User Manual:

SMARTSTART ®

6000 Series

Models:
6R15 – 6R830
6V90 – 6V630

ZENER®
Electronic Controls
for motors

(General Warning)

Read & familiarise yourself with the warnings detailed on Page 1 of the manual before proceeding.

(High Voltage Warning)

Read all operating instructions before installing, wiring, operating, servicing or inspecting the Smartstart®. Ensure that the instruction manual is made available to the final user of the product as well as all personnel involved in any aspect of installation, adjustment or maintenance.

This symbol identifies the essential parameters for quick setup.

Contents

IMPORTANT – Read this first !!

Read all operating instructions before installing, wiring, operating, servicing or inspecting the Smartstart® 6000. Ensure that the instruction manual is made available to the final user of the product as well as all personnel involved in any aspect of installation, adjustment or maintenance.

Your Smartstart® 6000 must be applied and installed by a suitably qualified and experienced electrical tradesperson in accordance with this manual, good engineering practice and all local rules and regulations.

There are hazardous voltages inside the Smartstart® 6000 whenever it is connected to an electrical supply.

The Smartstart® 6000 contains high energy circuits that may be hazardous. Do not operate with the covers removed or the doors of the enclosure in which it is installed open. Do not touch the terminals of the Smartstart® 6000 or any associated motor and wiring when it is energised, even if the Smartstart® 6000 and motor are stopped. Electric shock may result.

Do not modify this equipment electrically, mechanically or otherwise. Modification may create safety hazards as well as voiding the UL listing of models so listed.

The Smartstart® 6000 is designed to drive an appropriately rated and otherwise suitable 3 phase induction motor. It is not suitable for single phase motors or other types of motor or non-motor load. Use with inappropriate load types may create a safety hazard.

Where the Smartstart® 6000 is used as a component part of another product, it is the purchaser's responsibility to ensure that the final product meets all of the necessary safety, EMC, regulatory, operational and other requirements for that product. Requirements for the purchaser's final product may be substantially different to the requirements for stand-alone inverters.

The Smartstart® 6000 is intended for use only in fixed wiring applications. It is not intended for use on a flexible supply cable.

Mount the Smartstart® 6000 on a vertical, incombustible surface such as metal or masonry. Do not place combustible or flammable material near the Smartstart® 6000. Failure to observe these precautions may create a fire hazard

The Smartstart® 6000 is manufactured under strict quality control arrangements, however additional and independent safety equipment must be installed if the application is such that failure of the product may result in personal injury or property damage.

Ensure the Smartstart® 6000 is applied in a manner that does not adversely affect the proper operation of other equipment or systems, particularly those that have a safety function.

Install emergency stop circuitry that removes power from the Smartstart® 6000 and does not depend on any feature of the product for proper and safe operation.

The Smartstart® 6000 has features that may be used to cause an automatic restart in certain circumstances. The overall application (machine etc) must be designed such that automatic restart is not hazardous.

Do not install this equipment in locations where mechanical damage to the enclosure is possible. In particular, consider vehicles, vandalism and attack by insects or animals. Severe equipment damage and safety hazards may result.

The Smartstart® 6000 offers an Essential Services Overide (ESO) mode of operation. This mode of operation intentionally ignores some motor and starter protection. As a result the equipment may operate outside its thermal rating and void any warranty.

Introduction

Receiving:

Inspect the Smartstart® 6000 for any shipping damage. If any damage is found, report it to the carrier immediately. Remove cover of starter and visually check for damage.

Do not attempt to operate the Smartstart® 6000 if any obvious damage exists or suspect damage has occurred.

After the initial inspection, the Smartstart® 6000 can be repacked and stored in a clean, dry location until it is required for use.

Handling & Storage:

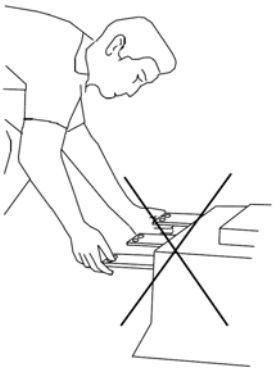
To ensure the starter is protected before installation, handle and store the equipment in its packaging.

DO NOT store this equipment in an area where the ambient temperature will fall below -20ºC or rise above 70ºC. DO NOT store this equipment in areas that are subject to condensation or corrosive atmosphere. Proper storage is necessary to ensure satisfactory startup and performance.

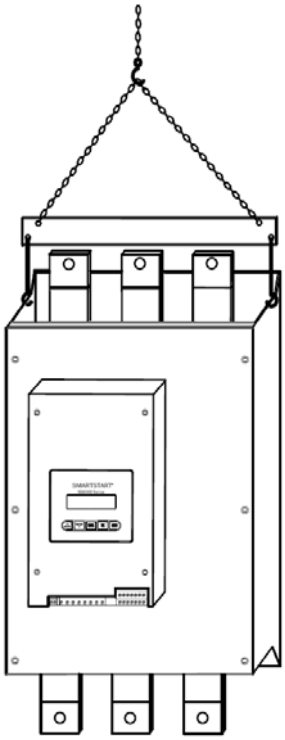
Handling on Installation:

The Smartstart® 6000 range comprises 5 sizes with various weights and dimensions.

An appropriate handling device must be used with large starters. 'Handling points' have been provided to aid lifting. The precautions described below must be followed:



DO NOT handle the starter by the power terminals/busbar.



Use handling points where provided to lift larger units.

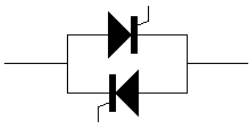
Software:

This manual applies to the Smartstart® 6000 series software revision V1.20. The Software revision can be viewed on the 'Dash Board' (Display) of the Starter.

The Smartstart 6000

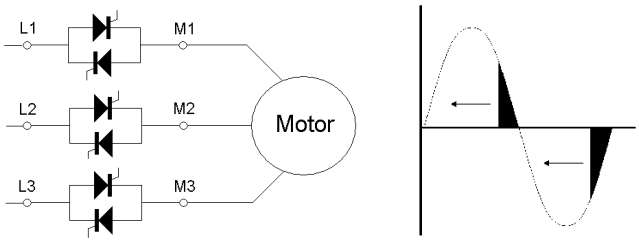
Basic Soft Starter Operation

The Zener Smartstart® 6000 is a reduced voltage controller designed for starting standard 3 Phase induction motors. The unit is solid state, using a microprocessor to control inverse parallel (back to back) pairs of SCR's.



An SCR/thyristor is a semiconductor device that latches when triggered. Once triggered it allows current to flow in one direction only and turns off at zero current.

The firing angle of the SCR's are controlled to achieve the desired acceleration of the motor.



Soft Starters provide the following benefits:

1. Reduced stresses and wear on the mechanics of the system
2. Reduced starting currents
3. Minimise voltage dips on the supply
4. Lowered Peak demand charges
5. Eliminate belt slippage on fans
6. Smooth acceleration of motor / load

SMART-TORQ® Torque Control Feature

The Zener Smartstart® 6000 incorporates a closed loop torque control system to provide better control over starting & stopping 3 phase induction motors. Conventional voltage ramp control systems typically produce low torque at low speeds. When starting & stopping variable torque loads (e.g Pumps) this can results in a very rapid acceleration or deceleration with a non linear change in motor speed.

The Smartstart® 6000 series overcomes these issues by regulating the torque in the motor to match the load type during the acceleration & deceleration. This essentially allows a constant torque to be produced in the motor. The continual monitoring of the motor characteristics during the ramp also allows instantaneous adjustment of the starter output to allow for changes in load conditions.

The 'SMART-TORQ®' control system provides smooth starting & stopping, allowing ramp profiling to produce a linear acceleration and deceleration of the motor speed. There are many benefits with variable torque loads such a pumps and fans by achieving a linear ramp profile and greater control over deceleration. With pump applications this provides better control to minimise water hammer problems.

SMART-TORQ Benefits include:

1. A true linear acceleration of the load and motor for all load types.
2. Reduced peak inrush starting currents.
3. Reduced stresses and wear on the mechanics of the system
4. Ramp profiling to better match type of load such as variable torque loads. Better control of pumps and fans, without rapid initial ramp but linear ramp.
5. Reduced heating in motor at low speeds.
6. No instability due to changing power factor. Closed loop system to monitor and react to changing power factor.
7. No instability due to slot ripple in 3 wire and 6 wire operation.
8. Better control of deceleration through closed loop torque control system.

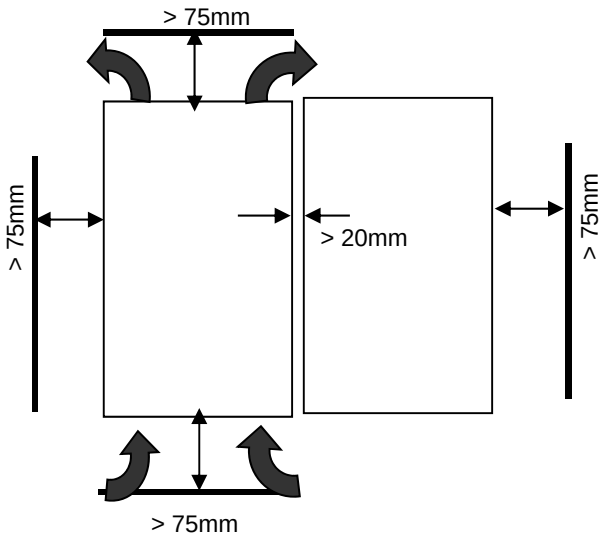
The Smartstart® 6000 also offers user access to ramp profiling parameters to fine tune the Torque Control System to achieve more application specific performance requirements. See Page 41 for more information.

Installation - Mechanical

Mechanical Installation

The Smartstart® 6000 should be installed by qualified electrical personnel only. The following should be considered when installing the Smartstart.

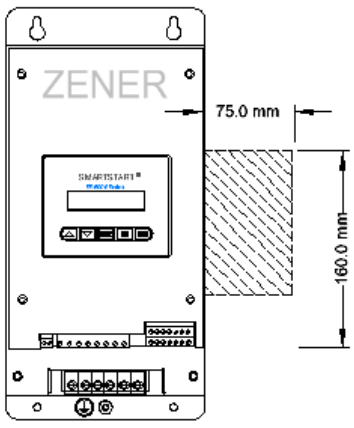
- Mount in a vibration free environment.
- Mount vertically and away from heat radiating sources.
- Do not mount in direct sunlight or on hot surfaces.
- Mount in a suitable enclosure for the environment in which it is to operate, the total heat dissipation must be considered.
- Do not drill holes into the Smartstart® 6000 enclosure.
- Do not allow metal shavings or any other conductive material to enter the enclosure or damage may result.



Models: 6R15/30/60/80 Only

Below illustrates the clearances to allow access to Ports if fitted;

i) Remote Console (RJ Connection)
ii) SD Card Slot
iii) Ethernet Port



Heat Dissipation

The Smartstart® 6000 is cooled by temperature controlled internal fans. Installing a bypass contactor will reduce the heat dissipated and the ventilation required. Soft Starters generally dissipate approximately 4.5watts per Amp when operated without a bypass contactor.

The heat dissipated can be calculated by;

Continuous Duty:

P = (FLC x 4.5)

Bypass Duty:

P = (FLC x SC x 4.5 x t x N) / 3600

Where;

P = Power dissipated in Watts
FLC = Nameplate FLC of Motor
SC = Average starting current expressed per unit of FLC
t = Starting time
N = Number of starts per hour

When installing the Smartstart® 6000 in an enclosure or switch board it is necessary to consider the heat dissipated and then the ventilation required.

The following formula's will assist in determining whether ventilation is required and how much.

Ventilated Enclosure:

V = (3.1 x P) / T

Where; V = Airflow required in m3/hour
P = Power dissipated in Watts
T = Temperature differential in °C (inside – outside)

Non Ventilated Enclosure:

A = P / (T x k)

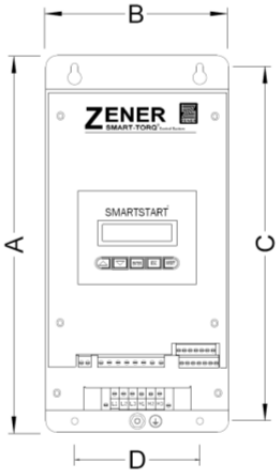
Where; A = Exposed surface area of cabinet in m2
P = Power dissipated in Watts
T = Temperature differential in °C (inside – outside)
k = Heat transmission constant (5 for Painted metal)

Installation - Mechanical

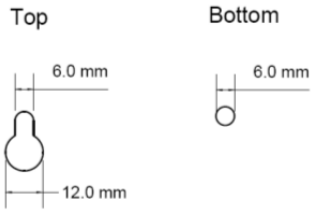
Dimensions

(All Dimensions in mm)

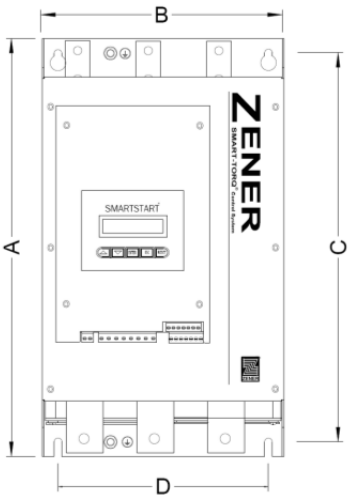
Model:	Chassis	A	B	C	D	Depth
6R015B2	B2	335	162	315	111	172
6R030B2	B2	335	162	315	111	172
6R060B2	B3	440	162	420	111	172
6R080B2	B3	440	162	420	111	172



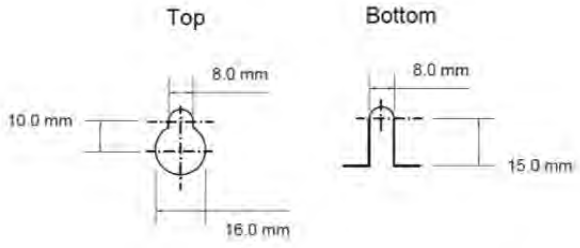
Mounting Holes:



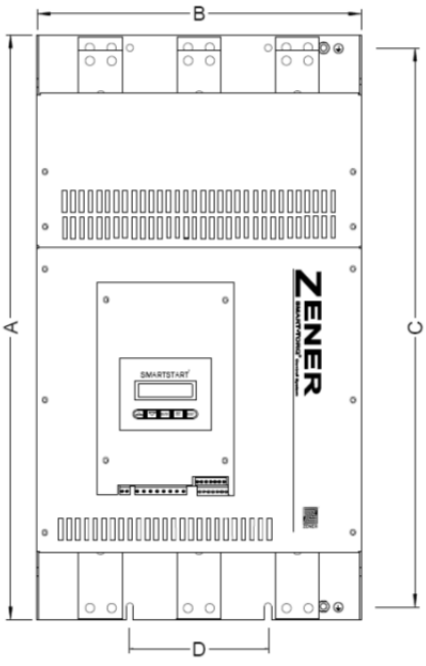
Model:	Chassis	A	B	C	D	Depth
6R10000	A2	430	248	400	216	232
6R19000	A2	430	248	400	216	232
6R22000	A2	430	248	400	216	232
6V09000	A2+	430	248+55	400	216	244



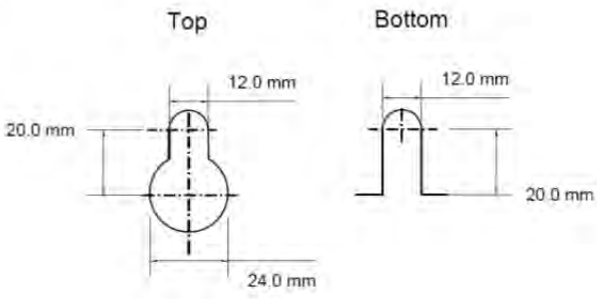
Mounting Holes



Model:	Chassis	A	B	C	D	Depth
6R36000	A3	670	375	640	159	285
6R58000	A3	670	375	640	159	285
6R83000	A3	670	375	640	159	285
6V20000	A3	670	375	640	159	305
6V40000	A3	670	375	640	159	305
6V60000	A4+	670	375+70	640	159	305



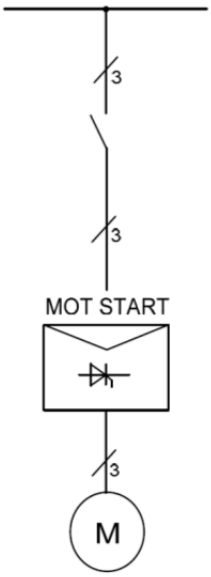
Mounting Holes



Installation - Power Wiring

Power Wiring

The Zener Smartstart® 6000 is installed between the mains and cable to the motor. If a mains or isolation contactor is used it is best controlled by the starters 'Line relay'.



3Wire / 6wire: The standard connection of an electronic soft starter is 3 wire. An alternative connection is 6 wire or inside delta connection. This is commonly used when replacing a star/delta type motor starter.

Bypass / Continuous: The Smartstart® 6000 can operate with or without a bypass contactor. Some models include an integral bypass contactor. The bypass contactor reduces the heat dissipation of the soft starter as the semiconductors are bypassed after the ramp time.

Select cables & install in compliance with local regulations

Motor Protection:

The Smartstart® 6000 provides advanced motor protection with user selectable overload classes, over & under current protection, phase imbalance and thermistor protection. It is important that the power wiring is followed correctly to ensure proper protection and starter performance.

Refer to page 23-26 and 37 for more details regarding motor protection.

Semiconductor Fuses

Semiconductor fuses are recommended for all electronic soft starters to provide protection of the thyristors in the event of an output short circuit. Semiconductor fuses are strongly recommended for applications such as submersible pumps.

Semiconductor fuses are optional with all models.

- For smaller models (15 – 80Amp) fuse kits are available.
- For larger models semiconductor fuse kits are available which mount to the 'Line' Busbar.
- Refer to page 40 for more details on semi-conductor fuses.

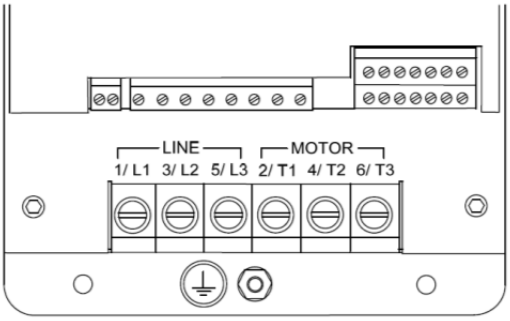
Installation - Power Terminals
(up to 80Amp)

3 Wire with integral Bypass

Only Models; 6R015B2
6R030B2
6R060B2
6R080B2

Power Terminations

Model:	Max cable size	Tightening Torque
6R015B2	6 mm^2	1.5 – 1.8 Nm
6R030B2	6 mm^2	1.5 – 1.8 Nm
6R060B2	35mm^2	3.2 – 3.7 Nm
6R080B2	35mm^2	3.2 – 3.7 Nm
Earth	M6 stud	-

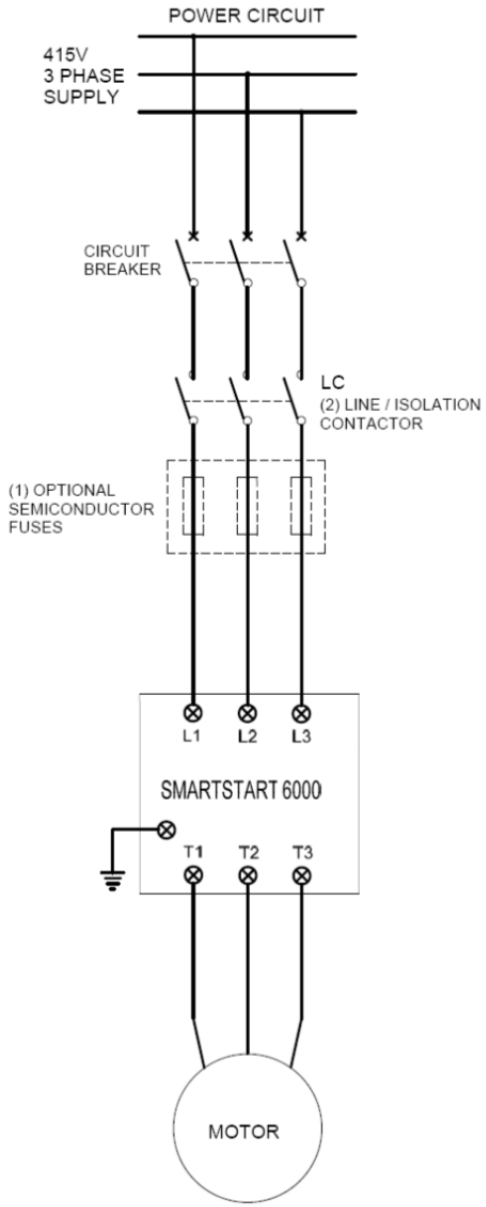


Semiconductor Fuse kit (Optional)

Refer to Page 40 for selection.

Semiconductor Fuse Replacement

Refer to Page 40 for replacement fuses.



(1) Optional Fast Acting Semiconductor Fuses selected to suit SCR Devices used.
(2) Line Contactor controlled by the Soft Starter (see Control Wiring Page 14 & Application Drawings Page 36-38)
(3) Models 6R15 to 6R80 include an integral Bypass Contactor. With these models an external Bypass Contactor is not required

Refer to page 13 For Control Wiring

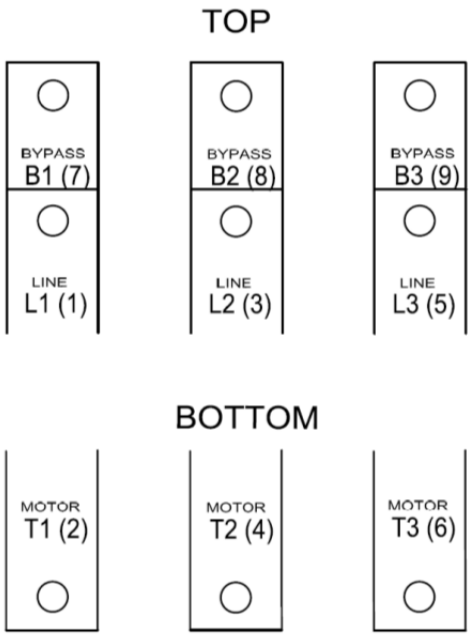
Installation - Power Terminals
(100A model and above)

Power Terminations

Model:	Chassis	Busbar Hole	Bolt Size	Earth Stud
6R10000	A2	1x 8.5mm	M8	M8
6R19000	A2	1x 10.4mm	M10	M8
6R22000	A2	1x 10.4mm	M10	M8
6V09000	A2+	1x 8.5mm	M8	M8
6R36000	A3	2x 10.4mm	M10	M8
6R58000	A3	2x 10.4mm	M10	M8
6R83000	A3	2x 10.4mm	M10	M8
6V20000	A3	2x 10.4mm	M10	M8
6V40000	A3	2x 10.4mm	M10	M8
6V60000	A3+	2x 10.4mm	M10	M8

(All soft starters include a bolt kit)

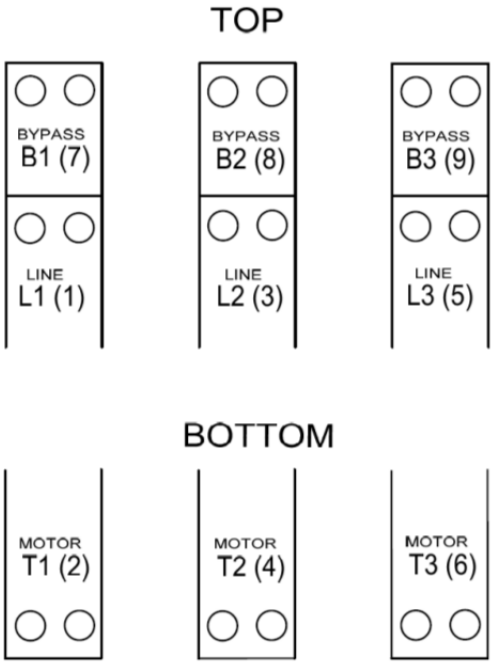
Chassis A2:



Semiconductor Fuse kit (Optional)

Model:	Description	Part No.
6R10000	Fuse Kit to suit 6R100	TQ60025
6R19000	Fuse Kit to suit 6R190	TQ60026
6R22000	Fuse Kit to suit 6R220	TQ60027
6R36000	Fuse Kit to suit 6R360	TQ60028
6R58000	Fuse Kit to suit 6R580	TQ60029
6R83000	Fuse Kit to suit 6R830	TQ60030

Chassis A3:

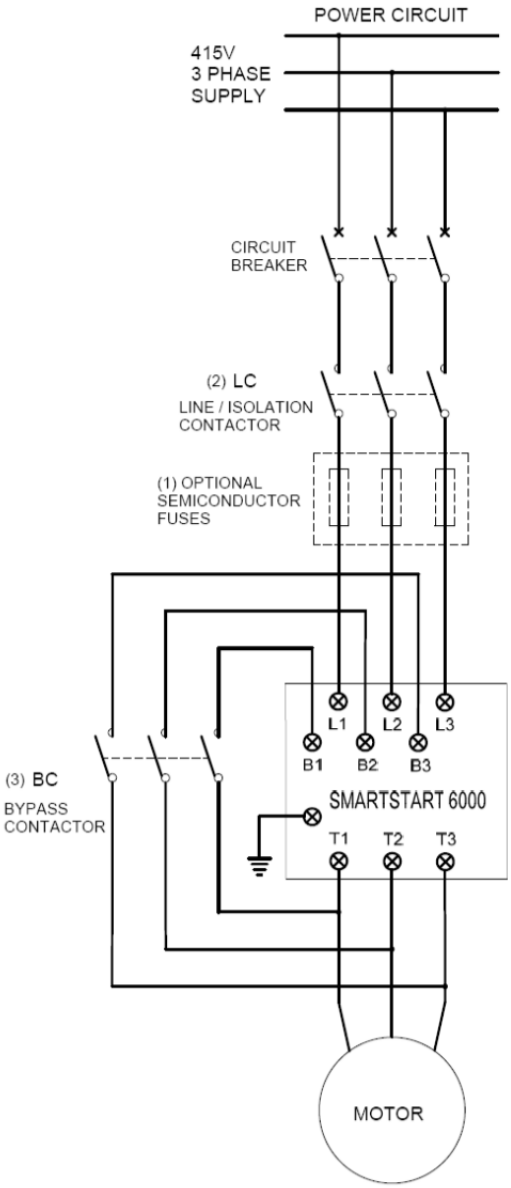


Semiconductor Fuse Replacement

Model:	Description	Part No.	Qty per Starter
6R10000	Semiconductor Fuse (200A)	TF22200	3
6R19000	Semiconductor Fuse (400A)	TF22400	3
6R22000	Semiconductor Fuse (400A)	TF22400	3
6R36000	Semiconductor Fuse (630A)	TF23630	3
6R58000	Semiconductor Fuse (500A)	TF23500	6
6R83000	Semiconductor Fuse (700A)	TF23700	6

Installation - Power Wiring
(100A model and above)

3 Wire Bypass

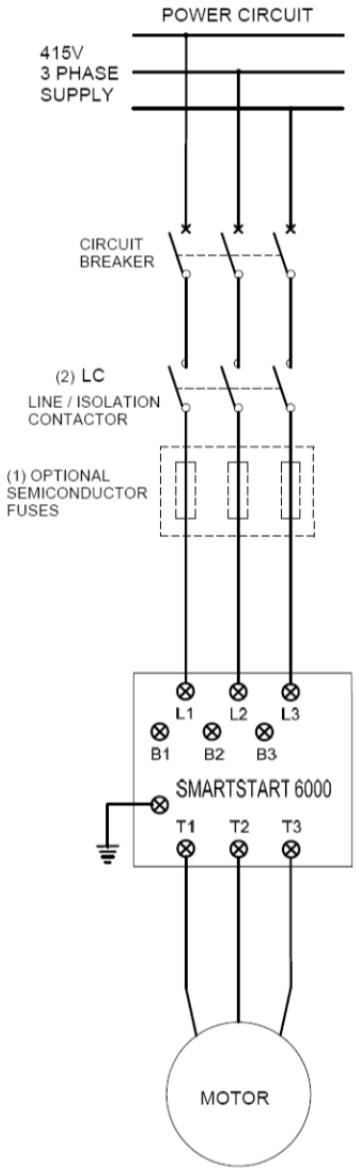


(1) Optional Fast Acting Semiconductor Fuses selected to suit SCR Devices used.
(2) Line Contactor controlled by the Soft Starter (see Control Wiring Page 14 & Application Drawings Page 36-38)
(3) Bypass Contactor controlled by the Soft Starter (see Control Wiring Page 14 & Application Drawings Page 36-38)

Refer to page 13 For Control Wiring

3 Wire Continuous
(Without Bypass Contactor)

NOTE: The SS6000 must have the appropriate rating to operate without a bypass contactor.



(1) Optional Fast Acting Semiconductor Fuses selected to suit SCR Devices used.
(2) Line Contactor controlled by the Soft Starter (see Control Wiring Page 14 & Application Drawings Page 36-38)

Refer to page 13 For Control Wiring

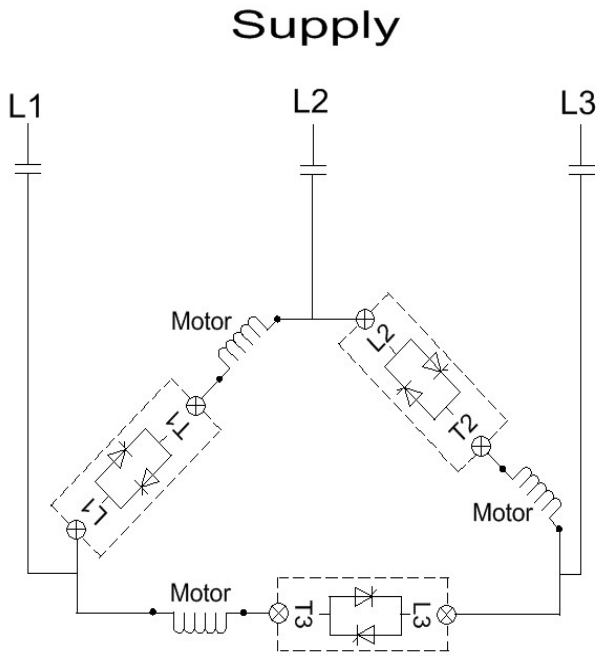
Installation - Power Wiring
(100A model and above)

Using 6 wire Configuration

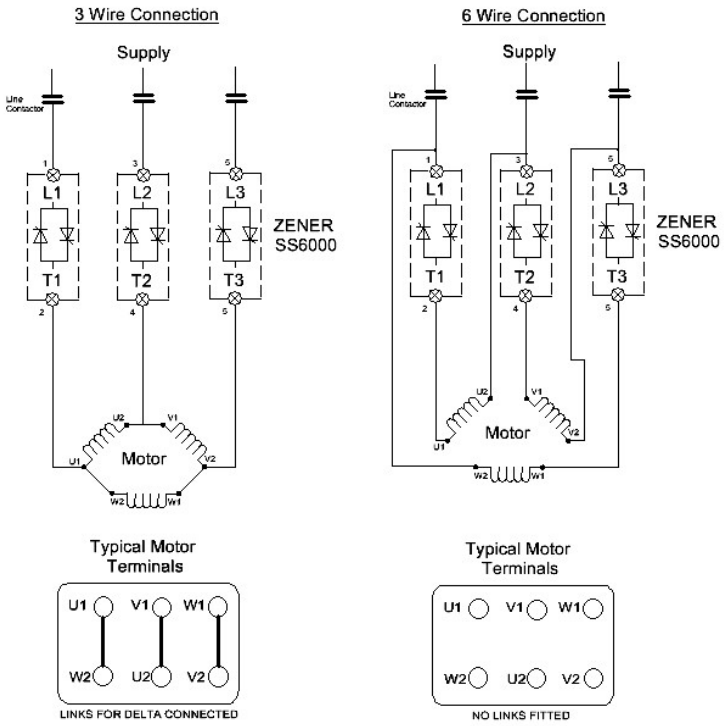
The Smartstart® 6000 can be configured to operate in 6 wire mode. 6 wire mode may be the preferred method due to:

1. Possible reduction in the size of starter required, saving on space and /or cost.
2. Wiring may already be present if a start/delta type starter was previously used.
3. Reduced motor cable size.

The major advantage is that the current in the SCR is 58% less than it would be for the same motor connected in 3 wire. The diagram below illustrates how the motor is connected in 6 wire, also known as inside delta.



The following illustrates the difference between 3 wire & 6 wire connection:



Current Monitoring & Torque Control:

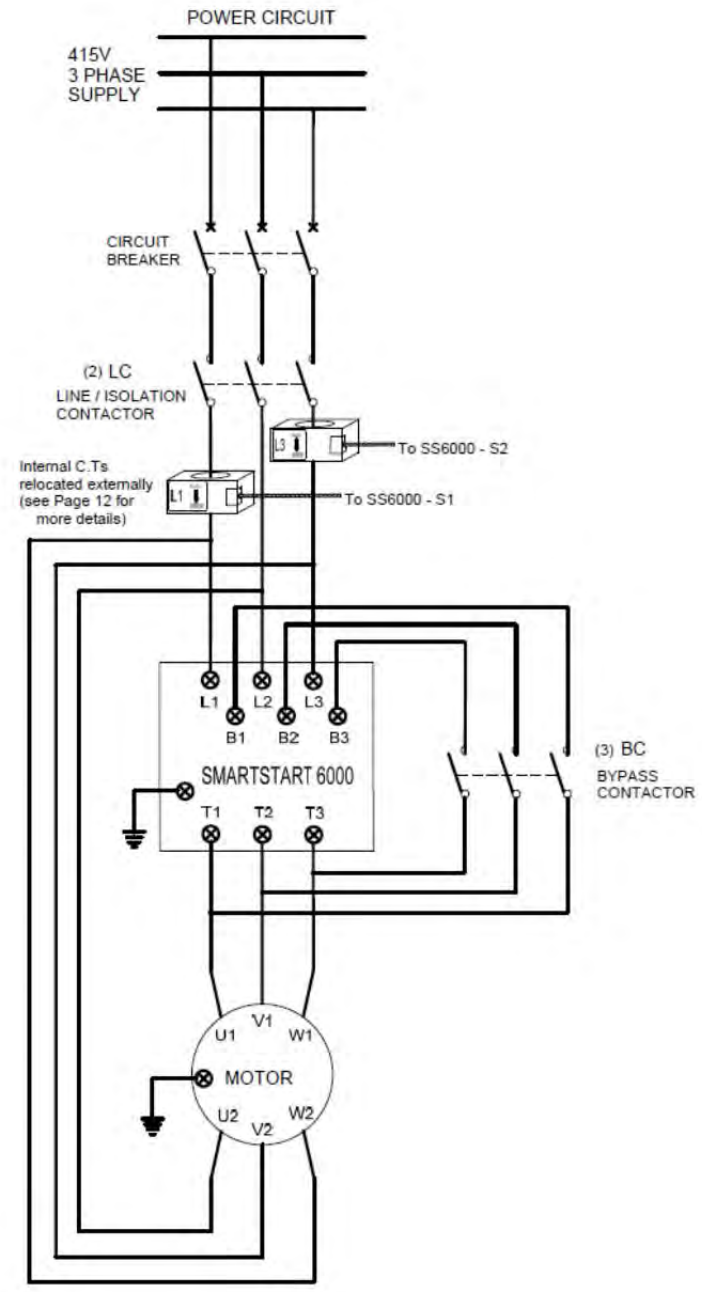
For the torque control to operate correctly the C.T's need to monitor the 'line' current and not the 'Phase' currents. For this reason the C.T's normally supplied internally, need to be relocated external to the soft starter.

It is critical that the C.T's be installed in the correct phase and in the correct direction. Page 12 provides instructions as to where the C.T's are to be located.

Refer to page 12
For details on correctly installing external C.T's

Installation - Power Wiring
(100A model and above)

Standard 6 wire Bypass

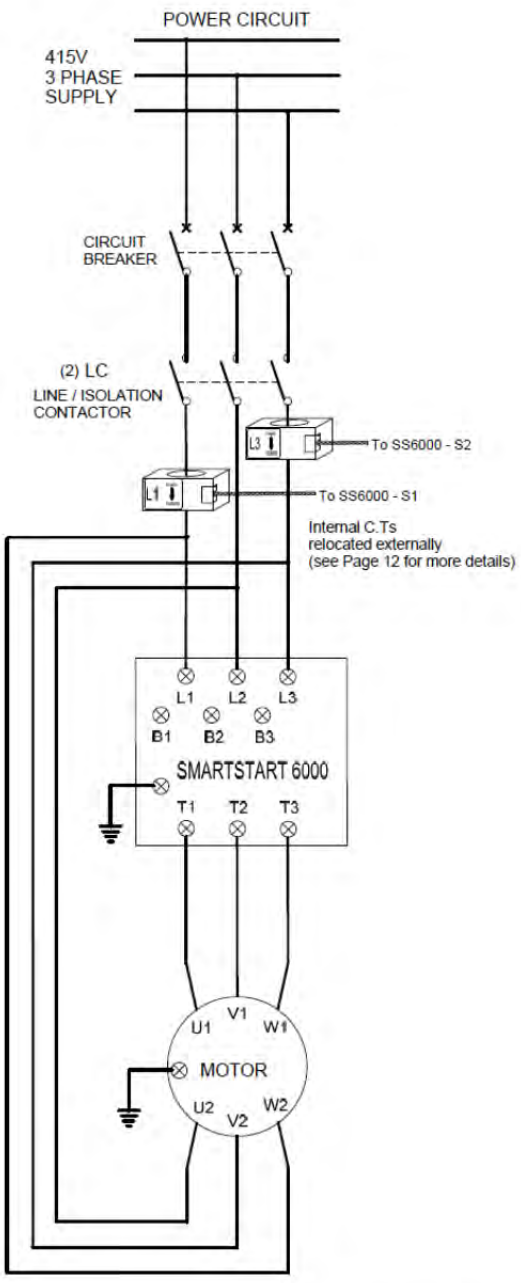


(1) Optional Fast Acting Semiconductor Fuses selected to suit SCR Devices used.
(2) Line Contactor controlled by the Soft Starter (see Control Wiring Page 13 & Application Drawings Page 36-38)
(3) Bypass Contactor controlled by the Soft Starter (see Control Wiring Page 13 & Application Drawings Page 36-38)

Refer to page 13
For Control Wiring

Refer to page 12
For details on correctly installing external C.T's

Standard 6 wire Continuous



(1) Optional Fast Acting Semiconductor Fuses selected to suit SCR Devices used.
(2) Line Contactor controlled by the Soft Starter (see Control Wiring Page 14 & Application Drawings Page 36-38)

Refer to page 13
For Control Wiring

Refer to page 12
For details on correctly installing external C.T's

Installation - Power Wiring
(100A model and above)

Relocating the Internal Current Transformers for 6 wire operation.

The Smartstart® 6000 comes standard with internal Current Transformers (C.T's) for monitoring the current during acceleration, deceleration and when in bypass.

It is important that the Smartstart® 6000 be wired in a manner to ensure the C.T's are always monitoring the motor current. For this reason 9 terminals are provided. This is important to ensure continual protection of the soft starter, the motor and the load. The correct installation of the C.T's is crucial for optimum performance of the torque control system. In some situations such as 6 wire operation, it may be necessary to relocate the C.T's external to the starter. For 6 wire operation the C.T's are to be installed on the incoming line supply cables so that the line current is monitored (not the phase currents).

The Smartstart® 6000 can be purchased with C.T's external by ordering 'prepared for 6 wire';

Part no.	Description:
TF60015	Prepare for 6 wire: 6R100-220
TF60016	Prepare for 6 wire: 6R360-830

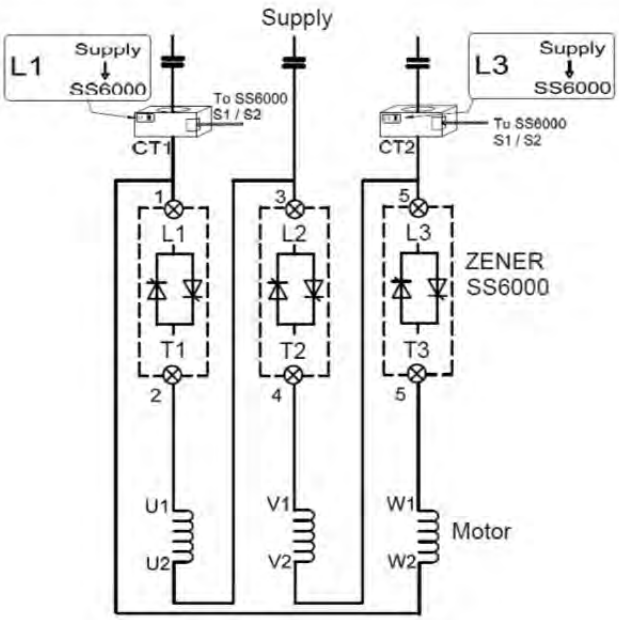
Installation of external C.T's

When relocating the C.T's external to the soft starter it is important to ensure the following:

1. C.T's are installed on L1 & L3
2. C.T's are installed in correct direction
   P1 label = line side
3. C.T's are terminated with correct phasing.
   S1 = Red
   S2 = Black

The C.T's supplied with the Smartstart® 6000 has a label which shows the correct phase and direction.

If the C.T's are not installed correctly the starter will display a fault or a 'C.T Phase error'.



Programming:

Program the starter for 3wire or 6 wire operation. The selection available for 6 wire is 'Standard 6 wire' or 'alternate 6 wire', depending on the wiring configuration used. The wiring in this manual is drawn for Standard 6 wire.

Refer to page 21: parameter 'M04 Motor Wiring'

Check for correct installation

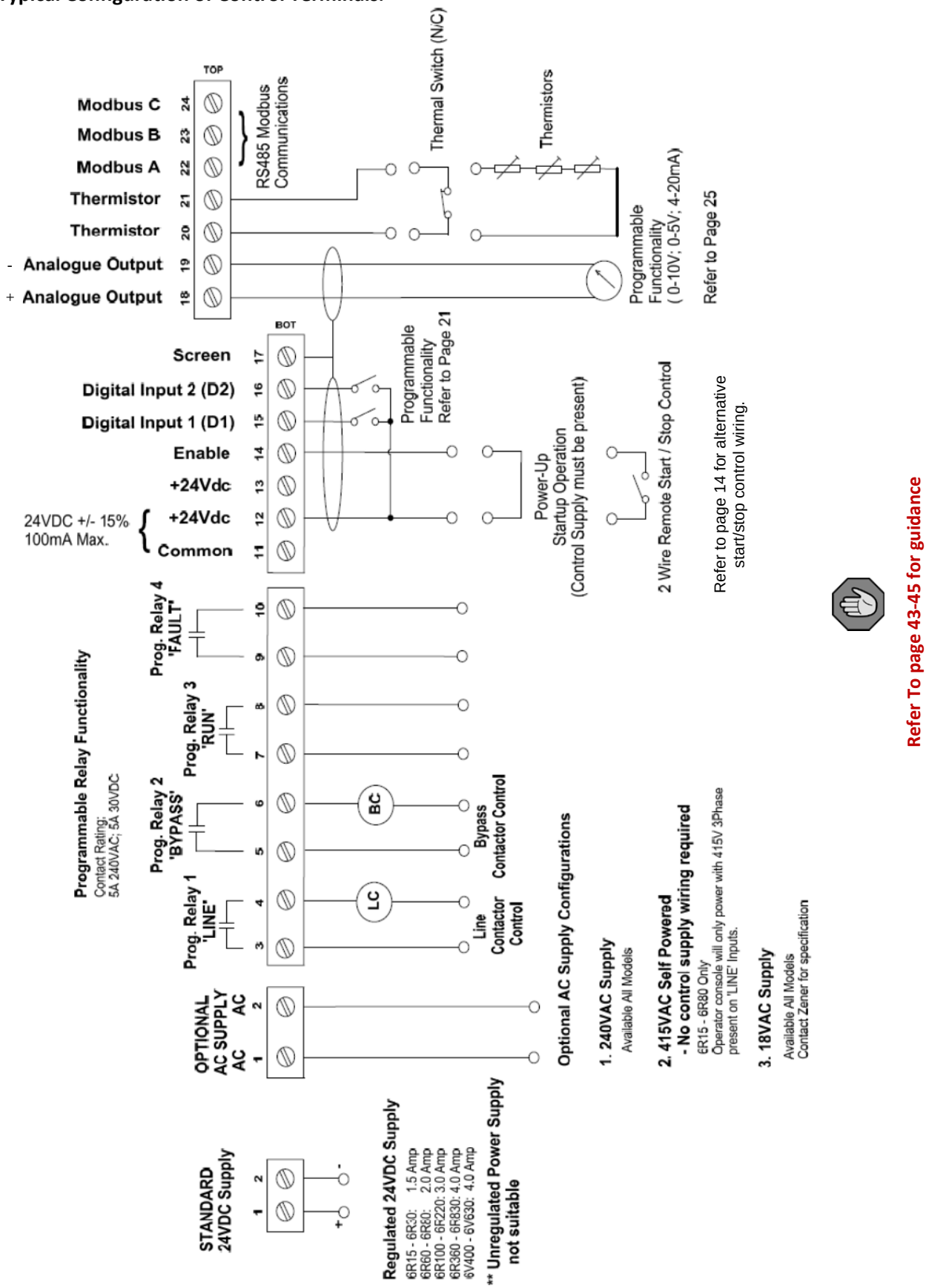
If a CT phase error occurs the problem may be identify under the menu 'Starter Diagnosis'. '+L1 / +L3' should be displayed.

> If L2 is displayed move the CT from L2 phase.

> If a "-" is displayed, the direction of the corresponding CT needs to be reversed.

Control Wiring

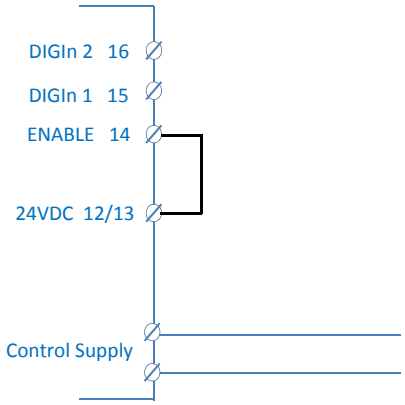
Typical Configuration of Control Terminals.



Control Wiring

Default/Standard Control:

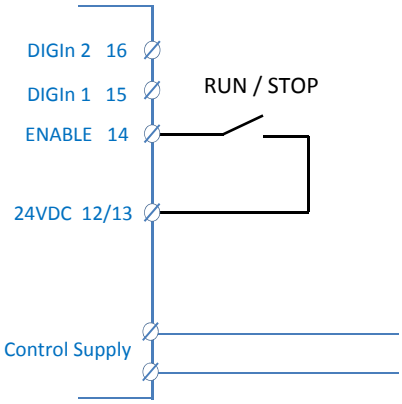
1. Standard Power-up Start (no Soft stop)



2. Standard Run/stop using enable input (Soft Start/Soft stop or coast)

C20 Decel Ramp : 0.0 for coast
: Adjust for soft stop (>0)

If enable is left on, power-up start will be supported



3. Network Communications (with local over-ride)

X10 Dig In 1 : inverted
X11 Dig In 1 Variable : Local
X11 Dig In 1 Delay : 0.0sec

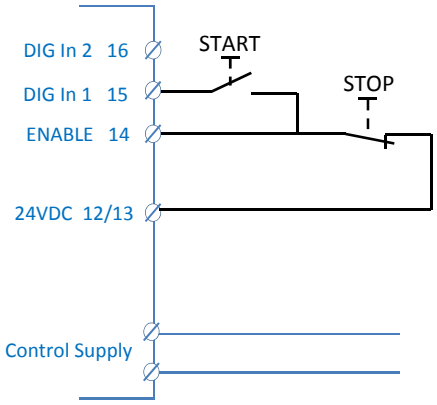
1) N/C contact to switch to local, to force starter in local with broken wire.
2) Use enable to start and stop

Alternative configuration available:

1. 3 wire start/stop

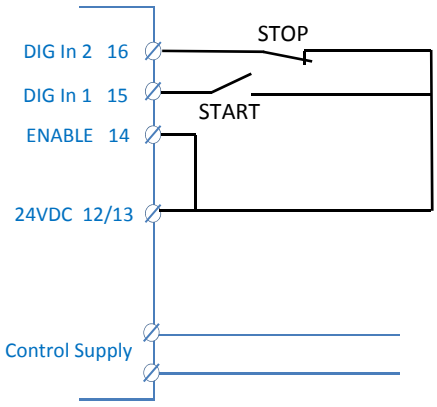
A53 Start Logic : 'edge sensed'
X10 Dig In 1 : Enabled
X11 Dig In 1 Variable : Start (latching)
X11 Dig In 1 Delay : 0.0sec

Use enable or DIG in2 for stop:
X20 Dig In 2 : Invert
X21 Dig In 2 Variable : Stop
X22 Dig In 2 Delay : 0.0sec
C20 Decel Ramp : 0.0 for coast
: Adjust for soft stop (>0)



2. Delayed softstart/softstop

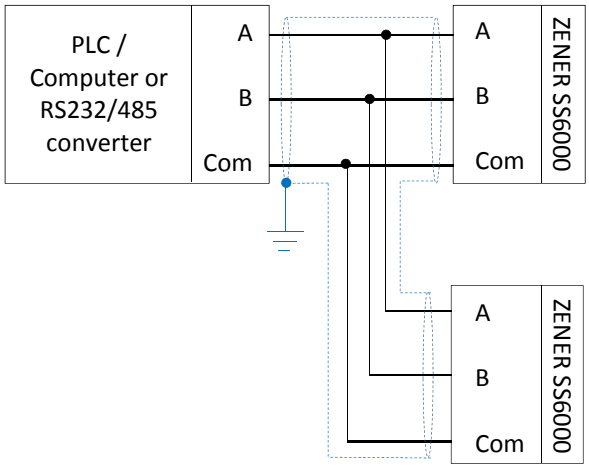
Multiple pump control systems or prestart warning A
X10 Dig In 1 : Enabled
X11 Dig In 1 Variable : Start (latching)
X11 Dig In 1 Delay : Adjust to suit (0-300seconds)
X20 Dig In 2 : Invert
X21 Dig In 2 Variable : Stop
X22 Dig In 2 Delay : Adjust to suit (0-300seconds)
(Adjust Accel and Decel to suit application)



Network Connections

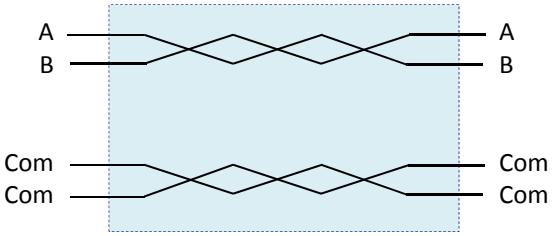
Modbus RS485

The Smartstart® 6000 comes standard with Modbus RS485 serial communications. Typical wiring for RS485 shown below.



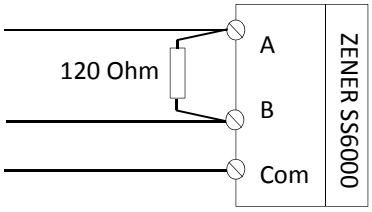
The following precautions will help minimize the risk of network failure:

- Use twisted pair shielded communications cable
- Each length of cable should have its shield connected to ground at one end only (recommended at the computer or controller end)
- It is recommended to use two twisted pairs, one pair for circuit 'common', and another pair for balanced data lines.



- The 'common' circuit must be connected to all devices on the bus and connected directly to protective ground (at one point only, typically near the master device). 'Screen' terminal provides a local protective ground. (Eg. For cable shield)

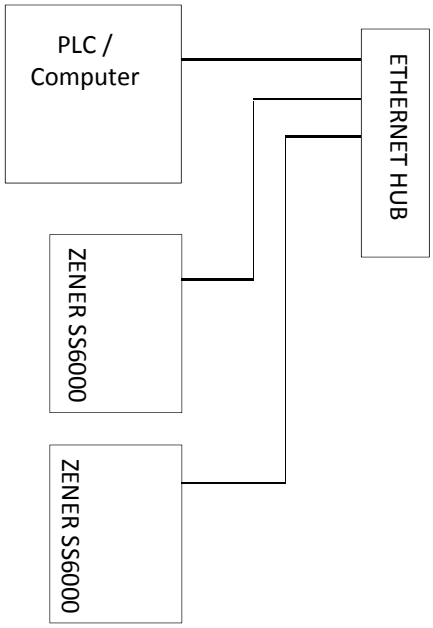
- To reduce network noise place a line terminator near each of the two ends of the bus. A 120 Ohm resistor is recommended for both line terminators. A capacitor (1nf) in series with the resistor may also improve performance.



- Line polarization (450 – 650 Ohms pull-up and pull down) is also recommended, typically in/near the master device.
- Avoid laying communications cables adjacent to power cables.
- If possible communications cables should cross power cables at right angle to each other.
- Up to 64 nodes (equipment) may be connected to the same network without an RS485 repeater.

Modbus Ethernet TCP

An Ethernet option card is available which provides an Ethernet socket. When the Ethernet card is fitted the RS485 connection will not operate.



Programming

Local Control Panel / Remote Console

The local control panel consists of 5 push buttons and a plain English display to simplify programming.

▲ Increase the value or change selection. Navigate up through menu / submenus.

▼ Decrease the value or change selection. Navigate down through menu / submenus.

ENTER Allows access to menu, submenus & saves the parameter entered.

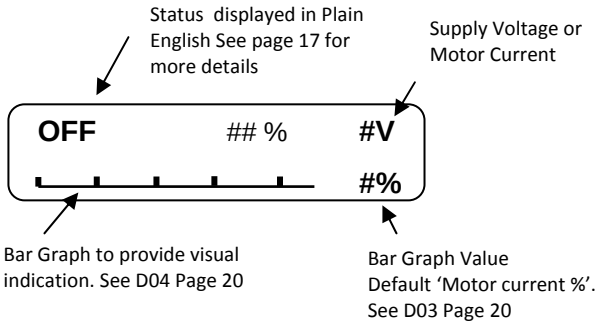
ESC Escapes from current menu position without saving.

RESET Manual reset of a trip (if enabled). This also takes you direct to the trip log.

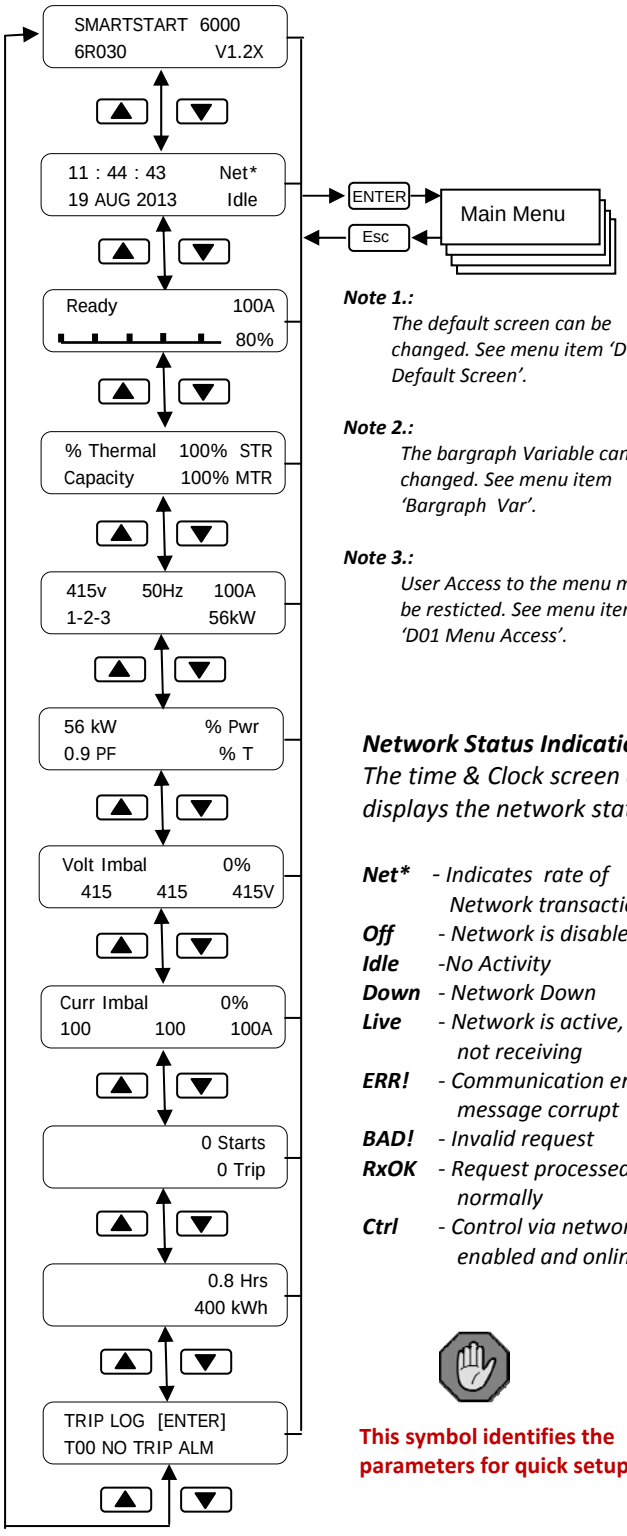
The DASHBOARD

The Smartstart® 6000 provides a comprehensive display of operating variables, status and alarms. The screens can be scrolled through using the UP/DOWN push buttons. These DASHBOARD screens are also accessible even when the menu lockout is enabled. Any of these screens may also be configured as the default screen on power-up.

Default Screen:



The Dash Board



Note 1.:
The default screen can be changed. See menu item 'D02 Default Screen'.

Note 2.:
The bargraph Variable can be changed. See menu item 'Bargraph Var'.

Note 3.:
User Access to the menu may be resticted. See menu item 'D01 Menu Access'.

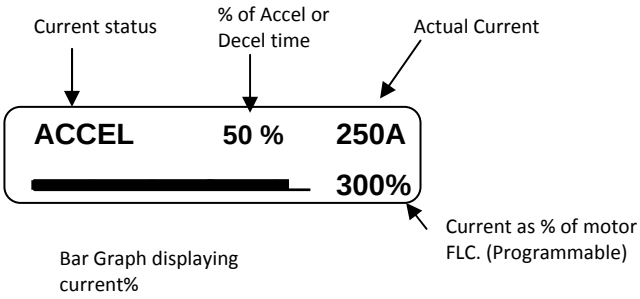
Network Status Indication:
The time & Clock screen also displays the network status.

Net* - *Indicates rate of Network transactions*
Off - *Network is disabled*
Idle -*No Activity*
Down - *Network Down*
Live - *Network is active, but not receiving*
ERR! - *Communication error message corrupt*
BAD! - *Invalid request*
RxOK - *Request processed normally*
Ctrl - *Control via network is enabled and online.*

This symbol identifies the parameters for quick setup.

Programming

Operating Status Indication



- **'Off' :** The Smartstart® 6000 has control power applied but not enabled and no line supply.
- **'Standby' :** The Smartstart® 6000 has been enabled to start and the run relay energized to bring in the line contactor (if installed). The Smartstart® 6000 will initiate a start immediately 3 phase supply is applied.
- **'Ready' :** Line supply on but nor enabled.
- **'ACCEL ##%' :** The Smartstart® 6000 is accelerating the motor. Ramp time completed (%) & Motor Current (A) displayed
- **'At Speed ##%' :** The motor is at full speed, the accel time period may not be complete. Ramp time completed (%) & Motor Current (A) is displayed.
- **'Run Bypass or Run Cont.' :** The ramp time is complete and the bypass contactor operated or SCR's are in full conduction. Motor Current (A) is displayed.
- **'DECEL ##%' :** The Smartstart® 6000 is decelerating the motor. Ramp time completed (%) & Motor Current (A) displayed
- **'Start Req' :** Enabled, but start delayed/postponed due to cooling or start timer delay.
- **'Kick Start':** Kick start is active.
- **'Motor Off':** Brief message as motor defluxes or Pending motor loss trip.
- **'Tripped':** System has tripped. (Not seen in Auto retart)
- **'Cooling':** Starter too hot to start or during "Minimum off time"
- **'Shut down':** PSU under voltage detected (SMARTSTART shutting down)
- **'Brownout':** Sustained PSU under voltage condition (supply problem/fault)
- **'AR Pending':** System tripped but waiting for auto restart.
- **'AR Lockout':** Final trip after all AR attempts exhausted.

Warnings, Alarms and Messages:

The Smartstart® 6000 has been designed to provide the user with a comprehensive display of its operating status. Messages in plain English are flashed across the screen (if enabled) to alert the user of its current status, any warnings, trips or pending actions. The code will have a prefix of T (trip), W (Warning) or I (Interlock).

Example 1: If auto restart is selected it will flash: **AR PENDING, the number of restarts and time before a restart.**

Example 2: If the motor or starter has reached a thermal state where cannot restart it will flash**: PENDING, I30 MTR OVERLOAD**

'FLASH ALERTS' (Top Line of Display)

The Smartstart® 6000 can be configured to Flash Warning & Alarm messages irrespective of the DASHBOARD screen currently active. See **'D05 Warning alarms'** on page 21. These alert include:

- **PENDING:**
- **WARNING:**.
- **TRIPPED**
- **OVERRIDE:**.
- **AR #12 in 1234s:**
- **AR#12 Anytime:**
- **LOCKOUT**

Refer to table 4 on page 34 for explanation of each.

'ALARMS and interlock Messages

The Smartstart® 6000 can be configured to Display the Trip code and Description over the bar graph on the default screen. Interlock messages can also be displayed. See **'D06 Alm over bar'** on page 21.

Interlock Messages

When this feature is enabled (ie. D06 - 'All Alarms') interlock messages are displayed on the 2nd line. Refer to 'D06 Warning Alarms' for more information) Interlock messages have an 'I' prefix. Eg. 'I70 Enable OFF' . These messages provide more information about the current status of the starter and provide diagnostics to why the motor may not be operating.

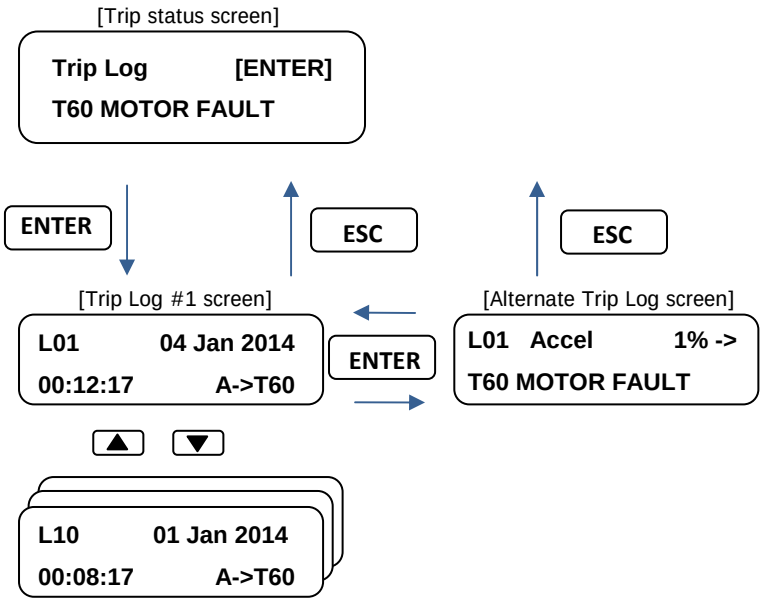
Refer to table 5 on page 34 for explanation of these messages.

Programming

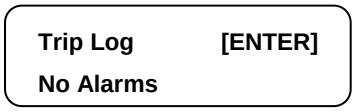
Trip Log:

The trip log is accessed from the 'Trip status' screen. The 'Trip status' screen is the last DASHBOARD screen (or press the reset button). The "Trip status' screen displays the last trip.

To access the trip log press [ENTER]

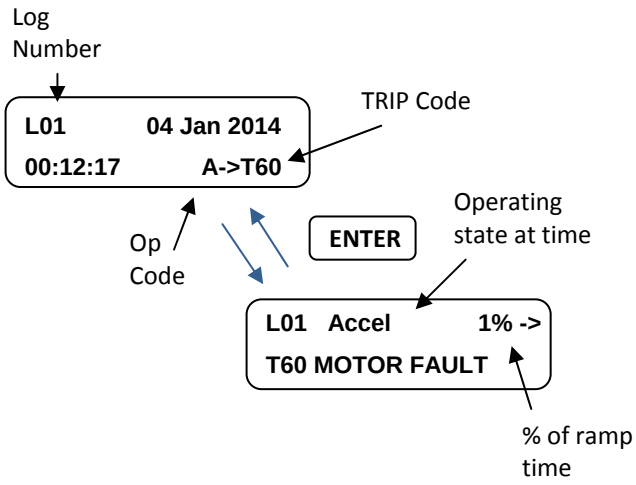


If no trips have occurred:



For all trip codes and descriptions refer to page 35.

The Trip Log Message:



Each trip log shows:

1. Log Number: L01 (most recent) to L10 (Oldest)
2. Date & Time of trip
3. The Trip code and description. See trip codes
4. 'Op Code' = Indicates the operating state when the trip occurred.

A = Accel ##% Accel Ramp up
(with ramp timer progress)
B = Run Bypass; Bypass contactor closed.
C = Run Cont.
D = Decel ##% (with ramp timer progress)
K = Kick Start
U = Atspd #% Motor up to speed
(with ramp timer progress)

How to Reset after a trip.

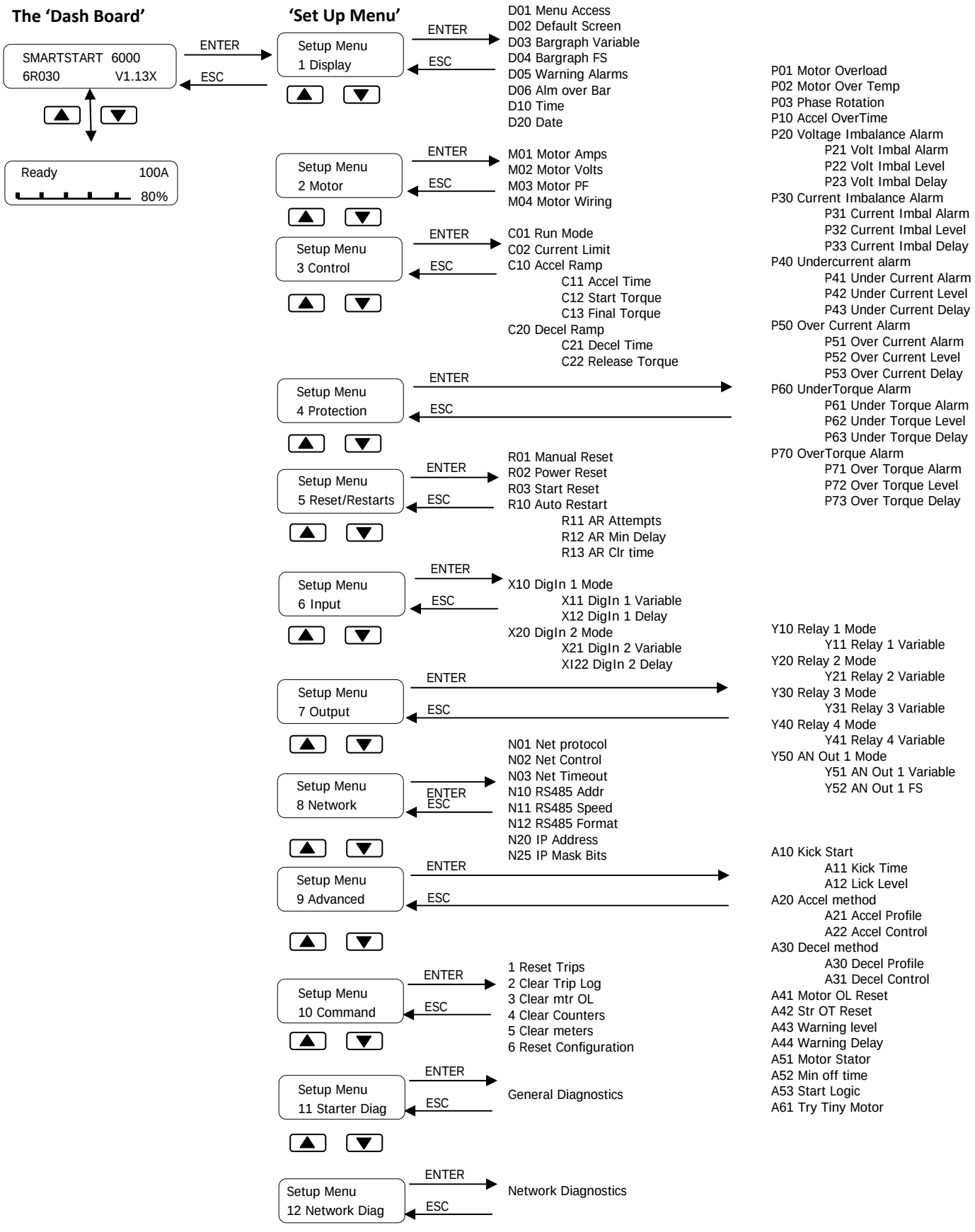
To reset the starter press the reset button for 3 seconds. The display will countdown '3…2…1…Resetting fault'.

The trip will be logged into the fault log.

The reset function can be configured multiple ways. Refer to '5 Reset/Restart' Menu and page 26 for more information.

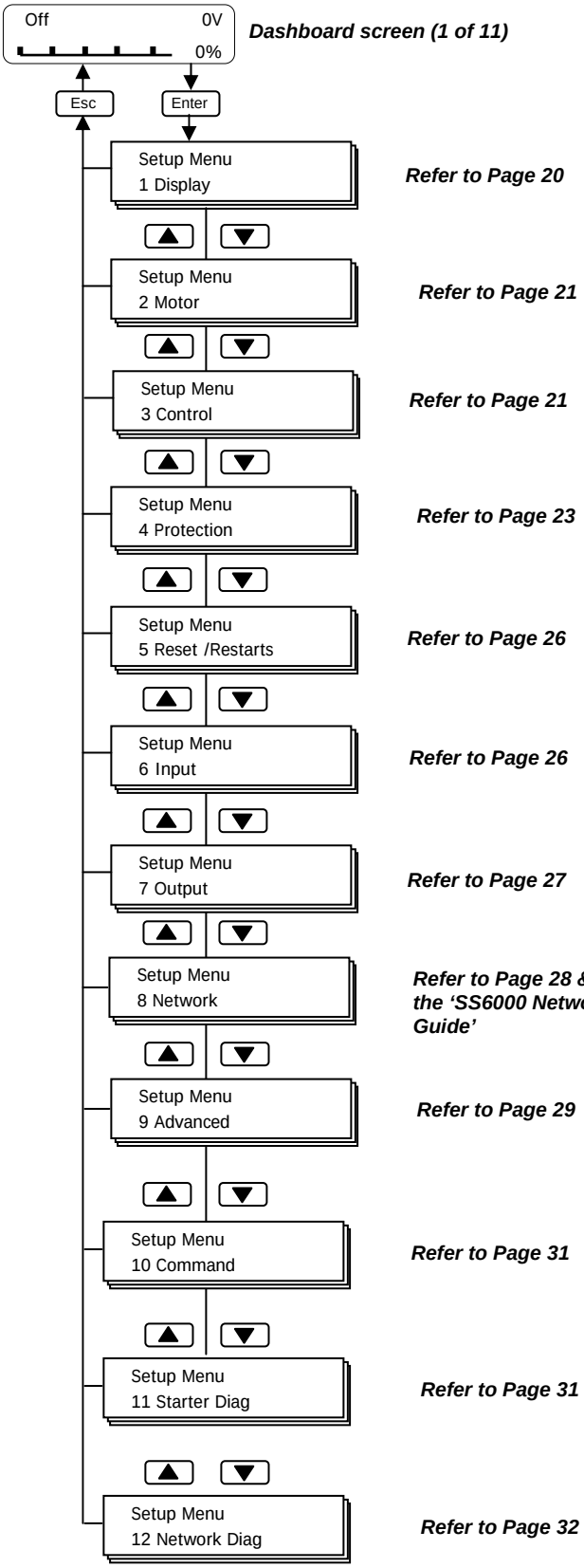
Programming

Menu Map Overview



Programming

Menu Navigation



Dashboard screen (1 of 11)

Refer to Page 20

Refer to Page 21

Refer to Page 21

Refer to Page 23

Refer to Page 26

Refer to Page 26

Refer to Page 27

Refer to Page 28 & the 'SS6000 Network Guide'

Refer to Page 29

Refer to Page 31

Refer to Page 31

Refer to Page 32

Setup Menu

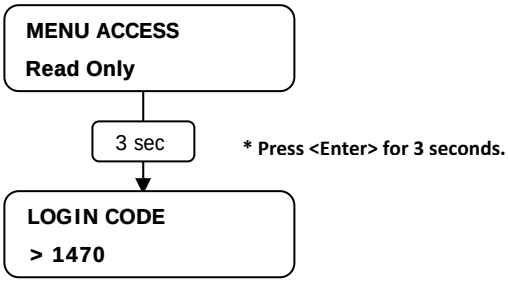
1 Display

D01 Menu Access:

Sets the desired user access to menu

▲ ▼ *Selection:* *Disabled; Setup; Read only*
▲ ▼ *Default:* *Setup*
ENTER *To save changes*
ESC *To exit without saving*

If the menu access is disabled a user access code is required to access the menu. The access code is 1470.



D02 Default Screen:

The default screen is the dashboard screen that the Soft Starter will return to - on power up, exit or time-out from the menu.

▲ ▼ *Selection:* *Overview; Thermal; Electrical; Power; Volt imbal; Curr imbal; Counters; meters; clock/net*
Default: *Overview*
ENTER *To save changes*
ESC *To exit without saving*

D03 Bargraph Var.:

Sets the bargraph variable to monitor & Display.

▲ ▼ *Selection:* *Mtr current; Mtr Torque; Mtr Thermal; SCR Thermal; Active Power; Power Factor*
Default: *Mtr Current*
ENTER *To save changes*
ESC *To exit without saving*

D04 Bargraph FS.:

Adjust the full scale of the bar graph meter as a percentage.

▲ ▼ *Selection:* *100;120;150;200;300;400;600*
Default: *300%*
ENTER *To save changes*
ESC *To exit without saving*

Programming

D05 (Flash) Warnings/Alarms:

General inclusion of warning alarms to be 'flashed over' the current dashboard screen. Refer to table 4 (p34) for alarm message explanation.

▲ ▼ *Selection: All Alarms; Disabled; Trips only; Flt Warnings; Major Warnings*
Default: All Alarms
ENTER *To save changes*
ESC *To exit without saving*

D06 Alm over Bar:

The default screen will display when a trip has occurred, with details of the type of trip in the trip log. The Smartstart® 6000 may be configured to display the trip or alarm warning on the default screen (over the bar graph).
The highest priority active alarm is displayed in place of the bar graph (only when the motor is off). Refer to table 5 (p34) for alarm message explanation.

▲ ▼ *Selection: All Alarms; Disabled; Trips only; Flt Warnings; Major Warnings*
Default: All Alarms
ENTER *To save changes*
ESC *To exit without saving*

Level/Option:	***Description:***
1/Trips Only	*Only displays 'trip' Alarms (T##). Incl. Tripped, AR & Lockout alerts.*
2/Flt Warnings:	*Include fault warning alarms: (W02,22,15,14,11,05,07,32,08,06)*
3/Major Warnings:	*Include major warning alarms: (W02,04,13,23,21,20,31,30,24,25,26)*
4/All Warnings:	*Include remaining (minor) alarms (W37,38,41,33,35,34,36)*
5/All Alarms:	*Include interlock warning alarms (see 'I' message/alarms on page 34)*

D10 Time:

Set the time of real time clock

▲ ▼ *Adjust the value of time*
ENTER *To save changes*
ESC *To exit without saving*

D20 Date:

Set the date of real time clock

▲ ▼ *Adjust the value of time*
ENTER *To save changes*
ESC *To exit without saving*

Setup Menu
2 Motor

M01 Motor Amps:

Adjust to the value of motor full load current (FLC) indicated on the motor rating plate, even if connected in 6 wire (inside delta).

▲ ▼ *Range: 40% of Nom. unit rating to max. rating*
Default: Nom. rating of unit
ENTER *To save changes*
ESC *To exit without saving*
['Nom. unit rating' = 3wire, bypass, light duty]

M02 Motor Volts:

Adjust the value to the motor nameplate voltage.

▲ ▼ *Range: 199 – 481V [480 -1160V]*
Default: 415V [1000V]
ENTER *To save changes*
ESC *To exit without saving*

M03 Motor PF:

Adjust to the value to the motor Power Factor as indicated on the motor rating plate.

▲ ▼ *Range: 0.60 – 0.98*
Default: 0.90
ENTER *To save changes*
ESC *To exit without saving*

M04 Motor Wiring: (excl. 6R15-6R80)

Select the wiring configuration of the soft starter.

▲ ▼ *Range: 3 Wire; Std 6 Wire; Alt 6 Wire*
Default: 3 Wire
ENTER *To save changes*
ESC *To exit without saving*

Setup Menu
3 Control

C01 Run Mode:

Set to the configuration of the Smartstart 6000.

▲ ▼ *Range: Bypass; Continuous*
Default: Bypass
ENTER *To save changes*
ESC *To exit without saving*

Programming

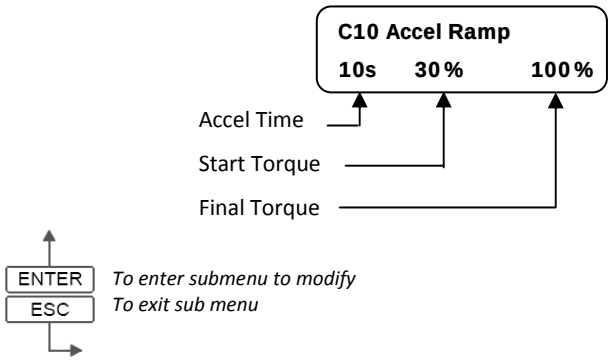
C02 Current Limit:

The current limit is expressed as a percentage of the entered motor Amps (FLC). This current limit setting operates during the ramp time only and will over-ride the torque settings. Reducing the current limit will limit the torque available to the motor and load. If set too low it may prevent the motor from accelerating or reaching full speed.

▲ *Range: 100 to 450% FLC*
▼ *Default: 450%*
ENTER *To save changes*
ESC *To exit without saving*

Appendix A – Page 42 provides a guide to starting parameters for various load types.

C10 Accel Ramp:



To enter submenu to modify
To exit sub menu

C11 Accel Time:

Adjust this to vary the time taken to ramp the voltage to full supply voltage or the torque to reach the 'finish torque'. The accel time will affect the actual current during starting – the faster the rate of acceleration the higher the start current.

▲ *Range: 1 to 60 seconds*
▼ *Default: 10 s*
ENTER *To save changes*
ESC *To exit without saving*

C12 Start Torque:

The initial torque provided when a start is initiated. Adjust to the lowest setting which allows the motor to turn on a start command. This is entered as a percentage of nominal Torque (FLT). This setting will be dependent on the torque required by the load.

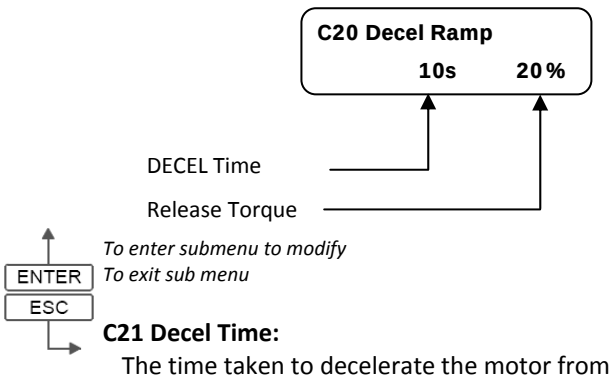
▲ *Range: 0% to 200%*
▼ *Default: 30%*
ENTER *To save changes*
ESC *To exit without saving*

C13 Final Torque: (torque control only)

This sets the torque provided at the end of the acceleration period. This is entered as a percentage of nominal Torque (FLT).

▲ *Range: 15 to 200%*
▼ *Default: 100%*
ENTER *To save changes*
ESC *To exit without saving*

C20 Decel Ramp:



To enter submenu to modify
To exit sub menu

C21 Decel Time:

The time taken to decelerate the motor from 100% to 0% V or FLT, actual time dependant on torque settings.

▲ *Range: 0 to 120 seconds*
▼ *Default: 0 s*
ENTER *To save changes*
ESC *To exit without saving*

C22 Release Torq:

The Smartstart® 6000 will decelerate the motor at the 'decel time' rate until the torque reaches the release torque value entered. This is entered as a percentage of nominal Torque (FLT).

▲ *Range: 0 to 100%*
▼ *Default: 20%*
ENTER *To save changes*
ESC *To exit without saving*

In pump applications the deceleration provided by the Smartstart® 6000 *will reduce problems with water hammer with greater control of the motor torque & speed. The* Smartstart® 6000 *has advanced settings to customise the control of the motor during acceleration and deceleration. Refer to Menu 'Advanced Controls' on page 29 for more details.*

Programming

Setup Menu

4 Protection

Some protection may be set for trip or warn. A 'Trip' will cause the soft starter to stop without a soft stop, based on the parameters configured. A Warning is based on the configuration of A43 warning level or A44 Warning delay and will not cause the soft starter to trip or motor to stop.

P01 Mtr Overload:

The Smartstart® 6000 continuously monitors the motor current (even in bypass) and calculates the temperature rise of the motor. The tripping curves are based on the protection classes as defined by IEC60947-4-2. Refer to page 37 for more details on overload class curves. Select the overload protection class suitable for the motor & load combination. This protection is type R1, thus will not reset the thermal capacity when power is removed or motor is stopped. This prevents the motor from restarting if the motor is too hot.

▲ *Range: 2;10a;10;15;20;25;30;disabled*
▼ *Default: 10*
ENTER *To save changes*
ESC *To exit without saving*

The overload setting must be selected according to the motor manufacturers recommendations.

P02 Mtr OverTemp:

Provides overload protection of the motor by monitoring the actual motor temperature. A thermistor (PTC Type only) or NC switch can be connected directly to terminals 20 and 21. This will operate in conjunction with P02 Mtr Therm OL.

▲ *Range: Thermistor (PTC only); NC switch; disabled*
▼ *Default: Disabled*
ENTER *To save changes*
ESC *To exit without saving*

***PTC type**:*

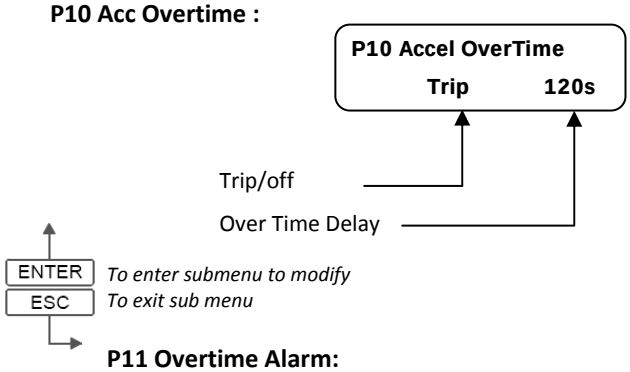
i. *Trip resistance: 3000 Ω*
ii. *Reset: 1650 Ω*
iii. *Thermistor Fault: <20 Ω*

P03 Ph Rotation:

Selectable phase sequence protection to inhibit motor operation if a prohibited phase sequence is detected (ie. reverse operation). Ideal for pumping applications.

▲ *Range: Ignore; 1-2-3; 3-2-1;*
▼ *Default: Ignore*
ENTER *To save changes*
ESC *To exit without saving*

P10 Acc Overtime :



P11 Overtime Alarm:

Protection against the start time exceeding the preset acceleration or ramp time.

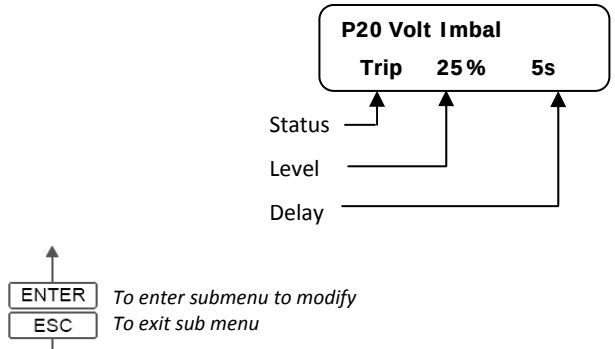
▲ *Range: off; trip; warn*
▼ *Default: off*
ENTER *To save changes*
ESC *To exit without saving*

P12 Overtime Del:

The time exceeding the set ramp time before a trip on Accel overtime occurs.

▲ *Range: 5 – 300 secs*
▼ *Default: 120s*
ENTER *To save changes*
ESC *To exit without saving*

P20 Volt Imbal :



P21 Volt Imbal Alarm:

Provide protection against a supply voltage imbalance.

▲ *Range: off; trip; warn*
▼ *Default: trip*
ENTER *To save changes*
ESC *To exit without saving*

Programming

P22 Volt Imbal Level:

Adjust to set the voltage imbalance threshold, as a percentage of the average phase voltage.

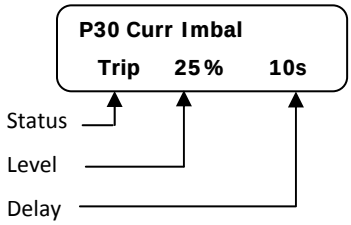
▲ *Range: 5 – 25%*
▼ *Default: 25%*
ENTER *To save changes*
ESC *To exit without saving*

P23 Volt Imbal Delay:

Adjust to set a delay for the voltage imbalance trip.

▲ *Range: 0– 5 seconds*
▼ *Default: 5 s*
ENTER *To save changes*
ESC *To exit without saving*

P30 Curr Imbal:



ENTER *To enter submenu to modify*
ESC *To exit sub menu*

P31 Curr Imbal Alarm:

Protection against a current imbalance.

▲ *Range: off; trip; warn*
▼ *Default: trip*
ENTER *To save changes*
ESC *To exit without saving*

P32 Curr Imbal Level:

Set the current imbalance threshold, as a percentage of the average phase current.

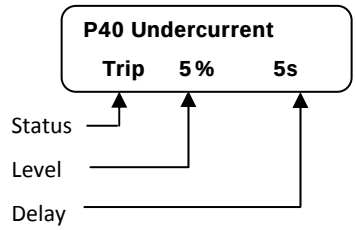
▲ *Range: 5 – 25%*
▼ *Default: 25%*
ENTER *To save changes*
ESC *To exit without saving*

P33 Curr Imbal Delay:

Set a delay for the current imbalance trip.

▲ *Range: 0 – 10 seconds*
▼ *Default: 10s*
ENTER *To save changes*
ESC *To exit without saving*

P40 Undercurrent:



ENTER *To enter submenu to modify*
ESC *To exit sub menu*

P41 Undercurrent Alarm:

Protection against under current. This protection is not active during accel & decel period. Active when motor is up to speed.

▲ *Range: off; trip; warn*
▼ *Default: off*
ENTER *To save changes*
ESC *To exit without saving*

Ideal for detecting loss of load or low load conditions such as belt breakages or blocked water pipes

'Trip': The soft starter trips , stops the motor and indicates an 'undercurrent trip'. The Trip relay will change state if selected.

'Warn': The soft starter does not trip or stop the motor. See D05 & D06 for more information regarding warning alarms.

P42 Undercurrent Level:

Adjust to the desired trip threshold, as a percentage (%) of the Motor Amps.

▲ *Range: 10 – 100%*
▼ *Default: 10%*
ENTER *To save changes*
ESC *To exit without saving*

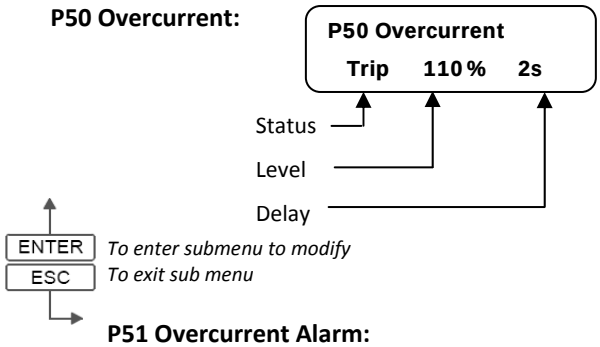
P43 Undercurrent Delay:

Adjust to set the time period that the current must fall below the threshold before a trip occurs.

▲ *Range: 1-90 seconds*
▼ *Default: 10 s*
ENTER *To save changes*
ESC *To exit without saving*

Programming

P50 Overcurrent:



P51 Overcurrent Alarm:

Provide protection against over current. This protection is not active during the accel & decel period.

▲	*Range: off; trip; warn*
▼	*Default: off*
ENTER	*To save changes*
ESC	*To exit without saving*

'Trip': The soft starter trips, stops the motor and indicates an 'over current trip'. The Trip relay will change state if selected.

'Warn': The soft starter does not trip or stop the motor. See D05 & D06 for more information regarding warning alarms.

P52 Overcurrent Level:

Adjust to the desired trip threshold, as a percentage (%) of the Motor Amps.

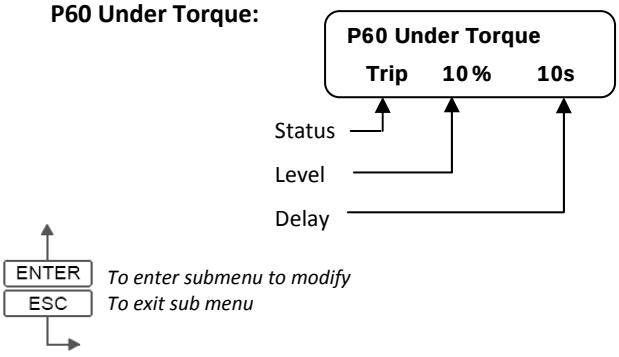
▲	*Range: 80 – 250%*
▼	*Default: 100%*
ENTER	*To save changes*
ESC	*To exit without saving*

P53 Overcurrent Delay:

Adjust to set the time period that the current must exceed the threshold before a trip occurs.

▲	*Range: 0 - 30 seconds*
▼	*Default: 10 s*
ENTER	*To save changes*
ESC	*To exit without saving*

P60 Under Torque:



P61 Under torque Alarm:

Provide protection against under-torque. This protection is not active during the accel & decel period.

▲	*Range: off; trip; warn*
▼	*Default: off*
ENTER	*To save changes*
ESC	*To exit without saving*

'Trip': The soft starter trips, stops the motor and indicates an 'Under Torque trip'. The Trip relay will change state if selected.

'Warn': The soft starter does not trip or stop the motor. See D05 & D06 for more information regarding warning alarms.

P62 Under Torque Level:

Adjust to the desired trip threshold, as a percentage of nominal torque.

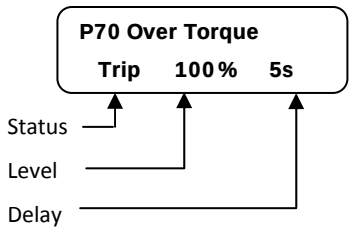
▲	*Range: 10 – 100%*
▼	*Default: 10%*
ENTER	*To save changes*
ESC	*To exit without saving*

P63 Under Torque Delay:

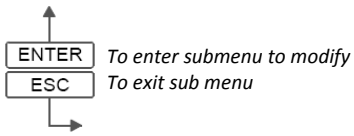
Adjust to set the time period that the torque must fall below the threshold before a trip occurs.

▲	*Range: 1 - 90 seconds*
▼	*Default: 10 s*
ENTER	*To save changes*
ESC	*To exit without saving*

P70 Over Torque (Electronic Shear Pin):



Electronic Shear Pin or protection against over torque. This protection is not active during the accel & decel period.



Programming

P71 Over Torque Alarm:

Provide protection against excess torque. This protection is not active during the accel & decel period.

▲	*Range:*	*off; trip; warn*
▼	*Default:*	*off*
ENTER	*To save changes*	
ESC	*To exit without saving*	

'Trip': The soft starter trips, stops the motor and indicates an 'Over Torque trip'. The Trip relay will change state if selected.

'Warn': The soft starter does not trip or stop the motor. See D05 & D06 for more information regarding warning alarms.

P72 Over Torque Level:

Adjust to the desired trip threshold, as a percentage of nominal torque.

▲	*Range:*	*80 – 250%*
▼	*Default:*	*100%*
ENTER	*To save changes*	
ESC	*To exit without saving*	

P73 Over Torque Delay:

Adjust to set the time period that the torque must exceed the threshold before a trip occurs.

▲	*Range:*	*0 - 30 seconds*
▼	*Default:*	*10 s*
ENTER	*To save changes*	
ESC	*To exit without saving*	

Setup Menu
5 Reset / Restarts

R01 Manual Reset

Activate or de-activate the manual reset ie. The reset on the local console.

▲	*Range:*	*Enable; Disable*
▼	*Default:*	*Enable*
ENTER	*To save changes*	
ESC	*To exit without saving*	

R02 Power Reset

Activate or de-activate reset on removal of control supply.

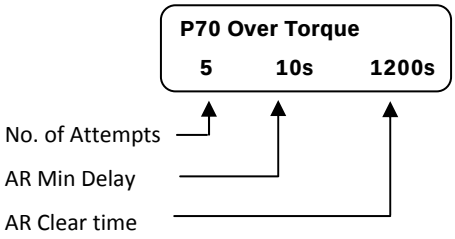
▲	*Range:*	*Enable; Disable*
▼	*Default:*	*Enable*
ENTER	*To save changes*	
ESC	*To exit without saving*	

R03 Start Reset

Activate or de-activate reset on a start command.

▲	*Range:*	*Enable; Disable*
▼	*Default:*	*Disabled*
ENTER	*To save changes*	
ESC	*To exit without saving*	

R10 Auto Restart



R11 AR Attempts

Enter number of restart attempts.

▲	*Range:*	*0 - 15*
▼	*Default:*	*0 = Disabled*
ENTER	*To save changes*	
ESC	*To exit without saving*	

R12 AR Min Delay

Enter Minimum delay before restart attempt.

▲	*Range:*	*5 – 3600 seconds*
▼	*Default:*	*10 seconds*
ENTER	*To save changes*	
ESC	*To exit without saving*	

R13 AR Clear Time

Enter time period the soft starter must run for to reset the 'R11 AR attempt log' to 0.

▲	*Range:*	*10 – 7200 seconds*
▼	*Default:*	*1200 seconds*
ENTER	*To save changes*	
ESC	*To exit without saving*	

Setup Menu
6 Inputs

For more detailed description of Digital input functions refer to table 3 page 33.

X10 DigIn 1 Mode

Activates digital input 1.

▲	*Range:*	*Enable; Invert; Disable*
▼	*Default:*	*Enable*
ENTER	*To save changes*	
ESC	*To exit without saving*	

Programming

X11 DigIn 1 Variable

Set the functionality of digital input 1. Refer to page 33 for more details.

Range: *Trip; Reset; Start; Stop; Coast; Local; ESO*
Default: *Reset*
To save changes
To exit without saving

X12 DigIn 1 Delay

Set the delay that the digital input needs to be active for the Soft starter to respond.

Range: *0.0 – 300.0 seconds*
Default: *0.0*
To save changes
To exit without saving

X20 DigIn 2 Mode

Activates digital input 2.

Range: *Enable; Invert; Disable*
Default: *Disable*
To save changes
To exit without saving

X21 DigIn 2 Variable

Set the functionality of digital input 2. Refer to page 33 for more details.

Range: *Trip; Reset; Start; Stop; Coast; Local; ESO*
Default: *Trip*
To save changes
To exit without saving

X22 DigIn 2 Delay

Set the delay that the digital input needs to be active for the Soft starter to respond.

Range: *0.0 – 300.0 seconds*
Default: *-*
To save changes
To exit without saving

Setup Menu

7 Outputs

Y10 Relay 1 Mode

Activates Relay 1.

Range: *Enable; Invert; Disable*
Default: *Enable*
To save changes
To exit without saving

Y11 Relay 1 Variable

Set the functionality of Relay 1.

Range: *See table on page 33*
Default: *Line Ctrl*
To save changes
To exit without saving

Y20 Relay 2 Mode

Activates Relay 2.

Range: *Enable; Invert; Disable*
Default: *Enable*
To save changes
To exit without saving

Y21 Relay 2 Variable

Set the functionality of Relay 2.

Range: *See table on page 33*
Default: *Bypass Ctrl*
To save changes
To exit without saving

Y30 Relay 3 Mode

Activates Relay 3.

Range: *Enable; Invert; Disable*
Default: *Enable*
To save changes
To exit without saving

Y31 Relay 3 Variable

Set the functionality of Relay 3.

Range: *See table on page 33*
Default: *Motor On*
To save changes
To exit without saving

Y40 Relay 4 Mode

Activates Relay 4.

Range: *Enable; Invert; Disable*
Default: *Enable*
To save changes
To exit without saving

Y41 Relay 4 Variable

Set the functionality of Relay 4.

Range: *See table on page 33*
Default: *Trip Alarm*
To save changes
To exit without saving

Programming

Y50 An Out 1 Mode

Activate and set the signal type for Analogue Output 1.

Range: *Disabled ; 0-10v; 0-5v; 0-20mA; 4-20mA*
Default: *Disabled*
To save changes
To exit without saving

Y51 An Out 1 Variable

Set the functionality of Analogue Output 1.

Range: *See table on page 33*
Default: *Current*
To save changes
To exit without saving

Y52 An Out 1 FS (Full Scale)

Set the full scale of the Analogue output signal.

Range: *50 – 500%*
Default: *200%*
To save changes
To exit without saving

Example: *On a 0-120A meter scale & 40Amp Motor FLC*
Scaling = 120/40 x 100 = 300%
Therefore, 20mA = 300% to display 120A

Setup Menu

8 Network

Below are the menu parameters that may require adjustment to allow communication to take place with other devices. The Communication setup must be completed and checked before communications can begin. For more comprehensive instructions and mapping details refer to the corresponding 'SS6000 Networking guide'.

N01 Net protocol

Select/enable the desired Communications protocol.

Range: *Disable; Modbus RS485: Modbus TCP*
Default: *Disable*
To save changes
To exit without saving

N02 Net Control (RS485 & Ethernet)

Select desired operation on a network control timeout.

Range: *Disabled; Stop On T/O; Trip On T/O*
Default: *Disable*
To save changes
To exit without saving

N03 Net Timeout (RS485 & Ethernet)

Adjust for the time delay for the timeout function.

Range: *0.1 – 60secs*
Default: *2.0sec*
To save changes
To exit without saving

N10 RS485 Addr (RS485 only)

Adjust to the desired network address value for the soft starter. Each device on the bus must have a unique address.

Range: *0-247*
Default: *0*
To save changes
To exit without saving

N11 RS485 Speed (RS485 only)

Adjust to the required baud rate.

Range: *4800,9600,19k2,38k4*
Default: *19k2*
To save changes
To exit without saving

N12 RS485 Format (RS485 only)

Select the correct protocol format.

Range: *8o1, 8n1, 8n2, 8e1*
Default: *8e1*
To save changes
To exit without saving

N20 IP Address (Ethernet Only)

Enter the IP address in format shown

N20 IP Address
000 . 000 . 000. 000

N21 IP Address 1 (Ethernet Only)

Range: *0 -255*
Default: *0*
To save changes
To exit without saving

N22 IP Address 2 (Ethernet Only)

Range: *0 -255*
Default: *0*
To save changes
To exit without saving

N23 IP Address 3 (Ethernet Only)

Range: *0 -255*
Default: *0*
To save changes
To exit without saving

Programming

N24 IP Address 4 (Ethernet Only)

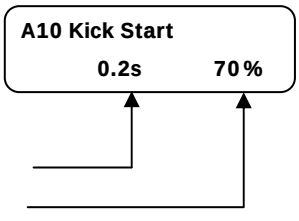
▲ ▼ *Range: 0 -255*
Default: 0
ENTER *To save changes*
ESC *To exit without saving*

N25 IP Mask Bits (Ethernet Only)

▲ ▼ *Range: /2 - /30*
Default: /24
ENTER *To save changes*
ESC *To exit without saving*

Setup Menu
9 Advanced

A10 Kick Start



Set to provide a kick during starting. This provides an adjustable torque boost to the motor when a start is initiated. This will also result in a higher start current during the kick duration.

When a kick time of 0.0 seconds is selected 'Disabled' will be displayed.

ENTER *To enter submenu to modify*
ESC *To exit sub menu*

A11 Kick Time

Set to the time of the kick

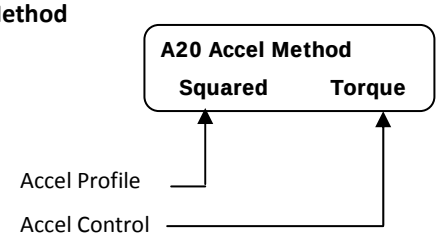
▲ ▼ *Range: 0.0 – 2.0 seconds*
Default: 0.0 (Disabled)
ENTER *To save changes*
ESC *To exit without saving*

A12 Kick Level

Set the level of kick as a percentage % of Locked Rotor Current.

▲ ▼ *Range: 50 – 100%*
Default: 70%
ENTER *To save changes*
ESC *To exit without saving*

A20 Accel Method



The acceleration method allows adjustment of the aceleration profile and acceleration control. This provides advanced control of the motor during the ramp time to better match the type of load or application. See Appendix A on Page 42 for more details.

ENTER *To enter submenu to modify*
ESC *To exit sub menu*

A21 Accel Profile

Select the type of acceleration profile to match the type of load or application.

Example: Pump/Fan = Squared

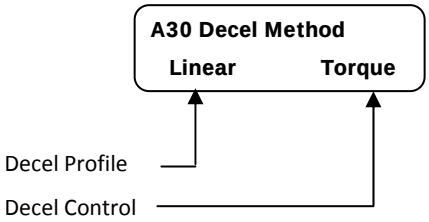
▲ ▼ *Range: Linear, Squared*
Default: Squared
ENTER *To save changes*
ESC *To exit without saving*

A22 Accel Control

Select the type of Acceleration control to suit the load or application. Torque Control will provide greater control of motor acceleration.

▲ ▼ *Range: Torque; Voltage*
Default: Torque
ENTER *To save changes*
ESC *To exit without saving*

A30 Decel Method



The deceleration method allows adjustment of the deceleration profile and acceleration control of the Soft Starter. This provides advanced control of the motor during the ramp down time to better match the type of load or application. This is especially useful in resolving water hammer related problems.

Programming

ENTER *To save changes*
ESC *To exit without saving*

A31 Decel Profile

Select the type of deceleration profile to match the type of load or application.

▲ ▼ *Range: Linear; Squared*
Default: Linear
ENTER *To save changes*
ESC *To exit without saving*

A32 Decel Control

Select the type of deceleration control to suit the load or application. Torque control will provide greater control over the deceleration / stopping of a motor under load.

▲ ▼ *Range: Torque; Voltage*
Default: Torque
ENTER *To save changes*
ESC *To exit without saving*

A41 Motor Mtr OL Reset

Enter the level for the Motor over load protection to allow a reset.

▲ ▼ *Range: 10 – 100%*
Default: 75%
ENTER *To save changes*
ESC *To exit without saving*

A42 Str OT Reset

Enter the level for the Starter over temperature protection to allow a reset.

▲ ▼ *Range: 40 – 90° C*
Default: 60° C
ENTER *To save changes*
ESC *To exit without saving*

A43 Warning Level

Set the threshold level for warning alarms with protection based on level only. Eg. Thermal trips such as Motor Overload. Enter as a %.

▲ ▼ *Range: 50-100%*
Default: 90%
ENTER *To save changes*
ESC *To exit without saving*

A44 Warning Delay

Set the warning threshold for protection based on a time function. Eg. Overcurrent. Enter as a % of the trip delay time.

▲ ▼ *Range: 25-100%*
Default: 50%
ENTER *To save changes*
ESC *To exit without saving*

Notes:

1) *If the soft starter is configured to display warning alarms(see D05 & D06) this sets the threshold point which a warning alert is displayed.*
The screen will display: WARNING followed by a code and description. Eg. W33 MTR OVERCURR

2) *If a relay is configured for 'Warning' then the relay will change state.*

A51 Motor Stator

Enter Details of the Motor Stator.

▲ ▼ *Range: 1.5 – 5.0%*
Default: 3.0%
ENTER *To save changes*
ESC *To exit without saving*

A52 Min off time

Adjust this parameter to provide a minimum off time before a start is permitted. This will limit the amount of starts per hour and allow the soft starter (or Motor) to cool before a restart.
** The motor may restart after time lapsed if enabled**

▲ ▼ *Range: 0 – 600mins*
Default: 0.0
ENTER *To save changes*
ESC *To exit without saving*

A53 Start logic

This parameter sets the operation of a start signal, whether it senses level or an edge of a start signal.

▲ ▼ *Range: Edge sense ; Level sense*
Default: Level sense
ENTER *To save changes*
ESC *To exit without saving*

The enable input is generally used as the level sensed run input for the soft starter.

Programming

An optional 'Start' function is also selectable as a digital input. This is a latching input, which is unlatched by a stop control input, deactivating the enable input or a trip.

***Level Sense:** The default setting when using the enable input to run the soft starter. For 'power-up' start with line supply to function, 'level sense' must be selected. Also used for 2 wire run/stop control using the digital input 'Start' and enable input. (may be used in conjunction with the 'stop' or 'coast' input).The start signal must be present until motor commences start.*

***Edge Sense:** Will only start with an edge trigger. This is the recommended setting for 3 wire start/stop control. May also be used to prevent an unexpected start, if 'stop/coast' is restored and enable/start input signal remains active.*

Refer to page 14 more wiring configuration.

Refer to pages 26-27 for selection of digital inputs and also page 33 for description of the digital input variables..

A61 Try Tiny Motor

Allows a test of the starter using a small test motor or motor smaller than the starter is rated.

▲	*Range: Enable/Disable*
▼	*Default: Disable*
ENTER	*To save changes*
ESC	*To exit without saving*

The Smartstart® 6000 will trip on motor loss if motor current falls below 15% of the entered FLC. This creates a problem for workshop testing or fault finding. If 'Try Tiny Motor' is enabled a start is allowed which ignores this protection. When the control supply is removed this automatically resets to 'disabled'.

Setup Menu

10 Commands

To clear/reset any of the following a confirmation code is required:

1 Reset Trip
2 ClrTrip Log
3 Clr Mtr OL
4 Clr Counters
5 Clr Meters
6 Restore Defaults

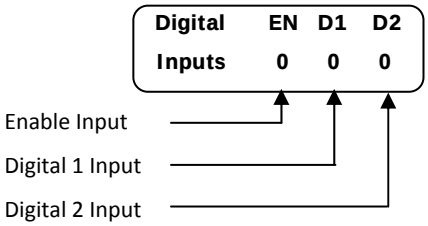
The Confirmation Code is: 1470

Setup Menu

11 Starter Diag

This menu provides indication of inputs and wiring checks.

Digital In:



0 = No control signal present
1 = Control signal present

Thermistor In:
Displays thermistor resistance in Kohms. The trip resistance is 3000 Ohms and a short circuit is detected when <20 Ohms. Ambient temperature is also display when a data logger option is fitted.

Relay Status:
Displays relay status of internal relays for Fan, Bypass and Programmable Relays 1, 2, 3 and 4.

Chk Motor Wiring:
Displays detected motor wiring.
Example: ' Correct Mtr 3 wire '

Chk CT1/CT2
Displays detected CT connection.

Example: 'Correct +L1 / +L3'

Programming

Setup Menu
12 Network Diag

This menu provides a diagnostic for Network Communications.

Network Status Idle Diag Flgs 0x0000	Network status & event wheel Network Diagnostic Flags (in hex)
C0: ReqsAoK 0 C1: BusMsgs 0	Count of requests processed normally Count of error free bus messages
C2: BusErrs 0 No Comms errors	Count of bus messages with a communication error
C3: Reqs Bad 0 No Exceptions	Count of bad requests received. Shows no or recent exception
C4: Reqs Rxd 0 No Requests	Count of requests received (with or without exceptions)
C5: ReqsCast 0 C6: RspNaks 0	Count of broadcast requests received Count of exception responses sent
C7: RspBusy 0 C8: OvrRuns 0	Count of busy responses sent Count of messages detected with a character over-run

For more comprehensive instructions and mapping details refer to the corresponding SS6000 communications/networking guide.

17:25:45 Net*
14 APR 2013 RxOK

The network status summary is also shown on the 'clock/date' dashboard screen.

Refer to the corresponding SS6000 networking guide for more information.

Programming

Table 1: Output Relay Functionality

Relay Function	
Selection:	**Description**
Line Ctrl	Control for Line Contactor
Bypass Ctrl	Control for Bypass Contactor
Accel Ramp	Starter in acceleration ramp mode
Decel Ramp	Starter in deceleration ramp mode
Ramping	Starter in Ramp Mode
Up to Speed	motor is up to speed
Motor On	Motor is running
Mtr Loss	Output phase(s) Open circuit/motor isolated
Trip Alarm	A trip alarm is active
Freq Error	Supply frequency range exceeded
Bypass FLT	Bypass contactor failed
STR OL Trip	Starter reached overload level
Mtr OL Trip	Motor reached overload level
Mtr OT Trip	Motor thermistor/switch trip active
Dig In Trip	Digital input trip active
Ph Rotation	Rotation trip active
Over time	Over time trip active
Volt Imbal	Voltage Imbalance trip active
Curr Imbal	Current imbalance trip active
Under Current	Under current trip active
Over Current	Over Current trip active
Under Torque	Under Torque trip active
Over Torque	Over Torque trip active
Warning Alarm	A warning alarm is active
TOL Warning Alarm	Motor Overload warning alarm
Regen. Mode	Soft starter is operating in regeneration mode
AR Pending	Waiting for restart (time)
AR Lockout	Restarts exhausted – starter tripped
ESO Proof	In ESO and current detected
Fan Control	Fan is ON
Test (ON)	Turns relay on

Table 2: Analogue Output Functionality

Analogue Output	
Selection:	**Description**
Mtr Torque	Estimated torque produced in motor
Mtr Thermal	Estimated Motor temperature of over load
STR thermal	Soft Starter temperature
Active power	Power consumed kW
Power Factor	Power Factor
Mtr Current	Motor Current
Test (100%)	Maximum output

Table 3: Digital Input Functionality

Digital Input	
Selection:	**Description**
Reset	Attempts to reset a Smartstart trip/fault condition. Motor may start immediately on successful reset. A delay can also be configured.
Trip	Trips the Smartstart after a configurable delay. Ideal for external pressure/flow switch.
Start	Enable this function where 3 wire start/stop control is required. The start request is latched once the motor starts. Use the enable or 'stop' input to a N/C stop button, to unlatch. Edge or level sense may be used.
Stop	Initiates a motor stop with the configured decel profile. A delay may be incorporated.
Coast	Forces a free wheel stop from any operating state. Optional delay
Local	Forces local control and disables network control
ESO	**Essential Services Override:** This feature is designed for systems that must operate in the event of an emergency (eg. Fire Mode). ESO overrides most protection and input conditions to run the motor.

Programming

Table 4: Flash Alerts / Messages

Message:	Explanation:
PENDING:	Start is delayed/postponed by an active interlock alarm.
WARNING:	There is an active warning alarm. The alarm is identified by W### displayed on 2nd line. The Soft starter has not tripped. Refer to 'D05 Warning Alarms' for selection and adjustment.
TRIPPED:	The SMARTSTART has tripped on a fault condition. The alarm is identified by T### displayed on 2nd line. Refer to page 30 for more detail on trip alarms.
OVERRIDE:	Essential Services Over-ride (ESO) requested.
AR #12 in 1234s:	Starter has tripped and automatic restart is pending. Includes AR counter value and delay to reset/restart attempt (with T## alarm displayed)
AR#12 Anytime: (Soft Starter or Motor Cooling)	Starter has tripped and automatic restart is pending. Includes AR counter value and delay to reset/restart attempt (with T## alarm displayed). The actual restart time is dependent on thermal reset level and cooling rate.
LOCKOUT:	Flashed after all Auto restart attempts exhausted.

Table 5: Interlock Messages

Message:	Explanation:
I21 STR OVERTEMP	Starter too hot to start. Waiting for heatsink to cool.
I30 MTR OVERLOAD	Motor is too hot to start. Motor TOL reset threshold not reached.
I31 MTR OVERTEMP	Motor (thermistor) is too hot to start
I51 Min Off Time	Waiting for min off timer to expire
I52 Prestart Dly	Waiting for 'start' input (D1/D2) timer to expire.
I53 No Supply	Line relay on but no supply detected.
I70 Enable OFF	Local Enable digital input is off.
I71 Coast ON	Local coast input is on (D1/D2)
I72 Stop ON	Local stop input is on (D1/D2)
I73 Start OFF	Local start input is off (D1/D2)
I74 Net Enbl OFF	Network enable command flag is off
I75 Net coast ON	Network coast command flag is on
I76 Net Strt OFF	Network Coast command flag is off

Programming

Programming

Trip (Warning) codes & messages

A warning message will have a W in place of the 'T' for the following messages.

CODE/Message	Description
T00 NO TRIP ALM	No fault or trip has occurred
T01 PSU LOW VOLT	Control supply voltage low. Check control voltage.
T02 LINE FREQ	Line supply frequency out of range while motor running.
T03 LINE PH FLT	3 Phase supply problem, one phase open. Check L1; L2; L3
T04 PHS ROTATION	Line Phase sequence in wrong direction – User selectable. See P03 page 23.
T05 MTR 3/6 WIRE	Wiring detected different to motor wiring setting. Check motor wiring.
T06 NET T/O	Loss of communications while network controlling motor
T07 CT PHASING	Incorrect CT phasing and/or insufficient motor current. Check correct installation of external CT's (6 wire only). Check CT phasing under the diagnostics menu to check or help identify the error
T10 START FAILED	Motor did not start
T11 MTR STUCK ON	Unexpected motor current detected while off. Check wiring, relay configuration and bypass contactor.
T13 MOTOR LOSS	Motor current lost in all 3 phases. Check Motor and motor wiring
T14 BYPASS FAULT	Bypass Contactor failed to close or opened unexpectedly.
T15 BP POLE FLT	Bypass Contactor failed to close or opened unexpectedly. 3 Phase/pole fault.
T20 STR OVERCURR	Starter instantaneous over current while up to speed.
T21 STR OVERTEMP	Starter heatsink over temperature
T22 STR TEMP FLT	Starter heatsink temperature sensor fault.
T23 STR OVERLOAD	Starter thermal overload. Motor or load problem, start time longer than normal. Excessive starts per hour. Insufficient start torque and/or current limit too low – check settings. Ambient temperature rating exceeded or Starter rating exceeded
T24 MOTOR STALL	Motor Stalled, current after start >300% for 3 seconds. Check motor, load and starter settings.
T25 VOLT IMBAL	Voltage imbalance as per user setting. See P20 page 23. Check supply
T26 CURR IMBAL	Current imbalance as per user setting. See P30 page 24. Check supply and motor.
T30 MTR OVERLOAD	Motor thermal overload trip as per user setting. See page 20. Incorrect overload class (& starter rating). Motor or load problem. Excessive starts per hour for overload class selected. Insufficient start torque and/or current limit too low – check settings.
T31 MTR OVERTEMP	Motor over temperature from the thermistor input. See P02 page 23. Check Motor and Load.

CODE/Message	Description
T32 MTR TEMP FLT	Motor thermistor sensor fault detected. Check thermistor and wiring
T33 MTR OVERCURR	Over current trip as per user setting. See P50 page 25
T34 MTR UNDERCURR	Under current trip as per user setting. See P40 page 24
T35 MTR OVERTORQ	Over torque trip as per user setting. See P70 page 25
T36 MTR UNDERTORQ	Under torque trip as per user setting. See P60 page 25
T37 D1 INPUT ALM	Trip initiated from external source connected to Digital input 1
T38 D2 INPUT ALM	Trip initiated from external source. connected to Digital input 2
T41 ACC OVERTIME	Acceleration time has exceeded set time as per user setting. See P10 page 23. Motor or load problem, start time longer than normal. Insufficient start torque and/or current limit too low – check settings.
T42 ESO MODE	Warning Message when Essential Services Over-ride is requested.
T43 A/R LOCKOUT	Auto Restart Lockout – Auto restarts exhausted or final trip
T50 MTR AMPS CFG	Motor Amps configuration Error – Check and adjust motor Amps and/or motor wiring.
T60 MOTOR FAULT	Current not detected in multiple phases during breakaway firing.
T61 T1 PHASE FLT	Current not detected in single phase during breakaway firing.
T62 T2 PHASE FLT	Current not detected in single phase during breakaway firing.
T63 T3 PHASE FLT	Current not detected in single phase during breakaway firing.

Specification

Input Voltage:

6R series:	220 to 460Vac 6R15-80: 380Vac to 415Vac
6V series:	600 to 1000V (+10%)

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

Control Supply: 24Vdc (+15%, -15%)

24VDC Power Supply (min. requirements):

Power Supply O/P:	24VDC Regulated

Peak power requirements:

6R15-30:	1.5 Amps (36W)
6R60-80:	2 Amps (48W)
6R100–220/6V90:	3.0Amps (72W)
6R300–880:	4.0 Amps (96W)
6V200-630:	4.0 Amps (96W)

These ratings allow for peak current requirements of internal fans

AC Control Supply Options Available:

240VAC:	All Models
18VAC:	All Models
415VAC Self Powered	6R15/30/60/80 Only

Configurations: i) 3 wire & 6 wire
ii) Bypass or Continuous
6R15 to 6R80 have integral Bypass Contactor.

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
SCR PIV:	Minimum 1400V (6R series) Minimum 3600V (6V series)
SCR configuration:	Full-wave
Dv/dt suppression:	RC snubber networks
Over Voltage:	MOV
Rated Insulation:	2Kv (6R series)
EMC	Class A (to AS61800 – C-tick)
Current Feedback	Current transformer in circuit at all times. Torque controlled Ramp or voltage ramp, with current limit override
Standards Compliance	AS31800 C-tick; AS3947.4.2, IEC60947-4-2

Environment:

Enclosure protection:	IP00 – IP20
Operating Temp.	0 to 55°C (derate by 1% / °C >40°C)
Cooling:	Temperature controlled forced ventilated
Maximum Altitude:	1000m without derating
Operating position:	Vertical
Pollution:	Degree 3 conforming to IEC947-4-2

Inputs:

Digital Inputs:	24Vdc logic
Function:	2x Programmable inputs 1x Enable Input
Thermistor:	Thermistor or NC switch PTC type, Trip Resistance 3000Ohms, <20ohms detected as Short Circuit.

Outputs:

Digital Output:	4 Programmable Relays
Contact Rating:	5A 250Vac; 5A 30VDC
Analogue Output:	1x Programmable Output
Signal:	0-10V, 0-5V, 4-20mA

Communications: Modbus RS485 (Standard)
Ethernet (Modbus) Option

Protection:

Motor Overload	Adjustable; Class 10, 10A, 20, 25, 30 type R1, total memory function
SCR Over temp.	Heat sink temperature
SCR protection:	Currrent & thermal modelling
Under Current	Adjustable level and trip time
Over Current	Adjustable level and trip time
Under Torque:	Adjustable level and trip time
Over Torque:	Adjustable level and trip time
Motor Stalled	300% for 3 seconds (run mode only)
Current limit	Adjustable
Starter Overload	Current & thermal modelling
O/P Short Circuit	Semiconductor fuses (optional)
Voltage imbalance	Input voltage imbalance
Current Imbalance	Input & output current imbalance
Bypass failure	No bypass after ramp time or during run mode
SCR fault	Open or Short circuit SCR
Acc over time	Accel time exceeds set time
Phase reversal	Phase rotation inhibit
Motor Loss	Motor or output open cct
CT fault	Fault with CT's
Line Freq/Phase	Problem with supply
Network Timeout	Network Fault
Remote Input	Forced trip from external source

Human Interface Module (HIM):

Type:	Local or remote mountable (IP66)
Display:	Backlit LCD (Blue) , English
Menu:	Coded & English
Menu Protected:	Selectable user access code
Cable type:	Ribbon or Cat-5

Essential Services Over-ride (ESO):
Selectable Digital input with 24Vdc logic.

Battery:

Type:	CR1220

Thermal Protection

Starter Thermal Protection:
Thermal protection of the soft starter is provided by a temperature sensor located on the heatsink and by calculating the temperature of the thyristor junction with sophisticated modeling of the specific devices used. Fans are powered by 24VDC supply and thermally controlled when the heatsink temperature exceeds 40°C and whist the motor is ramping.

Motor thermal Protection
The Smartstart® 6000 provides thermal protection of the motor by providing a thermistor input and also a programmable motor overload protection feature.

The starter continuously monitors the current and calculates the temperature rise of the motor based on the motor data provided. The standard IEC60947-4-2 defines the protection classes giving the starting capacities of the motor (warm or cold) without thermal trips.

The thermal protection displayed by the starter corresponds to the thermal time constant:

- An overload trip will occur and stop the motor, if the motor exceeds the critical temperature rise threshold of 125%
- This feature has a memory function based on the thermal capacity and may not allow a start if the temperature rise is too high.
- The thermal state continues to calculate even when the starter is off and powered down. Simply by turning power off and back on will not reset the thermal state.

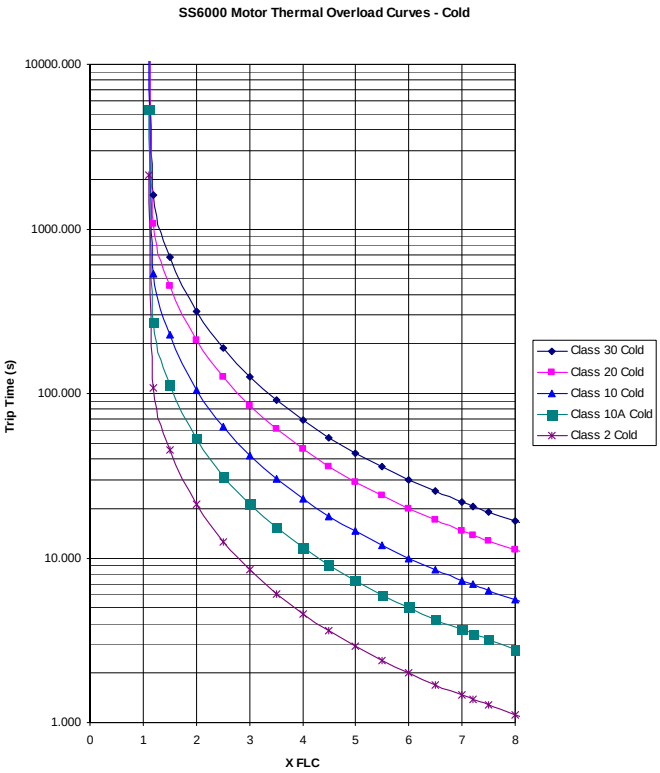
Motor thermistor Protection
The Smartstart® 6000 provides an input for a thermistor or normally closed switch. Thermistor / PTC probes integrated in the motor to measure its temperature can be connected to the thermistor input terminals.

This input has a trip resistance of 3000ohms and a resistance of 20ohms or less will be detected as a short circuit.

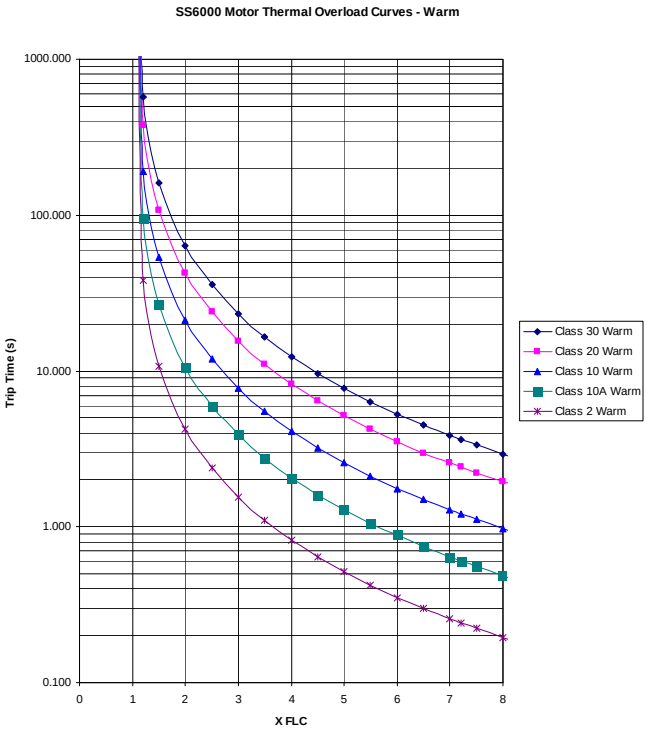
Alternatively, a normally closed thermal switch may be used which open circuits at a specific temperature.

Motor thermal Protection:

Cold Curves



Hot Curves



Unit ratings

The following tables provide the maximum motor FLC that should be used on each model for specific starting & operating duties.

15A – 80A with Integral Bypass Contactor (380 - 415V)

Light Duty: (Amps)	Standard Duty: (Amps)	Severe Duty: (Amps)	Model	Chassis	Dimensions (mm)
15	15	15	6R015B2	B2	335h 162w 174d
30	25	20	6R030B2	B2	335h 162w 174d
60	54	44	6R060B2	B3	440h 162w 174d
80	70	56	6R080B2	B3	440h 162w 174d

220 -460V 3 Wire Bypass

Light Duty: (Amps)	Standard Duty: (Amps)	Severe Duty: (Amps)	Model	Chassis	Dimensions (mm)
105	92	77	6R10000	A2	430h 248w 232d
193	170	139	6R19000	A2	430h 248w 232d
221	193	157	6R22000	A2	430h 248w 232d
367	321	271	6R36000	A3	670h 375w 285d
586	513	427	6R58000	A3	670h 375w 285d
830	806	647	6R83000	A3	670h 375w 285d

220 -460V 3 Wire Continuous

Light Duty: (Amps)	Standard Duty: (Amps)	Severe Duty: (Amps)	Model	Chassis	Dimensions (mm)
100	88	75	6R10000	A2	430h 248w 232d
178	157	131	6R19000	A2	430h 248w 232d
203	179	149	6R22000	A2	430h 248w 232d
341	302	258	6R36000	A3	670h 375w 285d
534	473	401	6R58000	A3	670h 375w 285d
796	710	608	6R83000	A3	670h 375w 285d

220 -460V 6 Wire Bypass (inside Delta Connection)

Light Duty: (Amps)	Standard Duty: (Amps)	Severe Duty: (Amps)	Model	Chassis	Dimensions (mm)
180	159	130	6R10000	A2	430h 248w 232d
330	290	238	6R19000	A2	430h 248w 232d
380	330	269	6R22000	A2	430h 248w 232d
635	555	478	6R36000	A3	670h 375w 285d
1015	888	731	6R58000	A3	670h 375w 285d
1435	1395	1108	6R83000	A3	670h 375w 285d

Unit ratings

220 -460V 6 Wire Continuous (Inside Delta Connection)

Light Duty: (Amps)	Standard Duty: (Amps)	Severe Duty: (Amps)	Model	Chassis	Dimensions (mm)
173	152	128	6R10000	A2	430h 248w 232d
308	270	224	6R19000	A2	430h 248w 232d
350	310	255	6R22000	A2	430h 248w 232d
590	520	442	6R36000	A3	670h 375w 285d
920	815	687	6R58000	A3	670h 375w 285d
1378	1225	1042	6R83000	A3	670h 375w 285d

600V – 1000V 3 Wire Bypass

Light Duty: (Amps)	Standard Duty: (Amps)	Severe Duty: (Amps)	Model	Chassis	Dimensions (mm)
90	79	67	6V09000	A2+	430h 305w 244d
214	187	156	6V20000	A3	670h 375w 305d
368	322	265	6V40000	A3	670h 375w 305d
571	499	401	6V60000	A3+	670h 435w 285d

600V – 1000V 3 Wire Continuous

Light Duty: (Amps)	Standard Duty: (Amps)	Severe Duty: (Amps)	Model	Chassis	Dimensions (mm)
86	76	65	6V09000	A2+	430h 305w 244d
196	173	146	6V20000	A3	670h 375w 305d
343	303	253	6V40000	A3	670h 375w 305d
514	457	375	6V60000	A3+	670h 435w 305d

Note:

1. The above ratings are based on a 40Degree Ambient. Ratings up to 60degC are available.
2. The bypass contactor is not included unless stated otherwise.

Shipping/Packaging Details

Part No.	Dimensions (mm)	Weight (kg)
6R015B2	380 x 220 x 248	5
6R030B2	380 x 220 x 248	5
6R060B2	488 x 220 x 248	6
6R080B2	488 x 220 x 248	7
6R10000	480 x 305 x 290	18
6R19000	480 x 305 x 290	18
6R22000	480 x 305 x 290	18
6R36000	770 x 470 x 430	68
6R58000	770 x 470 x 430	68
6R83000	770 x 470 x 430	68
6V200 -6V400	770 x 470 x 430	70
6V90	480 x 305 x 290	20

SS6000 Options

Control Supply Options

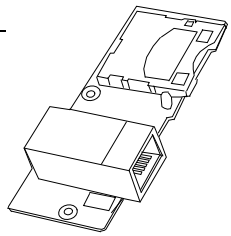
Part Number	Description	Comments
TF60013	415VAC Internal Control Supply, 6R15/30 - fitted	Control powered from 3phase 415V supply internally
TF60014	415VAC Internal Control Supply, 6R60/80 - fitted	Control powered from 3phase 415V supply internally
TF60031	18VAC Control Supply, 6R60/80 - fitted	
TF60032	18VAC Control Supply, 6R15/30 - fitted	
TF60033	18VAC Control Supply, 6R100+ - fitted	All models from 6R100 to 6R830
TF60034	240VAC Control Supply, 6R15/30	
TF60035	240VAC Control Supply, 6R60/80	
TF60036	240VAC Control Supply, 6R100+	All models from 6R100 to 6R830

24vdc Power Supplies

Part Number	Description	Comments
TQ60001	24Vdc Power Supply, 36W, 1.5 Amps	Power Supply to suit 6R15 to 6R30
TQ60002	24Vdc Power Supply, 48W, 2.0 Amps	Power Supply to suit 6R60 to 6R80
TQ60003	24Vdc Power Supply, 72W, 3.0 Amps	Power Supply to suit 6R100 to 6R220
TQ60004	24Vdc Power Supply, 96W, 4.0 Amps	Power Supply to suit 6R360 to 6R830 (& 6V series)

Option Boards

SS6000 Model	Description	Part Number:
All	Option Card: data logger with SD card	TQ60005
All	Option Card : data logger with SD card (fitted)	TF60005
All	Communications Option: Ethernet Modbus TCP + Data Logger	TQ60040
All	Communications Option: Ethernet Modbus TCP + Data Logger (Fitted)	TF60040



Remote SMART Console Option (H.I.M): Cat-5 Cable

Part Number	Description	Comments
TQ60011	SMART Console (IP66) - loose	Available for all models
TF60011	SMART Console (IP66) - fitted	Available for all models
TQ60012	Cable: SMART Console, per m	Max length of 30m
TQ60050	Cable: SMART Console, 1m	
TQ60051	Cable: SMART Console, 2m	
TQ60052	Cable: SMART Console, 3m	
TQ60053	Cable: SMART Console, 5m	

Note:
The Smartstart® 6000 will operate with the local console and a remote console connected. A connection port is provided when fitted. There is a 30second delay between operating either the local or remote keypad before the alternate keypad can be used.

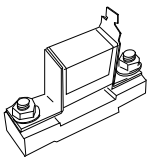
SS6000 Options

Other Options

SS6000 Model	Description	Part Number:
6R100 – 6R220	Prepared for 6 wire	TF60015
6R360 – 6R830	Prepared for 6 wire	TF60016

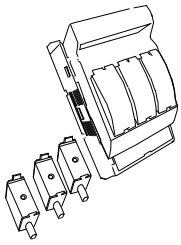
For 6 wire operation the Current transformers supplied integral to the Smartstart® 6000 must be relocated to L1 & L3 of the Line circuit (not the Phase circuit).

Semiconductor Fuse Kits – IP00



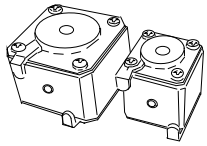
SS6000 Model	Description	Part Number:	Replacement Fuse:
6R015B2	Semiconductor Fuse Kit to suit 6R15	TQ60020	TF20032
6R030B2	Semiconductor Fuse Kit to suit 6R30	TQ60021	TF20080
6R060B2	Semiconductor Fuse Kit to suit 6R60	TQ60022	TF20125
6R080B2	Semiconductor Fuse Kit to suit 6R80	TQ60023	TF20160
6R15-6R80	Semiconductor Fuse Kit Cover	TQ60024	

Semiconductor Fuse Kits – IP20 Enclosed



SS6000 Model	Description	Part Number:	Replacement Fuse:
6R015B2	Semiconductor Fuse Kit to suit 6R15	TQ60120	TF20063
6R030B2	Semiconductor Fuse Kit to suit 6R30	TQ60121	TF20081
6R060B2	Semiconductor Fuse Kit to suit 6R60	TQ60122	TF20161

Semiconductor Fuse Kits – Busbar Mount



SS6000 Model	Description	Part Number:	Replacement Fuse:
6R10000	Semiconductor Fuse Kit to suit 6R100	TQ60025	TF22400
6R19000	Semiconductor Fuse Kit to suit 6R190 / 6R220	TQ60026	TF22400
6R22000	Semiconductor Fuse Kit to suit 6R190 / 6R220	TQ60027	TF22400
6R36000	Semiconductor Fuse Kit to suit 6R360	TQ60028	TF23630
6R58000	Semiconductor Fuse Kit to suit 6R580	TQ60029	TF23500 (2 per phase)
6R83000	Semiconductor Fuse Kit to suit 6R830	TQ60030	TF23700 (2 per phase)

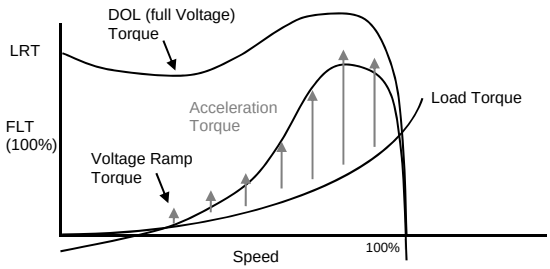
Appendix A
ZENER SMART-TORQ - Torque Control System

There are several methods available to soft start a motor. The more traditional methods are Direct-on-line, Star/Delta, Auto transformer and Primary resistance starters. The more sophisticated methods also provide a soft stop and include Soft Starters and Variable Speed drives (VSD's). VSD's can provide a better soft start with significantly lower starting currents and many other benefits including energy savings. However, a Soft Starter may provide a more economical solution to motor starting over the life of the motor.

Soft Starters provide the following benefits:

1. Reduced stresses and wear on the mechanics of the system
2. Reduced starting currents
3. Minimise voltage dips on the supply
4. Lowered Peak demand charges
5. Eliminate belt slippage on fans
6. Smooth acceleration of motor / load

The conventional voltage ramp Soft Starter is a reduced voltage starter and is similar to the traditional methods mentioned above. The problem with voltage ramp soft starters is a non linear acceleration of the motor. This is very noticeable on a pump type load where there is much higher acceleration torque available at the beginning of the start. The diagram below shows the variation in acceleration torque available for both a Direct on line (full voltage) and the voltage ramp type soft start.



'SMART-TORQ®' is a Torque Control System developed by Zener to overcome this problem with greater control over the acceleration torque in the motor. The torque is controlled in a manner which suits the type of load to achieve a linear acceleration in motor shaft speed. This control system is also active during the deceleration phase, providing a soft stop where the motor decelerates at a constant rate. This can be used to overcome water hammer problems associated with the closing or slamming of check valves.

ZENER SMART-TORQ Key Benefits:

1. A true linear acceleration of the load and motor for variable & constant torque loads.
2. Reduced stresses and wear on the mechanics of the system
3. Ramp profiling to better match type of load such as variable torque loads. Better control of pumps and fans.
4. Torque Control available in Accel & Decel Modes and 3wire or 6wire motor configuration.
5. Eliminate water hammer problems.
6. Reduced peak current draw, especially at motor pull-in/pull-out operating points.
7. Reduced heating in motor at low speeds.
8. No instability due to changing power factor. Closed loop system to monitor and react to changing power factor.
9. No instability due to slot ripple in 3 wire and 6 wire operation.
10. Better control of deceleration through closed loop torque control system.
11. No external speed sensor required to produce superior performance

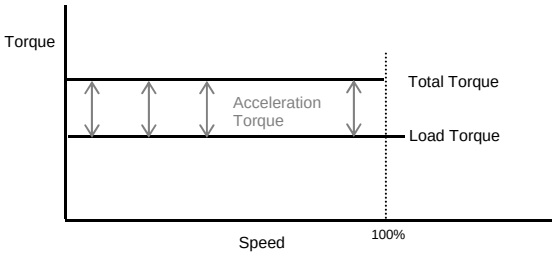
The rate of acceleration is dependent on the additional torque (Acceleration Torque) available in the motor.

Thus, we can achieve a constant or linear rate of Acceleration by providing 'constant' acceleration torque to the motor.

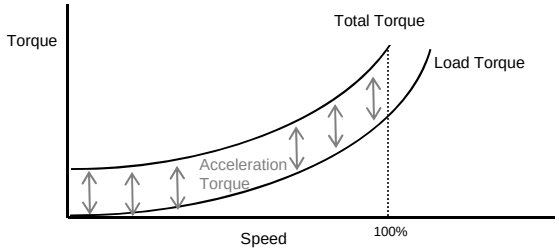
Since the torque required by the load may not be linear, the torque delivered by the soft starter must match that of the load. To achieve this, the torque developed in the motor must be the sum of the 'acceleration torque' and the load torque at a specific speed.

Below illustrates the constant acceleration torque applied for different load types;

1) Constant Torque type Load (eg. Conveyor)



2) Variable Torque type Load (eg. Pump/Fan)



How is this achieved ?

The SMARTSTART® 6000 continually monitors start variables such as motor current, voltage and power factor to determine the input electrical power. From the motor parameters, the IR & magnetic losses are used to calculate the Air Gap Power (ie. the power transmitted to the motor shaft). With an instantaneous value of shaft power the instantaneous torque can be determined. With this information we can vary the thyristor conduction to achieve the desired torque. The torque is varied to follow a specific curve, based on the initial torque setting, the final torque setting and the profile selected. The end result is equal acceleration torque over the ramp period to provide a linear acceleration in motor shaft speed. The profile is user adjustable allowing for non-linear torques if required to other or unusual types of loads.

Summary.

The 'SMART-TORQ®' Torque Control System provides smoother starting & stopping, allowing ramp profiling to produce a linear acceleration and deceleration of the motor speed. There are many benefits with variable torque loads such a pumps. A linear acceleration and deceleration provides better control to eliminate water hammer problems. The SMARTSTART® 6000 combines this superior torque control system with a robust design to suit all types of loads and applications. All models include substantial heatsink mass with temperature controlled force ventilation to accommodate the more severe (heavy) duty applications.

Appendix A

Indicative parameters for different load types

1. Pump (3 wire/Bypass with No Soft Stop)

Factory defaults are intended for general pumping/fan application with no Soft Stop. Enter motor parameters as per motor nameplate.

2. Submersible Pump (3 wire/Bypass with No Soft Stop)

Factory defaults are intended for general pumping application with no Soft Stop. The acceleration time needs to be reduced to 3secs or as per pump/motor manufacturers recommendations. Enter motor parameters as per motor nameplate.

Ref	Page	Parameter	Setting (factory Default)
C11	22	Accel time	3sec (10s)
M01	21	Motor Amps	'Nameplate Motor FLC'
M02	21	Motor Volts	'Nameplate Motor Volts'
M03	21	Motor PF	'Nameplate Motor PF'

3. Pump :(3 wire/Bypass with Soft Stop)

Factory defaults are intended for general pumping application with no Soft Stop. Enter motor parameters as per motor nameplate. Adjust the 'Release Torque' and 'Decel time' to achieve the required soft stop.

Ref	Page	Parameter	Setting (factory Default)
C21	22	Decel time	*15sec (0s)
C22	22	Release Torque	*2% (2%)
M01	21	Motor Amps	'Nameplate Motor FLC'
M02	21	Motor Volts	'Nameplate Motor Volts'
M03	21	Motor PF	'Nameplate Motor PF'

4. Fan :(3 wire/Bypass)

Factory defaults are intended for general pumping application which is similar to that required for a fan. However, the Accel time may need to be increased to allow for longer ramp times of high inertia fans. The Motor Overload Class may also need to be increased with the extended ramp of high inertia fans. Enter motor parameters as per motor nameplate.

Ref	Page	Parameter	Setting (factory Default)
C11	22	Accel time	15+ (10s)
P01	23	Motor Overload	Class 10 /Class 20 (10)
M01	21	Motor Amps	'Nameplate Motor FLC'
M02	21	Motor Volts	'Nameplate Motor Volts'
M03	21	Motor PF	'Nameplate Motor PF'

5. Conveyor: (3 wire/Bypass)

Factory defaults are preset for a variable torque load. The Torque settings will need to be adjusted for a constant torque type load. Enter motor parameters as per motor nameplate.

Ref	Page	Parameter	Setting (factory Default)
C12	22	Start Torque	80% (30%)
C13	22	Final Torque	150% (130%)
A21	29	Accel profile	Linear (Squared)
P01	23	Motor Overload	Class 20 (10)
M01	21	Motor Amps	'Nameplate Motor FLC'
M02	21	Motor Volts	'Nameplate Motor Volts'
M03	21	Motor PF	'Nameplate Motor PF'

6. Compressor: (3 wire/Bypass)

Factory defaults are preset for a variable torque load. The Torque settings will need to be adjusted for a constant torque type load. Enter motor parameters as per motor nameplate.

Ref	Page	Parameter	Setting (factory Default)
C12	22	Start Torque	60% (30%)
C13	222	Final Torque	130% (130%)
A21	29	Accel profile	Linear (Squared)
P01	23	Motor Overload	Class 20 (10)
M01	21	Motor Amps	'Nameplate Motor FLC'
M02	21	Motor Volts	'Nameplate Motor Volts'
M03	21	Motor PF	'Nameplate Motor PF'

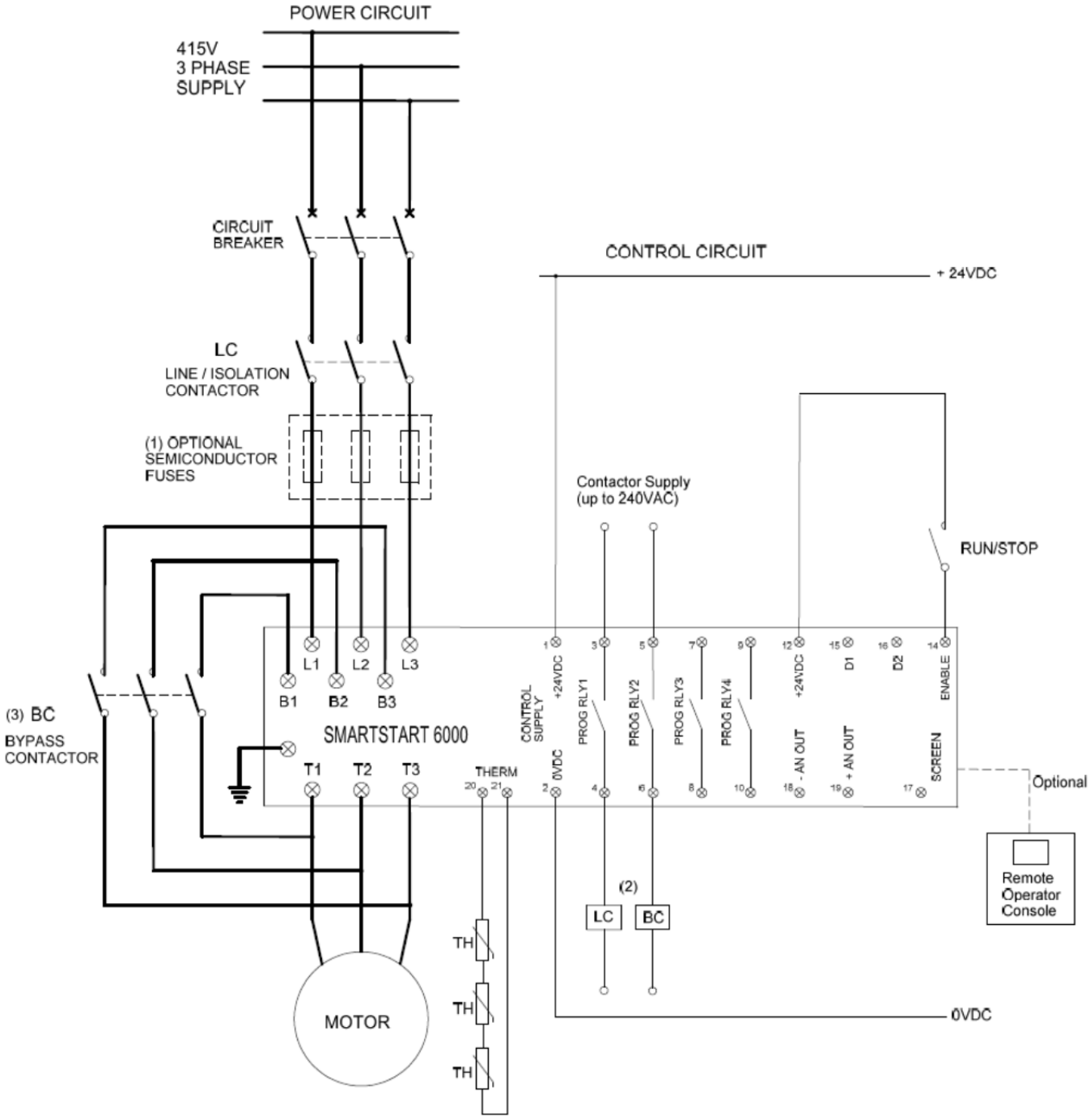
7. Suggested Protection Settings

Below are suggested settings to provide additional protection of the motor and load. These are general settings and should be further tuned to suit the application and load conditions.

Ref	Page	Parameter	Setting (factory Default)
P01	23	Motor Overload	Class 10a/10/20 (10)
P02	23	Motor O/Temp	Thermistor (Disabled)
P03	23	Phase Rotation	1-2-3 (Disabled)
P10	23	Accel O/Time	Trip / 5s (Disabled)
P20	24	Volt Imbal.	Trip / 25% / 5s (Default)
P30	24	Current Imbal.	Trip / 25% / 10s (Default)
P41	24	Under Current	Trip / 50% / 10s (Disabled)
P70	25	Over Torque	Trip / 110% / 10 s (Disabled)

Appendix B
Application Diagrams

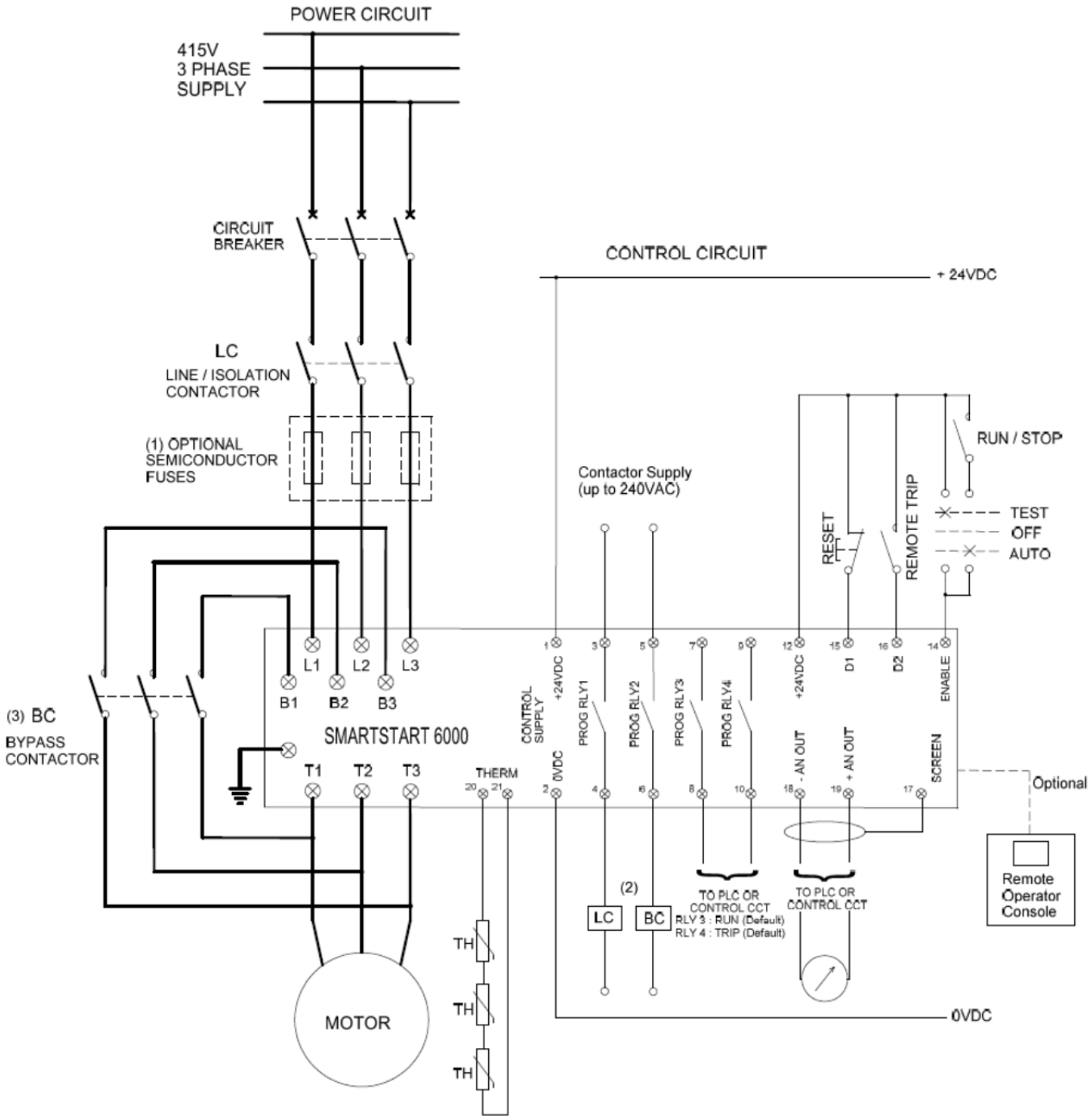
General Purpose :



(1) Optional Fast Acting Semiconductor Fuses selected to suit SCR Devices used.
(2) Relay Contacts are rated for 5A 240VAC/30VDC inductive. An intemediate 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

Appendix B
Application Diagrams

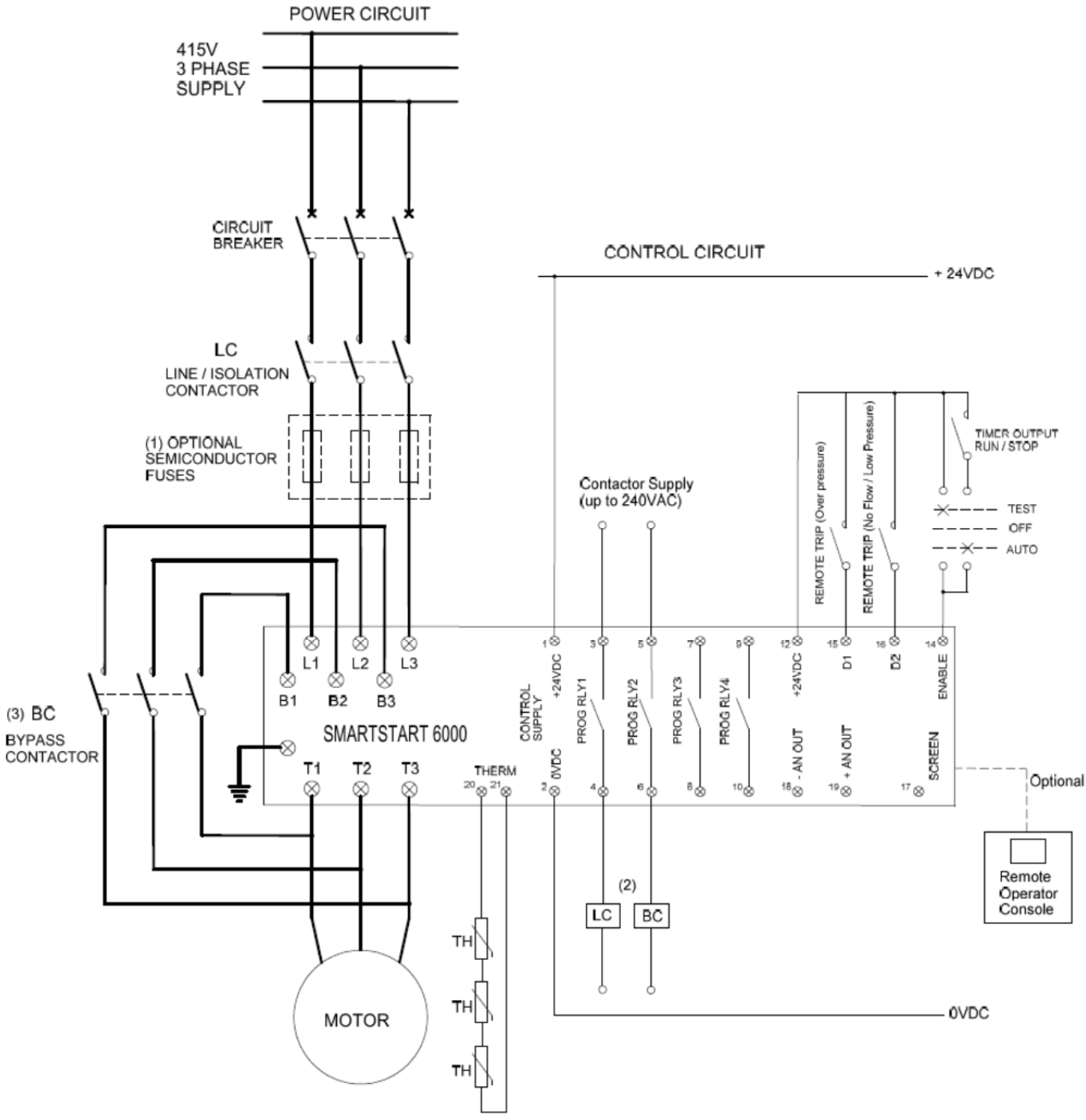
Typical Water & Sewerage Pumping :



(1) Optional Fast Acting Semiconductor Fuses selected to suit SCR Devices used.
(2) Relay Contacts are rated for 5A 240VAC/30VDC inductive. An intemediate 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

Appendix B
Application Diagrams

Irrigation Pump :



(1) Optional Fast Acting Semiconductor Fuses selected to suit SCR Devices used.
(2) Relay Contacts are rated for 5A 240VAC/30VDC inductive. An intemediate 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

Appendix C
Remote Console

Description:
The remote console kit provides the user remote access to perform the following:

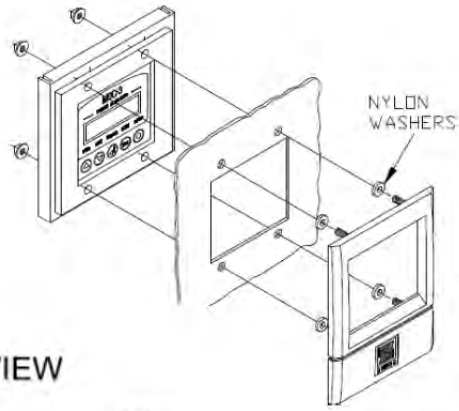
- Scroll and display the 'Dashboard' Variables, a display of the following;
  Operating status, Motor Amps (3), Supply Voltage (3), Power, Torque, Current imbalance, Voltage imbalance, Trip, kWhrs, Run Hrs, No. of starts, No. of trips.
- Program any user configurable parameter.
- Reset a trip
- Use the diagnostic menu and display I/O status.

Note: There is a 30 second delay between using the local or remote operator panels.

Specification:

IP Rating:	IP66 (when installed as per instructions)
Panel Thickness	1.2 to 5 mm
Cable Type:	Cat-5
Maximum Cable length:	30m (unscreened)
Standard cable lengths:	1m, 2m, 3m, 5m

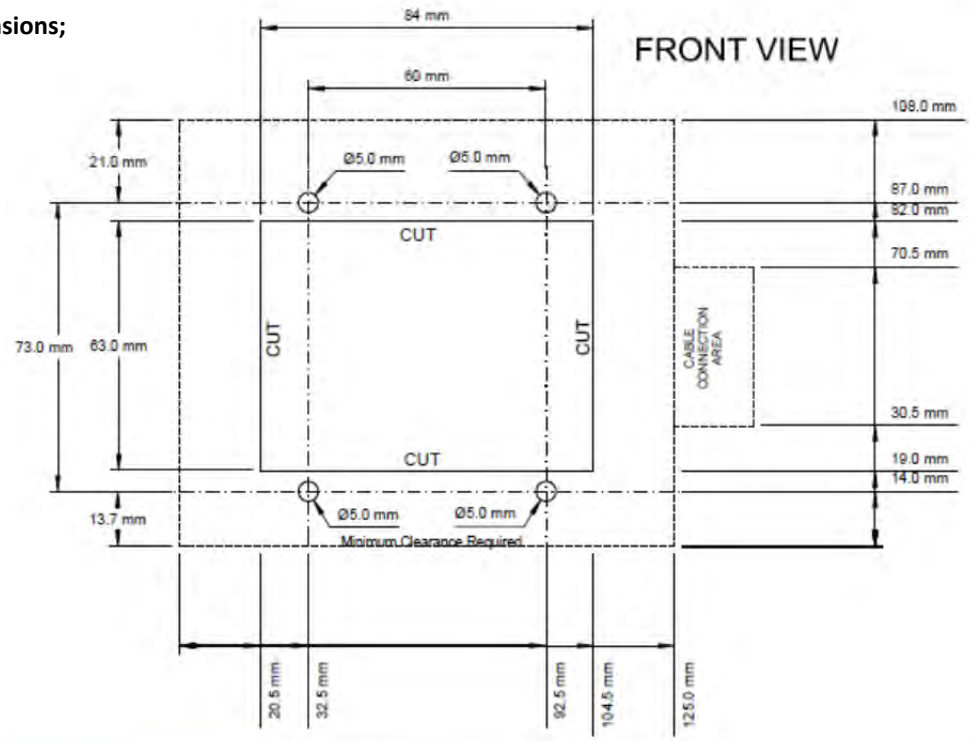
Installation:
The kit contains the remote console assembly and a plug-in module board to provide connection at the Smartstart® 6000. The plug in module provides a socket for the remote console as shown.



Remote Console Mounting:
Mark up you panel using the dimensions below. Ensure there is sufficient space to connect the cable(s).

1. Cut out the panel
2. Install as shown. Ensure the display modules has the black rubber seal fitted to ensure an IP66 rating is achieved.
3. Connect the connecting cable (Cat-5) to the module and the SMARTSTART 6000.

Cut-out Dimensions;



Appendix D
Data Logger Option Board

Description:

- The Data Logger Option Card provides a SD Card slot to record the soft starter's parameters and operating data.
    1. Operating data is logged at the following rates:
        i) A rate of 1/10second during acceleration and Deceleration.
        ii) Every 10 seconds during running.
        iii) Every 10seconds when in idle mode. ie. control supply 'ON' but starter not running
    2. The Soft Starter parameters are logged onto the data card when the unit is powered and if any parameters are changed.

- The data is stored as a text file (.txt) on to the SD card inserted. The SD card should not be removed while running or a short period after as recent data may be lost.

- The data may be read using 'Notepad' or other application capable of reading text files or use of a custom designed application to extract and report the data required. Included is a simple application that extracts and reports basic operating variables.

Compatibility:
SMARTSTART 6000 firmware revision 0.96X or later is required.

SD Cards Accepted:
Standard SD Card; 1G, 2G

Micro SD Card with Adapter

If the SD card has a write protect tab ensure it is not in the lock position.

Operation:

- With the control power to the soft starter off. Insert the SD card.

- Power up the control circuit. The Data Logger is now operational.
  The soft starter will create 2 files onto the data card:
  i) .txt file 'config.txt' , which logs the Baud Rate and Data Format.
  ii) .txt file. This is where the data will be stored. A new text file will be created each time the control supply is cycled or can save data to the one text file. (see over page on instructions on how to modify this)

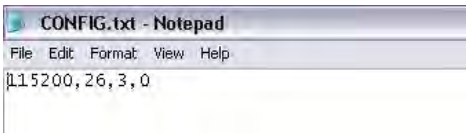
- The text file may be deleted on a computer at any stage, and a new file will be created.

- The text files may be removed, copied and/or sent via email to Zener for analysis should a problem exist.

Appendix D
Data Logger Option Board

Modifying the config.txt file:

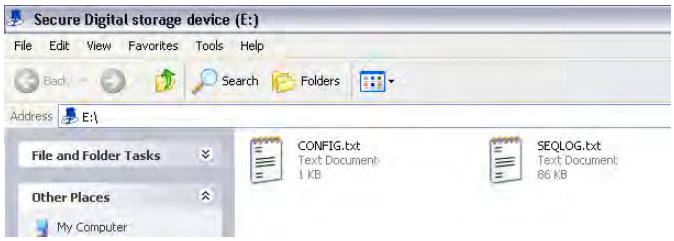
To change the logging behavior write over the last digit and save the changes.



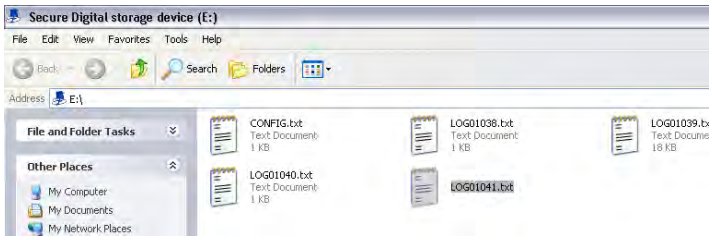
This last digit sets the logging behavior as follows:

0 = Creates a new data file when power is cycled
1 = Saves data is same file 'SEQLOG.txt'

= 1 ; Single storage TXT File



= 0 ; Multiple storage TXT Files



Installation:

1. Remove the top cover. There are 4x hex type screws holding the top cover in place.

2. The Option Board plugs into the control board into the socket marked 'OPTION' located on the right hand side of the control Board.

3. There are 2 nylon spacers and 4x 2.5mm screws supplied to secure the option card in place. The Control Board will need to be carefully removed to access the underside to fit the nylon spacers.

4. Carefully cut out the label marked 'SD Card'.

5. Return the control board ensuring all connectors/plugs are secure and screws in place. An insulation piece should be positioned over the gate leads (3x connectors located at the top end of the control board).

Menu Map / Set up Record Sheet

DESIGNATOR: _____

Software Revision: _____

Main menu	Sub menu Level 1	Sub menu Level 2	Default	Setting
1 Display	D01 Menu Access		Setup	
	D02 Default Screen		Overview	
	D03 Bargraph Var.		Mtr Current	
	D04 Bargraph FS		300%	
	D05 Warning Alarms		All Alarms	
	D06 Alarm over bar		All Alarms	
2 Motor	M01 Motor Amps		Unit Rating	
	M02 Motor Volts		415V	
	M03 Motor PF		0.9	
	M04 Motor Wiring		3 Wire	
3 Control	C01 Run mode		Bypass	
	C02 Current Limit		450%	
	C10 Accel Ramp	C11 Accel Time	10	
		C12 Start Torque	30%	
		C13 Final Torque	100%	
	C20 Decel Ramp	C21 Decel Time	0	
		C22 Release Torque	2%	
4 Protection	P01 Mtr Overload		Class 10	
	P02 Mtr Over Temp		Disabled	
	P03 Ph Rotation		Ignore	
	P10 Acc OverTime	P11 Overtime Alarm	Off	
		P12 OverTime Delay	120s	
	P20 Volt Imbal Alarm	P21 Volt Imbal Alarm	trip	
		P22 Volt Imbal Level	25%	
		P23 Volt Imbal Delay	5s	
	P30 Curr Imbal Alarm	P31 Curr Imbal Alarm	trip	
		P32 Curr Imbal Level	25%	
		P33 Curr Imbal Delay	10	
	P40 Undercurrent Alarm	P41 Undercurrent Alarm	off	
		P42 Undercurrent Level	10%	
		P43 Undercurrent Delay	10s	
	P50 Overcurrent Alarm	P51 Overcurrent Alarm	off	
		P52 Overcurrent Level	100%	
		P53 Overcurrent Delay	10s	
	P60 Under Torque Alarm	P61 Under Torque Alarm	off	
		P62 Under Torque Level	10%	
		P63 Under Torque Delay	10	
	P70 Over Torque Alarm	P71 Over Torque Alarm	off	
		P72 Over Torque Level	100%	
		P73 Over Torque Delay	10s	
Reset Restarts	R01 Manual Reset		Disabled	
	R02 Power Reset		Enabled	
	R03 Start Reset		Disabled	
	R10 Auto Restarts		Disabled	
		R11 AR Attempts	0	
		R12 AR Min Delay	-	
		R13 AR Clr time	-	

Menu Map / Set up Record Sheet

DESIGNATOR: _____

Software Revision: _____

Main menu	Sub menu Level 1	Sub menu Level 2	Default	Setting
6 Inputs	X10 DigIn 1 Mode		Enable	
		X11 DigIn 1 Variable	Reset	
		X12 DigIn 1 Delay	3.0s	
	X20 DigIn 2 Mode		Disable	
		X21 DigIn 2 Variable	-	
		X22 DigIn 2 Delay	-	
7 Outputs	Y10 Relay 1 Mode		Enable	
		Y11 Relay 1 Variable	Line Ctl	
	Y20 Relay 2 Mode		Enable	
		Y21 Relay 2 Variable	Bypass Ctl	
	Y30 Relay 3 Mode		Enable	
		Y31 Relay 3 Variable	Motor On	
	Y40 Relay 4 Mode		Enable	
		Y31 Relay 4 Variable	Trip	
	Y50 An Out 1 Mode		Disabled	
		Y51 An Out 1 Variable	Current	
		Y52 An Out 1 FS	200%	
8 Networks	N01 Net Protocol		Disable	
	N02 Net Control		Disable	
	N03 Net Timeout		2.0	
	N10 RS485 Addr		0	
	N11 RS485 Speed		19k2	
	N20 IP Address	N21	0	
		N22	0	
		N23	0	
		N24	0	
	N25 IP Mask		/24	
9 Advanced	A10 Kick Start	A11 Kick Time	0.0s	
		A12 Kick Level	70%	
	A20 Accel Method	A21 Accel Profile	Square	
		A22 Accel Control	Torque	
	A30 Decel Method	A31 Decel profile	Linear	
		A32 Decel Control	Torque	
	A41 Motor OL Reset		75%	
	A42 Str OT Reset		60DegC	
	A43 Warning Level		90%	
	A44 Warning Delay		50%	
	A51 Motor Stator		3.0%	
	A52 Min Off Time		0.0	
	A53 Start Logic		Level sense	