

 ***SAFTRONICS***



Saftronics SH6 Manual

PUBLICATION : PUB2-550-SH1

EFFECTIVE : JULY 2003

SH6 - HEATER SERIES

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1. DESCRIPTION

1.1 FEATURES

Saftronics Heater Controller SH6 series are solid state, variable voltage controllers for three phase resistance or primary transformer controller banks.

They provide 2 methods of controlling:

- A. VOLTAGE RAMP MODE
- B. VARIABLE VOLTAGE CONTROL

Each controller contains 6 x SCR's in the power circuit. The power circuit is controlled by means of a Saftronics PC550 series control card.

Saftronics solid-state controllers are constructed in a manner, which permits rapid removal, and replacement of PC boards, SCR's, control fuses, etc. This ensures minimum downtime in the unlikely event of failure of one of these devices.

In the case of loss, or insufficient cooling air resulting in overheating of the heat sink, a thermal switch will open and shut down the controller thereby protecting the SCR's from excessive heating.

1.2 CONFIGURATION

The SH6 range of heater controllers covers power ratings from 69Kw to 730Kw with 380V or 525V supplies as standard. Larger powers and different voltages are available on request.

TABLE 1.1 380v SH6 SERIES

TYPE	LOAD POWER (380 V)	LOAD POWER (525 V)	(NOMINAL) LINE VOLTAGE	LOAD CURRENT	SIZE
SH6 – 100	69 kW	90 kW	380V / 525V	100 Amps	B
SH6 – 150	100 kW	135 kW	380V / 525V	150 Amps	B
SH6 – 200	130 kW	180 kW	380V / 525V	200 Amps	B
SH6 – 300	200 kW	275 kW	380V / 525V	300 Amps	C
SH6 – 400	260 kW	360 kW	380V / 525V	400 Amps	D
SH6 – 600	400 kW	550 kW	380V / 525V	600 Amps	E
SH6 - 800	525 KW	730 KW	380V / 525V	800 Amps	E

The SH6 range of heater controllers come in three configurations.

1.2.1 **KIT FORM (CHASSIS)** for mounting into a customer's enclosure.

This consists of thyristor stack and PC550 control card only.

1.2.2 **KIT FORM (ENCLOSED)** for mounting between an existing MCC and ELEMENTS.

This consists of thyristor stack and PC550 control card in an IP23 enclosure.

1.2.3 **STANDARD FORM**

This is a complete heater controller consisting of; thyristor stack, PC550 control card, isolator, high speed fuses, potentiometer and stop/start pushbuttons in an IP23 enclosure.

1.2.4 **OPTIONAL FEATURES**

- 1 Multi motor starting
- 2 Line disconnect
- 3 Line fuses
- 4 Isolating contactor
- 5 Start / Stop pushbuttons
- 6 Bypass contactor

1.3 **TECHNICAL DATA**

1.3.1 SH6 INPUT DATA

NOTE: The stack input voltage and the control circuit supply must be synchronised i.e. R to R, S to S, T to T!!

STACK INPUT:

Voltage Type	-	3 Phase Input
SCR Voltage Rating	-	2,5 x line-line AC Voltage (min)
Type SH6-XX-3	-	420V Max Continuous RMS voltage
Type SH6-XX-5	-	580V Max Continuous RMS Voltage
Line Frequency	-	50Hz \pm 2Hz

PC550 CONTROL SUPPLY

Voltage Type	-	3 Phase Input Selectable 380/525V
Link at 380V Position	-	340v - 420v
Link at 525V Position	-	470v - 580v
Line Current	-	Less that 25mA
Line Frequency	-	50Hz \pm 2Hz

FAN SUPPLY

Type SH6 -100 to SH6-800	-	AC220V, 50Hz, 0,5A
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1.3.2 SH6 OUTPUT DATA

Unless otherwise specified, the currents listed below are maximum at a maximum ambient temp of 40 Deg°C and at an altitude of 1500m max.

OUTPUT CURRENT

Type SH6 - 100	-	100 A Max. Cont. Current
----------------	---	--------------------------

Type SH6 - 150	-	150A Max. Cont. Current
Type SH6 - 200	-	200A Max. Cont. Current
Type SH6 - 300	-	300A Max. Cont. Current
Type SH6 - 400	-	400A Max. Cont. Current
Type SH6 - 600	-	600A Max. Cont. Current
Type SH6 - 800	-	800A Max. Cont. Current

OVER CURRENT

Amount - 110% (Max Continuous Current) Max

Different ratings available on request.

DERATING

At higher temperature than 40 Deg. C. - 1.5% per 1 Deg.C.
At higher altitude than 1500m - 1% per 100m

1.4 PROTECTIVE MEASURES

In order to ensure high system reliability protective measures have been taken which protect both the controller and the load.

<p><u>NOTE:</u> For complete protection of the SH6 heater controller high speed input fuses must be installed.</p>

1.4.1 DRIVE PROTECTION MEASURES

PHASE ROTATION - In order to prevent misfiring in the case of swapped phases, a phase rotation sensing circuit has been installed. If phases are swapped, start up is inhibited and the PHASE LED extinguishes.

THERMAL CUT-OUT - A thermal cut-out element is mounted near the power devices. This element is a normally closed contact, which opens at approximately 80 degrees. In order to protect the drive, should the temperature rise, the element must be connected in the stop circuit of the drive.

dv/dt SUPPRESSION - The power devices have been suppressed by means of an RC network to ensure that their dv/dt ratio is not exceeded.

LINE IMPEDANCE - For increased protection against noise and overvoltages as well as for short circuit protection it is recommended that AC line reactors are used. Consult Safronics in this regards.

ISOLATION - The control circuits are electrically isolated from the power circuits.

1.5 INDICATORS

There are 4 LED indicators on the PC550/7 control card.

- | | | |
|-------------------|---|--|
| PHASE ROT- | | If the drive is correctly phased with the incoming supply the PHASE LED will be lit. |
| +12V | - | If the power supplies on the PC550/7 control card are healthy the +V LED will be lit. |
| RUN | - | When the drive is started the RUN LED will light. The RUN LED is extinguished when the drive is stopped. |
| BYPASS | - | When the Bypass Timer has been selected, the BYPASS LED will be lit. |

2. MECHANICAL LAYOUT AND MOUNTING

2.1 UNIT DIMENSIONS

The complete range of SH6 soft starters are divided into 4 physical sizes. Namely Size B,C,D and E.

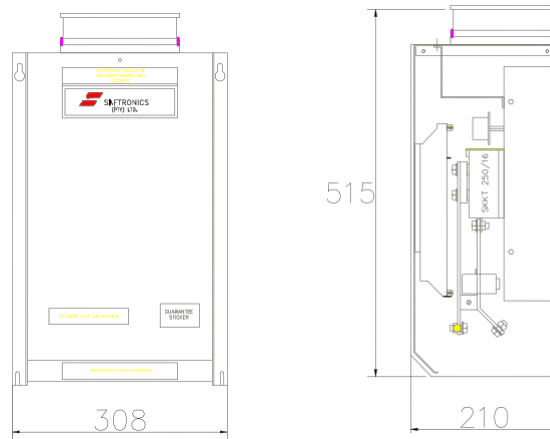


FIG 2.1 - SH6 SERIES - SIZE B OVERALL DIMENSIONS

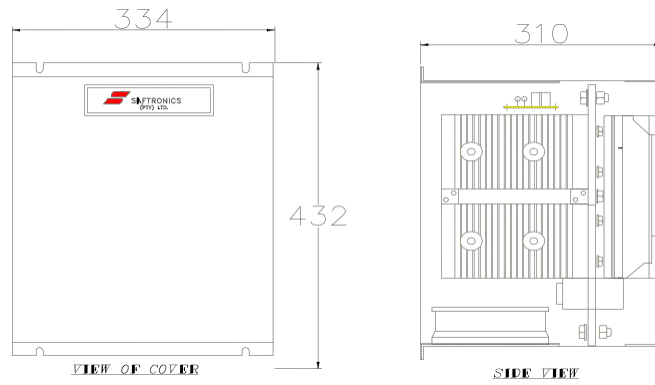


FIG 2.2 - SH6 SERIES - SIZE C OVERALL DIMENSIONS

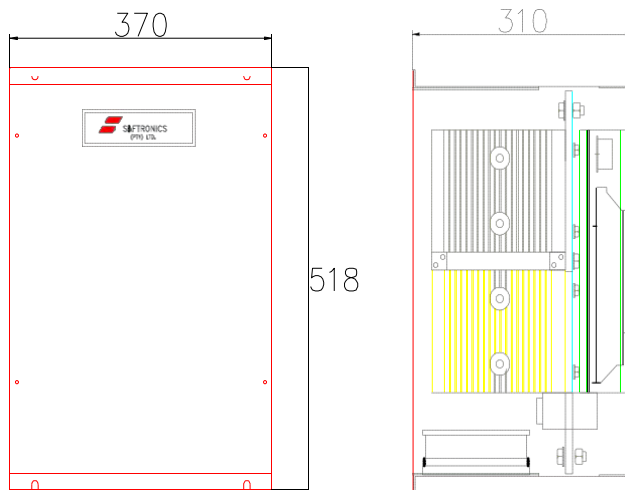
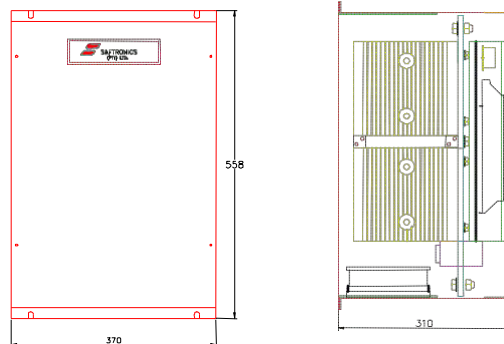


FIG 2.3 - SH6 SERIES - SIZE D OVERALL DIMENSIONS**FIG 2.4 - SH6 SERIES - SIZE E OVERALL DIMENSIONS**

2.2 ACCESS

The SH6 is designed to allow easy access to major components for easy maintenance.

WARNING: The unit contains non-insulated HIGH VOLTAGE points. MAKE SURE that all the power inputs are isolated before trying to access any internal point !!

NOTE: It is NOT recommended that the unit is customer serviced unless there is skilled and well trained personnel that can do the job.

2.2.1 ACCESSIBILITY – SIZE B.C.D and E.

Remove the PC550 Control Card by unscrewing the 4 screws (1) as indicated in Fig. 2.5.

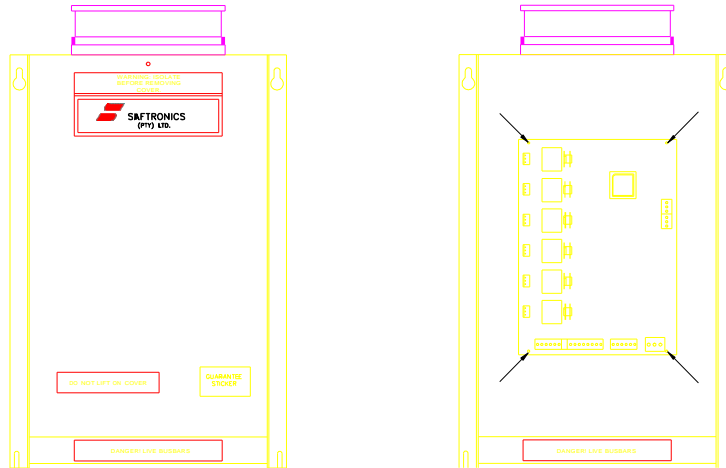


FIG 2.5

2.3 COOLING

NOTE: All SH6 specifications are subject to proper cooling! The following cooling requirements **MUST** be met to ensure proper operation and high reliability.

2.3.1 POSITION

All SH6 drives are to be mounted vertically. Any other rotation will impede the cooling of the drive.

2.3.2 FREE AIR

The SH6 heater controller must be provided with a free air supply, i.e.

- a) Mount the unit in a ventilated space of at least ten cubic meters! If this space is unavailable see Sect. 2.3.3 (mounting in an enclosure).
- b) 100mm of uninterrupted air above and below the drive must be left to ensure adequate cooling.

3. CONNECTIONS

Figures 3.1 to 3.4 show the physical positions of the control and power connections for the SH6 range of soft starters.

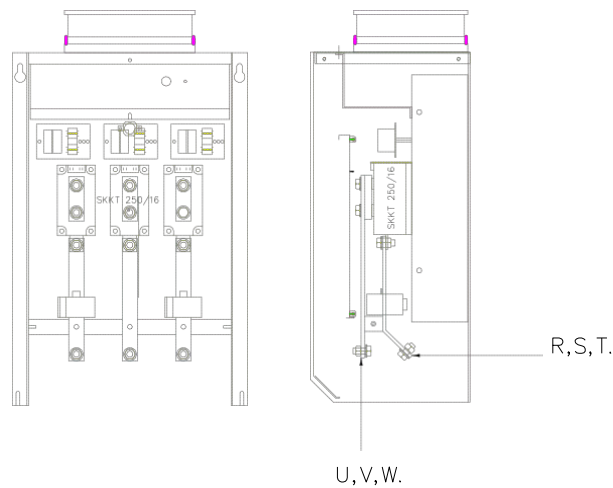


FIG 3.1 - SIZE B CONNECTION LAYOUT

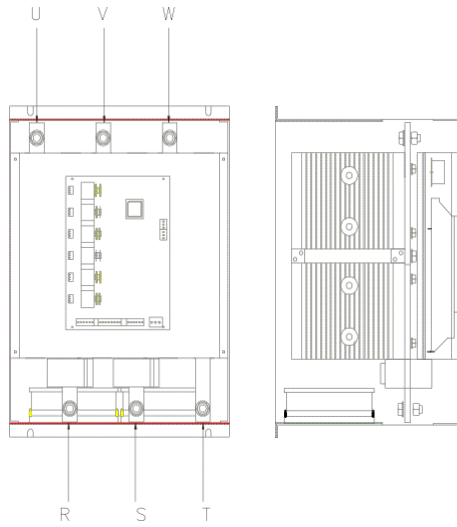


FIG 3.2 - SIZE C CONNECTION LAYOUT

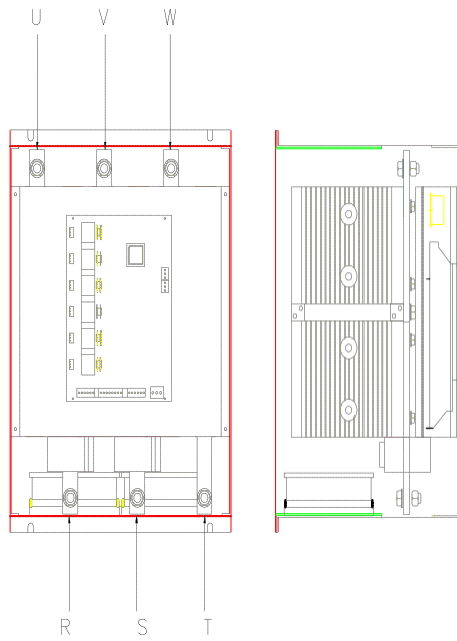


FIG 3.3 - SIZE D CONNECTION LAYOUT

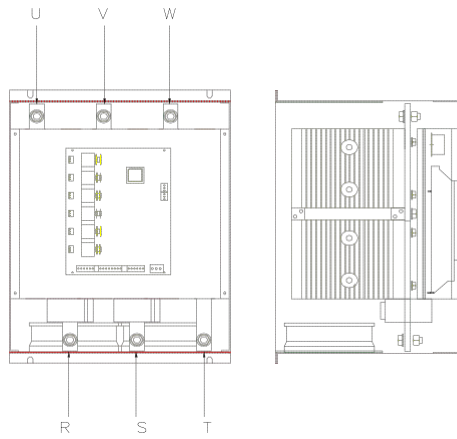


FIG 3.4 - SIZE E CONNECTION LAYOUT

3.1 PC550 CONTROL TERMINALS

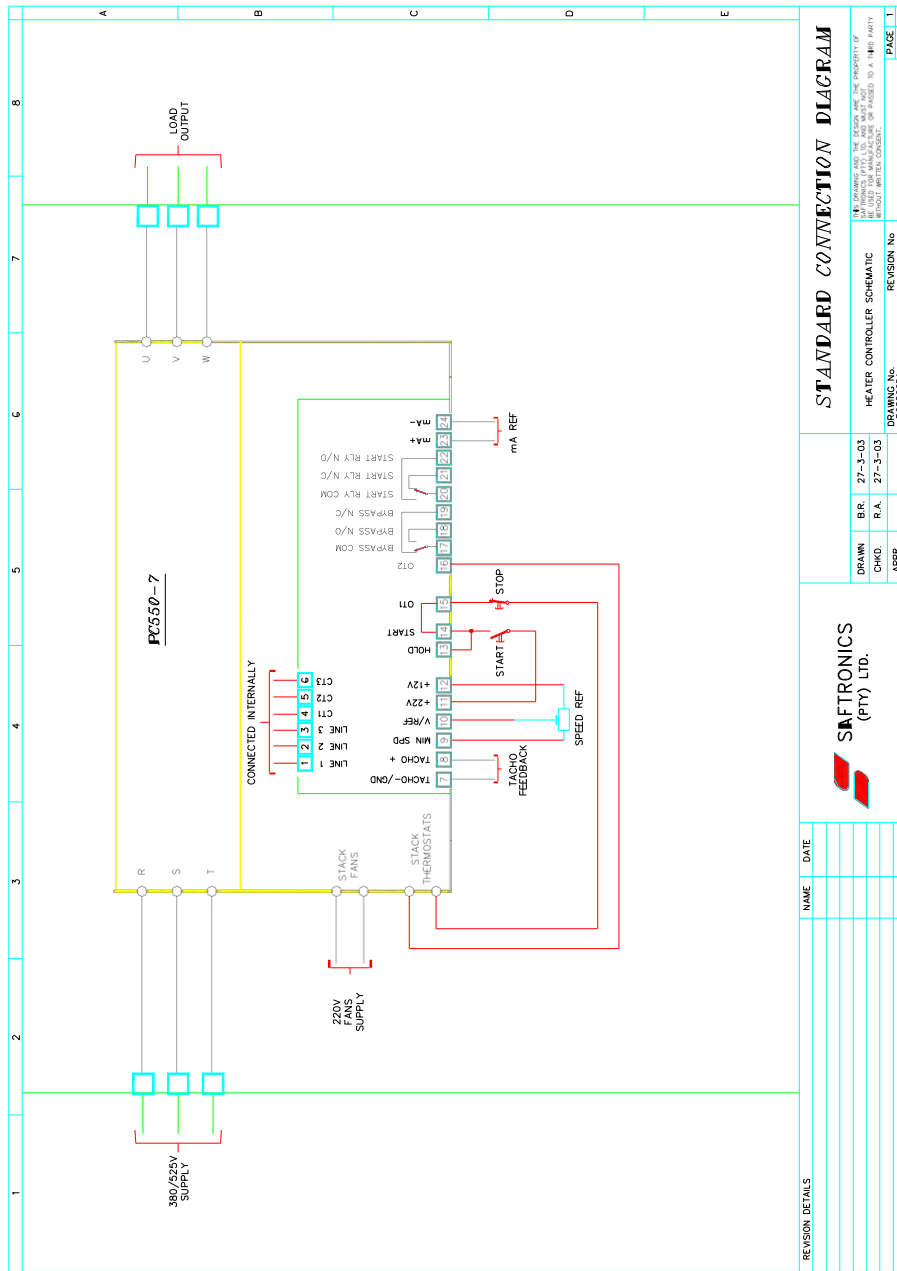


FIG 3.5 - PC550 CONTROL TERMINALS

T1	-	L1,L2,L3	The 3 phase supply to the PC550/7 control card. Care must be taken since the rotation order of the phases is critical. (Internal connection).
T2	-	CT1,CT2,CT3	CT connections used for current control. (OPTIONAL).
		GND	Tacho Negative – (Ground)
T3	-	F/B	Tacho Feedback Positive +
		MIN SPD	Potentiometer Negative, 0 volt
		VOLT REF	Potentiometer Wiper, control Voltage
		+22V	Positive Card voltage
T4	-	+12V	Potentiometer Positive, 12 Volt
		HOLD	Starting Latch
		STRT	Start input
		OT1	Over Temperature 1
T5	-	OT2	Over Temperature 2
		RL2 COM	Relay 2 Common
		RL2 N/O	Relay 2 Normally Open Contact
T6	-	RL2 N/C	Relay 2 Normally Closed Contact
		RL3 COM	Relay 3 Common
		RL3 N/C	Relay 3 Normally Closed Contact
T7	-	RL3 N/O	Relay 3 Normally Open Contact
		mA+	Current analogue reference input Positive +
		mA-	Analogue current reference input Negative–

3.2 FUSE RATINGS

3.2.1 CONTROL FUSES

The 3 phase supply to the PC550 control card is fused by means of three 2A slow-blow fuses. They are mounted separately from the PC550 control card. Control supply fuses for drives up to the SH6-30 are not supplied as standard.

3.2.2 MAIN FUSES

For complete protection it is recommended that the system be protected by means of 3 high speed fuses connected to the input terminals R,S and T.

The following table summarises the recommended value.

TYPE	FUSE RATING
SH6-100	125 AMP, 660V
SH6-150	200 AMP, 660V
SH6-200	250 AMP, 660V
SH6-300	315 AMP, 660V
SH6-400	400 AMP, 660V
SH6-600	630 AMP, 660V
SH6-800	800 AMP, 660V

TABLE 3.1 - AC FUSE RATINGS

3.3 POWER CONNECTIONS

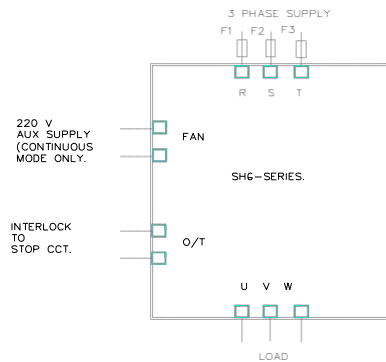


FIG 3.6 - SH6 POWER CONNECTIONS

Figure 3.6 shows a typical power connection diagram. The input terminals R,S and T are supplied with a 3 phase, fused supply.

The load is connected to U, V and W.
The FAN input requires a 220V aux supply to be connected to ensure adequate cooling of the stack. Failure to connect a FAN supply can cause damage to the drive.

The O/T output is on overtemperature interlock, which must be wired in series with the STOP circuit.

4. **START UP INSTRUCTIONS AND CALIBRATION PROCEDURE**
Don't apply power to the system yet!!!

NOTE: Before continuing with this procedure make sure that the connections are in accordance to an approved system diagram

4.1 **SYSTEM SET UP PRIOR TO OPERATION**

4.1.1 SH6-100-X THROUGH SH6-800-X

Check that the switches and potentiometers on the PC550/7 series control card are set as given in Table 4.1 for the specific heater controller.

SWITCHES	POSITION	
SW1 Control Reference	SW1-1 ON –2 OFF	0-10Vdc input
	SW1-1 OFF –2 ON	4-20mA input
SW2 Burden Resistor Selector	ON	4,7 Ohms
	ON	10 Ohms
SW3 Burden Resistor Selector Switches	ON	33 Ohms
	ON	56 Ohms
	ON	100 Ohms
SW4 Soft Starter/ Phase controller Select	BOTH ON	Phase control
	1 ON 2 OFF	Soft Starter
SW5 Bypass Activate Relay	BOTH ON	Activated
	BOTH OFF	Deactivated

POTENTIOMETERS	POSITION	
	SH6-100 THRU -800	
PHV	380v CCW	525v CW
BYP/TIME	MID RANGE	
BIAS	FACTORY SET	
MAX SPD	FULLY CCW	
SPD STAB	FULLY CCW	
GAIN	FACTORY SET	
DECEL	FULLY CW	
ACCEL	FULLY CW	
CURR STAB	MID RANGE	
MIN SPD	FULLY CCW	
TORQ	FULLY CCW	
MAX CURR	FULLY CCW	

TABLE 4.1 - CONFIGURATION SETUP

4.2 START UP PROCEDURE

Before turning on power to the drive confirm that the voltage rating of the drive is the same as that of the 3 phase input supply.

SH6-XX-3 - 380V SUPPLY
 SH6-XX-5 - 525V SUPPLY

Check the LK1 on PC550 is set to the correct input voltage.

If there are any problems during start up refer to Section 5 - Trouble Shooting, for assistance.

4.2.1 SH6-100-X THROUGH SH6-800-X

This range of heater elements use the current control method. Two current transformers are used to provide current feedback to the PC550 control card. The burden resistor DIP Switches on the PC550/7 card is selected so that the current drawn by the load can be limited to a max of 100% of FLC. See Table 4.1 - Current Burdens. (Value 1 must be in parallel with Value 2).

	DIP SWITCH SETTINGS	
	VALUE 1	VALUE 2
SH6-100	100?/5W DIP SWITCH 1	
SH6-150	56?/5W DIP SWITCH 2	
SH6-200	100?/5W DIP SWITCH 1	56?/5W DIP SWITCH 2
SH6-300	56?/5W DIPSWITCH 2	33?/5W DIP SWITCH 3
SH6-400	10?/5W DIP SWITCH 4	
SH6-600	4.7?/5W DIP SWITCH 5	
SH6-800	4.7?/5W DIP SWITCH 5	10?/5W DIP SWITCH 4

TABLE 4.1 – DIP SWITCH CURRENT BURDEN

The drive will ramp up under current control. The current limit is set to limit the max current drawn by the load.

- Check DIP Switch selected is installed and is the correct value. Note failure to do this can result in damage to the controller.
- Set REF INP to ZERO
- Apply power to the drive.
- Check POWER ON LED and PHASE ROT LED on PC550 are ON.
- Press start button.
- Check RUN LED on PC550 is on.
- Check that the drive can be stopped by pressing the stop button.
- Check RUN LED on PC550 will extinguish.
- Restart the drive.
- Slowly increase REF INP (Max 10V).
- Adjust ACCEL pot to give desired ramp time.
- Measure the current drawn by the load with a clip on ammeter.
- Adjust MAX CURR pot clockwise until the desired current limit setting is reached.
- Check that the elements are drawing desired current once acceleration is complete and there is a 10VDC reference.
- The controller is now set for operation.

5. TROUBLE SHOOTING

The Safronics SH6 range of Heater Controllers are thoroughly checked mechanically and electrically before leaving the factory. Therefore, if the system is correctly connected and the start up procedures are carefully followed there should be no problems.

However, if something goes wrong and the system is not operating as expected consult our Service Technicians or our Application Engineers.

5.1 The following table is a summary of the power devices, fuses and transformers used in the SH6 range. It is recommended that these components be held in stock to enable on site repairs.

SERIAL NO:	DESCRIPTION	QTY	APPLICABLE
	PCB		
1	PC 550 CONTROL CARD	1	ALL UNITS
	DEVICES 1600 V		
2		3	SH6-100 TO -300
3		3	SH6-400 TO -600
	TRANSFORMERS		
4	CURRENT TX	2	SH6-100 UPWARDS
	CONTROL FUSES		
5	2 AMP, 660 V	10	SH6-100 UPWARDS
	MAIN FUSES		
6	125 AMP, 660V	3	SH6-100
7	200 AMP, 660V	3	SH6-150
8	250 AMP, 660V	3	SH6-200
9	315 AMP, 660V	3	SH6-300
10	400 AMP, 660V	3	SH6-400
11	630 AMP, 660V	3	SH6-600
12	800 AMP, 660V	3	SH6-800

TABLE 5.1 - RECOMMENDED SPARES

5.2 TROUBLE SHOOTING TABLE

The following table is a basic trouble shooting table intended to assist fault find during installation. It does not pretend to and cannot cover every possibility. This is beyond the scope of this manual.

When you go through the trouble shooting table, bear in mind that it is arranged as much as possible in a logical order.

TROUBLE SHOOTING

CONDITIONS AND SYMPTOMS	POSSIBLE REASON	PROPOSED CHECKS	PROBLEM ELIMINATION
- POWER ON - POWER ON LED ON PC550 NOT LIT	THERE IS NO AC POWER ON TERMINALS R, S & T	MEASURE INCOMING VOLTAGES	CHECK EXTERNAL WIRING AND FUSES
	BLOWN F1, F2 OR F3 OR BLOWN F4, F5 OR F6	ISOLATE DRIVE, CHECK THE FUSES	REPLACE THE FUSES
	FAULTY PC550 CARD		REPLACE THE CONTROL CARD
- POWER ON - PHASE ROT LED ON PC550 NOT LIT	INCORRECT PHASE ROTATION OF R, S & T ON TERMINALS R, S & T	CHECK PHASE ROTATION	SWOP ANY TWO INCOMING R, S, T PHASES
- START IS PRESSED RUN LED NOT LIT	FAULTY PUSHBUTTON	CHECK P/B	REPLACE P/B
	STACK O/TEMP OR EXT. INTERLOCKS IN STOP CCT ARE OPEN CCT	CHECK INTERLOCKS	WAIT FOR STACK TO COOL OR RESET EXT INTERLOCKS
	FAULTY PC550	CHECK FOR 24VDC BETWEEN TERMINALS 14 AND 7 ON PC550	REPLACE PC550
		CHECK VALUE OF BURDEN DIP SWITCH SELECTION WITH TABLE 4.1	USE CORRECT DIP SWITCH WITH CORRECTLY RATED VALUE
- DRIVE STOPS DURING ACCEL	OVERLOAD RELAY HAS TRIPPED	CHECK SETTING AND RATING OF O/LOAD	RESET O/LOAD OR REPLACE WITH CORRECT RATING.
	MAIN FUSES HAVE TRIPPED	CHECK FUSE RATING AND CONTINUITY	TURN MAX CURR POT CW TO DESIRED CURR LIMIT
	EXTERNAL START COMMAND MISSING	CHECK START SIGNAL	RECTIFT START SIGNAL CCT



Other Products offered By Saftronics:

Saftronics Drives

LV/ MV Frequency Inverters
LV/MV Soft Starters
DC Drives
Induction and LED Lighting
Semiconductors (IGBT's, Thyristors)
Strato Starters for slip ring motors
Crane Drives
Heater Control
Transducers ATS/DTS
Load Monitors
Tachos and Encoders
Trailing Cable Tester
AC Motor Combo

Saftronics Power

Containerised DC Rectifiers
Copper Busbar Systems
IGBT Rectifiers

Saftronics Transformers

Distribution and Power Transformers

Saftronics Energy

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Static VAR compensators
PFC Correction

Saftronics Induction Heating

Induction Heating
Induction Melting

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