

## Solid state soft starter type VFS specification (rev.4)

### Introduction

The solid state soft starter type VFS is designed to operate in conjunction with standard medium voltage squirrel cage motors (asynchronous and synchronous).

### Motor voltage and frequency ratings

2300 V, 3300 V, 4160 V, 6000 V to 6900 V, 10000 V to 11000 V and 13800 V AC +10% to -15% @ 50/60 Hz.

### Power and current ratings

Up to 4850 kW @ 2300 V (max. 1400 A)  
Up to 6950 kW @ 3300 V (max. 1400 A)  
Up to 8750 kW @ 4160 V (max. 1400 A)  
Up to 12650 kW @ 6000 V (max. 1400 A)  
Up to 13900 kW @ 6600 V (max. 1400 A)  
Up to 14550 kW @ 6900 V (max. 1400 A)  
Up to 21050 kW @ 10000 V (max. 1400 A)  
Up to 23200 kW @ 11000 V (max. 1400 A)  
Up to 10400 kW @ 13800 V (max. 500 A)

### Control voltage

230 V AC +10% to -15% @ 50/60 Hz (standard)  
110 V AC +10% to -15% @ 50/60 Hz (optional)  
220 V DC +10% to -15% (optional)  
110 V DC +10% to -15% (optional)

### Power frequency withstand test

System voltage	Test voltage
2300 V to 6900 V	20 kV
10000 V to 11000 V	28 kV
13800 V	38 kV

### Basic impulse level (BIL)

System voltage	BIL
2300 V to 6900 V	60 kV
10000 V to 11000 V	75 kV
13800 V	95 kV

### Thyristor (SCR) peak inverse voltage rating

System voltage	PIV
2300 V	6900 V
3300 V	9900 V
4160 V	12500 V
6000 V to 6900 V	19500 V
10000 V to 11000 V	32500 V
13800 V	41000 V

### Motor and soft starter protections

Starting to running transition (19)  
Undervoltage (27)  
Undercurrent (37)  
Underpower (37) optional  
Bearing RTD protection (38) optional  
Mechanical condition protection (39) optional  
Phase-balance current (46)  
Phase loss (46)  
Phase-sequence (47)  
Incomplete sequence (48)  
Locked rotor (48)  
I<sup>2</sup>t electronic motor overload (49)  
Stator RTD protection (49) optional  
Instantaneous overcurrent (50)  
Instantaneous earth overcurrent (50G)  
AC inverse time overcurrent (51)  
AC inverse time earth overcurrent (51G)  
AC inverse time overcurrent/locked rotor (51LR)  
Power factor protection (55) optional  
Overvoltage (59)  
Number of starts per hour (66)  
Frequency protection (81) optional  
Lockout (86)  
Start inhibit (86)  
External fault (94/95)  
Shorted thyristor (SCR) protection  
Thyristor (SCR) overtemperature protection  
Transient voltage protection optional

### Acceleration and deceleration control

Initial Voltage, Current Limit, Dual Adjustment, Pulse Start and Soft Stop are only a few of the integrated acceleration and deceleration functions in our solid state soft starter type VFS, which allows the user to control the motor during start and stop.

### Operator interface device (HMI)

Keypad for programming and monitoring with a 2 lines x 16 characters backlit LCD and 8 status LEDs (ON, Test, Dual Adjustment, Fault, Start, Run, Soft Stop and Stop).

### Communications

RS485 with MODBUS RTU protocol is standard. RS232 port and other communication protocols like

MODBUS TCP or PROFIBUS DP are available on request.

### Statistical and fault data

The fault log contains the last 10 events with error description. Last starting time, last maximum starting current, last trip current, total run time, total number of starts and total number of trips are available as statistical data.

### Panel design

The standard panel is designed to meet IP4X according to IEC 60529 with cable entrance from bottom. The panel structure is made of galvanised sheet metal and the covers and doors are powder-coated with RAL7035. Higher IP codes, different panel colours and cable entrance from top are available on request.

### Ambient conditions

The solid state soft starter type VFS is designed to operate under the ambient temperature range of 0 °C to 50 °C (-20 °C to 50 °C as an option), a relative air humidity of  $\leq 95\%$  non-condensing and an altitude of  $\leq 1000$  m above sea level without derating.

### Approvals, certificates and standards

The solid state soft starter type VFS is type approved according to IEC 62271-200 and will be manufactured in compliance with IEC standards, the EC directives and the ISO 9001 standard. Individual approvals by ABS, BV, CCS, DNV-GL, LRS, RINA, RS, etc. are available on request.

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