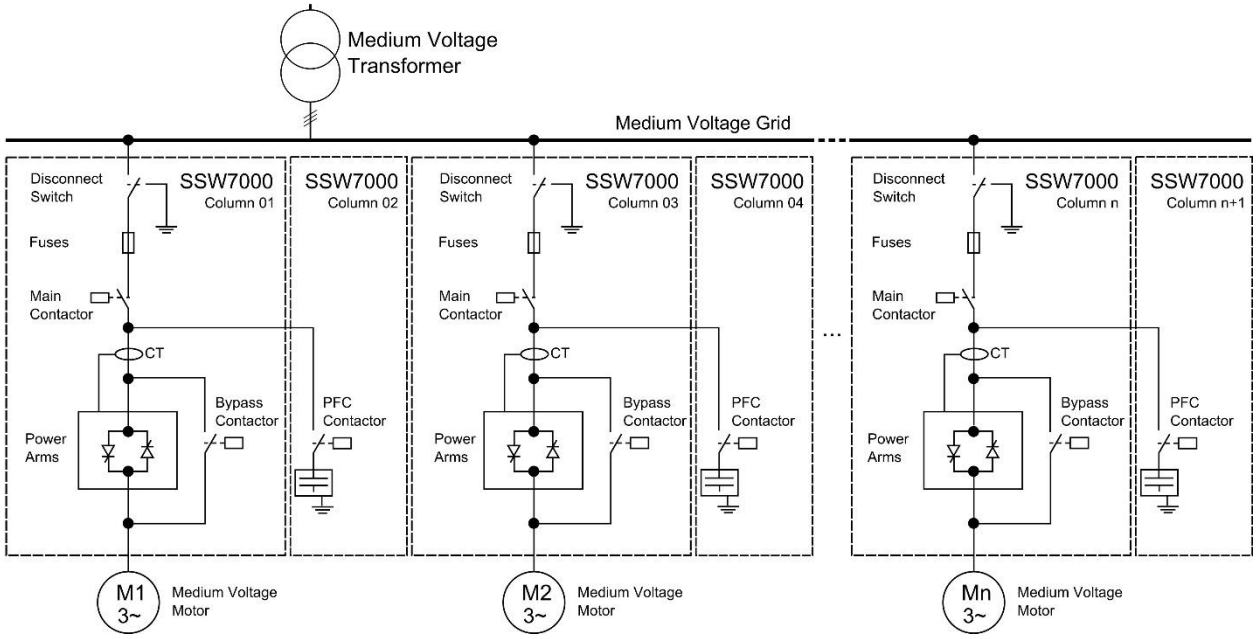


Figure 3.6: Parallel connections between "n" SSW7000

In order to automatically control the motor power factor correction (PFC) capacitor banks for multiple SSW7000, a digital input (DI1, DI2, DI3, DI4, DI5 or DI6) must be set to “PFC Lock”, a digital output (DO1, DO2 or DO3) must be set to “PFC Control”, and another digital output must be set to “PFC Lock”.

The electrical connections between the CC11 control boards of the Soft Starters must be done so that all the digital inputs receive the signal from the digital output “PFC Lock”, as shown in the example of figure 3.7. In this example, digital outputs DO1 and DO2 and digital input DI5 were used. The parameters configured in the example are “15=PFC Lock” (DO1), “14=PFC Control” (DO2) and “16=PFC Lock” (DI5).

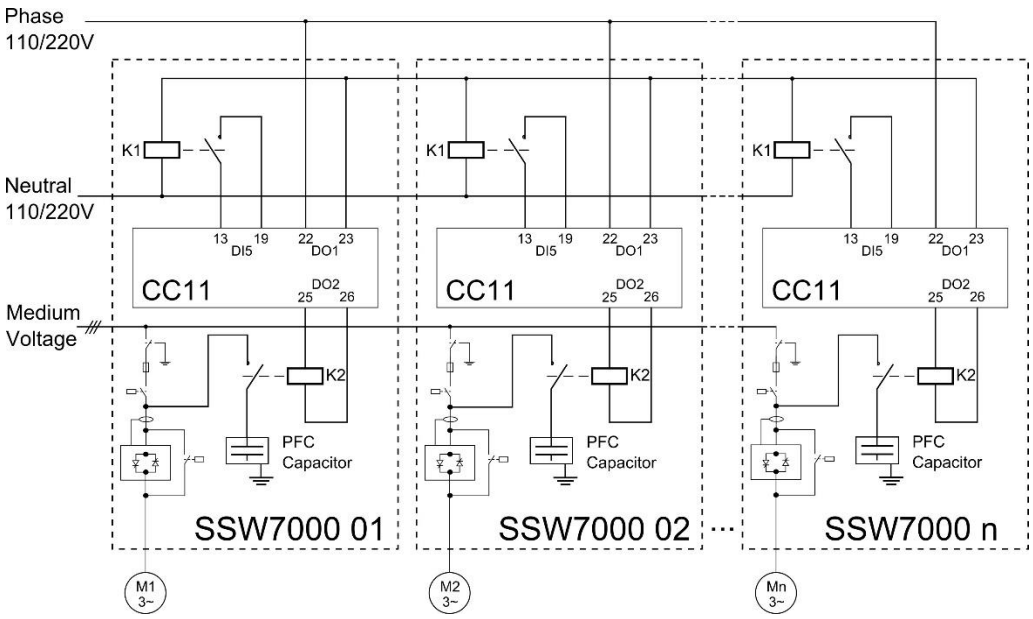


Figure 3.7 : Connection to PFC Controls for Multiple SSW7000 (example).

The start of multiple SSW7000 is done sequentially and/or simultaneously. For the simultaneous start condition of two or more SSW7000, the PFC capacitor banks will be enabled at the same time after the start of the last motor. As described by IEC 60871-1, the peak value of the capacitor bank inrush current must not exceed 100 times the value of the rated current. If the Inrush current is higher, a reactance must be installed in series with each capacitor bank. The reactance will reduce the peak current and attenuate the effect of transient overvoltage.

Discharge of the Power Factor Correction Capacitors

When the power factor correction capacitor is disconnected from the line, a residual voltage remains on it. When the capacitor is reconnected, such residual voltage can cause an inrush current of up to twice the value obtained when the capacitor is discharged during reconnection, thus reducing its useful life. In order to prevent the increase of the inrush current, the capacitors must be internally equipped with a discharge device able to reduce the residual voltage to a value close to zero after its disconnection.

Parameter P0280 - CAPACITOR DISCHARGE TIME defines the time the SSW7000 waits for the discharge of the power factor correction capacitors so as to allow a new connection. P0280 can be programmed with values between 60 to 600 seconds, and the standard value is 300 seconds (NBR5282 standard).

3.2. SSW7000 IDENTIFICATION LABEL

The SSW7000 identification label is affixed inside the product cabinet. This label contains important information on the SSW7000.

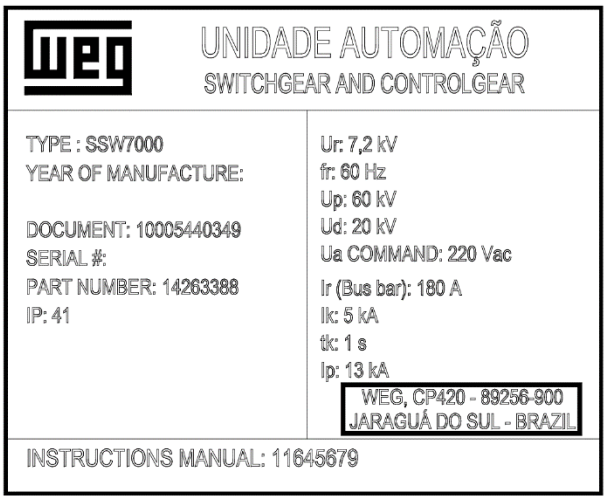


Figure 3.8. Identification label of SSW7000 (example).

Other important information can be found on the label of the Power Arms.

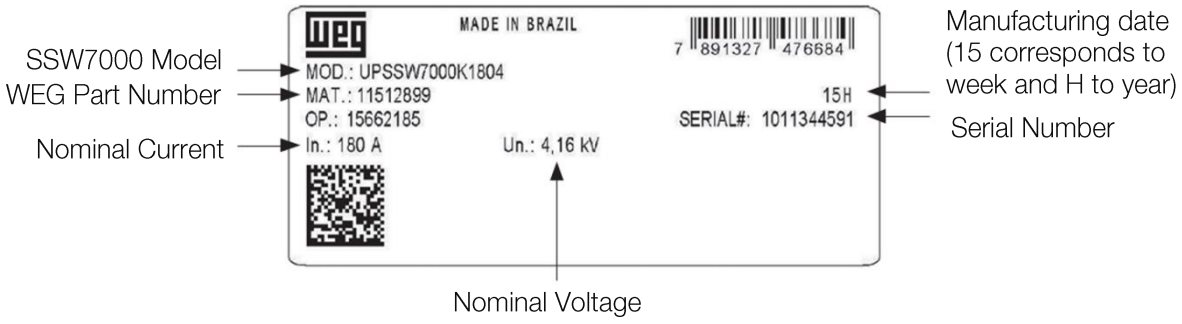


Figure 3.9 Identification label of Power Arm (example).

3.3. HOW TO SPECIFY THE SSW7000 MODEL (SMART CODE)

In order to specify the correct model of WEG Soft-Starter, use the product smart code. It is composed of several parts, which are described below:

SSW7000	A	180	T	4	11	41
1	2	3	4	5	6	7

Table 3.1. Smart Code

1 Model	2 Frame	3 Rated Current	4 Number of Phases	5 Rated Voltage	6 Electronics Power Supply	7 Degree of Protection	8 Blower Cooled	9 Special Hardware	10 Special Software	11 Market
SSW7000 = Soft-Starter WEG series 7000	A = Panel Frame A	070 = 70A 180 = 180A 300 = 300A 360 = 360A	T = Three-phase	2 = up to 2.3kV 4 = up to 4.16kV 6 = up to 6.9kV	11 = 110/220V	41 = IP41	Blank = Standard F = Blower-Cooled	Blank = Standard	Blank = Standard	Blank = Global
	B = Panel Frame B (2 columns)	500 = 500A 600 = 600A	T = Three-phase	2 = up to 2.3kV 4 = up to 4.16kV 6 = up to 6.9kV	11 = 110/220V	41 = IP41 N2 = NEMA 12	Blank = Standard F = Blower-Cooled	Blank = Standard	Blank = Standard	Blank = Global
	C = Panel Compact	125 = 125A 250 = 250A 359 = 360A	T = Three-phase	2 = up to 2.3kV 4 = up to 4.16kV 6 = up to 6.9kV	11 = 110/220V	41 = IP54 N2 = NEMA 12	Blank = Standard F = Blower-Cooled	Blank = Standard	Blank = Standard	Blank = Global
	D = Panel Frame D (MTW)	180 = 180A 300 = 300A 360 = 360A 500 = 500A 600 = 600A	T = Three-phase	9= up to 13,8kV	11 = 110/220V	4X = IP4X	Blank = Standard F = Blower-Cooled	Blank = Standard	Blank = Standard	Blank = Global

3.4. RECEIVING AND STORAGE

The standard SSW7000 is supplied with the power arms separated from the panel and packed individually.

The SSW7000 panel is supplied in a package composed by cardboard, plastic and wood.

Wood and polystyrene wedges compose the power arm package. There is an identification label outside this package, which is identical to the one affixed to the power arms. Confront the content of this label with the purchase order.

The contents of the packages should be verified on product receiving.

NOTES!
If any component is found damaged, it is recommended to:

1. Stop the package opening immediately.
2. Contact the carrier and fill in a format complaint of the problem found.
3. Take pictures of the damaged parts/components.
4. Contact your WEG representative or WEG service.

Guidance for handling, transportation, mechanical and electric installation of the product, is presented in the chapter 5 - Installation and Connection

3.4.1. Unpacking

Use proper tools to unpack the SSW7000 panel and its power arms. During this process, make sure that all the items listed in the documentation that comes with the product are present and in perfect conditions. Contact your local WEG representative or WEG service in case of any irregularity.

Remove the arm packages carefully. Note that the arms have hoisting eyes, as showed in the figure 3.10.

The SSW7000 power arms have fragile components (electronic boards, fiber optic connectors, busbars, wiring, etc.). Avoid touching these components.

The arms must always be handled through their external metallic frame. While opening the package, inspect the arms for transportation damage. Do not install the arms if they are damaged or if you suspect of any damage.

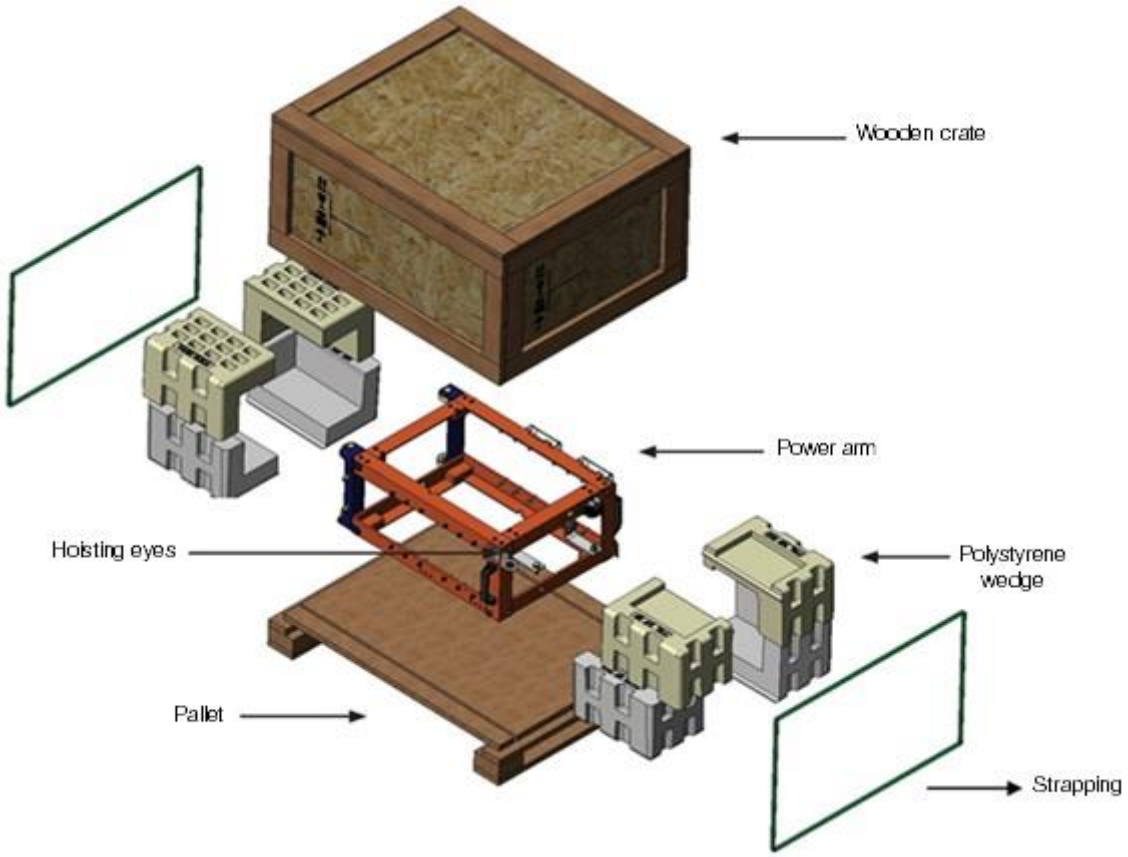


Figure 3.10: a) SSW7000 Power Arms with package

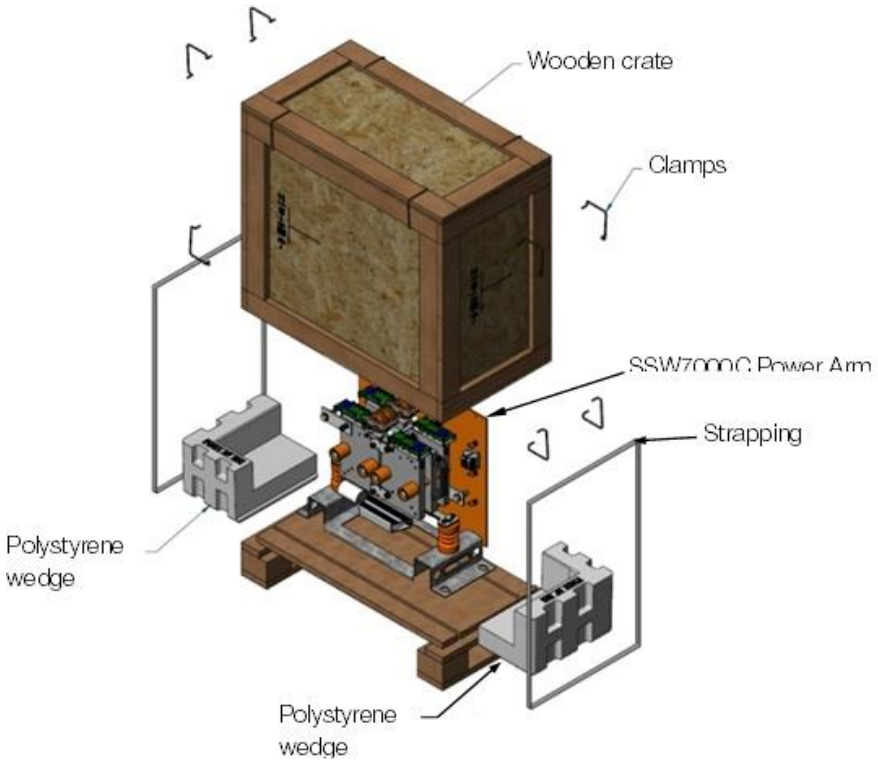


Figure 3.11: b) SSW7000C Power Arms with package

3.4.2. Panel and Power Arm Storage

If the panel and/or the power arms are not installed soon after unpacked, the following storage instructions must be followed:

- They must be packed again in their original packages, but without the plastic film, in order to avoid moisture condensation.
- They must be stored in a clean and dry environment (temperature between -25 °C and 50 °C (-13 °F and 122 °F) with moisture below 85 %).
- They must be covered up in order to avoid dust accumulation or water splashing.

4 HMI

4.1. BATTERY

The battery located inside the HMI is used to keep the clock operation while the soft-starter is deenergized. Its location and replacement are show in the figure 4.1.

The battery life expectancy is of approximately 10 years. To remove it rotate the cover located at the rear part of the HMI, according to the figure 4.1. When necessary, replace the battery by another of the CR2032 type.

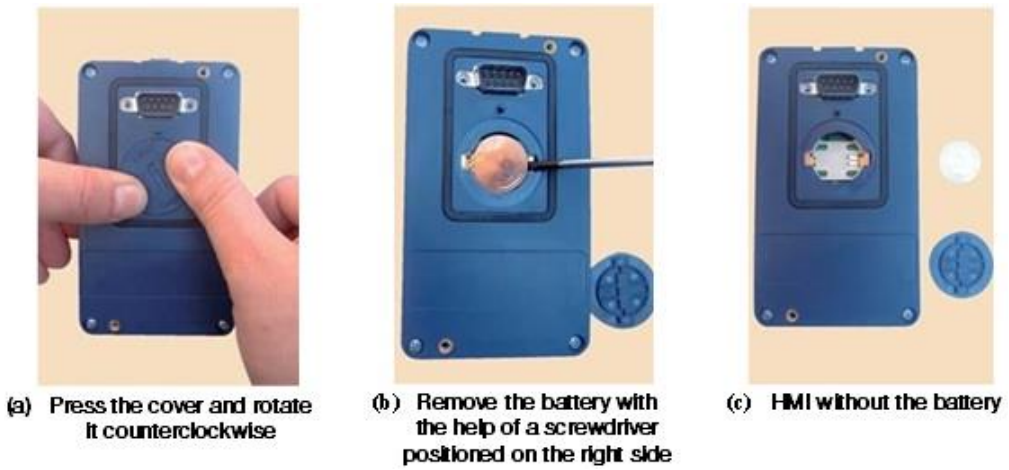


Figure 4.1: Location and battery replacement HMI

NOTE!
The battery is necessary only for clock-related functions. In the event of the battery being discharged or not installed in the keypad (HMI), the clock time becomes incorrect and the alarm A182 – "Invalid Clock Value" will be indicated every time the SSW7000 is powered up.

4.2. HMI CABLE

The HMI can be installed and removed even when power is applied to the SSW7000.

The HMI supplied with the product can also be used to command the SSW7000 remotely. Therefore, use a cable with male and female D-Sub9 (DB9) connectors, with pin-to-pin connections, or a market standard Null Modem cable. Maximum allowed cable length of 10 m (32.81 ft).

Examples:
Mouse extension cable - 1.8 m (5.91 ft); Manufacturer: Clone.
Belkin pro series DB9 serial extension cable 5 m (16.4 ft); Manufacturer: Belkin.
Cables Unlimited PCM195006 cable, 6 ft DB9 m/f; Manufacturer: Cables Unlimited.

The M3 x 5.8 metallic stand-offs supplied with the product must be used. Recommended tightening torque: 0.5 N.m (4.50 lbf.in).

5 INSTALLATION AND CONNECTION

This chapter describes the SSW7000 electrical and mechanical installation procedures. The presented instructions and guidelines must be followed aiming personnel and equipment safety, as well as the SSW7000 proper operation.

ATTENTION!
Only trained personnel, qualified to work with medium voltage installations, must handle the SSW7000 and perform the mechanical and electrical installation.

5.1. MECHANICAL INSTALLATION

5.1.1. Environmental Conditions

Avoid:

- Direct exposure to sunlight, rain, high humidity, or sea-air.
- Inflammable or corrosive gases or liquids.
- Excessive vibration.
- Dust, metallic particles, and oil mist.

Allowed environmental conditions:

- Temperature: -10 ºC a 40 ºC (14 ºF a 104 ºF) – at nominal conditions (surrounding the soft-starter).
- From 40 ºC to 50 ºC (104°F to 122 °F) - current derating of 2% for each Celsius degree above 40 ºC (104 F).
- Maximum ambient temperature: 50 ºC (122 °F).
- Relative humidity: from 5 % to 95 % non-condensing.
- Altitude: up to 1000 m (3280.83 ft) - nominal conditions. Consult WEG for other altitudes.
- Pollution degree: 2 (according to UL508) with non-conductive pollution. Condensation shall not originate conduction through the accumulated residues.

5.1.2. Dimensions with Package

Table 5.1; SSW7000 Panel Dimensions – IP41 with package

Width mm (in)	Height mm (in)	Depth mm (in)	Weight kg (lb)
1460 (57.48)	2530 (99.61)	1320 (51.97)	855 (1884.95)

Table 5.2: SSW7000C NEMA 12 dimensions with package

Model	Width mm (in)	Height mm (in)	Depth mm (in)	Weight kg (lb)
SSW7000C	1178 (46.36)	2514 (99.0)	1168 (46.0)	600 (1346)

Table 5.3. Power arms dimensions with package – SSW7000.

Rated Voltage kV	Width mm (in)	Height mm (in)	Depth mm (in)	Weight kg (lb)
2,3	935 (36.81)	561 (22.09)	643 (25.31)	87 (191.8)
4,16	935 (36.81)	561 (22.09)	760 (29.92)	103 (227.07)
6,9	935 (36.81)	561 (22.09)	877 (34.53)	122 (268.96)

Table 5.4. Power Arms dimensions with package – SSW7000C

Rated Voltage kV	Width mm (in)	Height mm (in)	Depth mm (in)	Weight kg (lb)
2,3	760 (29.92)	660 (25.98)	430 (16.93)	38 (83.78)
4,16	793 (31.22)	813 (32.01)	430 (16.93)	56 (123.5)
6,9	826 (32.52)	813 (32.01)	430 (16.93)	69 (152.1)

5.1.3. Panel and Arm Dimensions

The SSW7000 is supplied in panels with the following external dimensions:

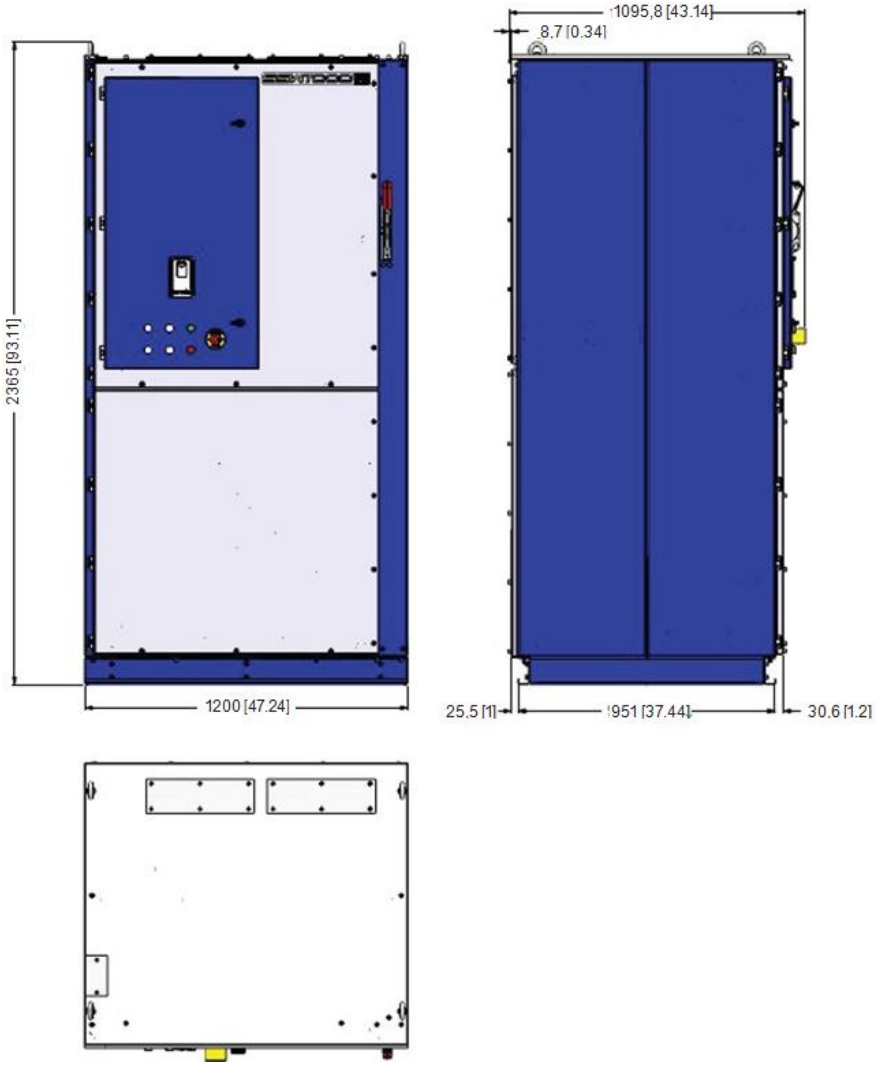


Figure 5.1 SSW7000 IP41 panel

Table 5.5. SSW7000 IP41 panel

Width mm(in)	Height mm in)	Depth mm (in)	Weight (without the arms) kg (lb)
1200 (47.24)	2365 (93.11)	1007 (39.64)	720,1 (1587.55)

The power arms of the SSW7000 are supplied separately from the panel and individually packed.

Table 5.6: SSW7000 Power arm dimensions without package

Rated Voltage kV	Width mm (in)	Height mm (in)	Depth mm (in)	Weight kg (lb)
2,3	262 (10.31)	722 (28.42)	430 (16.93)	53 (116.84)
4,16	262 (10.31)	722 (28.42)	546 (21.5)	68,6 (151,24)
6,9	262 (10.31)	722 (28.42)	664 (26.14)	83,3 (183.64)

The dimensions for the compacts versions NEMA12 and IP54 - SSW7000C are given below.

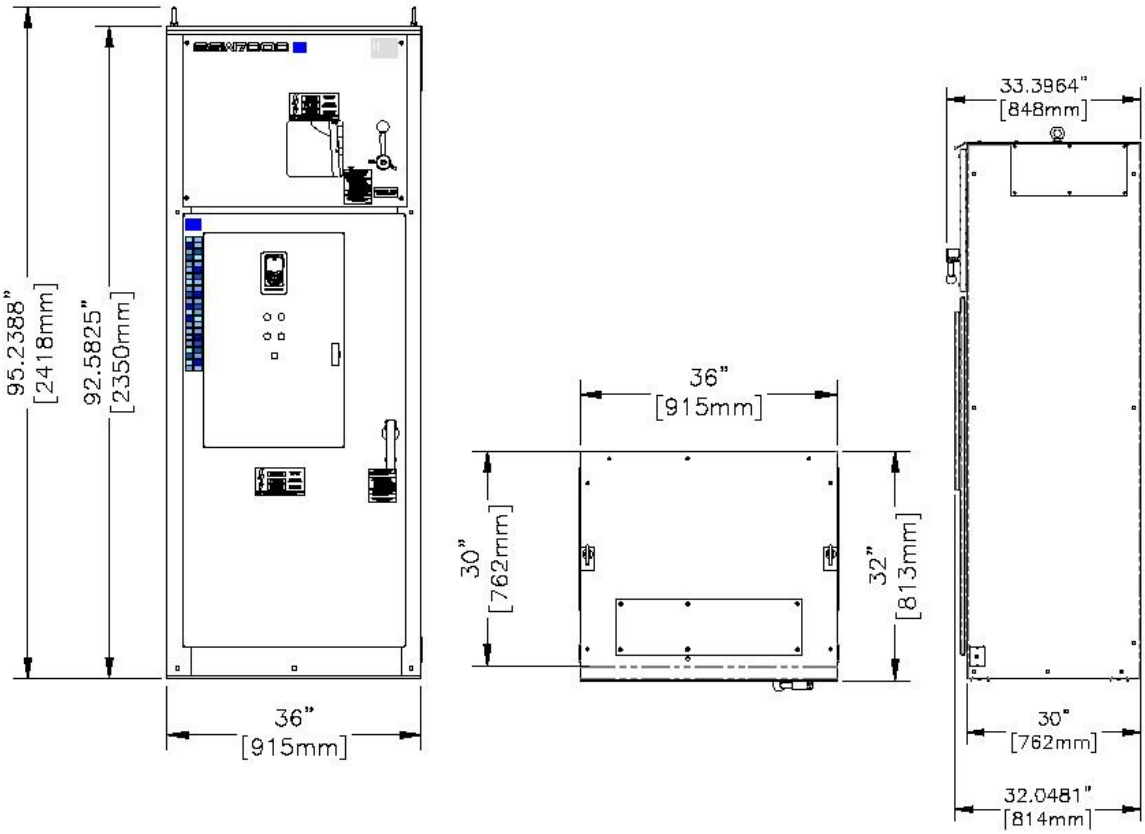


Figure 5.2 (a): Nema 12 panel - SSW7000C.

Table 5.7: SSW7000C Nema 12 and IP54 panel

Width mm (in)	Height mm (in)	Depth mm (in)	Weight (without arms) kg (lb)
915 (36)	2418 (95)	813 (32)	546,4 (1205)

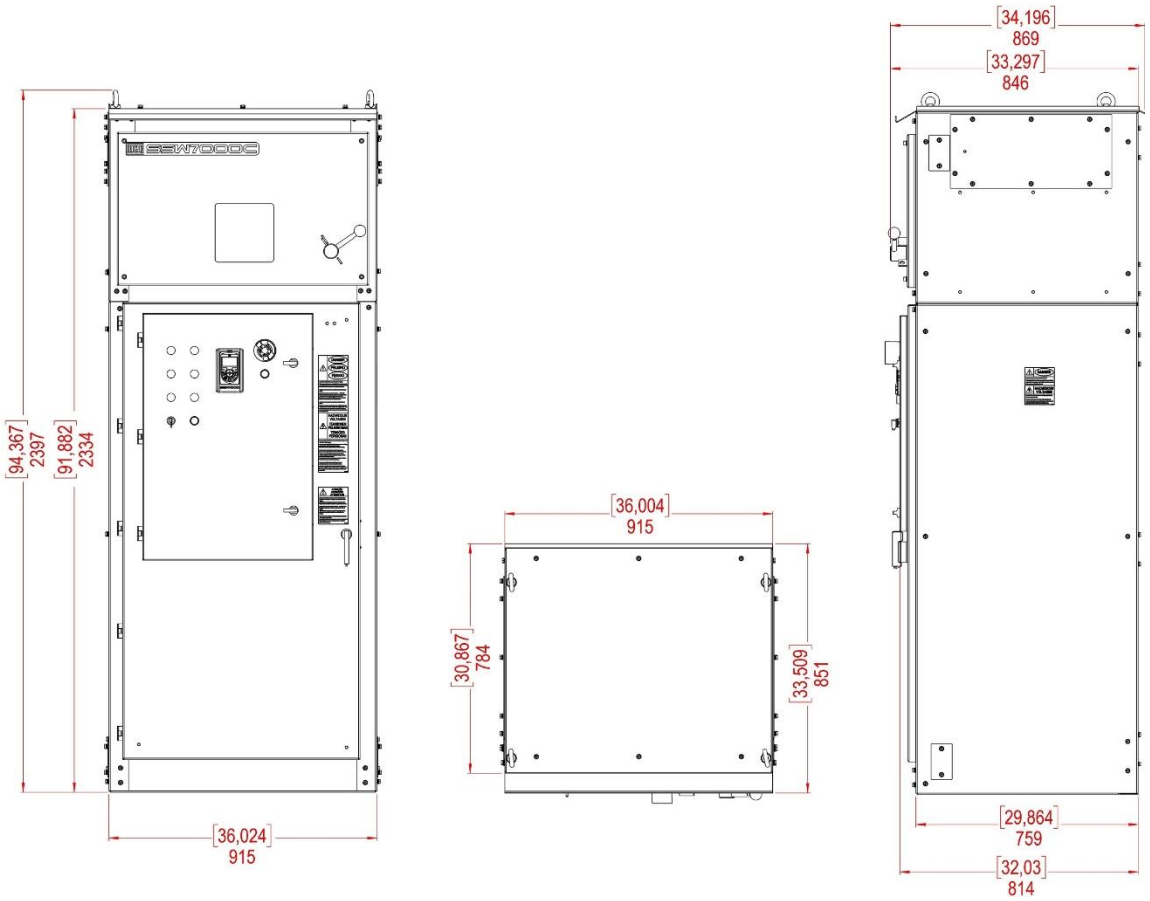


Figure 5.2 (b): IP54 panel - SSW7000C.

The power arms of the SSW7000C are supplied mounted on the panel.

Table 5.8 SSW7000C Power Arms dimensions without package

Rated Voltage kV	Width mm (in)	Height mm (in)	Depth mm (in)	Weight kg (lb)
2,3	226 (8.90)	458 (18,03)	482 (19.0)	20 (44,1)
4,16	230 (9.50)	585 (23.03)	482 (19.0)	30 (66,2)
6,9	265 (10.43)	585 (23.03)	482 (19.0)	40 (88,2)

The mechanical panel B used for models with currents of 500A and 600A, has a similar mechanical design as the compacts versions. The mechanical panel D used for 13,8kV models, has a similar mechanical design as the MTW panel WEG. The width and depth of the panels are larger to accommodate higher current and voltage capacity power arms. Consult the manufacturer for more details.

5.1.4. Handling Recommendations

Remove the package completely only at the installation site, where the panel will be operated.

Before hoisting or moving the panel, locate the hoisting eyes and fragile spots in the documentation that comes with the product.

Follow the handling instructions contained in the documentation that comes with the panel.

5.1.5. Hoisting

Make sure that the lifting device used to hoist the panel and the arms is suitable for their shape and weight indicated in the figure 5.1 at figure 5. and in the table 5.5 at table 5.8.

Observe the gravity center and ensure that the hoisting mechanism is adequate and safe. Use the configuration shown in the figure 5.3.

The cables or chains used for hoisting must be at a minimum angle of 45° regarding the horizontal plane.

Hoisting must be done in a slow and stable manner. Before starting, make sure the entire pass is clear of obstacles. If any alteration or damage in the panel structure is noticed, stop the hoisting and rearrange the cables or chains.

NOTE!
The hoisting eye supplied with the Nema 12 panel is optional.

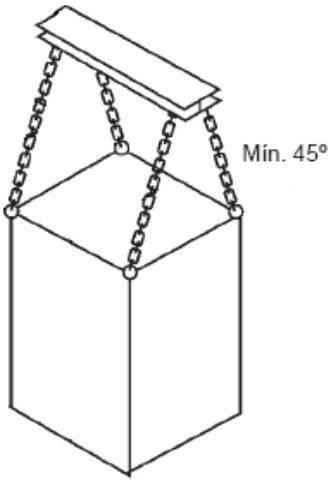


Figure 5.3: Recommended hoisting mechanism for the panel movement.

5.1.6. Moving

Make sure that all the panel doors are closed and locked and that the door handles are in a protected position.

When cranes or pulleys are used, make sure that the movements are slow and smooth, so that the panel and the arms do not suffer excessive swings and vibration.

When using movable hydraulic jacks, forklifts, rollers or other movement means, distribute the support points from one extreme of the panel through the other, avoiding pressure on fragile areas.

5.1.7. Positioning and Mounting

The SSW7000 panel must be placed on a flat leveled surface, thus avoiding mechanical instability, door misalignment, among other problems.

The permanent panel operation position must allow heat radiation from all its surfaces.

The area in front of the panel must remain unobstructed, so that the total opening of the doors is possible, as well as the insertion and extraction of the soft-starter arms and the installation and/or handling of the power and control cables. The connection of the power supply and motor cables is done at the rear of the cabinet.

The figure 5.4 presents the dimensions for the panel anchoring and the passage of the cables under the panel.

ATTENTION!
Make sure there is access for the electrical connections: power supply input and motor cables, command, motor protections, analog and digital inputs and outputs.

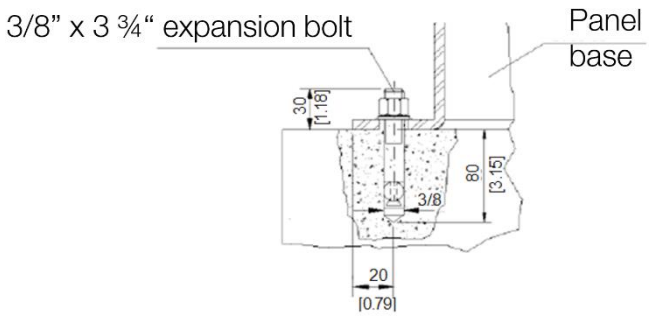
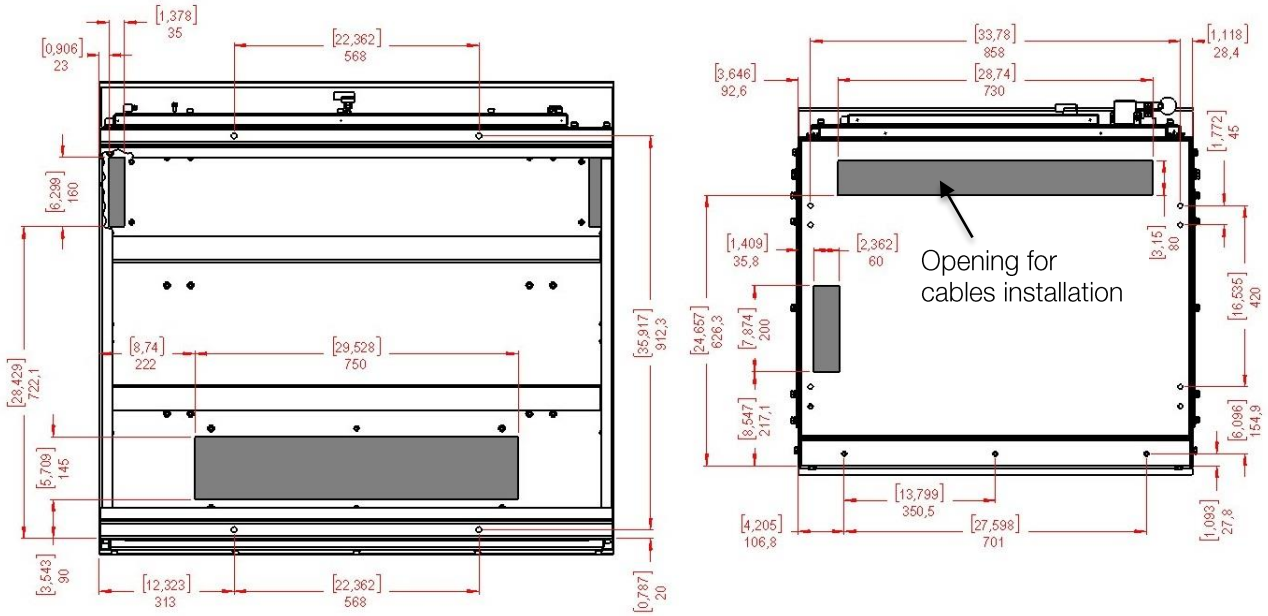


Figure 5.4 (a): Expansion bolt for anchoring of the SSW7000 panel to the floor – dimensions in mm [in]



(a): IP41 48" Panel - SSW7000A *(b): NEMA 12 36" Panel - SSW7000C*

Figure 5.4 (b): Anchoring of the SSW7000 panel to the floor – dimensions in mm [in]

The adjustment of the mechanical interlock of the doors of the medium voltage compartment of the SSW7000 and SSW7000C is carried out at the factory. If any problem is detected in the mechanical interlock operation, which may be caused by irregular surface where the panel is installed, for instance, adjust the locking part by means of the bolts indicated in figure 5.5 and figure 5.6.

.

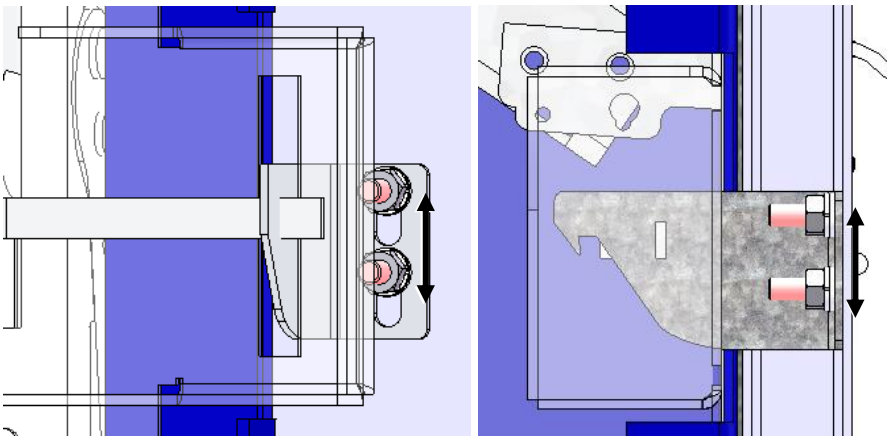


Figure 5.5: Position of the door interlock adjustment bolts of the medium voltage compartment – SSW7000.

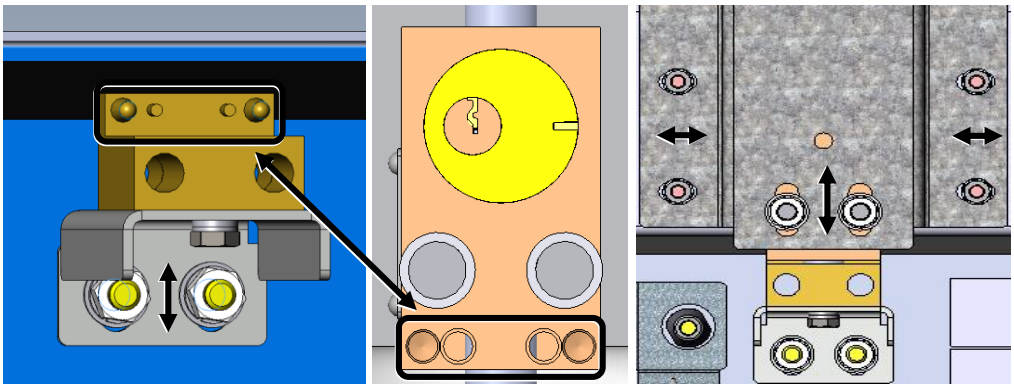


Figure 5.6 (a): Position of the door interlock adjustment bolts of the medium voltage compartment, model 1 SSW7000C.

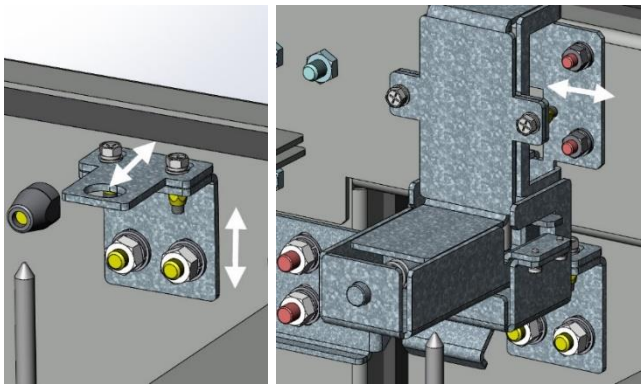


Figure 5.6 (b): Position of the door interlock adjustment bolts of the medium voltage compartment, model 2 - SSW7000C.

5.1.8. Medium Voltage Compartment

The disconnect switch, the fuses, the input contactor, the bypass contactor, the power arms and the control board 2 are stored in the medium voltage compartment.

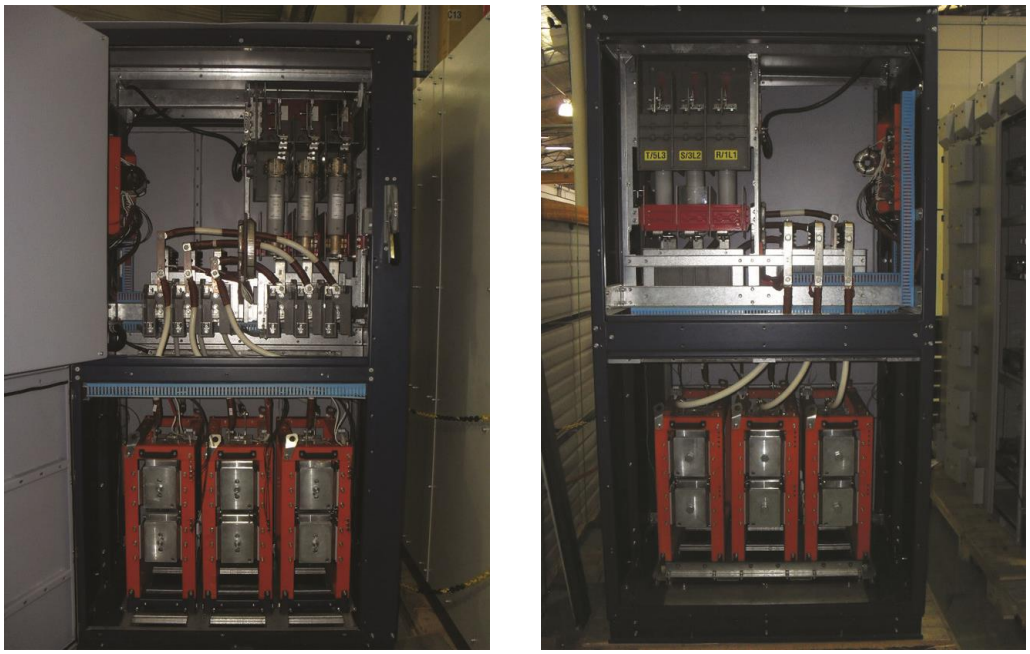


Figure 5.7: Medium voltage compartment (from view and rear view) – IP41

Figure 5.8: Medium voltage compartment (from view) SSW7000C – Nema 12

5.1.9. Low Voltage Compartment

In the low voltage compartment are the direct access components to the user's control connections: control board, power supply for control board, power supply for the medium voltage boards, auxiliary contactors and access terminals.

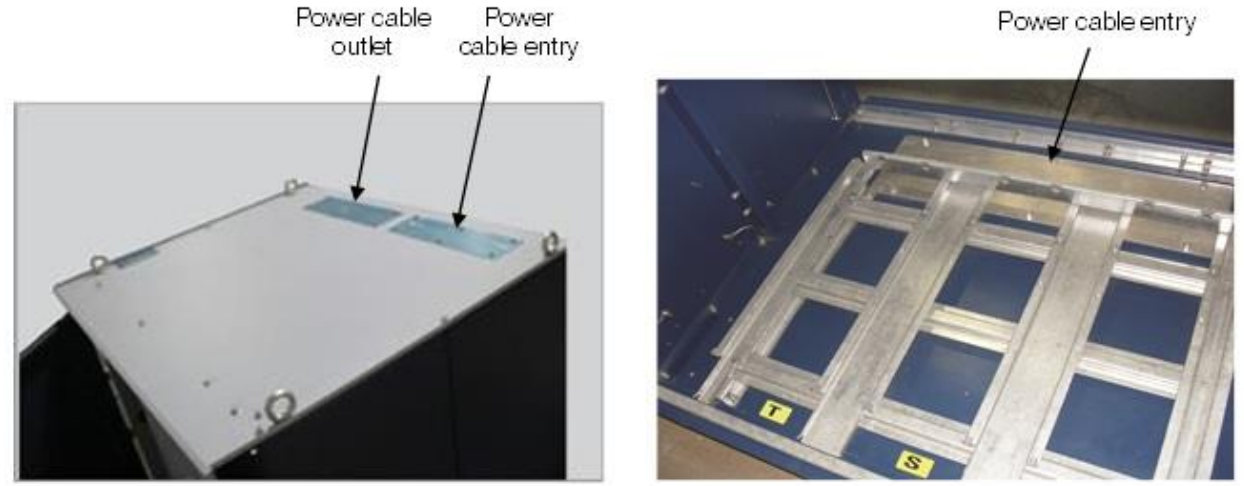
CONTROL VERSION 2 AND 3

Figure 5.9: Low voltage compartment.

For more details see chapter 6 - Internal Connections.

5.1.10. Power Cable Entry

The passage of power cables in the panels IP41 and Nema 12 is shown in figure 5.10 and figure 5.11.



(a) Passage of the cables by the upper part of the panel (b) Passage of the cables by the lower part of the panel

Figure 5.10. (a) and (b): Passage of the power cables – IP41.

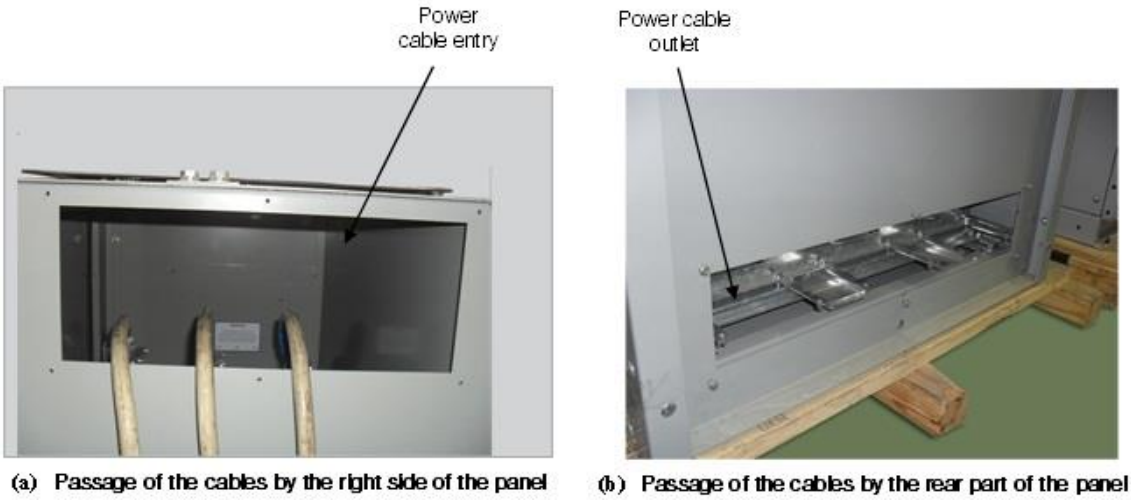


Figure 5.11. (a) and (b): Passage of the power cables – Nema 12

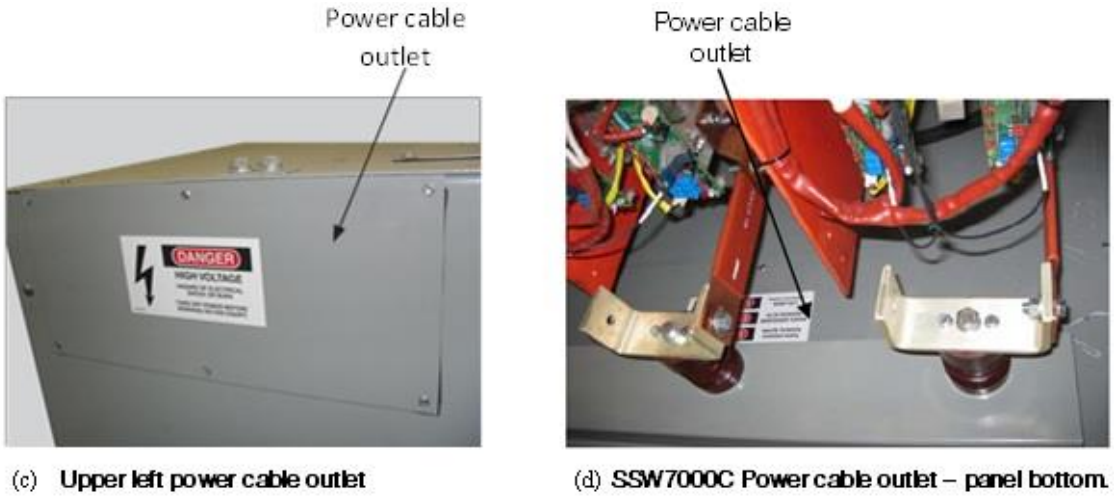
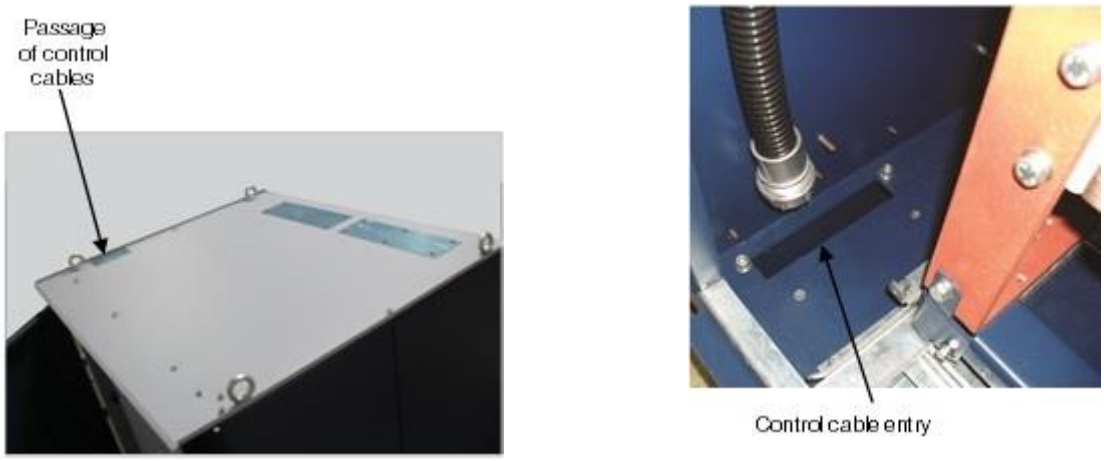


Figure 5.11. (c) and (d): Passage of the power cables – Nema 12.

5.1.11. Control Cable Entry

The passage of the control cables (digital and analog inputs and outputs, thermistor PT100 and low voltage supply cables) in the panels IP41 and Nema 12 of the SSW7000 is shown in figure 5.12 and figure 5.13 respectively.



(a) Passage of cables by the upper part of the panel

(b) Passage of the cables by the lower part of the panel

Figure 5.12: (a) e (b): Passage of the control cables – IP41.

Figure 5.13: Passage of the control cables by the lower part of the left side of the panel – Nema 12.

5.1.12. Power Arm Insertion

First, remove any packing residues (plastic, wood, polystyrene, metal, nails, bolts, nuts, etc.) that might have been left inside the power arms.

Insert the arms according to the following procedure:

1. Use the auxiliary guide brackets, shown in figure 5.14 (a), to move the arms. These auxiliary guide brackets are supplied with the product and are positioned at the internal part of the medium voltage compartment door when they are not used.
2. The arm must be inserted until the locking pins, located at the rear of the arm, fit into the rail base, refer to figure 5.14 (b).
3. 3. Install the locking bolts at the arm front bottom part, refer to figure 5.14 (c).

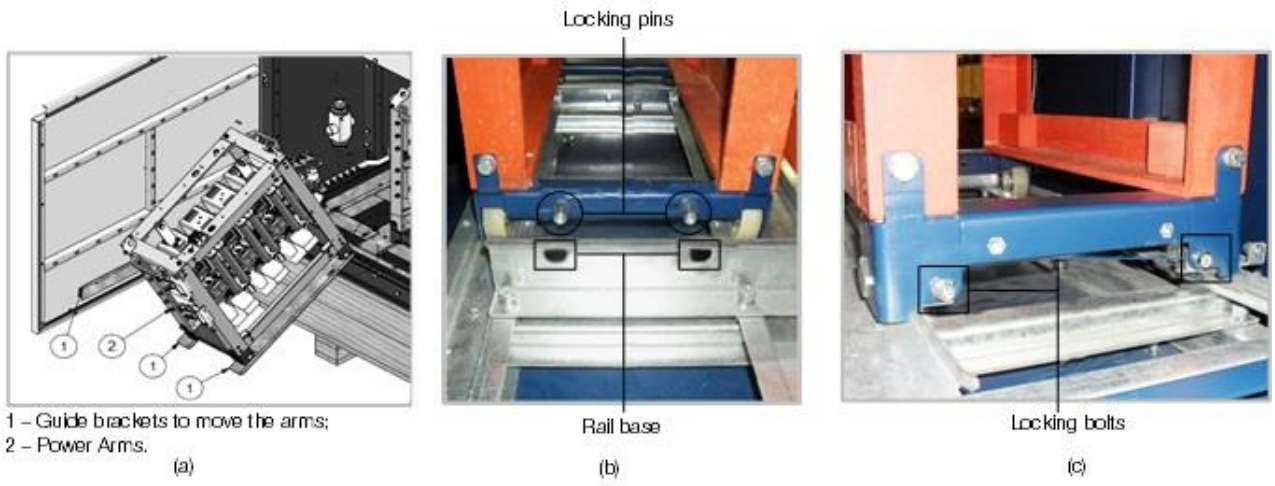


Figure 5.14 (a) to (c): Details of the arm insertion stages

For the SSW7000C, the power arms are lighter and are fixed at the panel rear by means of screws, as shown in figure 5.15.

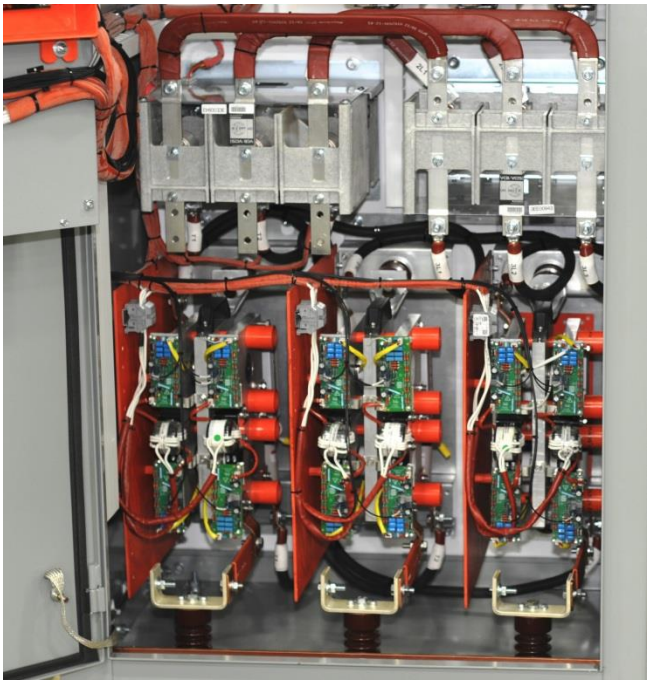


Figure 5.15 SSW7000C Power arms installation.

5.2. ELECTRICAL INSTALLATION

DANGER!
Before beginning the connections, make sure the power supply is disconnected.

DANGER!
The SSW7000 cannot be used as an emergency stop mechanism.

ATTENTION!
The following information is intended to be a guide for a proper installation. You must also comply with applicable local regulations for electrical installations.

ATTENTION!
During the commissioning, apply power first to the electronics and program the minimum necessary parameters to be able to run the Test Mode (according to the programming manual, section 14.2 - Test Mode).

The Test Mode execution is essential for the confirmation of the correct operation of the SSW7000 panel main components.

Start the motor only if the Test Mode results were satisfactory.

5.2.1. Power Arm Electrical and Fiber Optic Connections

After inserting the power arms (R-U, S-V and T-W phases) connect them to the power cables, to the fiber optic cables and to the firing board power supply. All the power arm connections are easy to access.

Power connections:

The input and output power connections are made with cables with lugs, connected to the module copper terminals. For SSW7000C, the input connection is at the top of the module and is made using cables with lugs. The output connection is made using copper bars.

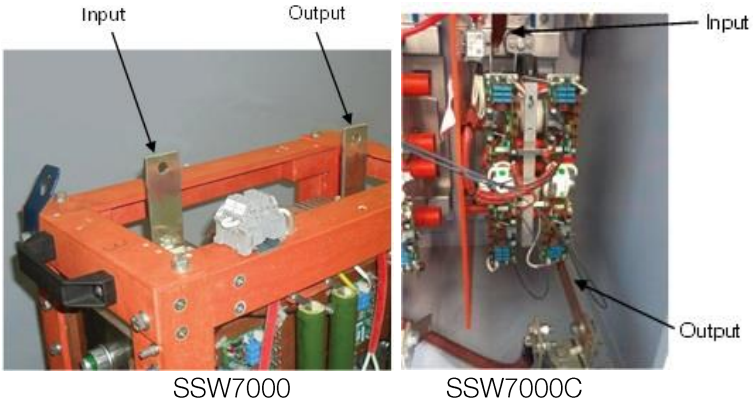


Figure 5.16: Connection of the power cables to the power arms

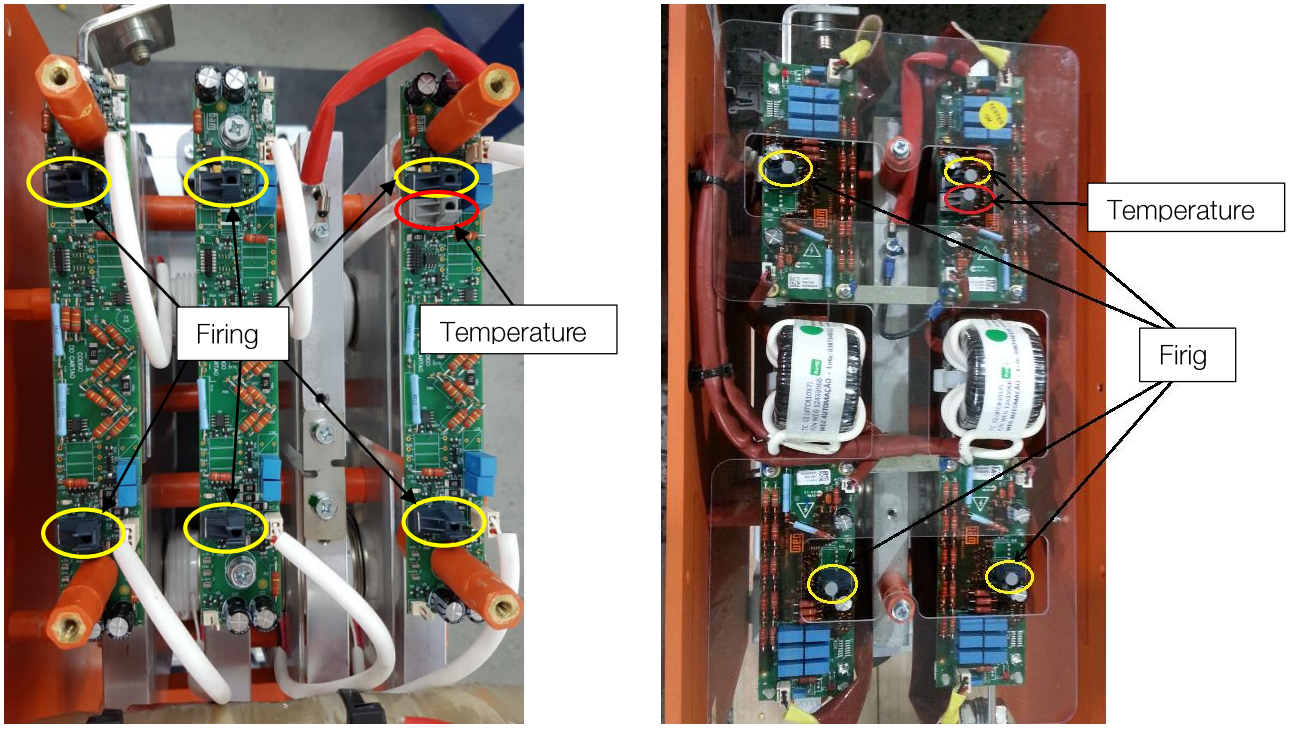
Table 5.9: Power cable identification

Power Cable Identification	Arm Terminal
R	R-U arm input
U	R-U arm output
S	S-V arm input
V	S-V arm output
T	T-W arm input
W	T-W arm output

Fiber optic cable connections:

The firing and temperature monitoring connections are made through fiber optic cables connected to the terminals available at the front of the power arm. The firing cables are connected to the blue terminals and the temperature reading to the gray one. The number of firing cables changes according to the power arm rated voltage. All the power arm firing connections are interchangeable amongst themselves.

Figure 5.17: Firing and temperature Reading fiber optic cable connections – SSW7000



(a) UPSSW7000C 6,9kV (b) UPSSW7000C 4,16kV

Figure 5.18: Firing and temperature Reading fiber optic cable connections – SSW7000C

Table 5.10: Number of firing fiber optic cables per power arm

Rated Voltage	Number of Firing Cables
2,30 kV	2
4,16 kV	4
6,90 kV	6

Table 5.11: Fiber optic cable identification

Power Arm	Fiber Optic Cable Identification	Terminal Color at the Power Arm
R-U arm	Fire R – SCR firing cables	Blue
	Temp. R – NTC themistorr cable	Gray
S-V arm	Fire S – SCR firing cables	Blue
	Temp. S – NTC thermistor cable	Gray
T-W arm	Fire T – SCR firing cables	Blue
	Temp. T – NTC thermistor cable	Gray

NOTES!
Precautions with the fiber optic cables:

1. Handle them with caution, in order not to fold, bend, squeeze or cut them.
2. To insert or disconnect the cables, apply pressure or pull only at the connector, and never at the cable.
3. Never bend the cables with a radius smaller than 40 mm (1.57 in).

Firing boards power supply connections:

The connections of the firing boards power supply depends on the power arm rated voltage. In order to achieve the proper supply operation, in version 2 (V2), always connect the three transformer sets in series, in version 3 (V3), always connect the transformers in parallel.

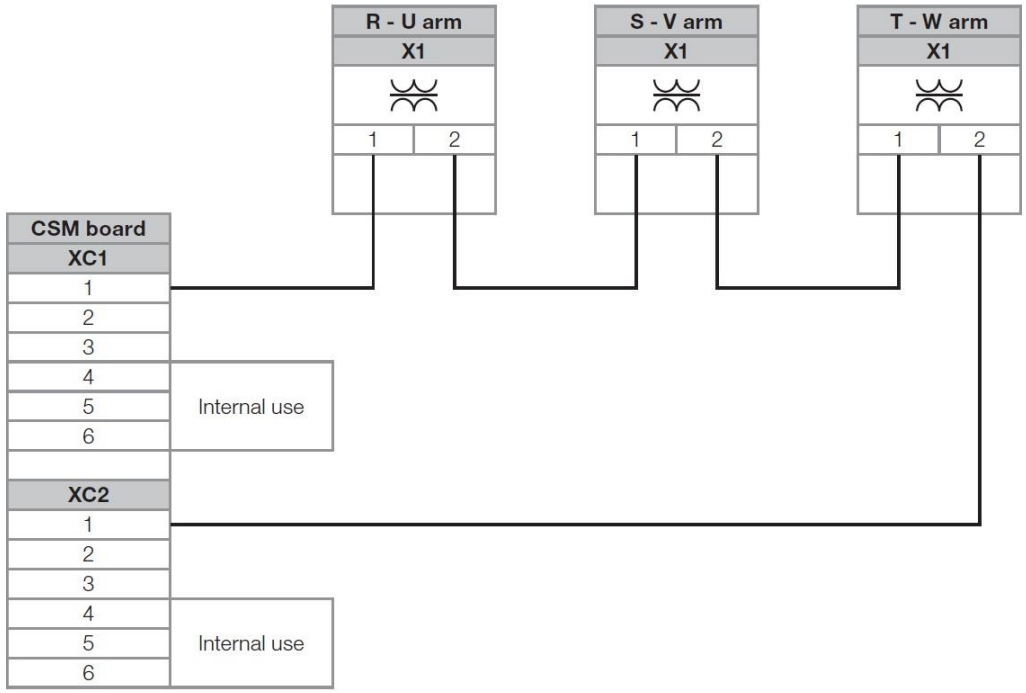


Figure 5.19: Insulated supply connections between the CSM2 board and the power arms of the model 2300 V (V2).

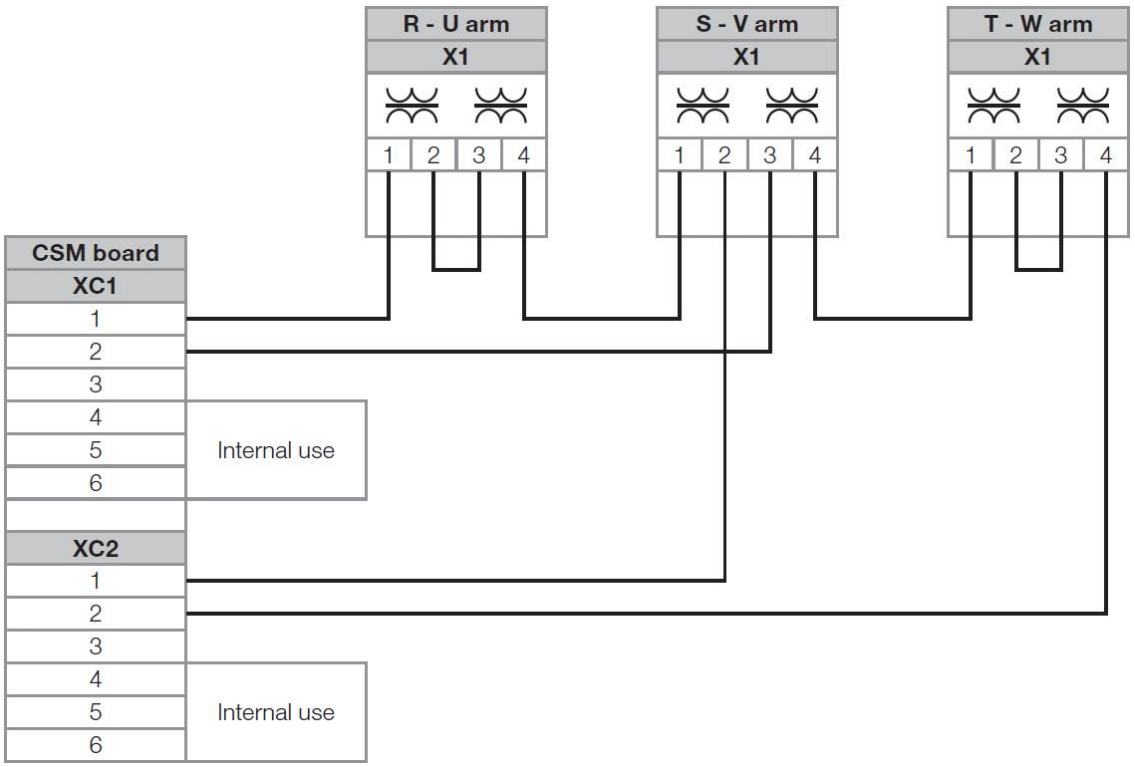


Figure 5.20: Insulated supply connections between the CSM2 board and the power arms of the model 4160 V (V2).

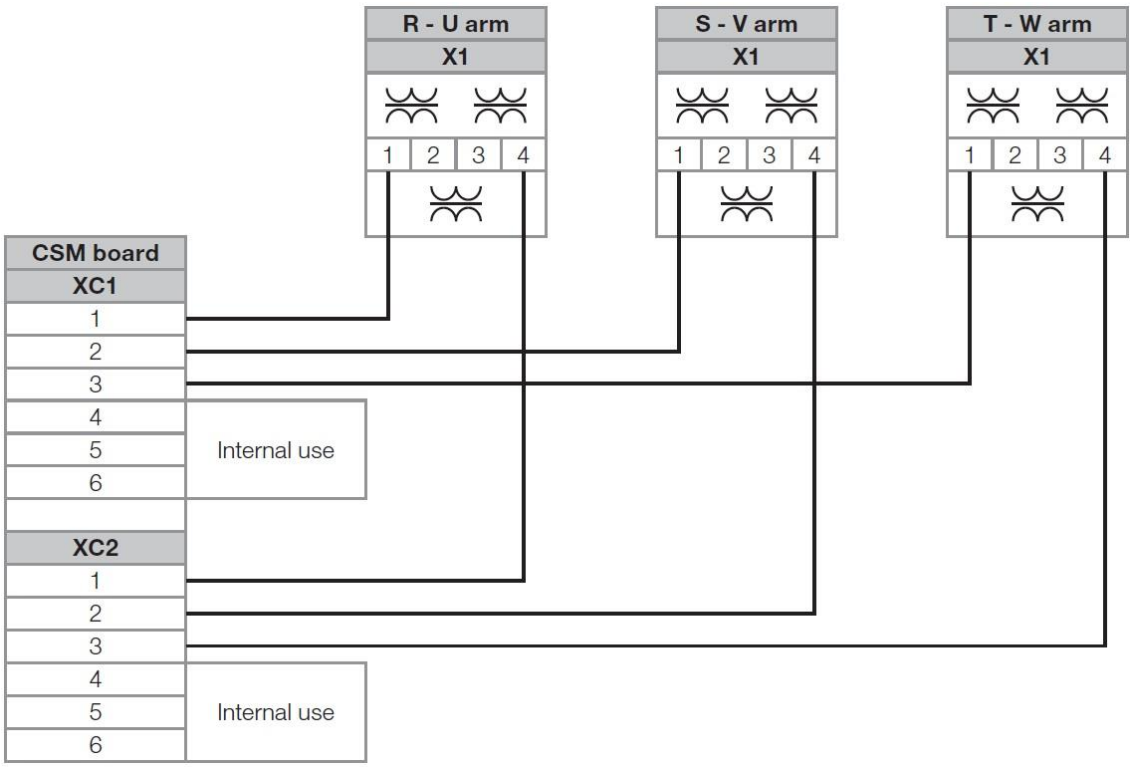


Figure 5.21: Insulated supply connections between the CSM2 board and the power arms of the model 6900 V (V2).

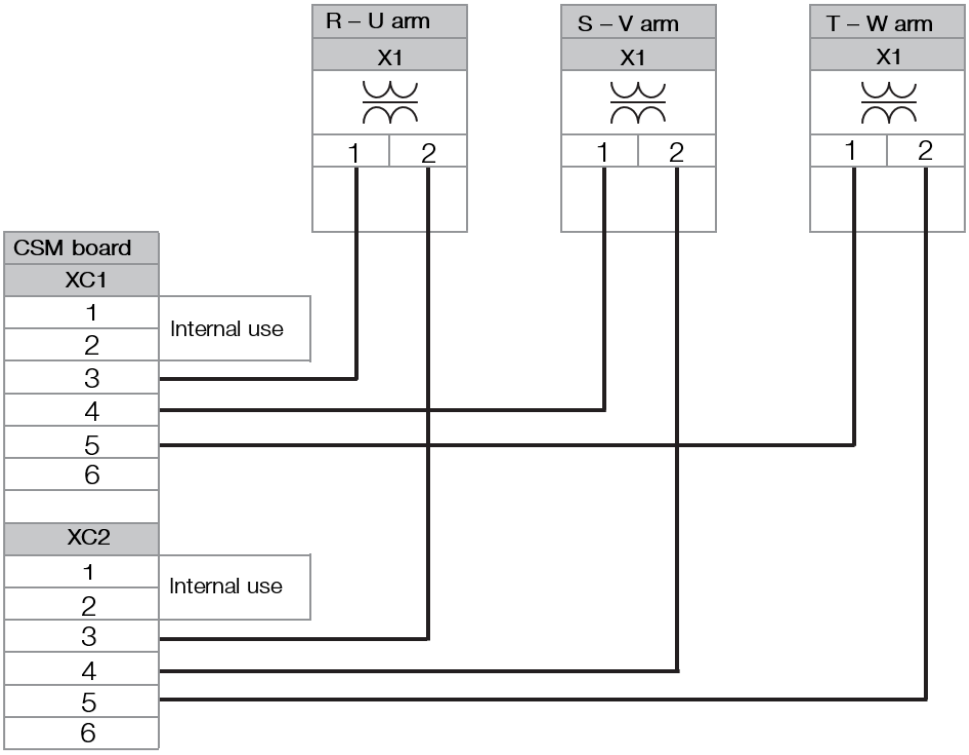
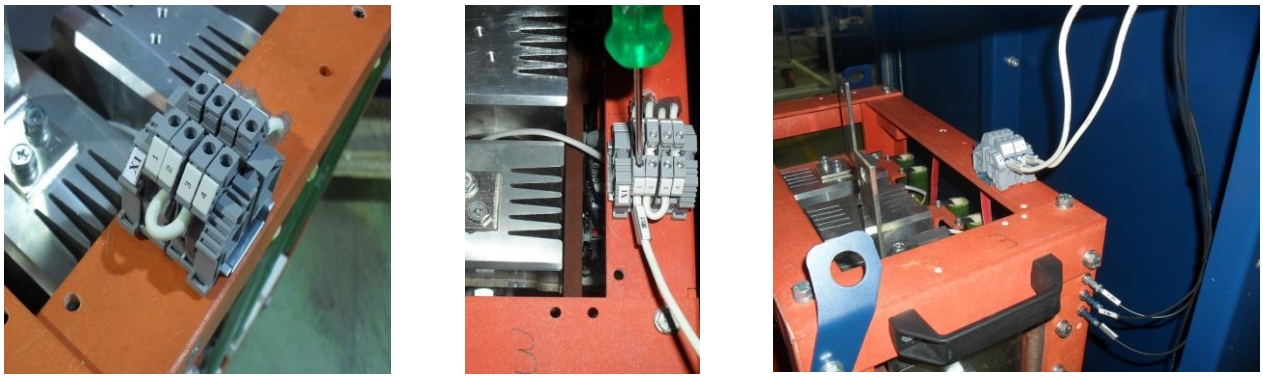


Figure 5.22: Insulated supply connections between the CSM3 board and the power arms of the model 6900 V (V3).

NOTE!
All the power supply connection cables must have medium voltage insulation, according to the following specifications: 15 kVac, 200 °C (392 °F), 14 AWG or superior.

Table 5.12: Identification of the power supply cables of the electronic boards of the power arms

Power Supply cable Identification	Identification on the Arm
A1 – Power supply cable	X1:1
A2 – Power supply cable	X1:2
A3 – Power supply cable	X1:3
A4 – Power supply cable	X1:4



(a) (b) (c)

Figure 5.23 (a) a (c): Details of the cable installation on the power arms

5.2.2. SSW7000 Simplified Block Diagram

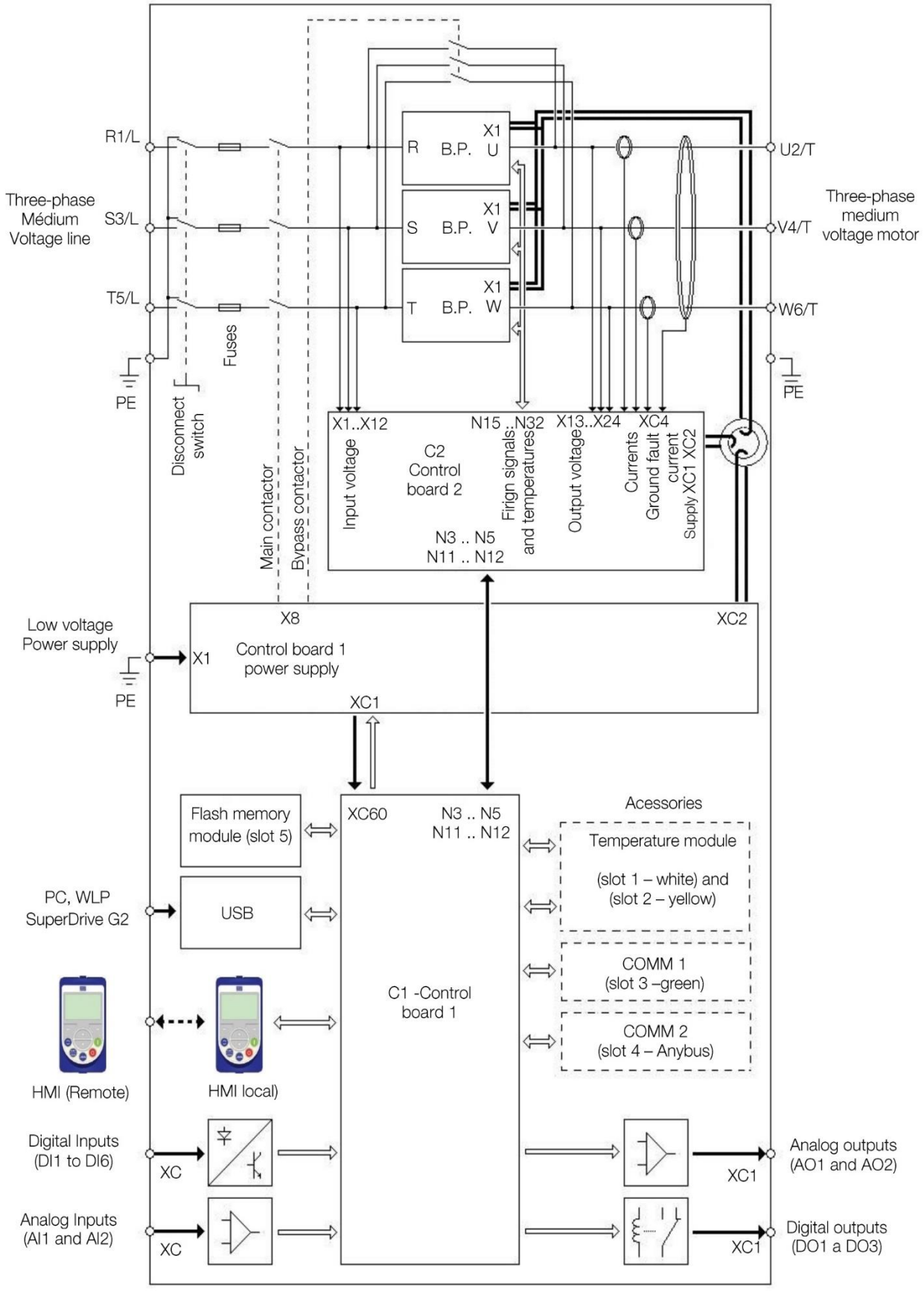


Figure 5.24: SSW7000 simplified block diagram

5.2.3. Location of the Power and Grounding Connections

T / 5L3, S / 3L2, R / 1L1: medium voltage line.

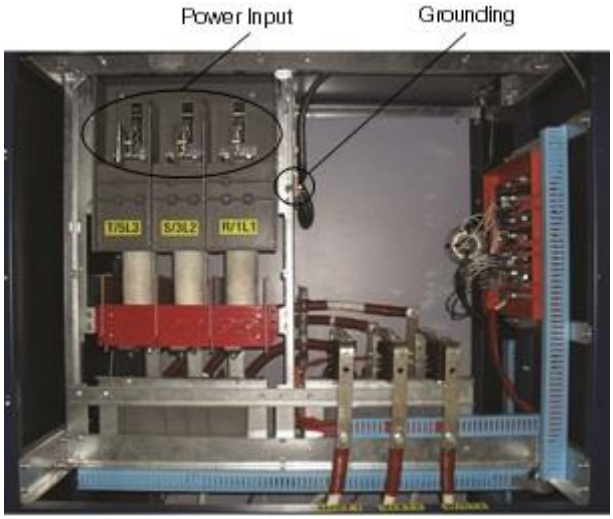


Figure 5.25 (a): Rear panel view. Power input and grounding connections – IP41

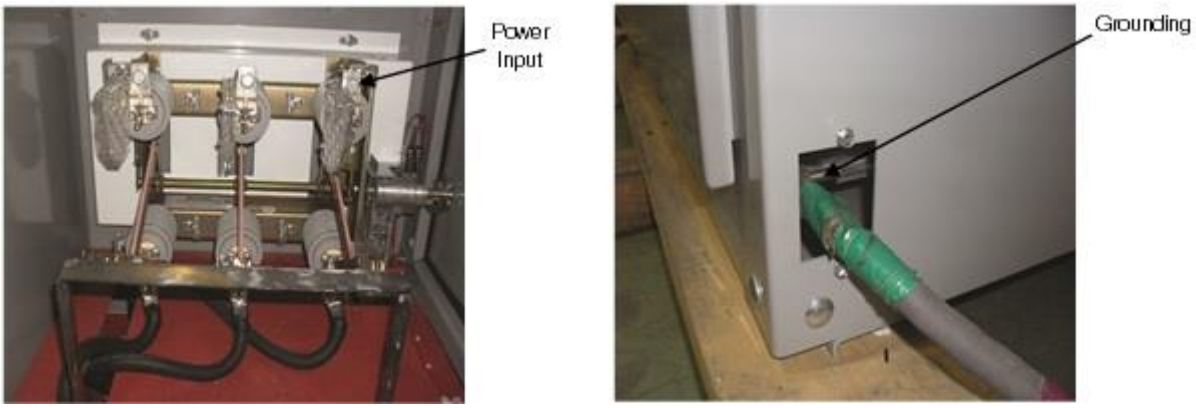


Figure 5.25 (b): Power input and grounding connections – Nema 12

U / 2T1, V / 4T2, W / 6T3: motor connection.

Figure 5.26 (a): Rear panel view. Motor connections – IP41

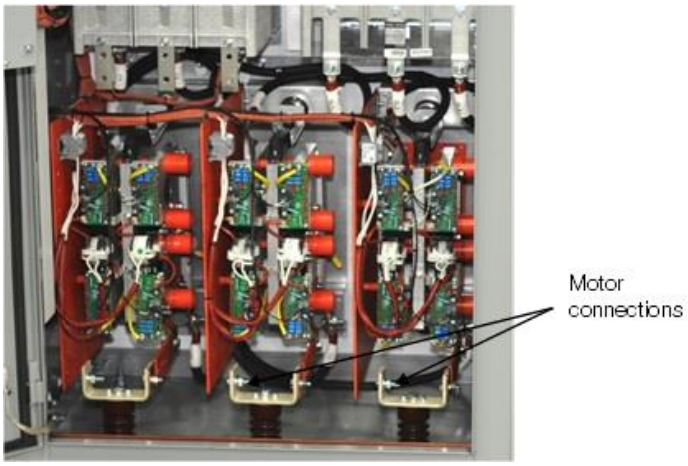


Figure 5.26 (b): Motor connections – SSW7000C

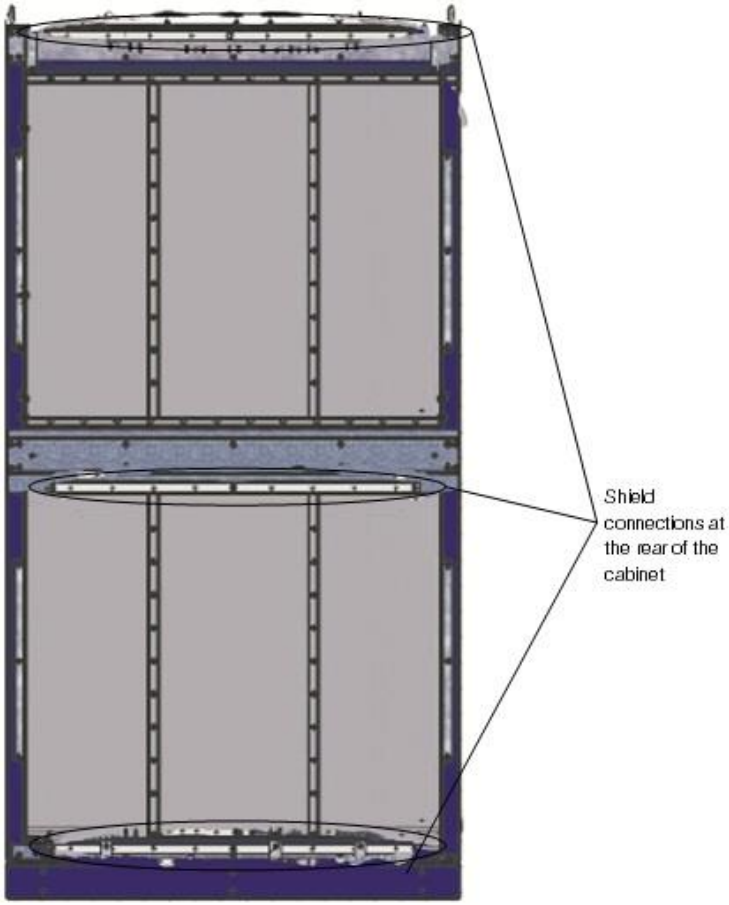


Figure 5.27: Cable shield connection

5.2.4. Recommended Power and Grounding Cables

The cables that connect the medium voltage line to the SSW7000 panel input disconnect switch and those that connect the medium voltage to the panel output, showed in the figure 5.28, must be specific for medium voltage application and dimensioned for the motor rated currents.

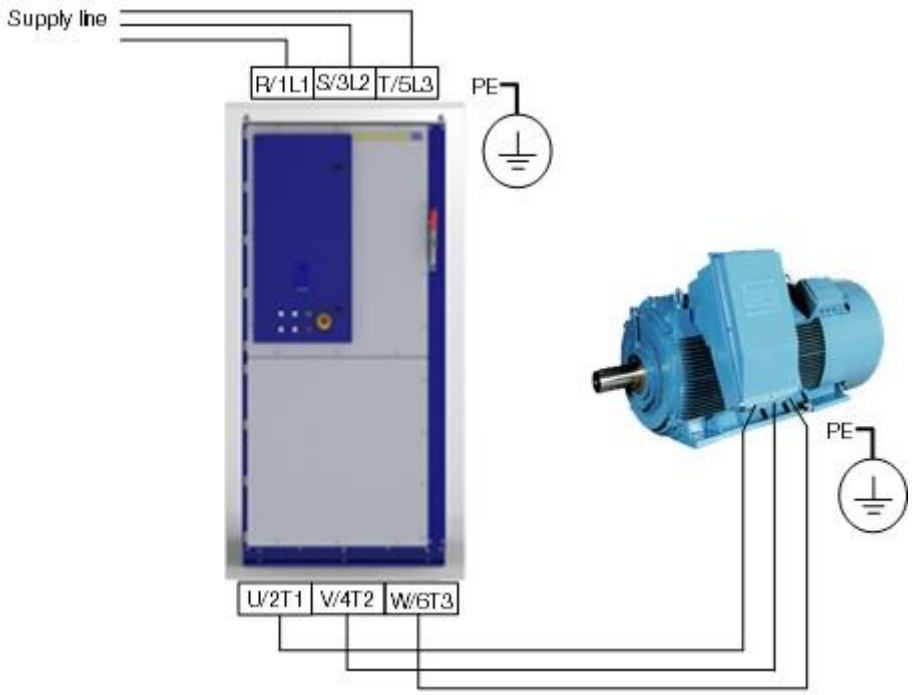


Figure 5.28: Connections of power and grounding

■ Minimum insulation voltage of the cables according to the power supply.
Commercial examples: Cofiban – Cofialt, Pirelli – Eprotenax, Ficap – Fibep.

Table 5.13: Recommended cable for 100 % of the rated current

Model	Power Cable Cross Section mm² (in²)	Grounding Cable Cross Section mm² (in²)
70 A	35 (0,06)	25 (0.04)
125 A	50 (0.08)	25 (0.04)
180 A	70 (0.11)	35 (0.05)
250 A	150 (0.24)	95 (0.15)
300 A	185 (0.29)	95 (0.15)
360 A	240 (0.37)	120 (0.19)
500 A	2 x 150 (2 x 0.24)	2x 95 (2 x 0.15)
600 A	2 x 185 (2 x 0.29)	2x 95 (2 x 0.15)

■ Use adequate lugs for the power and grounding connections.

■ Tighten the connections with the adequate torque.

Table 5.14: Tightening torque at the power connections

Terminal	Bolt	Torque (Nm) ±20%
R / 1L1	M10	30
S / 3L2		
T / 5L3		
U / 2T1		
V / 4T2		
W / 6T3		
Grounding		

NOTE!
For the correct selection of the cables consider the installation conditions, the maximum allowed voltage drop and use the applicable local regulations on electrical installations.

5.2.5. Fuses

In the panel IP41, the R-type fuses are installed inside the cabinet, close to the disconnect switch, and they protect both motor and installation against short circuit. They must comply with the rated medium voltage supply voltage.

In the panel Nema 12 the disconnect switch is installed in the medium voltage upper compartment and the R-type fuses are in the medium voltage lower compartment beside the line and bypass contactors.

The table 5.15 presents the fuses used in the standard SSW7000. They comply with the standard operational SSW7000 capacity.

Table 5.15: Recommended fuses

Rated Current	Fuse
70 A	12R (ou 6R)
125 A	12R (ou 6R)
180 A	12R
250 A	18R
300 A	18R
360 A	24R
500 A	32R
600 A	36R

Table 5.16: Fuse manufacturer codes

Manufacturer	Voltage		
	2300V	4160V	6900V
Bussmann	JCK-x-rr	JCL-x-rr	JCR-x-rr
Ferraz	A240Rxx	A480Rxx-1	A720xxDxRO-xx

xx = Recommended fuse

NOTE!
The fuses will not protect the SCRs in a short circuit event. If a short circuit occurs, retest the SSW7000 according to the procedures described in chapter 7 - First Energization, before activating the motor.

5.2.6. Connection of the Power Supply to the SSW7000

DANGER!
The line voltage must be compatible with the soft-starter rated voltage.

DANGER!
Provide a device for cutting off the SSW7000 power supply. This device must be able to remove the power supply at the soft-starter input whenever necessary (for instance during maintenance work at the SSW7000 panel disconnect switch.

5.2.7. Power Supply Short Circuit Rating

When protected by the fuses supplied in the panel, the SSW7000 is suitable to be used in a circuit able to supply at most the current (Symmetric arms) established for each respective model and voltage (V) according to table 5.17.

Table 5.17: Maximum current capacity of the power supply

Model	Maximum curent capacity
2300 V	40 kA
4160 V	40 kA
6900 V	40 kA

5.2.8. Motor Connection

DANGER!
Power factor correction capacitors must never be installed at the SSW7000 output (U/2T1, V/4T2 and W/6T3).

DANGER!
The SSW7000 has been designed for standard motor connection (three cables).

Connection inside the motor delta is not allowed (six cables.

Multimotor connection is not allowed.

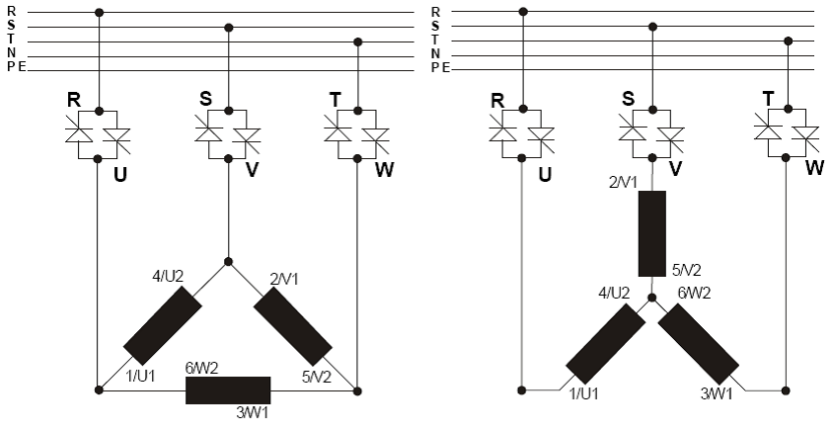


Figure 5.29: Connection of the SSW7000 to the motor.

ATTENTION!
In order that the protections based on the current reading and indication (motor overload for example) operate properly, the motor rated current must not be less than 20% of the SSW7000 rated current.

We do not recommend the use of motors that operate in steady state with load of less than 50% of their rated current.

NOTES!
The majority of medium voltage motors are special and able to withstand high starting duties, therefore, also special protection methods must be used:

1. The electronic overload protection must be adjusted according to the data supplied by the manufacturer of the used motor.
2. It is recommended to use thermal sensors for the motor protection.

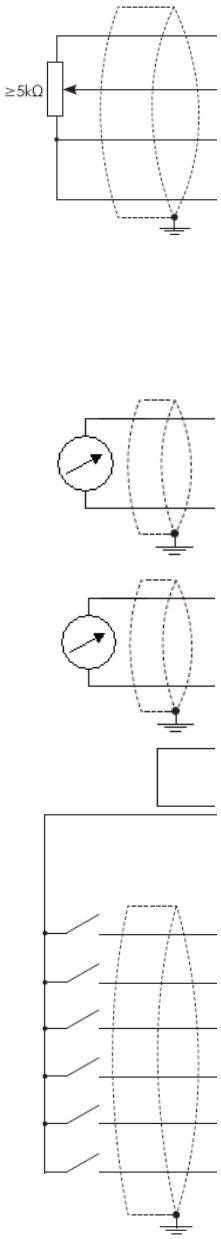
5.2.9. Grounding Connection

DANGER!
The SSW7000 must obligatorily be connected to a protective earth (PE). The grounding connection must comply with the local regulations. Use at least the wire gauge indicated in the table 5.13. Connect it to a specific grounding rod, or to a specific grounding point or to the installation general ground (10 ohm resistance).

DANGER!
Use a specific conductor to the ground, never use the neutral conductor.

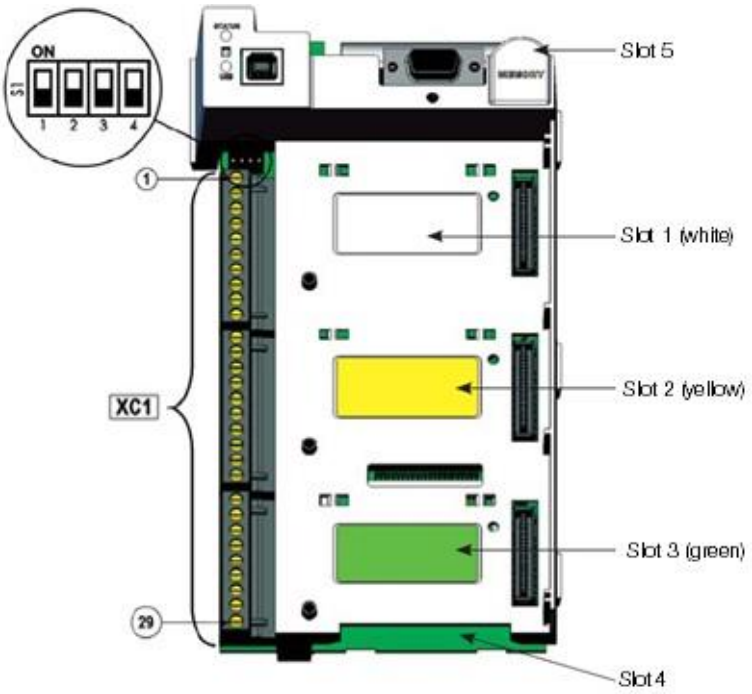
5.2.10. User Signal and Control Connections

The signal connections (analog inputs and outputs) and control (digital inputs and outputs) available to the user are performed in the control board 1 (CC11).



Terminal Strip		Factory Setting Function	Specifications
1	+REF	Potentiometer positive referente	Output voltage:+5.4 V, ±5 %. Maximum output current: 2 mA
2	AI1+	Analog Input 1: No function	Differential Resolution: 12 bits Signal: 0 to 10 V (R_{IN} = 400kΩ) Signal: 0 to 20mA or 4toa 20mA (R_{IN} = 500Ω) Maximum voltage: ±30 V
3	AI1-		
4	REF	Potentiometer negative reference	Output voltage: -4.7 V, ±5 %. Maximum output current: 2 mA
5	AI2+	Analog Input 2: No function	Differential Resolution: 11 bits + signal Signal: 0 to 10 V (R_{IN} = 400kΩ) Signal: 0 to 20mA or 4 to 20mA (R_{IN} = 500Ω) Maximum voltage: ±30 V
6	AI2-		
7	AO1	Analog output 1: No function	Galvanic Isolation Resolution: 11 bits Signal: 0 to 10 V (R_L ≥10kΩ) Signal: 0 to 20mA or 4 to 20mA (R_L ≤ 500Ω) Protected against short circuit
8	AGND (24 V)	Reference (0 V) for analog ouputs	Connected to the ground (frame) throught impedance: 940 Ω resistor in parallel with a 22 nF capacitor
9	AO2	Analog output 2: No function	Galvanic Isolation Resolution: 11 bits Signal: 0 to 10 V (R_L ≥10kΩ) Signal: 0 to 20mA or 4 to 20mA (R_L ≤ 500Ω) Protected against short circuit
10	AGND (24 V)	Reference (0 V) for the analog outputs	Connected to the ground (frame) throught impedance: 940 Ω resistor in parallel with a 22 nF capacitor
11	DGND*	Reference (0 V) for the 24 Vdc power supply	Connected to the ground (frame) throught impedance: 940 Ω resistor in parallel with a 22 nF capacitor
12	COM	Common point of the digital Inputs	
13	24 Vcc	24 Vdc power supply	24 Vdc, ±8 % power supply Capacitor: 500 mA
14	COM	Common point of the digital Inputs	
15	DI1	Digital Input 1: Start / Stop	6 Isolated digital Inputs High level ≥ 18 V Low level ≤ 3 V Maximum input voltage. = 30 V Input current: 11 mA @ 24 Vcc
16	DI2	Digital Input 2: Reset	
17	DI3	Digital Input 3: No function	
18	DI4	Digital Input 4: No function	
19	DI5	Digital Input 5: No function	
20	DI6	Digital Input 6: No function	
21	NF1	Digital output 1 DO1 Running	Contact rating: Maximum voltage: 240 Vcac Maximum current: 1 A NF – Normally closed contact C - Common NA – Normally open contact
22	C1		
23	NA1		
24	NF2	Digital output 2 DO2 Bypass	
25	C2		
26	NA2		
27	NF3	Digital output 3 DO3 Fault	
28	C3		
29	NA3		

Figure 5.30: XC1 terminal strip description



Note: in order to check the accessories available for each slot, refer to table 8.1.

Figure 5.31: Disposition of the connections on the control board 1

Directions for signal and control wiring:

- The SSW7000 digital inputs allow several types of electrical connection. They can be activated by the internal auxiliary +24 Vdc supply using as the common point the DGND* or the +24 Vdc. They can also be activated through an external +24 Vdc (wired to a PLC) using either the 0 V of that power supply or the +24 Vdc as the common point, according to the application needs:

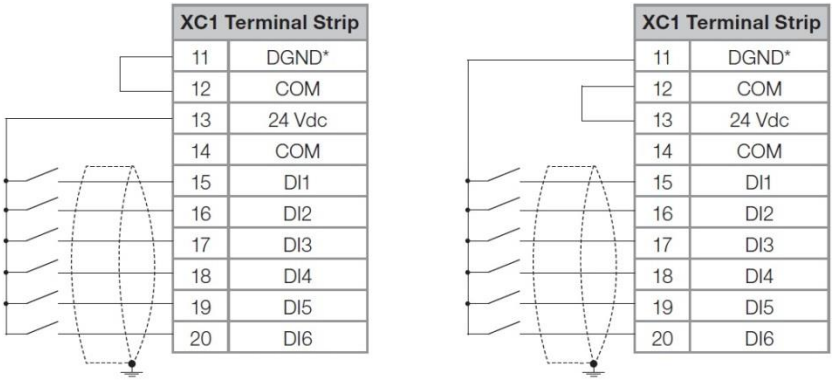


Figure 5.32: Wiring diagram of the digital inputs using the internal power supply

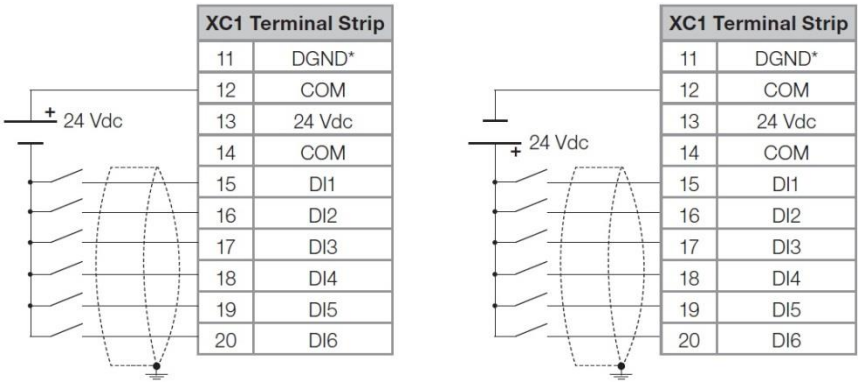


Figure 5.33: Wiring diagram of the digital inputs using na external power supply

- The analog inputs and outputs are programmed to operate in the 0 to 10 V range as the factory setting, and they can be changed through the S1 DIP switches, according to the table 5.18.

Table 5.18: Configuration of the DIP-switches for the analog input and output signal type selection

Signal at	Factory setting Function	DIP Switch	Type of Signal Selection	Ajuste de fábrica
AI1	No function	S1.4	OFF: 0 to 10 V (factory setting) ON: 4 to 20 mA / 0 to 20 mA	OFF
AI2	No function	S1.3	OFF: 0 to ±10 V (factory setting) ON: 4 to 20 mA / 0 to 20 mA	OFF
AO1	No function	S1.1	OFF: 4 to 20 mA / 0 to 20 mA ON: 0 to 10 V (factory setting)	ON
AO2	No function	S1.2	OFF: 4 to 20 mA / 0 to 20 mA ON: 0 to 10 V (factory setting)	ON

The parameters related to AI1, AI2, AO1 and AO2 must also be adjusted according to the DIP switch selection and the desired values

- Wire gauge: 0.5 mm² (20 AWG) to 1.5 mm² (14 AWG).
- Maximum tightening torque: 0.5 N.m (4.50 lbf.in).
- The wiring at XC1 must be made with shielded cables and laid separately from other wirings (power, 110 V / 220 V commands, etc.), according to the table 5.19.

Table 5.19: Separation distances between wirings

Wiring Length	Minimum Separatin Distance
30 m (100 ft)	10 mm (3.94 in)
> 30 m (100 ft)	25 mm (9.84 in)

- The figure 5.34 shows the cable shield connection. Refer to the shield connection example showed in the figure 5.35.

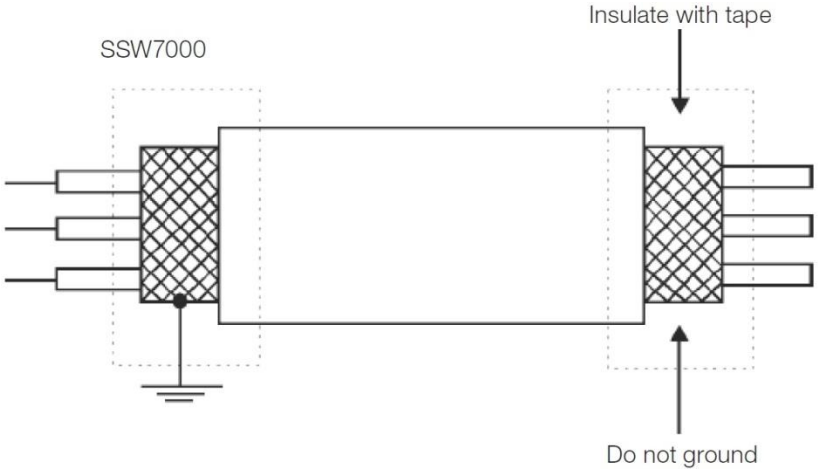


Figure 5.34: Shielding conection

- Relays, contactors and solenoids installed inside the SSW7000 cabinet may generate interferences in the control circuit. In order to eliminate this effect, RC suppressors must be installed in parallel with the coils in case of AC power supply, and freewheeling diodes in case of DC power supply.
- When the HMI is installed outside the SSW7000 cabinet, its cable must be laid separately from the other installation cables, distant at least 100 mm (3.94 in) from those cables.

Figure 5.35: Example of cable shield connection of connector XC1

Motor starting control through digital inputs:

- The SSW7000 presents 5 command sources: HMI, digital inputs, serial communication, fieldbus communication and SoftPLC. The command source is selected through the parameters P0220, P0228, P0229 and P0230. For more details, refer to the section 10.1 - Local/Remote Configuration, in the programming manual.

- When the command source is selected as digital inputs, then the programming is done through the parameters P0263 to P0268. For more details, refer to the section 10.4 - Digital Inputs, in the programming manual.

- The digital inputs feature programmable functions; figure 5.36 shows some examples of programming.

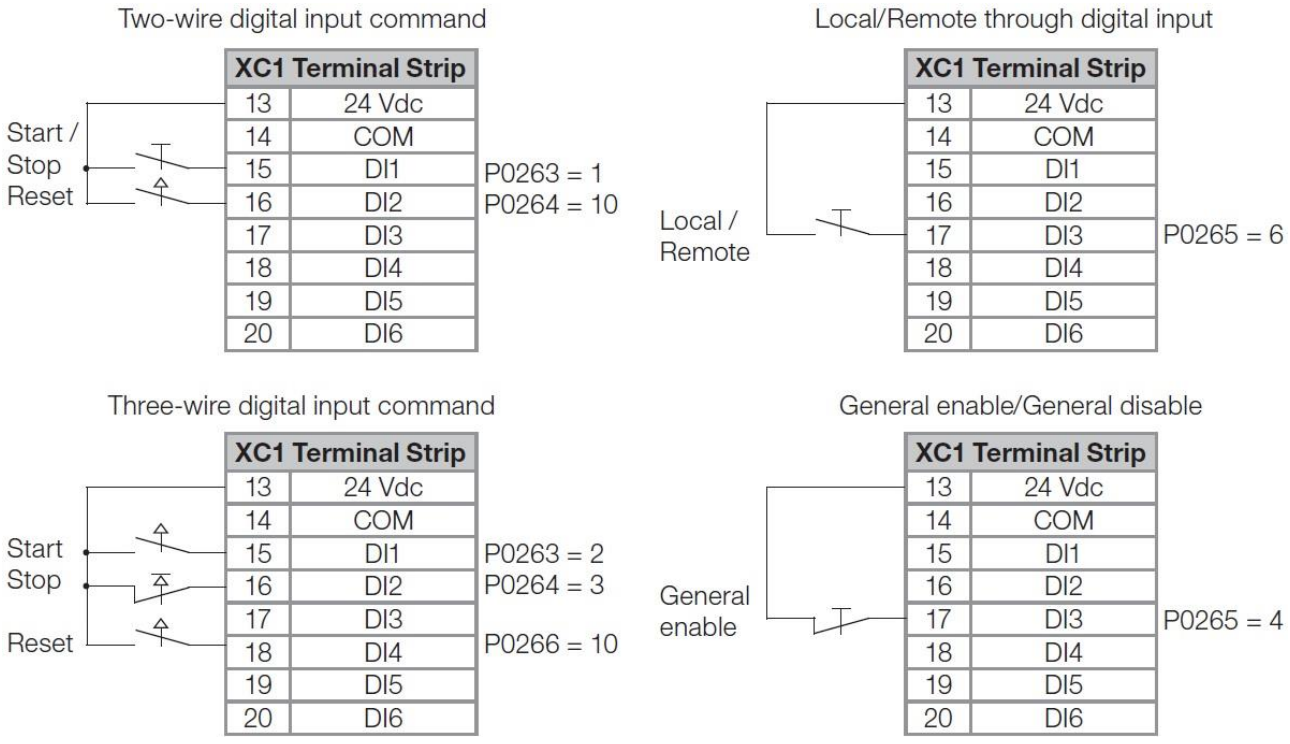


Figure 5.36: Digital input command examples

5.2.11. Auxiliary Low Voltage Supply Connection

Check the electric project that accompanies the product, which must contain the indication of the connections, including the power supply and the use of circuit breakers to protect the power supply circuit.

Components fed by the auxiliary power supply:

- The electronic board FSMT.
- The coils of the line and by-pass contactors.
- Auxiliary contactors used in the cabinet.
- Power arm fans (if used).

NOTE!
The auxiliary low voltage power supply value must match the electronics supply value specified in the product code. Refer to the section 3.3 - How to Specify the SSW7000 Model (Smart Code).

6 INTERNAL CONNECTIONS

6.1. SSW7000 ELECTRONIC BOARDS

The SSW7000 is supplied with the versions of electronic boards 2 (V2) and 3 (V3). The both versions use the same source board (FSMT), but with different firmware. The version 3 was developed to attend the electrical isolation class required for the SSW7000 of 13.8kV. The two versions of electronic boards operate with voltage supply at 110/220Vac (automatic selection).

Table 6.1: Versions of electronic boards SSW7000/SSW7000C

Version 2				Version 3	
SSW7000 (110V/220V)		SSW7000C (110/220V)		SSW7000C (110/220V)	
Name	Description	Name	Description	Name	Description
CC11	Control board C1 – interface with the user	CC11	Control board C1 – interface with the user	CC11	Control board C1 – interface with the user
CSM2.00	Control board C2 – medium voltage control for 2.3 kV	CSM2.00	Control board C2 – medium voltage control for 2.3 kV	CSM3.02	Control board C2 – medium voltage control for 6.9 kV
CSM2.01	Control board C2 – medium voltage control for 4.16 kV	CSM2.01	Control board C2 – medium voltage control for 4.16 kV	CSM3.03	Control board C2 – medium voltage control for 13.8 kV
CSM2.02	Control board C2 – medium voltage control for 6.9 kV	FSMT.00	Power supply of board CC11, fixed relay outputs	FSMT.01	Power supply of board CC11, fixed relay outputs
FSMT.00	Power supply of board CC11, fixed relay outputs	GDSMC.00	Gate driver with temperature measurement	GDSMC2.00	Gate driver with temperature measurement
GD1SM	Upper gate driver	GDSMC.01	Gate driver without temperature measurement	GDSMC2.01	Gate driver without temperature measurement
GD2SM	Lower gate driver				

Note. In the CSM board is connected a specific toroidal transformer for each version of electronic boards.

6.1.1. CC11 Board

Table 6.2: Description of the CC11board connectors

Terminal Strip		Description
XC1		User connections
1 a 29		Refer to the item 5.2.10. - User Signal and Control Connections
SLOT		User connections
1		Accessory for the motor temperature measurement
2		
3		Communication accessories
4		Anybus-CC communication accessories
5		Flash memory
Interface		User connections
XC20		USB
XC21		HMI
CC11	FSM	Connections between boards
XC60	XC1	Signals and CC11 feeding

NOTE!
The SSW7000 CC11 hardware is identical to that of the CFW-11 CC11. However, the firmware version and the PLD code are different. Because of the different PLD code, it is not possible to transform a CFW-11 board into an SSW7000 one by simply updating the firmware. Only the CC11xy.Sz boards are adequate for the SSW7000. If an SSW7000 firmware version is flashed into a board with a CFW-11 PLD, then the fault “Incompatible PLD Firmware” will appear on the display.

6.1.2. CSM Board Connections

Table 6.3: Description of the CSM2/CSM3 board connections

CSM2	
Terminal Strip	Description
XC1 CSM2	Isolated supply
1 a 5	CT input, common points (red)
6	CT input (yellow)
XC2 CSM2	Isolated supply
1 a 6	Common points for the connections of the CTs (blue)

CSM3	
Terminal Strip	Description
XC1 CSM3	Isolated supply
1	CT input (blue)
2 a 6	Common points for the connections of the CTs (red)
XC2 CSM3	Isolated supply
1 a 2	CT input (yellow)
3 a 6	Common points for the connections of the CTs (blue)

CSM2 / CSM3		
Terminal Strip	Description	
XC4	CT cable	Current Reading
1	Red	CT - R-U arm current
2	Black	
3	Red	CT –S-V arm current
4	Black	
5	Red	CT – T-W arm current
6	Black	
7	Red	CT – Ground fault
8	Black	
Terminal Strip		Description
Optocouplers		Power arm SCR firing and temperature reading
N27 a N32		R-U arm firing
N21 a N26		S-V arm SCR firing
N15 a N20		T-W arm SCR firing
N7		R-U arm temperature
N8		S-V arm temperature
N9		T-W arm temperature
CSM2/CSM3	FSMT	Connections between boards
N3	N3	Communication between the C1 and C2 control boards through fiber optic cables
N4	N4	
N5	N5	
N11	N11	Current and voltage synchronism feedback
N12	N12	

Table 6.4: CSM2/CSM3 board voltage measurement connections

500V	2300V	4160V	6900V(*)	Voltage measurent
X1	X3	X4	X4	R / 1L1
X5	X7	X8	X8	U / 2T1
X9	X11	X12	X12	S / 3L2
X13	X15	X16	X16	V / 4T2
X17	X19	X20	X20	T / 5L3
X21	X23	X24	X24	W / 6T3
X25	X27	X28	X28	PE

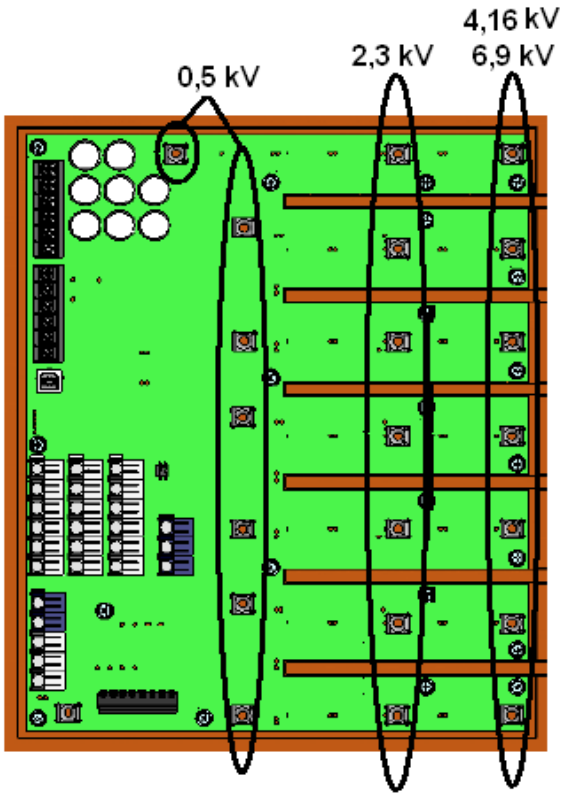


Figure 6.1: CSM2/CSM3 board layout

6.1.3. FSMT Board Connections

Table 6.5: Description of the FSMT board connectors

Terminal Strip		Description
X1		AC supply
1	Phase	Control Unit Version 2: - 110 to 230 Vac (-15 % (93,5 Vac) to 10 % (253 Vac)) or 125 to 320 Vdc Control Unit Version 3: - 100 to 230 Vac (-15 % (85 Vac) to 10 % (253 Vac)) or 110 to 320 Vdc
2	Neutral	
3	Ground	
X8		Command ouput for the contactors
1	NO	AC – Coil – Bypass contactor
2	Phase	Supply for the contactors
3	NO	AC – Coil – Line contactor
4	Phase	Supply for the contactors
5	NO	AC – Coil – Rotation direction
6	Phase	Supply for the contactors
7	NO	NO relay – Fan
8	NO	NO relay - Fan
9	NC	Not connected
FSMT	CC11	Connections between boards
XC1	XC60	Signals and CC11 feeding
FSMT	CSM	Connections between boards
N3	N3	Communication between the C1 and C2 control boards through optic cables
N4	N4	
N5	N5	
N11	N11	Current and voltage synchronism feedback
FSMT	TF	Connections between FSMT and CSM transformer
XC2: 1	Red	Phase – transformer TF primary - CSM
XC2: 2	Black	Phase – transformer TF primary - CSM
XC2: 3	Shield	Shield ground - PE

NOTE!
The timer delay must be set for 0.2 seconds.

Connection diagram of the digital outputs with defined functions to control contactors with AC coil and auxiliary closing coil.

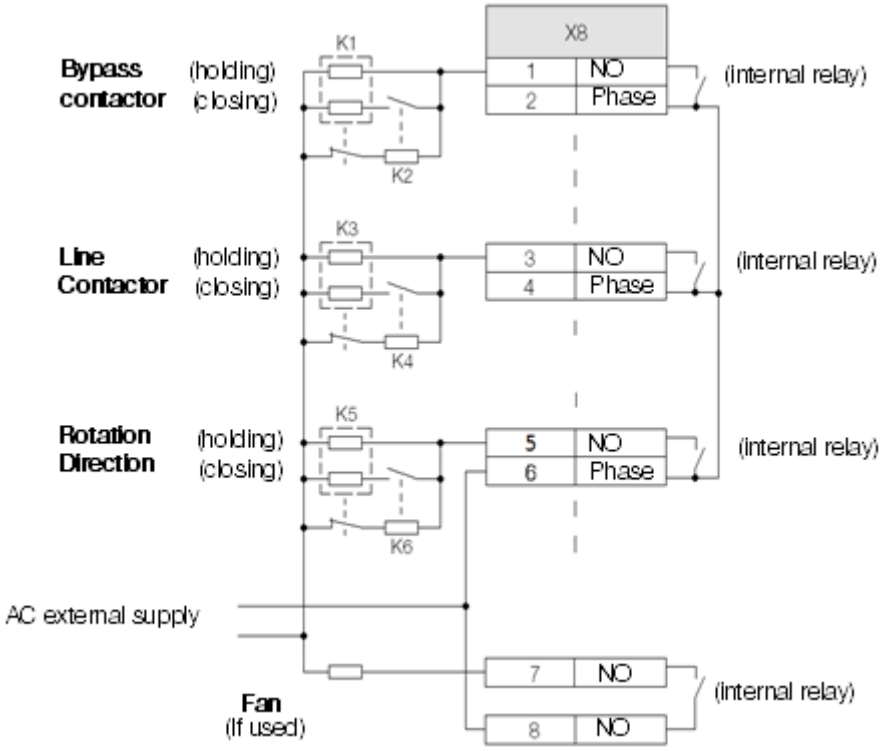


Figure 6.2: FSMT AC contactor wiring diagram.

6.1.4. Power Arm Internal Connections

Refer to the item 5.2.1 - Power Arm Electrical and Fiber Optic Connections to make the external power arm connections.

GDSMC2.00:

Table 6.6: GDSMC2.00 boards connections

Conector	Description
XC3:1 and XC4:1	SCRs gate
XC3:2 and XC4:2	SCRs cathode
XC1 and XC2	Supply CTs
XC5	Heatsink NTC
N3 and N4	Firing fiber optic cables
N5	Temperature fiber optic cable

GDSMC2.01:

Table 6.7: GDSMC2.01 boards connections

Conector	Description
XC3:1 and XC4:1	SCRs gate
XC3:3 and XC4:2	SCRs cathode
XC1 and XC2	Supply CTs
N3 and N4	Firing fiber optic cables

GD1SM / GDSMC.00:

Table 6.8: GD1SM and GDSMC.00 boards connections

Conector	Description
XC1:1	SCR gate
XC1:3	SCR cathode
XC2	Supply CT
XC3	Heatsink NTC
N1	Firing fiber optic cable
N4	Temperature fiber optic cable
J1	SCR anode
J2	SCR cathode

GDSMC.01:

Table 6.9: GDSMC.01 board connections

Conector	Description
XC1:1	SCR gate
XC1:3	SCR cathode
XC2	Supply CT
N1	Firing fiber optic cable
J1	SCR anode
J2	SCR cathode

GD2SM:

Table 6.10: GD2SM board connections

Conector	Description
XC1:1	SCR gate
XC1:3	SCR cathode
XC2	Supply CT
N1	Firing fiber optic cable
J1	SCR anode
J2	SCR cathode
J3	Snubber connection

The location of the GD1SM, GD2SM, (SSW7000A) and GDSMC, GDSMC2 (SSW7000C) boards in the power arm is showed in the figure 6.3 and figure 6.4.

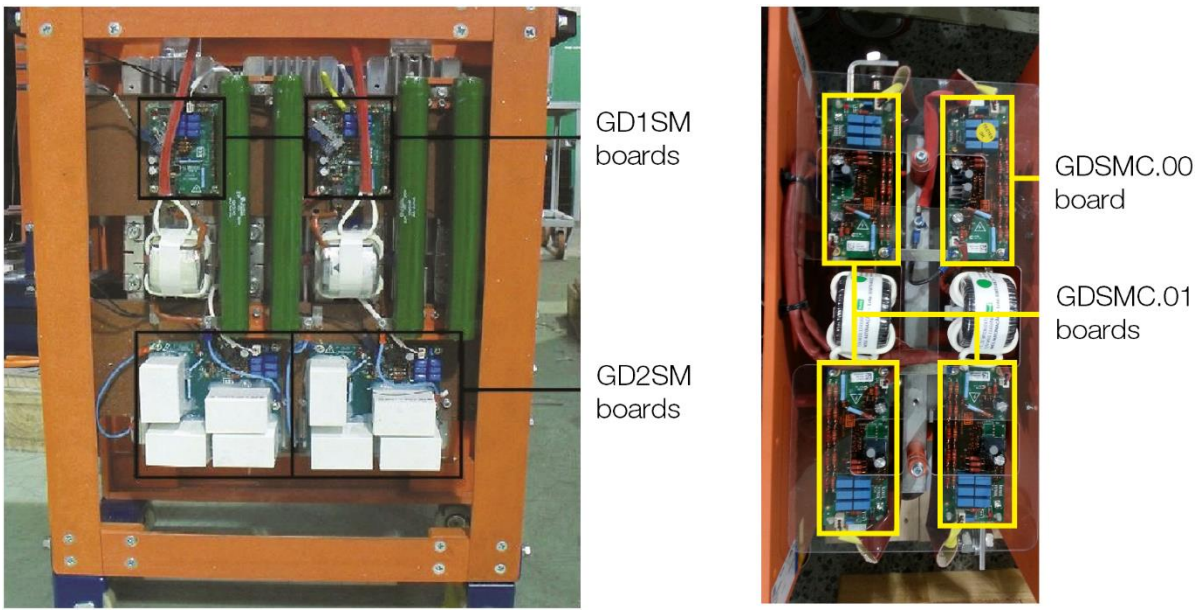


Figure 6.3: GD1SM, GD2SM (SSW7000) and GDSMC (SSW7000C) firing boards.

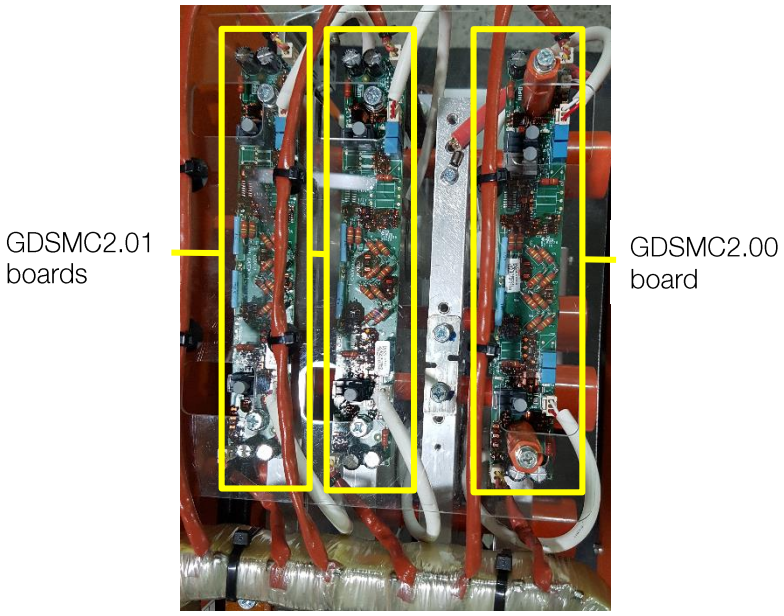


Figure 6.4: GDSMC2.00 e GDSMC2.01 (SSW7000C) firing boards.

6.1.5. Connections between the CSM Board and the TF Transformer

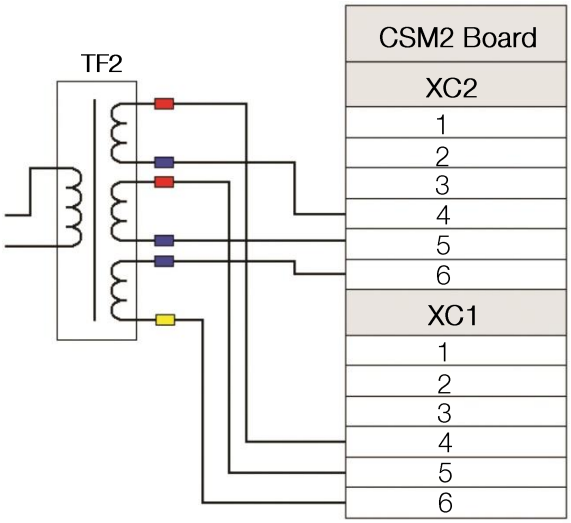


Figure 6.5: Connection of the transformer to the CSM board (Version 2)

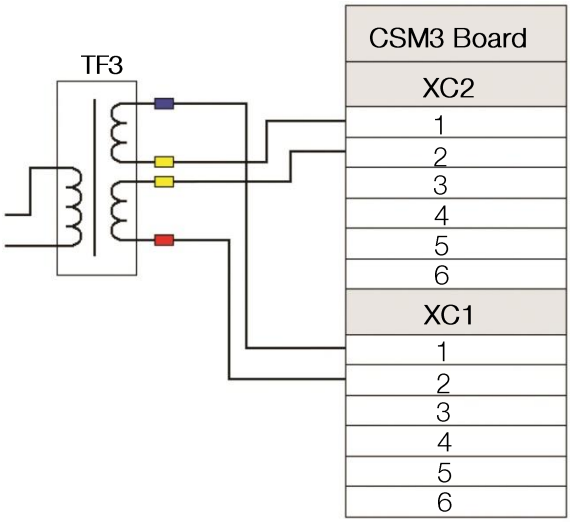


Figure 6.6: Connection of the transformer to the CSM3 board (Version 3)

- Transformer TF2 (version 2), supplied at 90Vac, 800Hz.
- Transformer TF3 (version 3), supplied at 66Vac, 400Hz.

6.1.6. Connections between the Low Voltage and the Medium Voltage Controls

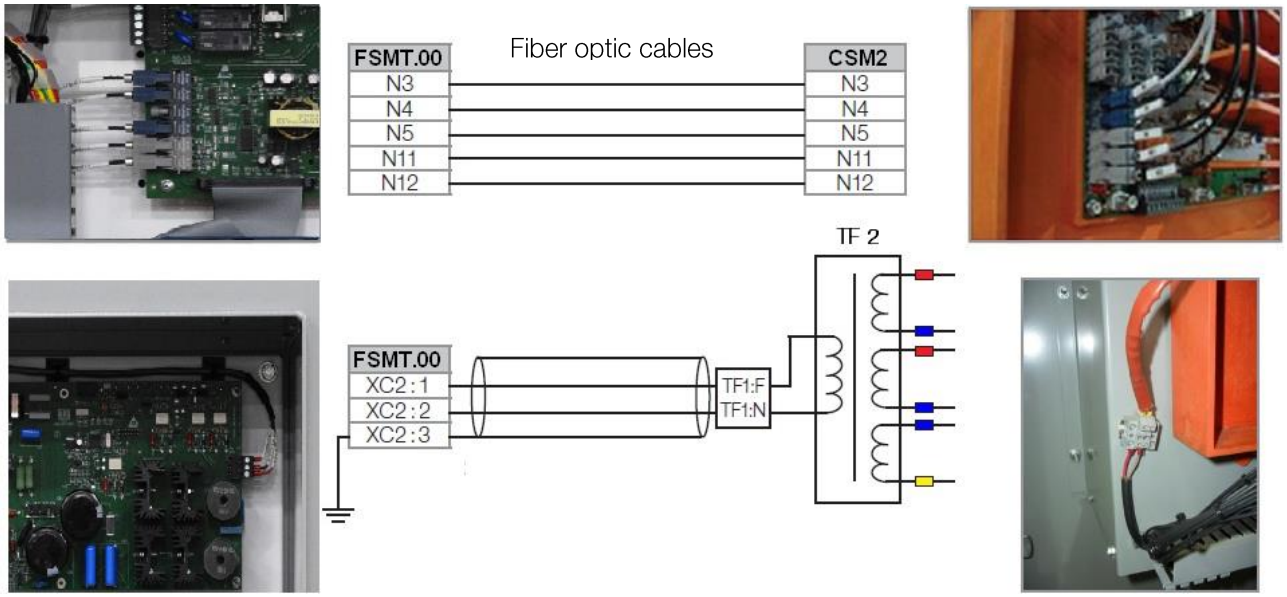


Figure 6.7 (a): Connections between the low voltage and the medium voltage controls – Version 2

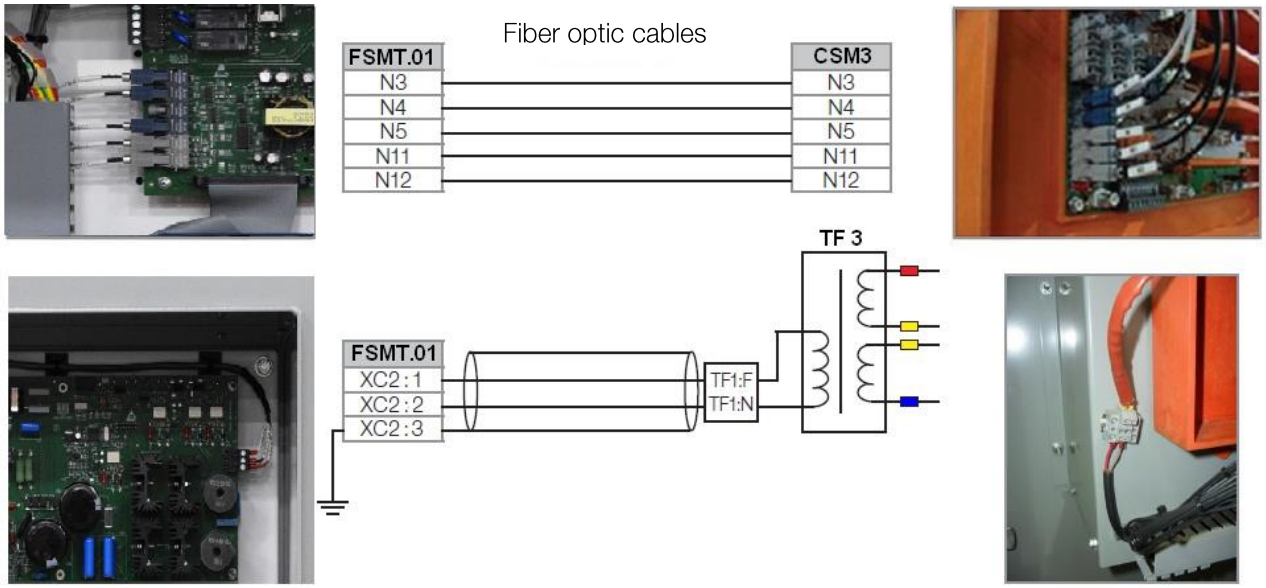


Figure 6.7 (b): Connections between the low voltage and the medium voltage controls – Version 3

- Use a two wire shielded cable with 0.5 mm2 cross section, 300 V insulation and the shield connected to the ground at the FSMT cable end, in order to make the connection between the FSMT.00/FSMT.01 and the TF2/TF3.

7 FIRST ENERGIZATION

After finishing the electrical installation according to the section 5.2 - Electrical Installation and before starting any test with the SSW7000, check the following points:

DANGER!
Switch on the medium voltage only after the proper installation of the power arms.

1. Verify whether the power, ground, motor and control connections are correct and tight.
2. Verify whether the CSM voltage reading connections match the line voltage.
3. Remove all the tools and odd materials from the SSW7000 panel.
4. Verify whether the motor current and voltage match the SSW7000 model.
5. Decouple the motor from the load.
6. Switch on the electronics and execute the test mode to check the wiring with the panel door open.
7. Close the doors of the SSW7000 panel.
8. Measure the line voltage and verify whether it is within the allowed tolerances for the SSW7000 model and for the motor.
9. Carry out the tests described in section 7.1 - SSW7000 Operation Verification, in order to check the proper operation of the SSW7000.

DANGER!
Always disconnect the main supply before performing any connection inside the SSW7000 cabinet.

DANGER!
Disconnect the upstream voltage and connect the SSW7000 input to the ground at an adequate point when any maintenance is performed at the SSW7000 disconnect switch.

7.1. SSW7000 OPERATION VERIFICATION

DANGER!
In case the power supply of the low voltage circuits of the SSW7000 is performed by transformer with primary connected to the medium voltage circuit, tests must not be carried out with the panel door open. In this case, the test sequence described in item 7.1.1 - Test without Three-phase Voltage must not be carried out and, additionally, maintenance procedures on the SSW7000 must be carefully planned in order to prevent accidents.

The SSW7000 has a test mode that allows verifying if the cables of the panel are properly connected. The test mode commands the selected signals and does not allow starting the motor.

There are two stages in the test mode. The first stage is executed with the three-phase supply off and with the cabinet door open. The second stage of the test mode requires the three-phase supply switched on and a connected motor. During this stage, the cabinet door must be closed.

The test can be performed either with medium voltage or with low voltage.

7.1.1. Test without Three-phase Voltage

1. Switch on the low voltage.
2. Verify whether all the red LEDs on the gate driver boards (GD1SM, GD2SM, GDSMC and GDSMC2) and on the CSM board are on.
3. Remove each arm temperature reading fiber optic cable at a time and check if the error indicated on the HMI is related to the respective phase, then connect the cable again and reset the fault
4. Start the test mode and verify the results with P0321 options from 1 to 5. To get more details, refer to the SSW7000 programming manual.
5. Switch off the low voltage.

7.1.2. Test with Medium Voltage

In order to carry out the medium voltage test, follow the procedures below.

1. Connect the SSW7000 input to the supply line, according to the section 5.2 - Electrical Installation.
2. Connect the motor to the SSW7000 output, according to the section 5.2 - Electrical Installation.
3. Close the cabinet door.
4. Decouple the motor from the load.
5. Switch on the low voltage. Refer to the item 5.2.11 - Auxiliary Low Voltage Supply Connection. Verify the energization success through the SSW7000 HMI.
6. Read the programming manual chapters 6 - About the SSW7000 Soft-Starter, 7 - HMI and 8 - Programming Basic Instructions, and then perform the recommended programming.
7. Program the motor parameters, P0400 to P0405 according to its nameplate data.
8. Follow the test mode routine according to the programming manual, section 14.2 - Test Mode (P0321 options 6 to 9).

> **NOTE!**
> In order to perform the functional test and the CT tests the motor rated current must be at least 10% of the SSW7000 rated current.

9. If the test mode results are satisfactory, perform a functional test running the motor with the desired control type. For more details, refer to the programming manual, chapter 11 - Control Type.

7.1.3. Test with Low Voltage

It is possible to perform the tests of the item 7.1.2 - Test with Medium Voltage, with low voltage. Therefore, a hardware modification and a parameter change are necessary. It is very important to undo these modifications before energizing the SSW7000 in medium voltage.

In order to carry out the low voltage test, follow the procedures below.

1. Change the CSM board voltage measurement cables to the 500 V position. Refer to the item 6.1.2 - CSM Board Connections.
2. Connect the SSW7000 input to a supply line of up to 500 Vac, according to the section 5.2 - Electrical Installation.
3. Connect the motor to the SSW7000 output, according to the section 5.2 - Electrical Installation.
4. Close the cabinet door.
5. Switch on the low voltage. Refer to the item 5.2.11 - Auxiliary Low Voltage Supply Connection. Verify the energization success through the SSW7000 HMI.
6. Program the line rated voltage parameter, P0296, to 220/500 V.
7. Program the motor parameters, P0400 to P0405 according to its nameplate data.
8. Follow the test mode routine according to the programming manual, section 14.2 - Test Mode.

> NOTE!
> In order to perform the functional test and the CT tests the motor rated current must be at least 10% of the SSW7000 rated current.

9. If the test results are satisfactory, leave the test mode.
10. Perform a functional test running the motor with the desired control type. For more details, refer to the programming manual, chapter 11 - Control Type.

> DANGER!
> After the low voltage motor test, reconnect the voltage measurement cables to their original positions and adjust the SSW7000 rated voltage at P0296. Refer to the item 6.1.2 - CSM Board Connections.

7.2. COMMISSIONING

If the test mode results are satisfactory, perform a functional test with the motor decoupled from the load.

1. Initially, voltage ramp control can be used to start the motor, with long starting times (P0102 ≈ 25 s) and low initial voltages (P0101 ≈ 40 %), in order to minimize the starting currents. For details on the control method to be used, refer to the programming manual, chapters 11 - Control Type and 20 - Programming Information and Suggestions.

2. Before coupling the load to motor, verify the rotation direction and program the protections as explained in the programming manual, chapter 15 – Protections.

3. Program a motor thermal protection method.

4. Couple the load to the motor shaft, power up the system and start the motor.

5. Data from this starting can be monitored in several ways:
   - Diagnosis parameters such as maximum starting current, average starting current and real starting time. Refer to the programming manual, section 16.3 - Diagnostics.
   - In the trace function, it is possible to register the current and voltage variable of the SSW7000. Refer to chapter 19 - Trace Function, of the programming manual.
   - Through the SuperDrive G2 graphic monitoring. Check out information about the SuperDrive G2 at WEG website (www.weg.net).

6. By means of the monitoring, it is possible to set a better programming of the SSW7000 to be applied in the next starts at full operation duty

ATTENTION!
Pay close attention to the SSW7000 limits:

- Maximum starting time.
- Maximum starting current.
- Interval between starts.

The nonobservance of these limits may lead to damage to the SSW7000.

7.3. CONNECTION TO A PC

NOTE!
For the USB connection, use a laptop computer isolated from the ground or a desktop connected to the same protection earth (PE) as the SSW7000.

The USB connection is electrically isolated from the supply line and from other internal high voltages; however, it is not isolated from the protection earth (PE)..

NOTE!
Always use a shielded USB cable, “standard host/device shielded USB cable”. Cables without shield may cause communication erros.

Exemple of cables: Samtec:
USBC-AM-MB-B-B-S-1 (1 meter [3.28 ft]);
USBC-AM-MB-B-B-S-2 (2 meter [6.56 ft]);
USBC-AM-MB-B-B-S-3 (3 meter [9.84 ft]).

To control the SSW7000, and to visualize or program its parameters through a personal computer (PC), it is necessary to install the SuperDrive G2 in the PC. The SuperDrive G2 can be downloaded from the website www.weg.net.

Basic procedure for transferring data from the PC to the SSW7000:

1. Install the SuperDrive G2 software in the PC.
2. Connect the PC to the SSW7000 through the USB cable
3. Start the SuperDrive G2.

For more details on the SuperDrive G2 operation, refer to its help menu.

7.4. FLASH MEMORY MODULE

Location of the module according to the figure 5.31.

Functions:

- Storage of an image of the SSW7000 parameters.
- It allows transferring parameters stored in the flash memory module to the SSW7000
- It allows transferring the firmware stored in the flash memory module to the SSW7000.
- It stores the program used by the SoftPLC..

Every time the SSW7000 is energized, the SoftPLC program is transferred to the RAM memory located on the SSW7000 control board 1, and it is executed.

For more details, refer to the SSW7000 programming and SoftPLC manuals.

ATTENTION!
Before installing or removing the flash memory module, remove the power from the SSW7000 and wait until the HMI and LEDs go off.

8 ACCESSORIES

Accessories are incorporated to the SSW7000 in a simple and fast manner, using the plug and play concept. When an accessory is fitted into the slot, the control circuit identifies its model and presents the installed accessory code in P0027 or P0028. Accessories must be installed and removed with the control circuit of the SSW7000 de-energized.

The part number of each accessory and the available models are presented in the table 8.1. They can be ordered separately and are shipped in their own packages, which contain the parts and manuals for their installation, programming and operation.

NOTE!
Each slot accommodates just one module at a time.

Table 8.1: Accessory models

Part number	Name	Description	Slot	Identification Parameter	
				P0027	P0028
Control accessories for installation in the slots 1, 2 e 3					
11638312	IOE-04	Module for 8 temperature sensors PT100 type	1 and 2	28	---
11008102	RS485-01	RS-485 serial communication module (Modbus)	3	---	CE--
11008103	RS232-01	RS-232C serial communication module (Modbus)	3	---	CC--
11008104	RS232-02	RS-232C serial communication module with switches fo the microcontroller flash memory programming	3	---	CC--
Anybus-CC accessories for Installation in the Slot 4					
11008107	PROFDP-05	ProfibusDP Interface module	4	---	---(2)
11550548	PROFINETIO-05	ProfinetIO interface module	4	---	---(2)
11008158	DEVICENET-05	DeviceNet Interface module	4	---	---(2)
10933688	ETHERNET/IP-05	Ethernet/IPInterface module	4	---	---(2)
11008160	RS232-05	RS-232 Interface module (passive) (Modbus)	4	---	---(2)
11008161	RS485-05	RS-485 Interface module (passive) (Modbus)	4	---	---(2)
Flash memory module for Installation in the slot 5 – Included as a factory standard					
11008912	MMF-01	Flash memory module	5	---	---(1)
Other accessories					
11008913	HMI-01	SeparatedHMI (3)	HMI	---	---
11010521	RHMIF-01	Frame for remote HMI mounting (IP56 protection degree)	HMI	---	---
11940242	TC FT	Ground fault CT	---	---	---

(1) See programming manual.
(2) See Anybus-CC Communication Manual.
(3) See section 4.2 - HMI Cable for cable details.

9 TECHNICAL SPECIFICATIONS

9.1. POWER DATA

Table 9.1 Power dara

Power supply	Power section voltage (R/1L1, S/3L2, T/5L3)	Low voltage test: 500Vac: (-60% to +10%) or (200 a 550Vca) Models: 2300Vca: (-60% to +10%) or (920 to 2530Vca) 4160Vca: (-60% to +10%) or (1664 to4576Vca) 6900Vca: (-60% to +10%) or (2760 to 7590Vca)
	Frequency	(50 to 60Hz): (±10%) or (45 a 66Hz)
Capacity	Number maximum of starts	5 starts in 2 hours (one start every 30 minutes)
	Starting cycle – SSW7000	AC-53a: 4,5-30:50–2
	Starting cycle – SSW7000C	AC-53a: 4,0-20:50–2
Thyristors	Medium voltage SCRs per power arm	2300Vac: 2 SCRs per power arm 4160Vac: 2 matched pairs of SCRs 6900Vac: 2 sets of 3 matched SCRs
	Maximum reverse peak voltage on the power arms.	2300Vac: 6,5k V 4160Vac: 13 kV 6900Vac: 19,5 kV
Protections	Hardware protections	dV/dt filter Active overvoltage protection at the SCRs

9.1.1. Operational Capacity

180A: AC-53a: 4,5-30:50-2

180A	SSW7000 rated current.
AC-53a	Utilization category according to the IEC 60947-4-2 standard.
4,5	Starting current regarding the rated current.
30	Starting time in seconds.
50	Duty cycle in percentage.
2	Number of starts per hour.

Table 9.2. Maximum motor power driven by SSW7000A,B and D

Model	Voltage					
	2300V		4160V		6900V	
	cv	kW	cv	kW	cv	kW
70 A	300	220	600	440	1000	730
180 A	800	590	1500	1100	2500	1840
300 A	1350	1000	2500	1840	3900	2870
360 A	1600	1180	3000	2200	4700	3500
500 A	2200	1620	4000	2940	6600	4860
600 A	2600	1910	4900	3600	7800	5740

Table 9.3: Maximum motor power driven by SSW7000C

Model	Voltage					
	2300V		4160V		6900V*	
	cv	kW	cv	kW	cv	kW
125 A	500	400	1000	730	1650	1220
250 A	1100	810	2100	1550	3250	2400
360 A	1600	1180	3000	2200	4700	3500

For bigger motor power, please contact WEG.

The SSW7000 standard is designed to withstand a 4,5xIn overload duty for 30s, the SSW7000C standard is designed to withstand a 4xIn overload duty for 20s.

In order to select the SSW7000 model according to the desired overload duty, see table 9.4 to table 9.11, which inform the maximum motor starting time for different current levels and different quantities of starts per hour.

NOTE!
For different overload duties, it is important to take into account the correct sizing of the medium-voltage fuses.

SSW7000A – 180A

Table 9.4: Maximum time per start for the SSW7000A – 180A

SSW7000 - 180A	Starts per Hour (Initial Temperature 40°C)									
Current limitation	1	2	3	4	5	6	7	8	9	10
150% (270A)	60s	60s	60s	60s	60s	60s	60s	60s	60s	60s
200% (360A)	60s	60s	60s	60s	60s	60s	60s	60s	60s	60s
250% (450A)	60s	60s	60s	60s	60s	60s	57s	50s	44s	40s
300% (540A)	60s	60s	60s	60s	54s	45s	38s	34s	30s	27s
350% (630A)	60s	60s	60s	45s	36s	30s	26s	23s	20s	18s
400% (720A)	60s	59s	39s	30s	24s	20s	17s	15s	13s	12s
450% (810A)	60s	36s	24s	18s	15s	12s	10s	9s	8s	7s
500% (900A)	39s	19s	13s	10s	8s	6s	6s	5s	4s	4s
550% (990A)	12s	6s	4s	3s	3s	3s	2s	2s	2s	2s
600% (1080A)	2s	2s	2s	2s	2s	1s	1s	1s	1s	1s

SSW7000A – 300A

Table 9.5: Maximum time per start for the SSW7000A – 300A

SSW7000 - 300A	Starts per Hour (Initial Temperature 40°C)									
Current limitation	1	2	3	4	5	6	7	8	9	10
150% (450A)	60s	60s	60s	60s	60s	60s	60s	60s	60s	60s
200% (600A)	60s	60s	60s	60s	60s	60s	60s	55s	49s	44s
250% (750A)	60s	60s	60s	60s	59s	49s	42s	37s	33s	29s
300% (900A)	60s	60s	60s	51s	40s	34s	29s	25s	22s	20s
350% (1050A)	60s	60s	47s	35s	28s	23s	20s	18s	16s	14s
400% (1200A)	60s	49s	32s	24s	19s	16s	14s	12s	11s	10s
450% (1350A)	60s	33s	22s	16s	13s	11s	9s	8s	7s	7s
500% (1500A)	41s	21s	14s	10s	8s	7s	6s	5s	5s	4s
550% (1650A)	23s	11s	8s	6s	5s	4s	3s	3s	3s	3s
600% (1800A)	8s	4s	3s	3s	2s	2s	2s	2s	2s	2s

SSW7000A – 360A

Table 9.6: Maximum time per start for the SSW7000A – 360A

SSW7000 - 360A	Starts per Hour (Initial Temperature 40°C)									
Current limitation	1	2	3	4	5	6	7	8	9	10
150% (540A)	60s	60s	60s	60s	60s	60s	60s	60s	60s	60s
200% (720A)	60s	60s	60s	60s	60s	60s	60s	58s	52s	46s
250% (900A)	60s	60s	60s	60s	60s	57s	49s	43s	38s	34s
300% (1080A)	60s	60s	60s	60s	52s	43s	37s	32s	29s	26s
350% (1260A)	60s	60s	60s	51s	41s	34s	29s	25s	23s	20s
400% (1440A)	60s	60s	54s	41s	32s	27s	23s	20s	18s	16s
450% (1620A)	60s	60s	44s	33s	26s	22s	19s	16s	15s	13s
500% (1800A)	60s	54s	36s	27s	21s	18s	15s	13s	12s	11s
550% (1980A)	60s	44s	29s	22s	18s	15s	13s	11s	10s	9s
600% (2160A)	60s	37s	24s	18s	15s	12s	10s	9s	8s	7s

SSW7000D – 500A

Table 9.7: Maximum time per start for the SSW7000D – 500A

SSW7000D - 500A	Starts per Hour (Initial Temperature 40°C)									
Current limitation	1	2	3	4	5	6	7	8	9	10
150% (750A)	60s	60s	60s	60s	60s	60s	60s	55s	49s	44s
200% (1000A)	60s	60s	60s	60s	58s	49s	42s	36s	32s	29s
250% (1250A)	60s	60s	60s	51s	41s	34s	29s	26s	23s	21s
300% (1500A)	60s	60s	50s	38s	30s	25s	22s	19s	17s	15s
350% (1750A)	60s	57s	38s	28s	23s	19s	16s	14s	13s	11s
400% (2000A)	60s	43s	29s	22s	17s	14s	12s	11s	10s	9s
450% (2250A)	60s	33s	22s	17s	13s	11s	9s	8s	7s	7s
500% (2500A)	51s	25s	17s	13s	10s	8s	7s	6s	6s	5s
550% (2750A)	39s	19s	13s	10s	8s	6s	6s	5s	4s	4s
600% (3000A)	29s	14s	10s	7s	6s	5s	4s	4s	3s	3s

SSW7000D – 600A

Table 9.8: Maximum time per start for the SSW7000D – 600A

SSW7000D - 600A	Starts per Hour (Initial Temperature 40°C)									
Current limitation	1	2	3	4	5	6	7	8	9	10
150% (900A)	60s	60s	60s	60s	60s	60s	57s	49s	44s	40s
200% (1200A)	60s	60s	60s	60s	53s	44s	38s	33s	29s	27s
250% (1500A)	60s	60s	60s	47s	38s	32s	27s	24s	21s	19s
300% (1800A)	60s	60s	47s	35s	28s	23s	20s	18s	16s	14s
350% (2100A)	60s	54s	36s	27s	21s	18s	15s	13s	12s	11s
400% (2400A)	60s	42s	28s	21s	17s	14s	12s	10s	9s	8s
450% (2700A)	60s	32s	22s	16s	13s	11s	9s	8s	7s	6s
500% (3000A)	51s	25s	17s	13s	10s	8s	7s	6s	6s	5s
550% (3300A)	40s	20s	13s	10s	8s	7s	6s	5s	4s	4s
600% (3600A)	31s	15s	10s	8s	6s	5s	4s	4s	3s	3s

SSW7000C – 125A

Table 9.9: Maximum time per start for the SSW7000C – 125A

SSW7000C - 125A	Starts per Hour (Initial Temperature 40°C)									
Current limitation	1	2	3	4	5	6	7	8	9	10
150% (188A)	60s	60s	60s	60s	60s	60s	60s	60s	60s	60s
200% (250A)	60s	60s	60s	60s	60s	60s	60s	60s	60s	60s
250% (313A)	60s	60s	60s	60s	60s	60s	60s	60s	60s	60s
300% (375A)	60s	60s	60s	60s	60s	60s	60s	56s	50s	45s
350% (438A)	60s	60s	60s	60s	60s	55s	48s	42s	37s	33s
400% (500A)	60s	60s	60s	60s	50s	42s	36s	31s	28s	25s
450% (563A)	60s	60s	60s	48s	38s	32s	27s	24s	21s	19s
500% (625A)	60s	60s	48s	36s	29s	24s	21s	18s	16s	14s
550% (688A)	60s	54s	36s	27s	22s	18s	16s	14s	12s	11s
600% (750A)	60s	40s	27s	20s	16s	13s	11s	10s	9s	8s

SSW7000C – 250A

Table 9.10: Maximum time per start for the SSW7000C – 250A

SSW7000C - 250A	Starts per Hour (Initial Temperature 40°C)									
Current limitation	1	2	3	4	5	6	7	8	9	10
150% (375A)	60s	60s	60s	60s	60s	60s	60s	60s	60s	60s
200% (500A)	60s	60s	60s	60s	60s	60s	60s	58s	52s	47s
250% (625A)	60s	60s	60s	60s	60s	54s	46s	40s	36s	32s
300% (750A)	60s	60s	60s	57s	46s	38s	33s	29s	26s	23s
350% (875A)	60s	60s	56s	42s	34s	28s	24s	21s	19s	17s
400% (1000A)	60s	60s	41s	31s	25s	21s	18s	16s	14s	12s
450% (1125A)	60s	46s	31s	23s	18s	15s	13s	11s	10s	9s
500% (1250A)	60s	33s	22s	17s	13s	11s	10s	8s	7s	7s
550% (1375A)	48s	24s	16s	12s	10s	8s	7s	6s	5s	5s
600% (1500A)	32s	16s	11s	8s	6s	5s	5s	4s	4s	3s

SSW7000C – 360A

Table 9.11: Maximum time per start for the SSW7000C – 360A

SSW7000C - 360A	Starts per Hour (Initial Temperature 40°C)									
Current limitation	1	2	3	4	5	6	7	8	9	10
150% (540A)	60s	60s	60s	60s	60s	60s	60s	60s	59s	53s
200% (720A)	60s	60s	60s	60s	60s	60s	52s	45s	40s	36s
250% (900A)	60s	60s	60s	60s	53s	44s	38s	33s	30s	27s
300% (1080A)	60s	60s	60s	51s	41s	34s	29s	25s	23s	20s
350% (1260A)	60s	60s	53s	40s	32s	26s	23s	20s	18s	16s
400% (1440A)	60s	60s	42s	32s	25s	21s	18s	16s	14s	13s
450% (1620A)	60s	51s	34s	26s	21s	17s	15s	13s	11s	10s
500% (1800A)	60s	42s	28s	21s	17s	14s	12s	11s	9s	8s
550% (1980A)	60s	35s	23s	17s	14s	12s	10s	9s	8s	7s
600% (2160A)	57s	29s	19s	14s	11s	10s	8s	7s	6s	6s

9.2. CONTROL DATA

Table 9.12: Control data.

Supply	Control voltage	Control Unit Version 2: - 110 to 230 Vac (-15 % (93,5 Vac) to 10 % (253 Vac)) or 125 to 320 Vdc Control Unit Version 3: - 100 to 230 Vac (-15 % (85 Vac) to 10 % (253 Vac)) or 110 to 320 Vdc *Note: The values informed are specific for the Control Units; they do not cover other components of the SSW7000, such as contactor coils.
	Frequency	„ (50 a 60 Hz): (±10 %) or (45 a 66 Hz)
	Consumption	■ 110 Vac: - Continuous: 1400 mA - Peak: 9,5 A ■ 220 Vac: - Continuous: 700 mA - Peak: 6,0 A
Control	Method	■ Voltage ramp ■ Current limit ■ Pumb control ■ Torque control ■ Current ramp
Inputs	Digital	■ 6 isolated digital inputs, 24 Vdc, with programmable functions
	Analog	■ 2 differential inputs isolated by differential amplifier ■ AI1 with a 12 bit resolution ■ AI2 with 11bit resolution + sign, (0 to 10) V, (0 a 20) mA or (4 to 20) mA ■ Impedance: 400 kΩ for (0 to 10 V), 500 Ω for (0 a 20 mA) or (4 to 20 mA), programmable functions
Outputs	Digital	■ 3 relays with NO/NC contacts, 240 Vac, 1 A, programmable functions
	Analog	■ 2 isolated outputs,, (0 a 10 V) RL ≥ 10 kΩ (maximum load), 0 to 20 mA or 4 to 20 mA RL ≤ 500 Ω, 11 bit resolution, programmable functions
HMI Human Machine Interface	Standard HMI	■ 9 keys: Start/Stop, Increment, Decrement, rotation direction, Jog, Local/remote, right soft key and Left soft key ■ Graphic LCD display ■ It allows access/modification of all the parameters ■ Indication accuracy - Current 3% of the rated current ■ Accessible at the cabinet door
Safety	Main protections	■ Under-, overcurrent and current imbalance ■ Under-, overvoltage and voltage imbalance ■ Under-, overtorque and active overpower ■ Phase loss ■ Inverted phase sequence ■ Power arm overtemperature ■ Motor overload ■ Motor overtemperature (optional) ■ External fault ■ Ground fault by voltage or by current ■ Power arm faults ■ Power contactor faults ■ Control board faults ■ Communication fault of the HMI and between control boards ■ Communication network faults ■ Programming error ■ For more details and more implemented functions, refer to the programming manual
Enclosure	IP41	■ Standard cabinet
	IP54	■ Compact cabinet
PC connection for programming	USB connector	■ USB standard Ver. 2.0 (basic speed) ■ USB plug Type B “device” ■ Interconnection cable: Standard host/device shielded USB cable

10 TROUBLESHOOTING AND MAINTENANCE

10.1.FAULT TRIPS AND ALARMS

In order to avoid dangerous situations, damages to the motor, damages to the soft-starter or other materials, the protections of the SSW7000 may actuate so that certain physical limits will not be exceeded.

In this regard, a fault is a condition that requires immediate stop of the soft-starter so as to prevent possible losses. When a fault occurs, the SSW7000 is automatically disabled, and it cannot be restarted until the cause of the fault is removed.

When a fault “FXXX” is detected, the following occurs:

- Disabling of the SCR firing.
- Opening of the vacuum contactors (line and bypass).
- Indication of the fault code and description on the display.
- Indication of the present fault at P0020.
- Indication of the occurrence in the status word – P0680.
- Status LED transition to flashing red.
- Opening of the relay programmed for “No Fault”.
- It saves the following data in the control circuit EEPROM:
  - The code of the occurred fault (it shifts the nine previous faults).
  - The motor overload integrator status.
  - The status of the enabled time (P0043) and powered time (P0042) counters.

In order to be able to operate the SSW7000 again after a fault trip, reset in one of the following manners:

- Pressing the HMI O key (manual reset).
- Through the reset soft key.
- Automatically through P0208 setting (auto-reset time).
- Through a digital input: DIx = 10 (P0263 to P0268).
- Removing the power supply and reapplying it again (power-on reset).

When an alarm is detected, the following occurs:

- Indication of the alarm code and description on the display.
- Indication of the present alarm at P0021.
- Indication of the occurrence in the status word – P0680.
- Status LED transition to yellow.
- The SCR firing is not disabled, the contactors do not open and the SSW7000 remains in operation.

Alarms are automatically removed when the condition that caused them no longer exists.

NOTE!
Fault and alarm occurrences are described in the programming manual, chapter 2 - Faults and Alarms.

10.2.MOST FREQUENT PROBLEMS

Table 10.1: Frequent problem cause

Problem	Most Likely Causes	Cause Description
The SSW7000 does not respond to the commands	Fault	HMI indication: "FXXX" The SSW7000 does not allow motor starting during a fault situation. Verify what fault it is. Refer to the programming manual, chapter 2 - Faults and Alarms
	Time interval after stopping	HMI indication: "TmpP831" The SSW7000 is waiting the time after the motor stopping, programmed in P0831. Refer to the programming manual, section 15.9 - Timer Protections.
	General enabling	HMI indication: "Des.Ger" General disabled. Verify the command source. If any DI is programmed for general enable, this input can disable the soft-starter even if the commands are from other sources. Refer to the programming manual, section 10.4 - Digital Inputs.
	ConFiguretion mode	HMI indication: "Config" It indicates that the SSW7000 is in a special condition while it cannot start the motor. Refer to the programming manual - P0692
	Command source LOC/REM	Verify whether the active command source is Local or Remote. HMI indication: "LOC" or "REM" Verify at P0220 what the origin of the LOC/REM selection is. If in "LOC", verify which the local command source is. If in "REM", verify which the remote command source is. Refer to the programming manual, section 10.1 - Local/Remote Configuration.
	Commands by HMI – I,O keys	Verify fault conditions, the time after stopping, general enable input, configuration mode and the command source indicated on the HMI. Refer to the programming manual, chapter 7 - HMI.
	Commands by DIx – Digital Inputs	Verify fault conditions, the time after stopping, general enable input, configuration mode and the command source indicated on the HMI. Verify the type of starting, 2-wire or 3-wire. Refer to the item 5.2.10 - User Signal and Control Connections. Verify digital input connections, DIx, 24 V and COM. Refer to the item 5.2.10 - User Signal and Control Connections. Refer to the programming manual, section 10.4 - Digital Inputs.
	Commands by Serial/USB	Verify fault conditions, the time after stopping, general enable input, configuration mode, and the command source indicated on the HMI. Verify at P0682 the commands sent through the Serial/USB. Verify at P0680 the SSW7000 status word. Refer to the programming manual - P0680 and P0682 and to the serial communication manual.
	Commands by Anybus-CC	Verify fault conditions, the time after stopping, general enable input, configuration mode, and the command source indicated on the HMI. Verify at P0686 the commands sent through the Anybus-CC. Verify at P0680 the SSW7000 status word. Refer to the programming manual - P0680 and P0686 and to the Anybus-CC communication manual.
	Commands by SoftPLC	Verify fault conditions, the time after stopping, general enable input, configuration mode, and the command source indicated on the HMI. It depends on the applicative software being executed in the SoftPLC. The SoftPLC is controlled through P1001. Verify at P1000 the SoftPLC status. Verify at P0680 the SSW7000 status word. Refer to the programming manual - P0680, P1000 and P1001 and to the SoftPLC manual.
The motor does not reach the rated speed	Motor does not start	Current or torque limits are too low for the load applied to the motor.
	Motor starts	The line voltage is too low or the medium voltage transformers are undersized.
The motor speed is too high or too low	Motor data	Verify whether the used motor matches the application requirements.
Jerking during motor deceleration	General applications	The stopping (deceleration) time must only be used with centrifugal hydraulic pump applications. For other applications P0104 must remain in 0 = Inactive.
	Pumps	The deceleration control method is not appropriated for the application. Refer to the programming manual, chapters 11 - Control Type and 20 - Programming Information and Suggestions.

Table 10.2 (cont.): Frequent problem causes

Problem	Most Likely Causes	Cause Description
Noise at the motor	While starting	The noise produced by the motor while starting depends on the used starting method and on the involved times. However, it is continuous, with medium level and with no jerks.
	During JOG	The SSW7000 JOG function applies a low frequency to the motor, which produces high and pulsing noises at the motor, according to the JOG level.
	While breaking	The optimal braking method produces high and intermittent noises at the motor, which decrease and become more continuous while stopping. The DC braking method produces constant medium level noises at the motor. The reverse stopping method produces noises similar to the starting motor noises, becoming like the optimal braking at the stopping end.
Increase of the motor current during the deceleration	General applications	The stopping (deceleration) time must only be used with centrifugal hydraulic pump applications. For other applications P0104 must remain in 0 = Inactive.
	Pumps	It is normal that during controlled decelerations of centrifugal hydraulic pumps the motor current increases as the motor stops, because the motor is entering the blocked rotor condition. In order to reduce this effect, P0105 can be adjusted for the voltage value (in % of the motor voltage) present at the moment the motor stops, and this value can be visualized at P0007. Refer to the programming manual - P0007 and P0105
HMI display off	HMI connection	Verify the cable that connects the HMI to the control board C1 (CC11).
	Power supply	Verify the low voltage power supply at X1 of the FSM board. It must be in the range from 94 to 253 Vac. Verify the connection between the FSM (XC1) and CC11 (XC60) boards.
	Fuse	Inspect the FSM board fuse

NOTE!
The operation of alarms and faults is described in the programming manual, chapter 2 - Faults and Alarms.

10.3. FAULTS ON THE FSMT BOARD

The FSMT power supply board is responsible for supplying the CC11 and CSM electronic boards, and for driving the relays.

The FSMT board has two versions. The version FSMT.01 modulates a voltage of 66Vac at 400Hz, and is used in the SSW7000C 6.9kV. The version FSMT.00 modulates a voltage of 87Vac at 800Hz and is used in the other lines of the Soft-Starter.

The faults presented by the FSMT board are indicated by LEDs. The description of each LED is detailed table 10.3.

Table 10.3: Description of the faults indicated by the LEDs of the FSMT board.

LED	Description	Fault Actuation
H4	Active processor	In the OFF state, the processor is in fault or powered down.
H6	Undervoltage fault	Monitors and actuates if the voltage on the link is below 94.5 Vdc (70 Vac), resets above 121.5Vdc (90 Vac) for Dip2 closed or 90Vdc (66.6Vac) for Dip2 open.
H8	Overcurrent fault	Above 3.0A (positive or negative). Reset by time after 60 seconds. After three overcurrent faults in a row, resets by time will no longer occur (only by powering down the board)
H9	Overload fault	Actuates with current above 1.8A, and resets with current below 1.5A. It does not check while in the starting ramp. Reset by time after 60 seconds. After three overloads in a row, resets by time will no longer occur (only by powering down the board)
H10	Overvoltage fault	Actuates above 356 Vdc (263.7Vac) on the link and resets below 324 Vdc (240 Vac).
H11	Overtemperature fault	Actuates with temperature above 90°C (2.22V on the A/D) and resets with temperature below 80°C (1.99V on the A/D).

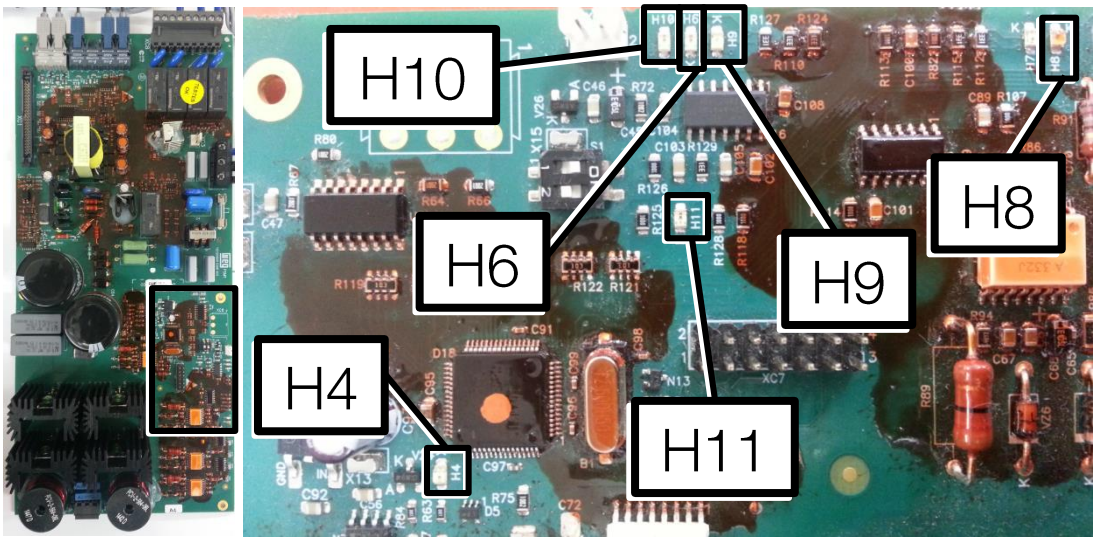


Figure 10.1: Location of the fault LEDs of the FSMT board.

Dip Switch 1: Defines the maximum output voltage of the FSMT board (connector XC2). If open (default option), the output voltage will be 83 Vac (FSMT.00) and 66 Vac (FSMT.01). If closed, it will be 87 Vac (FSMT.00) and 69 Vac (FSMT.00).
Dip Switch 2: Enables protection against power supply undervoltage of the FSMT board during the motor start. The reset limit is 121.5Vdc (90 Vac).

10.4.PREVENTIVE MAINTENANCE

DANGER!
Always disconnect the input power before touching any electrical component associated to the SSW7000. Follow the disconnection sequence described in this manual, item 10.4.1 - SSW7000 Disconnection Sequence.

High voltages may be present even after disconnecting the power supply.

Wait at least 3 minutes for the complete discharge of the power capacitors.

Always connect the equipment frame to the protective earth (PE) at the suitable connection point.

ATTENTION!
Electronic boards have components sensitive to electrostatic discharges.

Do not touch directly on components or connectors. If necessary, touch the grounded metallic frame before or use an adequate grounded wrist strap.

Do not perform any high pot tests with the SSW7000!
If it is necessary, consult WEG.

10.4.1. SSW7000 Disconnection Sequence

The safe disconnection sequence is the following:

1. Program P0330 = 1 in order to enter the safe disconnection mode.
2. Parameter P0331 will show the steps of the safe disconnection.
3. The HMI will display P0331 = 0, and also a message asking if the medium voltage power supply was turned off.
4. Manually open the isolating switch of the SSW7000.
5. After opening the isolating switch, select P0331 and answer “OK”.
6. Then, the main and bypass contactors will be automatically closed and opened in order to eliminate possible residual voltages on the product.
7. During the entire procedure, messages will be displayed on the HMI screen, informing the sequence of commands executed by the function.

DANGER!
The whole procedure must be carried out with the SSW7000 panel door closed.

NOTE!
The safe disconnection procedure is for the connections of the circuits on the output of the isolating switch only. In order to perform operations which require access to the input circuits, make sure they are not energized.

Table 10.4: Preventive maintenance

Maintenance	Intervalo	Instruções
Replacement of fans (if used)	After 50000 operation hours	Take out the power arm and replace the fan
Replacement of the HMI battery	Every 10 years	Refer to the chapter 4 - HMI

Table 10.5: Periodic inspections every 6 months

Component	Abnormality	Corrective Action
Terminals, connectors	Loose screws	Tighten
	Loose connectors	
Fans (if used)	Dirty fans	Cleaning
	Abnormal acoustic noise	Take out the power arm and replace the fan
	Stopped fan	
	Abnormal vibration	
Printed circuit boards	Accumulation of dust, oil, humidity, etc.	Cleaning
	Odor	Replacement
Power arms	Accumulation of dust, oil, humidity, etc.	Cleaning
	Loose connection bolts	Tighten
	Power module bolts	Checking and tighten
Snubber resistors	Discoloration	Replacement
	Odor	
Heatsinks	Dust accumulation	Cleaning
	Dirty	

10.5. DIRECT ONLINE START – DOL

In emergency situations, in which a defect in one or more power arms occurs, it is possible to use the direct online start mode (DOL) to drive the motor, enabling the continuation of the production process. In this mode, when a "RUN" command is sent, the by-pass and main contactors are activated so as to apply full voltage to the motor terminals, effectively performing a direct online start.

NOTE!
Refer to section 11 – Control Types of the programming manual in order to select the DOL start mode.

When using the D.O.L. start mode, it is responsibility of the user to check the following items:

- Capacity of the power supply suitable for the direct online starting current to be drained by the motor under the existing load conditions. It is recommended that the maximum voltage drop at the start be limited to 20% of the rated supply voltage.
- Programming of protection relays present in the installation that feeds the SSW7000.
- The cycle of direct online starts to be performed must be compatible with the specified motor start capacity.

NOTE!
All the protections, except for the detection of "Motor Not Connected – F015" remain active when the DOL start is used. Parameter P0102 is used as reference for the maximum starting time.

ATTENTION!
The motor current at the end of the start (P0102) must be smaller than 120% of the rated motor current (P0401).

10.6.DATA FOR CONTACT WITH THE TECHNICAL SUPPORT

NOTE!
In order to request support or services, it is important to have the following data at hand:

- The SSW7000 model, serial number and manufacturing date, presented on the product nameplate (refer to the section 3.2 - SSW7000 Identification Label).
- The installed software versions (refer to P0023 and P0099).
- Motor nameplate data (power, voltage, current and number of poles)
- Application data and parameter settings