570 SERIES THREE PHASE CONVERTORS

PRODUCT MANUAL

HA056929

Issue 1

WARNING

NEVER WORK ON THE CONTROLLER, MOTOR,
OR AUXILIARY EQUIPMENT WITHOUT FIRST
ISOLATING ALL SUPPLIES TO THE SYSTEM.

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1 INTRODUCTION

All members of the 570 Series of armature controllers accept standard three phase supply voltages in the range 110 to 480 Volts A.C. and provide controlled D.C. output voltages and currents suitable for powering D.C. shunt field and permanent magnet motors.

Control of the 570 series is implemented by means of a 16 Bit Microcontroller which provides several advanced features:-

a) Complex control algorithms not achievable by simple analogue circuitry.

b) Software configurable control circuitry built around standard software blocks.

c) Communication via a serial link with other drives or a host computer for advanced process system realisation.

The motor armature controllers include both regenerative and non-regenerative models.

Non-regenerative controllers consist of a fully-controlled Thyristor bridge with full transient and overload protection, together with its associated electronic control circuitry, and provide accurate speed and/or torque control in one direction of rotation.

Regenerative controllers consist of two fully-controlled, Thyristor bridges together with a sophisticated electronic control of acceleration and deceleration, speed and torque in both directions of rotation.

All models of armature controller offer a fixed D.C. supply for field excitation. Some applications, however, require an extended speed or constant horsepower range of control. For these applications the 570 series includes a field current regulator option. This consists of a half-controlled single phase Thyristor bridge with transient and overload protection, together with it's associated electronic control circuitry.

In all members of the 570 series, the control circuitry is totally isolated from the power circuitry, thus simplifying the interconnection of controllers within a system and improving operator safety. The control circuitry adjusts automatically to accept supply frequencies in the range 45-65 Hz and possesses high immunity to supply borne interference. The armature controllers are phase rotation insensitive.

All units of the range are designed for simple and economical panel mounting using keyhole slots. If it is necessary to remove the controller from the panel, disconnection and reconnection is simplified by plug-in control connectors.

Standardisation of parts wherever possible throughout the range reduces the variety of spare parts required to maintain a multi-drive system. For example, the same basic control and power supply PCB's are used in all types of three phase armature controller regardless of horsepower or bridge configuration.

Start-up and locating of faults (both within the controller and external to it) are greatly assisted by the built-in two line alpha-numeric display which automatically displays the first fault. The display also provides access to all alarms, inputs and principal software blocks in the controller. Front panel LED indicators show the status of the drive, key inputs and outputs.

This manual covers the following models from the 570 series.

Three phase, regenerative, four quadrant armature controllers.

570 - for currents up to 150 Amps.
572 - for currents in the range 151 to 270 Amps.
574 - for currents in the range 271 to 450 Amps.
576 - for currents in the range 451 to 720 Amps.
578 - external stack option for currents exceeding 721 Amps.

Three phase non-regenerative, two quadrant armature controllers.

571 - for currents up to 150 Amps.
573 - for currents in the range 151 to 270 Amps.
575 - for currents in the range 271 to 450 Amps.
577 - for currents in the range 451 to 720 Amps.
579 - external stack option for currents exceeding 721 Amps.

2 TECHNICAL DETAILS

2.1 GENERAL

Control Circuits:	Fully isolated from power circuit.
Control Action:	Fully digital. Advanced PI with fully adaptive current loops for optimum dynamic performance. Self Tuning Current Loop utilising "Autotune" algorithm. Adjustable speed PI with integral defeat.
Speed Control:	By Armature feedback with IR compensation. By Encoder feedback or analogue tachogenerator.
Speed Range:	100 to 1 typical with tachogenerator feedback.
Steady State Accuracy:	Better than 0.01% with MICROTACH encoder. Absolute (0.0% error) using QUADRALOC Mk II digital controller.
Adjustments:	All adjustments are in software by serial link or on board pushbuttons and LCD display.
Protection:	Interline device networks. High energy MOV's. Overcurrent (instantaneous). Overcurrent (inverse time). Field failure. Speed feedback failure. Motor overtemperature. Thyristor Stack overtemperature (Force ventilated units). Thyristor "Trigger" failure. Zero-speed detection. Standstill logic.
Diagnostics:	Fully computerised with first fault latch and automatic display. Digital LCD monitoring. Full diagnostic information available on RS422 port. LED circuit state indication.
Storage:	-20°C — +50°C Protect from direct sunlight. Ensure dry, corrosive free environment.

2.2 ELECTRICAL RATINGS

Power Configuration:	570, 572, 574, 576, 578*	- Two Anti-parallel three phase Thyristor bridges.
	571, 573, 575, 577, 579*	- One three phase fully controlled Thyristor bridge.
	* External stack options.	
Power Supply:	3-Phase, 45-65 Hz, phase rotation insensitive. No adjustment required for frequency change.	
Voltage ranges:	110-220v ~ ±10% 220-480v ~ ±10% 480-660v ~ ±10% 578/579 only	
Supply Current:	(0.9 x Idc) Amps ac	

Control and Fan* Supply Voltage:	Single Phase, 45-65 Hz.			
	Voltage ranges:	110-120v ~ ±10% 220-240v ~ ±10% §		
	§ On 574/575 and 576/577 240 Vac fans are prohibited. * Force ventilated units.			
	Supply Power	Quiescent	30VA	fused at 400mA
		Fans	50 VA when fitted	fused at 500mA
		Contactor	As contactor data sheet	fused at 3A
Output Current Ratings:(Field)	10A 570/1/2/3 20A 574/5/6/7 30A 578/579			
Reference Supplies:	(For speed and Current setpoints)	+10V ± 0.01 at 10mA Max. -10V ± 0.01 at 10mA Max.		
DC Supply	+24V Nominal Internally Regulated. Maximum output capability 6W or 250mA. Auxiliary loading should be totalled before specification to check DC supply loading if excessive fit a separate power supply.			

DC Power Supply Loading

5701 Microtach and Microtach Option Board	1.8W or 75mA
Serial Link Option Board	1W or 40mA
Relays	1.2W or 50mA
5702/1 Repeater	1.2W or 50mA
5702/2 Terminal Rail Repeater	1.2W or 50mA
5702/3 Encoder to Fibre Optic Convertor	
5702/5 Splitter	
5702/6 Marker Pulse Repeater	
5703/1 P3 Port Expander	1.7W or 70mA

Note:- When a 5701 Microtach and Microtach option board is used with a Serial Link Option board and two relays the power supply is close to maximum, if a repeater is required the loading is exceeded.

2.3 OUTPUT RATINGS

	570/1				572/3	574/5	576/7	578/9		
Output Current Ratings (Armature) [4]	35A	70A	110A	150A	270A	450A [3]	720A	950A	1100A	1388A
Nominal Power Rating @ 460V dc Assuming 95% Motor Efficiency	14.5KW (20HP)	29KW (40HP)	45KW (60HP)	60KW (80HP)	110KW (150HP)	190KW (250HP)	300KW (400HP)	395KW (530HP)	455KW (610HP)	575KW (770HP)
Maximum Rating Ambient [1]	45°C	45°C	35°C	35°C	35°C	35°C	35°C	35°C	35°C	35°C
Cooling Forced or Natural	N	N	F	F	F	F	F	F	F	F
Cooling Fan Integral/Separate	—	—	I	I	I	S [3]	S	S	S	S
Overload Capacity Available (Armature Current) [2]	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Field Current Rating	10A	10A	10A	10A	10A	20A	20A	30A	30A	30A
Maximum Supply Voltage	480V	480V	480V	480V	480V	480V	480V	600V	600V	600V
Maximum Field Supply Voltage	480V	480V	480V	480V	480V	480V	480V	480V	480V	480V

[1] Derate linearly at 1% per degree centigrade for temperatures exceeding the maximum rating ambient. Maximum operating ambient is 55°C.

[2] The standard overload capacity available is 200% for 10 seconds, 150% for 30 seconds. 576/577 has no overload capacity at maximum current, at output currents less than 650Amps overload capacity is as normal.

[3] A lower current version limited to 360Amps is available with an integral fan.

[4] Altitude derating, nominal sea level to 500 metres, derate above 500 metres at 1% per 200 metres up to maximum of 5000 metres.

2.4 MECHANICAL DETAILS

570 and 571 Convertors

Mounting Centres:	Vertical - 400mm (15.75") Horizontal - 200mm (7.87")	
	Rating up to 32kw (40 HP)	Rating up to 69kw (90 HP)
Overall Width:	250mm (9.8")	250mm (9.8")
Overall Height:	415mm (16.5")	440mm (17.3")
Overall Depth:	170mm (6.7")	170mm (6.7")
Weight:	(10Kg-14Kg) (22lbs-30lbs)	(15Kg) (33.2lbs)
Minimum Airflow Clearance:	100mm(4") above 100mm(4") below	100mm(4") above 100mm(4") below
Nominal Blower Throughput:		100m3/Hour
Control Terminations:	Plug-on connectors with retaining catches.	
Power Terminations:	Bus-bars with 8mm screws and captive nuts.	
Access:	Hinge-down cover for keypad. Hinge-up cover for control circuit terminals and Option Modules. Hinge-out Control Printed Board with its own independent cover.	

572 and 573 Convertors

Mounting Centres:	Vertical - 400mm (15.75") Horizontal - 200mm (7.87")
Overall Width:	250mm (8.75")
Overall Height:	500mm (19.7")
Overall Depth:	210mm (8.3")
Weight:	20Kg (44lbs)
Minimum Airflow Clearance:	150mm (6") above and 100 (4") below.
Nominal Blower Throughput:	350m3/Hour.
Control Terminations:	Plug-on connectors with retaining catches.
Power Terminations:	Bus-bars with screws and captive nuts.
Access:	Hinge-down cover for keypad. Hinge-up cover for control circuit terminals and Option Modules. Hinge-out Control Printed Board with its own independent cover.

574 and 575 Convertors

Mounting Centres:	Vertical - 600mm (23.6") Horizontal - 200mm (7.87")	
Overall Width:	250mm (8.75mm")	(322mm (12.7") over dc terminals)
Overall Height:	705mm (27.75") Integral Fan 675mm (26.6") Roof Fan	
Overall Depth:	252mm (9.9")	
Weight:	30Kg (66lbs)	
Minimum Airflow Clearance:	100mm (4") below 150mm (6") above }	Integral Fan
	100mm (4") below duct for roof fan }	Roof Fan
Nominal Blower Throughput:	490m^3/hr Integral Fan	
Control Terminations:	Plug-on connectors with retaining catches.	
Power Terminations:	AC Busbars with M12 screws and captive nuts. DC M10 screws and nuts.	
Access:	Hinge-down cover for keypad. Hinge-up cover for control circuit terminals and Option Modules. Hinge-out Control Printed Board with its own independent cover.	

576 and 577 Convertors

Mounting Centres:	(see drawing)	
Overall Width:	319mm (12.6")	(362mm over dc terminals)
Overall Height:	920mm (36.2") (Module only not including fan equipment and ducting).	
Overall Depth:	194mm (7.6") to mounting plane. 140mm (5.5") behind mounting plane.	
Weight:	65Kg (143lbs)	
Minimum Airflow Clearance:	See installation drawings HG049669F and HG054248F.	
Nominal Blower Throughput:	1000m3/Hour @ 8mm head for rated output.	
Control Terminations:	Plug-on connectors with retaining catches.	
Power Terminations:	AC Busbars with M14 screws and captive nuts. DC M10 bolts and nuts.	
Access:	Hinge-down cover for keypad. Hinge-up cover for control circuit terminals and Option Modules. Hinge-out Control Printed Board with its own independent cover.	

3 PRODUCT CODE

570 Series Three phase converters.
All members of the three phase converter range can be fully specified using a 40 digit numerical order code.

Block No.	No. of Digits	Function
1	3	Basic product
2	3	Output current
3	4	Input power supply voltage
4	1	Field converter configuration
5	1	Input auxiliary supply voltage
6	1	User language
7	1	Speed feedback source
8	1	Serial link
9	4	Speed feedback calibration
10	3	Field voltage
11	3	Field current
12	3	Armature voltage
13	1	Armature current profile
14	2	Speed break 1
15	2	Armature current break 2
16	2	Speed break 2

The last two blocks in the product code allow for special control features and special build options .

17	2	Special hardware
18	2	Special software

The 18 blocks are defined as follows:-

BLOCK 1 3 Digits identifying the basic product.

570	3 phase 4 quadrant (regenerative) converter up to 150amps.
571	3 phase 2 quadrant (non-regenerative) converter up to 150amps.
572	3 phase 4 quadrant (regenerative) converter up to 270amps.
573	3 phase 2 quadrant (non-regenerative) converter up to 270amps.
574	3 phase 4 quadrant (regenerative) converter up to 450amps.
575	3 phase 2 quadrant (non-regenerative) converter up to 450amps.
576	3 phase 4 quadrant (regenerative) converter up to 720amps.
577	3 phase 2 quadrant (non-regenerative) converter up to 720amps.
578	3 phase 4 quadrant (regenerative) external stacks up to 1500 Amp
579	3 phase 2 quadrant (non-regenerative) external stacks up to 1500 Amp.

BLOCK 2

570 to 577 Inclusive

4 digits identifying the DC output current rating.

The digits in this block represent a number between 000.0 and 999.9. To form the code from the numbers, the decimal point is suppressed and leading zeros are added where necessary.

Examples: 234.5 Amps - Code 2345
Conversely: Code 1234 - 123.4 Amps

578 and 579

5 digits identifying the DC output current rating.

The digits in this block represent a number between 0000.0 and 2000.0. To form a code from the numbers, the decimal point is suppressed and leading zeros are added where necessary.

Examples: 1250 Amps - Code 12500
Code 11250 - 1125 Amps

BLOCK 3 1 Digit identifying the 3 Phase AC power, supply voltage.

0	110v	A 500 V	578 / 579 External Stacks only
1	115v		
2	208v		
3	220v	B 550 V	
4	240v		
5	380v		
6	415v	C 600 V	
7	440v		
8	460v		
9	480v	D 660 V	

BLOCK 4 1 Digit identifying field supply configuration.

0	Externally supplied field.
1	Internally supplied field regulator.
Note:	This digit requires a second part product code (Blocks 10 to 16).
2	Internally supplied full wave rectifier.
3	Internally supplied half wave rectifier.
4	Externally supplied field regulator.
Note:	This digit requires a second part product code (Blocks 10 to 16).
5	Externally supplied full wave rectifier.
6	Externally supplied half wave rectifier.
7	
8	Internally supplied 3 phase rectifier.
9	

BLOCK 5 1 Digit identifying the auxiliary AC control supply voltage.

0	110v
1	115v
2	
3	220v
4	240v

BLOCK 6 1 Digit code to define user interface language.

0	English

BLOCK 7 1 Digit code identifying the speed feedback source.

0 Armature Voltage.

1 DC Tacho.

2 5701 Microtach.

BLOCK 8 1 Digit code identifying the serial link.

0 No Serial Link.

1 Serial Link Fitted RS422/485

BLOCK 9 4 Digits code identifying full speed.

Note: Block 9 is dependent upon Block 7

IF Block 7 is 0 i.e. Armature Voltage Feedback.

The four digits form a number which represents the ACTUAL armature voltage at full speed, rounded to the nearest whole number and with leading zeros added where necessary.

For example: 490 volts - Code 0490
Code 0500 - 500 volts

IF Block 7 is 1 i.e. DC Tachogenerator Feedback.

The four digits form a number which represents the ACTUAL tacho feedback voltage at full speed, rounded to the nearest whole number and with leading zeros added where necessary.

For example: 123 volts - Code 0123
Code 0090 - 90 volts

IF Block 7 is 2 i.e. 5701 MICROTACH Feedback.

The four digits form a number which represents the ACTUAL motor revolutions per minute at full speed, rounded to the nearest whole number and with leading zeros added where necessary.

For example: 1500RPM - Code 1500
Code 1000 - 1000RPM

BLOCK 10 3 Digits identifying the DC field voltage

The digits in this block represent the DC field voltage of the motor rounded to the nearest whole number with leading zeros added where necessary.

For example: 100 volts - Code 100
Code 180 - 180 Volts

BLOCK 11 3 Digits identifying the DC field current

The digits in this block represent the DC field current of the motor, the current being in the range 00.0 to 30.0. To form the code from the numbers, the decimal point is suppressed and leading zeros are added where necessary.

For example: 12.5 Amps - Code 125
Code 085 - 8.5 Amps

BLOCK 12 3 Digits identifying the armature voltage at base speed.

The digits in this block represent the armature voltage of the motor at base speed. Where base speed is the motor speed at full field, full armature volts. To form the code from the voltage, round to the nearest whole number with leading zeros added where necessary.

For example: 400 volts - Code 400
Code 500 - 500 Volts

BLOCK 13 1 Digit identifying the requirement for armature current profile.

0 No armature current profile.

Note: Blocks 14, 15 and 16 are not required but should be entered as zeros on the product code.

1 Armature current profile required.

Note: Blocks 14, 15 and 16 are required to complete the current profile specification.

BLOCK 14 2 Digits identifying the motor speed at armature profile break 1.

For example: 50% - Code 50
Code 65 - 65%

The digits in this block represent the percentage of motor top speed at the first (break 1) armature current profile point. Add leading zeros as necessary.

Note: Block 14 is not required if Block 13 = 0 but should be entered as zeros on the product code.

BLOCK 15 2 Digits identifying the motor armature current at armature profile break 2.

The digits in this block represent the percentage of full load armature current at the second (break 2) armature current profile point. To form the code from the numbers, round to the nearest whole number with leading zeros added where necessary.

For example: 49% - Code 49
Code 59 - 59%

Note: Block 15 is not required if Block 13 = 0 but should be entered as zeros on the product code.

BLOCK 16 2 Digits identifying the motor speed at armature profile break 2.

The digits in this block represent the percentage of motor top speed at the second (break 2) armature current profile point. To form the code from the numbers, round to the nearest whole number with leading zeros added where necessary.

For example: 60% - Code 60
Code 90 - 90%

Note: Block 16 is not required if Block 13 = 0 but should be entered as zeros on the product code.

BLOCK 17 2 Digits identifying special options (hardware)

00 No special options

00 to 99 Documented special options

BLOCK 18 4 Digits identifying special options (software).

000 The Basic Block Diagram

001

002

003

004

005

006

007

008

009

010 to 999 Documented Special options

4 BASIC INSTALLATION AND WIRING INSTRUCTIONS

4.1 INSTALLATION

The 570 series motor control units are all designed to mount directly onto a flat surface. They should be fastened by means of bolts or screws through the fixing points at each corner. These points are in the form of keyholes and slots to simplify fastening or removal.

Please see the relevant installation drawings in this manual for overall dimensions and positions of fixing holes and to identify size of holes and fixings.

Note:- The fixing centres of 570 series controllers are designed to allow use of 100mm grid fixing.

4.2 VENTILATION AND COOLING

In normal operation the drive unit needs to dissipate heat and must, therefore, be mounted to permit the free flow of cool air vertically through the circuit board area, over the fuses and across the heat sink area at the back.

The normal maximum ambient operating temperatures are:-

Naturally ventilated unit: 45°C (113°F)
Fan-force cooled units: 35°C (95°F)

For operation above these limits derating of the controller may be necessary, refer to the electrical specification within this manual or the engineering department of SSD.

Care should be taken to ensure that the mounting surface is also cool and that any heat generated by adjacent equipment is not transmitted to the drive unit.

As a general rule allow about (150mm) 6" of clear space above and below the drive for free air flow.

4.3 BASIC WIRING INSTRUCTIONS

The following set of instructions is a description of the wiring requirements of a 570 series controller configured in the General Purpose mode for operation as a basic speed controller. The complexity of connection when configured in any other mode for specific drive applications, precludes the inclusion of diagrams showing all wiring options. Special options are usually part of the engineering of a customer specific system and connection diagrams of these controllers form part of the information provided for the system.

Information showing the connections required to provide a basic speed control system when using a 570 series controller are given in diagram HB056869D.

1. Power cables must have a minimum rating of 1.1 x full load current.
2. Control wiring must have a minimum cross-sectioned area of 0.75mm2(square millimetre).
3. All incoming main ac power supply connections must be protected with High Speed semiconductor fuses. The rating of these fuses being as shown below:-

Product Code Block 2	Fuse Rating	SSD Fuse Part Number	Thyristor A^2t @ 125°C Junction Temperature
0010 to 0350	35A	CH110353	800 A^2t
0351 to 0700	75A	CH120753	8,000 A^2t
0701 to 1100	110A	CH120114	8,000 A^2t
1101 to 1500	150A	CH120154	15,000 A^2t
1501 to 2700	300A	CH130035	125,000 A^2t
2701 to 4500	---	---	320,000 A^2t
4501 to 7200	---	---	500,000 A^2t

4. A substantial ground or earth connection should be made to the earth terminal of the drive.
5. A 3 phase contactor should be connected in the main ac power supply connections with a rating suitable for the controller concerned. The contactor does not switch current and is primarily for isolation and sequencing of the power bridge. The main contactor must be energised directly from the controller by connecting the coil to terminals D5 (Line) and D6 (Neutral). (If the coil inrush at switch-on is likely to exceed 3A a slave relay must be used.) The main contactor coil and the slave relay, if used, must have operating voltages compatible with the controller auxiliary supply.

Note:- A dc contactor can be used but the sequencing must be adjusted to accommodate its use, an auxiliary normally open volt-free contact of the contactor must be connected in series with the "enable" input C5 to disable the drive until after the contactor is closed.

6. A 3 phase ac line reactor should be fitted in series with the incoming main 3 phase ac power supply. (SSD stock a series of reactors suitable for this duty mechanically designed to connect directly to the controller ac supply terminals.) The reactor should be connected between the controller and the ac contactor for optimum protection and safety.

7. The auxiliary or control supply (single phase 50/60Hz) should be connected to terminals D8 (Line) and D7 (Neutral) with suitable external fuse protection. The steady state current absorbed by the controller is nominal, the external fuse is determined chiefly by considering the contactor holding VA and the controller cooling fans.

   Note:- Check that the auxiliary supply transformer tapping on the power board is connected to the voltage used within the system.

8. Connect the motor field (-) to terminal D3 and field (+) to terminal D4. If the motor has no field connections, a permanent magnet motor, or if the field is derived externally, it will be necessary to override the field failure circuit. This is achieved by operation of the MMI interface in the set-up parameters menu, alarms inhibit sub-section. If the controller is correctly specified by means of the product code, the external field option will be provided and the field failure alarm overridden automatically at power-up.

9. If an external field supply is required to the controller for application reasons this supply should be connected to terminals D1 and D2. The magnitude of this voltage is determined by the desired field voltage and the connection of the rectifier block. (For more information on this subject see terminal block descriptions.) The supply must be protected externally with suitable fuses. If uncontrolled field rectifier is used the phasing and polarity of the external field supply is not important, however, when using a controlled regulator the phasing of the incoming supply is important. The supply must always be derived from the Red and Yellow phases of the main power supply with Red phase connected to terminal D1 and Yellow phase to terminal D2.

   Note:- It is important that connection of the controller and the external field supply is consistent when using an externally supplied field regulator. To ensure correct operation Red phase and Yellow phase are required to be those phases connected to terminals L1 and L2 respectively of the main power connections.

   It is relatively simple to change the controller from an external to an internal field type. The red wire on the FE terminal adjacent to D1 must be moved to the RED phase internal terminal and the yellow wire on the FE terminal adjacent to D2 must be moved to the YELLOW phase internal terminal.

   Functional changes such as field rectifier to field regulator cannot easily be performed in the field, it is better to ensure that the correct product is ordered by means of the product code.

10. The main ac power is connected to bus bar terminals L1, L2 and L3, there is no specific phase connection to these three terminals as the controller is phase rotation independent. The connections must be made via the correct high speed semiconductor fuses, the main contactor and the ac line reactor.

11. The motor armature should be connected to bus bar terminals A+ and A-. If a dc contactor is used the poles should be interposed between the controller terminals and the motor terminals.

    Note:- When the controller is operating in a regenerating mode for extended periods acting as a load generator for another machine it is advisable to fit additional protection in the armature circuit. A dc fuse or a high speed circuit breaker will provide this protection, if in doubt consult the SSD Engineering Department.

12. For normal operation the speed demand signal is connected to the "Setpoint Ramp Input" terminal A4.

    This input is scaled so that:-

    +10v input = maximum forward speed demand
    -10v input = maximum reverse speed demand

    The speed demand signal can be generated by connecting the two ends of an external 10K potentiometer to the +10v reference terminal B3 and -10v reference terminal B4, the wiper of the potentiometer being connected to the "setpoint ramp input" as the speed reference.

    For non-reversing applications and 2 quadrant controller (571, 573 etc.) the speed demand only needs to operate between 0 and +10 volts, the anti-clockwise end of the potentiometer should then be connected to signal ground terminal A1.

Two other terminals are provided as speed setpoint inputs terminals A2 and A3, terminal A2 "speed setpoint No. 1" is a direct speed demand by-passing the "setpoint ramp generator", and should be used if direct control is required. Terminal A3 is a dual function terminal either "speed setpoint No. 2" or "current demand" as selected by mode switch control "current demand isolate" terminal C8. As a speed setpoint it can be used in the same way as terminal A2.

13. The controller has the capability of operating with three forms of feedback:-

i) Analogue dc tachogenerator.
ii) SSD MICROTACH.
iii) Armature Voltage feedback.

Product Code block 7 shows the form of feedback for which the controller is supplied.

If an analogue tachogenerator is required this should be connected with its negative terminal connected to terminal B1 and its positive terminal connected to terminal B2. It is important that this signal cable is a screened twisted pair cable throughout its entire length. The screen should be grounded or earthed only at the controller end, any other grounding arrangement may cause problems.

An SSD MICROTACH uses an additional board, the MICROTACH option module to provide connections. This board fits onto the main control board and has two types of connection, a three-way conventional terminal block to provide power to the MICROTACH and a fibre optic receiver to accept the speed feedback. The power supply to the MICROTACH should be taken from terminal G2 + 24v dc, and terminal G3 power ground. The fibre optic "cable" requires a special connector for termination of the cable, these connectors are available from SSD as is the fibre optic cable. Two connectors are stocked one completely black, the other black with a red insert, the black is used at the receiver end the red at the transmitter end. This arrangement is to aid with the identification of incoming and outgoing signals in multiple connection systems.

If the controller is supplied for use with Armature Voltage feedback no external connections are required, all connections are made within the controller.

14. If the motor is fitted with over-temperature sensing devices such as thermo-stats, microtherms or PTC thermistors these should be connected between terminals C1 and C2. If more than one temperature sensing device is fitted they should be connected in series, if none are fitted terminals C1 and C2 must be linked to allow the drive to run. Thermistors must have a working resistance of 200 Ohms or less rising to 2000 Ohms at over-temperature.

15. The Main Current Limit is adjustable by means of the "Current Limit" Parameter P16 within the Primary Set-up parameters of the MMI. For normal operation the Main Current Limit terminal A6 should be connected to the +10v reference terminal B3, this allows Current Limit Parameter P16 to adjust the current limit between 0 and 200% full load current. If external control of the main current limit is required a 10K potentiometer connected between +10v B3 and signal ground B1 with the wiper to A6 gives 0 to 200% of Full Load Current provided parameter P16 is set to 200%.

16. The Enable terminal C5 must be connected to +24v terminal C9 in order to allow the drive to run. The enable input is useful to inhibit the drive without opening the main contactor to give a rapid repeat inch for example or for use with a dc contactor.
However, it is not an entirely safe mode of operation as the drive dc output is only reduced to zero, if the equipment controlled by the drive is to be serviced then this method should be avoided and the drive disabled by opening the main contactor.

17. The basic stop/start sequence of the controller is provided by terminals C3 "Start/Run" and C4 "Stop" although other safeguards for extra protection are provided by "program stop" terminal B8 and "coast stop" terminal B9. Assuming that the program stop and coast stop terminals are in held true to enable controller operation two modes of operation of the start/stop sequence are available.

i) Momentary Contacts.

A normally closed STOP contact connected between terminals C9 "+24v" and C4 "stop".
A normally open START contact connected between terminals C4 "stop" and terminal C3 "start/run".
Momentary operation of the "start" contact starts the drive provided the "stop" pushbutton is not operated.
Momentary operation of the "stop" pushbutton stops the drive.

ii) Signal Holding Contact.

A single contact connected between terminal C9 "+24v" and C3 "start/run".
Close contact to RUN
Open contact to STOP

Additional terminals B8 "program stop" and B9 "coast stop" provide extra facilities for the control of the drive.

Terminal B9 "Coast Stop" must be held at +24v to allow closure of the main contactor, the connection provides the power supply to allow the electronics to operate the auxiliary relay and hence the main contactor.

Terminal B9 "coast stop" should be connected to C9 "+24v" via a normally open contact of an "emergency" stop relay. The emergency stop relay should not be part of the normal sequencing of the system, which is implemented via the START/STOP and RUN contacts, but is a relay which can be operated in exceptional circumstances where human safety is of paramount importance.

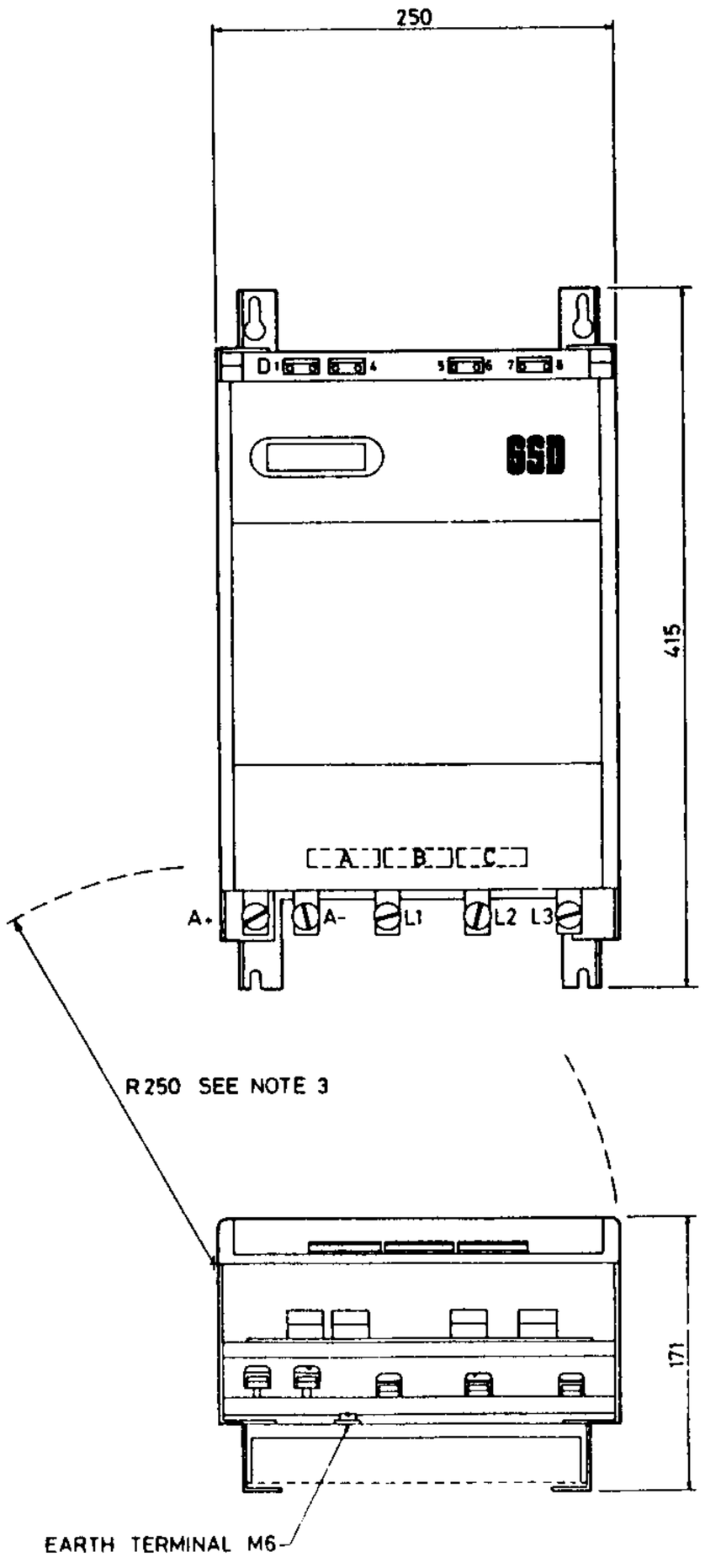
Terminal B8 "program stop" provides a facility for regenerative braking on a 4 Quadrant drive such as the 570, 572, etc.

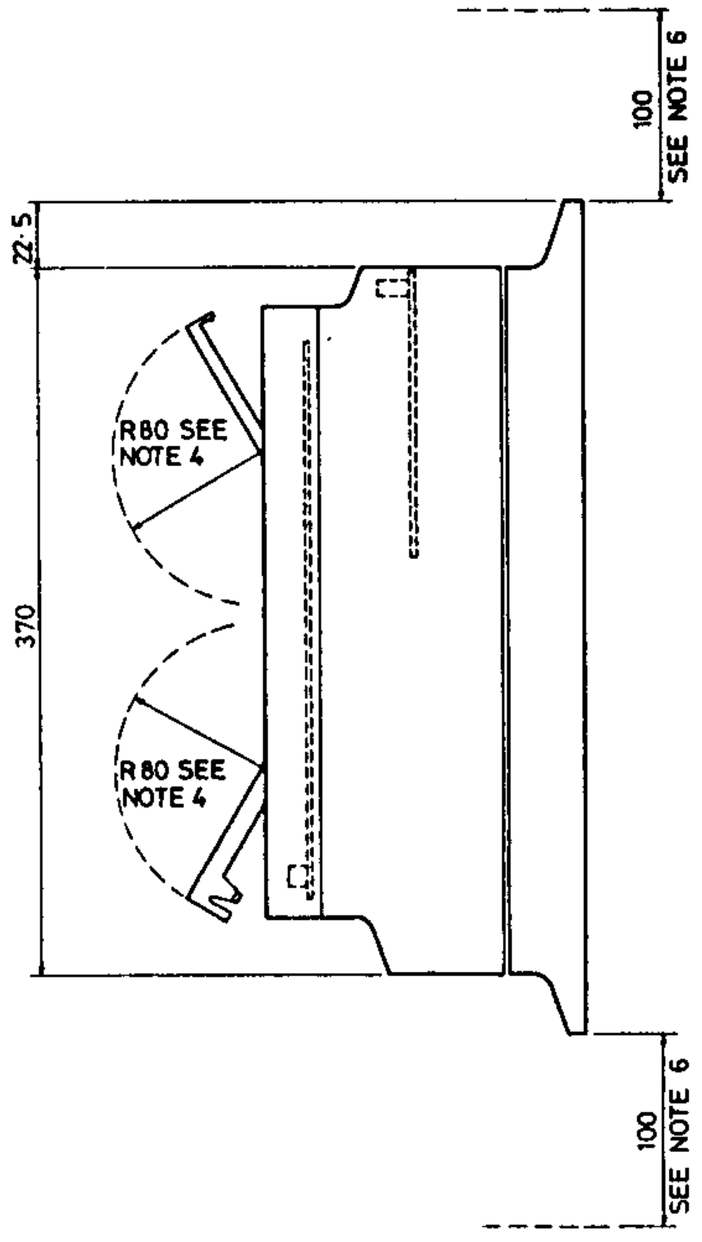
If the "+24v" is removed from B8 while the drive is controlling the motor under "run" conditions, the drive will cause the motor to decelerate rapidly to rest at a rate determined by the "program stop" parameters. If the signal is re-applied to B8, the motor remains stationary until a new start/run command is applied to C3. Care must be taken when using the "program stop" command, if the signal is re-applied before the motor comes to rest it will accelerate back up to speed setpoint. Program stop command should be interlocked with zero speed from the drive.

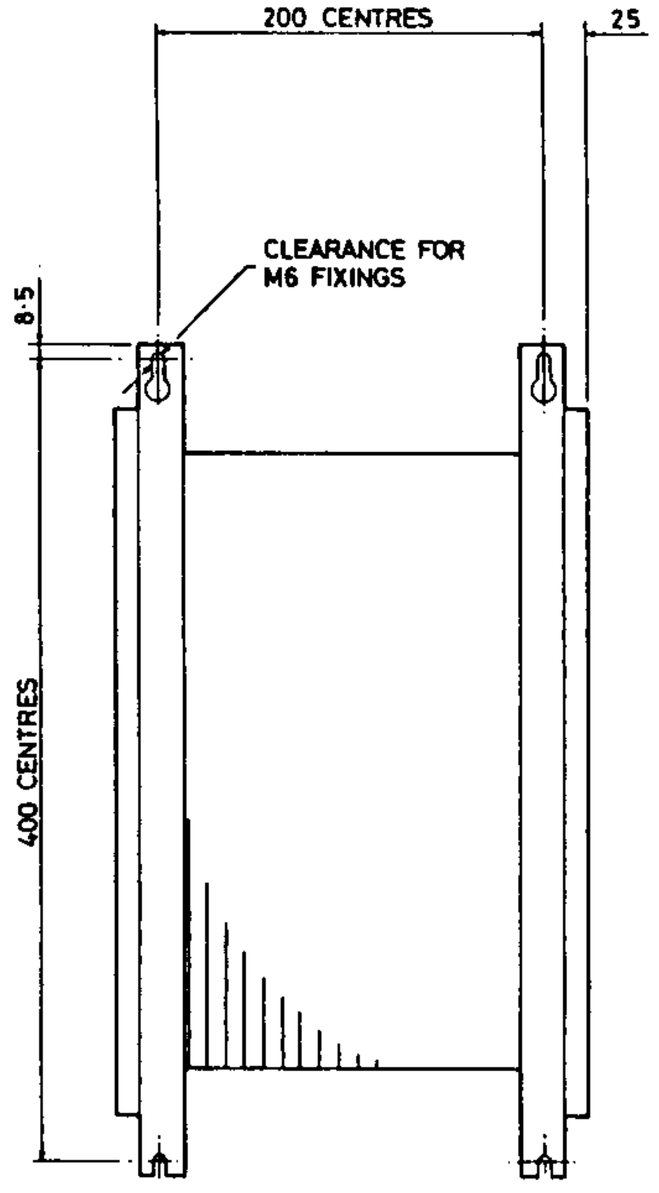
4.4 NOTES ON WIRING

1. Indicator lamps, annunciators, etc., for "Drive On" condition should be switched by an auxiliary contactor of the main contactor, not by the controller auxiliary relay.
2. All connections made to terminal blocks A, B and C must be isolated signal voltages.
3. To avoid damaging the drive NEVER carry out high voltage resistance or dielectric strength tests without first completely disconnecting the drive from the circuit being tested.
4. If in doubt about the connection of the dc motor to the controller check with SSD Engineering Department.

DO NOT SCALE | THIRD ANGLE PROJECTION | GENERAL DRAWING PRACTICE TO BS 308 BS 3939







REAR VIEW FIXING CENTRES

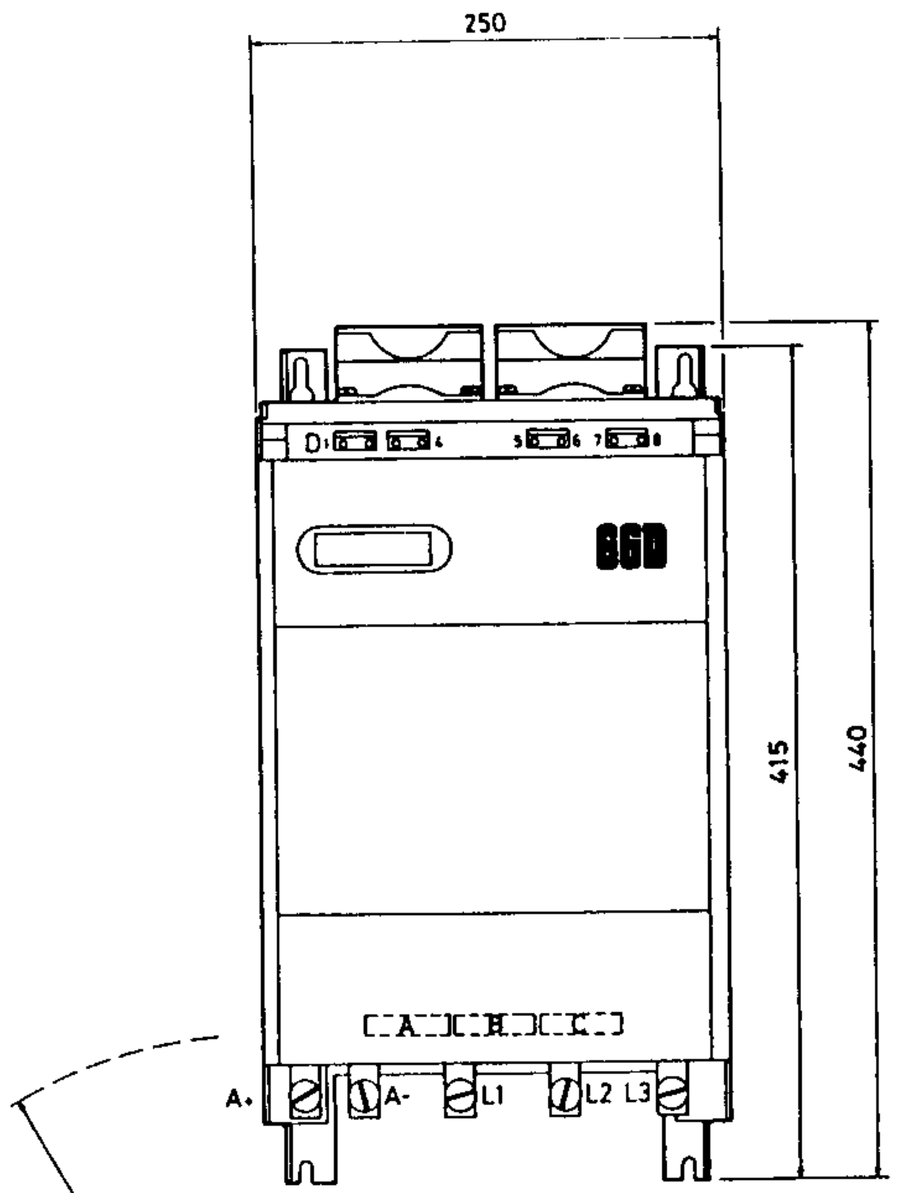
NOTES.

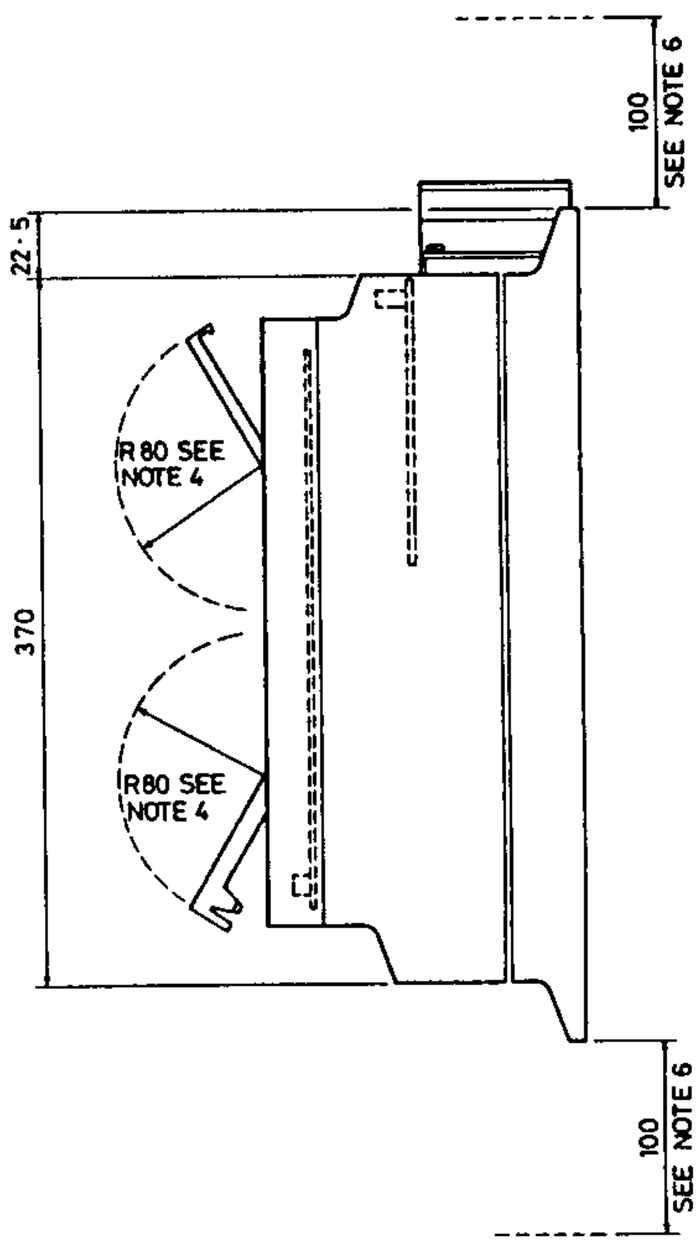
1. CONNECTIONS A,B & C ARE PLUG-IN STYLE TERMINALS CAPABLE OF ACCEPTING 1 5mm^2 CABLE INTO CLAMP STYLE LOOPS.
2. TERMINAL BLOCKS D1 – D8 ARE CAPABLE OF ACCEPTING 2·5mm^2 CABLE INTO CLAMP STYLE LOOPS
3. FRONT COVER CAN PASS THROUGH 180° (CVR. HOUSES CONT PCB) (ONLY 90° NECESSARY SEE NOTE 7)
4. ANCILLARY COVERS CAN PASS THROUGH 180° AND CAN BE LATCHED IN OPEN POSITION.
5. EARTH CONNECTION IS M6 ALL OTHER CONNECTIONS ARE M8 ALL NECESSARY FIXINGS FOR ELECTRICAL CONNECTIONS SUPPLIED. MECHANICAL MOUNTING FIXINGS ARE NOT SUPPLIED
6. AT LEAST 100mm CLEARANCE ABOVE AND BELOW CONVERTER MUST BE PROVIDED FOR COOLING AIR
7. IT IS NOT NECESSARY TO OPEN FRONT COVER WHEN ELECTRICAL CONNECTIONS ARE BEING MADE

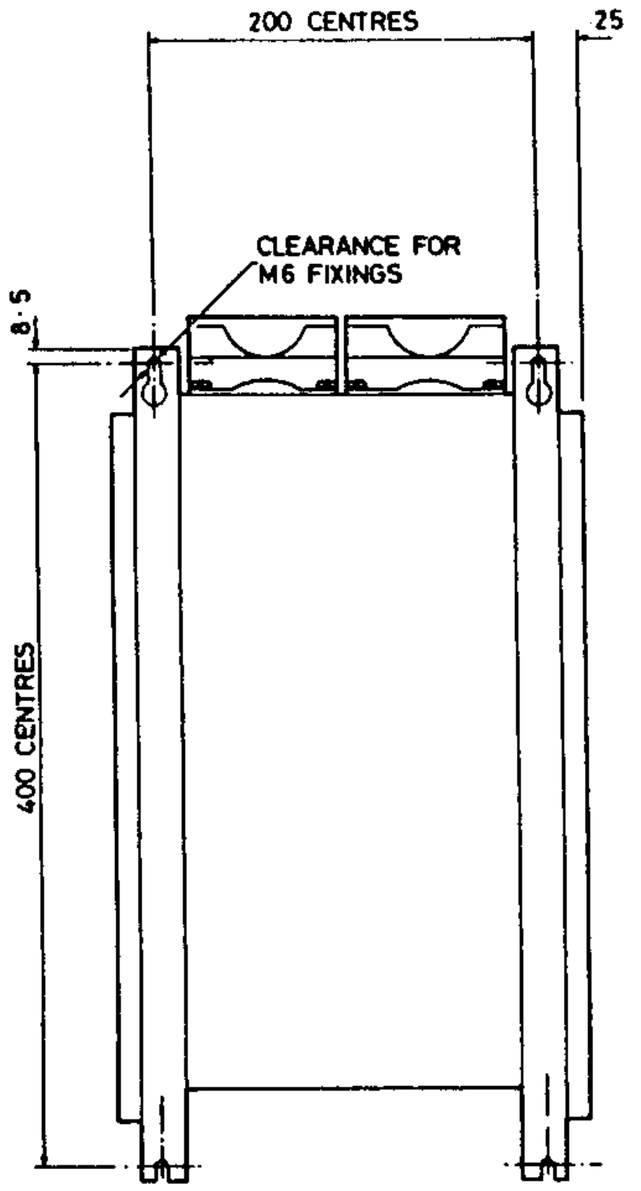
CRM | MATERIAL | FINISH | DIMS IN M.M. APPLY OVER FINISH

SSD LITTLEHAMPTON ENGLAND TELEX 87142 | SCALE 1 2 | EI | HG 055805 F

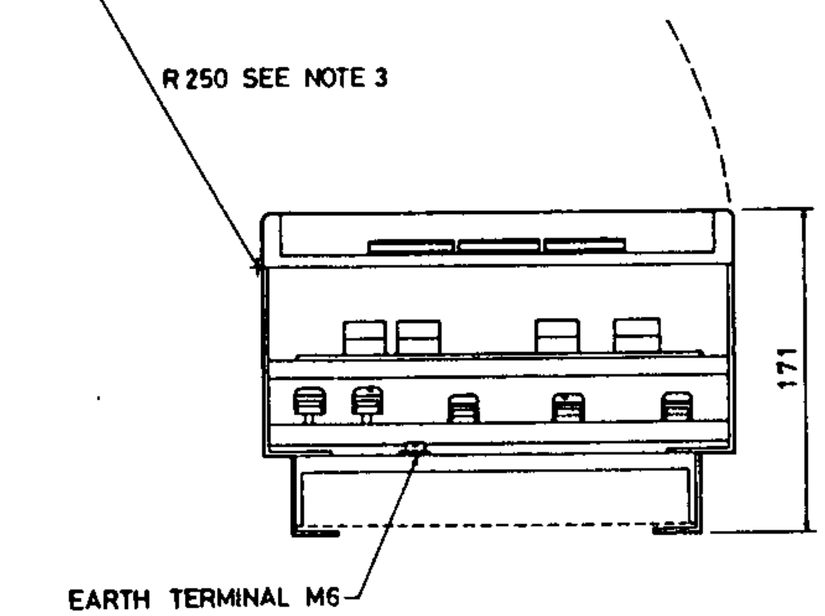
DO NOT SCALE | THIRD ANGLE PROJECTION | GENERAL DRAWING PRACTICE TO BS 308 BS 3838







REAR VIEW FIXING CENTRES



NOTES.

1. CONNECTIONS A,B & C ARE PLUG-IN STYLE TERMINALS CAPABLE OF ACCEPTING 1·5mm² CABLE INTO CLAMP STYLE LOOPS.
2. TERMINAL BLOCKS D1- D8 ARE CAPABLE OF ACCEPTING 2·5mm² CABLE INTO CLAMP STYLE LOOPS
3. FRONT COVER CAN PASS THROUGH 180° (CVR.HOUSES CONT. PCB)(ONLY 90° NECESSARY SEE NOTE 7)
4. ANCILLARY COVERS CAN PASS THROUGH 180° AND CAN BE LATCHED IN OPEN POSITION.
5. EARTH CONNECTION IS M6 ALL OTHER CONNECTIONS ARE M8. ALL NECESSARY FIXINGS FOR ELECTRICAL CONNECTIONS SUPPLIED. MECHANICAL MOUNTING FIXINGS ARE NOT SUPPLIED.
6. AT LEAST 100mm CLEARANCE ABOVE AND BELOW CONVERTER MUST BE PROVIDED FOR COOLING AIR.
7. IT IS NOT NECESSARY TO OPEN FRONT COVER WHEN ELECTRICAL CONNECTIONS ARE BEING MADE.

ISS	DATE	
C	11·4·88	TRACED
D	17·5·88	A,A1,L1-L3 ADDED TERM.BLKS WERE DEFG
E	21·4·89	

DRAWN CRM | CHECKED | DESIGN APPROVAL | QUAL APPROVAL

MATERIAL | FINISH

DIMS. IN M.M. APPLY OVER FINISH EXCEPT FOR PAINT AND LACQUER. GENERAL TOLERANCE

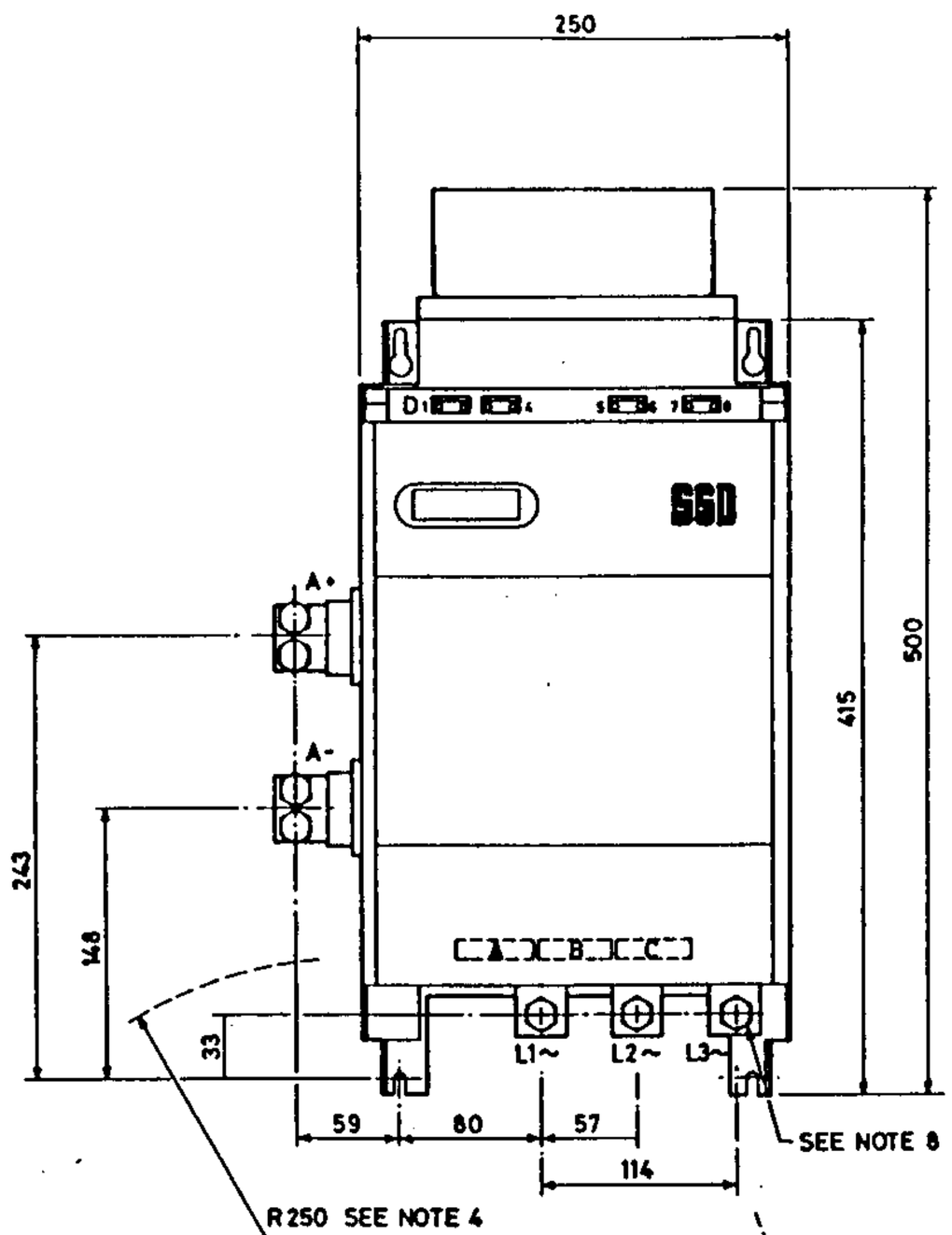
SSD UTTLEHAMPTON ENGLAND TELEX 87142

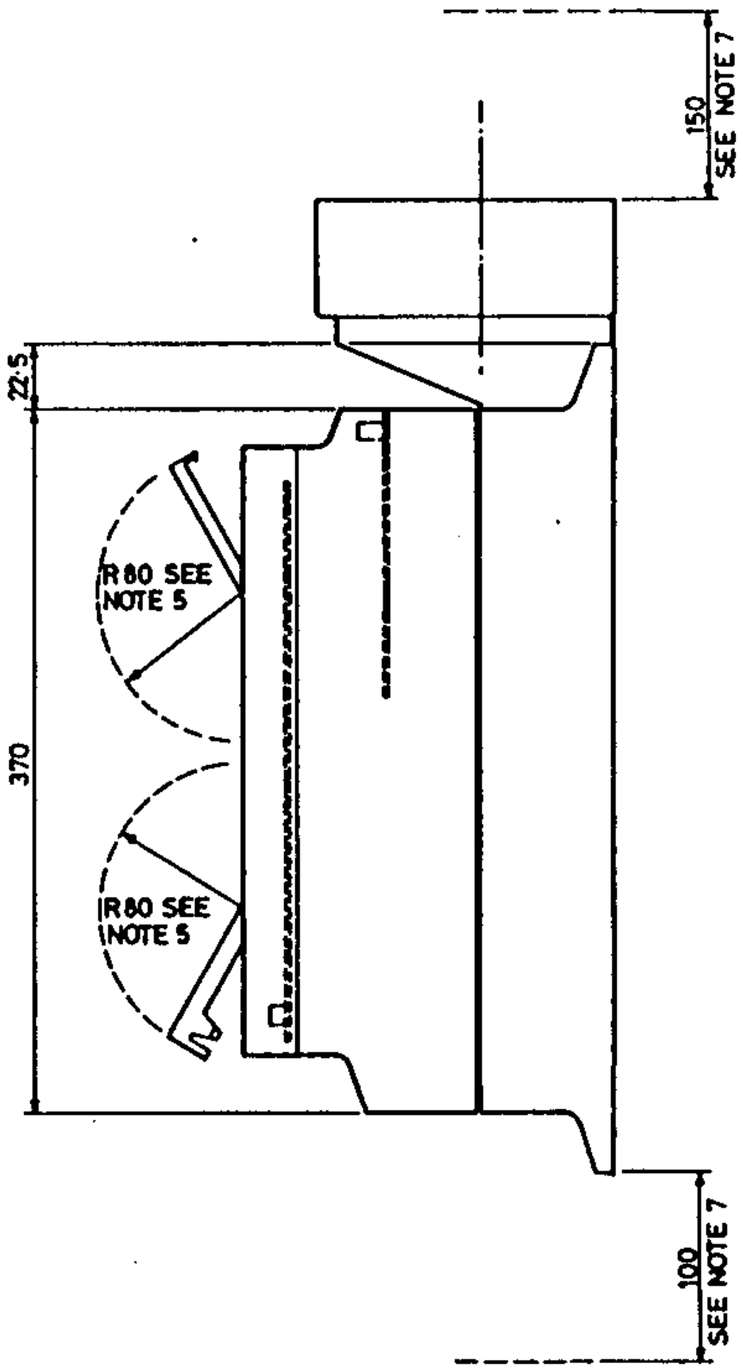
SCALE 1:2

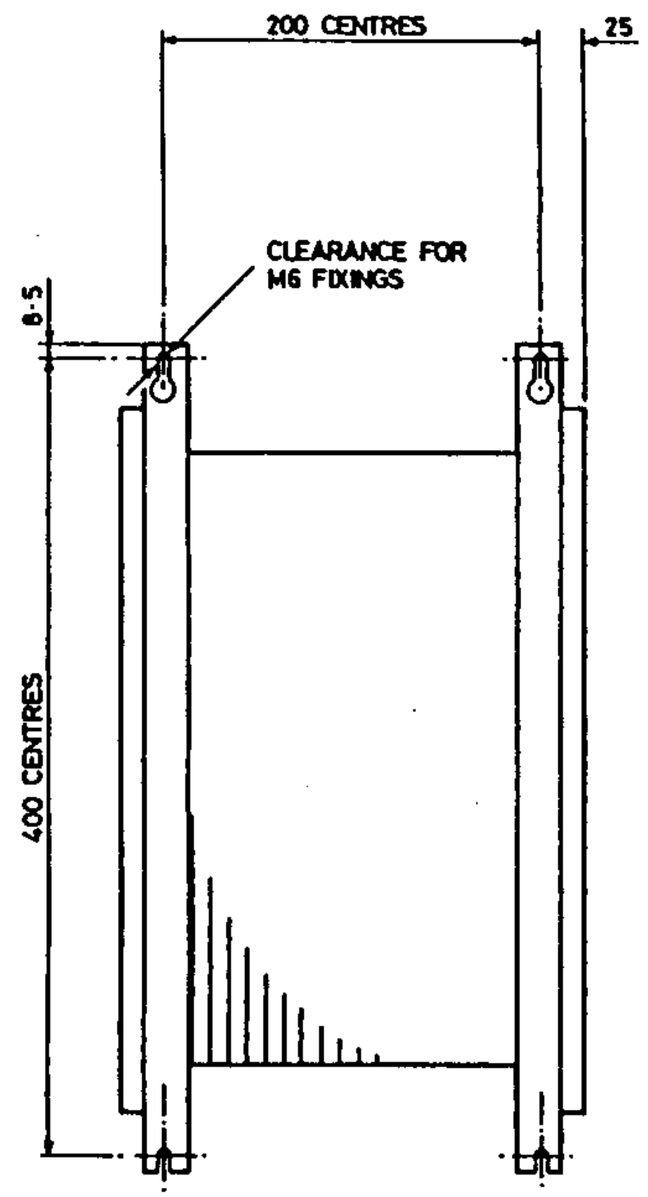
TITLE INSTALLATION DRAWING 570/1 110 & 150A DC DRIVE

DRAWING NUMBER HG 055806 F

DO NOT SCALE | THIRD ANGLE PROJECTION | GENERAL DRAWING PRACTICE TO BS 308 / BS 3636







REAR VIEW FIXING CENTRES

NOTES.

1. CONDUCTOR SPACER BLOCK AND SUITABLE FIXINGS CAN BE POSITIONED ON EITHER A+ AND A-, EITHER ABOVE OR BELOW TO FACILITATE BUS BAR CONNECTIONS.
2. CONNECTIONS A, B & C ARE PLUG-IN STYLE TERMINALS CAPABLE OF ACCEPTING 1·5mm^2 CABLE INTO CLAMP STYLE LOOPS.
3. TERMINAL BLOCKS D1 – D8 ARE CAPABLE OF ACCEPTING 2·5mm^2 CABLE INTO CLAMP STYLE LOOPS.
4. FRONT COVER CAN PASS THROUGH 180° (CVR HOUSES CONT. PCB) (ONLY 90° NECESSARY SEE NOTE 9)
5. ANCILLARY COVERS CAN PASS THROUGH 180° AND CAN BE LATCHED IN OPEN POSITION.
6. EARTH CONNECTION IS M6 ALL OTHER CONNECTIONS ARE M8. ALL NECESSARY FIXINGS FOR ELECTRICAL CONNECTIONS SUPPLIED. MECHANICAL MOUNTING FIXINGS ARE NOT SUPPLIED.
7. AT LEAST 150mm CLEARANCE ABOVE AND 100mm BELOW CONVERTER MUST BE PROVIDED FOR COOLING AIR.
8. ALL HEAVY CURRENT TERMINALS M8 HEX. HD. BOLTS, NUTS AND BELVILLE WASHERS.
9. IT IS NOT NECESSARY TO OPEN FRONT COVER WHEN ELECTRICAL CONNECTIONS ARE BEING MADE.

DATE		
C	11·6·88	TRACED
D	17·5·89	TERM. BLKS WERE DEPG

DRAWN CRM | CHECKED | ENGR APPROVAL | QUAL APPROVAL | MATERIAL | FINISH

DIMS. IN MM APPLY OVER FINISH (EXCEPT FOR PLATE AND LACQUER)

SSD LITTLEHAMPTON ENGLAND TELEX 87142

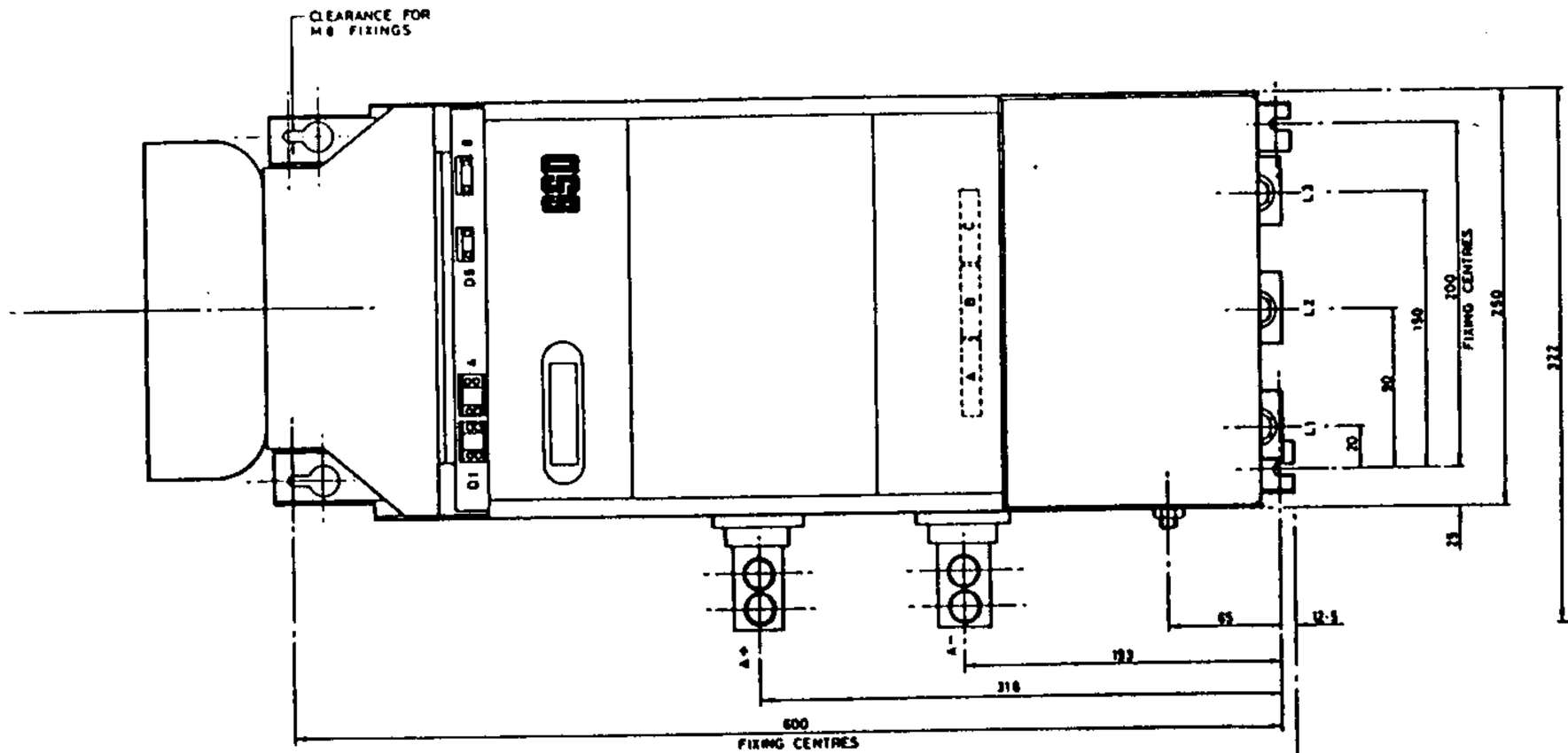
SCALE

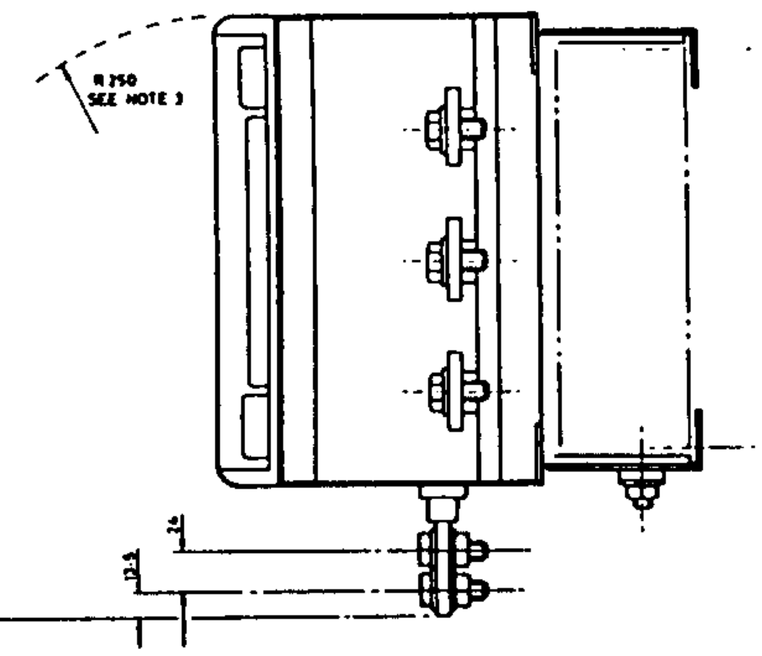
EI

TITLE INSTALLATION DRG. 572/3 270A DC DRIVE

DRAWING NUMBER HG 055807 F

DO NOT SCALE | THIRD ANGLE PROJECTION | GENERAL DRAWING PRACTICE TO BS 308 / BS 3939





NOTES.

1. CONNECTIONS A B & C ARE PLUG IN STYLE TERMINALS CAPABLE OF ACCEPTING 1·5mm² CABLE INTO CLAMP STYLE LOOPS.
2. TERMINALS D1 TO 4 ARE CAPABLE OF ACCEPTING 4·0mm² CABLE AND D5 TO 8 ARE CAPABLE OF ACCEPTING 2·5mm² CABLE INTO CLAMP STYLE LOOPS.
3. FRONT COVER CAN PASS THROUGH 180° (COVER HOUSES CONTROL P.C.B). IT IS NOT NECESSARY TO OPEN FRONT COVER WHEN ELECTRICAL CONNECTIONS ARE BEING MADE.
4. ANCILLARY FLAPS (2 OFF) CAN PASS THROUGH 180° AND CAN BE LATCHED IN OPEN POSITION.
5. ANCILLARY COVER CAN PASS THROUGH 90° OR CAN BE COMPLETELY REMOVED.
6. A+ & A- CONNECTIONS ARE M10 HEX. HD. BOLTS, NUTS & BELVILLE WASHERS.
7. L1, L2 & L3 CONNECTIONS ARE M12 HEX. HD BOLTS & BELVILLE WASHERS.
8. EARTH CONNECTION IS M10 STUD, NUT & BELVILLE WASHERS.
9. MECHANICAL MOUNTING FIXINGS ARE NOT SUPPLIED.
10. AT LEAST 150mm ABOVE AND 100mm BELOW CONVERTER MUST BE PROVIDED FOR COOLING AIR.

DATE		
A	22 2 89	S/L/PA
B	3 5 89	
C	/	

KE 0430109

DRAWN | CHECKED | MATERIAL | FINISH | DIMS IN M M APPLY OVER FINISH (EXCEPT FOR PAINT AND LACQUER)

SSD LITTLEHAMPTON ENGLAND TELEX 87142

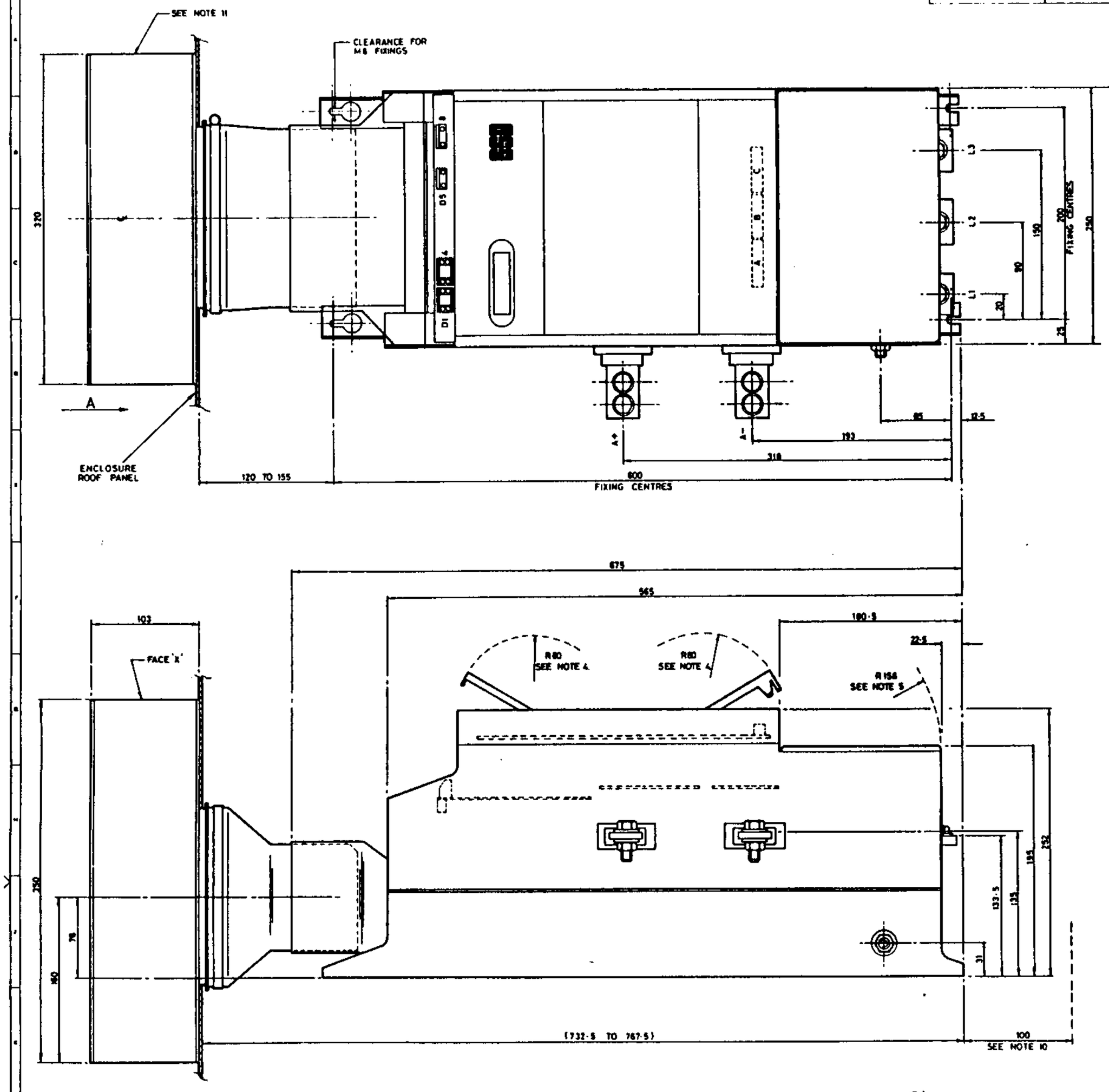
SCALE 1:2

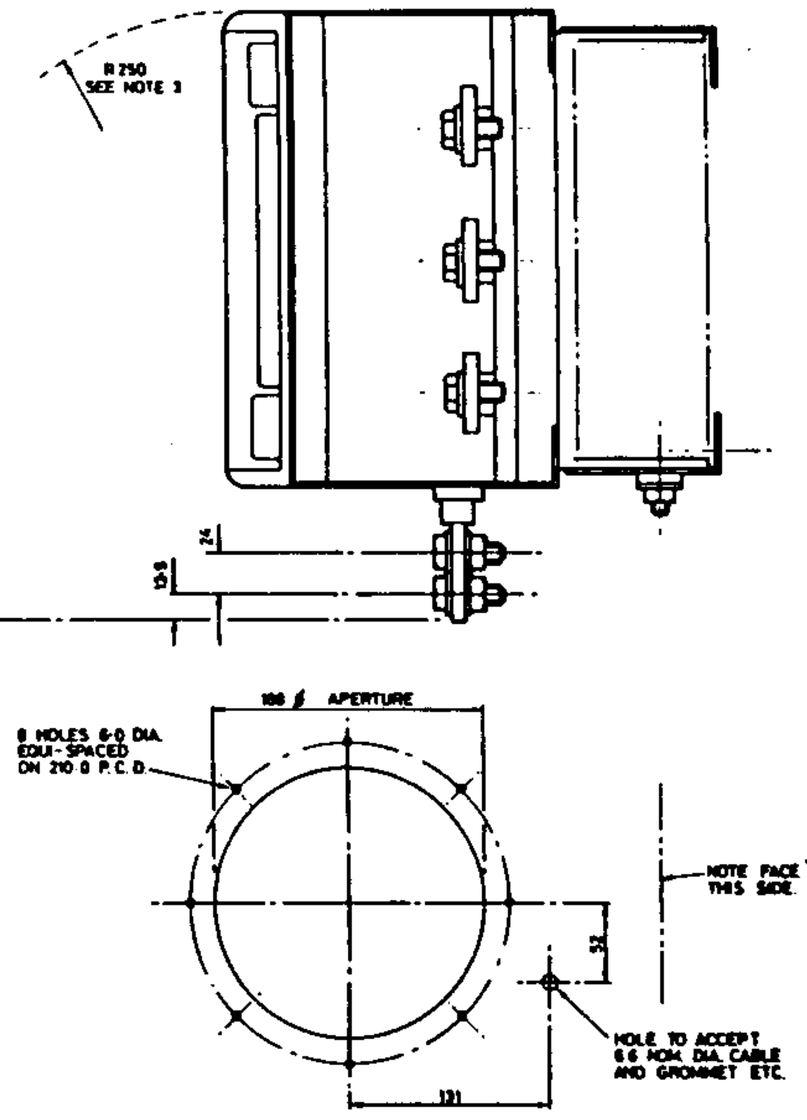
EI

TITLE INSTALLATION DRG S74/5 WITH INTERNAL FAN COOLING

DRAWING NUMBER HG 057208 F

DO NOT SCALE | THIRD ANGLE PROJECTION | GENERAL DRAWING PRACTICE TO BS 308 BS 3638





SCRAP VIEW IN DIRECTION OF ARROW A SHOWING BLOWER ASSY PANEL CUT OUT DETAIL

NOTES.

1. CONNECTIONS A, B & C ARE PLUG IN STYLE TERMINALS CAPABLE OF ACCEPTING 1·5mm² CABLE INTO CLAMP STYLE LOOPS.
2. TERMINALS D1 TO 4 ARE CAPABLE OF ACCEPTING 4·0mm² CABLE AND D5 TO 8 ARE CAPABLE OF ACCEPTING 2·5mm² CABLE INTO CLAMP STYLE LOOPS.
3. FRONT COVER CAN PASS THROUGH 180° (COVER HOUSES CONTROL P.C.B.) IT IS NOT NECESSARY TO OPEN FRONT COVER WHEN ELECTRICAL CONNECTIONS ARE BEING MADE.
4. ANCILLARY FLAPS (2 OFF) CAN PASS THROUGH 180° AND CAN BE LATCHED IN OPEN POSITION.
5. ANCILLARY COVER CAN PASS THROUGH 90° OR CAN BE COMPLETELY REMOVED.
6. A+ & A- CONNECTIONS ARE M10 HEX. HD BOLTS, NUTS AND BELVILLE WASHERS.
7. L1, L2 & L3 CONNECTIONS ARE M12 HEX. HD BOLTS AND BELVILLE WASHERS.
8. EARTH CONNECTION IS M10 STUD, NUT AND BELVILLE WASHER.
9. MECHANICAL MOUNTING FIXINGS ARE NOT SUPPLIED.
10. AT LEAST 100mm BELOW CONVERTER MUST BE PROVIDED FOR COOLING AIR.
11. AIR EXITS (4 POSITIONS) MUST NOT BE OBSTRUCTED

ISS	DATE	DRAWN BC	MATERIAL	ASSEMBLED ON	SCALE 1:2
A	27.2.89	CHECKED	FINISH	SSD LITTLEHAMPTON ENGLAND TELEX 87142	EI
B	31.5.89				
C					

DIMS. IN M M APPLY OVER FINISH (EXCEPT FOR PAINT AND LACQUER)

	0	0·5		
GENERAL	0·5	0·2	HOLES ±1mm	
TOLERANCE	1·00	0·1	·002 0·07	

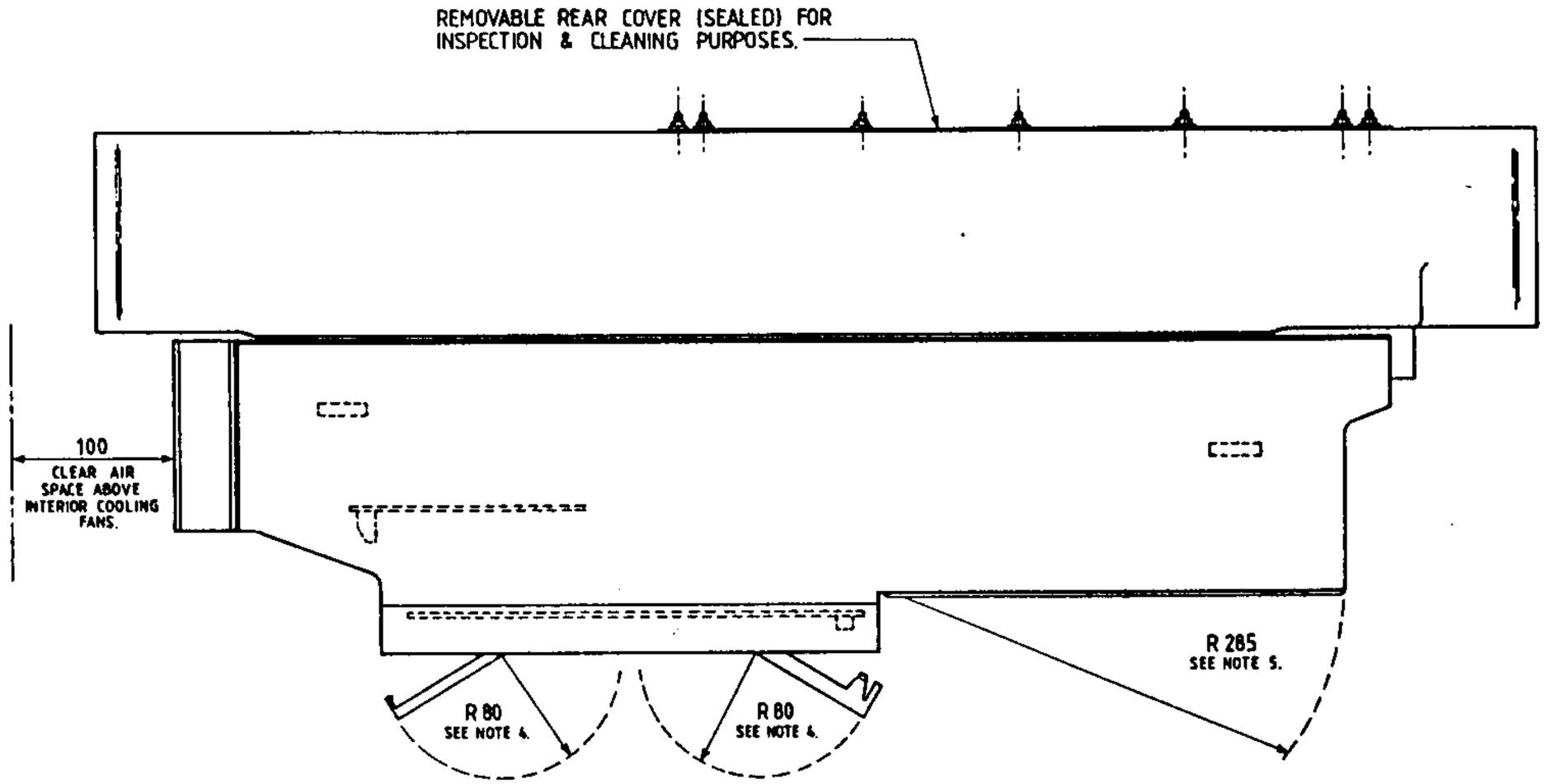
TITLE: INSTALLATION DRG STK/S WITH EXTERNAL FAN COOLING

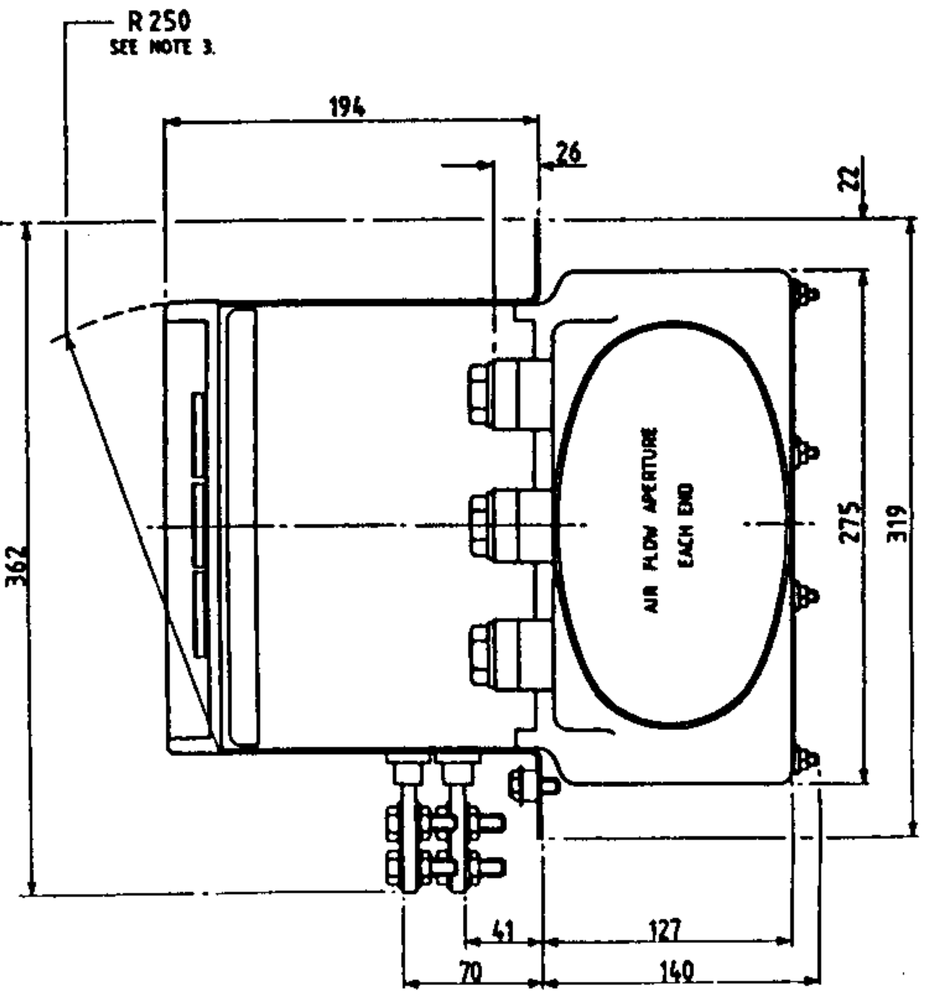
DRAWING NUMBER: HG 057209 F

ISS

KF 049010F

DO NOT SCALE | THIRD ANGLE PROJECTION | GENERAL DRAWING PRACTICE TO BS 308 / BS 3838

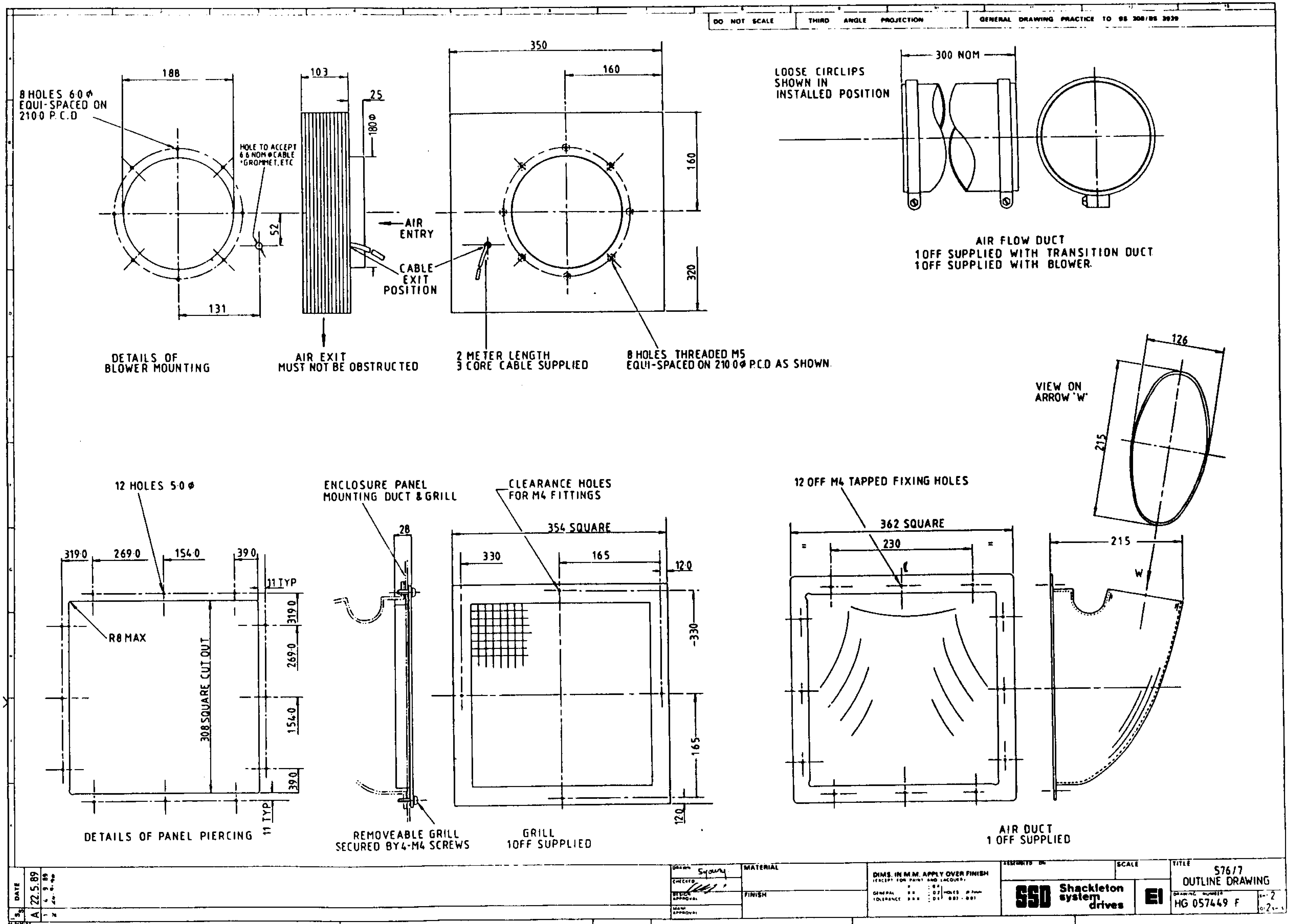




NOTES

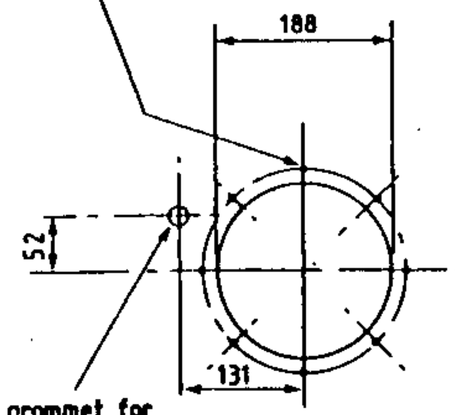
1. CONNECTIONS A, B & C ARE PLUG IN STYLE TERMINALS CAPABLE OF ACCEPTING 1·5mm² CABLE INTO CLAMP STYLE LOOPS.
2. TERMINALS 01 TO 4 ARE CAPABLE OF ACCEPTING 4·0mm² CABLE AND 05 TO 8 ARE CAPABLE OF ACCEPTING 2·5mm² CABLE INTO CLAMP STYLE LOOPS.
3. FRONT COVER CAN PASS THROUGH 180° (COVER HOUSES CONTROL P.C.B). IT IS NOT NECESSARY TO OPEN FRONT COVER WHEN ELECTRICAL CONNECTIONS ARE BEING MADE.
4. ANCILLARY FLAPS (2 OFF) CAN PASS THROUGH 180° AND CAN BE LATCHED IN OPEN POSITION.
5. ANCILLARY COVER CAN PASS THROUGH 90° OR CAN BE COMPLETELY REMOVED.
6. A+ & A- CONNECTIONS ARE M10 HEX. HD. BOLTS, NUTS & BELVILLE WASHERS.
7. L1, L2 & L3 CONNECTIONS ARE M16 HEX. HD. BOLTS & BELVILLE WASHERS.
8. EARTH CONNECTION IS M8 (2 POSITIONS).
9. MECHANICAL MOUNTING FIXINGS ARE NOT SUPPLIED.
10. AT LEAST 100 mm ABOVE AND 100mm BELOW CONVERTER MUST BE PROVIDED FOR COOLING AIR.
11. OVALS ENDS SUITABLE FOR 178 (7") I/D FLEXIBLE AIR DUCTING.
12. MINIMUM AIR VELOCITY OF 16 M/S REQUIRED FOR COOLING CONVERTER.
13. MAIN COOLING AIR FLOWS IN A SEALED STREAM LINED PATH.
14. SEE SHEET 2 FOR AIR FLOW COMPONENTS.
15. SEE HG 069669 F FOR TYPICAL INSTALLATION.
    SEE HG 054248 F FOR ALTERNATIVE TOP OF PANEL MOUNTING.

DATE	DRAWN	MATERIAL	DIMS IN M M APPLY OVER FINISH (EXCEPT FOR PAINT AND LACQUER)	SCALE 1:2	TITLE 576/7 OUTLINE DRAWING
A 22.5.89	P.A.W.			SSD LITTLEHAMPTON ENGLAND TELEX 87102	DRAWING NUMBER HG 057449 F
	CHECKED	FINISH		EI	SHT 1 SHTS 2


DO NOT SCALE
THIRD ANGLE PROJECTION
GENERAL DRAWING PRACTICE TO BS 308/BS 3939
8 HOLES 6·0 ⌀ EQUI-SPACED ON 210·0 P.C.D
188
131
HOLE TO ACCEPT 6.6 NOM ⌀ CABLE GROMMET, ETC
52
DETAILS OF BLOWER MOUNTING
103
25
180 ⌀
AIR ENTRY
CABLE EXIT POSITION
AIR EXIT MUST NOT BE OBSTRUCTED
350
160
320
2 METER LENGTH 3 CORE CABLE SUPPLIED
8 HOLES THREADED M5 EQUI-SPACED ON 210·0 ⌀ P.C.D AS SHOWN.
300 NOM
LOOSE CIRCLIPS SHOWN IN INSTALLED POSITION
AIR FLOW DUCT
1 OFF SUPPLIED WITH TRANSITION DUCT
1 OFF SUPPLIED WITH BLOWER.
VIEW ON ARROW 'W'
126
215
12 HOLES 5·0 ⌀
319·0
269·0
154·0
39·0
11 TYP
R8 MAX
308 SQUARE CUT OUT
DETAILS OF PANEL PIERCING
ENCLOSURE PANEL MOUNTING DUCT & GRILL
28
REMOVEABLE GRILL SECURED BY 4-M4 SCREWS
CLEARANCE HOLES FOR M4 FITTINGS
354 SQUARE
330
165
12·0
GRILL
1 OFF SUPPLIED
12 OFF M4 TAPPED FIXING HOLES
362 SQUARE
230
215
W
AIR DUCT
1 OFF SUPPLIED
DATE
22.5.89
MATERIAL
FINISH
DIMS. IN M.M. APPLY OVER FINISH
SCALE
TITLE
S76/7
OUTLINE DRAWING
SSD Shackleton system drives
EI
HG 057449 F

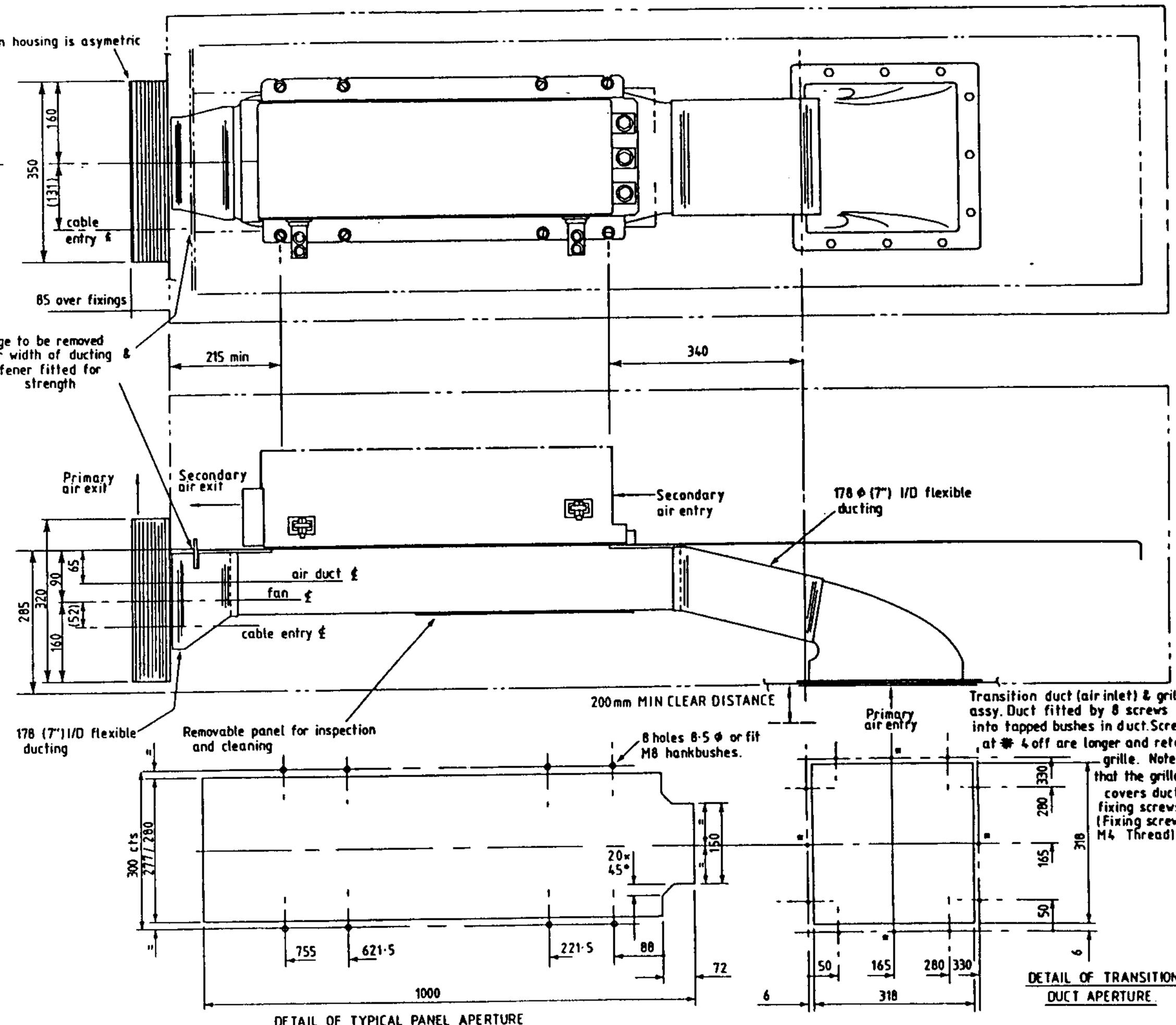
DO NOT SCALE | THIRD ANGLE PROJECTION | GENERAL DRAWING PRACTICE TO BS 308 / BS 3939

8 holes 6·0 ⌀ equi-spaced on 210·0 PCD as shown



Fit suitable grommet for 6·6 nom.⌀ cable (SSD grommet DF 044208 in 9⌀ hole is suitable).

BLOWER ASSY. MOUNTING DETAILS



DETAIL OF TYPICAL PANEL APERTURE

DETAIL OF TRANSITION DUCT APERTURE

No.	DATE
A	13-6-83
B	7/8/85
C	16-7-86
1	4·8·86
2	22 9·88

DRAWN SJM | CHECKED | APPROVED BS | ISSUE APPROVAL

MATERIAL | FINISH

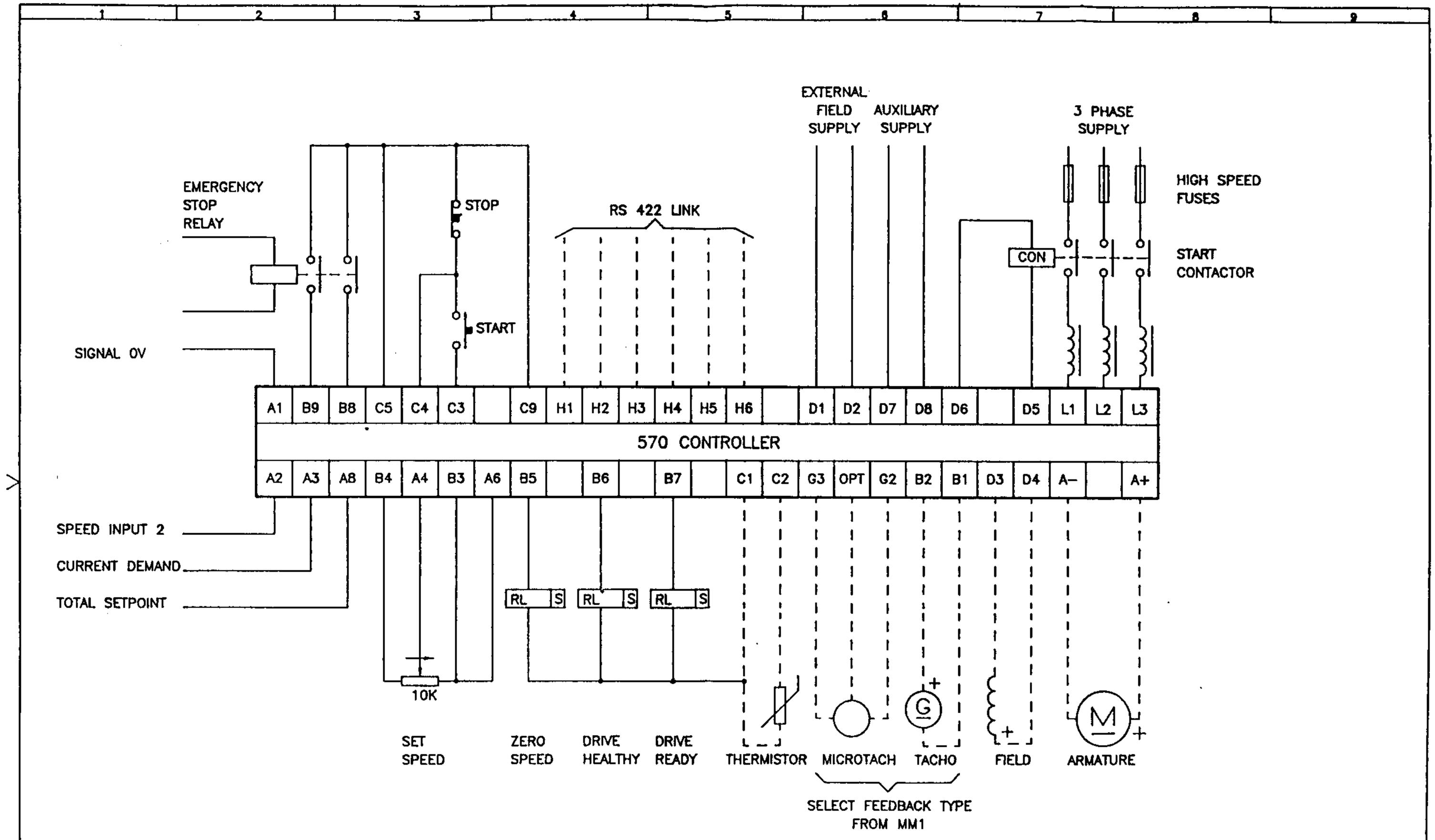
DIMS IN M M APPLY OVER FINISH

SCALE 1:4

SSD Shackleton system drives

TITLE: SSD/1 & SD6/7 INSTALLATION DRAWING

HG 049669 F



DRAWN	CHECKED	DATE	ISS
TRACED	DESIGN APP.	29-9-88 17-3-89 20-10-89	A B C

ELECTRICAL SYMBOLS GENERALLY TO BS 3939

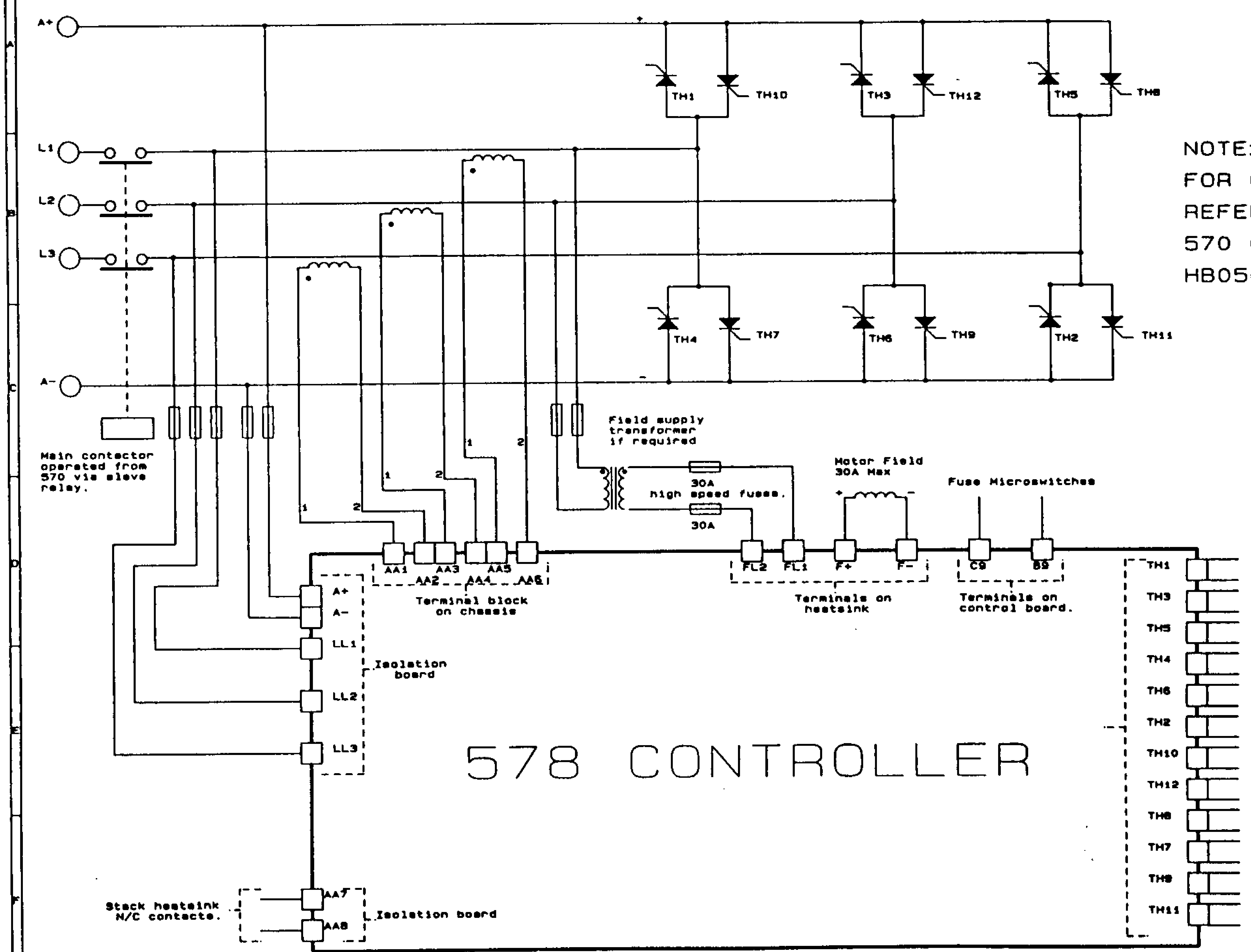
SSD LITTLEHAMPTON ENGLAND TELEX 87142

TITLE: CIRCUIT DIAGRAM FOR 570 MANUAL

USED ON: 570

DRAWING NUMBER: HB 56869 D

SHT. 1 OF 1



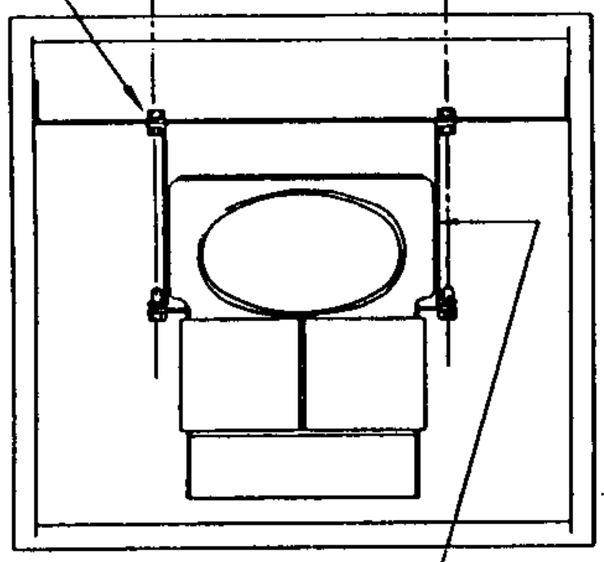
NOTE:
FOR CONTROL CONNECTIONS
REFER TO THE STANDARD
570 CIRCUIT DIAGRAM
HB056869D

CAD FILENAME: 578_2.SCH	NO ALTERATIONS OR ADDITIONS TO BE MADE TO THIS DIAGRAM RE-PLOT ONLY.		
DRAWN: ANW	CHECKED: GDR	ELECTRICAL SYMBOLS TO BS 3939	TITLE: CIRCUIT DIAGRAM FOR 578 EXTERNAL CONNECTIONS
C.A.D. LINK: —	DESIGN APP.: —	SSD LITTLEHAMPTON ENGLAND TELEX 87142	USED ON: —
ISS: A B C	DATE: 140090 / 060790 / 020391	EI	DRAWING NUMBER: HB058299D
© SSD 1989	SHT. 1 OF 8		

DO NOT SCALE | THIRD ANGLE PROJECTION | GENERAL DRAWING PRACTICE TO BS 308/BS 3939

8 M8 holes in back plate preferably threaded in line with fixing holes in 550

300 O C TS



SECTION AA

2 off support brackets BA 050451
(ordered seperately)

See sheet 2 of HC049663 for top plate piercing

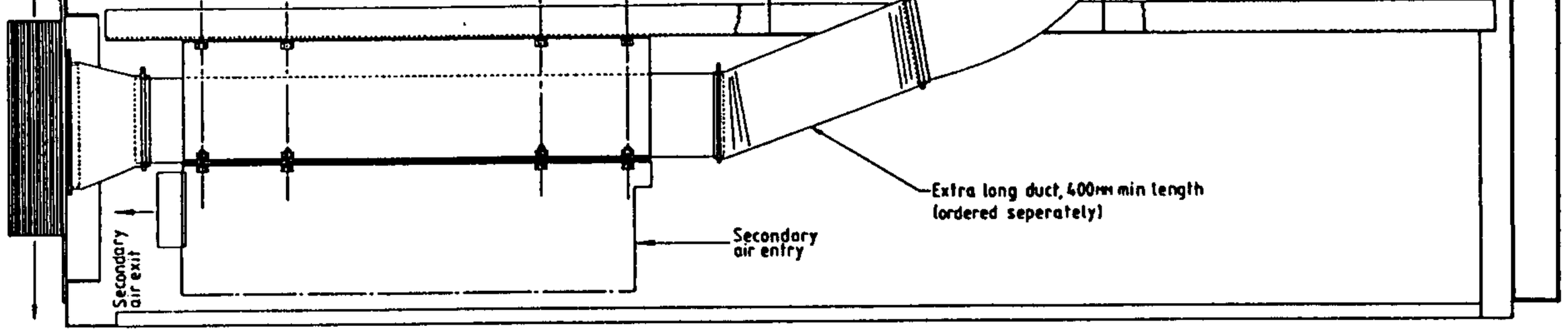
See sheet 2 of HC049663 for rear panel piercing

Primary air entry

215 | 133·5 | 533·5 | 667·0 | 890 TO CUT OUT | 520mm CUT OUT

200mm min clear distance

Primary air exit

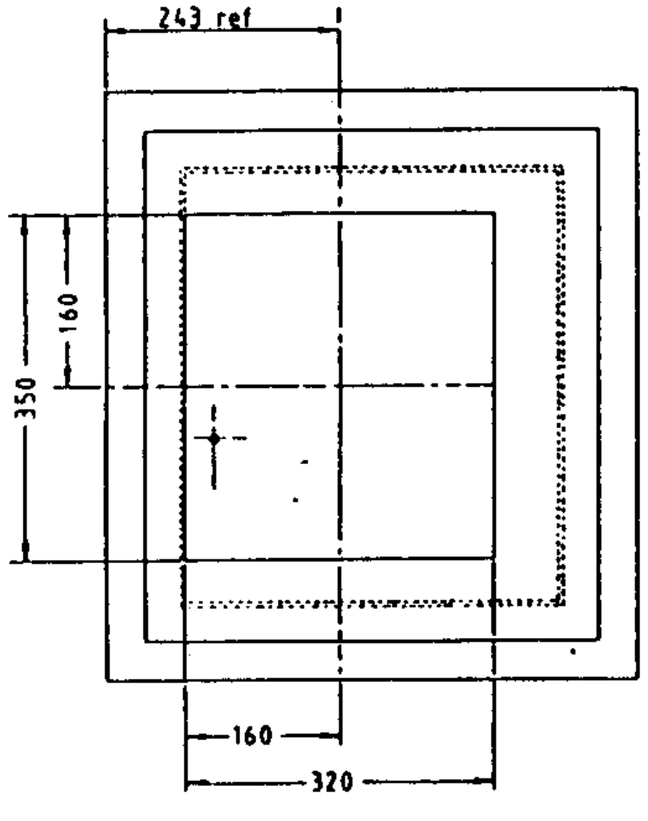


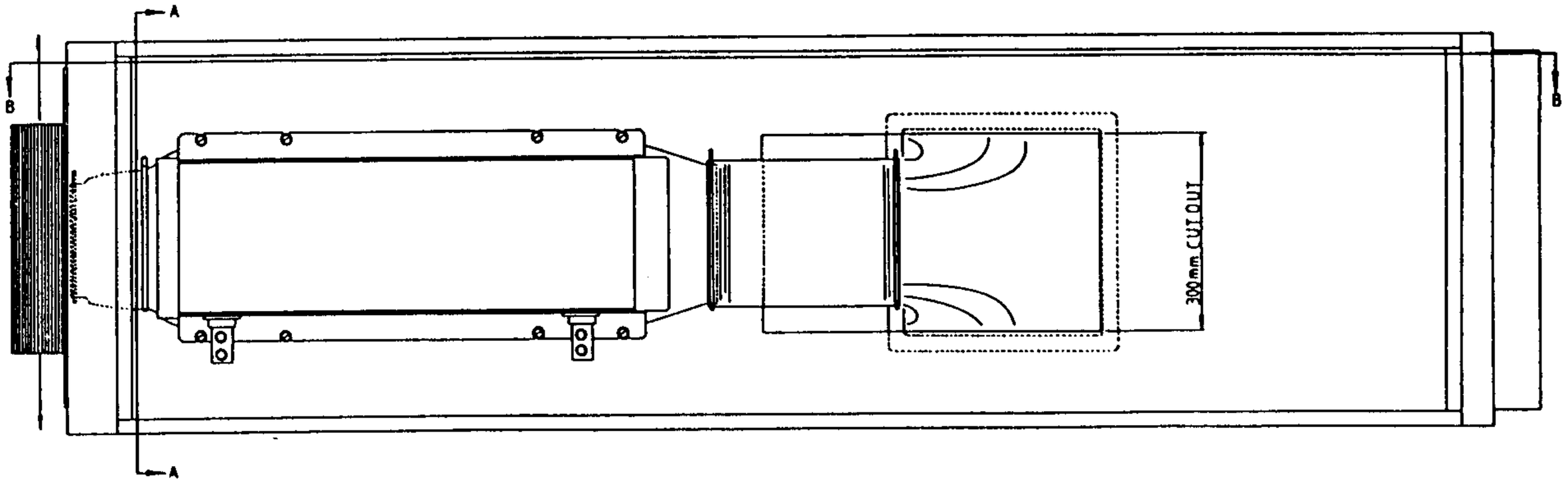
Extra long duct, 400mm min length (ordered seperately)

Secondary air exit

Secondary air entry

SECTION BB





For cut out details & outline drawing see HG 049669 F

DATE	
A 29 7 86	
1 6 8 86	
21 8 86	
12 9 86	

DRAWN Sperring | MATERIAL | DIMS. IN M.M. APPLY OVER FINISH (EXCEPT FOR PAINT AND LACQUER) | SCALE 1 : 4

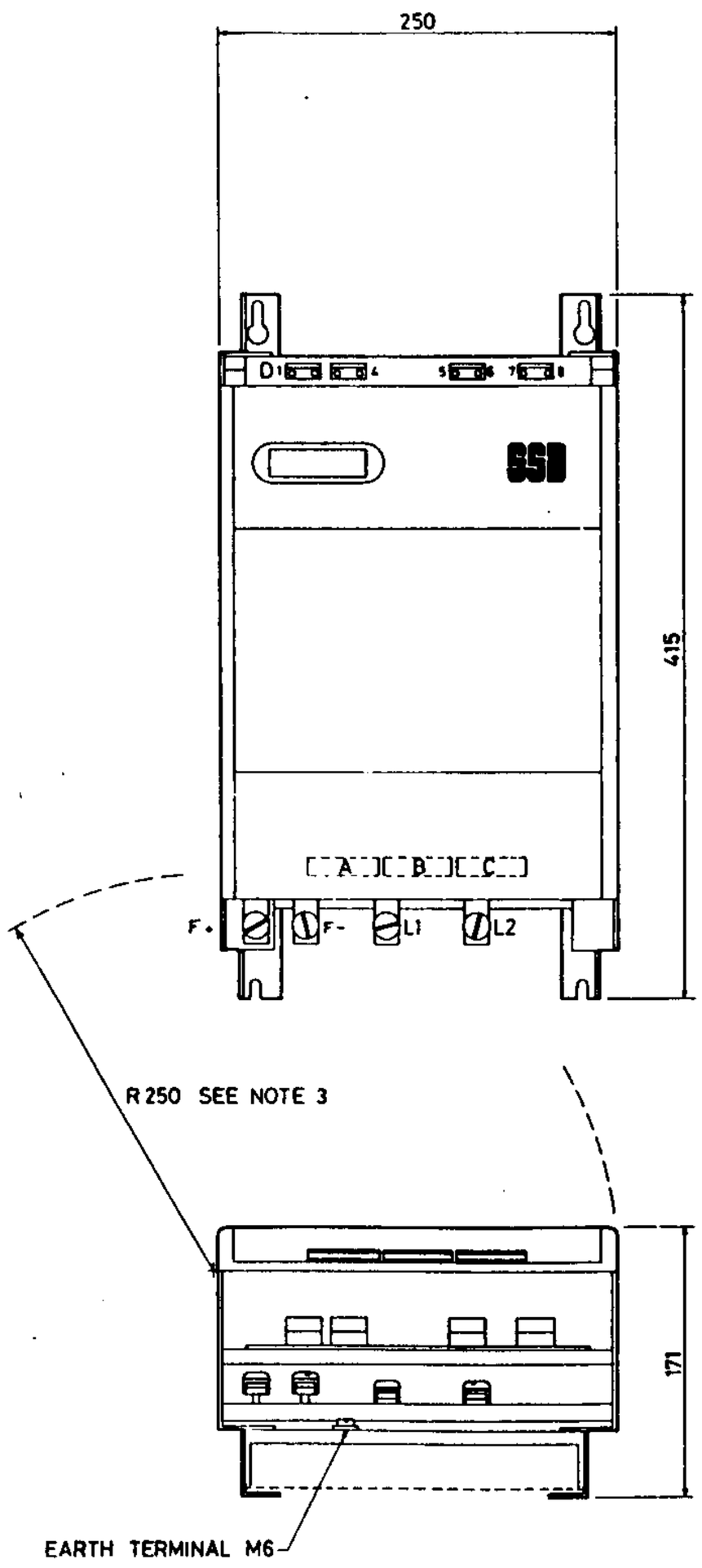
FINISH

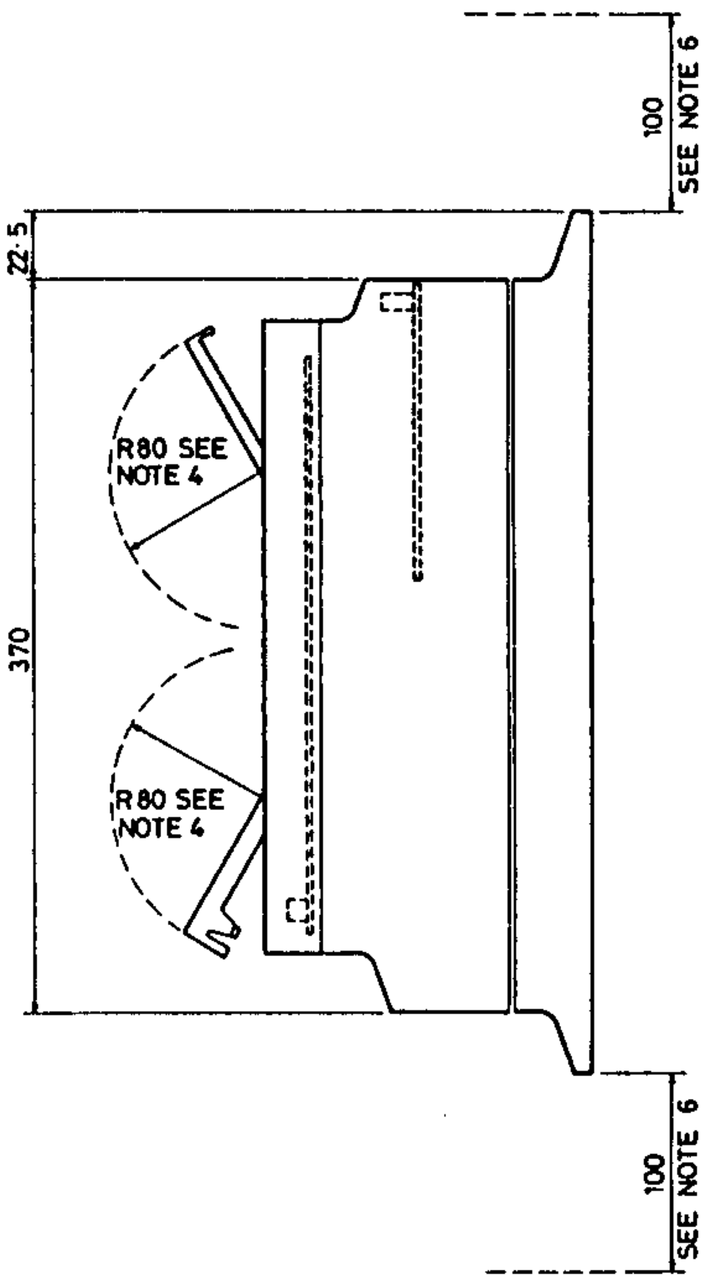
Shackleton system drives

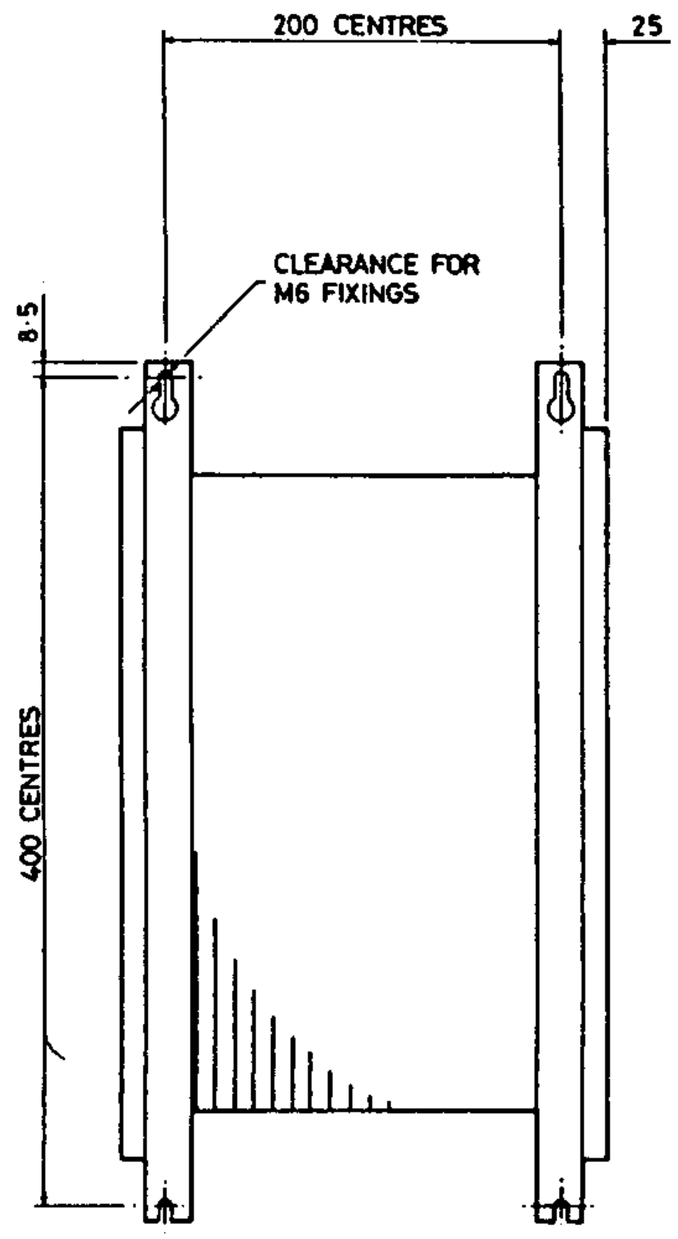
TITLE 350/1 & 370/7 INSTALLATION (ALTERNATIVE BRACKET MOUNTED)

DRAWING NUMBER HG 054248 F

DO NOT SCALE | THIRD ANGLE PROJECTION | GENERAL DRAWING PRACTICE TO BS 308 / BS 3939







REAR VIEW FIXING CENTRES

NOTES.

1. CONNECTIONS A,B & C ARE PLUG-IN STYLE TERMINALS CAPABLE OF ACCEPTING 1·5mm² CABLE INTO CLAMP STYLE LOOPS.
2. TERMINAL BLOCKS D1 – D8 ARE CAPABLE OF ACCEPTING 2·5mm² CABLE INTO CLAMP STYLE LOOPS.
3. FRONT COVER CAN PASS THROUGH 180° (CVR. HOUSES CONT. PCB) (ONLY 90° NECESSARY SEE NOTE 7)
4. ANCILLARY COVERS CAN PASS THROUGH 180° AND CAN BE LATCHED IN OPEN POSITION.
5. EARTH CONNECTION IS M6 ALL OTHER CONNECTIONS ARE M8 ALL NECESSARY FIXINGS FOR ELECTRICAL CONNECTIONS SUPPLIED. MECHANICAL MOUNTING FIXINGS ARE NOT SUPPLIED.
6. AT LEAST 100mm CLEARANCE ABOVE AND BELOW CONVERTER MUST BE PROVIDED FOR COOLING AIR
7. IT IS NOT NECESSARY TO OPEN FRONT COVER WHEN ELECTRICAL CONNECTIONS ARE BEING MADE.

DATE 30/10/84 | DRAWN | CHECKED GPE | DESIGN APPROVED | QUAL APPROVED | MATERIAL | FINISH

DIMS IN M.M. APPLY OVER FINISH (EXCEPT FOR PAINT AND LACQUER)

ASSEMBLED ON

SSD LITTLEHAMPTON ENGLAND TELEX 87142

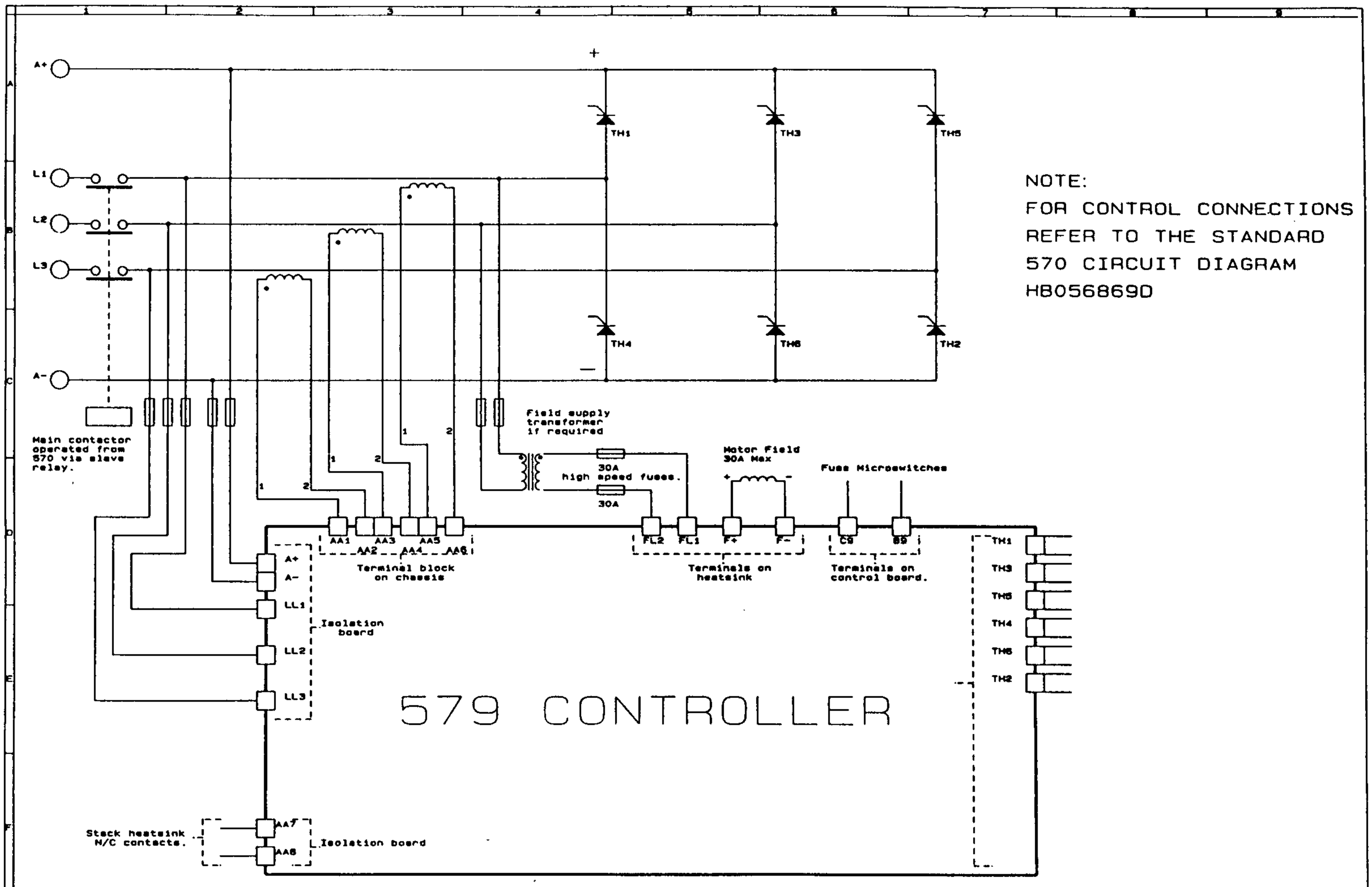
SCALE 1:2

EI

TITLE INSTALLATION DRAWING

DRAWING NUMBER 4655-2-1

SHT OF SHTS



NOTE:
FOR CONTROL CONNECTIONS
REFER TO THE STANDARD
570 CIRCUIT DIAGRAM
HB0568690

CAD FILENAME: 578_4.SCH

NO ALTERATIONS OR ADDITIONS TO BE MADE TO THIS DIAGRAM RE-PLOT ONLY.

DRAWN	CHECKED	DATE	14/05/90	06/07/90	02/03/91
ANW	GDR	ISS	A	B	C
C.A.D. LINK	DESIGN APP.				
—	—				

ELECTRICAL SYMBOLS TO BS 3939

SSD LITTLEHAMPTON ENGLAND TELEX 87142 EI

TITLE
CIRCUIT DIAGRAM FOR
579
EXTERNAL CONNECTIONS

USED ON —

DRAWING NUMBER HB0582990

SHT. 4 OF 5

5 TERMINAL DESCRIPTIONS

Terminal blocks A, B, and C are located on the control board each block being a 9 way plug-in connector. In addition to terminal blocks A, B and C, terminal blocks G and H provide connections when the two option modules are fitted on the control board.

TERMINAL BLOCK A

Terminal	Description	Function	Signal Level
A1	Ov(Signal Ground)	Zero Volt reference for analogue signals only.	
A2	Analogue Input No.1	Direct Speed Setpoint.	+10v = Full Speed Setpoint Forward. -10v = Full Speed Setpoint Reverse.
A3	Analogue Input No.2	Auxiliary Speed Setpoint or Current Demand. The Function of this input is determined by Digital Input No. 6 at terminal C8. C8 open circuit = Speed Setpoint C8 at +24v = Current Demand	+10v = Full Speed Setpoint Forward. -10v = Full Speed Setpoint Reverse in speed setpoint mode. +10v = 200% positive current demand. -10v = 200% reverse current demand.
A4	Analogue Input No.3	Ramped Speed Setpoint	+10v = Full Speed Setpoint. -10v = Full Speed Setpoint Reverse.
A5	Analogue Input No.4	Auxiliary Current. Clamp Negative.	+10v = 200% positive current demand -10v = 200% reverse current clamp.
A6	Analogue Input No.5	Main Current Limit or Auxiliary Current Clamp Positive. The function of Analogue Inputs 4 and 5 is determined by Digital Input No.4 on terminal C6. C6 open circuit. Analogue Input No.5 = Main Current Limit. C6 at +24v. Analogue Input No.5 = Auxiliary Current Clamp Positive Analogue Input No.4 = Auxiliary Current Clamp Negative.	+10v = 200% main current limit mode. +10v = 200% positive current clamp. -10v = 200% negative current demand.
A7	Analogue Output No.1	Speed Feedback output.	+10v = Full Speed Feedback Forward. -10v = Full Speed Feedback Reverse.
A8	Analogue Output No.2	Total Speed Setpoint or Current Demand. The function of Analogue Output No.2 is determined by Digital Input No.4 on terminal C6. C6 open circuit. Analogue Output No.2 is the Total Speed Setpoint. C6 at +24v. Analogue Output No.2 is the Total Current Demand.	+10v = Full Speed Setpoint Forward. -10v = Full Speed Setpoint Reverse in speed setpoint mode. +10v = 200% current demand Forward. -10v = 200% current demand Reverse in Total Current Demand mode.

A9	Analogue Output No.3	Buffered Output Current. The output voltage at Analogue Output No.3 is modified by the setting of parameter P23, Meter Drive, which can set bipolar or unipolar output.	+10v = 200% output current Forward. -10v = 200% output current Reverse. Bipolar Mode +10v = 200% output current unipolar Mode.

Input/Output Resolution	10 Bit 10mV
Input/Output Accuracy	10 Bit 10mV (0.1%)
Input Impedance	100K ohm with a 1 millisecond filter.
Input Sample Rate	5 milliseconds.
Input Overload Capability	10% i.e. Maximum Recognisable voltage 11v.
Output Capacity	10v at 5mA. Short Circuit Protected.
Output Update Rate	5 milliseconds.
Output Overdrive Capability	10% i.e. Maximum Output Voltage 11v.

TERMINAL BLOCK B

Terminal	Description	Function	Signal Level
B1	Ov(Signal Ground)	Zero Volt reference for analogue signals only specifically the analogue tachogenerator.	
B2	Analogue Tachogenerator Input	Tachogenerator Feedback	+200v dc Maximum at Full Speed Feedback Forward. -200v dc Maximum at Full Speed Feedback Reverse.

This input is intended solely for the connection of an analogue dc tachogenerator. Terminals B1 and B2 should be used for the two connections of the tachogenerator. A dc voltage of up to 200v dc maximum can be applied directly to B2 with respect to B1. Tachogenerator calibration is achieved by resistors R4 and R5 on the plug-in calibration board, the resistors being selected using the formula:-

R4 + R5 = (Full Speed Tachogenerator Volts - 10) K ohms.

The minimum tachogenerator voltage is 10v with a calibration resistor of zero ohms. If the tachogenerator voltage exceeds 200 volts an external potentiometer chain is necessary to reduce the voltage to an acceptable level.

Fine calibration of the tachogenerator feedback is performed in software and is adjusted using the MMI in the Set-up Parameters Calibration Menu, "Analog Tach Cal" (See Set-up procedure).

For forward motor rotation corresponding to a positive setpoint signal, the tachogenerator feedback voltage at terminal B2 must be positive with respect to OV (signal).

Note:

Block 8 of the product code specifies the speed feedback source. Only when block 8 is coded as '1' is terminal B2 used for speed feedback.

B3	+10v Reference	Positive Reference Supply	+10v at 10mA short circuit protected.
B4	-10v Reference	Negative Reference Supply	-10v at 10mA short circuit protected.
B5	Digital Output No.1	Zero Speed Detected. The operating level of this output can be modified by parameter P8 the zero threshold to give the desired accuracy of operation.	+24v at zero speed.

B6	Digital Output No.2	Drive Healthy (Drive Operational) This output is true when the auxiliary/control supply is applied to the drive controller. When a start/run signal is applied to 'C3', it reflects the condition of the Ready output.	+24v when Healthy
B7	Digital Output No.3	Drive Ready. This output is true when all alarms are valid and the drive is ready to function.	+24v when Ready

Digital Output Voltage	+24V dc.
Digital Output Current	+50mA maximum Source.
Output Update Rate	5 milliseconds.
Output Impedance	47ohms, short circuit protection not provided.

These outputs are active high and source current from the terminal to the load. Thus the load must be connected between the output and the power ground terminal C1.

B8	Program Stop	Controlled Stop Input. When the Program Stop input is held at +24v, the drive operates as required by the inputs. When the Program Stop is open circuit or at zero volts, the drive causes a controlled or program stop to take place as defined by the Program Stop parameters.	+24v drive run 0v (o/c) drive stop
B9	Coast Stop	Uncontrolled Stop Input. When the Coast Stop input is at +24v, the drive operates normally. When the Coast Stop is at zero volts or open circuit, the main contactor is open and the drive no longer operates. The motor coasts to rest.	+24v drive run 0v (o/c) drive coasts to rest.
C1	0v (Power Ground)	Control and Relay Ground	
C2	Thermistor/ Microtherm	Motor overtemperature protection element input.	

It is good practice to protect DC motors against sustained thermal overloads by fitting temperature sensitive resistors or switches in the field and interpole windings of the machine. These devices have a low resistance (typically 200 Ohms), up to a reference temperature (125°C). Above this temperature, their resistance rises rapidly to about 2000 Ohms. Motor overtemperature sensors should be connected in series between terminals C1 and C2. An alarm will be activated if the external resistance between C1 and C2 exceeds 1.8k Ohms ± 200 Ohms. The controller will inhibit the Thyristor firing circuits and de-energise the main contactor control relay. The controller will not restart when the thermistor resistance falls until the overtemperature alarm is reset. The overtemperature alarm is automatically indicated on the LCD Display when it occurs.
Terminals C1 and C2 must be linked if overtemperature sensors are not used.

C3	Digital Input No.1	Start/Run When an input is applied to this terminal the drive will run provided there are no alarms and program stop/coast stop signals are valid. When the input is removed the drive will stop unless the stop input on C4 is held at 24v, in this case the drive continues to run until the stop signal is removed.	+20v Minimum +24v Typical

C4	Digital Input No.2	Stop This input is intended to provide the maintain input for a simple start/stop pushbutton system. Provided the stop input is held at +24v a momentary signal on Digital Input No.1 (Start/ Run) will cause the drive to operate. Operation will continue until the stop signal is removed.	+20v Minimum +24v Typical
C5	Digital Input No.3	Enable The enable input provides a means of co-ordinating the operation of a number of drives. When all drives are Ready, then the electronic enable command is applied to all drives which start to run together.	+20v Minimum +24v Typical
C6	Digital Input No.4	Selection Control No. 1 The select control has two effects. (a) To alter the function of analogue output No.2 terminal A8. Inactive (open circuit or connected to 0v). The analogue output shows the total setpoint. Active (+24v applied). The analogue output shows the total current demand. (b) To re-configure the current limit controls. Inactive. Analogue Input No.5 is the main current limit with auxiliary current limits provided by Current Variables 2 and 3, No.2 being the negative current limit, No.3 the positive current limit. Active. Analogue Input No.5 is the auxiliary current limit positive, Analogue Input No.4 is the auxiliary current limit negative. Current Variable No.1 is the main current limit.	+20v Minimum +24v Typical
C7	Digital Input No.5	Ramp Hold If the input is held active the Ramp Generator output is frozen at that value irrespective of the Ramped Setpoint Input. When inactive the Ramp Output follows the Ramped Setpoint Input with a delay determined by the Ramp Up and Ramp Down parameters.	+20v Minimum +24v Typical
C8	Digital Input No.6	Current Demand Isolate. This input alters the drive operation from Speed Control to Current Control. When digital input No.6 is active, analogue input No.2 provides the current demand and the speed loop is disconnected. When inactive the speed loop is in control and analogue input No.2 is an auxiliary speed reference.	+ 20v Minimum + 24v Typical
C9	+24 volt supply	Maximum output current: 50mA. This is a regulated +24 volt supply which can be used to activate the Digital inputs, program stop and stop terminals. Output impedance 47R.	

Control Board Terminal Summary

Signal Ground	0v	A1
Speed Setpoint	Analogue Input 1	A2
Aux. Speed Setpoint/Current Demand	Analogue Input 2	A3
Ramped Speed Setpoint	Analogue Input 3	A4
Aux. Current Clamp -ve	Analogue Input 4	A5
Main Current Limit/Aux. Current Clamp +ve	Analogue Input 5	A6
Buffered Speed Feedback	Analogue Output 1	A7
Total Speed Setpoint/Current Demand	Analogue Output 2	A8
Buffered Current Output	Analogue Output 3	A9

Signal Ground	0v	B1
	DC Tachogenerator Input	B2
	+10v DC Reference	B3
	-10v DC Reference	B4
Zero Speed Output	Digital Output 1	B5
Drive Healthy	Digital Output 2	B6
Drive Ready	Digital Output 3	B7
	Program Stop Input	B8
	Coast Stop Input	B9

Power Ground	0v	C1
	Thermistor Input	C2
Start/Run	Digital Input 1	C3
Stop	Digital Input 2	C4
Enable	Digital Input 3	C5
Selection Control	Digital Input 4	C6
Ramp Hold	Digital Input 5	C7
Current Demand Isolate	Digital Input 6	C8
	+24v Supply	C9

TERMINAL BLOCK G

G1	External +24v dc Supply	Alternate external +24v Microtach power supply source input connection terminal.
G2	+24v dc Microtach Supply	This is a regulated +24v supply which can be used to power the microtach and the microtach option modules. The maximum load of the 24v supply is 250mA when supplying terminals C9, G2 and any digital outputs. If this load is likely to be exceeded an external 24v supply should be connected to G1 to supplement the internal supply.
G3	Microtach Power Supply Ground	
F1	Microtach Input	Fibre Optic Receiver Input Socket.

TERMINAL BLOCK H

H1 H2	XMT - XMT +	Serial Communications Port Transmit Terminals. Balanced Line Driver outputs compatible with RS422 signal levels.
H3	0v Isolated	Serial Communication Port Signal ground with galvanic isolation from controller signal ground or power ground.
H4	0v Screen	Signal Screen ground point
H5 H6	RCV - RCV +	Serial Communications Port Receive Terminals Balance Line Receiver input compatible with RS422 signal levels.

Power Board Terminal Description

D1 D2	FE FE	External AC input to field bridge. Controllers with field options 4, 5 and 6 in Product Code Block 4 require an AC input to these terminals. The output voltage at the field output terminals D3 and D4 will depend upon the magnitude of this applied voltage and the connection of the rectifier bridge. For field options 4 and 5 (field regulator and full wave rectifier bridge) Required AC Input Voltage = 1.11 x Rated Field Voltage. Note: The field regulator will control the field current provided that the input voltage selected gives an output voltage exceeding the field voltage by at least 10%. For field option 6 (half wave rectifier bridge). Required AC Input Voltage = 2.22 x Rated Field Voltage The external AC supply must be protected with high speed fuses to protect the field regulator or the rectifier bridge. For controllers with 10A field capability 10A fuses should be used, those with 20A field capability 20A fuses. When using the externally supplied regulated field option it is important to have the correct phase relationship on the input. The field must always be supplied from L1 (Red) and L2 (Yellow) phases directly or indirectly through a transformer. L1 must be connected to D1 and L2 to D2.

Caution:- The voltage applied to the external ac terminals must not exceed the level specified by the AC Power Supply Voltage Product Code Block 3.

D3 D4	Field Output - Field Output +	Motor Field Connections. The DC output voltage at these terminals will depend upon the AC supply voltage and the field rectifier configuration. Output Voltage for Controllers with Field Options 1 and 2 can be calculated from the following formula:- DC Output Voltage (Full Wave Rectifier and Field Regulator) = 0.9 x 3 phase power supply line voltage. Note: For control of the field current to be maintained with the field regulator the field voltage should not be greater than 90% of DC output voltage. Field Option 3 (half wave rectifier bridge) DC Output Voltage = 0.45 x 3 phase power supply line voltage. Field Option 8 (Internally supplied 3 phase 1/2 wave rectifier.) DC Output Voltage = 0.67 x 3 phase power supply line voltage.
D5	Main Contactor Coil(L)	The terminal is the switched output from the contactor control relay and is derived from the auxiliary supply at terminal D8. The output is internally fused at 3A hence contactor coils having a high pick-up current must be operated via a slave relay.
D6	Main Contactor Coil (N)	This terminal is internally connected to the auxiliary supply neutral and provides a convenient connection point for the contactor coil neutral connection.
D7 D8	Auxiliary Supply (N) Auxiliary Supply (L)	These terminals are the mains input connections for control supply transformer, contactor control relay supply and cooling fan supply (when force cooled). The voltage applied to these terminals is Product Code dependant, ensure that the input voltage tapping coincides with both the applied voltage and the Product Code. Failure to do so may cause the supply fuse to fail and may cause permanent damage.

CONTROL BOARD OPTION MODULE TERMINAL ALLOCATION

Microtach Option Module

External +24VDC Supply	G1
+24V DC Supply	G2
0 volt power	G3
Fibre Optic Input Socket	F1

RS422 Serial Link Option Module

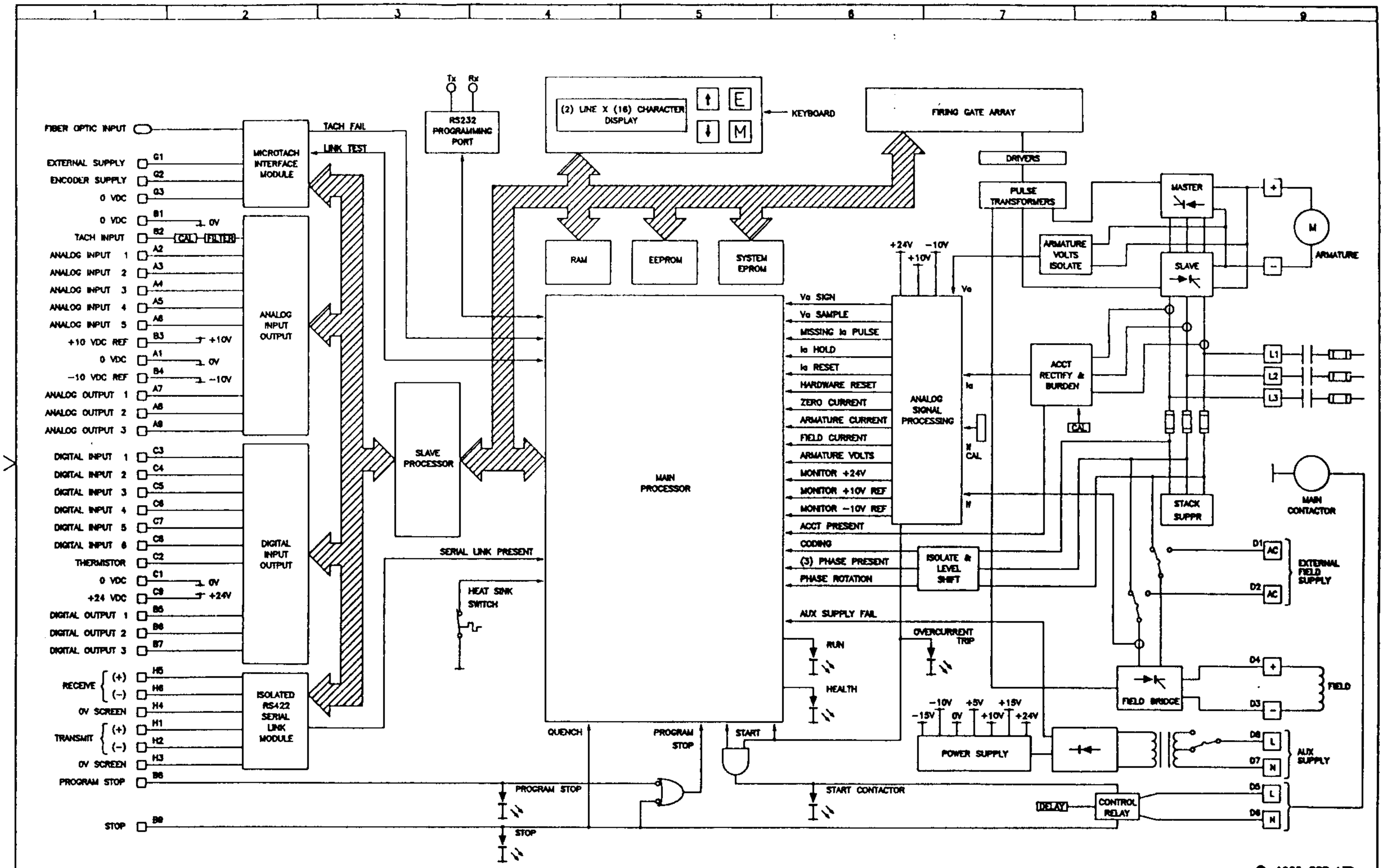
Transmit -	H1
Transmit +	H2
0V Isolated	H3
0V Shield Screen	H4
Receive -	H5
Receive +	H6

Power Board Terminal Allocation

External field supply - AC	D1
External field supply - AC	D2
Field supply -	D3
Field supply +	D4
Main contactor coil - AC	D5
Main contactor coil - AC	D6
Auxiliary supply 110/240 Neutral	D7
Auxiliary supply 110/240 Line	D8

Power Terminals

Three phase supply 110 - 480 VAC	L1
Three phase supply 110 - 480 VAC	L2
Three phase supply 110 - 480 VAC	L3
Armature connection positive	A+
Armature connection negative	A-



DRAWN ***	CHECKED	DATE	26/09/89	ELECTRICAL SYMBOLS TO BS 3939	TITLE BLOCK DIAGRAM FOR HARDWARE	USED ON 570
TRACED	DESIGN APP.	ISS	A	SSD LITTLEHAMPTON ENGLAND TELEX 87142		DRAWING NUMBER HH 057715 D SHT. 1 OF 1

6 HARDWARE OVERVIEW

6.1 MAIN MICRO-PROCESSOR - 16 BIT

The main processor performs all the major controller functions. These include:-

Main Thyristor firing algorithms
Current loop
Speed loop
Field regulator algorithms
Alarm conditioning
Controller Sequencing
Liquid Crystal Display and Keypad
General controller housekeeping functions
5703 Support Functions
Primary LED Diagnostics

6.2 CODE AND MESSAGE STORAGE MEDIUM

EPROM Capacity 64k Bytes

6.3 WORKING MEMORY

Static RAM. Capacity - 8k Bytes

6.4 PARAMETER STORAGE MEDIUM

EEPROM Capacity - 8k Bytes

6.5 DIRECT MAIN PROCESSOR FEEDBACK VARIABLES

(a) Armature Current

Armature current is sensed using A.C. current transformers to provide an isolated and normalised signal of 1.1 volts for full load current.

If the armature current ever exceeds 300%, a hardware overcurrent trip is activated. This provides an armature current clamp to the main processor, and also directly de-energises the main contactor. An alarm condition is set on the LCD Display, which must be cleared to re-start the controller.

Armature current feedback total accuracy is better than 1%. Calibration is set by resistors on the plug-in calibration board.

Calibration equation:-

$$RA = \frac{2200}{(FLC-1)} \text{Ohms} \qquad \text{Where FLC = Armature Full Load Current}$$

(b) Field Current

Field current is monitored using a current transformer, to provide an isolated and normalised signal to the main processor. This is used in two possible ways:-

1. To provide a field fail alarm to the main processor when an uncontrolled field bridge is used. This alarm is set to indicate that the motor field or wiring is open circuit.
2. To provide current feedback when the field current regulator option is specified for the controller. The field fail alarm is activated if the demanded field current value cannot be achieved.

Field current feedback total accuracy is better than 1%. Calibration is set by resistors on the plug-in calibration board.

Calibration equation:-

$$RF = \frac{3000 \text{ Ohms}}{\text{Full scale field current}}$$

Note this equation is modified on the 578/579 to:-

$$RF = \frac{4000 \text{ Ohms}}{\text{Full scale field current}}$$

(c) Armature Voltage

Motor armature voltage is sensed using precision resistors to provide an isolated and normalised signal to the main processor. This can be used in two possible ways:-

1. To provide armature voltage feedback for motor speed control.
2. To provide armature voltage feedback for field weakening. This only applies if the on board field current regulator has been specified.

Armature voltage feedback total accuracy is 1%. Calibration is set by resistors on the plug-in calibration board.

Calibration equation:-

RV = 0.1 (Full scale armature volts) - 10k Ohms

The minimum allowable armature voltage is 100 volts: this would require a calibration resistor value of zero Ohms.

Final calibration of armature voltage feedback is performed in software and adjusted using the LCD Display. (See Setup procedure).

6.6 MAIN PROCESSOR AC SUPPLY SYNCHRONISATION

The Coding Module

Thyristor stack synchronisation signals are generated for the main processor by a module mounted on the power board. This coding module provides isolation from the supply using opto-isolators, and gives excellent integrity when operating the controller on poor quality power sources. The module also provides signals which indicate the supply phase rotation, and that the main supply is present.

Three options of the coding module are designed to cover a voltage range of 110 Vac to 660 Vac, 50 to 60Hz. Normal supply voltage variations of + 10% at the high voltage end, -10% at the low voltage end can be catered for by the circuits as well as 10% variation in frequency. These three options operate over the ranges 110 Vac to 240 Vac, 220 Vac to 480 Vac, 440 Vac to 660 Vac with 220/480 Vac being the standard option.

The mains supply present function sends an alarm to the microprocessor if the incoming three phase supply fails, or if a phase loss occurs. This phase loss indication must be treated with some caution since it is entirely feasible that external equipment, connected to the three phase input to the controller, could reproduce the missing phase. Under these circumstances, the phase loss detector would not indicate an alarm condition. Both phase rotation and supply present detectors use opto-isolators to isolate the incoming supply from the signal supplies.

6.7 ALARM SIGNALS

(a) Missing Armature Current Pulse Detection

In the event of Thyristor trigger faults, the armature current can become very distorted. Although outwardly operation is satisfactory, the motor will experience severe heating which can cause failure. This armature current distortion is detected and fed back to the main processor. After approximately 30 seconds, the "missing pulse" alarm is indicated on the LCD Display. The armature current is clamped off and the main contactor control relay is de-energised. The alarm must be reset in order to re-start the controller.

(b) Power Supply Monitor

Three power supplies are monitored by the main processor:-

1. +10v reference
2. -10v reference
3. +24v main power supply

Alarms are activated if any of these power supplies are out of tolerance.

(c) Armature Current Firing Circuit Inhibit

Inhibit the armature current when activated.

This input is activated under two possible conditions.

1. Overcurrent trip
2. Stop terminal B9 de-activated

(d) Heatsink Trip

On fan ventilated versions of the 570 controller (over 70 amps bridge rating), a thermostatic switch is included on the heatsink. If the heatsink ventilation fails and the heatsink temperature rises, the switch activates and causes an alarm condition. This clamps the armature current firing circuit and de-energises the main contactor.

(e) Miscellaneous Inputs

1. Plug in Calibration board present
2. Serial Communication link board present
3. AC current transformers present

The above three signals cause alarm conditions to be generated if the respective items are not plugged in and the drive is started. In the case of the serial link board, an alarm is generated if the serial link is accessed by the main processor when the board is not plugged in.

6.8 DIRECT MAIN PROCESSOR OUTPUT SIGNALS

Main Contactor Control Relay

This relay is controlled from an output on the main processor, via hardware gating. This gating allows de-energisation of the main contactor from the hardware overcurrent latch. In addition, the control relay power supply is derived directly from terminal B9. This allows the contactor to be de-energised in the case of main processor failure.

Hardware Reset

This output allows the hardware current trip latch to be reset under main processor control. An additional output also allows the slave micro-processor to be reset if any errors occur.

6.9 P3 PORT

The P3 Port is accessed via the connector under the bottom flap of the 570. It is primarily intended for the loading or retrieval of parameter information from the 570 onto a PC or Personal Organiser, for further information see section on Upload/Download. There is an alternate use of the P3 Port which enables simple setpoint or feedback data transfer between 570 controllers for further information see section on P3 Port Expander.

6.10 THE LIQUID CRYSTAL LCD DISPLAY AND KEYPAD

A two line by sixteen character liquid crystal display is mounted under the top flap of the controller. The display, together with the four key keypad, allows the following functions:-

a. Display and reset of alarm status where applicable. This function is activated when any alarm occurs, irrespective of the last state of the display.

b. Display and adjustment of controller setup parameters.

c. Display of controller diagnostic functions.

d. Display of controller product code. This allows access to the current controller product code.

e. Display of sales and service information. This allows access to the phone and telex numbers of all principal SSD sales and service locations throughout the world.

f. Display and entry of software access code. This access code allows entry to higher level software within the 570.

The operation of the LCD Display is discussed fully in a later section of this manual.

6.11 THYRISTOR STACK CONTROL

The main Thyristors for armature current control are operated directly from the main processor via a custom gate array. This device sequences the firing of the individual Thyristors in the motoring and regen stacks under control of the main processor. The outputs of the gate array drive pulse transformers, which fire the Thyristors. These provide voltage isolation between the incoming supply and signal supply. The gate array is also used to provide firing signals to the pulse transformers which operate the field regulator Thyristors.

6.12 PRIMARY LED DIAGNOSTICS

Six LED indicators are mounted under the top flap of the controller. These allow the operational status of the controller to be monitored easily without using the LCD Display.

6.13 SLAVE MICRO-PROCESSOR

The slave micro-processor performs all the primary input/output functions which are connected to the drive terminals. This information is normalised and passed between main and slave processors. In this way, the main micro-processor is relieved of any primary input/output duties.

(a) Analogue Inputs and Outputs

All analogue inputs and outputs which interface with the drive terminals are routed through the slave micro-processor.

The slave processor interfaces with a digital to analogue converter which allows high accuracy data acquisition. The processor, together with the converter, performs both analogue input and analogue output duties. The data acquisition system specifications are:-

Accuracy	-	0.1% (10 bits) per input or output
Resolution	-	Better than 0.1% per input or output
Voltage range	-	± 10 volts DC
Input impedance	-	100K Ohms
Output drive current	-	± 1-mA
Sample rate	-	200 Hz

A track and hold amplifier is used to freeze the analogue input signals prior to conversion. This prevents any conversion errors. The data acquisition system is calibrated automatically against a high precision on-board voltage reference. This calibration is activated on power-up of the auxiliary supply and also periodically during normal operation of the controller. This allows temperature effects within the analogue hardware to be compensated in real time. The high precision reference is also buffered and used to supply the drive reference terminals B3 and B4.

(b) Digital Inputs and Outputs

All digital inputs and outputs which interface with the drive terminals are routed through the slave processor.

Digital Inputs	-	Input Impedance 4.7K Ohm Maximum Voltage 24V DC
Digital Outputs	-	Output Voltage 24V DC Maximum Current 50mA

(c) RS422 Serial Link Module

Serial communications to the 570 are performed using a serial link option module mounted under the lower flap of the product. This option module allows access to the controller functions as serial messages. The serial link hardware conforms to the international RS 422 standard specification, and is of multi-drop format. The serial message transfer format conforms to the Eurotherm BiSynch standard, and as such allows SSD 570 controllers to be networked together with other instruments within the Eurotherm Group. The slave processor is responsible for the basic protocol handler for message transfer.

The serial link option module is a removable component PCB which provides full isolation of the serial link from the main power supply on the 570. An alarm signal is generated on the LCD Display if the serial link is enabled from the controller when the module is not installed. The alarm signal can be inhibited through the MMI in the alarm override menu.

(d) MICROTACH Option Module

The SSD 5701 MICROTACH transducer allows high accuracy speed feedback to the controller. The transducer consists of an incremental shaft encoder which is mounted on the back of the motor. This communicates with the controller via a single fibre optic link and an option module mounted under the lower flap on the front of the door. The transducer and module entirely replace the conventional DC tachometer which normally would interface to terminal B2. Use of the transducer allows the steady state motor speed to be controlled to better than 0.01%. It must be noted that in order for this accuracy to be fully realised, the speed setpoint must also be of high accuracy. This implies that this setpoint must be supplied down the serial link to the main micro-processor.

The fibre optic transducer module interfaces the controller to the fibre optic cable. The power supply for the transducer is also supplied from terminals on this module. Ultimately the transducer power source is derived from the on board power supply of the controller. Speed feedback data from the module is captured in real time by the slave processor, and sampled at regular intervals by the main processor.

6.14 POWER SUPPLY

The power supplies for the controller are generated from the single phase auxiliary supply via the control transformer. A bridge rectifier and filter capacitor feed an unregulated 40 volt DC supply to a high efficiency switched mode pre-regulator. This generates 24 volts DC which is used for Thyristor stack firing, digital I/O and other power functions. The logic supply is stabilised to +5 volts using a high efficiency switched mode regulator. Stabilised +/-15 volt supplies are generated for the analogue hardware. All power supplies are short circuit protected, and the 40 volt and 5 volt supplies are protected against overvoltage using a crowbar. The control transformer is provided with two primary taps which allow auxiliary supply voltages of 110 VAC and 240 VAC. The auxiliary supply fuse FS3 on the power supply PCB protects the control transformer primary. This fuse is also cleared should the crowbar operate, which can happen if the wrong auxiliary supply voltage tap is selected.

6.15 THE POWER CONFIGURATION

Three phase power is supplied to the AC input terminals (L1, L2, and L3) of the controller via the main contactor. The phase rotation of the supply is not important and is automatically compensated within the controller. There is no internal high speed fusing to protect the stack against short circuits. This must be provided externally to ensure safe operation. Three low current cartridge type high speed fuses provide on-board protection to the power wiring, internal field supply, suppression networks and coding module.

(a) Stack Suppression

The Thyristor stack is protected against supply overvoltage transients using non-linear surge suppressors. Capacitor/resistor networks are also used to help damp transient oscillation of the stack supply when the Thyristors are switching.

(b) Auxiliary Supply

The auxiliary single phase supply which powers the drive electronics is connected to terminals D7 (neutral) and D8 (line) on the power board. The supply is fused in three places to individually protect equipment on the controller:

FS1 -Force ventilation fan fuse, rating 0.5 Amp

FS2 -Main contactor fuse, rating 3 Amps

FS3 -Control transformer fuse, rating 0.315 Amp slow blow

It is very important that the fuses be replaced with the correct value and type to ensure the safe operation of the controller.

(c) Contactor Control

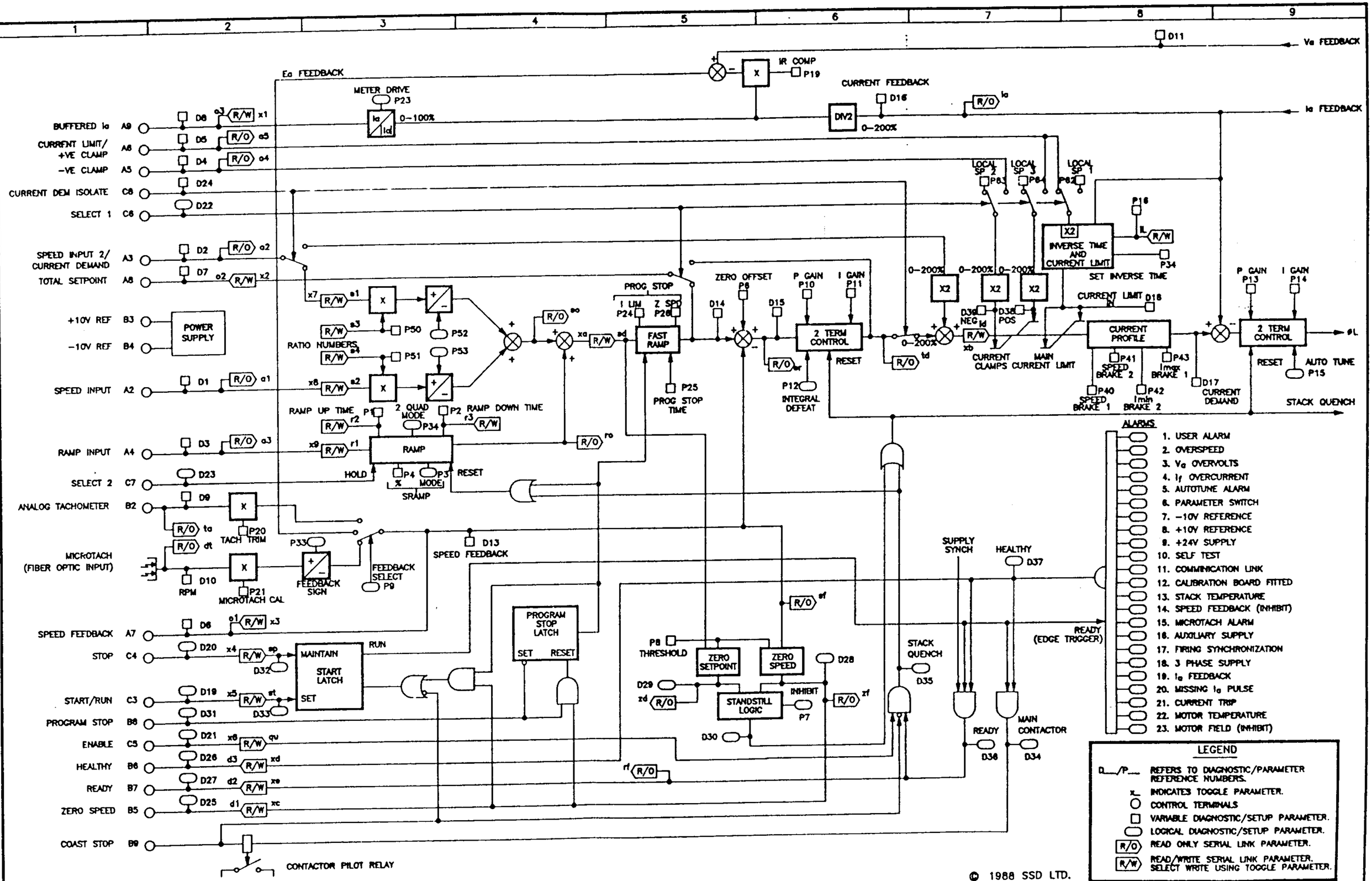
The main contactor connects the three phase supply to the controller and is operated by the contactor control relay on the power board. Suppressed contacts of the control relay switch the auxiliary supply onto terminals D6 (line) and D7 (neutral) to energise the contactor. The control relay has a switching capability of 3 Amps inductive at up to 240 volts AC. For contactors with higher voltage or current ratings, an external slave relay should be interposed between the internal control relay and the main contactor. A DC loop contactor may be utilised as an alternative to the AC contactor described above; the contactor control relay handles either.

(d) Field Supply

The DC supply for field excitation is available from terminals D3 (negative) and D4 (positive) on the power board. It is obtained from one of two on board sources:-

1. A fixed bridge rectifier with either full wave or half wave configuration dependant upon the specified product code. This field bridge is supplied as standard on 570 Series Controllers. The AC supply for the rectifier can be provided either internally from the line to line supplies, or externally through terminals D1 and D2. The field rectifier is protected by the coding fuses if the internal supply option is specified. External protection fuses are required if the external supply option is specified. A non linear surge suppressor always protects the field rectifier irrespective of the AC connection.

2. A half-controlled thyristor bridge can be supplied as a current regulator with the 570 as an option and is specified by the product code. This provides control of the motor field current and prevents "overfluxing" of the motor field when the motor is cold. The "overfluxing" effect sometimes prevents operation of the motor at full speed until operating temperature has been achieved. The regulator field option may also be used as a field weakener to allow increased motor speed range. Since the field controller synchronisation is derived from the main stack sychronising module, the field controller bridge should be supplied from the internal connection to the line to line supplies within the 570 controller if feasible. External connection is allowed provided the red to yellow phases are always used to provide the supply directly or indirectly via a transformer.



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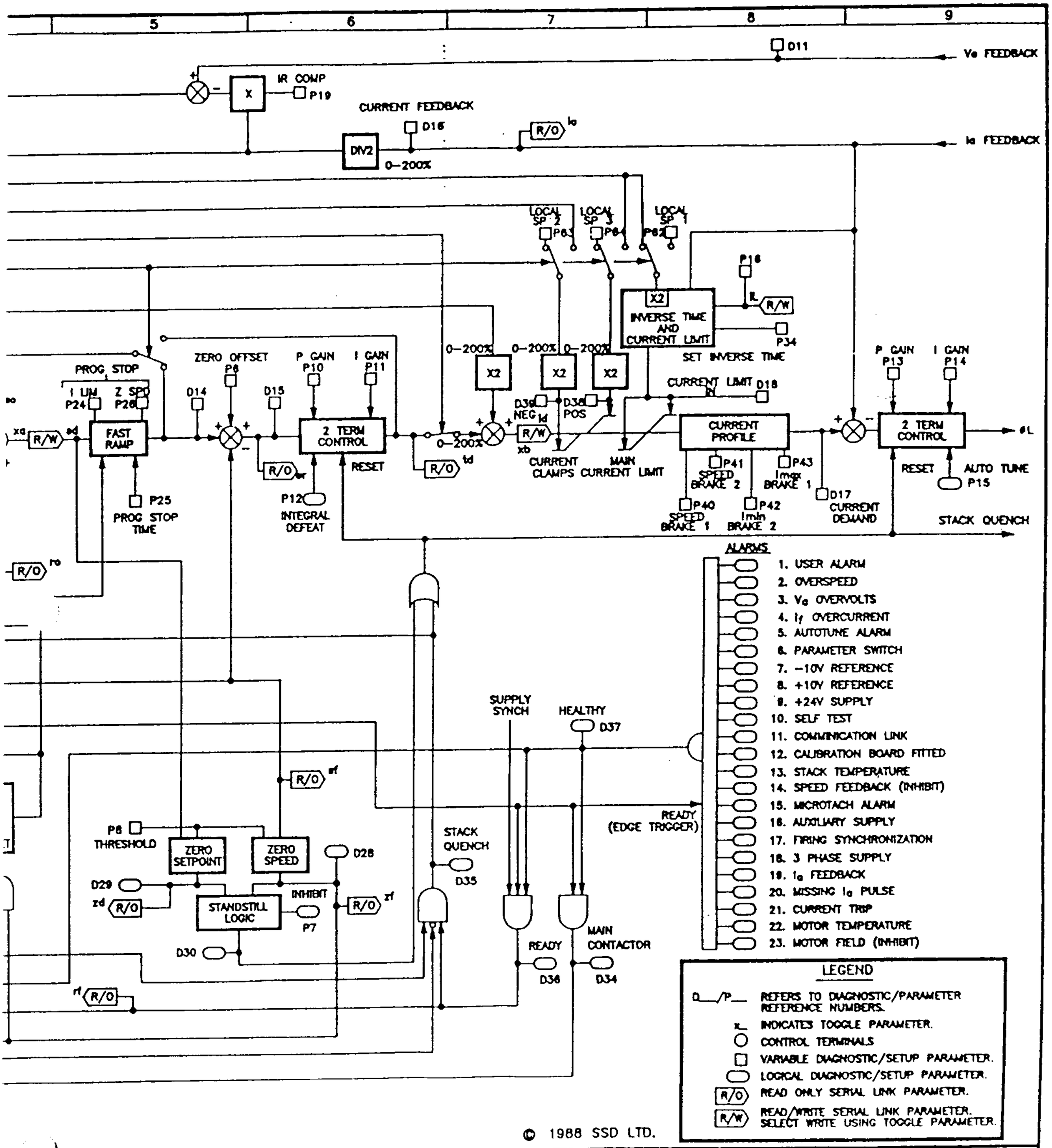

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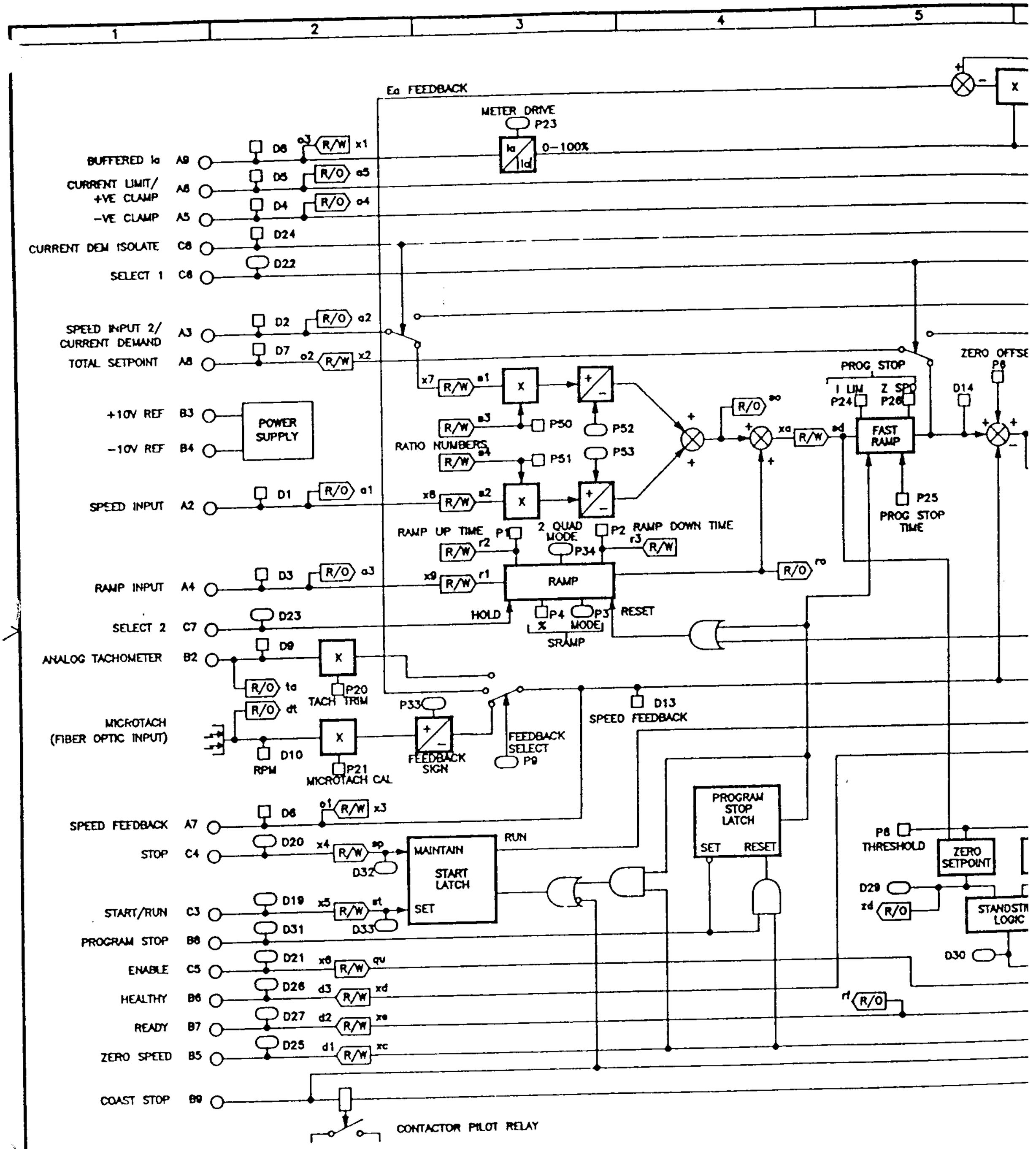

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7 FIELD CONTROLLER

Setting up the 570 for Field Control and Field Weakening Applications

570 Drives with the controlled-field option use a single-phase half-controlled thyristor bridge to give simple and robust control of the motor's field current. The rating of the field bridge varies according to the rating of the main armature current bridge.

The field winding of an industrial DC machine increases in resistance by some 40% as the motor warms up; it is common to supply the field at constant voltage, and field current falls accordingly. The machine is designed to operate correctly when warm, so a cold machine, with too strong a field, may be unable to operate at full speed. In applications where armature voltage feedback is used, a large variation in field strength makes the speed feedback term inaccurate.

The field controller of the 570 Drive features two loops: an inner field current loop, and an outer armature voltage loop. In fixed-field applications, only the inner loop is active. In field-weakening applications, both loops are active. Please refer to the block diagram of the field controller.

Field Current Loop:

The field current loop is activated by setting the FIELD ENABLE parameter through the MMI (Man-Machine Interface). Current is regulated by a Proportional-plus-Integral controller with a fixed setpoint of 100%. The fixed 100% setpoint may be overwritten using the serial link, but it is expected that this facility will rarely be used. Current feedback is derived from an isolating current transformer, and the value of current corresponding to 100% is determined by resistor values on the detachable calibration card; fine adjustment is performed by the FIELD I CAL parameter of the MMI.

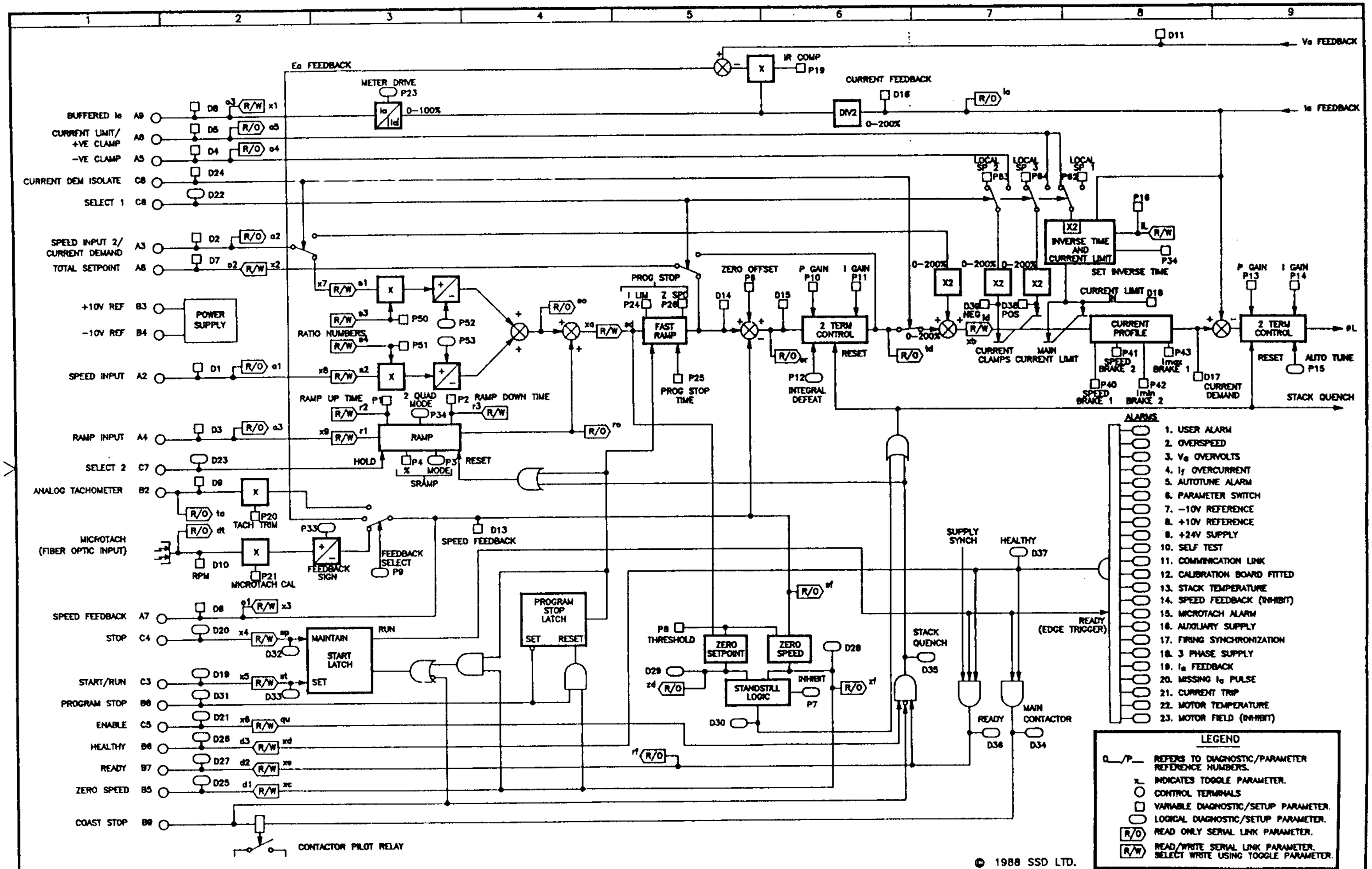
The default values of the Proportional and Integral gains have been set so that the controller will be stable for nearly all industrial motors. The field current may be monitored using the FIELD I FBK diagnostic, and the gains may be adjusted if necessary using the FIELD P GAIN and FIELD I GAIN parameters.

The armature voltage loop is activated by setting the FLD WEAK ENABLE parameter. The setpoint to the field current loop is reduced as speed increases so that armature voltage is maintained at or below the value set by MAX VOLTS. Armature voltage feedback is scaled coarsely by calibration resistors and finely by the ARMATURE V CAL parameter.

Field weakening begins at 'base speed', and the field current is reduced progressively right up to full speed. Any instability in the armature voltage loop will begin to become apparent at base speed and will become more pronounced at higher speeds. When commissioning, take the speed up in small steps and keep a watchful eye upon the ARMATURE VOLTS and TOTAL FLD SETPOINT diagnostics. To improve stability, increase the EMF LAG and EMF LEAD parameters, maintaining the lag term at some 10 or 20 times the lead term. The EMF GAIN parameter should not need to be adjusted in a properly calibrated controller.

During running, the field controller is enabled and disabled by the operation of the armature current controller. Field current is maintained at 100% (or the value set by the armature voltage loop) whenever armature current is enabled, and falls to zero after armature current is disabled, with a delay set by FLD QUENCH DELAY. To allow for faster start-up, it is possible to set FLD QUENCH MODE to 'standby' so that when armature current is disabled, the field current falls not to zero but to 50%.

Field current ceases altogether when the main contactor is dropped out by a stop or by an alarm. Even when the field bridge is supplied externally, current will cease because firing pulses to the bridge are disabled; but note that when an uncontrolled field is supplied from an external field supply, the field current will continue until the external supply is removed.



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TITLE

CIRCUIT DIAGRAM FOR

570 GENERAL PURPOSE CONFIGURATION

USED ON

DRAWING NUMBER HH 056869 D

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8 BASIC SETTING UP AND OPERATING INSTRUCTIONS

A. BEFORE ATTEMPTING TO CONNECT POWER:

CAREFULLY CHECK:

1. Auxiliary power supply voltage is correct.
2. Main power supply voltage is correct.
3. Armature voltage and current ratings.
4. Field option, voltage and current rating.
5. All external wiring circuits -
   Power connections
   Control connections
   Motor connections

   Note:- Completely disconnect the controller before point to point checking with a buzzer or when checking insulation resistance with a megger.
6. For damage to equipment or wiring.
7. For loose ends, clippings, drilling chips, etc., lodged in the drive or electrical equipment.
8. Inspect the motor, in particular the commutator for any extraneous matter. If an air line is available it is recommended to blow over the commutator. Check that the brushes are properly seated and that the brush spring tensions are adequate. If possible check that the motor (and vent fan motor when fitted) can be turned freely by hand.

ENSURE:

1. That rotation of the machinery in either direction will not cause a hazard.
2. That nobody else is working on another part of the equipment that can be affected by powering up.
3. That other equipment will not be adversely affected by powering up.

B. PREPARATION:

1. Prevent the Main 3-phase power supply and single phase auxiliary supply from becoming connected to the drive by removing the main external HRC fuses.
2. Disconnect the load from the motor shaft is possible.
3. If there is any doubt about the integrity of a particular installation, insert a high wattage resistor i.e. fire elements, in series with the motor armature.
4. Check the tachogenerator calibration resistors and current calibration resistors on the small plug-in card which is accessible under the front cover.

   Note:-These resistors should be good quality 2% metal film type.

Tachogenerator Calibration:

(a) For full speed tacho voltages of up to 200 volts:

R4 + R5 = (tacho volts - 10)K Ohms

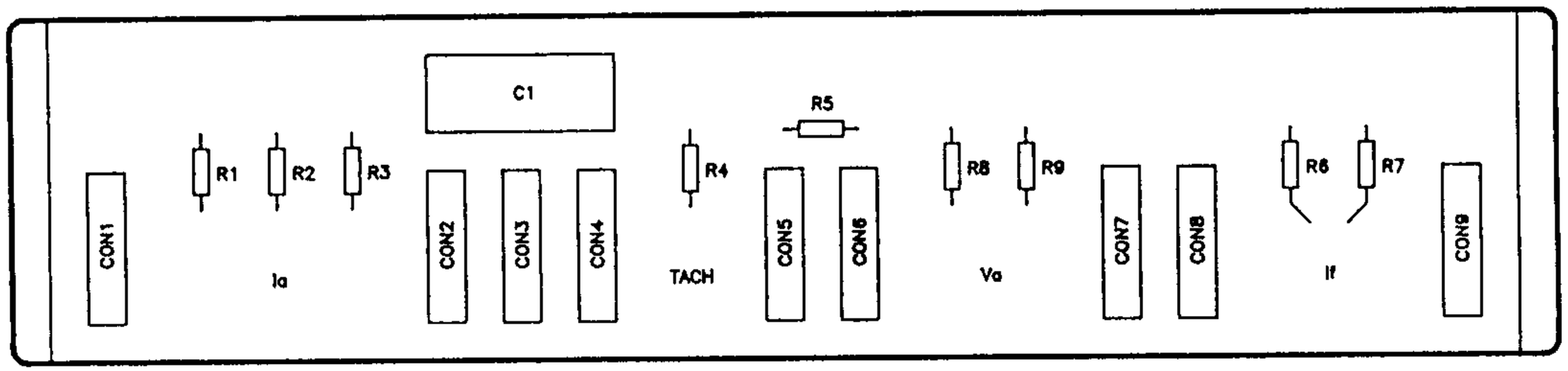
(b) For full speed tacho voltages greater than 200 volts, an external resistor, value RE, is required in series with the tachogenerator connection to terminal B2.

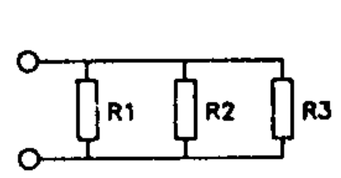
Assuming maximum values of R4 and R5 are fitted for 200V on B2 i.e. R4 = 120K R5 = 68K and R4 + R5 = 188K. Then RE is given by the formula:-

$$RE = \frac{(\text{tacho volts} - 200)}{5} \text{KOhms}$$

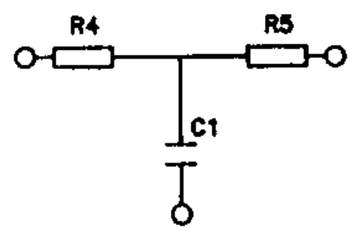
The power dissipation of this resistor is given by the formula

RE = (tacho volts - 200) x 5 milliwatts

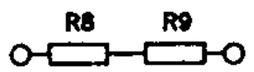




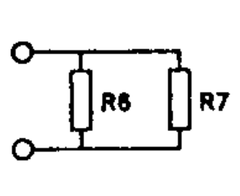
ARMATURE CURRENT CALIBRATION



ANALOG TACH CALIBRATION



ARMATURE VOLTAGE



FIELD CURRENT CALIBRATION

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Armature Voltage Feedback Calibration

Two series resistors R8 and R9 provide the armature voltage scaling, the total sum of the resistors is of greater importance than the individual values.

$$R8 + R9 = \frac{(\text{FULL SPEED ARMATURE VOLTS-100})}{10} \text{KOhms}$$

The minimum allowable armature voltage is 100V with R8 and R9 having no (zero) resistance.

Note:- It is essential that the Armature Voltage calibration is correct for the motor at base speed. If not problems will occur with the speed feedback alarm as soon as motor RUN trials are attempted.

Microtach Feedback

Microtach feedback uses no scaling components, the required maximum motor speed is programmed into the controller from the information in the product code. The preset value of the maximum motor speed can be checked a later stage in the procedure before running the motor but with the auxiliary supply connected.

Current Calibration

The armature current is scaled by the parallel resistor network consisting of resistors R1, R2 and R3. The combined value RA of all these resistors is calculated as follows:-

$$RA = \frac{2200}{(\text{Full Load Current} - 1)} \text{Ohms}$$

The combined value of the resistors fitted can be verified using the formula.

$$\frac{1}{RA} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}$$

Values are selected in the factory on the basis of the best combination of standard resistor values.

Note:- The armature current calibration resistors should not be changed to increase the current above the factory set value without consulting the SSD Engineering Department.

Field Current Calibration

Accurate field current calibration is not necessary unless a field regulator is fitted, product code block 4 is 1 or 4. Where a field rectifier is fitted the field current calibration will only affect the sensitivity of the field failure sensing.

The field current is scaled by the parallel resistor network consisting of Resistors R6 and R7. The combined value of these resistors is calculated as follows:-

$$RF = \frac{3000}{\text{Full Field Current}} \text{Ohms}$$

The combined value of the parallel resistors R6 and R7 can be verified from the formula:-

$$RF = \frac{R6 \times R7}{R6 + R7}$$

Where a field rectifier is used the resistor value is set on the basis of a notional field current of 200mA.

$$\text{Hence } RF = \frac{3000}{0.2} = 15\text{KOhms}$$

Note:- The field current calibration resistor is calculated from the formula $RF = \frac{4000}{\text{Full Field Current}} \text{Ohms}$

for an external stack controller 578/579.

C. CHECKING THE DRIVE AND SETTING UP

1. When all the preceding steps are completed the auxiliary power supply can be connected to terminals D7 and D8, (but do not connect the Main 3-phase power supply at this stage). Immediately check that the correct voltage appears between D7 and D8.

2. Now check:-

i) The LCD display shows the text:-
SSD MICRODRIVE
RELEASE X.XX

Where X.XX is an alphanumeric code representing the software issue and release.

Note:- If the LCD display is not readily visible the intensity can be adjusted at this stage using the up and down arrows.

ii) The LED indicators, these are the 6 LEDS under the RHS of the top covers, the HEALTH, OVERCURRENT TRIP, PROGRAM STOP and STOP LED's should be on.

iii) Using a digital voltmeter

(a) +24v rail at terminal C9
(b) +10v rail at terminal B3
(c) -10v rail at terminal B4

3. Using the MMI move into the DIAGNOSTICS menu, press 'M' once to move straight into the DIAGNOSTICS menu, press 'M' again for the first diagnostic point.

Normally the setpoint ramp input at terminal A4 is the speed reference source. Using the down arrow move through to "Analogue I/P 3" A4. Use 'M' again to display the value of the analogue I/P.

Vary setpoint potentiometer and observe input voltage.

Note:- The value can be displayed in two forms a numerical value or an analogue bar, pressing the 'M' button in the value display changes between the two display modes.

Additional Setpoint Inputs may also appear at:-

i) Analogue I/P 2 A3.

ii) Analogue I/P 1 A2.

Note:- The sum of all the setpoints appears at diagnostic point Z14 "Speed Setpoint" and is also output at terminal A8, except when the controller is selected to dual current clamp mode i.e. terminal C6 high. (+ 24V).

4. Check External Current Clamp settings.

a) If using single external clamp, C6 low.

Check "Analogue I/P 5 A6" is at +10v or adjustable up to +10v.

b) If using dual external clamps, C6 high.

Check "Analogue I/P 5 A6" is at +10v or adjustable up to +10v and "Analogue I/P 4 A5" is at -10v or adjustable up to -10v.

5. If possible check the speed feedback by rotating the shaft manually in the forward direction.

a) Analogue Tachogenerator:- The voltage at B2 ("Diagnostic Tacho Input B2") should go positive.

b) MICROTACH:- The diagnostic point "Microtach" should give a positive reading.

Also check "Speed Feedback" diagnostic for the correct reading.

6. Exit from the "Diagnostic" Menu of the MMI and move over to "Set-up Parameters" menu.

Scroll through the Set-up Parameters noting the preset values and adjusting those which are obviously incorrect. One parameter the "Current Limit" in the current loop sub menu should be set to zero. Special attention should be paid to the feedback source selection.

Note:- Selection of Speed Feedback source is difficult in some issues of the software. Analogue Tachogenerator feedback the middle selection can be bypassed very easily and brief operation of the up or down arrows is required to select it.

PARAMETER SAVE

At this point any parameters which have been altered must be written into the Non Volatile memory of the microprocessor. For details of the Parameter Save operation see Section 10.8.

CHECK LIST **SOFTWARE RELEASES 1 & 2**

SUB MENU	DISPLAY	SOFTWARE SETTINGS[1]	FACTORY SETTINGS[2]	FINAL SETTING
RAMPS	RAMP UP TIME	10 SEC		
	RAMP DOWN TIME	10 SEC		
	2 QUAD MODE	DISABLED		
	S RAMPS %	12.5%		
	RAMP MODE	LINEAR		
FIELD VARIABLES	FIELD CONTROL MODE	VOLTAGE		
FIELD CURRENT VARIABLES	FIELD ENABLE	DISABLED		
	FIELD I GAIN	0.01		
	FIELD P GAIN	0.10		
	FLD. WEAK ENABLE	DISABLED		
	EMF LEAD	2.00		
	EMF LAG	40.00		
	EMF GAIN	0.30		
	MAX VOLTS	100.00%		
	MIN FLD CURRENT	10.00%		
	FLD QUENCH DELAY	30.00 SEC		
	FLD QUENCH MODE	QUENCH		
FIELD VOLTAGE VARIABLES	RATIO OUT/IN	90%		
	FIELD ENABLE	ENABLED		
CURRENT PROFILE	SPEED BRK 1	100%		
	SPEED BRK 2	100%		
	IMIN BRK 2	200%		
	IMAX BRK 1	200%		
PROGRAM STOP	PROGRAM STOP TIME	1 SEC		
	PROGRAM STOP I LIMIT	50%		
	PROGRAM STOP ZERO SPEED	1.00%		
CALIBRATION	ARMATURE VOLTAGE CAL	100.00%		
	IR COMPENSATION	0.00%		
	MICROTACH RPM	2000RPM		
	ANALOGUE TACH CAL	100.00%		
	ENCODER LINES	1000		
	METER DRIVE (A9)	BIPOLAR		
	SPD FBK ALM LEVEL	50.%		
	FIELD I CAL.	100.00%		
	FIELD WEAKENING RANGE	1.0:1.0		
INHIBIT ALARMS	FIELD FAIL	ENABLED		
	SPEED FBK ALARM	ENABLED		
CURRENT LOOP	CURRENT LIMIT	100.00%		
	CURRENT P GAIN			
	CURRENT I GAIN			
	AUTOTUNE	OFF		
	FEED FORWARD	9.5%		
	DIS/CONTINUOUS	0.5%		
	CURRENT VARIABLE 1	100.00%		
	CURRENT VARIABLE 2	-100.00%		
	CURRENT VARIABLE 2	100.00%		
	SET INVERSE TIME	110.%		
	2 QUAD MODE	DISABLED		
SPEED LOOP	SPEED INT GAIN	3.00%		
	SPEED PROP GAIN	25.00%		
	ZERO OFFSET	0.00%		
	SPEED INT DEFEAT	OFF		
	MICROTACH SIGN	NEGATIVE		
	SPEED FEEDBACK SELECT	ARM VOLTS FBK		
STANDSTILL	STANDSTILL LOGIC	DISABLED		
	ZERO THRESHOLD	0.10%		
RATIOS	RATIO 1	1.00		
	RATIO 2	1.00		
	SIGN 1	POSITIVE		
	SIGN 2	POSITIVE		

[1] The software settings are a series of values carried in the 570 software which are a reasonable compromise to the final requirement. These values can be restored at any time by switching on the ancillary supply with the four MMI buttons depressed.

[2] The factory settings are averaged settings, which allow complete testing of the equipment prior to despatch, the true values must be set to optimise the motor and/or system within which the controller is used.

CHECK LIST **SOFTWARE RELEASES 4 ONWARDS**

SUB MENU	DISPLAY	SOFTWARE SETTINGS(1)	FACTORY SETTINGS(2)	FINAL SETTING
RAMPS	RAMP UP TIME RAMP DOWN TIME 2 QUAD MODE S RAMPS % RAMP MODE	10 SEC 10 SEC DISABLED 12.5% LINEAR		
FIELD CONTROL				
GENERAL CONTROLS	FIELD CONTROL MODE FIELD ENABLE FIELD QUENCH MODE FIELD QUENCH DELAY	VOLTAGE ENABLE QUENCH 5 SECONDS		
FIELD CURRENT VARIABLES	FIELD I GAIN FIELD P GAIN FIELD WEAK ENABLE MAXIMUM VOLTS MINIMUM FIELD CURRENT	0.01 0.10 DISABLE 100% 10%		
FIELD VOLTAGE VARIABLES	RATIO OUT/IN	90%		
CURRENT PROFILE	SPEED BRK 1 SPEED BRK 2 IMIN BRK 2 IMAX BRK 1	100% 100% 200% 200%		
PROGRAM STOP	PROGRAM STOP TIME PROGRAM STOP I LIMIT PROGRAM STOP ZERO SPEED	1 SEC 50% 1.00%		
CALIBRATION	ARMATURE VOLTAGE CAL IR COMPENSATION MICROTACH RPM ANALOGUE CAL ENCODER LINES METER DRIVE (A9) SPD FBK ALM LEVEL FIELD I CAL. FIELD WEAKENING RANGE	100.00% 0.00% 1000RPM 100.00% 1000 BIPOLAR ARM I 50.% 100.00% 1.0:1.0		
INHIBIT ALARMS	FIELD FAIL SPEED FBK ALARM	ENABLED ENABLED		
CURRENT LOOP	CURRENT LIMIT CURRENT P GAIN CURRENT I GAIN AUTOTUNE FEED FORWARD DIS/CONTINUOUS CURRENT VARIABLE 1 CURRENT VARIABLE 2 CURRENT VARIABLE 2 2 QUAD MODE	100.00% 1.28% 1.28% OFF 2.56% 20.00% 100.00% -100.00% 100.00% DISABLED		
SPEED LOOP	SPEED INT GAIN SPEED PROP GAIN ZERO OFFSET SPEED INTEGRAL DEFEAT MICROTACH SIGN SPEED FEEDBACK SELECT	25.00% 25.00% 0.00% OFF NEGATIVE ARM VOLTS FBK		
STANDSTILL	STANDSTILL LOGIC ZERO THRESHOLD	DISABLED 2.00%		
RATIOS	RATIO 1 RATIO 2 SIGN 1 SIGN 2	1.00 1.00 POSITIVE POSITIVE		

(1) The software settings are a series of values carried in the 570 software which are a reasonable compromise to the final requirement. These values can be restored at any time by switching on the ancillary supply with the four MMI buttons depressed.

(2) The factory settings are averaged settings, which allow complete testing of the equipment prior to despatch, the true values must be set to optimise the motor and/or system within which the controller is used.

7. Press the "Drive Start" pushbutton or otherwise initiate START:-

The main 3 phase contactor should pull-in and latch via the control relay within the drive.

Press the "Drive Stop" push button or otherwise initiate STOP:-

The main 3 phase contactor should drop-out and remain open when the STOP is released.

If the above sequence does not function remove the auxiliary power and check out start/stop sequencing and contactor wiring.

If the contactor is left energised for an extended time during this check, the controller will detect that 3-phase is not connected and switch off the contactor flagging the 3-phase alarm.

Note:- The main contactor should never be operated by any means other than the drive internal controls, nor should any additional circuitry be placed around the contactor coil circuit.

WARNING

DO NOT PROCEED FURTHER UNLESS THE STOP/START CIRCUITS AND CONTACTOR OPERATE CORRECTLY.

8. Turn off all power supplies to the equipment and when the whole system is totally isolated and safe re-connect the Main 3-phase power supply.

9. Turn on auxiliary supply.

10. Turn on Main 3-phase supply.

11. Turn the Speed Setpoints to zero so that the total setpoint Diagnostic "Speed Setpoint" is zero.

12. Verify that the "Current Limit" Parameter is set to zero.

13. Initiate "Drive Start" and immediately check that the correct field voltage appears between terminals D4 and D3. Note this is high voltage DC, so proceed with caution. Do not continue if this is incorrect, switch off all supplies and re-check the product code.

There are several options available for the generation of the motor field.

(a) Internally supplied full wave rectifier i.e. Product Code Block 4 Code 2. The output voltage will be 0.9 x Vph where Vph is the line to line main supply voltage.

(b) Internally supplied half wave rectifier, i.e Product Code Block 4 Code 3. The output voltage will be 0.45 x Vph.

(c) Internally supplied field regulator, Product Code Block 4 Code 1. The maximum output voltage will be 0.9 x Vph as the full wave rectifier. This voltage will now depend upon the calibration of the field current loop or on the adjustment of the "Ratio" parameter. If no output at all is produced check that the field control is ENABLED in the FIELD VARIABLES sub menu of SET-UP PARAMETERS in the MMI. For a regulated field this is essential.

(d) Externally supplied fields must have an ac voltage applied to terminals D1 and D2, Vext.

If the Product Code Block 4 is Code 5 the field voltage will be 0.9 x Vext volts dc.
Product Code Block 4 is 6, Vfield = 0.45 x Vext volts dc.
Product Code Block 4 is 4, Vfield = 0.9 x Vext volts dc maximum and will depend upon the calibration of the field loop or on the adjustment of the "Ratio" parameter. Again the field regulator must be enabled via the MMI.

With externally supplied regulated fields the voltage applied to the terminals D1 and D2 must be correctly phased, D1 must be connected directly or via a transformer to Red phase while D2 must be connected to Yellow phase. It is also necessary to apply the 3 phase main supply to the controller to provide the necessary reference voltages for the coding to obtain field control.

(e) Internally supplied 3 phase $^1/_2$ wave rectifier Product Code Block 4 Code 8. The field voltage will be 0.67 x Vph., this is a special configuration move often used in the U.S.A.

Note:- Any changes made to the set-up Parameters due to field checking should be saved to prevent loss due to removal of the auxiliary supply during subsequent checking.

14. Check that all Drive Condition indicators are now be on. See description of front cover indicators for explanation of LED functions. Note any external interlocks which affect the enable input C5 as this will affect the state of the RUN LED.

15. Note status of standstill logic if enabled, disable temporarily.

Note:- During subsequent stages be ready to STOP the drive should the motor try to overspeed.

16. Adjust the "Speed Setpoint" Diagnostic so that Total Setpoint Voltage is about 5%, 0.5v at setpoint input. Slowly increase the "Current Limit" Parameter up to a maximum of about 20%. The motor should begin to rotate and if all connections are made correctly the motor speed should settle at about 5% of Full Speed.

If this speed is exceeded and the motor continues to accelerate a reversed connection is implied, decrease the "current limit" parameter to zero.

i) Analogue Tachogenerator:-

First open main contactor and switch off all supplies, then correct the connections.

(a) If the motor is turning in the right direction reverse the tachogenerator connections only.

(b) If the motor is turning in the wrong direction, reverse the field connections only.

ii) MICROTACH:-

Open main contactor.

(a) If the motor is turning in the right direction, changeover the "Feedback Sign" in the "Set-up Parameters" menu.

(b) If the motor is turning in the wrong direction switch off all supplies then reverse the field connections only.

Re-connect the supplies if disconnected and repeat the test from the beginning. If the motor still runs out of control check the tachogenerator and the continuity of the wiring. In the case of the MICROTACH there are three LED's on the MICROTACH option board, all these LED's should be on for healthy operation of the wiring and tacho. If in doubt about the operation of the tachogenerator either Analogue or MICROTACH during this test monitor terminal A7 with respect to signal ground on a meter this will show if a feedback is present.

Note:- If drive trips on speed feedback alarm with tachogenerator feedback of the correct polarity check armature voltage calibration.

Check the "Speed Feedback" source selection under Set-up Parameters this could be set incorrectly allowing the drive to run open loop.

WARNING:-

Proceed further only when this test has been satisfactorily completed.

17. If the drive has run satisfactorily without any need for reconnection of the field or tachogenerator but the direction of rotation is wrong. Open the main contactor, and disconnect all supplies.

i) Analogue Tachogenerator:-

Reverse both field and tachogenerator connections.

ii) MICROTACH:-

Reverse the field re-establish the auxiliary supply and reverse the "feedback sign" in the Set-up Parameters menu.

WARNING:-

When changing Set-up Parameters such as the feedback polarity this change must be saved in the non-volatile memory before switching off the Auxiliary supply or the Set-up will be lost. It is therefore important at this stage when satisfactory operation has been achieved to STOP the drive and SAVE the parameters. The parameters cannot be saved when the drive is running nor can the drive be run when the WRITE switch is in the ON position.

18. If the motor does not turn at all when the "current limit" is increased to 20%, check the "current feedback" diagnostic point to verify that current is flowing into the armature. If no current is flowing switch off and check the armature connections.

19. With the "Current Limit" set to 20% or the level required to achieve rotation. Increase the total setpoint to 10% and the motor should accelerate to this speed setting.

20. 4 Quadrant Drives which require reverse rotation.

Alter setpoint to -10% and check that motor runs in the reverse direction.

21. Adjustment of zero offset potentiometer.

(a) 4 Quadrant, Non-reversing drives.

Set the Speed Setpoint Potentiometer to zero and adjust "Zero Offset" parameter for minimum shaft rotation.

(b) 2 Quadrant, Non-reversing drives.

Set the Speed Setpoint Potentiometer to zero and adjust the Zero Offset parameter until the shaft is just rotating then reduce level until the shaft stops.

(c) 4 Quadrant, Reversing drives.

Set the Zero Offset Parameter to balance maximum speed in forward and reverse directions.

22. Gradually increase the speed setpoint to maximum and check the shaft speed is correct. If fine adjustment is required adjust the calibration as appropriate to the speed feedback selection.

(a) Analogue Tachogenerator has a 10% trim, greater changes require re-calibration of external scaling components.

(b) The MICROTACH should give an absolute rotational speed for which adjustment is unnecessary however the motor speed may not be the relevant factor thus speed of rotation can be altered by simply adjusting the calibration.

(c) Armature Voltage feedback also has a 10% trim, again changes outside this range require re-calibration of the external scaling components.

23. If the drive requires field weakening to achieve top speed, run the drive up to base speed (speed control by armature voltage, constant field) and check the motor volts are correct.

Armature Voltage has a 10% trim as used in the case of armature voltage feedback, greater changes need re-calibration of the external scaling resistors.

Verify in the FIELD VARIABLES sub-menu of the SET-UP PARAMETERS that FIELD WEAKENING ENABLE is selected and that MINIMUM FIELD is set appropriately, adjust MAXIMUM armature volts to the required scaled level.

Increase speed above base speed checking that the armature volts remains constant while the field falls, gradually increase to Maximum speed monitoring armature volts at maximum speed trim speed using Analogue Tacho Calibration. Trim Minimum field setting.

If at any time while running the drive in speed control the SPEED FEEDBACK alarm trips the drive verify calibration of the armature volts.

Adjust calibration of FIELD WEAKENING RANGE parameter as this corrects the algorithm of the speed feedback alarm to allow for operation at constant armature voltage in the field weakening range.

24. For reversing drives. Check maximum reverse speed. Imbalance in reversing drives can only be corrected by adjusting the Zero Offset which may be to the detriment of operation at Zero Setpoint.

25. Re-set the "Current Limit" parameter to the original position which was previously noted. If in doubt set the Current Limit to 110% to correspond 110% FLC. If the current limit is set to maximum 200%, and the motor runs into an overload condition, the current is automatically reduced on an inverse time characteristic from the current limit level down to 110% FLC.

Note:- When in an overload or stall condition the drive will hold 110% or the current limit setting indefinitely, the inverse time overload does not trip out or cause any form of alarm. Motor protection must be provided by the Motor Microtherm or other temperature sensing device which is connected as detailed in the wiring instructions.

D. CONTROLLER PERFORMANCE ADJUSTMENT

When effective speed control of the motor has been achieved the performance of the controller should be optimised by the following steps.

1. Current Loop.

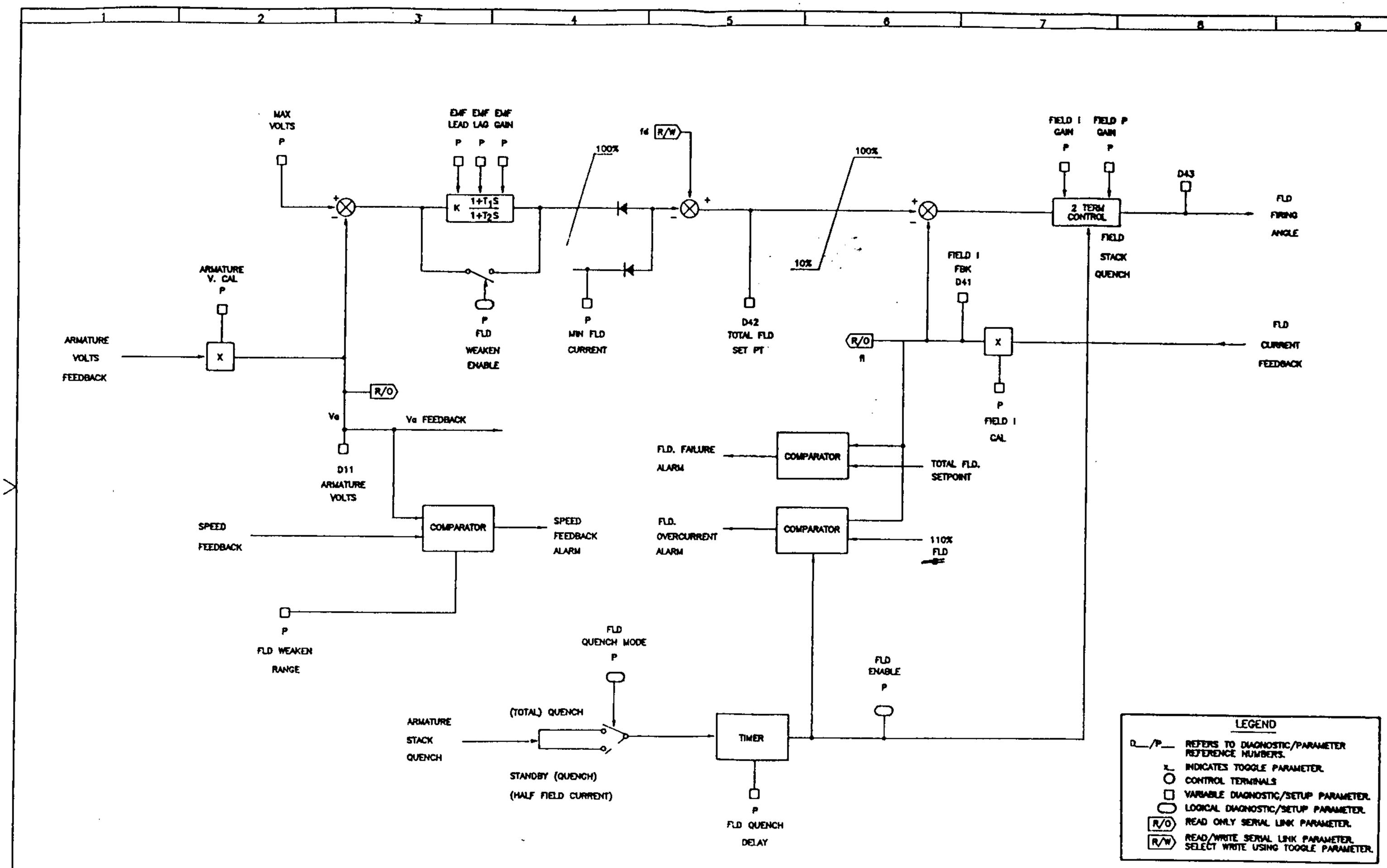
This can be easily adjusted by use of the Autotune function, full details of this operation is given in section 10.5. Optimum performance of the controller cannot be expected unless the Autotune function has been performed with each individual controller motor combination.

If an oscilloscope is available, correct operation of the controller output can be monitored by observation of the current waveform. There is a group of test points under the lower terminal cover on the left hand side. The upper group of three are the test signals while the terminal below signal ground. The left most terminal is the armature current feedback signal, the signal level being 1.1v average at full rated current. At all times there should be six current pulses per mains cycle.

2. Speed Loop.

Optimum Speed Loop performance is achieved by adjusting the Speed Loop Integral and Proportional gain terms in the Set-up Parameters Menu, Speed Loop parameters.

The response to a small change in setpoint should be observed on the tachogenerator feedback and proportional and integral gain terms adjusted to give rapid change of speed feedback between the values with minimum overshoot. If the controller uses Microtach feedback then speed response can be monitored by observing speed feedback on terminal A7 of the controller.



LEGEND

- D__/P__ REFERS TO DIAGNOSTIC/PARAMETER REFERENCE NUMBERS.
- x_ INDICATES TOGGLE PARAMETER.
- ○ CONTROL TERMINALS
- □ VARIABLE DIAGNOSTIC/SETUP PARAMETER.
- ⬭ LOGICAL DIAGNOSTIC/SETUP PARAMETER.
- R/O READ ONLY SERIAL LINK PARAMETER.
- R/W READ/WRITE SERIAL LINK PARAMETER. SELECT WRITE USING TOGGLE PARAMETER.

DRAWN	CHECKED	DATE	10.10.89	ELECTRICAL SYMBOLS TO BS 3939	TITLE	USED ON 570
TRACED	DESIGN APP.	ISS	A	SSD UTTLEHAMPTON ENGLAND TELEX 87142	BLOCK DIAGRAM FOR FIELD CONFIGURATION	DRAWING NUMBER HH 057713 D; SHT. 1 OF 1

9 FRONT PANEL INDICATORS

Six LED indicators are located under the control board top cover. These allow the operational status of the drive to be monitored while the LCD display is being used for other purposes (drive setup for example).

In the normal run condition all LEDs on the drive front panel are illuminated. Any LED which is off indicates a condition which prevents operation of the controller.

Two of these LEDs are driven directly by the main processor:-

HEALTH
RUN

The remaining four LEDs are driven directly by hardware:-

OVERCURRENT TRIP
START CONTACTOR
PROGRAM STOP
STOP

1. HEALTH

On: Drive Normal Condition Off: Drive Fault Condition

The Health condition depends on the status of the following sources of alarm:-

a) Self test complete (power supply, memory, microprocessors).
b) Field Failure.
c) 3 phase supply.
d) Overcurrent trip(300%).
e) Motor over-temperature (thermistor/microtherm).
f) Drive over-temperature (drive heatsink).
g) Phase locked loop synch (45-65Hz).
h) Missing current pulse.
i) Auxiliary supply (115/240).
j) Armature current feedback.
k) Calibration board installed.
l) Tach fail/speed feedback fault.
m) Pulse received fail (fibre optic feedback).
n) User defined alarm.

NOTE:- Any fault will remove health and will automatically display the fault alarm on the diagnostic display. The drive will always be defined as healthy unless an alarm condition has occurred during a run condition (when this occurs the display will automatically identify the alarm source).

Reset Health: 1) on power up
2) on re-start (stop-then start)

2. RUN

On: Drive in a Run condition.
Drive healthy, (as indicated by the health LED).
Ready (which requires a start instruction) and enabled. Indicates that the controller is in a normal run condition. The main contactor control relay is energised and the Thyristor bridge is enabled. This LED is extinguished if:-

a) The Thyristor bridge is disabled.
b) The main contactor control relay is de-energised.
c) An alarm is present.

Off: Drive not enabled.

3. START CONTACTOR

On: Start contactor closed by the application of a start instruction and the drive is healthy.

Off: Start contactor open

4. PROGRAM STOP

On: Program stop mode not employed. Indicates that +24 volts is applied to terminal B8.

Off: The program stop line is open and the program stop is carried out until main contactor drop out occurs.

5. OVER CURRENT TRIP

On: Armature current normal.

Off: Armature current has exceeded 300% full load. In this condition the over current alarm is set, the drive becomes "unhealthy" and the start contactor will be automatically tripped. The display will also show an alarm condition. The entire system must be checked thoroughly for the cause of failure. The drive can then be reset and restarted.

6. COAST STOP

On: Stop not active. Indicates that +24 volts is applied to terminal B9.

Off: Hardware stop by main contactor dropout.

10 MAN MACHINE INTERFACE (MMI)

DISPLAY

Featured on all 570 series products is a two line sixteen character liquid crystal display designed to provide a clear and simple user interface with the product.

The use of the display is defined by the two lines of alphanumeric characters:

The upper line of the display describes the current menu or function.

The lower line describes the next menu or function available or the displayed value or status of the function selected on the upper line.

This display philosophy gives a clear indication of where changes can be made to modify the performance of the product to suit the particular application.

FUNCTION KEYS

Adjacent to the display are four function keys which change the display within a "tree" structure to allow the user to interrogate and modify the drive parameters in a simple, user-friendly fashion.

To locate the four function keys, lower the top protective cover. A simple positive key stroke is required (key de-bounce is included in the software and multiple keys cannot be simultaneously activated). Each key is identified by an engraved legend in its top surface:

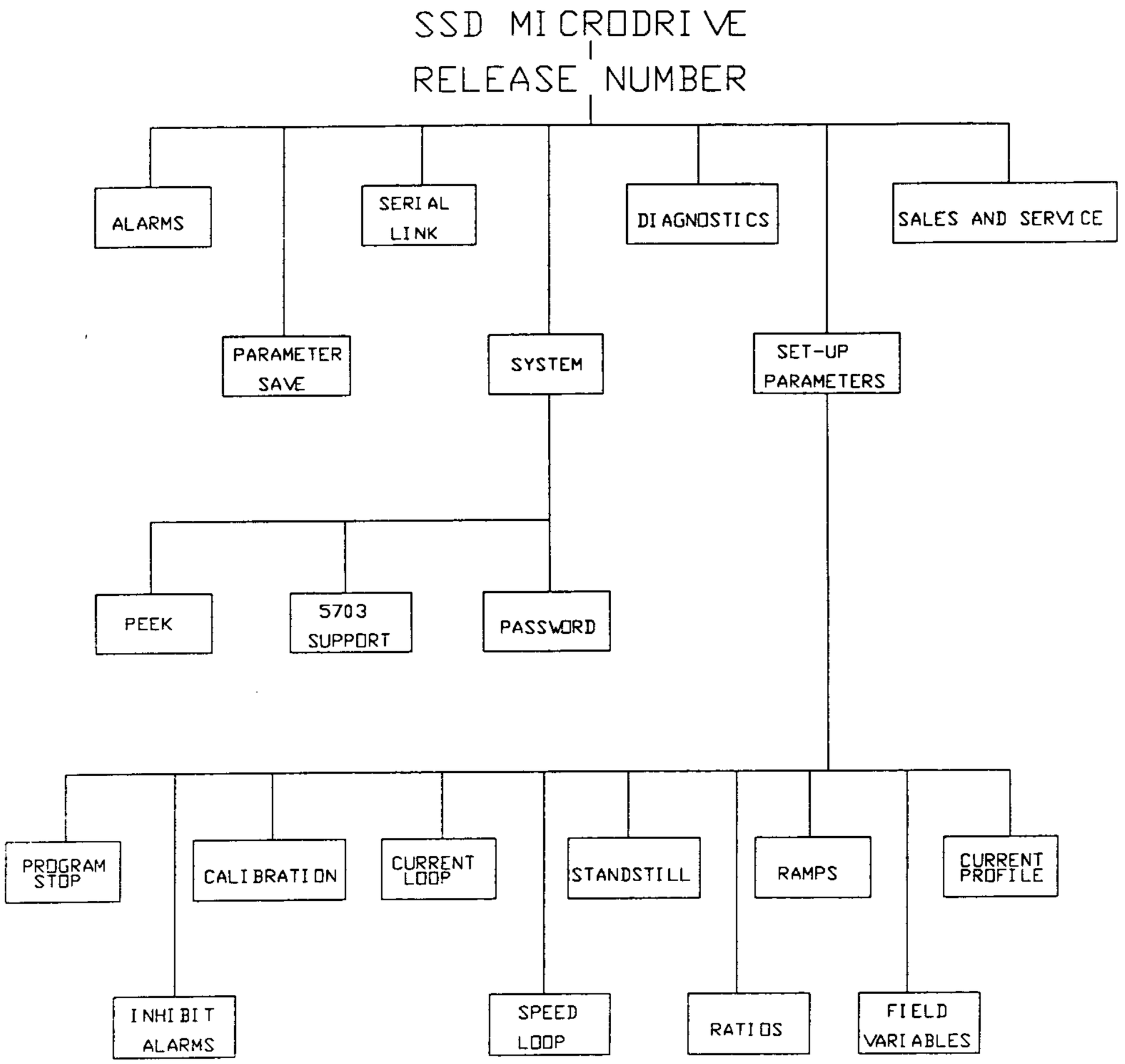
(M) MENU SELECT	This allows entry to the menu or function offered in the second line of the display. Use of this key will not alter any of the stored parameters. It ill toggle the displayed variable between bar graph presentation for trending and numeric value for accuracy.
(E) ESCAPE	Allows selection of the preceding menu. Use of this key will not alter any of the stored parameters. ESC always takes you back to the last point on which you were working.
(↑) RAISE	This allows movement in a forward fashion to explore the options available in any selected menu. The selected menu is always displayed on the top line of characters. When a modifiable function is displayed on the top line, the raise function will increment its value.
(↓) LOWER	This allows movement in a backward fashion to explore the options available in any selected menu. The selected menu is always displayed on the top line of characters. When a modifiable function is displayed on the top line, the lower function will decrement its value.

The MENU Tree Structure

The menu tree structure employed in all 570 series controllers has been carefully designed to provide non-expert users with a simple and easy way to read, and set parameters associated with the drive with a minimum of key strokes and confusion.

The central core (or trunk of the tree), menu level 1, will display six further menus each associated with one specific aspect of the product. Any of these may then be explored as branches from the central core(sub menus) until the desired function or parameter is displayed. When displayed, the value may be observed and/or changed or cancelled.

To progress from the Power-up default display SSD 570 operate the "M" key. The first menu selection DIAGNOSTICS is displayed. Scanning through the various menus is achieved by operation of the RAISE AND LOWER keys. When positioned at the desired menu operate the MENU key for more information.



10.1 PRIMARY DIAGNOSTICS

The primary controller diagnostics are specific monitoring points that allow the user to check the external wiring and connections to the controller. Monitoring points are also provided to examine the effect of adjusting setup parameters such as speed loop gain.

These diagnostic variables can be classified into two types:-

1. Variable diagnostics

2. Logic diagnostics

The primary diagnostics are presented on the two line display in the following format:-

MENU LEVEL
DIAGNOSTICS

Here, operation of the "RAISE" or "LOWER" keys allows different menu level items to be selected.

Operation of the "M" key gives the display:-

"ANALOG INPUT 1 A2"
"+7.60 VOLTS" (for example)

The top line now contains information about:-

1. The monitoring point name.
2. The drive terminal number (if applicable).

The bottom line presents information in one of two ways:-

1. Numerical values.
2. Bar graph.

Selection is made by using the "M" key as a toggle when the value is displayed. This is at the bottom of the "tree menu", where the "E" key will move the display level up the tree shown above.

Logic diagnostic "VALUE"s are indicated using appropriate names. Each monitoring point has an associated value format and value range.

10.2 DIAGNOSTIC DESCRIPTIONS

DIAGNOSTIC POINT	TERMINAL	DESCRIPTION	REF	SCALING
ANALOG I/P1	A2	SPEED SETPOINT No. 1	D1	± 10V
ANALOG I/P2	A3	SPEED SETPOINT No. 2/CURRENT DEMAND	D2	± 10V
ANALOG I/P3	A4	RAMPED SPEED SETPOINT	D3	± 10V
ANALOG I/P4	A5	NEGATIVE CURRENT CLAMP	D4	± 10V
ANALOG I/P5	A6	EXTERNAL CURRENT LIMIT/POSITIVE CURRENT CLAMP	D5	± 10V
ANALOG O/P1	A7	SPEED SPEEDBACK	D6	± 10V
ANALOG O/P2	A8	TOTAL SPEED SETPOINT	D7	± 10V
ANALOG O/P3	A9	BUFFERED ARMATURE CURRENT/POWER LEVEL	D8	± 10V
TACH INPUT	B2	SCALED ANALOGUE TACHOGENERATOR FEEDBACK	D9	± 100%
MICROTACH		MICROTACH SPEED FEEDBACK (DIRECT READING OF MOTOR SPEED ASSUMING STANDARD MICROTACH SCALING 1000PPR)	D10	± 3000RPM
ARMATURE VOLTS		SCALED ARMATURE VOLTS	D11	± 100%
SPEED FEEDBACK		SPEED LOOP FEEDBACK	D13	± 100%
SPEED SETPOINT		SPEED LOOP TOTAL SETPOINT	D14	± 100%
SPEED ERROR		SPEED LOOP ERROR	D15	± 100%
CURRENT FEEDBACK		SCALED ARMATURE CURRENT	D16	± 200%
CURRENT DEMAND		CURRENT LOOP CURRENT DEMAND (SPEED ERROR PI OUTPUT OR EXTERNAL CURRENT DEMAND CLAMPED BY ALL LIMITS)	D17	± 200%
CURRENT LIMIT		MAIN CURRENT LIMIT IS DETERMINED BY THE PRODUCT OF EXTERNAL CURRENT LIMIT (OR CURRENT VARIABLE) AND CURRENT LIMIT PARAMETER	D18	± 200%
DIGITAL I/P1	C3	START/RUN INPUT (RUN INPUT FOR MAINTAINED SEQUENCING START INPUT FOR MOMENTARY INPUT)	D19	ON/OFF
DIGITAL I/P2	C4	STOP INPUT (MAINTAIN INPUT FOR MOMENTARY INPUT)	D20	ON/OFF
DIGITAL I/P3	C5	ENABLE INPUT FOR CO-ORDINATING SEVERAL DRIVES AND RAPID INCH FUNCTIONS	D21	ON/OFF

Continued/...

DIAGNOSTIC POINT	TERMINAL	DESCRIPTION	REF	SCALING
DIGITAL I/P4	C6	CONFIGURATION INPUT No. 1 SINGLE CURRENT CLAMP/AUXILIARY CURRENT CLAMPS	D22	ON/OFF
DIGITAL I/P5	C7	RAMP HOLD INPUT	D23	ON/OFF
DIGITAL I/P6	C8	CONFIGURATION INPUT No. 2 CURRENT DEMAND ISOLATE, GIVING SPEED OR CURRENT OPERATION	D24	ON/OFF
DIGITAL O/P1	B5	AT ZERO SPEED	D25	ON/OFF
DIGITAL O/P2	B6	DRIVE HEALTHY (DRIVE OPERATIONAL) AUXILIARY SUPPLY ON AND NO RUN INPUT APPLIED OR READY WHEN RUN INPUT APPLIED	D26	ON/OFF
DIGITAL O/P3	B7	READY DRIVE READY TO RUN ALL ALARMS HEALTHY AND SUPPLIES PRESENT	D27	ON/OFF
AT ZERO SPEED		AT ZERO SPEED FEEDBACK	D28	ON/OFF
AT ZERO SETPOINT		AT ZERO SPEED SETPOINT	D29	ON/OFF
AT STANDSTILL		AT STANDSTILL, i.e. AT ZERO SPEED AND ZERO SPEED SETPOINT	D30	ON/OFF
PROGRAM STOP I/P	B8	PROGRAM STOP INPUT WHEN OFF PROGRAM STOP SEQUENCE IS ENABLED	D31	ON/OFF
STOP INPUT	C4	STOP INPUT WHEN ON STOP MAINTAIN FUNCTION IS OPERATIONAL		ON/OFF
START		START/RUN INPUT		ON/OFF
MAIN CONTACTOR		MAIN CONTACTOR STATUS		ON/OFF
STACK QUENCH		STATUS OF STACK QUENCH CONTROL		ON/OFF
DRIVE READY		DRIVE READY TO RUN		ON/OFF
DRIVE HEALTHY		DRIVE HEALTHY OR DRIVE OPERATIONAL		ON/OFF
RAMP HOLD ENABLE		RAMP HOLD INPUT STATUS		ON/OFF
+ CURRENT CLAMP		POSITIVE CURRENT CLAMP		0 to +200%
- CURRENT CLAMP		NEGATIVE CURRENT CLAMP		0 to - 200%
FIELD IFBK		SCALED FIELD CURRENT FEEDBACK		0 to 100%
TOTAL FIELD SETPOINT		SETPOINT FOR FIELD CURRENT LOOP		0 to 100%
FLD FIRING ANGLE		CURRENT VALUE OF FIELD FIRING ANGLE		0 to 180°

10.3 PRIMARY SETUP PARAMETERS

The primary setup parameters are parameters which can be readily adjusted to suit a specific application of the controller. The primary parameters are commonly used functions. Access to these parameters is not restricted by the requirement of access code entry. Other parameters are protected and can only be modified after entering an access code on the on-board keyboard and display.

The primary setup parameters can be classified into two types:-

1. Variable setup parameter.
2. Logic setup parameter.

All these parameters are stored in non-volatile EEPROM (battery back-up is not required). On power-up of the auxiliary supply, these parameters are loaded into volatile RAM memory from the EEPROM memory.

These parameters can be altered via the MMI at any time. Note that the parameters are not transferred to non-volatile EEPROM unless a SAVE operation is performed (see later descriptions).

At the Menu Level, find the SETUP PARAMETERS menu by operating the "RAISE" and "LOWER" keys. The display will show:-

MENU LEVEL
SETUP PARAMETERS

Enter the SETUP PARAMETERS menu by pressing "M". The display will show:-

SETUP PARAMETERS
"RAMPS"

Here, operation of "RAISE" or "LOWER" keys allows different Submenus (RAMPS, SPEED LOOP, etc.,) to be selected.

Further operation of the "M" key gives the display:-

"RAMPS"
"RAMP UP TIME"

The "RAISE" and "LOWER" keys allow selection of other variables within the Submenu (e.g., RAMP DOWN TIME).

Further operation of the "M" key gives the display:-

"RAMP UP TIME"
" X SECS"

At this level it is possible to modify the value of the parameter. The "RAISE" and "LOWER" keys change the value displayed; the "M" key toggles between digital and bar-graph display (for those variables which may be displayed in either format) and the "F" key returns to the Submenu for selection of another variable.

10.4 SET-UP PARAMETER DESCRIPTIONS

PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	REF.
	RAMPS			
RAMP UP TIME	Rate of change of increasing speed setpoint (see 2 quad mode).	0.1-250.0	10.0 seconds	P1
RAMP DOWN TIME	Rate of change of decreasing speed setpoint (see 2 quad mode).	0.1-250.0	10.0 seconds	P2
2 QUAD MODE	In a reversing drive system with analogue ramps, ramp up time becomes ramp down time with reverse rotation. Because the ramps are implemented in software in the 570 this problem can be overcome. 2 Quad mode gives consistent operation of the ramp settings in forward or reverse when enabled by this parameter.		DISABLED	P3
S RAMP %	When 'S' Ramp mode is enabled this adjusts the amount of the intended change over which the 'S' ramp controls the transition.	0.1-50.0 %	12.5%	P4
RAMP MODE	The ramp generator operates either as a simple linear ramp or as a complex 'S' ramp. The 'S' ramp controls the initial rate of change to give a smooth change from fixed setpoint to ramped setpoint, similarly it controls the change from ramped setpoint to fixed setpoint.		LINEAR	
	FIELD VARIABLES			
FIELD CONTROL MODE	When a controlled field regulator is fitted there is a possibility of two control algorithms: (a) Field Voltage Control, an open loop phase angle control to simulate rectifier fields. (b) Field Current Control, a closed loop current control for accurate field control or expansion to field weakening.	VOLTAGE OR CURRENT	VOLTAGE CONTROL	
	FIELD CURRENT VARIABLES			
FIELD ENABLE	When a controlled field regulator is fitted, the control algorithm must be enabled (uncontrolled diode bridge fields do not need the field enabled). Field enable allows the regulator to control field current		DISABLED	
FIELD I GAIN	When the field regulator is controlling the field current a PI loop is in operation. This is the integral gain adjustment of the PI loop	0.00-5.00	0.01	
FIELD P GAIN	This is the proportional gain adjustment of the field PI loop.	0.00-5.00	0.10	
FLD. WEAK ENABLE	Certain applications of a DC motor controller are best achieved in speed control by field weakening. If a controlled field regulator is fitted and enabled, field weakening enable adds the additional PID loop of the field weakening (field overspill) control.		DISABLED	

PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	REF.
	Field Current Variables/Continued			
EMF LEAD	With field weakening control enabled a PID loop is brought into operation this is the derivative adjustment of the field weakening PID loop.	0.10-50.00	2.00	
EMF LAG	This is the integral adjustment of the field weakening PID loop.	1.00-100.00	40.00	
EMF GAIN	This is the gain adjustment of the field weakening PID loop.	0.00-5.00	0.30	
MAX. VOLTS	Maximum volts is the level at which field weakening begins. The level is set relative to the 100% calibration value set by the calibration resistors and armature voltage calibration.	0.00-100.00%	100.00%	
MIN FLD CURRENT	The field weakening loop reduces the field current to achieve speed control. At top speed the field reaches a minimum value. This limit is a fixed minimum value to set the absolute lower field limit.	0.00-100.00%	90.00	
FIELD QUENCH DELAY	If dynamic breaking is used the field must be maintained for a period after the drive is disabled. The field quench delay is the period of time the field is maintained.	0.1-250.0 seconds	30.0 seconds	
FIELD QUENCH MODE	After the field quench delay the field can be entirely quenched or put into a standby mode at minimum field level.		Quench	
	FIELD VOLTAGE VARIABLES			
RATIO OUT/IN	This parameter controls the output voltage from the open loop voltage control. Where ratio is the nominal AC in to DC out ratio of a rectifier bridge.	0-100%	90% single phase rectifier	
FIELD ENABLE	When a field regulator is fitted and voltage control required it must be enabled by the field enable parameter.		ENABLED	
	CURRENT PROFILE			
SPEED BREAK 1	When speed control is obtained by field weakening, the ability of the motor to commutate current is reduced at low field currents. Speed breakpoint 1 is the relative motor speed at which current profiling begins.	0-100%	100%	P40
SPEED BREAK 2	Speed break 2 is the upper speed limit at which current profiling ends.	0-100%	100%	P41
I. MIN BREAK 2	This sets the current limit value at or above speed break point 2.	0-200%	200%	P42
I. MAX BREAK 1	This sets the current limit value at or below speed break point 1, provided other limits are greater than its setting.	0-200%	200%	P43
	PROGRAM STOP			
PROG. STOP TIME	Time to reach zero speed from 100% set speed.	0-250 seconds	1 second	P25
PROG. STOP I LIM	Current limit level in program stop mode provided other limits are set higher.	0-200%	50%	P24
PROG. STOP Z SPEED	Zero speed level in program stop mode at which contactor is de-energised and the drive quenched.	0.00-10.00%	1.00%	P26

PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	REF.
	CALIBRATION			
ARMATURE V CAL	Trim adjustment of the motor armature level giving 100% armature volts. Note:- Primary voltage calibration is achieved by the selection of resistors R8 and R9 on the calibration board.	95-110.00%	100.00%	P18
IR COMPENSATION	Compensation for motor IR drop to improve regulation when using armature voltage feedback for speed control.	± 20.00%	0.00%	P19
MICROTACH RPM	Motor top speed setting when using the 5701 microtach unit for speed feedback.	0-3000 RPM	1000 RPM	P21
ANALOG TACH CAL	Trim adjustment of the motor speed at 100% speed demand.	95-110.00%	100.00%	P20
ENCODER LINES	Note:- Primary tacho calibration is achieved by the selection of resistors R4 and R5 on the calibration board.	+10 TO +5000	+ 1000	
METER DRIVE (A9)	Sets operation of current meter output, either bipolar or unipolar.		BIPOLAR	P23
SPDFBK ALARM LEVEL	The speed feedback alarm compares speed feedback to armature voltage. The alarm level is the difference at which the alarm is set.	0-100%	50%	
FIELD I. CAL	Trim adjustment of the motor field at 100% field current demand. Note:- Primary field calibration is achieved by the selection of resistors R6 and R7 on the calibration board.	95-110.00%	100.00%	
FLD. WEAK RANGE	During field weakening the armature voltage and motor speed are not related. By setting in the field weakening speed range a compensation can be carried out to maintain functionality of the speed feedback alarm.	0.0:1.0-10.0:1.0	1.0:1.0	
	INHIBIT ALARMS			
FIELD FAIL SPEED FBK ALARM	Override for minimum field current level alarm. Override for speed feedback alarm.		ENABLED ENABLED	P17
	CURRENT LOOP			
CURRENT LIMIT	Internal main current limit parameter. All limits operate on basis of lowest level controls.	0.00-200.00%	100.00%	P16
CURRENT P GAIN	Proportional gain control for armature current PI loop.	1.00-100.00	1.28	P13
CURRENT I GAIN	Integral gain control for armature current PI loop.	0.10-50.00	1.28	P14
AUTOTUNE	Initiating control for current loop autotune adjustment. (See description at the end of table)	---	---	P15
FEED FORWARD	Autotune control parameter. Normally set by autotune algorithm during current loop autotune adjustment.	0.10-50.00	2.56	--
DIS/ CONTINUOUS	Autotune control parameter. Normally set by autotune algorithm during current loop autotune adjustment.	0.00-200.00%	0.80%	--
CURRENT VAR 1	If terminal "C6" [select 1] is connected to +24V to give independent external positive and negative current clamps, current variable 1 acts as an internal main current clamp. If "C6" is unused current variable 1 has no effect.	± 100.00%	100.00%	P62

PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	REF.
	Current Loop/continued			
CURRENT VAR 2 CURRENT VAR 3 }	If terminal "C6" [select 1] is unused giving an external main current clamp. Current variable 2 becomes an internal negative current clamp. Current variable 3 becomes an internal positive current clamp.	± 100.00%	100.00%	P63 P64
SET INVERSE TIME (IF INCLUDED IN SOFTWARE VERSION)	This is the inverse time overload minimum clamp level. This parameter should not be adjusted, the default value of 110% is the correct operating value.	0-200%	110%	P34
2 QUAD MODE	This parameter informs the control board that it is operating a 2 quad thyristor bridge option, i.e. non-reversing.		DISABLED	
	SPEED LOOP			
SPEED INT. GAIN	Speed loop PI integral gain adjustment.	0.00-10.00	3.00	P11
SPEED PROP. GAIN	Speed loop PI proportional gain adjustment.	0.10-50.00	4.00	P10
ZERO OFFSET	Zero motor speed for zero setpoint input trim adjustment.	± 5.00%	0.00%	P6
SPEED INT. DEFEAT	Inhibits the integral part of the speed loop PI control to give proportional gain only speed control.		OFF	P12
MICROTACH SIGN	Since the microtach feedback cannot be reversed electrically, the signal polarity must be reversed by the control software.		NEGATIVE	P33
SPEED FBK SELECT	Three options are available:- i) Armature voltage feedback ii) Analogue tachogenerator feedback iii) Microtach feedback. Note:- It is difficult on some versions of the software to select analogue tacho.		ARM VOLTS FBK	P9
	STANDSTILL			
STANDSTILL LOGIC	Standstill Logic quenches drive below zero threshold.		DISABLED	P7
ZERO THRESHOLD	Speed Level at which standstill logic is operative.	0.00-5.00%	0.1%	P8
	RATIOS			
RATIO 1	Speed Input 1 Scaling	0.00-5.00	1.00	P50
RATIO 2	Speed Input 2 Scaling	0.00-5.00	1.00	P51
SIGN 1	Speed Input 1 Polarity	POS-NEG	POSITIVE	P53
SIGN 2	Speed Input 2 Polarity	POS-NEG	POSITIVE	P52

ISSUE 4 MMI VARIATIONS

SET-UP PARAMETERS

PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	REF.
	GENERAL CONTROLS			
FIELD CONTROL MODE	When a controlled field regulator is fitted there is a possibility of two control algorithms: (a) Field Voltage Control, an open loop phase angle control to simulate rectifier fields. (b) Field Current Control, a closed loop current control for accurate field control or expansion to field weakening.	VOLTAGE OR CURRENT	VOLTAGE	
FIELD ENABLE	When a controlled field regulator is fitted, the control algorithm must be enabled (uncontrolled diode bridge fields do not need the field enabled). Field enable allows the regulator to control field current	ENABLED OR DISABLED	ENABLED	
FIELD QUENCH MODE	After the field quench delay the field can be entirely quenched or put into a standby mode at minimum field level.	QUENCH OR STANDBY	QUENCH	
FIELD QUENCH DELAY	If dynamic breaking is used the field must be maintained for a period after the drive is disabled. The field quench delay is the period of time the field is maintained.	0.1-250.0	5 seconds	
	FIELD CURRENT VARIABLES			
FIELD I GAIN	When the field regulator is controlling the field current a PI loop is in operation. This is the integral gain adjustment of the PI loop	0.00-5.00	0.01	
FIELD P GAIN	This is the proportional gain adjustment of the field PI loop.	0.00-5.00	0.10	
FIELD WEAK ENABLE	Certain applications of a DC motor controller are best achieved in speed control by field weakening. If a controlled field regulator is fitted and enabled, field weakening enable adds the additional PID loop of the field weakening (field overspill) control.	ENABLED OR DISABLED	DISABLED	
MAX. VOLTS	Maximum volts is the level at which field weakening begins. The level is set relative to the 100% calibration value set by the calibration resistors and armature voltage calibration.	0.00-100.00%	100%	
MIN FLD CURRENT	The field weakening loop reduces the field current to achieve speed control. At top speed the field reaches a minimum value. This limit is a fixed minimum value to set the absolute lower field limit.	0.00-100.00%	10.00%	
	FIELD VOLTAGE VARIABLES			
RATIO OUT/IN	This parameter controls the output voltage from the open loop voltage control. Where ratio is the nominal AC in to DC out ratio of a rectifier bridge.	0-100%	90%	

	CALIBRATION			
ARMATURE V CAL	Trim adjustment of the motor armature level giving 100% armature volts. Note:- Primary voltage calibration is achieved by the selection of resistors R8 and R9 on the calibration board.	95.00-110.00%	100.00%	P18
ANALOG TACH CAL	Trim adjustment of the motor speed at 100% speed demand.	95-110.00%	100.00%	P20
ENCODER LINES	Microtach feedback encoder resolution standard Microtach 1000 ppr	+10 TO +5000	1000	
METER DRIVE	Sets operation of motor output, either bipolar, unipolar current, armature current demand or speed error.	SPEED ERROR ARM CUR DEMAND UNIPOLAR ARM I BIPOLAR ARM I	BIPOLAR	P23
FIELD I. CAL	Trim adjustment of the motor field at 100% field current demand. Note:- Primary field calibration is achieved by the selection of resistors R6 and R7 on the calibration board.	95.00-110.00%	100%	
	SPEED LOOP			
SPEED INT. GAIN	Speed loop PI integral gain adjustment.	0.00-200.00	25.00	P11
SPEED PROP. GAIN	Speed loop PI proportional gain adjustment.	1.00-100.00	25.00	P10

10.5 AUTO - TUNE

The Auto-Tune facility provided for automatic adjustment of the Current Loop control parameters is easy to use provided certain rules are observed.

10.5.1 If there is field current in the motor Auto-Tune cannot be satisfactorily activated at any time, this can be overcome in three ways:-

(i) For a controller with a fixed field rectifier the motor field must be disconnected at terminals D3 and D4 to prevent current flow and the field failure alarm inhibited in the Inhibit Alarms Sub-Menu.

(ii) For a controller with Issue 1 Software and a field regulator the field control algorithm must be disabled.

(iii) For a controller with Issue 2 Software and a field regulator no action need be taken provided the correct sequence is operated from the stop condition. However if the controller is being used in the standby field mode, it may be necessary to eliminate field current completely.

Providing the field current qualifications are observed the following sequence will always ensure satisfactory operation of the Auto-Tune function.

10.5.2 Initial Conditions:-

(a) Main Contactor open, no "START/RUN" signal on C3.
(b) Auto-Tune flag OFF.
(c) Controller Disabled at terminal C5.
(d) Motor shaft clamped to prevent rotation.

10.5.3 Sequence:-

(a) Close main contactor by operation of drive "START/RUN" terminal C3.
(b) Set Auto-Tune flag ON.
(c) Enable controller at terminal C5.

Note:- The current limit must be set to at least 50%.

10.5.4 The controller will then perturb the current loop adjusting the parameters in the current loop to give optimum response.

These parameters are:-

1) Current Proportional Gain
2) Current Integral Gain
3) Dis-continuous
4) Feed Forward

Parameters 3 and 4 give optimum performance of the loops but are not recommended for adjustment outside the Auto-tune algorithm. Conversely optimum performance of the Current Loop cannot be achieved without the setting of these two parameters, thus the Auto-tune facility should be completed at least once with each controller - motor combination.

10.5.5 After the Auto-Tune action has been completed the Main Contactor is opened automatically signalling the end of the algorithm and returning the controller to a safe condition.

If the motor turns the action will cease automatically. Operation of the STOP or ENABLE will stop the controller action immediately in both cases the main-contactor is opened.

10.5.6 At this point the parameters adjusted by the Auto-Tune facility must be "saved" otherwise loss of power will cause the loss of these parameters. Remember that any parameters set to allow the running of the Auto-Tune facility should be reset before the saving operation is executed. This includes the "START/RUN" and "ENABLE" input signals which are still active although the "MAIN CONTACTOR" has been opened automatically.

10.5.7 Restore field connections if removed and removed mechanical clamp before proceeding further.

10.6 ALARMS

The controller alarms are, in general, latched digital outputs that indicate fault conditions within the controller/motor combination. These alarms are gated together to provide a "controller healthy" logic variable. If the healthy variable is not true, the armature current is inhibited and the main contactor control relay is de-energised.

The alarm condition may be reset by opening and closing the main contactor. In the case of a fault the MMI will automatically display the activated alarm, together with its current status.

Selected alarms are non-fatal under certain conditions, and therefore are not gated or latched into the health logic variable. These include the 10v reference monitor points on terminals B3 and B4.

The controller alarms are presented on the two line display in the following format:-

MENU LEVEL
ALARMS

Here, operation of "RAISE" or "LOWER" keys allow different menus to be selected. Operation of the "M" key gives the display:-

ALARMS
ALARM TITLE

Here, operation of "RAISE" or "LOWER" keys allow different alarms to be selected. Operation of the "M" key gives the display:-

ALARM TITLE
STATUS Where STATUS = OK or FAIL.

Operation of the "E" key will move the display level up the tree shown above.

The controller alarms are presented below:-

REF	ALARM TITLE	STATUS	INHIBIT
1.	MOTOR FIELD	OK/FAILED	YES
2.	OVERSPEED	OK/FAILED	-
3.	VA OVERVOLTS	OK/FAILED	-
4.	IF OVERCURRENT	OK/FAILED	-
5.	AUTOTUNE ALARM	OK/FAILED	-
6.	PARAMETER SWITCH	OK/FAILED	-
7.	-10 VOLT REF.	OK/FAILED	-
8.	+10 VOLT REF.	OK/FAILED	-
9.	+24 VOLT SUPPLY	OK/FAILED	-
10.	SELF TEST	OK/FAILED	-
11.	COMMS LINK	OK/FAILED	-
12.	CAL BOARD FITTED	OK/FAILED	-
13.	STACK TEMP	OK/FAILED	YES
14.	SPEED FBK ALARM	OK/FAILED	-
15.	MICROTACH ALARM	OK/FAILED	-
16.	FIRING SYNCH	OK/FAILED	-
17.	3 PHASE SUPPLY	OK/FAILED	-
18.	IA FEEDBACK	OK/FAILED	-
19.	MISSING IA PULSE	OK/FAILED	-
20.	CURRENT TRIP	OK/FAILED	-
21.	MOTOR TEMP	OK/FAILED	-

1. The alarms are displayed at all times, but are only latched into the health logic when the main contactor is energised.
2. A delay of about 30 seconds takes place before the missing pulse alarm is latched into the health logic.
3. The microtach alarm and comms link alarms are disabled automatically when microtach feedback is not selected or the serial link is disabled.
4. Some alarms such as 3-phase supply only show a failed condition transiently since the alarm causes the contactor to be opened and the 3-phase supply removed. Any alarm displayed on the MMI after a fault is likely to be the cause of failure unless the MMI was left in that condition prior to operation. It is therefore advisable to leave the MMI displaying a diagnostic position prior to operation of the drive to ensure correct fault diagnosis.

10.7 ALARM DESCRIPTION

General

The following alarm outputs are used to protect the 570 controller/motor combination. The two line display is used to indicate to the technician the type of failure.

If a failed alarm becomes active when the controller is started, the Thyristor firing circuits are inhibited and the main contactor is de-energised.

The alarm is latched and is automatically displayed from the time of failure. The display shows the CURRENT STATUS of the alarm, which may be OK by the time you read the display. The failed alarm may also be read as a health word, via the serial communications link.

The first alarm that causes failure is latched, and subsequent alarms are ignored. This allows easy fault determination within the controller.

The latched alarm is reset by stopping and re-starting the controller.

1. Motor Field Alarm

If the 570 is configured with an uncontrolled field bridge supply, this alarm will show a failed condition if the motor field current drops below a preset value. (This value is a percentage of programmed full field current.)

If the field configuration includes a field regulator bridge, the alarm will show a failed condition if the field current drops below the value set by the field controller current demand. Faulty operation of the field controller will also cause a motor field fail alarm.

The most usual cause for the motor field alarm is an open circuit motor field; if this alarm occurs, the motor field connections should be checked and the field resistance measured.

If the 570 is operating a motor which requires no field supply, for example a permanent magnet motor, then the field fail inhibit should be used. This is included in the setup parameters and will inhibit the field fail alarm for these applications.

2. Overspeed Alarm

If the speed feedback signal exceeds 110% of the expected level, overspeed alarm is activated. The alarm is likely to be caused by a badly adjusted speed loop or field weakening loop.

3. VA Overvolts Alarm

If the motor armature voltage exceeds 110% of the expected level the alarm is operated. When triggered the cause maybe a badly adjusted field or field loop, or a badly adjusted field weakening loop.

4. If Overcurrent Alarm

When the field regulator is enabled the controller checks that the field current, If, does not exceed 110% of the calibrated value. This alarm is normally triggered by regulator failure or a badly tuned control loop.

5. Autotune Alarm

During the autotune operation the motor must remain stationary, if the motor rotates as shown by the speed feedback the autotune alarm is triggered.

6. Parameter Change Switch Alarm

The 570 Series of drives are programmable products. This allows configuration of the EEPROM memory to suit individual application requirements.

The configuration and setup information is stored in non-volatile memory on the control card. This allows the configuration and setup information to be retained when the 570 is powered down. This configuration information is crucial for the correct operation of the product.

During configuration and setup, the main processor on the control board retains the information in volatile memory this information must be transferred to the non-volatile memory for permanent storage and the parameter switch enables this activity. If the parameter switch is left in the enabled or 'on' position during drive run the parameter switch alarm will be activated and shut down the controller.

7. & 8. -10 Volt Reference Alarms, +10 Volt Reference Alarm

Precision setpoint references of +10 Volts and -10 Volts are available on drive terminals B3 and B4 respectively. These references allow the connection of external potentiometers to provide setpoints to the controller.

The current rating of the setpoint references is a maximum of 10mA. If this current is exceeded, or if the references are short circuited, the reference voltage will be out of tolerance. This will cause the respective reference alarms to show a failed condition. These two alarms will not inhibit the firing circuits or open the main contactor if they occur.

If either alarm operates, the output voltage of the reference supplies should be checked to make sure that each supply shows the correct output voltage. (9 mV).

If the references are out of tolerance, the current loading should be checked.

If the loading is correct but the reference voltage is out of tolerance, consult the nearest SSD sales and service outlet.

9. +24 Volt Supply Alarm

The main low voltage supply within the 570 is a regulated +24 supply. This powers the main control board and the thyristor stack firing transformers.

The main processor monitors this supply. If an out of tolerance condition is detected, the +24 Volt Supply alarm will operate.

In this case, the nearest SSD sales and service outlet should be consulted.

10. Self Test

The main processor performs a number of tests on the hardware and software within the product. Most of these tests are performed when the auxiliary supply is applied.

If any of these tests fail, the self test alarm will operate. In this case, the nearest SSD sales and service outlet should be consulted.

11. Comms Link Alarm

Communication to the Series 570 is via a RS422/485 serial link. The standard protocol is to the Eurotherm BiSynch standard which allows communication with products within the Eurotherm Group and other supervisory systems.

This serial link is optional to the 570, and consists of a small plug-in module mounted under the lower front cover of the product.

If the communications link fails the comms link alarm will operate. In this case the cable connecting the serial link to the host computer should be checked and, if necessary, the serial link module replaced.

This alarm is inhibited by disabling the serial comms from the MMI.

12. Cal Board Fitted Alarm

Calibration resistors are necessary for:-

1. Armature current.
2. Field current.
3. Armature voltage.
4. Analogue tachometer feedback.

These calibration components allow the 570 to be calibrated quickly and accurately to specific motor requirements.

To ease this calibration process, and to allow rapid replacement of the controller should a fault occur, the calibration components are mounted on a plug-in card under the bottom flap of the product. If the card is not fully installed, the cal board fitted alarm will operate when the controller is started.

If this alarm operates the calibration board should be checked for correct insertion as a printed circuit jumper link on the PCB is needed to complete the cal board fitted alarm.

13. Stack Temp Alarm

Higher horsepower versions of the model 570 (above 70 amp bridge rating) are equipped with blowers to force extra cooling air over the heatsink of the product. These 570 versions are equipped with a thermal switch on the heatsink.

In the event of blower failure, or restriction of the cooling airflow, the heatsink temperature may rise to unacceptable limits. Under these conditions, the heatsink switch will open, and the stack temp alarm will operate.

If this alarm operates, the heatsink blower should be checked and the cooling air path should be checked for obstructions. If the blower does not run, the fuse should be checked on the power board of the product. This fuse is labelled FS 1, and if blown, must be replaced with a fuse of the same rating. The blower fuse rating is 0.5A quick blow.

The stack must be allowed to cool in order to re-start the controller.

14. Speed Feedback (Inhibit) Alarm

A continuous comparison is made by the controller of the speed feedback and armature voltage if the difference is greater than the value set by the speed feedback alarm level the alarm is operated. If armature voltage feedback is selected then the speed feedback alarm is automatically suppressed. It can also be suppressed in the inhibit alarms sub menu.

The speed feedback alarm is normally triggered by failure of the feedback mechanism in one of the following ways:-

i) Disconnection of wiring including fibre optics.

ii) Failure of the tachogenerator.

iii) Failure of the tachogenerator coupling.

15. Microtach Alarm

The 570 is designed to accept speed feedback signals from the SSD Microtach. This is a custom digital tachometer which communicates to the 570 via an optical fibre link.

In the event of failure of this tach, or failure of the optical fibre link, the microtach alarm will operate.

If this occurs, the fibre optic link to the 570 should be checked for damage. The bend radius of the fibre optic cable must not be exceeded or this may cause failure.

The Microtach will drive up to 45 meters (145 feet) of fibre optic cable. If this maximum length is exceeded, the Microtach alarm may operate. In this case one or more repeater modules must be inserted in the link to boost the signal to the 570.

The SSD Microtach is optional to the 570 Series controller. If the module is not fitted the Microtach alarm is automatically inhibited.

16. Firing Synch Alarm

The 570 controller automatically "locks on" to any three phase supply within a frequency range of 45 to 65 Hertz. This allows the thyristors to be fired at the correct times during each supply cycle. The synchronisation circuit will reject a large level of supply distortion and this allows accurate firing at all times.

If the supply frequency exceeds the limits the firing synch alarm will operate. If the controller is supplied from a power supply which is highly distorted this may cause synchronisation errors which will cause the alarm to operate.

In the case of firing synch failure contact the nearest SSD sales and service outlet.

17. Three Phase Supply Alarm

The controller continuously monitors the incoming three phase supply of the L1, L2 and L3 busbars. If the supply fails when the start contactor is energised, the three phase supply alarm will operate.

The controller will detect total failure of the supply. A missing phase is detected under most circumstances. However, if the controller is connected to the same supply as other equipment there is a possibility that this equipment may generate a voltage in the missing phase. Under these circumstances, the three phase supply alarm may not fail.

In the case of a missing phase alarm, the supply to the controller should be checked. The controller should be provided with high speed fusing to protect the thyristor stack in the case of direct output short circuits. These fuses should be checked. 570 Series controllers are available with three supply voltage options:-

1. Less than 220VAC.
2. 220 to 480VAC.
3. 480 to 660VAC 578/579 (External Stack Only).

The voltage option is specified in the product code which is printed on the back of the control card. The three phase supply alarm may operate if the wrong supply voltage option is specified for the controller.

The three phase supply alarm will only operate when the start contactor is energised. This allows either AC or DC main contactors to be used with the controller.

If the three phase supply alarm is reset without rectifying the supply fault, the start contactor will energise, the alarm will operate again, and the contactor will drop out.

18. IA (Armature Current) Feedback Alarm

The motor armature current is monitored by the 570 using current transformers. These transformers are mounted on the heatsink and are connected to the control circuit via a plug on the power board.

This plug has an extra link which allows monitoring the presence, or absence, of this plug. If the plug is not installed and the controller is started, the IA feedback alarm will operate. This prevents starting of the controller without armature current feedback.

This feature is especially important in the case of external stack controllers, where the thyristor stack is remote from the control board. Here, it is quite conceivable that the controller could be started without the current transformers plugged in.

If this alarm operates, the armature current transformer plug should be checked for correct installation.

19. Missing IA Pulse Alarm

The controller continuously monitors the armature current waveform. If a fault develops within the controller the armature current waveform shape may become very distorted. Although the controller may appear to function normally, the motor will experience severe heating due to the distorted current waveform.

If the armature current becomes distorted, the missing IA pulse alarm will operate and the motor will be protected.

The most usual cause for missing pulse failure is incorrect setup of the controller. The nearest SSD sales and service outlet should be contacted.

20. Current Trip Alarm

A hardware current trip is provided on the 570 control board. If the armature current ever exceeds 300% of rated value, the trip will operate. Under these conditions, the current trip alarm will fail.

The current trip will operate for two basic reasons:-

1. Motor Faults: If the motor armature windings fail, the armature resistance may drop sharply. This may cause excessive armature current which will activate the current trip. If this occurs, the motor armature should be checked (Meggered) for insulation resistance, which should be above acceptable limits. If the motor becomes completely short circuit, the current trip will not protect the controller. High speed Thyristor fusing should always be provided to protect the thyristor stack in the case of direct output short circuits.

2. Controller Faults: In the event of 570 faults the current trip may operate. For example if the main processor becomes faulty, the hardware current trip ensures that the incoming supply is safely disconnected from the controller via the start contactor.

21. Motor Temp Alarm

It is good practice to protect DC motors against sustained thermal overloads by fitting temperature sensitive resistors or switches in the field and interpole windings of the machine. Temperature sensitive resistors have a low resistance (typically 200 Ohms), up to a reference temperature (125c). Above this, their resistance rises rapidly to about 2000 Ohms. Temperature switches are usually normally closed, opening at about 105c.

Motor overtemperature sensors should be connected in series between terminals C1 and C2. If the motor temperature rises such that the resistance of the sensor exceeds 1800 Ohms, the motor temp alarm will fail. If this happens the motor must be allowed to cool before the alarm can be reset by re-starting the drive.

Motors overheat due to many factors, but the most common cause is inadequate ventilation. Check for blower failure, wrong rotation of the blower, blocked ventilation slots, and clogged air filters. Other causes of overheating relate to excessive armature current. The armature current on the motor nameplate should be checked against the current rating for the 570. This rating is for a 100% current demand.

There is no motor temperature alarm inhibit: terminals C1 and C2 must be linked if overtemperature sensors are not used.

10.8 PARAMETER SAVE

Whenever parameters are adjusted or altered to levels other than those previously stored in the non-volatile memory, it is important to re-store the new values to prevent loss due to power failure or an unexpected power-alarm.

To perform a Parameter Save or Store use the following sequence:

1. Page through the MMI main menus using the up or down arrows to "Parameter Save".

2. Enter "Parameter Save" sub menu using "M" key to "Data Write".

3. Move through "Data Write" menu with "M" key to instruction "Turn S5 on" where S5 is the parameter storage enable switch under the bottom flap switch on S5.

4. Proceed to the final level where the Message "Save?" is displayed. Initiate the save function using the up arrow when the display will show "Saving", wait until the message returns to "Save?" before performing any other action. It is important to wait until the Parameter Save activity is completed otherwise the incomplete storage cycle may result in subsequent operational difficulties.

5. Exit from Save activity by the "E" key via the Prompt message "Turn S5 off" to the main menu level at "Parameter Save". Don't forget to turn S5 off.

The "Parameter Save" operation can be performed as many times as is required to ensure safe and satisfactory data storage, however the operation cannot be carried out during a running condition of the controller.

Note:

If a Parameter Save is performed after running the auto-tune algorithm, input signals such as Start/Run and Enable, Field override and any other parameters set to allow the auto-tune algorithm to run should be returned to their normal level before a Save is carried out to prevent incorrect data from being stored.

10.9 SERIAL LINK

Serial Link Parameters

		Range	Default
1. Serial Link Enable	Press UP button to ENABLE DOWN button to DISABLE		Disabled
2. Unit ID (UID)	Use UP and DOWN arrows to adjust	0000-0009	0000
3. Group ID (GID)	Use UP and DOWN arrows to adjust	0000-0009	0000
4. Baud Rate	Use UP and DOWN arrows to adjust	300 - 9600	9600
5. Instrument ID		Fixed at 5700	
6. Version No.	Software version number		
7. EEPROM Verson	Fixed HEX Code		
8. Config. Info.	Serial Link Configuration data. Read only		
9. Buffer length	Serial Link Configuration data. Read only		
10. Error Report	Serial Link Configuration data. Read only		
11. Mode No.	Serial Link Configuration data. Read only		
12. ASCII/Binary	Press UP button for ASCII DOWN button for BINARY		ASCII
13. ESP/T2001 HOST	Press UP button for ON DOWN button for OFF		OFF

Setting the Serial Link from the MMI

During the serial communication, the d.c. Drive behaves as a slave. Serial messages are therefore received by the drive from an external master. The serial link uses the Eurotherm Bisynch Communications Protocol (for further information on the protocol refer to the corresponding manual).

The MMI provides the following information some of which can be programmed by the user. The rest are fixed (read only parameters) as described below:-

1. Serial Link Enable/Disable:

This allows the user to enable or disable the serial link by the use of the rise and lower keys. It is presented in the MMI as "SRL LINK DISABLE". The default value is DISABLE.

2. Unit Address Identifier (UID):

This allows the user to select the first of the two identification digits of the drive. The selection is achieved by the use of the rise and lower keys, where the value can be changed from 0 to 9. It is presented in the MMI as "UNIT ID (UID)". The default value is 0000.

3. Group Address Identifier (GID):

This allows the user to select the second of the two identification digits of the drive. The selection is achieved by the use of the rise and lower keys, where the value can be changed from 0 to 9 in the ASCII mode and from 0 to 7 in the binary mode. It is presented in the MMI as "GROUP ID (GID)". The default value is 0000.

4. Baud Rate:

The baud rate can be selected by the use of the rise and lower keys, where it can be one of the following six values:-

300, 600, 1200, 2400, 4800, 9600 Baud

It is presented in the MMI as "BAUD RATE" and the default value is 9600 Baud.

5. Instrument Identity:

This is a read only parameter which identifies the instrument. It is presented in the MMI as "INSTRUMENT ID". The 570 drive is identified by 5700.

6. Version Number:

This is a read only parameter which presents the user with a number identifying the version of the software in the drive.

7. EEPROM Version

This is a read only parameter which allows automatic checking of EEPROM compatibility with current software version.

8. Configuration Information:

This parameter is used to indicate the configuration of the drive. It is a read only parameter which consists of two bytes. It contains a fixed value 4CCC indicating that it is a variable speed drive which supports both fixed and variable length data formats and it does not support multi-block transmission. It is presented in the MMI as "CONFIG. INFO.".

9. Communication Buffer Length:

This parameter is used to indicate the maximum length of a message that the drive can accept. It is a read only parameter which consists of two bytes. The high byte is the output buffer length, while the low byte represents the length of the input buffer. In the 570 drive, the length of both buffers if fixed as 09. The buffer length parameter is therefore equal to 0909. It is presented in the MMI as "BUFFER LENGTH".

10. Instrument Error Code:

This parameter is used to indicate the type of latest serial error. It is presented in the MMI as "ERROR REPORT". It is a read only parameter which consists of four hex. digits. The MSD (most significant digit) is always zero, the third MSD is always equal to "C" indicating that it is a d.c. drive. The second MSD can be any of:-

0 no error is detected
1 invalid mnemonic
2 checksum error
3 parity error
5 writing to a read-only parameter
7 invalid format

The fourth MSD, i.e. the least significant digit can be any of:-

0 no error detected
1 character oriented error, e.g. parity error
2 message data error, e.g. checksum error
7 invalid message e.g. unknown mnemonic
8 invalid message contents, e.g. write to a read only parameter.

11. Mode Number:

This parameter is presented in the MMI as "MODE NO'". It is a read/write parameter which consists of four hex. digits. The two MSD (most significant digit) contain the following flags:-

bit 15 unacknowledged alarm
bit 14 value of a parameter has changed
bit 12 instrument health
bit 11 fixed/variable data length enable
bit 9 power failure occurred

The third MSD is always equal to "C" indicating that it is a d.c. drive. The fourth MSD, i.e. the least significant digit can be any of:-

0 drive is running
1 drive is idle
2 drive is unhealthy

12. Serial Mode:

The serial link can be selected to operate in either of two modes. The first is the ASCII mode, while the second is the BINARY mode. Both of these modes are described in the Eurotherm BISYNCH manual. It is presented in the MMI as "ASCII/BINARY" and the default mode is ASCII.

13. ESP/T2001 Host Support:

This parameter switches on or off Host Support either ESP or T2001. If serial Mode is ASCII then Host Support if selected 'on' is ESP, if serial mode is BINARY then Host Support selected 'on' is T2001.

10.10 SYSTEM PARAMETERS

The SYSTEM menu is selected from the Menu Level by operating the "M" key. The display reads:-

SYSTEM
PASSWORD

The "RAISE" and "LOWER" keys may be used to select from three submenus: PASSWORD, 5703 SUPPORT and PEEK.

1. The PASSWORD menu may be selected by pressing "M". The display will read:-

   PASSWORD
   ENTER PASSWORD

   and by using the "RAISE" and "LOWER" keys it is possible to reach CLEAR PASSWORD and CHANGE PASSWORD.

   The Password is stored invisibly in the EEPROM; the factory default value is 0000.

   As long as the value displayed under ENTER PASSWORD is correct, all other functions are accessible. These functions include the setup parameters and the CHANGE PASSWORD function.

   To change the password, first set the correct value under ENTER PASSWORD. Now go into CHANGE PASSWORD and enter the new value. Press "E" to exit and pay attention to the prompt "PLEASE REMEMBER".

   Should your memory or your confidence fail, go back into CHANGE PASSWORD or ENTER PASSWORD to confirm the new value of the password, which will still be visible.

   To make the new password invisible go into CLEAR PASSWORD and press "M". The ENTER PASSWORD and CHANGE PASSWORD functions will now display 0000. Password protection is now active.

   5703 SUPPORT

2. Under SYSTEM the 570 may be configured to support the 5703 range of products, which pass a high-accuracy setpoint over a fibre-optic link between drives using the P3 Port. A full description is given in Section 12.

3. The PEEK function allows SSD staff access to the memory of the Drive's Main Processor.

4. The UPLOAD/DOWNLOAD system of external parameter storage and retrieval via the P3 port is enabled via the SYSTEM Menu.

   This is more fully described in the UDP Support Manual HA058623.

5. The RESERVED menu as it's name implies is only for use by SSD staff or under direct supervision by SSD staff. **NO NOT ALTER.**

11 SERIAL COMMUNICATIONS

11.1 ASCII Communications

General Description

Supervision and monitoring of SSD 570 Series drives has been made simple by the provision of a supervisory communications interface. This option provides a serial data port that can be installed on each drive. These RS422/RS485 links can be bussed together to allow an intelligent device to monitor or update the parameters of a network of drives.

Using this link a supervisory control system can be implemented where each drive is in continuous local control and the central computer is only to perform periodic setpoint updating, control sequencing and data collection.

The main advantages of this type of control system are:-

a. Multi-wire analogue transmission from a central programmable controller is replaced by a bussed digital system using serial data transmission over twisted pair wire links. This reduces cabling costs.

b. Digital transmission is fundamentally less noise-prone than analogue methods, and the accuracy of the transmitted data is unaffected by the transmission medium. The use of intelligent devices at either end of the data link allows error checking to be used. This virtually eliminates the effects of electrical noise on data integrity. It is therefore possible to issue setpoints to drives with much higher accuracy using this method.

c. The communication standard used allows up to 16 drives to be connected to a single link which can be driven from a computer serial port. Additional drives can be readily accommodated through additional ports. Most computers are equipped with RS232 serial ports which can be easily converted to accommodate the RS422 standard. Modules are available from SSD to make this conversion.

d. The chosen standard and protocol are compatible with other Eurotherm group products. Temperature controls, process controls, data loggers, and drives can communicate easily with a common supervisory system.

The communications protocol employed by the Eurotherm group instruments, including SSD drives, comes under the heading of Binary Synchronous Communications Data Link Control (BSCDLC). The specific form of communication implemented corresponds with the following full American National Standard definition:-

ANSI standard: x3.28

Revision: 1976

Establishment and Termination Control Procedures Sub-category 2.5:
Two-way Alternate, Nonswitched Multipoint with Centralised Operation and Fast Select.

Message Transfer Control Procedure Sub-category B1:
Message Associated Blocking, with Longitudinal Checking and Single Acknowledgment.

This is known by the abbreviation:

ANSI - x3.28 - 2.5 - B1.

This is all part of an internationally recognized ANSI standard protocol called BISYNCH (Binary Synchronous) and known by the abbreviation x3.28. This is widely used by manufacturers of computers, computer peripherals, and communications equipment.

11.1.1 Formal Specification

Multi Drop Supervisory Link

Transmission Standard	: RS485(RS422)(bi-directional)
Protocol	: ANSI-X3.28-2.5-A4
Data Rates	: 300,600,1200,2400,4800 or 9600 baud
Character Format (300 to 9600 baud)	: ASCII + 1 start, 1 parity and 1 stop bit. [10 BIT]
Parity	: Even

Digital Communications

	RS422	RS485
Electrical Connections	4-wire differential	4-wire differential
No. of drivers and receivers allowed per line	1 driver 16 receivers	32 drivers 32 receivers
Maximum cable length	4000ft/1200 metres	

11.1.2 Explanation of Terms

ASCII (American Standard Code for Information Interchange)

ASCII is a binary code which represents letters, digits, and control signals (collectively called characters). The code originated by the American National Standards Institute (ANSI) has become a world-wide standard for information interchange. The code uses a seven bit binary word to represent all the letters, digits, punctuation marks and control signals, a complete list of these codes being given at the end of the section.

Protocol

The Protocol defines the string or sequence of characters called a message which must be sent between communicating instruments to produce specific responses. The sequence of characters usually comprises control characters, instrument address, parameter mnemonic and data.

Control Characters

Control Characters are ASCII binary codes which define actions rather than information. Six ASCII codes are used:-

ASCII-HEX		
02	(STX)	Start of Text
03	(ETX)	End of Text
04	(EOT)	End of Transmission
05	(ENQ)	Enquiry
06	(ACK)	Positive Acknowledge
15	(NAK)	Negative Acknowledge

Instrument Address

The 570 or associated Eurotherm Instrument has an address, the first digit being the "group" number (GID) in the range 0 to F, the second a "unit" number (UID) in the range 0 to F. There are therefore 256 different addresses from 00 to FF.

Parameter Mnemonic

Each Eurotherm instrument has a number of parameters defined within its program structure, each parameter is specified by a two character Mnemonic. Information is exchanged between instruments by use of these Mnemonics.

Examples are:-

a1 the analogue input 1
he the instrument health word
sd the drive speed demand

Full tables of the 570 mnemonics are given in Terminal Descriptions Section.

Data

Data can be considered to consist of two types:-

i) Numerical Data:- Where the parameter refers to number which is a level, setpoint, gain or result within the instrument being either positive or negative.

ii) Boolean Data:- Where a Boolean parameter such as a switch can be monitored enabled, or disabled from the serial link.

iii) Status Information:- Where the parameter refers to a binary word each bit within the word being a significant switch within the program structure:-

Examples of numerical data are:-

er, speedloop error a number in the range ± 100.00%
id, current demand a number in the range ± 200.00%
dt, Digital tach a number in the range ± 3000 RPM

Examples of status information are:-

he health word:- bit 1 represents the missing pulse alarm
bit 9 three phase present
bit 13 current trip alarm

Full information on the data types and the status words is contained in Terminal Descriptions Section.

Data Format

The 570 uses an ASCII free format mode of operation for data transfer to make it easy to implement with languages such as BASIC, PASCAL, FORTRAN and assembler languages. This makes it easy to implement a simple supervisory system using an IBM PC.

Numerical Data (Format 21 - Free Format Numeric)

Numerical Data is transferred by transmission of a string of characters, the length of the string required to transmit the data value is determined by the value itself, no leading zeros are added to pad out the string length, however, the numerical value is always ended by the addition of two decimal places even if not required.

i.e.	1	is sent as	1.00
	-2.2	is sent as	-2.20
	19.99	is sent as	19.99

Status Information (Format 23 - Hexadecimal)

Status Information is transmitted by first encoding the data into a hexadecimal format. The length of the string is then determined by the number of characters in the encoded data. The hexadecimal data ia preceded by a '>' sign to differentiate from numerical data.

Note:- Hexadecimal refers to the common practice of counting to the base of 16 in computing rather than the base of 10. The sixteen numbers used being 0 to 9, A to F. Thus an 8 bit byte is represented by two characters in the range 00 to FF, while a 16 bit word is represented by four characters in the range 0000 to FFFF.

Data Transfer Sequence

The data transfer sequence in the ASCII mode offers the following facilities:-

i) Asking questions (Known as polling)

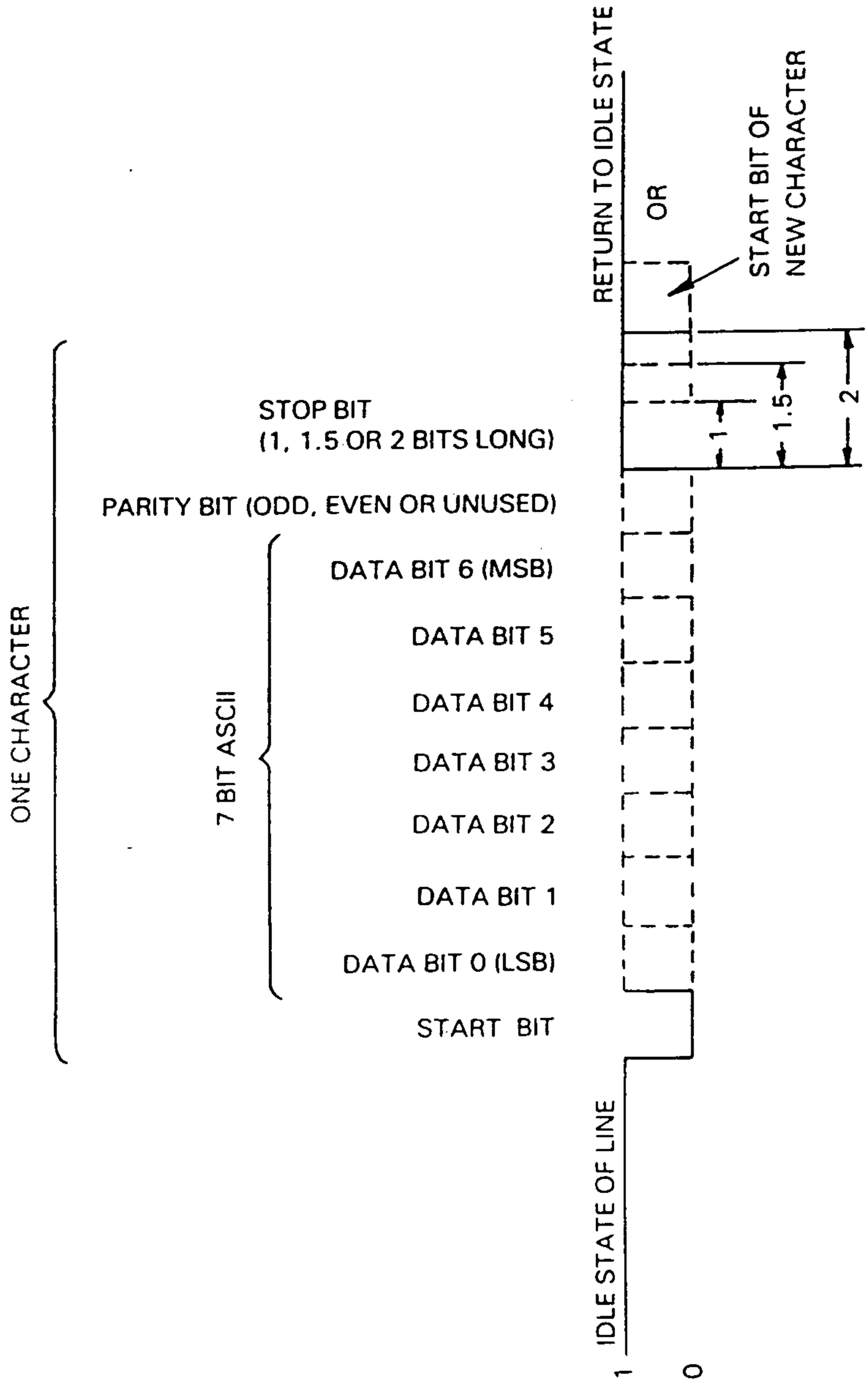
a. Single parameter poll
b. Continuous polling of one parameter
c. Sequential polling down the parameter list (fast polling)
d. Multi-block download of long messages.

ii) Setting parameters (known as selection)

a. Single parameter update
b. Continuous updating of one or more individual parameters
c. Multi-block download of long messages.

Serial Data Transmission

When an ASCII character is sent by means of serial data transmission the Bit pattern is transmitted in a fixed order the start and finish of that pattern being indicated by the transmission of signal levels called the start and the stop bits. The seven bit ASCII code is usually extended by one bit called the parity bit which indicates whether the total number of bits in each character code is odd or even. Eurotherm Protocol requires that the parity bit indicates even parity, i.e. it is set if the number of bits set in an ASCII character is odd. The serial data pattern also allows the use of multiple stop bits however Eurotherm Protocol dictates that there is only one stop bit if the data rate is greater than 110 baud, 570 instruments use 300 to 9600 baud.



11.1.3 Sequence to Read Information from the 570 by Computer

Enquiry

The computer initially has master status, with the 570 in slave status and begins by transmitting a message, known as the "establish connection" message, which is represented by the following format:-

(EOT) (GID) (GID) (UID) (UID) (CI) (C2) (ENQ)

These symbols are defined as follows:-

(EOT) - This control character resets all instruments on the link and causes them to examine the next four transmitted characters to see if they correspond with their group/unit address identifiers.

(GID) - These characters represent the required group address identifier, repeated for security.

(UID) - These characters represent the required unit address identifier, repeated for security. (Together these units define the address of a particular instrument). If, for example, GID = 3 and UID = 4, then the instrument to be addressed is number 34.

(C1)(C2) - These characters specify the parameter by mnemonic.

(ENQ) - This character indicates the end of the message, and that it is an enquiry.

The transmission of this message initiates a response procedure from the 570.

Valid Response of the 570 to this Message

(For no response see 3.4)

After the message has been sent, the computer adopts slave status and expects to receive a reply from the 570. In so doing, the 570 assumes Master status and providing the 570 has successfully received the message in full, it responds in the following form:-

(STX) (C1) (C2) (D1) (D2) (D3)....(DN) (ETX) (BCC)

which constitutes a message defined as thus:-

(STX) - start of text.

(C1)(C2) - parameter specified by mnemonic

(D1 to DN) - value of the requested parameter (string may be of any length as determined by the data).

(ETX) - end of text

(BCC) - verification digit which is the character generated by taking the exclusive OR of the ASCII values of all the characters transmitted after and excluding (STX) up to and including (ETX).

ie: (BCC) = (C1) EOR (C2) EOR (D1) EOR (D2) EOR (D2) EOR (D3) EOR (D4) EOR (D5) EOR (ETX)

where EOR = Exclusive OR

The computer must check this (BCC) before accepting this reply as valid. Also the software must be able to extract the number from the data string taking into account the protocol of the data transmission.

NOTE: If the 570 receives the message but does not recognize the mnemonic it will respond with (EOT). The (EOT) hands back control to the computer.

Further Enquiry and Termination

The computer then assumes master status again and three options are available:-

i) Repeat Parameter Facility (NAK)

If the computer transmits a (NAK) after the valid reply, it causes the 570 to repeat the parameter that was just received. This allows continuous monitoring of the same parameter without having to re-establish the connection.

ii) Scroll Mode Facility (ACK)

If the computer transmits a (ACK) after a 'valid reply', it causes the 570 to fetch the next parameter from the parameter list. This facility enables the computer to continuously sequence through all the parameters of the 570.

iii) Terminate Communication (EOT)

The termination procedure is entered when the selection of a particular instrument is no longer required or when a 570 does not respond to a message or replies with an (EOT) character. The computer assumes Master status and transmits an (EOT) character to enable all the instruments on the data link to be responsive to the next GID-UID address parameter.

No Response

Under certain circumstances the computer may not receive a response from the 570. This could be due to any of the following reasons:-

i) Group/Unit address identifiers not recognized.

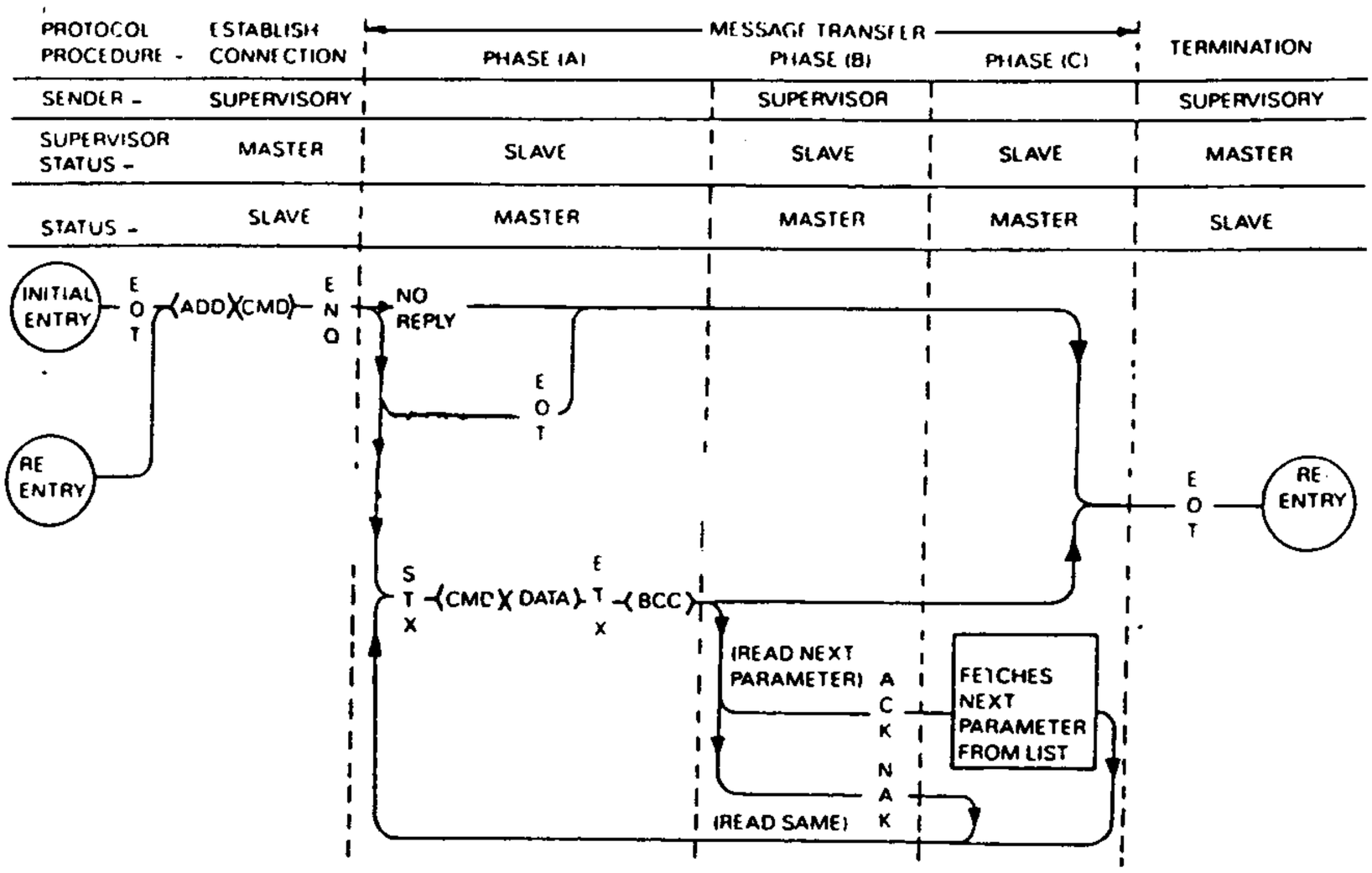
ii) An error (e.g. parity) is found in one or more of the characters up to and including ENQ.

iii) Communications loop failure perhaps due to noise or wrong baud rate being selected.

iv) Hardware failure.

In these cases the computer should be programmed to "time-out", i.e. wait for a response for a short time (160msec minimum) before trying again.

SELECTION SEQUENCE FOR TRANSMITTING DATA FROM THE 570 CONTROLLER TO THE SUPERVISOR.



11.1.4 Sequence to Send information to the 570 from the Computer

Establish Connection

Connection is established with a particular 570 by sending
(EOT) (GID) (GID) (UID) (UID) followed immediately by the data transfer
(STX) (C1) (C2) (D1) (D2) (D3).....(DN) (ETX) (BCC)
(Note that this message is identical to that transmitted by a 570 when giving a "valid reply").
The symbols of this message are defined as follows:-

(STX)	-	start of text character
(C1)(C2)	-	parameter specified by mnemonic
(D1 to DN)	-	parameter value
(ETX)	-	end of text character
(BCC)	-	Block Check Character (verification check digit which is again the exclusive OR of (C1) to (ETX) inclusive and must be calculated by the computer before transmission).

Responses

After transmission of the whole message, the 570 responds to it by sending (ACK), (NAK) or by giving no reply.

i) Positive acknowledgement (ACK)

When the 570 has received the message, it performs the following tasks:-
Checks for any parity errors in the message. If none then it...
Verifies that the (BCC) character corresponds to the data pattern received. If no error then it...
Verifies that the (C1), (C2) command characters are a valid mnemonic that may be written to. If so then it...
Verifies that the data (D1 to DN) is valid and not out-of-range*. If so then it...
Updates the selected parameter with the new value contained in the message.
Only when all these tasks have been successfully completed does the 570 send the (ACK) response to the computer.
This signifies that the message was correctly received and implemented.

ii) Negative acknowledgement (NAK)

If the message fails any of the above checks, the 570 sends (NAK) response to the computer. This signifies that the message received by the 570 contained an error and accordingly it has not updated the selected parameter. One possible reason is the incorrect calculation of (BCC). At this point, the selected command may be repeated by sending the data transfer string without re-establishing connection, until the (ACK) response is received by the computer.

* Data out-of-range is clamped and used.

iii) No Reply

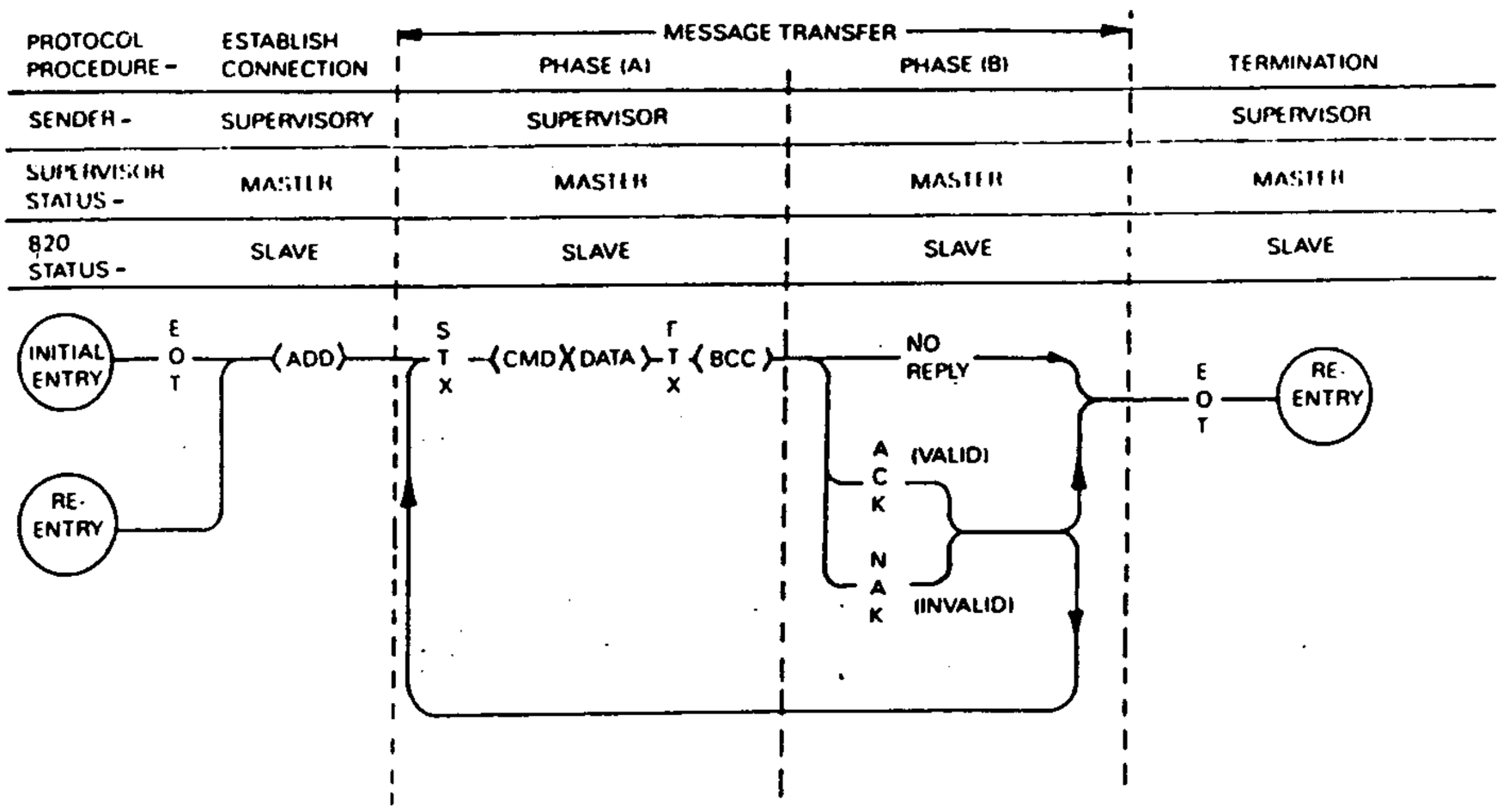
Under certain circumstances, the computer may not receive a response from the 570. This could be due to any of the following reasons:-

Group/Unit address identifiers not recognized.
An error (e.g. parity) is found in one or more of the characters up to and including (BCC).
Communications loop failure perhaps due to noise or wrong baud rate selected.
Hardware failure.
In these cases the computer should be programmed to 'time-out', i.e. wait for a response for a short time (160ms minimum) before trying again.

Termination

The termination procedure is used if the computer wishes to stop selecting a particular 570 and establish connection with another. This is achieved by sending the 'establish connection' sequence. The computer retains Master status and transmits an (EOT) character to reset all instruments on the data link to be responsive to the next GID-UID address parameter.

SELECTION SEQUENCE FOR THE TRANSMITTING DATA
FROM THE SUPERVISOR TO THE 570 CONTROLLER



11.1.5 Mnemonic Parameters

Eurotherm Group Standard Parameters

Each of the Eurotherm Group instruments contains a minimum set of parameters. These are known as the Prime Set and allow access to the following:-

a. Instrument Identifier - so that a supervisory program can deal with instrument specific communications. It is represented by mnemonic (II). Example on contents 5700.

b. Software version number - for debugging purposes. It is represented by mnemonic (VO). Example on contents 0005.

c. Instrument configuration information - indicates instrument category and status flags. It is represented by mnemonic (CI). Example of contents 4CCC.

d. Instrument Buffer length - defines communication buffer sizes. It is represented by mnemonic (BL) and contains the value 0909.

e. Error reporting - contains an error-code corresponding to the last communication error detected. These are:-

00C0		: No error detected.
01C7		: Non-existing mnemonic.
02C1		: Check sum error.
03C1		: Parity error.
03C2		: Receive buffer overflow, or message sequence error.
05C8		: Writing to a read-only parameter.
07C7 07C8	}	: Wrong format.

The error reporting is represented by mnemonic (EE)

f. Instrument Mode number - indicates instrument operating mode. It is represented by mnemonic (MN). Example of contents if 08C1.

In addition to the Prime Set, each drive or instrument supports an application set of parameters to allow fast access to commonly required variables such as:-

a. Process variables.

b. Setpoints.

c. PI gains.

All parameters can be found by polling the instrument identifier parameter and then sequentially polling until the instrument identifier parameter is repeated. This will result in a circular list that contains all supported by the instrument.

Serial Communication Link Mnemonics

Prime-set Parameters

NAME	DESCRIPTION	FORMAT	ACCESS
II	Instrument Identifier	23	R/O
VO	Version Number	23	R/O
CI	Configuration Information	23	R/O
BL	Buffer Length	23	R/O
EE	Error Report	23	R/O
MN	Mode Number	23	R/O

TABLE

ASCII CODES

ASCII CODES			ASCII-HEX
STX	-	Start of Test	02
ETX	-	End of Text	03
EOX	-	End of Transmission	04
ENQ	-	Enquiry	05
ACK	-	Positive Acknowledge	06
NAK	-	Negative Acknowledge	15
	-	Space	20
-	-	Minus Sign	2D
•	-	Decimal Point	2E
0			30
1			31
2			32
3			33
4			34
5			35
6			36
7			37
8			38
9			39
>	-	(greater than)	3E

HEX-ASCII TABLE complete list

00	NUL	15	NAK	2B	+	40	@	56	V	6A	k
01	SOH	16	SYN	2C	,	41	A	57	W	6B	l
02	STX	17	ETB	2D	-	42	B	58	X	6C	m
03	ETX	18	CAN	2E	.	43	C	59	Y	6D	n
04	EOT	19	EM	2F	/	44	D	5A	Z	6F	o
05	ENQ	1A	SUB	30	0	45	E	5B	[	70	p
06	ACK	1B	ESC	31	1	46	F	5C	/	71	q
07	BEL	1C	FS	32	2	47	G	5D	}	72	r
08	BS	1D	GS	33	3	48	H	5E	^	73	s
09	HT	1E	RS	34	4	49	I	5F	-	74	t
0A	LF	1F	US	35	5	4A	J	60	'	75	u
0B	VT	20	space	36	6	4B	K	61	a	76	v
OC	FF	21	!	37	7	4C	L	62	b	77	w
0D	CR	22	"	38	8	4D	M	63	c	78	x
0E	SO	23	£	39	9	4E	N	64	d	79	y
OF	SI	24	$	3A	:	4F	O	65	e	7A	z
10	DLE	25	%	3B	;	50	O	66	f	7B	{
11	DC1(X-ON)	26	&	3C	<	51	Q	67	g	7C	|
12	DC2	27	'	3D	=	52	R	68	h	7D	}
13	DC3(XOFF)	28	(	3E	>	53	S	69	i	7E	~
14	DC4	29	)	3F	?	54	T	6A	j	7F	DEL
		2A	*			55	U				

11.2 BINARY COMMUNICATIONS

This mode has many similarities with the ASCII mode. This document mainly concentrates on presenting those parts which are different from the ASCII mode.

11.2.1 Specifications

a. Character Format:

Each byte is transmitted as 11 bits rather than adapting the 10-bit format used by the ASCII mode. This is because of using a control bit which is cleared in the control character, and set in a data character. The format is presented by the following:-

1	Start bit (lo)	
7	Data bits (LSB first)	
1	Control bit	*
1	Even parity bit	
1	Stop bit (hi)	

* 0 = Control character
1 = Data character

b. The Message:

The message received from the supervisor can be in any of several modes. They can be divided into two categories, the first is the "main messages", and the second is the "continuation messages". Before presenting the format of these messages, the following gives the symbols they use. These symbols are divided into two parts, they are "control characters" and "data characters".

11.2.2 Control Characters

"EOT"	:	It indicates the end of transmission. It therefore clears the line and is sent by the master at the start of a new message.
"STX"	:	This is the start of test character.
"ENQ"	:	This is the enquiry character. It is sent by the master as the last character of any type of a polling message.
"ETX"	:	This is the end of test character. It is followed by another character containing the checksum.
"ETB"	:	This is the end of block character. It is sent by the 570 drive instead of the "ETX" when it wishes to reply with more than one message. The "ETB" indicates the end of a block, but not the end of a message. Each block contains information on one parameter. The "ETB" is used in replies to enquiry polling and multi-parameter polling (these are explained below).
"ACK"	:	This is the positive acknowledgement character.
"NAK"	:	This is the negative acknowledgement character.

11.2.3 Data Characters

"INO"	:	This is the instrument number. It contains the address of the slave drive and is equivalent to the combination of the GID, UID characters of the ASCII mode.
"PNO"	:	This is the parameter number. It is equivalent to the combination of the C1 and C2 characters of the ASCII mode and is sent as a hexadecimal number rather than two ASCII characters.
"D1", "D2" and "D3"	:	These three characters contain both the value and the mode number. The format is explained in section (c) below.
"CCC"	:	This is the connection check control character. It contains the checksum of all the characters following the "EOT" character in the message.
"BCC"	:	

11.2.4 Types of Messages

As described above there are two types of message they are:-

a. Main Messages:

The main messages are in four types, these are:-

1. Selection:

The supervisor writes to one parameter.

E	I	C	S	P	D	D	D	E	B
O	N	C	T	N	1	2	3	T	C
T	O	C	X	O				X	C

where the "BCC" character contains the checksum of all characters following the "STX".

2. Polling:

The supervisor requests to read the value of one parameter.

E	I	P	C	E
O	N	N	C	N
T	O	O	C	Q

3. Enquiry Polling:

The supervisor requests to read all those parameters that have changed since the last read.

E	I	C	E
O	N	C	N
T	O	C	Q

4. Multi-parameter polling:

The supervisor requests to read a given number of parameters. That number is referred to as the count number ("CNO"), it is included in the request message and the reply will be sent by the drive, one parameter at a time. If the end of the parameter table is reached before sending the requested number of parameters, then transmission continues by sending parameters from the beginning of that table.

E	I	P	C	C	E
O	N	N	N	C	N
T	O	O	O	C	Q

Note that the CCC is the checksum of the characters following an "EOT" and is therefore equal to "INO" in selection and enquiry-polling messages.

b. Continuation messages:

In addition to the above, there are two types of continuation messages (sent by the supervisor). These are:

1. Next : (send next item from a list)

   Only valid if sent following an enquiry polling or a multi-parameter polling

   A
   C
   K

2. Repeat : (repeat last reply)

   Only valid if sent following any type of polling. It requests a repetition of the previous reply.

   N
   A
   K

c. Data Format:

Data values are presented in three consecutive characters, D1, D2 and D3. These characters include the mode name as well as the value read from or to be written to one of the parameters. A data character is represented by setting its MSB (bit 7). The contents of these characters are as follows:-

D1 :	bits 2 → 6	: mode number, use 00000 as format 0 is adapted.
	bits 0 and 1	: bits 14 and 15 of the value.
D2 :	bits 0 → 6	: bits 7 to 13 of the value.
D3 :	bits 0 → 6	: bits 0 to 6 of the value.

d. Baud Rate:

This can be any of six values, these are:

300, 600, 1200, 2400, 4800, 9600 bauds

11.2.5 Serial Transmission

During serial communications, the 570 drive acts as a slave and replies to messages sent from a supervisor. It responds by transmitting a reply which can be one of two types:

a. one character:

It can be one of the following:-

1. "ACK" : sent after the correct reception of a selection message.
2. "NAK" or "EOT" : in case of detecting a fault.

b. more than one character:

This is the case when sending a reply to any type of a polling message. The reply is in the form:

S	P	D	D	D	E	B
T	N	1	2	3	T	C
X	O				X	C

In case of enquiry polling and multi-parameter polling, the reply can consist of more than one message. Such a reply is divided into a group of messages (blocks). The "ETX" character is only sent at the end of the last message. In other messages, the "ETX" is replaced by an "ETB" to indicate an end of a block rather than the end of reply, as explained earlier.

11.3 SERIAL LINK MNEMONICS

11.3.1 Mnemonic Tables

Name	Pno Dec	Pno Hex	Description	Format	Access	Limits	Real Time Trend	History	Recipe	Control op	Control ip	Enq poll
a1	1	01H	analogue i/p 1	21	R/O	± 110.00%	y	y	y	n	y	y
a2	2	02H	analogue i/p 2	21	R/O	± 110.00%	y	y	y	n	y	y
a3	3	03H	analogue i/p 3	21	R/O	± 110.00%	y	y	y	n	y	y
a4	4	04H	analogue i/p 4	21	R/O	± 110.00%	y	y	y	n	y	y
a5	5	05H	analogue i/p 5	21	R/O	± 110.00%	y	y	y	n	y	y
c1	55	37H	switches 00→0FH	23	R/W		n	n	y	n	n	n
d1	6	06H	digital o/p 1	23	R/W		n	n	n	n	n	n
d2	7	07H	digital o/p 2	23	R/W		n	n	n	n	n	n
d3	8	08H	digital o/p 3	23	R/W		n	n	n	n	n	n
di*	9	09H	digital inputs	23	R/O		n	y	n	n	y	y
do*	57	39H	digital o/p 1 - 3	23	R/W		n	y	y	y	n	y
dt	10	0AH	digital tach	21	R/O	± 3000RPM	n	y	n	n	n	n
er	11	0BH	speedloop error	21	R/O	± 100.00%	n	y	n	n	n	n
fd	77	4DH	field demand	21	R/W	± 100.00%	n	y	y	n	n	n
fi	64	40H	field current	21	R/O	± 120.00%	n	y	n	n	n	y
he*	12	0CH	health word	23	R/O		y	y	n	n	y	y
hf	13	0DH	health flag	23	R/O		n	n	n	n	n	n
hs*	14	0EH	health store	23	R/O		y	y	n	n	y	y

* See Serial Link Hexwords for individual bit definition.

ia	15	0FH	armature current	21	R/O	± 200.00%	y	y	n	n	n	y
id	16	10H	current demand	21	R/W	± 200.00%	y	y	y	y	y	y
ie	60	3CH	spd.loop int defeat	23	R/W		n	n	y	n	n	n
il	17	11H	current limit	21	R/W	0→200.00%	y	y	y	n	n	n
in	61	3DH	spd. loop I gain	21	R/W	0→100.00	n	n	y	n	n	n
ir	62	3EH	ir comp	21	R/W	±100.00	n	n	y	n	n	n

o1	18	12H	analogue o/p 1	21	R/W	±100.00 %	n	y	y	y	n	n
o2	19	13H	analogue o/p 2	21	R/W	±100.00 %	n	y	y	y	n	n
o3	20	14H	analogue o/p 3	21	R/W	±100.00 %	n	y	y	y	n	n

pc	21	15H	pulse count (CLEARED BY A READ)	21	R/O	±30000 counts	n	n	n	n	n	n
pl	65	41H	prog stop I limit	21	R/W	±200 %	n	n	y	n	n	n
pn	66	42H	spd. loop P gain	21	R/W	0→100	n	n	y	n	n	n
pr	78	4EH	p3 ratio	21	R/W	0 to 300%	n	n	y	y	n	n
pt	68	44H	prog stop time/10	21	R/W	60	n	n	y	n	n	n
pz	69	45H	prog stop zero spd.	21	R/W	0 - 5 %	n	n	y	n	n	n

q4	70	46H	4-Quad mode	23	R/W		n	n	y	n	n	n
qu	22	16H	quench	23	R/W		n	n	y	y	n	n

r0	23	17H	ramp output	21	R/O	±100.00 %	n	y	n	n	n	n
r1	24	18H	ramp input	21	R/W	±100.00 %	n	y	y	n	n	n
r2	25	19H	ramp up time	21	R/W	0→60 SEC	n	n	y	n	n	n
r3	26	20H	ramp down time	21	R/W	0→60 SEC	n	n	y	n	n	n
rf	27	21H	ready flag	23	R/O		n	y	n	n	n	n

s0	28	22H	setpoint sum o/p	21	R/O	±100.00 %	n	y	n	n	n	n
s1	29	23H	setpoint sum i/p 1	21	R/W	±100.00 %	n	y	y	n	n	n
s2	30	24H	setpoint sum i/p 2	21	R/W	±100.00 %	n	y	y	n	n	n
s3	31	25H	setpoint ratio 1	21	R/W	0→5.00 %	n	n	y	n	y	n
s4	32	26H	setpoint ratio 2	21	R/W	0→5.00 %	n	n	y	n	y	n
sd	33	27H	speed demand	21	R/W	±100.00 %	y	y	y	y	y	y
sf	34	28H	speed feedback	21	R/O	±110.00 %	y	y	n	n	y	y
sp	35	29H	stop	23	R/W		n	y	y	n	n	n
sr	73	49H	s-ramp	23	R/W		n	n	y	n	n	n
st	36	2AH	start	23	R/W		n	y	y	n	n	n

ta	37	2BH	tacho feedback	21	R/O	±110.00 %	n	n	n	n	n	n
td	38	2CH	torque demand	21	R/O	±200.00 %	n	y	y	n	n	n

va	76	4CH	armature voltage	21	R/O	±120.00	n	y	n	n	n	y

x1	39	2DH	switch 1(o3) *	23	R/W		n	n	n	n	n	n
x2	40	2EH	switch 2(o2) *	23	R/W		n	n	n	n	n	n
x3	41	2FH	switch 3(o1) *	23	R/W		n	n	n	n	n	n
x4	42	30H	switch 4(sp) *	23	R/W		n	n	n	n	n	n
x5	43	31H	switch 5(st) *	23	R/W		n	n	n	n	n	n
x6	44	32H	switch 6(qu) *	23	R/W		n	n	n	n	n	n
x7	45	33H	switch 7(s1) *	23	R/W		n	n	n	n	n	n
x8	46	34H	switch 8(s2) *	23	R/W		n	n	n	n	n	n
x9	47	35H	switch 9(r1) *	23	R/W		n	n	n	n	n	n
xa	48	36H	switch a(sd) *	23	R/W		n	n	n	n	n	n
xb	49	37H	switch b(id) *	23	R/W		n	n	n	n	n	n
xc	50	39H	switch c(d1) *	23	R/W		n	n	n	n	n	n
xd	51	3AH	switch d(d3) *	23	R/W		n	n	n	n	n	n
xe	52	3BH	switch e(d2) *	23	R/W		n	n	n	n	n	n

zd	53	3ch	zero speed demand	23	R/O		n	n	y	n	n	n
zf	54	3DH	zero speed feedback	23	R/O		n	n	y	n	n	n

* NOTE: The value in brackets indicates the mnemonic that the switch controls.

11.3.2 Serial Link Hex Word Definitions

Mnemonic	Meaning	Units
di	Digital inputs	HEX WORD
	Bit 0	Unused
	Bit 1	Digital Input 1
	Bit 2	Digital Input 2
	Bit 3	Digital Input 3
	Bit 4	Digital Input 4
	Bit 5	Digital Input 5
	Bit 6	Digital Input 6
	Bit 7	Unused
do	Digital Outputs	HEX WORD
	Bit 0 ↓ Bit 12	Unused ↓
	Bit 13	Digital Output 1
	Bit 14	Digital Output 2
	Bit 15	Digital Output 3
he	Health word	HEX WORD
	Bit 0	Built in test
	Bit 1	Missing pulse
	Bit 2	EE switch
	Bit 3	Fin temp
	Bit 4	Thermistor
	Bit 5	Comms link
	Bit 6	Tach fail
	Bit 7	Microtach fail
	Bit 8	Field fail
	Bit 9	Three phase
	Bit 10	PLL
	Bit 11	User alarm
	Bit 12	Aux supply
	Bit 13	Current trip
	Bit 14	Cal board
	Bit 15	Ia feedback

The health store word has the same format as the health word but only records the first alarm that occurred. Thus the health word shows the current state of the alarms and the health store shows the reason the drive shut down.

All bits are at zero state unless active. Thus the health word will read 00 (HEX) when the drive is healthy. All unused bits in all hex words are undefined to allow for future upgrades.

12 5703 SUPPORT

12.1 Overview

This unit provides the facility to run a line of drives in speed-lock without the use of a 5720 Quadraloc controller; for accurate speed-holding, encoder feedback is required. Ratioed speed-locking is supported, although the unit is not intended to supplant Quadraloc in applications requiring high accuracy.

A 16-bit speed signal is passed between drives through a fibre-optic link and the 'P3' port on each 570 drive (a port otherwise used only off-line for the up- and down-load of EEPROM data). The port operates RS232 compatible signal levels, the 5703/1 converts these signal levels to fibre optic signals for transmission and from fibre optics to RS232 for reception.

Signal processing is provided in software so that the input signal can be:-

a) direct

b) ramped using standard setpoint path of the 570

c) prescaled

d) inverted

Similarly the output signal can be generated from several sources within the controller either:-

a) total setpoint

b) Speed feedback

c) current demand

d) unscaled input

e) scaled input

f) analogue input 1 (A2)

The input signal is added to the other input setpoint signals within the controller so that ratio and trim functions can be easily implemented. Use of the standard ramp setpoint path eliminates the normal analogue ramped input setpoint.

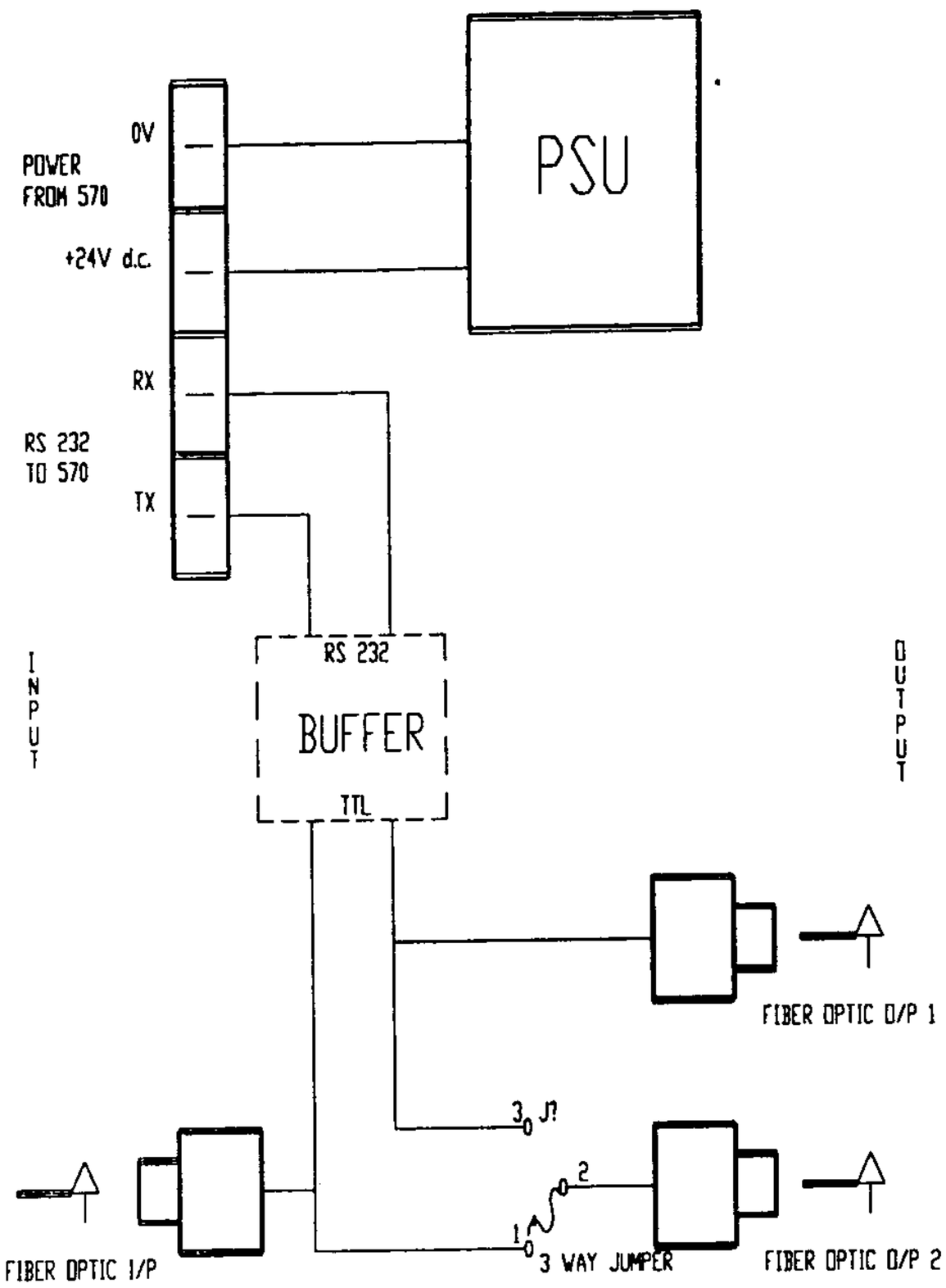
12.2 Hardware Description

The 5703/1 is housed in a DIN rail mounted box and is provided with a "Ribbon" cable to connect into the P3 port. The ribbon cable is of a fixed maximum length of 400mm to limit transmission errors, the primary unit to unit interconnection is intended to be achieved by a fibre optic cable.

The 5703 unit itself is simply an electric signal to light converter as such it does not alter the signal in any way, this is achieved within the software data of the 570 converter.

The 5703 is fitted with one fibre optic receiver and two fibre optic transmitters, the fibre optic receiver has a fixed function to receive data from the "preceding" unit while on the transmitter sends data to the "following" unit. The additional transmitter can be used either to re-transmit the incoming signal or provide a second transmission of the output signal, this gives the unit wide functionality. When the link is in the normal right hand position, assuming the board is mounted with the fibre optics downward, the second transmitter repeats the output signal. In the left hand position it repeats the input signal.

ISS.	DATE
B	9.2.89
C	7.3.89



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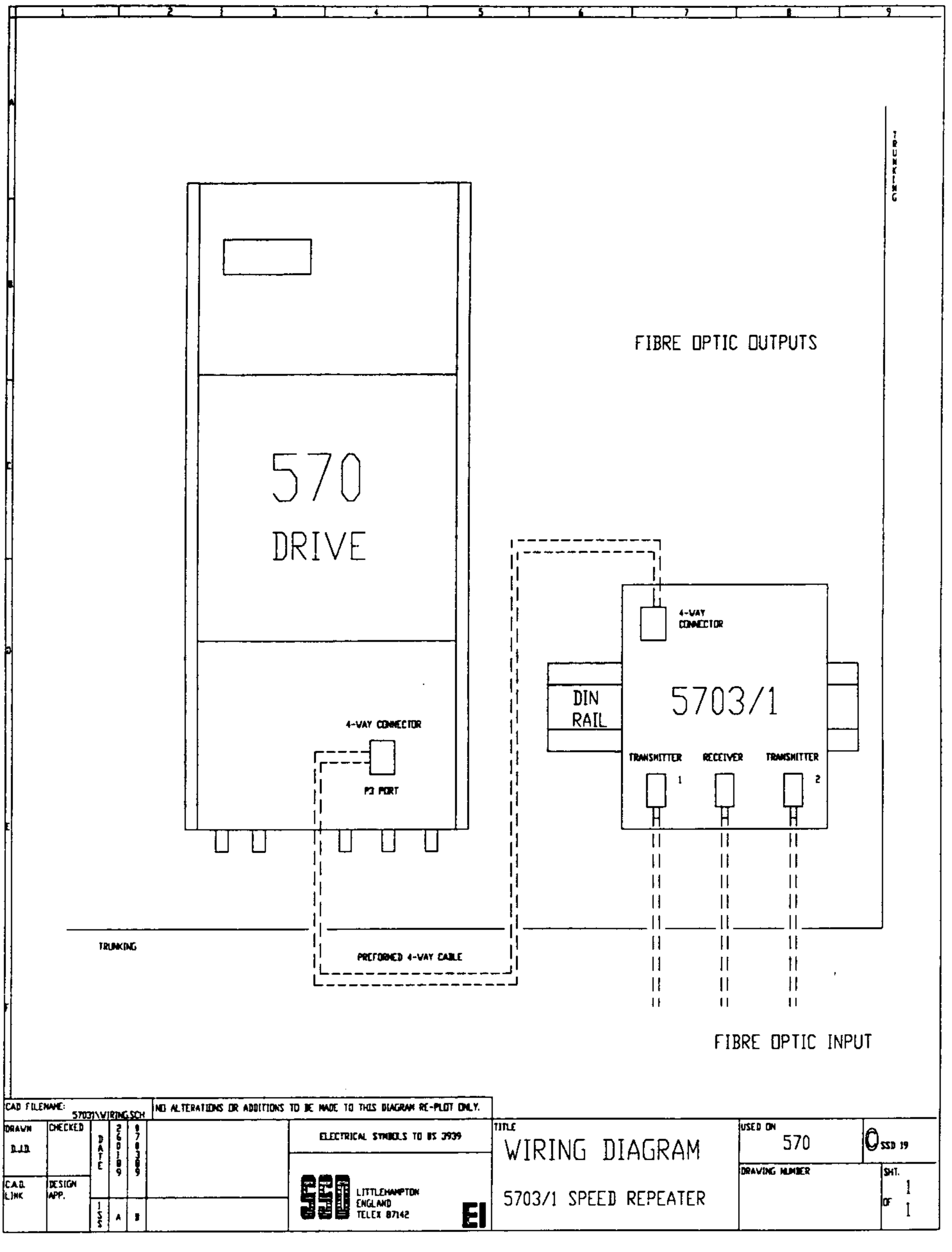
C.A.D. LINK	DESIGN APP.	SSD LITTLEHAMPTON ENGLAND TELEX 87142		DRAWING NUMBER

SHT. 1 OF 1


1
2
3
4
5
6
7
8
9
570
DRIVE
4-WAY CONNECTOR
P3 PORT
TRUNKING
PREFORMED 4-WAY CABLE
FIBRE OPTIC OUTPUTS
4-WAY CONNECTOR
DIN RAIL
5703/1
TRANSMITTER 1
RECEIVER
TRANSMITTER 2
FIBRE OPTIC INPUT
CAD FILENAME: 5703\WIRING.SCH
NO ALTERATIONS OR ADDITIONS TO BE MADE TO THIS DIAGRAM RE-PLOT ONLY.
DRAWN D.J.D.
CHECKED
C.A.D. LINK
DESIGN APP.
DATE 26-8-89
1 SS A B
ELECTRICAL SYMBOLS TO BS 3939
LITTLEHAMPTON ENGLAND TELEX 87142
TITLE
WIRING DIAGRAM
5703/1 SPEED REPEATER
USED ON 570
DRAWING NUMBER
SHT. 1 OF 1
0 SSD 19

12.3 COMMISSIONING THE 5703/1

The configuration of the operation of the P3 port for 5703 support is carried out through the MMI at commissioning, and subsequently the RS422 serial link of the drive allows control over the scaling of the input by an operator-station or by a host processor. Please refer to the block diagram of the 570 Series drive (drawing number HH056869D) and to the block diagram of the 5703/1 function.

The Inputs of the Drive

The speed setpoint from the 5703/1 enters the drive via the P3 port and, after scaling, is added together with analogue inputs 1, 2 and 3 (ramped). IN BASIC TACHO-FOLLOWER MODE, ALL THE ANALOGUE INPUTS MUST BE DISABLED TO PREVENT LOSS OF ACCURACY, yet it may be necessary in some applications to provide analogue inputs for trim signals or inch setpoints:

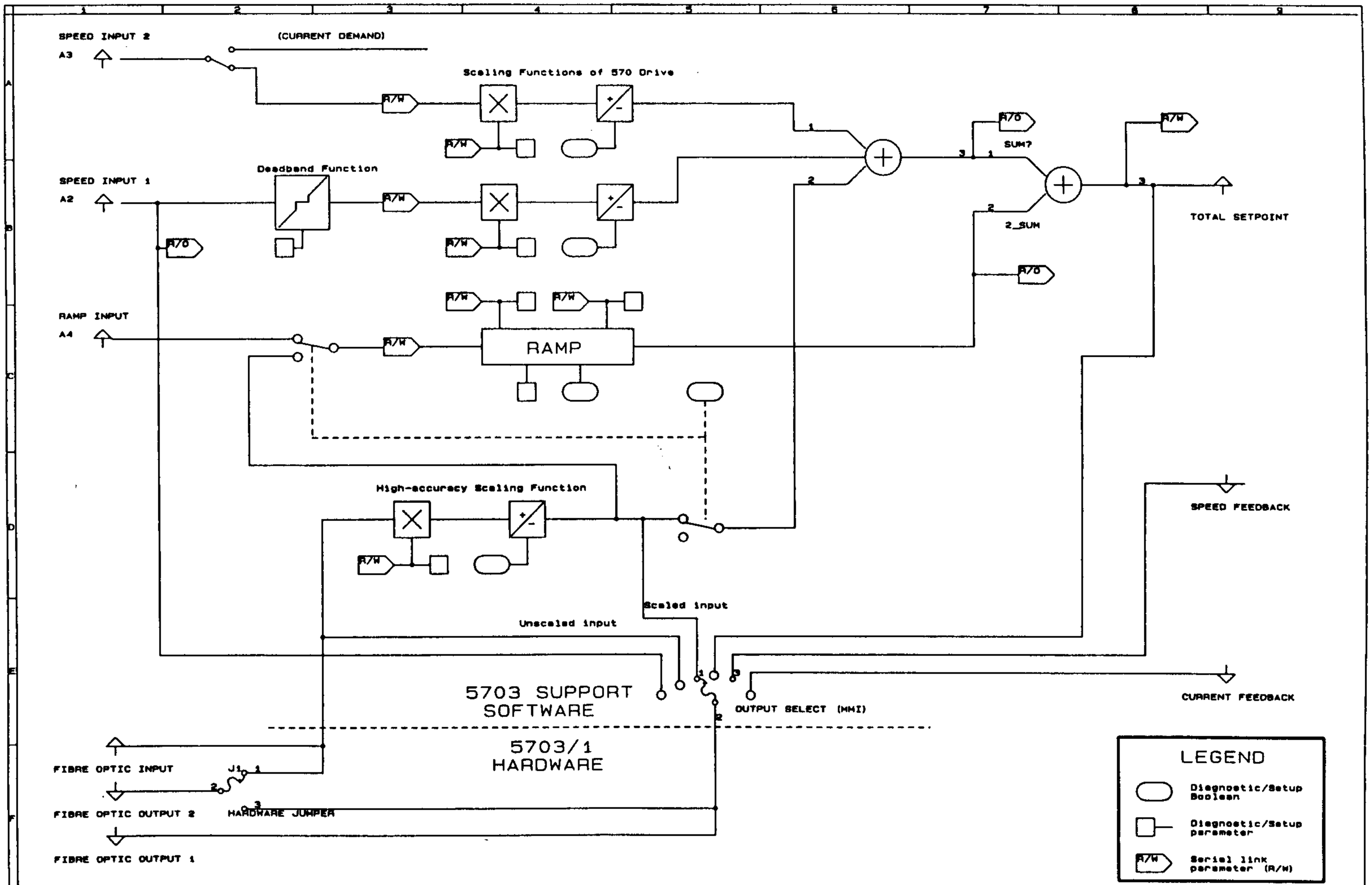
i) The ramp input may be disabled by taking terminal C7 (Ramp Hold) permanently high; the ramp is automatically cleared when the drive is quenched, and its output will never move from (exactly) zero. The ramp input may often by of use in line master drives; but the ramp should be disabled in slave drives. Note that the P3 setpoint may be passed through the ramp function; in such a case, the analogue input to the ramp (terminal A4) is automatically disconnected.

ii) Analogue input 1 (terminal A2) is used for inch setpoints. During normal running, the terminal is shorted to 0V and the deadband function is used so that no signal at all passes to the summing junction. The analogue inch setpoints are set a little above the threshold of the deadband so as to give the required inching speeds, forward or backward. Selection between analogue inching and absolutely zero analogue input is thus accomplished automatically.

iii) Analogue input 2 (terminal A3) may be disabled by writing zero to its scaling block; this will normally be done through the MMI at commissioning, but may be overridden by the serial link. Alternatively, this input may be used for a local analogue trim.

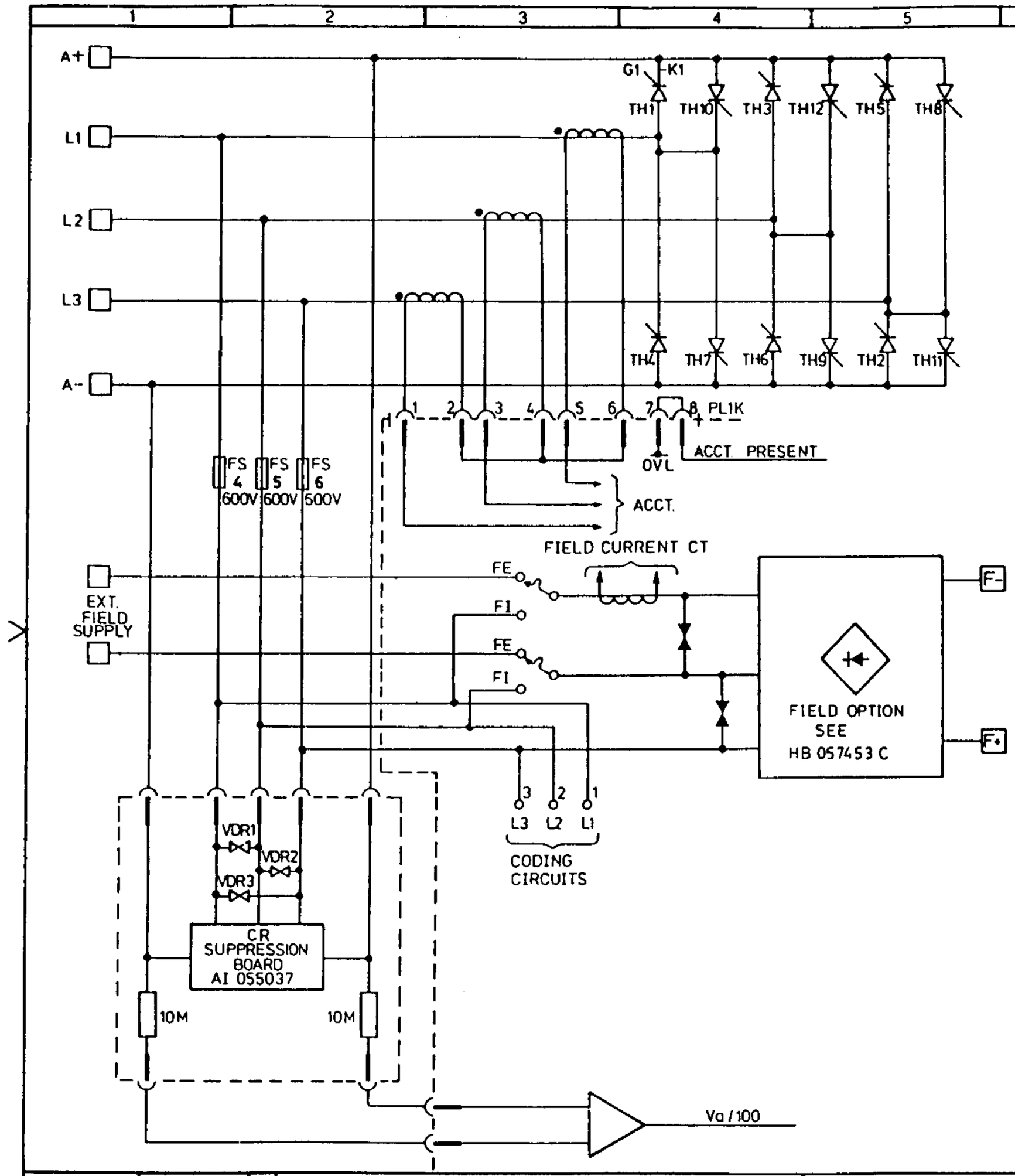
5703 SUPPORT

SETPOINT SCALING	SCALES THE INPUT SIGNAL	0.0000 TO 3.0000	0.0000
DEADBAND WIDTH	SETS A DEADBAND AROUND OR ON ANALOG I/P 2(3)	0.0 TO 100.0%	0.0%
5703 MODE	SELECTS CONTROLLER MASTER/SLAVE MODE	MASTER SLAVE	SLAVE
INPUT SELECT	ROUTES INPUT SIGNAL EITHER DIRECT OR VIA RAMP. IF RAMP SELECTED ANALOG INPUT A3 (A4) IS DISCONNECTED	DIRECT RAMPED	DIRECT
OUTPUT SELECT	SELECTS THE SIGNAL DIRECTED TO THE OUTPUT	ANALOG I/P1 A2 CURRENT DEMAND SPD FEEDBACK TOTAL SETPOINT SCALED INPUT UNSCALED INPUT	SPD F/B
SETPOINT SIGN	SETS THE SIGN OF THE INPUT SIGNAL	POSITIVE OR NEGATIVE	POSITIVE

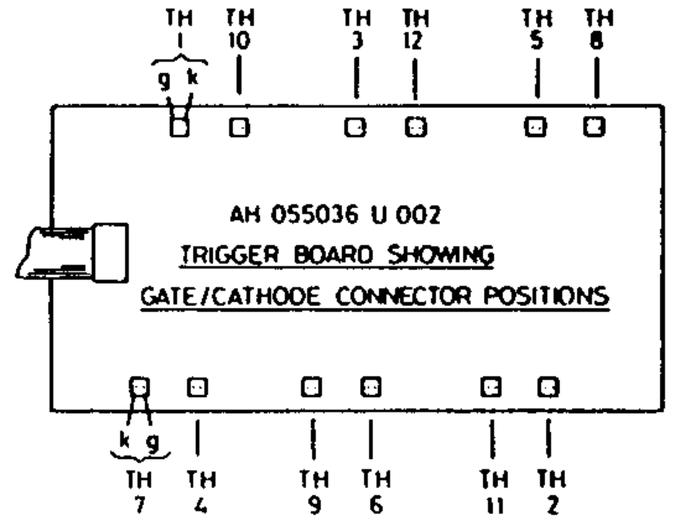


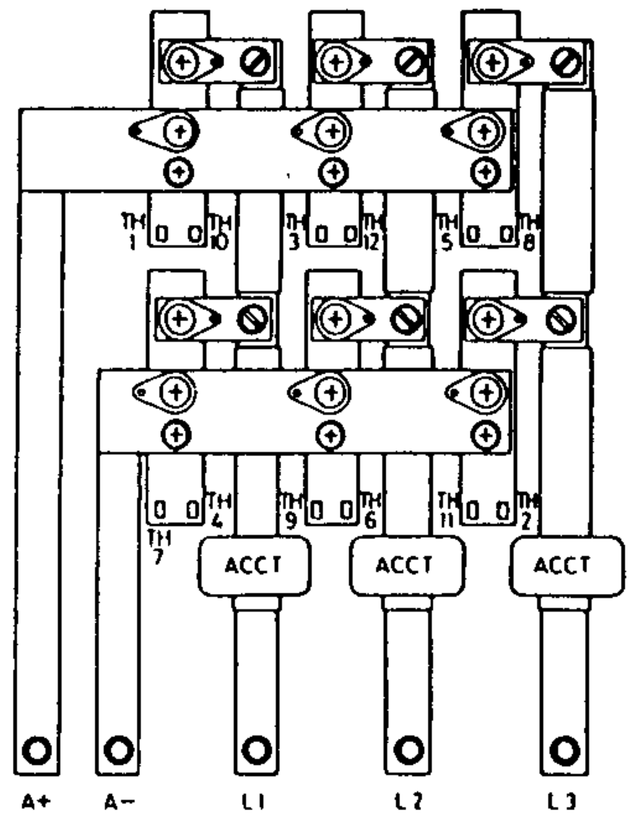
CAD FILENAME: FUNCTION.SCH							NO ALTERATIONS OR ADDITIONS TO BE MADE TO THIS DIAGRAM RE-PLOT ONLY.		
DRAWN DJD	CHECKED GDR	DATE	CHECKED	CHECKED	ISSUED	CHECKED	ELECTRICAL SYMBOLS TO BS 3939	TITLE BLOCK DIAGRAM 5703/1	USED ON 570
		1988	B	C	D	1	SSD LITTLEHAMPTON ENGLAND TELEX 87142 EI		DRAWING NUMBER HH059527D

SHT. 1 OF 1



	PULSE WIRE COLOURS	
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	RED	BLACK
EXT. STACK	YEL	RED

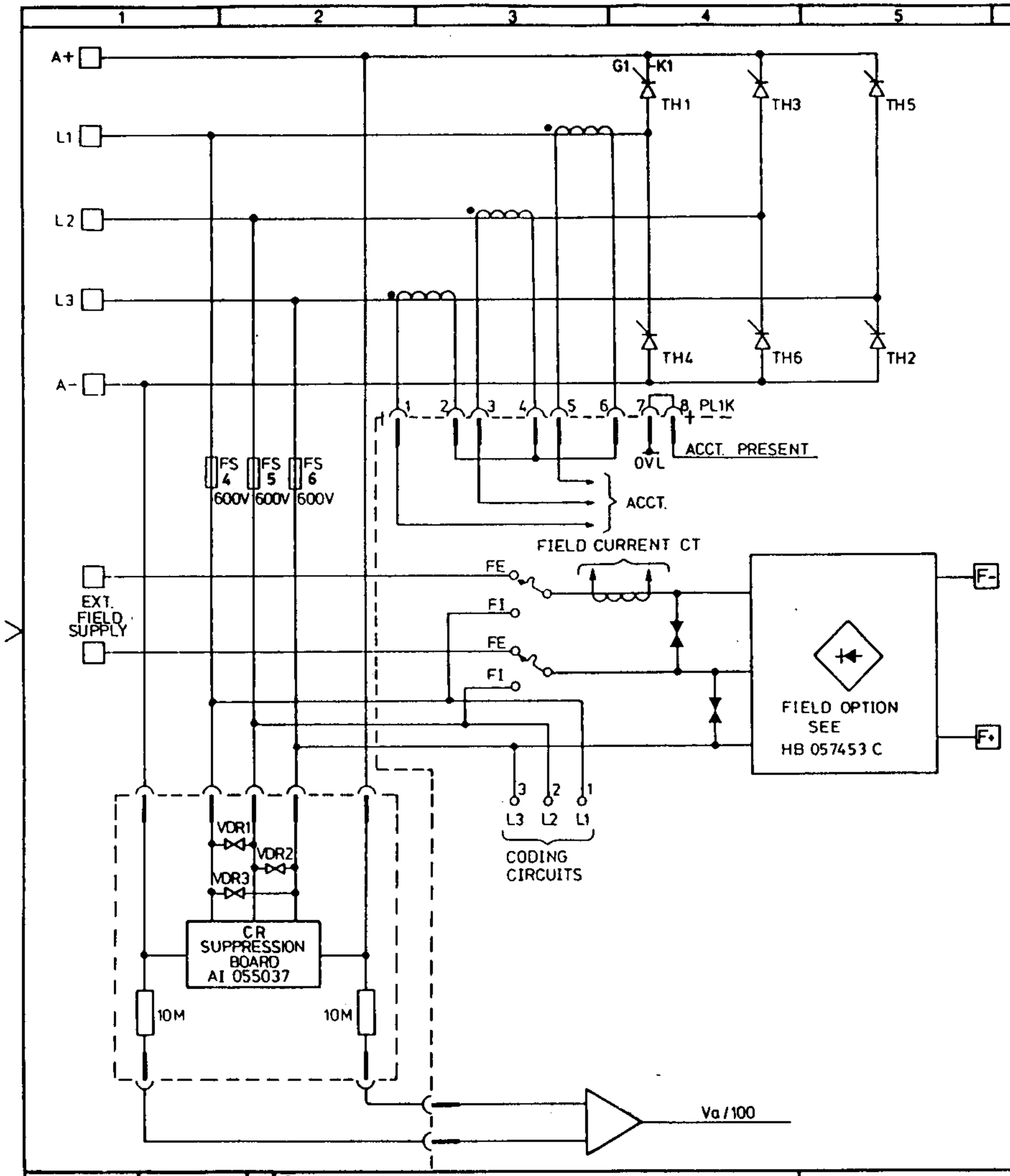




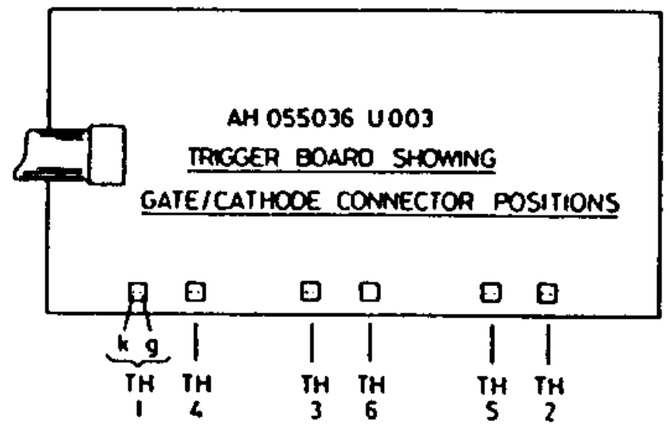
DRAWN WS	CHECKED GDR	DATE	13·6·89	ELECTRICAL SYMBOLS TO BS 3939	TITLE 570 POWER CIRCUIT AND CONFIGURATION	USED ON 570
TRACED PB/EDES		SHT	A 4·3·91 B	SSD LITTLEHAMPTON ENGLAND TELEX 87142 E1		DRAWING NUMBER HJ 057470 D — SHT 1 OF 1

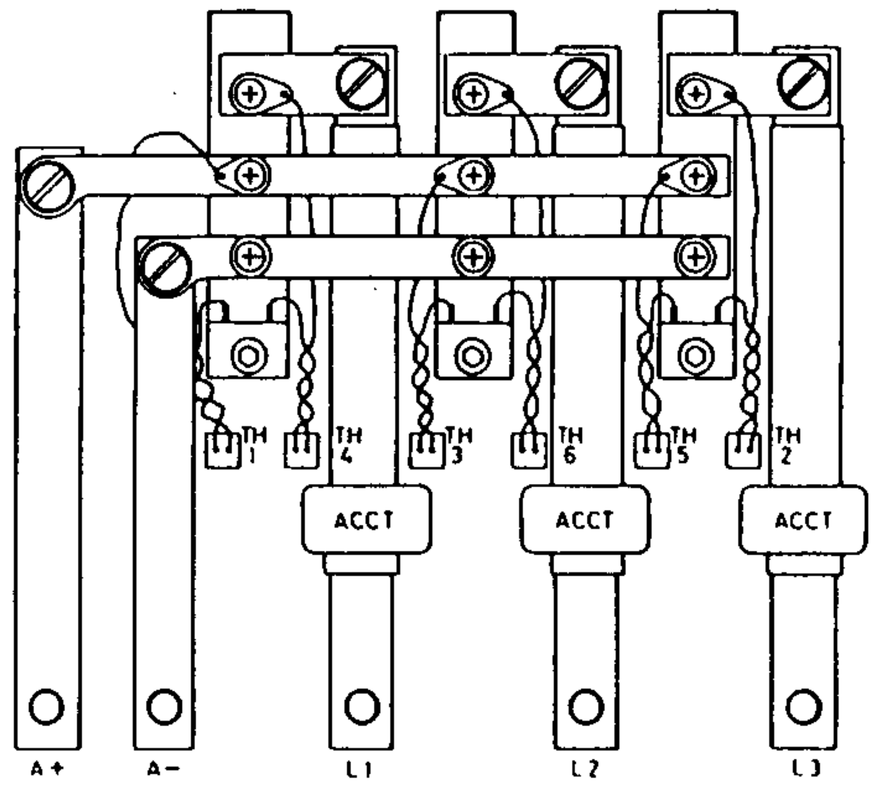
KE048614D

SRS CRAWLEY LTD 78047/0/88



	PULSE WIRE COLOURS	
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	RED	BLACK
EXT. STACK	YEL	RED





DRAWN WS	CHECKED GDL	DATE A 13·6·89 B 4·3·91	ELECTRICAL SYMBOLS TO BS 3939
TRACED PB/EDES			SSD LITTLEHAMPTON ENGLAND TELEX 87142

TITLE: 571 POWER CIRCUIT AND CONFIGURATION

USED ON: 571

DRAWING NUMBER: HJ 057471 D

SHT 1 OF 1

1	2	3	4	5	6	7	8	9

A+
L1
L2
L3
A-

G1 K1
TH1 TH10 TH3 TH12 TH5 TH8
TH4 TH7 TH6 TH9 TH2 TH11

1 2 3 4 5 6 7 8 PL1K
OVL
ACCT PRESENT
ACCT.

FS 4 600V
FS 5 600V
FS 6 600V

FIELD CURRENT CT

EXT. FIELD SUPPLY

FE
FI
FE
FI

FIELD OPTION SEE HB 057453 C

F-
F+

3 2 1
L3 L2 L1
CODING CIRCUITS

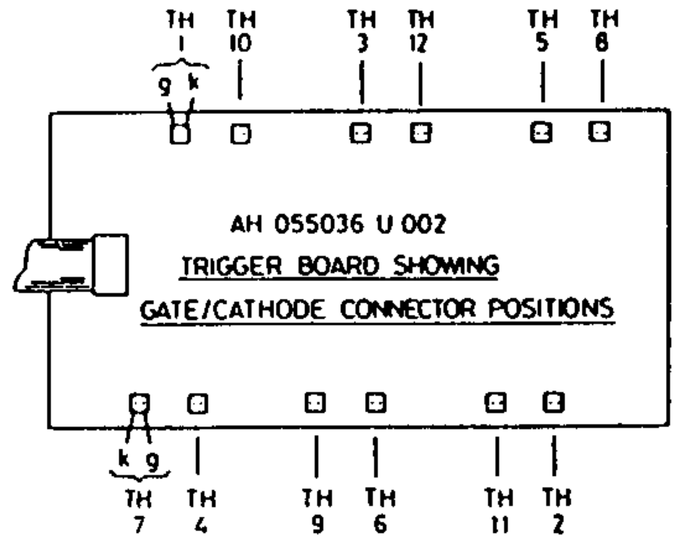
VDR1
VDR2
VDR3

CR SUPPRESSION BOARD AI 055037

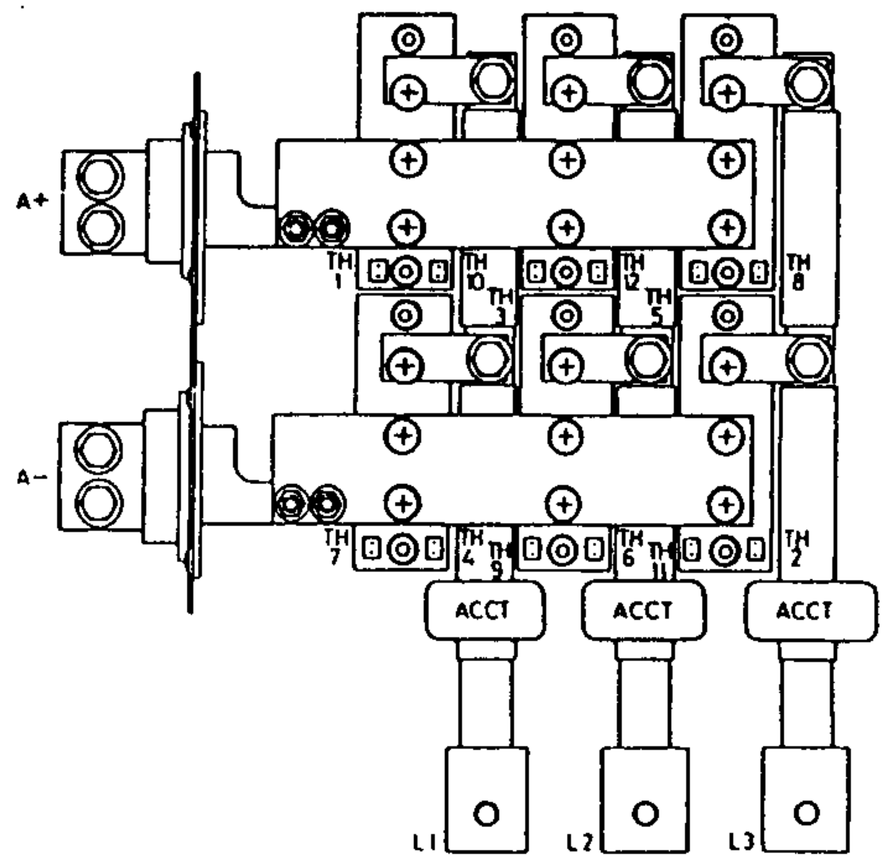
10M
10M

Va / 100

PULSE WIRE COLOURS		
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	RED	BLACK
EXT STACK	YEL	RED



AH 055036 U 002
TRIGGER BOARD SHOWING
GATE/CATHODE CONNECTOR POSITIONS



DRAWN	CHECKED	DATE	
WS	GDR	A 13.6.89	
TRACED		B 4.3.91	
PB/EDES			

ELECTRICAL SYMBOLS TO BS 3939

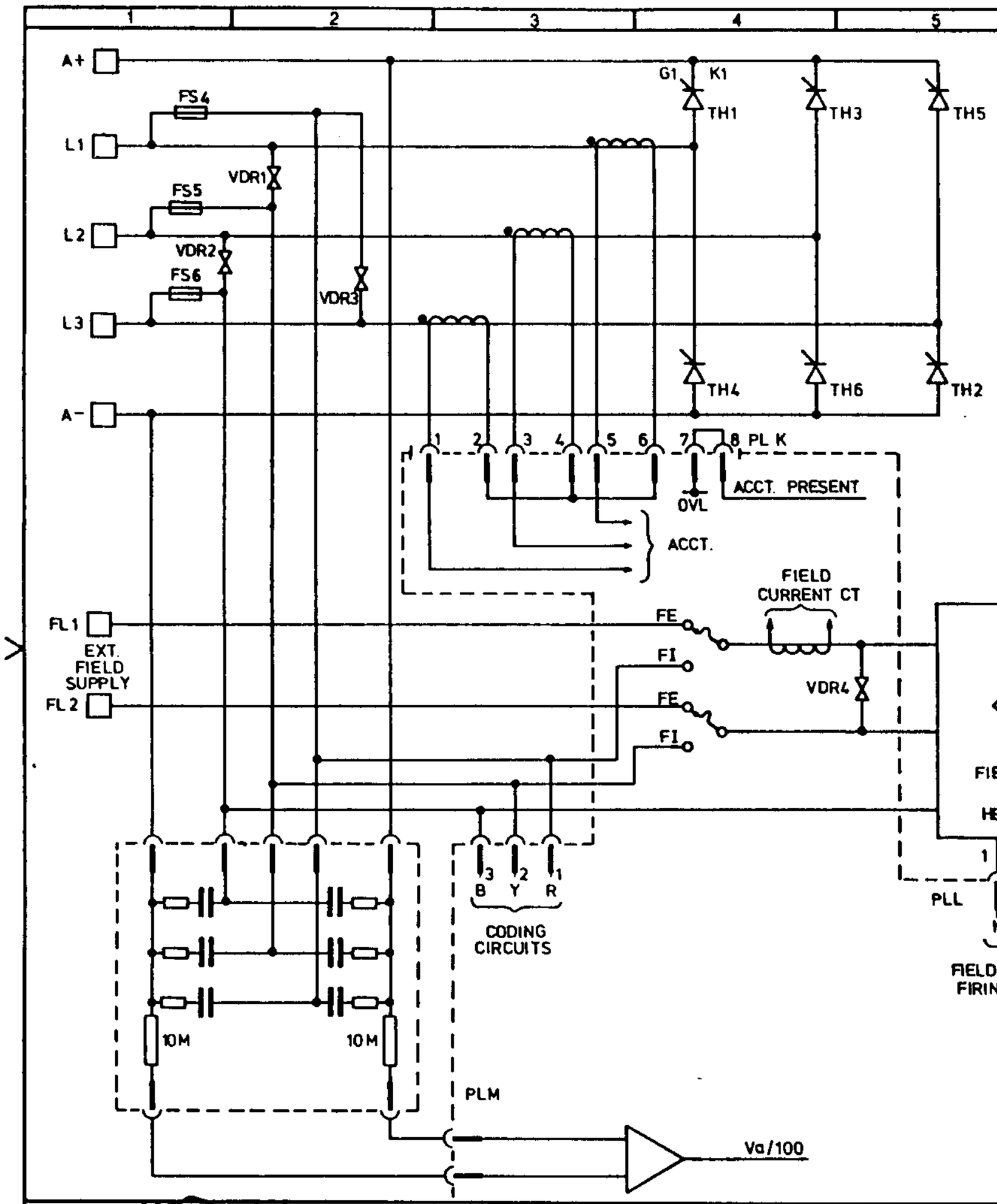
SSD LITTLEHAMPTON ENGLAND TELEX 87142 E1

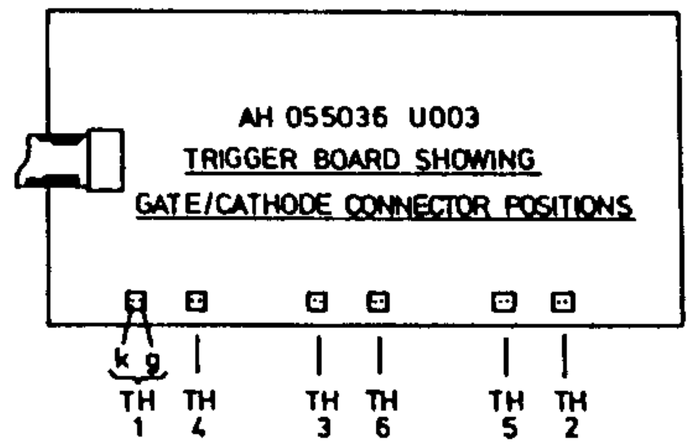
TITLE: 572 POWER CIRCUIT AND CONFIGURATION

USED ON: 572

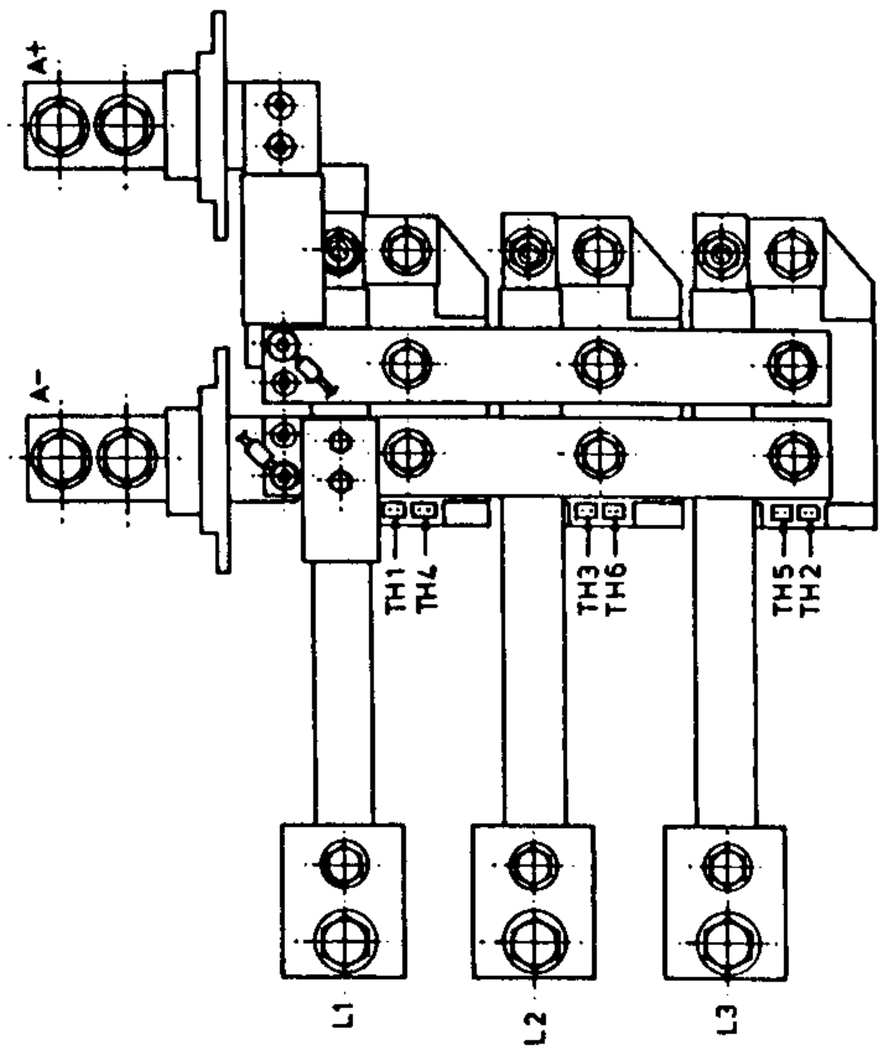
DRAWING NUMBER: HJ 057472 D

SHT 1 OF 1





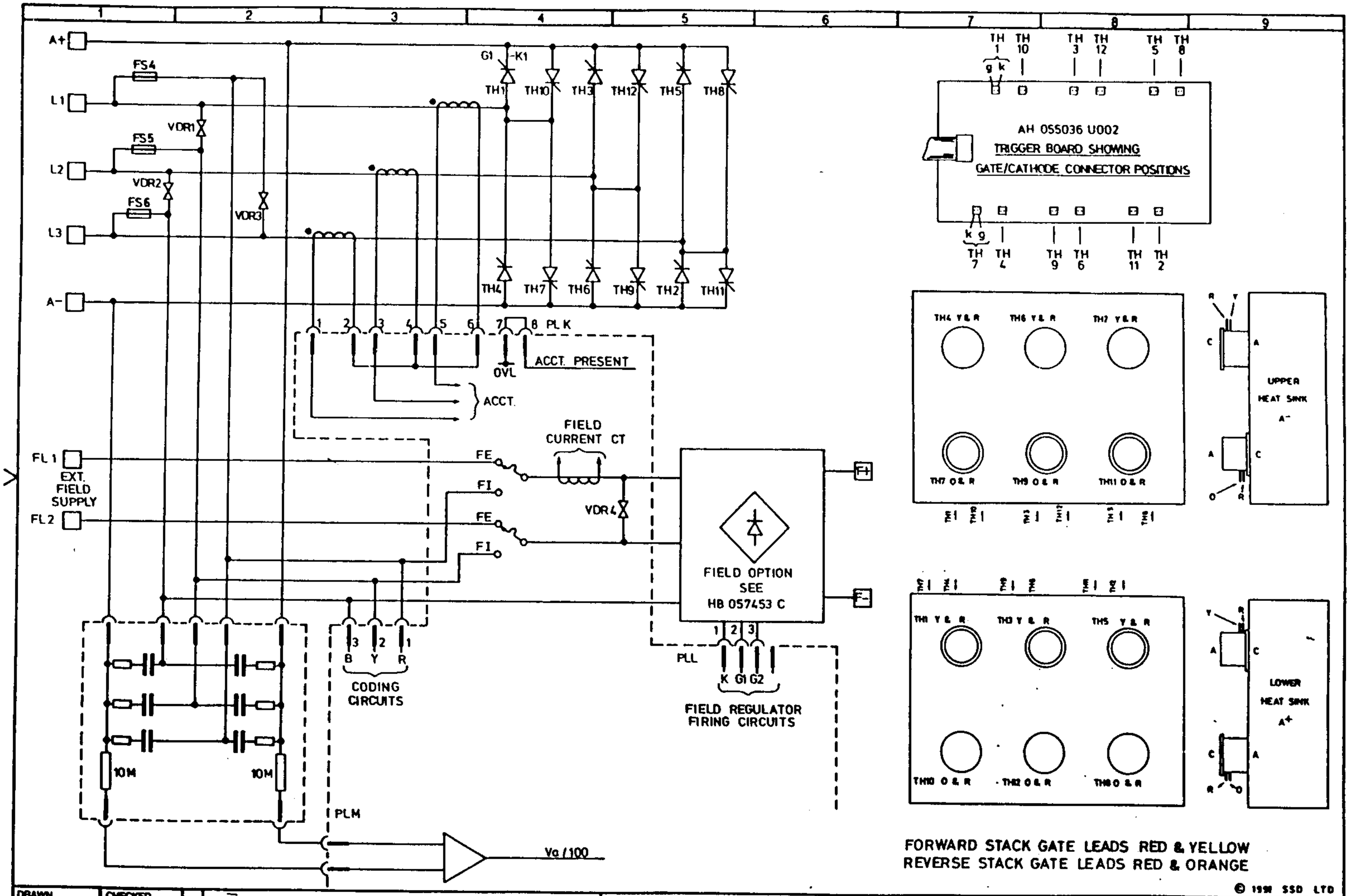
PULSE WIRE COLOURS		
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	YELLOW	RED



DRAWN G.D.R.	CHECKED	DATE A 16.11.90 B 4.3.91	ELECTRICAL SYMBOLS TO BS 3939	TITLE 575 POWER CIRCUIT AND CONFIGURATION	USED ON 575
TRACED PB/EDES			SSD LITTLEHAMPTON ENGLAND TELEX 87142		DRAWING NUMBER HJ 059045 D SHT 1 OF 1

KE0486140

SRS CRAWLEY LTD



FORWARD STACK GATE LEADS RED & YELLOW
REVERSE STACK GATE LEADS RED & ORANGE

DRAWN CRM	CHECKED GDR	DATE A 14.2.91 B 4.3.91	ELECTRICAL SYMBOLS TO BS 3939	TITLE 576 POWER CIRCUIT AND CONFIGURATION	USED ON 576	
TRACED —	—		SSD LITTLEHAMPTON ENGLAND TELEX 87142		DRAWING NUMBER HJ 059562 D	SHT 1 OF 1

KE0486140

SRS CRAWLEY LTD

01-21

1	2	3	4	5	6	7	8	9

A+
L1
L2
L3
A-
EXT. FIELD SUPPLY

G1 K1
TH1 TH3 TH5
TH4 TH6 TH2

1 2 3 4 5 6 7 8 PL1K
ACCT PRESENT
OVL
ACCT.
FIELD CURRENT CT

FS 4 600V
FS 5 600V
FS 6 600V

FE
FI
FE
FI
F-
F+
FIELD OPTION SEE HB 057453 C

3 2 1
L3 L2 L1
CODING CIRCUITS

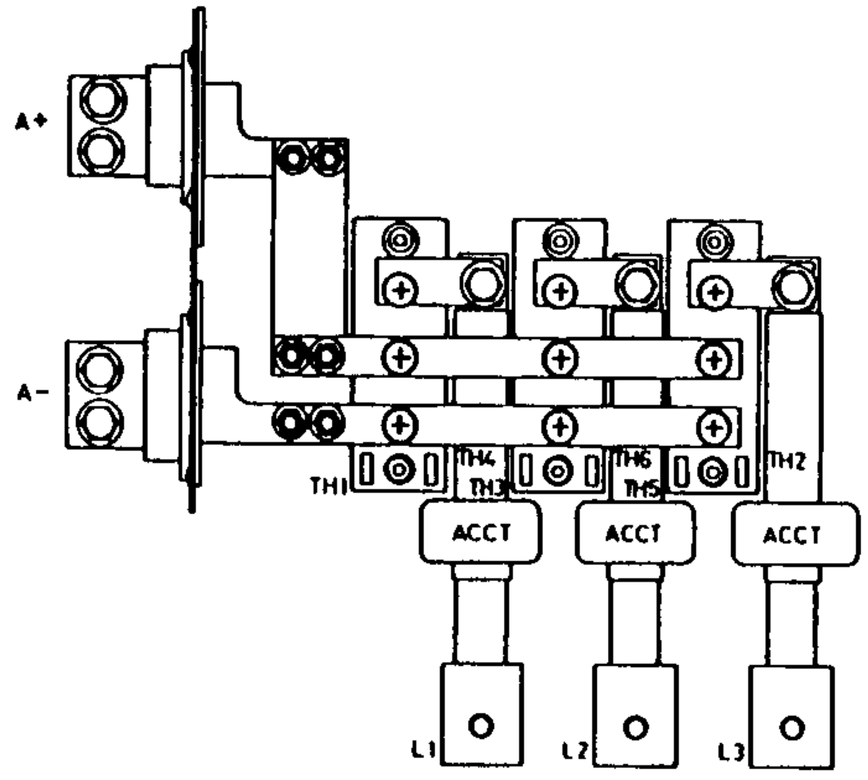
VDR1
VDR2
VDR3
CR SUPPRESSION BOARD AI 055037
10M
10M

Va/100

PULSE WIRE COLOURS		
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	RED	BLACK
EXT. STACK	YEL	RED

AH 055036 U003
TRIGGER BOARD SHOWING
GATE/CATHODE CONNECTOR POSITIONS

k g
TH 1 TH 4 TH 3 TH 6 TH 5 TH 2



DRAWN	CHECKED	DATE	
WS	GDR	13-6-89	
TRACED			
PB/EDES			

ELECTRICAL SYMBOLS TO BS 3939

SSD LITTLEHAMPTON ENGLAND TELEX 87142

TITLE: 573 POWER CIRCUIT AND CONFIGURATION

USED ON: 573

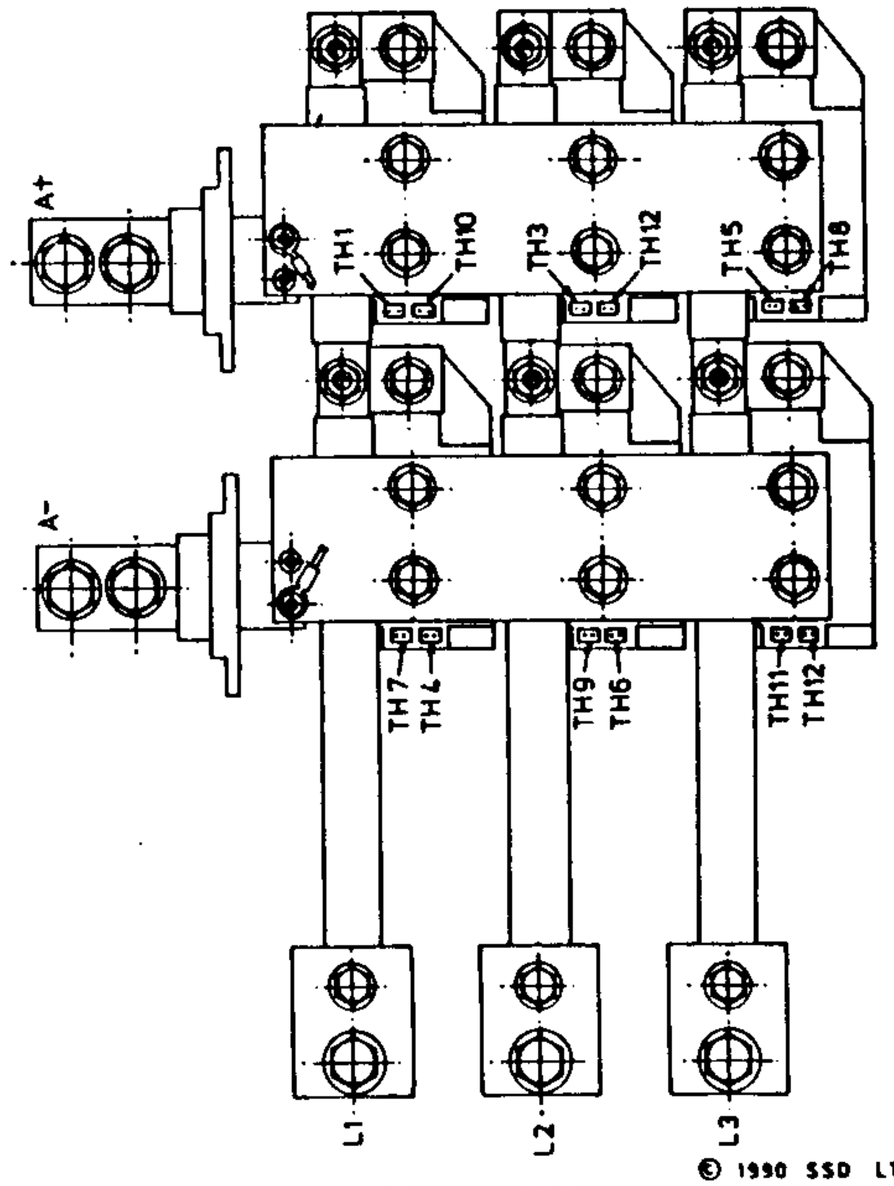
DRAWING NUMBER: HJ 057473 D

SHT 1 OF 1

A+
L1
L2
L3
A-
FS4
FS5
FS6
VDR1
VDR2
VDR3
G1 -K1
TH1 TH10 TH3 TH12 TH5 TH8
TH4 TH7 TH6 TH9 TH2 TH11
1 2 3 4 5 6 7 8 PL K
OVL
ACCT. PRESENT
ACCT.
FIELD CURRENT CT
FE
FI
FE
FI
VDR4
FL1
EXT. FIELD SUPPLY
FL2
F+
F-
FIELD OPTION SEE HB 057453 C
1 2 3
PLL
K G1 G2
FIELD REGULATOR FIRING CIRCUITS
3 2 1
B Y R
CODING CIRCUITS
10M
10M
PLM
Va / 100

TH 1 TH 10 TH 3 TH 12 TH 5 TH 8
g k
AH 055036 U002
TRIGGER BOARD SHOWING
GATE/CATHODE CONNECTOR POSITIONS
k g
TH 7 TH 4 TH 9 TH 6 TH 11 TH 2

PULSE WIRE COLOURS		
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	YELLOW	RED



DRAWN G.D.R.	CHECKED	DATE 16.11.90	ELECTRICAL SYMBOLS TO BS 3939
TRACED PB/EDES		A BD 24.08.91	SSD LITTLEHAMPTON ENGLAND TELEX 87142

TITLE: 574 POWER CIRCUIT AND CONFIGURATION

USED ON: 574

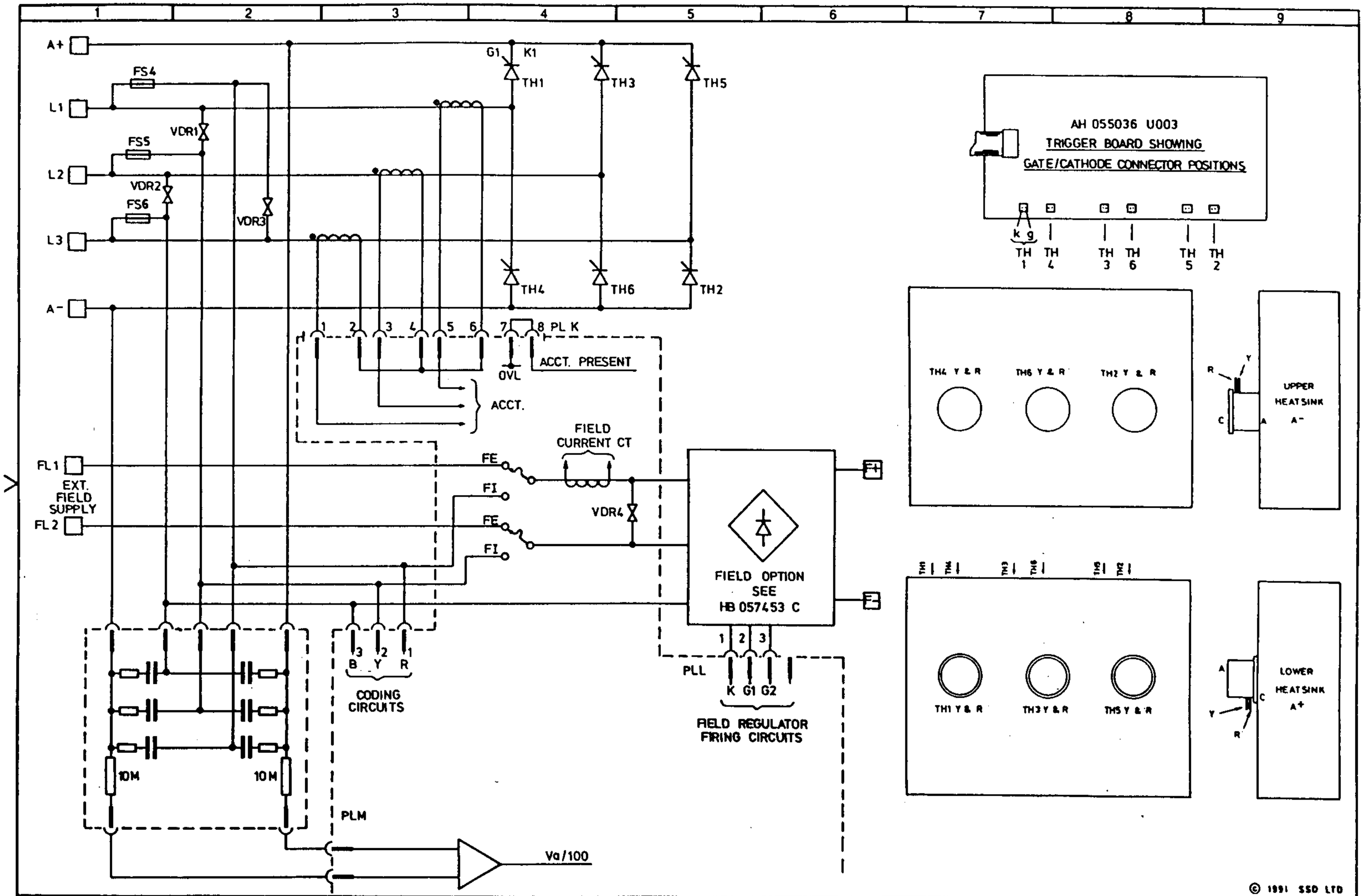
DRAWING NUMBER: HJ 059044 D

SHT 1 OF 1

KE04B614D

SRS CRAWLEY LTD 28047/0/88

12-21



DRAWN	CHECKED	DATE	
CRM	GOR	A 14.2.91	
TRACED		B 4.3.91	

ELECTRICAL SYMBOLS TO BS 3939

SSD LITTLEHAMPTON ENGLAND TELEX 87142 E1

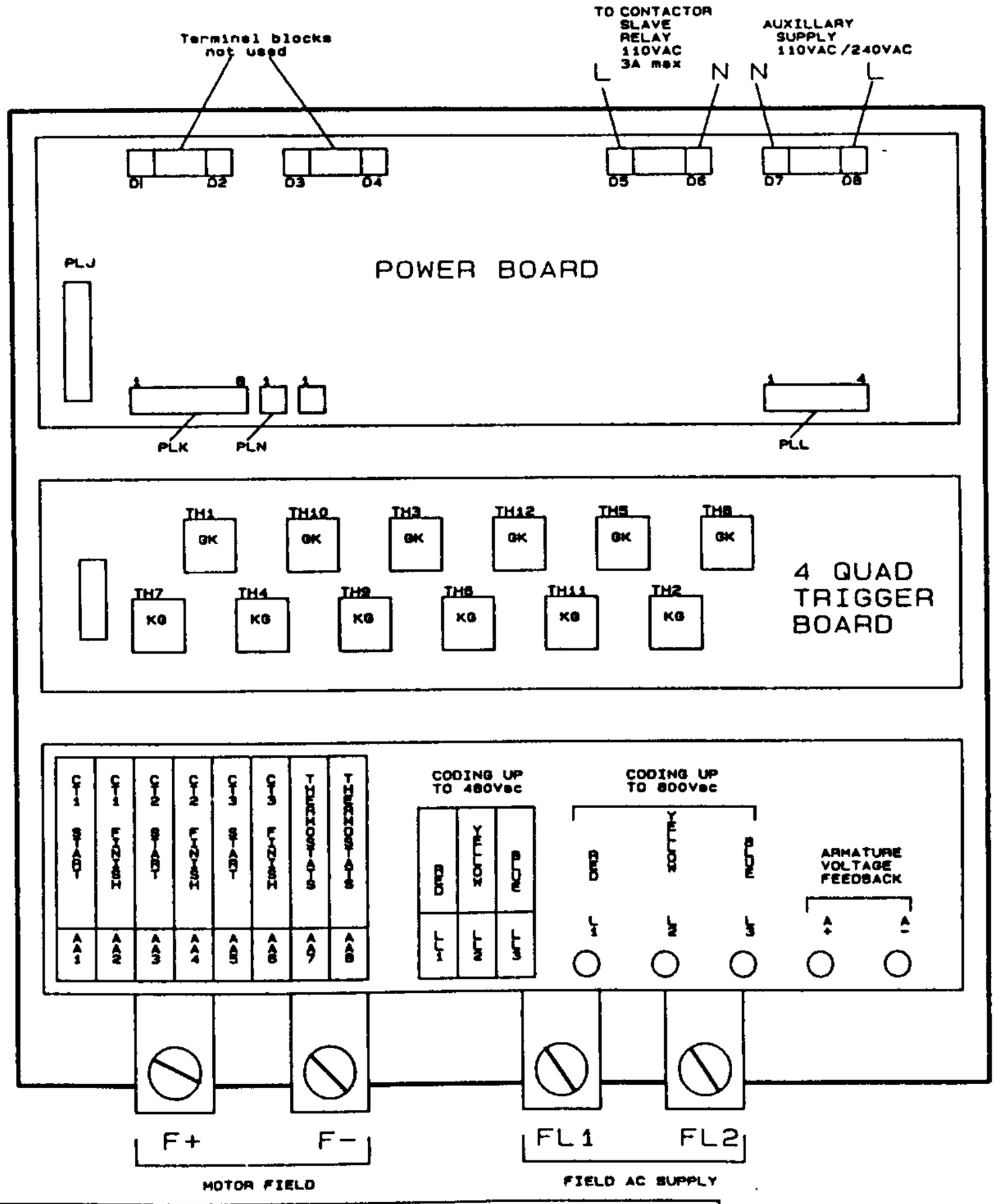
TITLE: 577 POWER CIRCUIT AND CONFIGURATION

USED ON: 577

DRAWING NUMBER: HJ 059561 D

SHT 1 OF 1

578 4 QUAD EXTERNAL STACK CONTROLLER ARRANGEMENT



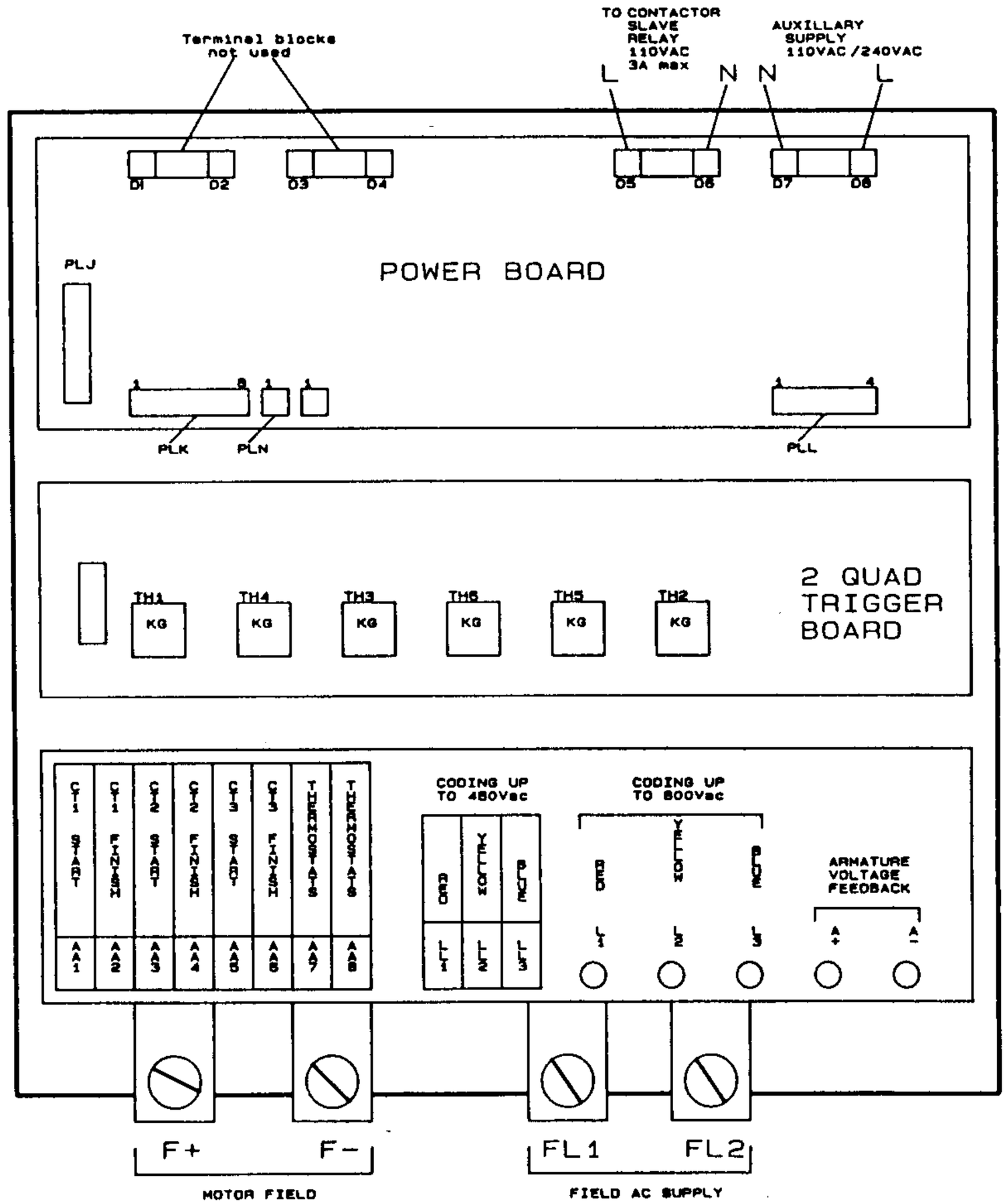
Socket identification.

PLK - current transformers.
PLN - Stack heatsink trip.
PLL - Field thyristor firing.

h1-21

CAD FILENAME: 578_3.SCH					NO ALTERATIONS OR ADDITIONS TO BE MADE TO THIS DIAGRAM RE-PLOT ONLY.		
DRAWN ANW	CHECKED GDR	DATE	ISSUE 1	ISSUE 2	ISSUE 3	ELECTRICAL SYMBOLS TO BS 3939	TITLE LAYOUT EXT STACK CONTROLLER 578 4 QUAD
C.A.D. LINK –	DESIGN APP. –	ISSUE 1	A	B	C	SSD LITTLEHAMPTON ENGLAND TELEX 87142 EI	USED ON –
							DRAWING NUMBER HB058299D
							© SSD 19 89
							SHT. 2 OF 5

579 2 QUAD EXTERNAL STACK CONTROLLER ARRANGEMENT



Socket identification.

PLK - current transformers.
PLN - Stack heatsink trip.
PLL - Field thyristor firing.

CAD FILENAME: 579_5.SCH		NO ALTERATIONS OR ADDITIONS TO BE MADE TO THIS DIAGRAM RE-PLOT ONLY.				
DRAWN ANW	CHECKED GDR	DATE	4/06/90	08/07/90	09/09/91	ELECTRICAL SYMBOLS TO BS 3939
C.A.D. LINK —	DESIGN APP. —	ISS	A	B	C	SSD LITTLEHAMPTON ENGLAND TELEX 87142 EI

TITLE: LAYOUT
EXT STACK CONTROLLER
579 2 QUAD

USED ON —

© SSD 19 89

DRAWING NUMBER HB0582990

SHT. 5 OF 5

Use external fusing.

Field input
Transformer feed
NOTE PHASING

FL1
FL2

Field output.
25A Max.

F+
F-

VDR

TH1
TH2
D1

Field current calibration equation: -

$$R = \frac{4000}{If}$$

Armature current calibration equation: -

$$R = \frac{2200}{IA-1}$$

FIELD CT CONNECTIONS

PLL

Red
Yellow
Coding module
Blue

LL1
LL2
LL3

RL
RH
YL
YH
BL
BH

L1
L2
L3

Transformer isolated coding supply (480V Max)

Main coding supply (800V Max)

A+
A-

PLK
PLN
PLM

Motor armature

AH057916U001

FB+
FB-

R1 R2 R3 R4

AA1
AA2
AA3
AA4
AA5
AA6

External Stack Current Transformers

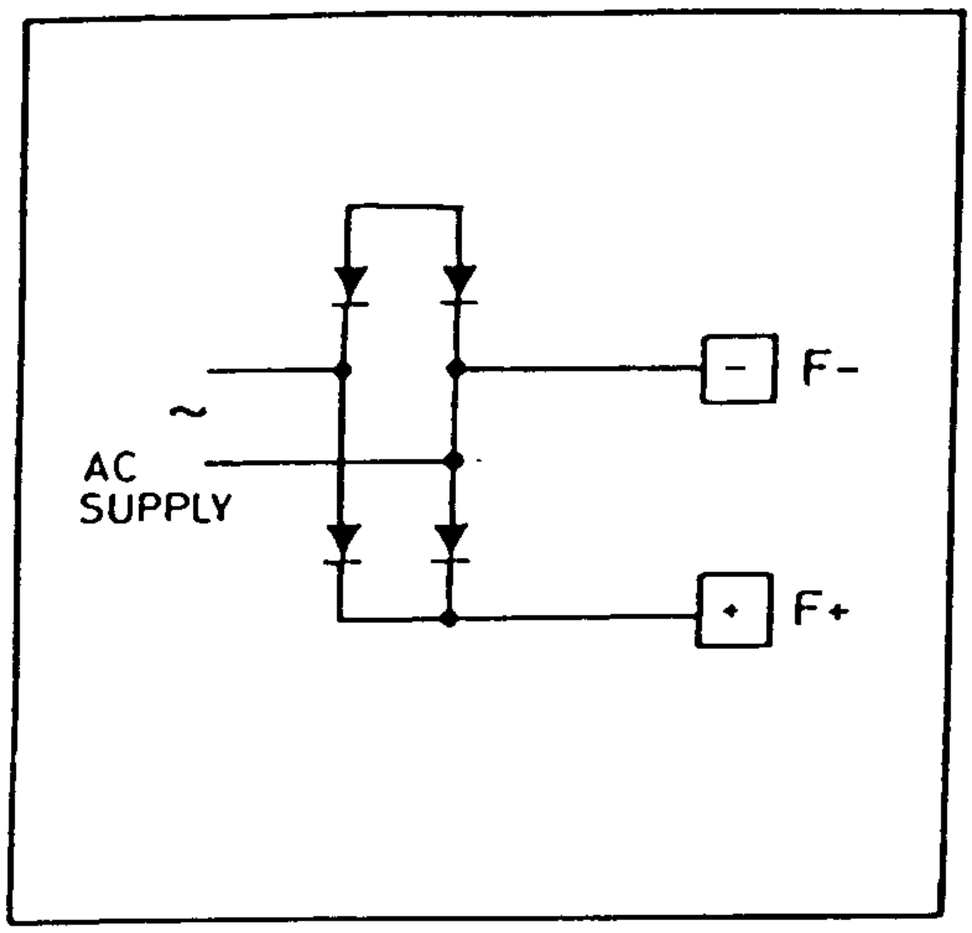
T1
T2

AA7
AA8

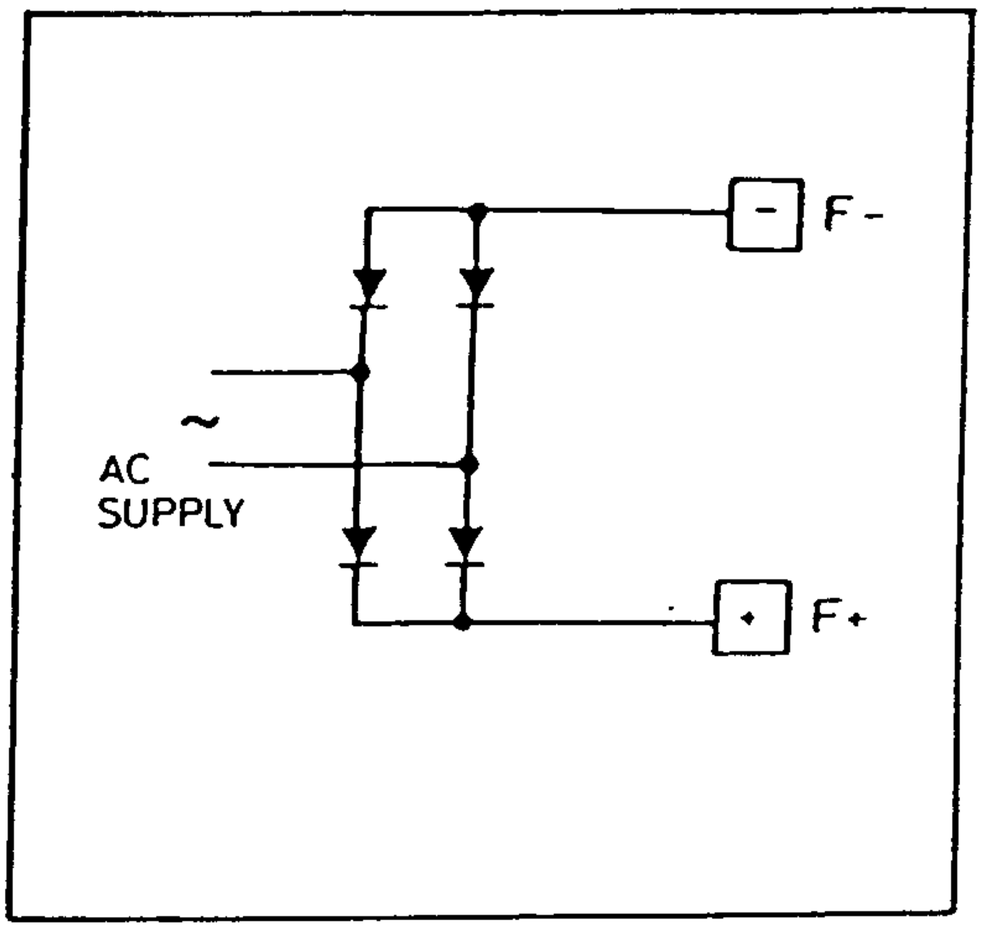
External Stack Thermostats

12-16

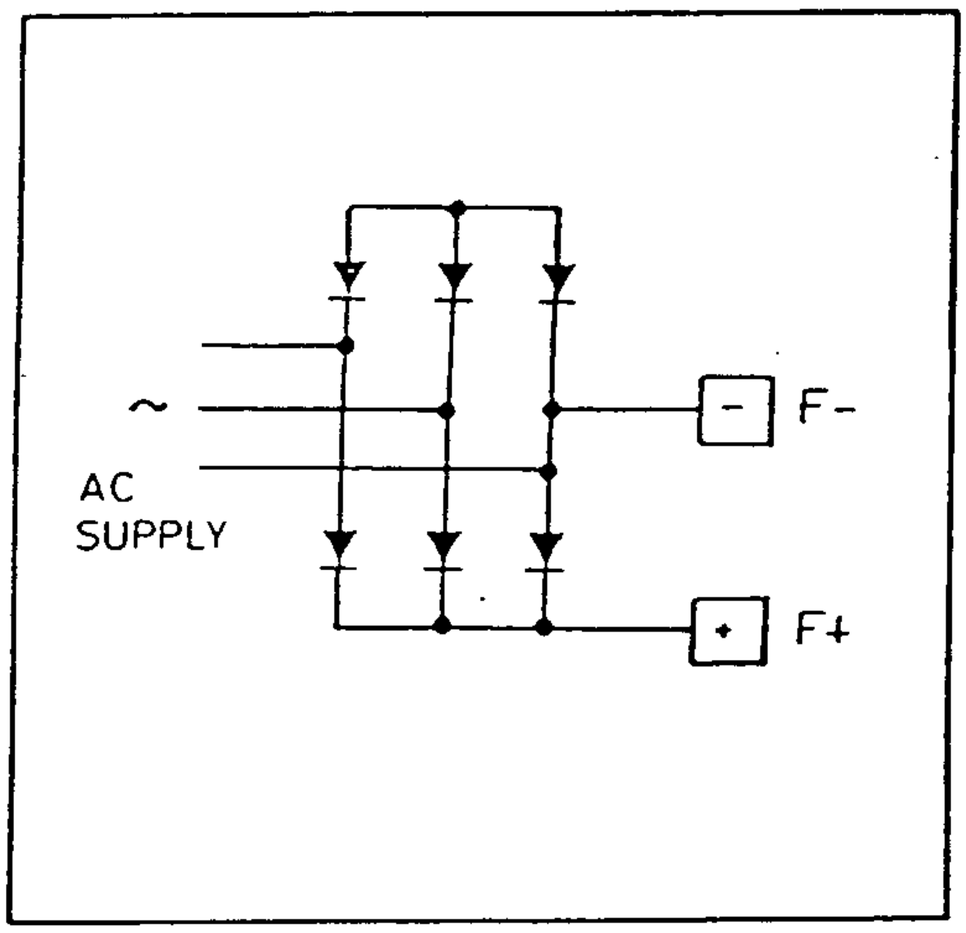
CAD FILENAME: 578_1.sch					NO ALTERATIONS OR ADDITIONS TO BE MADE TO THIS DIAGRAM RE-PLOT ONLY.		
DRAWN ANW	CHECKED GDR	DATE	ISSUED	CONFIGD	CHKD	ELECTRICAL SYMBOLS TO BS 3939	TITLE CIRCUIT DIAGRAM EXTERNAL STACK CONTROLLER WIRING
C.A.D. LINK —	DESIGN APP. —	14/2/89	A	B	C	SSD LITTLEHAMPTON ENGLAND TELEX 87142 EI	USED ON —
							DRAWING NUMBER HB058299D
							SHT. 3 OF 5



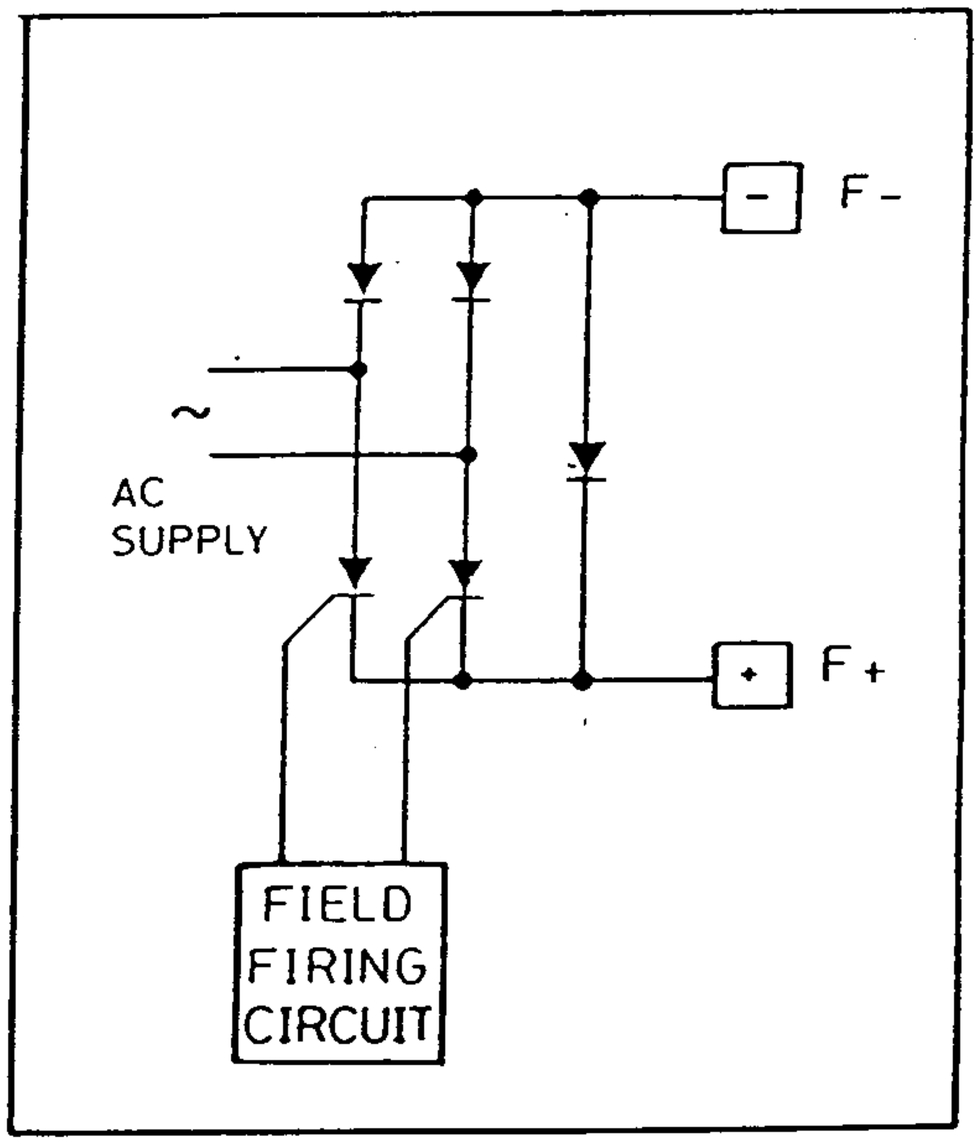
HALF WAVE RECTIFIER



FULL WAVE RECTIFIER



3 PHASE HALF WAVE RECTIFIER



FIELD FIRING CIRCUIT

ISS.	MODIFICATION	CP.NO.	DATE	APPROVAL
1	Initial Issue	3332	07.02.91	EOR

FIRST USED ON	MODIFICATION RECORD 570 Product Manual

SSD	LITTLEHAMPTON ENGLAND TELEX 87142	EI	DRAWING NUMBER ZZ056929C	SHT. 1 of 1