

ENGINEERING DATA SHEET



SMARTSTART 6000 SoftStarter

With 'SMART-TORQ' Torque Control System

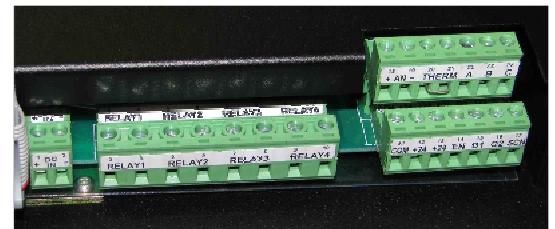
- Torque Control System (TCS) with selectable torque curves
- Torque controlled start to provide linear acceleration
- Torque Controlled stop to provide better pump control to eliminate water hammer.
- A 'Dash Board' display of operating variables
- Plain English, simple menu structure
- Advanced protective features for Motor & Load
- 4x Programmable relays
- 2x Programmable inputs
- Remote Console with menu lockout
- Analogue Output
- Thermistor Input
- Low Voltage control (24VDC)
- Designed for all load types with heavy duty rating for long start times.



24VDC Control Supply with Plug-in terminals with segregation of control I/O and Relay Outputs.

'Dash Board'; Display of operating variables

Off 0V 0% 0%	▶ Operating status with user selectable variables
145 SCR %Thermal 121 Mtr Capacity	▶ Thermal overload capacity (Motor & Starter)
0V 0Hz 0.0A 0.0kW	▶ Electrical status; Voltage / Freq. / Current / Power / Phase rotation
0% Torq 0.00PF 0% Pwr 0.0kW	▶ Power Status; Torque / Power Factor / Power
Volt Imbal 0 % 0 0 0 V	▶ Voltage imbalance; Phase voltages & % imbalance
Curr Imbal 0 % 0.0 0.0 0.0 A	▶ Current imbalance; Phase currents & % imbalance
11 Starts 11 Trips	▶ Counters; Starts / Trips
0.1 RunHrs 1.8 kW.Hrs	▶ Meters; Run Hrs / KW.Hrs
Last Trip T21 STR OVERTEMP	▶ Last trip



Remote Console (IP66)



PLEASE NOTE:
Specifications and product information provided within this document may change without notice.
Some of the features listed may not be available until a later date.

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Overview:

The SMARSTART® 6000 is a micro processor based solid state soft starter suitable for controlling the acceleration & deceleration of a 3 phase AC induction motor. This Soft Starter incorporates SMART-TORQ®, a closed loop torque control system with user selectable acceleration and deceleration profiles to suit different load types. The SMARTSTART 6000 Torque Control System provides a linear acceleration of motor shaft speed without the use of external devices to monitor shaft speed, current or other variable. The torque control provides greater control of motor deceleration to eliminate water hammer problems.

The SMARSTART® 6000 is Designed & Manufactured by Zener Electric with technical support, service and spare parts available within Australia.

General Specification:

SCR PIV:	Minimum 1400V
SCR configuration:	Full-wave
Dv/dt suppression:	RC snubber networks
Over Voltage:	MOV
Rated Insulation:	2Kv
EMC	Class A (to AS61800 – C-tick)
Current Feedback:	C.T in circuit at all times.
Control:	Torque controlled Ramp or voltage ramp, with current limit override
Ramp profiles:	Square & Linear
Accel Torque adj.	Start & Finish torque adjustments 15-200%
Decel Torque Adj.	Final or Release Torque adjustment 0-100%
Compliance	AS31800 C-tick; AS3947.4.2,

Input Voltage:

6R series:	220 to 460Vac
6R15-80:	380Vac to 415Vac

Input Frequency: 50 / 60Hz +/- 3Hz,, Auto detecting

Control Supply: 24Vdc (+15%, -15%)
(Other supply options available with select models)

Configurations: 3 wire & 6 wire
Bypass or Continuous

Environment:

Enclosure protection:	IP00 (IP20: 6R15-80)
Operating Temp.	0 to 55°C (de-rate by 1% / °C >40°C)
Cooling:	Temperature controlled forced ventilated
Maximum Altitude:	1000m without de-rating
Pollution:	Degree 3 conforming to IEC947-4-2

Duty:

Light Duty:	300% for 15 secs; 10start/hr
Standard Duty:	300% for 40secs; 10start/hr 400% for 10 secs; 10start/hr
Severe Duty:	450 for 20 secs; 5start/hr 300% for 60 secs; 5start/hr

Protection:

Motor Phase Fault	Motor incorrectly wired
Motor Loss	Motor or output open cct
SCR Over temp.	Heat sink temperature
SCR protection	Current & thermal modeling
Current Limit	Adjustable current limit during start
Starter Overload	Current & thermal modeling
Bypass failure	No bypass after ramp time or during run mode
CT Phase Fault	Fault with CT's
PSU Control Supply	Control Supply voltage low
Line Freq Fault	Supply frequency out of range
Start Failed	Soft Starter failed to start
Output Fault	Problem with motor or cable detected

User Adjustable/selectable:

Motor Overload	Adjustable; Class 10, 10A, 20, 25, 30 type R1, total memory function. Overload may be disabled.
Motor Over Temp	Motor Over temp via thermistor input
Motor Temp Fault	Fault detected with thermistor
Motor Under Current	Adjustable level and trip time
Motor Over Current	Adjustable level and trip time
Motor Under Torque	Adjustable level and trip time
Motor Over Torque	Adjustable level and trip time
Motor Stalled	300% for 3 seconds (run mode only)
Voltage imbalance	Input voltage imbalance
Current Imbalance	Input & output current imbalance
Acc over time	Accel time exceeds set time
Phase reversal	Phase rotation inhibit
Remote Trip:	Trip via digital input with invert & timer function (0-30s)

Optional:

O/P Short Circuit	Semiconductor fuses (optional)
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Diagnostics:

Digital Inputs:	Logic Display of input status
Thermistor:	Resistance displayed
Relay Outputs:	Test function (ON)
Analogue Output:	Test Function (100%)

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Inputs:

Control Power Supply (min. requirements):

Output Voltage:	24VDC Regulated
6R15-30:	1.5 Amps (36W)
6R60-80:	2.0 Amps (48W)
6R100-200:	3.0 Amps (72W)
6R360-830A:	4.0 Amps (96W)

Control:

Enable (Run) Input:	1x 24Vdc logic
Programmable inputs:	2x 24Vdc logic
Functions:	

- i. Remote Reset: with invert & 0-30s timer function
- ii. Remote Trip: with invert & 0-30s timer function
- iii. ESO: with invert & 0-30s timer function**

Thermistor: Thermistor or NC switch; PTC type, with short circuit detection

Outputs

Digital Outputs:	4x Programmable Relays
Contact Rating:	5A 250Vac; 5A 30VDC
Functions:	Line Control (Relay 1 Default) Bypass Control (Relay 2 Default) Accel Ramp Decel Ramp Ramping Up to speed Motor On (Relay 3 Default) Trip Alarm (Relay 4 Default) Motor Loss Freq Error Bypass Fault SCR O/L Trip Motor O/L Trip Ph Rotation Trip Remote Trip Over Time Trip Volt Imbalance Trip Current Imbalance Trip Under Current Trip Over Current Trip Under Torque Trip Over Torque Trip Warning Alarm TEST (On)

Analogue Output:	1x Programmable Output
Signal Selection:	0-10V, 0-5V, 4-20mA
Functions:	Motor Torque Motor Thermal SCR Thermal Active Power Power Factor Mtr Current TEST (100%)
Full Scale adj.:	50-500%

Options:

- I.T Option Cards **:
 - i. Ethernet Port providing Modbus TCP
 - ii. Data Logging with SD card slot

**** Features or options marked with asterisk are currently under development. Please check with your Zener distributor for availability.**

Human Interface Module (HIM):

Type:	Local or Remote mount option
Display:	Backlit LCD (Blue), Coded & English
Language:	Coded & English
Menu Lockout:	User access code (Selectable)

Dash Board Display:	Display of the following variables: Amps Torque Kw / kWhr % Load Motor Thermal Capacity remaining Starter Thermal Capacity remaining Supply Voltage on each phase Phase Voltage imbalance Current on each Phase Phase current imbalance No. of starts No. of trips Run hrs Kw.Hrs Phase Rotation Frequency
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Remote Console:

Cable:	Ribbon Cable Cat 5 **
IP Rating	IP66

Communications:

Modbus RS485 **
Ethernet – Modbus TCP **

Models & Dimensions:

For Heavy duty and other ratings contact your Zener Distributor.

3 Wire Bypass, Light Duty rating;

Model	Amps	Chassis	Dimensions
6R15	15A	B2	335h 162w 174d
6R30	30A	B2	335h 162w 174d
6R60	60A	B3	440h 162w 174d
6R80	80A	B3	440h 162w 174d
6R100	105A	A2	430h 248w 232d
6R190	193A	A2	430h 248w 232d
6R220	220A	A2	430h 248w 232d
6R360	367A	A3	670h 375w 285d
6R580	586A	A3	670h 375w 285d
6R830	830A	A3	670h 375w 285d

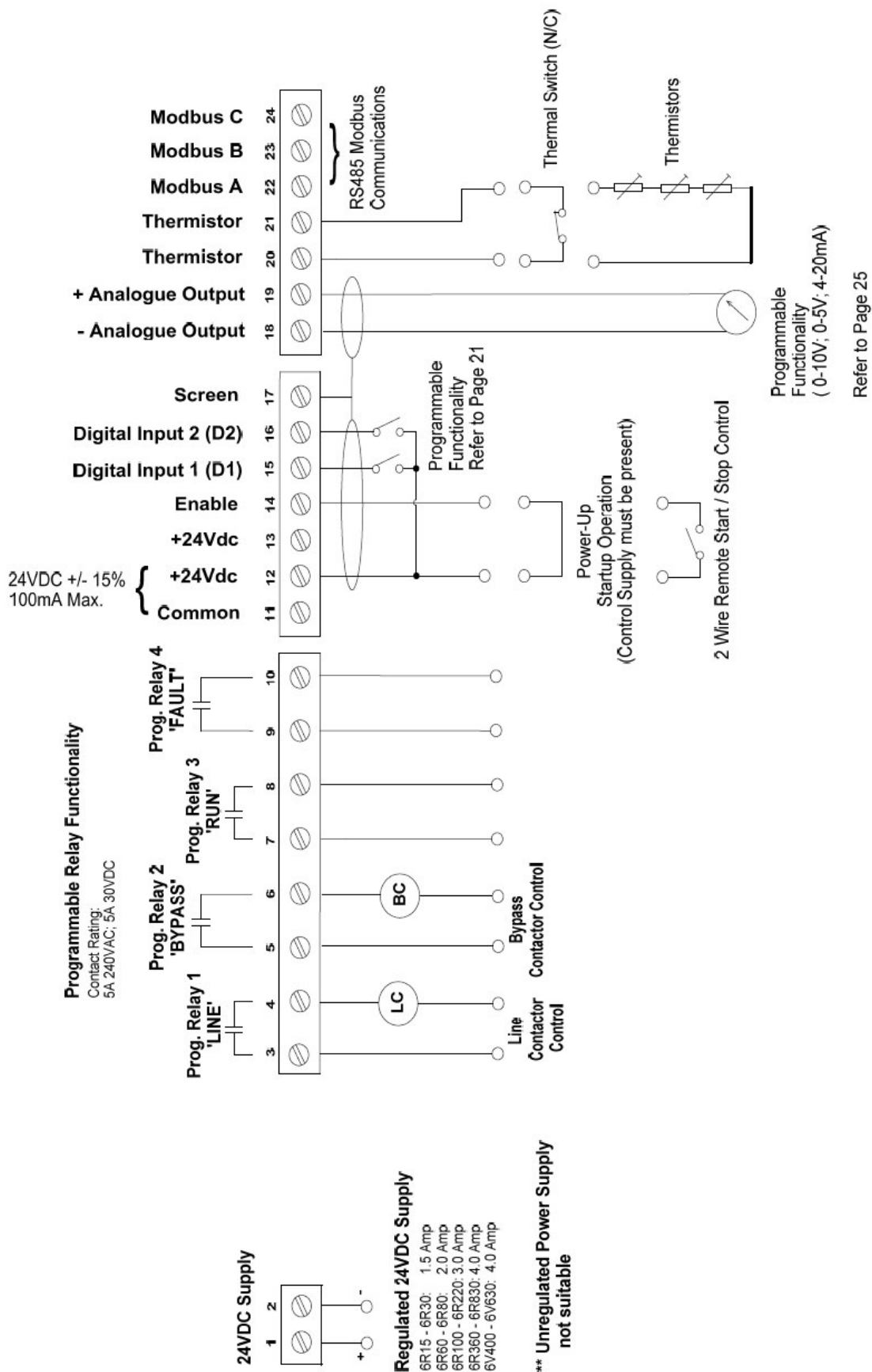
3 Wire Bypass, Standard Duty rating;

Model	Amps	Chassis	Dimensions
6R15	15A	B2	335h 162w 174d
6R30	25A	B2	335h 162w 174d
6R60	54A	B3	440h 162w 174d
6R80	70A	B3	440h 162w 174d
6R100	92A	A2	430h 248w 232d
6R190	170A	A2	430h 248w 232d
6R220	193A	A2	430h 248w 232d
6R360	321A	A3	670h 375w 285d
6R580	513A	A3	670h 375w 285d
6R830	806A	A3	670h 375w 285d

Chassis B2 & B3 include integral Bypass Contactor

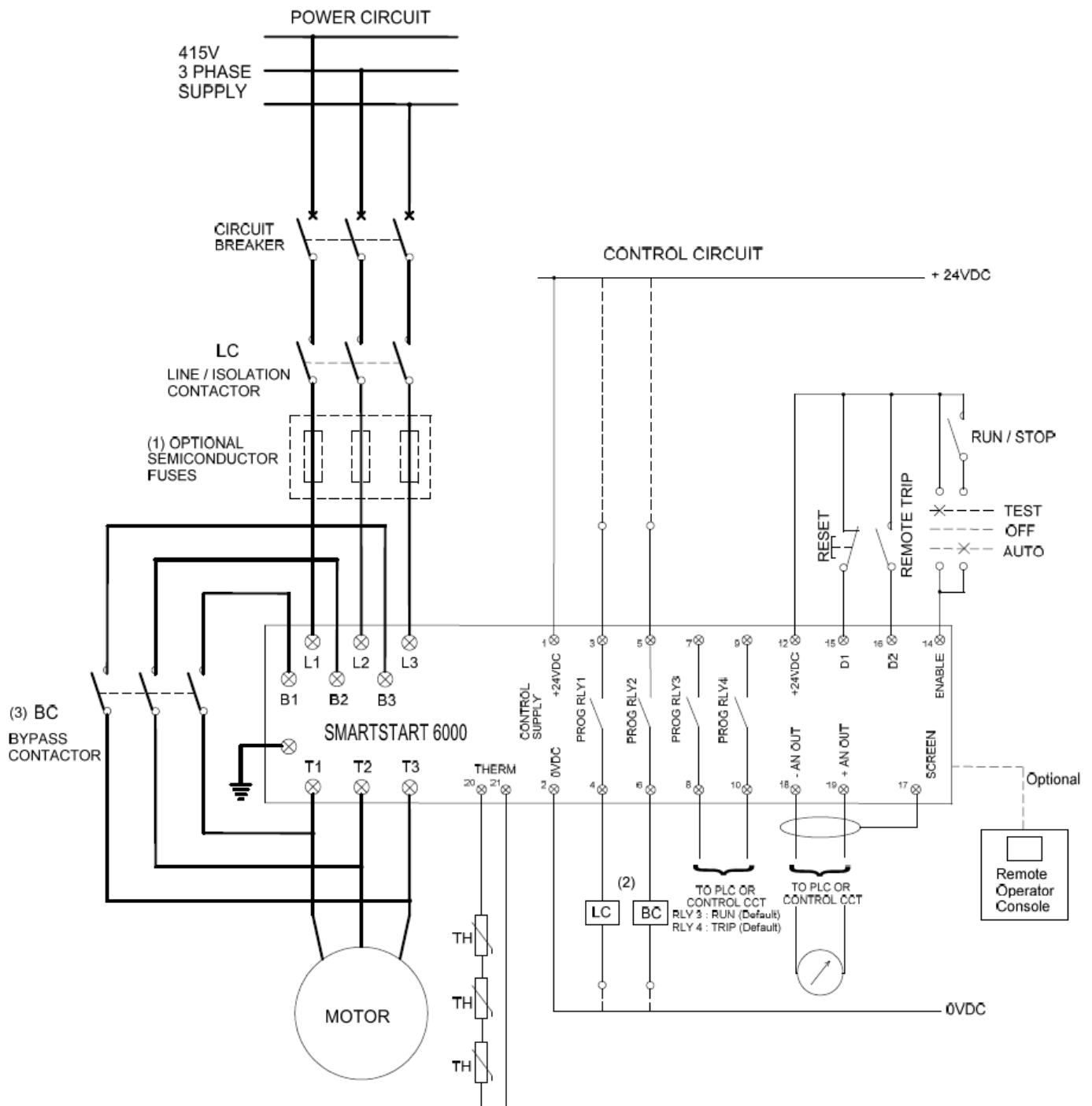
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Control Wiring:



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Application Drawing: Water & Sewerage Pumping



- (1) Optional Fast Acting Semiconductor Fuses selected to suit SCR Devices used.
- (2) Relay Contacts are rated for 5A 240VAC/30VDC inductive. An intermediate relay may be required where peak currents may exceeds this rating.
- (3) Models 6R15 to 6R80 include an integral Bypass Contactor. With these models an external Bypass Contactor is not required

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(Sample Tender Specification)

1.0 Soft Starters

1.1 General

This specification describes the requirements for a micro processor based solid state soft starter suitable for controlling the acceleration & deceleration of a 3 phase AC induction motor. The Soft starters shall provide a closed loop torque control system which provides a user selectable acceleration profile suitable for the type of load. The Soft starter shall be able to achieve a linear acceleration of shaft speed without the use of external devices to monitor shaft speed, current or other variable.

The soft starter shall be Zener manufactured Smartstart 6000 series or equivalent. The equipment must be manufactured to Australian Standards and satisfy the requirements of the Australian EMC standards AS61.800.3.

1.2 Operational

1.2.1 The Torque Control System:

The Soft Starter shall have an integrated Torque Control System which provides user adjustment for the start and finish torque. The start & finish torque settings shall be adjustable between the following ranges.

Start Torque: 15 – 200% FLT
Finish Torque: 15 – 200% FLT

Soft Starters without a finish torque adjustment for the Acceleration profile are not acceptable.

The Torque Control System shall provide torque control of the motor during the deceleration phase. The deceleration curve shall be selectable for a 'linear' and 'squared' type profile, with user adjustment of the release torque between 0 -100% FLT.

Soft Starters shall provide a fully functioning torque control system in both 3 wire & 6 wire configuration without instability due to slot ripple.

1.2.2 Duty Selection:

The Soft Starter shall be rated for 40 °C when installed within a Switch room environment and 50°C in an outdoor cubicle or enclosure.

Soft Starters shall be selected for the following duty:

i. Pump :

Light Duty; 300% FLC for 15 Seconds, 10 Starts per hour

ii. Pump with Extended Decel or High Starts per hour:

*Standard Duty; 300% FLC for 40 Seconds, 10 Starts per hour
or equiv. 300% FLC 20 second, 20 starts per hour*

iii. Other Loads: *As specified*

1.2.3 Monitoring & Display:

The Soft Starter shall provide an alpha numeric Plain English LCD display of status and fault conditions for ease of operator interpretation. A coded system is not acceptable. The menu, status and trips shall be in plain English and not require reference to a manual or code for interpretation.

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The Soft starter must monitor and display the following variables:

1. Operating status
2. Fault or trip
3. Average running current
4. Average supply voltage
5. Supply frequency
6. Power
7. Phase Rotation
8. Torque
9. % Voltage Imbalance & Individual Phase Voltages
10. % Current Imbalance & Individual Phase Currents
11. No. of Starts
12. No. of Trips
13. Hours Run
14. KwHrs
15. Last Trip

These variables must be easily accessible by the operator via a remote display console.

A lock out code is to be provided to prevent unauthorised or accidental entry into the Soft Starters setup menu.

The menu structure shall be in Plain English without reference to number codes for ease of programming.

1.2.4 Remote User Console:

The Soft Starter shall include a Remote Console Option with an IP66 rating. This IP rating shall be achieved without a removable cover or door. The Remote console shall display all variables listed in clause 1.2.3 & 1.2.5 and allow access to the menu parameters.

A lock out code is to be provided to prevent unauthorised or accidental entry into the Soft Starters setup menu.

1.2.5 Fault Display & Reset

The Soft starters shall clearly display the fault or trip on the remote console in plain English without coded reference.

The soft starter shall maintain in memory the last trip even if all power is removed.

The soft starter shall be configurable to reset from the starters remote operator console and by removing control supply. A digital input must also be provided for a remote reset.

1.3 Control Inputs & Outputs

Control inputs and outputs must be the same numbering, layout and functionality for all sizes. All relay output terminals shall be segregated from 24VDC control inputs/outputs.

1.3.1 Control Supply

The Soft Starter Control supply shall be 24Vdc.

1.3.2 Digital Outputs

4 Programmable NO relays with a 240VAC 5Amp inductive (reactive) rating shall be supplied. A relay is to be provided for 'Line Contactor' control, 'Bypass Contactor' control, 'run or up to speed' and 'fault' indication.

Each output relay must have MOV protection on each contact.

The 'Line Contactor' control relay shall isolate the soft starter in the event of a fault condition.

The 'Bypass Contactor' control shall only operate if the motor is up to speed.

The 'up to speed' relay function shall operate when the motor is up to speed not at the end of ramp time.

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The functionality of the 'Trip' Relay shall include an 'invert' option.

Each Relay shall have programmable functionality with an invert function, including:

1. Over torque / Under Torque
2. Motor overload or Motor over temp
3. Starter overload
4. Accel ramp / Decel ramp / Ramp Mode
5. Indication for each type of trip – standard and user selected
6. Remote Trip

1.3.3 Digital Inputs

All digital inputs shall be 24vdc logic.

A dedicated enable input shall be provided to start and stop the motor.

An additional two (2) programmable digital inputs shall be provided with the following functionality. Each input shall have inverse operation and a timer function.

1. External Reset
2. External / Remote Trip
3. Essential Services Over-ride (Fire Mode)

2.0 Analogue Output

The soft starter shall provide an analogue output with programmable functionality and full scale adjustment from 50 – 500%. The variables available shall include: Motor Torque; Motor Current; Motor Thermal; SCR Thermal; Active power; Power Factor; Mtr Current.

The output signal shall be configurable for 0-10V, 0-5V 0-20ma and 4-20mA.

2.1 Electrical Specification

Voltage range shall be between 380 – 415V +10%, -15% and a supply frequency of 50/60Hz +/- 3Hz.

All models must consist of thyristors with a minimum of 1400V PIV connected in an inverse parallel configuration. Each phase must have dvdt suppression.

Where the soft starter uses an external bypass contactor, the soft starter shall provide nine (9) terminals for power terminals. Three (3) terminals provided for bypass contactor connection to ensure current monitoring during bypass operation.

2.2 Essential Services / Fire Mode

An Essential Service Over-ride (ESO) input must be available for fire mode or other critical operations.

2.3 Protection

The soft starter shall include standard protection to protect itself from excessive starts, over load current and excessive ambient temperatures. The soft starter protection shall be based on the thermal modeling and the specifications of the Semiconductors fitted.

An Essential Service Over-ride (ESO) input shall be selectable for fire mode or other critical operations.

Protection offered shall include;

2.3.1 Standard Protection

The soft starter must trip on a 'Motor Loss' fault if an isolation switch is opened in the field, on the output of the soft starter. The soft starter shall not restart when isolation switch is closed and only restart when manually reset. The soft starter must open the line contactor and remove the 3 Phase supply to the soft starter.

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The soft starter must continue to monitor current and all other variables for torque control when in bypass mode.

2.3.1.1 Soft Starter Thermal Protection

The soft starter shall provide over temperature protection of the thyristors due to high ambient, excessive starts per hour or fan failure or inadequate enclosure ventilation/cooling.

2.3.1.2 Supply / Motor Fault

The soft starter shall provide protection and isolate the supply in the event of a supply or motor fault. The soft starter must trip and not restart unless the soft starter is manual reset. If a motor isolator is operated in the field, the starter must trip on a fault and open the line contactor.

2.3.1.3 Bypass Failure

The soft starter shall trip if a bypass fault is detected.

2.3.1.4 Motor Stalled

The soft starter shall trip after the motor is up to speed and the motor current reaches 300% FLC for 3 seconds.

2.3.2 User configurable Protection

2.3.2.1 Motor Overload / Thermal Protection

The soft starter shall provide an integral motor overload in accordance with IEC60947-4-2, a selection of overload classes to include; Class 2; 10; 10a; 15; 20; 25; 30. An option to disable the motor overload shall be provided and the ability to adjust the reset point. The overload must have a memory function based thermal capacity which is not reset by removing power. The thermal capacity shall continue to be calculated with power removed.

The soft starter shall include a thermistor input which can be configured for a thermistor or N/C thermal switch.

2.3.2.2 Phase Rotation

The soft starter shall include protection against incorrect phase rotation.

2.3.2.3 Acceleration Over time

The soft starter shall include protection against the motor not reaching full speed within the set acceleration time.

2.3.2.4 Voltage Imbalance

The soft starter shall continually monitor input voltage and provide a user adjustable protection against voltage imbalance. An adjustment for the trip level (5-25%) and a trip delay of 0–5seconds must be provided.

2.3.2.5 Current Imbalance

The soft starter shall continually monitor motor current and provide a user adjustable protection against current imbalance. An adjustment for the trip level (5-25%) and a trip delay of 0–5seconds must be provided.

2.3.2.6 Under Current / Over Current Protection

The soft starter shall continually monitor motor current and provide a user adjustable protection against under and/or over current.

2.3.2.7 Electronic Shear Pin & Under Torque / Over Torque Protection

The soft starter shall continually monitor motor torque and provide a user adjustable protection against under and/or over torque. The level shall be adjustable with a trip delay.

2.4 Commissioning, Testing & Diagnostics

The soft starter shall operate on a small motor for testing or commissioning purposes.

A diagnostics tool shall be provided to assist fault finding. This shall display status/value of digital inputs and thermistor resistances.

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Diagnostics shall be provided to confirm the correct configuration of the supply, motor and current monitoring devices.

The 'Analogue Output' shall include a '100% (full scale)' test.

All relays shall include an 'ON' selection for testing purposes.

2.4.1 Data Logger with Secure Digital (SD) capability

The soft starter shall include data logging capabilities to record critical operational parameters and status at least every 1/10 sec during starting and every 10 seconds during running. The SD card shall hold approx 2 months of operational data. Critical operational data includes, torque, current, supply voltage, power, power factor, heatsink & ambient temperatures and fault indication.

2.5 Environmental

The soft starter shall be designed to operate to 50degC enclosed in a suitable switchboard enclosure. The supplier shall provide details of equipment heat dissipation for the specified configuration.

2.5.1 Starter Ventilation / Cooling

The soft starter shall be temperature controlled fan forced ventilated powered from the 24VDC control supply. The fan shall operate during acceleration and deceleration and operate without 3 phase supply present.

2.6 Mechanical Specification

The soft starter shall include hardware for terminating cables including 'bellevue' washers for bus bar terminations.

For all bus bar terminations, the line termination shall be located at the top of the soft starter and the motor terminals at the bottom. Each bus bar termination shall be clearly identified with Line (L), Motor (M or T) and Bypass (B).

Current Transformers shall be located on the line side and supplied fitted within the soft starter. The C.T shall be removable for external installation if desired, and clearly labeled for correct installation.

2.7 Warranty, Service & Support

The manufacturer shall provide local service and support with access to technical support after hours (24 /7).

The product shall include a 12 month warranty provided by the manufacturer of the equipment or the Local Distributor if the manufacturer is not located in Australia.

The goods supplied shall be serviceable with spare parts available from a local supplier for a period of no less than 7 years.