



Specification guide

Type PST Softstarters



Softstarters

Type PST

Specification guide

1. Introduction.....	4
2. Codes and Standards.....	4
3. Product Features	
A. Acceleration Control	4
B. Preset Application Macros	4
C. Sequence Start.....	4
D. Deceleration Control (Softstop)	4
E. Motor and Load Protection	4
F. Softstarter Protection	5
G. Fault Detection	5
H. Warning Indications	6
I. Inputs.....	6
J. Outputs	6
K. Operator Interface	7
L. Metering.....	7
M. Serial Communications.....	8
N. Fault history	8
4. Design Specifications	8
A. Power Ratings	8
B. SCR Devices	8
C. Ambient Conditions	8
5. Mechanical Construction	9
A. Housing and Termination.....	9
B. Ventilation	9
C. Integrated Bypass Contactors	9
D. Inline and Inside Delta Connections	9
E. Integrated Cable Clamps.....	9
6. Quality Requirements	9
A. ISO 9002 and ISO14001	9
B. Environmental Product Declaration	9
C. Testing	9
D. Inspection	9
E. Quality Control.....	9
7. Spare Parts and Accessories	9
8. Documentation	9
9.. Markings.....	10

Specification guide

Type PST Softstarters

1. Introduction

This specification guide describes the required performance, functional specification, fabrication details and installation of digital solid state low voltage Softstarter, used for stepless start and stop, motor control and motor protection of AC squirrel cage induction motors.

2. Codes and Standards

The softstarter shall be designed, built and tested according to the latest editions of applicable UL and IEC standards. The softstarter shall have CCC approval.

The softstarter(s) must be approved and/or certified by the following organizations:

- A. Underwriters Laboratories (UL)
- B. Canada Standards Association (CSA)

3. Product Features

The softstarter shall be ABB Type PST Series or pre-approved equal. The softstarter shall contain the following features, functions and adjustments as a minimum.

A. Acceleration Control

As a minimum, the softstarter shall come complete with the following settings:

- 1) Initial Voltage: Initial voltage output shall be adjustable between 30-70% of the nominal voltage.
- 2) Maximum Current Limit: Current Limit shall be adjustable between 200% and 500% of the softstarter's rated full load current.
- 3) Ramp Time: The time between initial torque and full output torque shall be adjustable between 1 and 120 seconds in increments of one second.
- 4) Kick Start: In order to accommodate high inertia loads, the softstarter shall include settings for a kick start. The kick start initial voltage setting shall be adjustable between 50-100% of nominal voltage. The kick start time shall be adjustable between 0.1 and 1.5 seconds in increments of 0.1 seconds.
- 5) Jog: In order to allow rotation checks during start-up or in order to perform test procedures, the softstarter shall include a jog function that matches the programmed

acceleration profile. The jog function shall be initialised either directly from the keypad or through a programmable input.

B. Preset Application Macros

The softstarter shall be provided with preset application macros. The macros shall be fully adjustable in order to allow optimisation of starting and stopping parameters. The softstarter must contain macros for the most common applications as follows:

- Hydraulic Pump
- Centrifugal Pump
- Compressor
- Conveyor Belt
- Fan
- Axial Fan
- Crusher
- Mixer
- Bow Thruster

C. Sequence Start

The softstarter shall have the ability to sequentially start up to three motors. Each sequential start shall include independently programmable start ramp profiles. Each start ramp profile shall include programmable settings for initial voltage, ramp time, and maximum current limit.

D. Deceleration Control (softstop)

Deceleration control (softstop) shall be a standard feature. All deceleration setting shall be independent of any acceleration setting. As a minimum, the softstarter shall come complete with the following settings:

- 1) Step Down Voltage: In order to eliminate hunting effects for pump applications, a step down voltage shall be available and adjustable from 30 to 100% of the line voltage
- 2) Ramp Time: The deceleration time should be adjustable from 0-120 seconds in increments of one second to allow controlled deceleration (soft stop) of motors.
- 3) End Voltage Level: The end voltage level shall be adjustable from 30-70% of line voltage.

Specification guide

Type PST Softstarters

E. Motor and Load Protection

Motor and Load Protection shall be integrated with the softstarter. All protection functions shall under no circumstances be disconnected or disabled when a by-pass contactor is used. In order to protect both the motor and load, the Softstarter shall be provided with the following functions as a minimum:

- 1) Motor Overload Protection: Motor overload protection shall be programmable from Class 10A, 10, 20 and 30. The overload protection shall be based on a Dynamic Thermal Register retained in memory even upon loss of power.
- 2) Dual Overload Protection: The softstarter must include two separate overload curves – one for starting and one for continuous run. Dual overload protection will allow a higher trip class to avoid nuisance tripping during acceleration while providing maximum motor protection during continuous run conditions. For maximum flexibility, each trip curve shall be independently programmable within the four different trip curve classes described above.
- 3) Manual or Automatic Reset: For maximum flexibility, the softstarter shall be programmable to allow automatic reset for unattended remote applications. The factory default shall be manual reset.
- 4) Thermal Memory: The over load protection shall not loose track of the motor temperature after loss of power. Upon reapplication of power, the microprocessor shall update the motor temperature and adjust for real time cooling while the power was off.
- 5) PTC Protection: Input terminals for PTC signals directly from the motor to the softstarter shall be available as a standard design feature.
- 6) Thermal Capacity Reset Level: The softstarter shall not allow a restart of the motor after an over load trip if sufficient thermal capacity is not available for a successful re-start.
- 7) Phase Imbalance Protection: The softstarter shall be provided with programmable phase imbalance protection. The sensitivity shall be adjustable for imbalances between any two

phases between 10% and 80% of the rated current.

- 8) Phase Reversal Protection: Protection for phase reversal shall be available to prevent the softstarter from starting if the phases are connected in a different order than ABC. This will ensure that the motor will not turn in an inappropriate direction.
- 9) High Current Protection: The softstarter shall be equipped with high current protection and shall trip if the current exceeds eight times the set rated current.
- 10) Locked Rotor Protection (electronic shear pin protection): Locked rotor protection shall be available. The trip current shall be programmable from 300% to 800% of set rated current. The time delay before tripping shall be adjustable from 0.2 to 10 seconds.
- 11) Under Load Protection: The softstarter shall be equipped with under load protection and shall trip if the current falls below a preset level during a certain time period. The trip level shall be programmable from 40% to 100% of the programmed full load motor current. The time delay before tripping shall be adjustable from 1 to 30 seconds.

F. Softstarter Protection

Softstarter protection shall be provided to maintain reliability for both the driven equipment and the electrical components. Softstarter Overload Protection shall be built-in and protect the SCR'S from exceeding their maximum load capacity.

G. Fault Detection

In order to protect the motor and load, the softstarter shall be provided with fault detections. All fault detections and signals shall be standard and shall not be possible to disable. When a fault occurs, the type of fault shall be clearly indicated on the LCD screen. As a minimum, the following fault indications shall be available:

- 1) Softstarter Over Temperature Fault: Softstarter over temperature protection shall be built-in and protect the SCR's from excessive heat in the enclosure and/or heat sink. The temperature shall be measured directly on the Softstarter's heat sink with an internal temperature sensor.

Specification guide

Type PST Softstarters

- 2) Phase-Loss Detection: Phase loss detection shall be standard and shut down the softstarter if the voltage in any phase is not detected on the line side of the softstarter.
 - 3) Shorted SCR Detection: Shorted SCR detection shall automatically prevent a start sequence when at least one SCR is shorted.
 - 4) Non-conducting SCR Detection: The softstarter shall prevent a start when at least one SCR is not conducting.
 - 5) Frequency Out of Range Detection: The softstarter shall automatically shut down if the line frequency is outside the standard range specified under Power Ratings.
 - 6) Main Voltage on Line Side Detection: The softstarter shall indicate if there is no line voltage connected when in standby mode.
 - 7) Open Circuit on Motor Side: The softstarter shall indicate open circuit on motor side and shall stop the motor if the circuit is open on the motor side (i.e., no motor is connected).
 - 8) Bypass Monitoring: If an external by-pass contactor is used, and for any reason the by-pass contactor does not close when given the closing signal, the softstarter shall indicate a fault and stop.
 - 9) Fieldbus Fault: In the event of a communications failure, the softstarter shall give indication of the failure and revert to the off position. This fault shall only activate when serial communication is utilized.
- 2) Softstarter Overload Warning: It shall be possible receive a warning signal when theoretical temperature of the SCR's exceeds 90% of it's rated maximum capacity.
 - 3) High Current Warning: It shall be possible to receive a warning signal when the current reaches a settable level between 0.5 and 5 times the full load current for 200ms.
 - 4) Low Current Warning: It shall be possible to set an under current level between 40 and 100% of the full load current at which point the softstarter will create a low current warning.

H. Warning Indications

In order to prevent nuisance tripping, warning signals shall be available. This feature makes it possible to detect and correct a fault before tripping. The following warning signals shall be provided as a minimum:

- 1) Motor Overload Warning: It shall be possible to set a temperature level between 40 and 99% of the maximum theoretical motor temperature at which a warning signal will be activated.

I. Inputs

Two programmable input signals shall be available. Each input shall be programmable for the following: None, Remote Reset, Jog, Enable, Start of Second motor, and Start of third motor.

All input and control devices shall be rated for 24VDC control.

Start and Stop shall be possible using either the softstarter's internal control voltage supply, or utilizing an external 24VDC source. Using an external 24VDC source for the control voltage makes it possible to operate the softstarter directly from a PLC without the need of an external relay.

J. Outputs

The softstarter unit shall have a minimum of three physical signal relays and one virtual relay when communication is utilized. Each relay shall have one normally open (NO) and one normally closed (NC) potential free contact. Each relay shall be individually programmable for any one of the three functions listed below. All options included in the "Event" list shall be enabled or disabled individually.

- 1) Run
- 2) Top of Ramp
- 3) Event list options shall include the following:
 - a. Motor overload protection
 - b. High current protection
 - c. SCR overload protection
 - d. Locked rotor protection
 - e. Underload protection

Specification guide

Type PST Softstarters

- f. Phase reversal protection
- g. Phase imbalance protection
- h. PTC protection
- i. Fault
- j. By-pass monitoring
- k. Overload warning
- l. SCR overload warning
- m. High current warning
- n. Low current warning

For details of the event called Fault, please see Fault Detection above.

K. Operator Interface

The softstarter shall be provided with an energy saving LCD display with the following design specifications:

- 1) LCD Display: A 2-line 20 character per line LCD display shall be provided. The use of binary, hexagonal code, or any other code is not acceptable.
- 2) Energy Saver: A programmable LCD energy saving function shall be provided. The energy saver shall allow the LCD to turn off after a pre-programmed amount of time. The energy saver function can be disabled if desired.
- 3) Languages:
In order to reduce the risk of misinterpretations and errors and to ensure complete international compatibility, it shall be possible to select between the following languages:
 - a. English
 - b. Chinese (Characters)
 - c. Spanish
 - d. Portuguese
 - e. Italian
 - f. French
 - g. German
 - h. Dutch
 - i. Swedish
 - j. Finnish

- 4) Adjustments: All adjustments shall be made by a four-button keypad. No binary coded dipswitches shall be used for programming or function selection.
- 5) Password Protection: Password protection shall be available to prevent unauthorised changes to the programming.
- 6) Data: All data presented shall be possible to interpret without the use of index tables and manuals. Data should always be presented with a description, the actual value, and the unit of the data (i.e. V, A or %).

A function shall be available for listing all the changed settings and data in the softstarter. The listing of all the changed setting is an essential tool in order to trouble-shoot and service the softstarter.

Data entered and selections made to the softstarter using the display and keypad shall be stored prior to power loss and shall be retrievable after a power loss.

- 7) LED Indicators: Long life LED's shall provide annunciation of Power On for indicating that supply voltage is provided, Fault trip, and Protection trip. For a full description of Fault and Protections, see Outputs.

L. Metering

Metering functions shall be provided as follows:

- 1) Output Current: The output current of each phase shall be indicated in the range of 0 to 9999 amps.
- 2) Output Voltage: The output voltage shall be displayed in terms of % of rated full voltage. The indicating range shall be 0 to 100%
- 3) Total Number of Start Sequences of the Softstarter: A run counter shall be provided. This counter shall not be possible to reset.
- 4) Total Run Time: An electronic elapsed time meter shall be provided. The elapsed time meter shall not be possible to reset.
- 5) Motor Temperature: At any given time, it shall be possible to check the temperature of the

Specification guide

Type PST Softstarters

motor from the softstarter. The temperature shall be given as a percentage of the maximum allowed motor temperature at which the motor over load protection will trip when enabled.

- 6) Real time clock: A real time clock shall be available in order to determine when different events have occurred.

M. Serial Communication

Serial Communications shall be built-in as a standard feature. A separate adapter, the ABB Field Bus Plug, shall be used to connect the softstarter to a serial communication system.

The following communication protocols shall be available through the Field Bus Plug:

MODBUS
DeviceNet
Profibus DP
ASI

The softstarter shall have at least 1000 different addresses.

N. Fault History

Fault message and Fault History shall be displayed automatically upon any new fault and retained in non-volatile memory for viewing by service personnel when necessary. The number of faults stored should be at least the last 20 events. Each stored fault shall provide the exact fault condition and time the fault occurred.

4. Design Specifications

The softstarter shall be controlled completely through solid state design algorithms. The softstarter shall be control the current in all three phases, using two anti-parallel SCR's in each phase. The softstarters shall be designed to the following specifications:

A. Power Ratings

- 1) Input: 208 to 600V or 380 to 690V, -15% to +10%, 3 phase 50/60Hz \pm 5%.

- 2) Output: Reduced voltage, three-phase AC derived from phase-angle fired inverse-parallel SCR's, ramped to full voltage.
- 3) Output Capacity: The starting capacity shall allow the use of a Class 30 over load relay up to 500% of the rated current.
- 4) Control Power: Wide voltage range, 100-250VAC -15% to +10% at 50/60Hz \pm 5%, shall be standard on each softstarter.

B. SCR Devices

- 1) PIV Ratings:
 - a. 230-600V: 1400V Minimum
 - b. 400-690V: 1800V Minimum
- 2) Protection: RC snubber network circuits shall be provided on each phase assembly.

C. Ambient Conditions

The softstarter shall be capable of withstanding the following environmental conditions during operation. Electrical/ mechanical damage or degradation of performance shall not occur under these conditions.

- 1) Temperature: As a standard softstarter design quality, UL documentation shall be available to show that open chassis designs have been tested for 0 – 60° C operation with de-rating above 40°C. Enclosed ventilated units shall be designed for 0 to 40° C.
- 2) Altitude: 1000m (3300 feet) maximum without derating.
- 3) Humidity: 0 to 95% RH, non-condensing.
- 4) Thermal: The softstarter shall be equipped with a heat sink temperature switch designed to protect the SCR's from over temperature.
- 5) Storage: The softstarter shall be stored within a temperature range of -25°C to +70°C.

Specification guide

Type PST Softstarters

5. Mechanical Construction

The softstarters shall be constructed to the following mechanical specifications:

- A. Housing and Termination:** The softstarter shall be housed in plastic or metal material and termination points provided to accommodate the required incoming cables for the line and load connections.
- B. Ventilation:** The softstarter shall be ventilated with fan cooling when necessary. The fans shall be temperature regulated and automatically switch on only when cooling is necessary in order to reduce energy consumption and noise level.
- C. Integrated Bypass Contactors:** Softstarters with a rating over 300A shall be equipped with an integrated by-pass contactor as standard. The integrated by-pass contactor shall reduce the power losses during continuous run to less than 200W per softstarter, independent of the size. A means to allow external energization of the integrated bypass contactor shall be provided to allow emergency bypass operation in the unlikely event that the softstarter should fail. Consult factory for proper softstarter selection when emergency bypass operation is required.
- D. Inline and Inside Delta Connection:** Each softstarter shall be possible to connect inside the delta of delta wound motors or in-line with standard 3-lead motors. The inside-delta connection makes it possible to reduce the softstarter size by 42%. The softstarter shall automatically detect if it is wired in-line or inside delta. The use of dipswitches or other settings for the selection of the two alternate connections is not acceptable.
- E. Bypass Connection Terminals:** For softstarters not equipped with an integrated bypass contactor, the softstarter shall be equipped with double connections on the incoming side. The extra terminals shall be used for the by-pass connections allowing the protection functionality integrated in the softstarter to be utilized when the softstarter is in bypass mode.

6. Quality Requirements

The following quality related standards must be adhered to in order to ensure the highest degree of reliability:

- A. ISO 9002 and 14001:** The vendor shall be certified to ISO 9002 (quality certification) and ISO 14001 (environmental certification).
- B. Environmental Product Declaration:** A complete environmental product declaration (EPD) shall be available upon request. The EPD shall describe the material used for the softstarter, energy consumption, losses, etc.
- C. Testing:** The softstarter shall be functionally tested under load conditions prior to shipment to assure proper operation per specification.
- D. Inspection:** All incoming material and subassemblies shall be inspected and/or tested for conformance to quality standards.
- E. Quality Control:** All softstarters shall be marked with the manufacturing date and person responsible for the assembly.

7. Spare Parts & Accessories

The following spare parts shall be available:

- A. Printed Circuit Boards
- B. SCR's
- C. Cable Termination Kits for Power Cables for softstarters provided with bus stabs.
- D. Shrouds to increase protection rating to IP20
- E. Cooling Fans

8. Documentation

The softstarter shall be shipped with a complete set of documentation as follows:

- A. Installation and Maintenance Manual
- B. Assembly and wiring diagrams
- C. Dimensional drawings

Specification guide

Type PST Softstarters

In addition to the documentation delivered with the softstarter, a softstarter catalog and drawings of the various softstarter frame sizes in dxf or dwg format shall be provided upon request.

9. Markings

Each open chassis softstarter shall be marked with the following information:

- A. Current and voltage ratings
- B. National and international approval ratings

All information shall be provided on the face of the softstarter unit. Information printed on the side of the softstarter is not accepted as the surrounding components and/or enclosure can easily cover this information.



Low Voltage Products & Systems

ABB Inc.
1206 Hatton Road
Wichita Falls, TX 76302
Tel. 888-385-1221
940-397-7000
Fax 940-397-7085
Web www.abb.com/lowvoltage

1SXU132171M0201 [AC 1006.8]
May, 2003