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590 SERIES THREE PHASE CONVERTORS

PRODUCT MANUAL

HA059665

Issue 3

WARNING

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

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CONTROLLER WARRANTY

For further details on SSD Controller Warranty and Repair refer to the Standard Conditions of Sale IA058393C

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1 INTRODUCTION

The 590 series of motor speed controllers are designed as components which are fitted in a standard enclosure with associated control equipment. The controllers accept standard three phase supply voltages in the range 110 to 500 Volts A.C. and provide controlled D.C. output voltage and current for the armature and field and are suitable for powering D.C. shunt field and permanent magnet motors.

Control of the 590 series is implemented by means of a 16 Bit Microcontroller which provides many advanced features:-

a) Complex control algorithms which are not achievable by simple analogue techniques.

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 full transient and overload protection, together with its associated electronic control circuitry, and provide accurate speed and/or torque control in one selected 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 provide a field regulator as a standard option, the regulator consists of a full-wave half controlled single phase thyristor bridge with transient and overload protection. The regulator provides either a fixed voltage or fixed current source depending upon the selected mode of operation for constant torque applications. The field current mode of operation can be further enhanced to provide field weakening range for systems which required extended speed or constant horsepower control.

The control circuit is totally isolated from the power circuit, 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 are designed for simple and economical panel mounting using keyhole tags. 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 trigger PCB's are used in all types of three phase armature controller regardless of horsepower or bridge configuration.

Start-up and location of faults (both within the controller and external to it) are greatly assisted by the MMI display which automatically displays the first fault. The display also provides a powerful diagnostic tool with access to all alarms, inputs and principal software blocks in the controller. Front panel LED indicators provide an instantaneous display of the status of the drive, key inputs and outputs.

This manual covers the following models from the 590 series.

Three phase, regenerative, four quadrant armature controllers.

590 - for currents up to 150 Amps.
592 - for currents in the range 151 to 270 Amps.
594 - for currents in the range 271 to 450 Amps.
596 - for currents in the range 451 to 720 Amps.
598 - external stack option for currents exceeding 721 Amps.

Three phase non-regenerative, two quadrant armature controllers.

591 - for currents up to 150 Amps.
593 - for currents in the range 151 to 270 Amps.
595 - for currents in the range 271 to 450 Amps.
597 - for currents in the range 451 to 720 Amps.
599 - external stack option for currents exceeding 721 Amps.

All drives include the patented SSD extended firing range which means that regenerative or non-regenerative controllers can be operated at the same dc output voltages without de-rating for regenerative application.

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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 Voltage feedback with IR compensation. By Encoder feedback or analogue tachogenerator.
Speed Range:	100 to 1 typical with tachogenerator feedback.
Steady State Accuracy:	0.01 % Encoder Feedback with Digital setpoint (serial link or P3) 0.1 % Analogue Tach Feedback 2 % Voltage Feedback Absolute (0.0% error) using QUADRALOC Mk II digital controller. Note: Long term analogue accuracy is subject tachogenerator temperature stability.
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. Stall protection.
Diagnostics:	Fully computerised with first fault latch and automatic display. Digital LCD monitoring. Full diagnostic information available on RS422/RS485. LED circuit state indication.
Operating Temperature Range:	0°C — +55°C Derate linearly above 35°C for force cooled units Derate linearly above 45°C for naturally cooled units
Storage:	-20°C — +55°C Protect from direct sunlight. Ensure dry, corrosive free environment.
Humidity:	85% Relative humidity maximum. Relative humidity is temperature dependent. If the ambient temperature falls the relative humidity will rise and may ultimately cause condensation. This should be avoided.
Atmosphere:	Non-flammable, non-condensing.
Encoder:	Maximum Microtach frequency 50KHz i.e. with a 1000 lines per revolution encoder the motor speed cannot exceed 3000 rpm. Maximum Encoder frequency 100K Hz i.e. with a 1000 lines per revolution encoder the motor speed cannot exceed 6000 rpm.

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2.2 ELECTRICAL RATINGS

Power Configuration:

590, 592, 594, 596, 598* - Two Anti-parallel three phase Thyristor bridges.

591, 593, 595, 597, 599* - 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.

Power:	Voltage ranges:	110-240v	~	±10%
		380-415v	~	±10%
		440-480v	~	±10%
		500v	~	±10%
		500-660v	~	±10% 598/599 only
	Supply Current:	(0.9 x Idc) Amps ac rms		
Coding:	Voltage ranges:	110-220v	~	±10%
		220-500v	~	±10%
		500-660v	~	±10% 598/599 only

Control and Fan* Supply Voltage: Single Phase, 45-65 Hz.

Voltage ranges: 110-120v ~ ±10%
220-240v ~ ±10%

* Force ventilated units.

Supply Power	Internal	30VA	fused at 400mA	FS3
	Fans	100 VA when fitted	fused at 1A	FS1
	Contactor	As contactor data sheet	fused at 3A	FS2

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	1.2W or 50mA
5702/5 Splitter	1.8W or 75mA
5702/6 Marker Pulse Repeater	1.2W or 50mA
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.

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2.3 OUTPUT RATINGS

2.3.1 Armature.

	590/1				592/3	594/5	596/7	598/9		
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	500V	500V	500V	500V	500V	500V	500V	600V	600V	600V
Maximum Field Supply Voltage	500V	500V	500V	500V	500V	500V	500V	500V	500V	500V
Power Loss	105w	210w	330w	450w	710w	1350w	2160w	2850w	3300w	4164w
Installation Drawing	HG055805	HG055805	HG055806	HG055806	HG055807	HG057209	HG057449 [5]	HG057829		

[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. 596/597 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 (HG057208).

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

[5] For Installation Drawings for 720A Stack Assembly see: HG049669 Standard Mounting / HG054248 Bracket Mounting

2.3.2 Field.

Output Current Ratings:(Field) 10A 590/1/2/3
20A 594/5/6/7
30A 598/599

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2.4 MECHANICAL DETAILS

General

1. All controllers should be mounted vertically in the cubicle to allow good air flow across the cooling fin. Naturally cooled units should be given special consideration to permit cool air entry into and hot air exit below and above the controller.
2. If the enclosure is totally enclosed the metal surface dissipates 50 watt sq. metre for a 10°c temperature rise.

590 and 591 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.	

592 and 593 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.

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594 and 595 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.

596 and 597 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 @ 80 bar 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.

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3 PRODUCT CODE

590 Series Three phase converters.

All members of the three phase converter range can be fully specified using a digit numerical order code.

Block No.	No. of Digits	Function
1	3	Basic product
2	4 or 5	Output current
3	1	Supply voltage (Power)
4	1	Field converter configuration
5	1	Supply voltage (Auxiliary)
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	3	Special software

The 18 blocks are defined as follows:-

BLOCK 1 3 Digits identifying the basic product.

590	3 phase 4 quadrant (regenerative) converter up to 150 amps.
591	3 phase 2 quadrant (non-regenerative) converter up to 150 amps.
592	3 phase 4 quadrant (regenerative) converter up to 270 amps.
593	3 phase 2 quadrant (non-regenerative) converter up to 270 amps.
594	3 phase 4 quadrant (regenerative) converter up to 450 amps.
595	3 phase 2 quadrant (non-regenerative) converter up to 450 amps.
596	3 phase 4 quadrant (regenerative) converter up to 720 amps.
597	3 phase 2 quadrant (non-regenerative) converter up to 720 amps.
598	3 phase 4 quadrant (regenerative) external stacks up to 1388 amp.
599	3 phase 2 quadrant (non-regenerative) external stacks up to 1388 amp.

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BLOCK 2

590 to 597 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

598 and 599

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
1	115v
2	208v
3	220v
4	240v
5	380v
6	415v
7	440v
8	460v
9	480v
A	500v
B	550v
C	600v
D	660v

598 / 599 External Stacks only

BLOCK 4 1 Digit identifying field supply configuration.

0	Externally supplied field.
1	Internally supplied field regulator.
	(Note: This digit requires a second paret 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	
Note:	Options marked with an asterisk will only be supplied on special request.

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

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

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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.

3 Wire ended encoder.

BLOCK 8 1 Digit code identifying the main serial link port (P2).

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 and 3 i.e. an Encoder.

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

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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

01 to 99 Documented special options

BLOCK 18 3 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

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4 BASIC INSTALLATION AND WIRING INSTRUCTIONS

4.1 INSTALLATION

The 590 series motor speed controllers are designed as components which are to be fitted with other control equipment in a suitable enclosure. The 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 590 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 590 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 590 series controller are given in diagram HB059771.

1. Power cables must have a minimum rating of 1.1 x full load current. (1.25 x FLC when required to comply with UL requirements).
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	BS88 Type Fuse		DIN Type Fuse		Thyristor A^2t @ 125°C Junction Temperature
	Fuse Rating	Part Number	Fuse Rating	Part Number	
0010 to 0350	35A	CH110353	40A	CH570044	800 A^2t
0351 to 0700	75A	CH120753	80A	CH570084	8,000 A^2t
0701 to 1100	110A	CH120114	160A	CH580164	8,000 A^2t
1101 to 1500	150A	CH120154	200A	CH580025	15,000 A^2t
1501 to 2700	300A	CH130035	550A	CH590554	125,000 A^2t
2701 to 4500	---	---	700A	CH590075	320,000 A^2t
4501 to 7200	---	---	800A	CH590085	500,000 A^2t

4. Where a system is being designed to comply with the United States National Electrical Code an overload relay should be fitted in the 3-phase supply to provide motor overload protection.
5. A substantial ground or earth connection should be made to the earth terminal of the drive.

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6. 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). No additional series contacts or switches are permitted since they will interfere with the sequencing of the controller and cause unreliability and possible failure.

   Notes
   1. If the 3-phase contactor has a coil with an inrush greater than 3 Amps a slave relay must be used to drive the contactor coil.
   2. The contactor and slave relay (if required) must have coil voltages compatible with the controller auxiliary supply voltage.
   3. 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.

7. 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.

8. 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.

   Notes
   1. Check that the auxiliary supply transformer tapping on the power board is connected to the voltage used within the system.
   2. The auxiliary supply must be connected directly to the incoming supply, no series switches or contacts are permitted without consultation with SSD Engineering Department.

9. 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.

10. 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.

11. 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.

12. 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.

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13. 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 (+100 %)
-10v input = maximum reverse speed demand (-100 %)

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 (591, 593 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.

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

i) Analogue dc tachogenerator.
ii) SSD MICROTACH/ Encoder.
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 four-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.

15. 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.

16. The Main Current Limit is adjustable by means of the "Main Current Limit" Parameter [Tag 15] 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 the Main Current Limit Parameter 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 the "Main Current Limit Parameter" is set to 200%.

17. 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.

18. The basic run/start sequence of the controller is provided by terminal C3 "Start/Run" 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 held true then a single contact connected between terminal C9 "+24v" and C3 "start/run" when closed will cause the controller to energise the "Main Contactor" and, provided the Enable terminal C5 is also true, "Run" the associated dc motor.

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When the single contact to "Start/Run" terminal C3 is opened the controller will decelerate the motor to zero speed at a rate determined by the "stop time" setting and the "current limit" setting. The overall time "stop limit" provides protection to invoke coast stop if either "stop rate" or "current limit" fails to produce the required action within the"stop limit" period.

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/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 590, 592, etc.

If the "+24v" is removed from B8 while the drive is controlling the motor under "run" conditions, the controller 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.

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.

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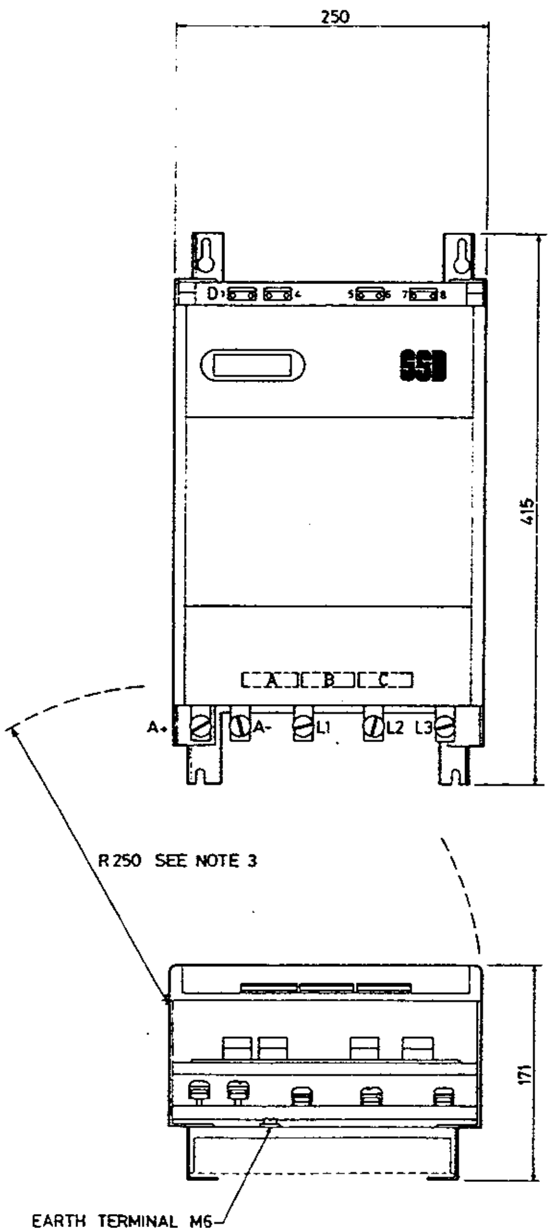
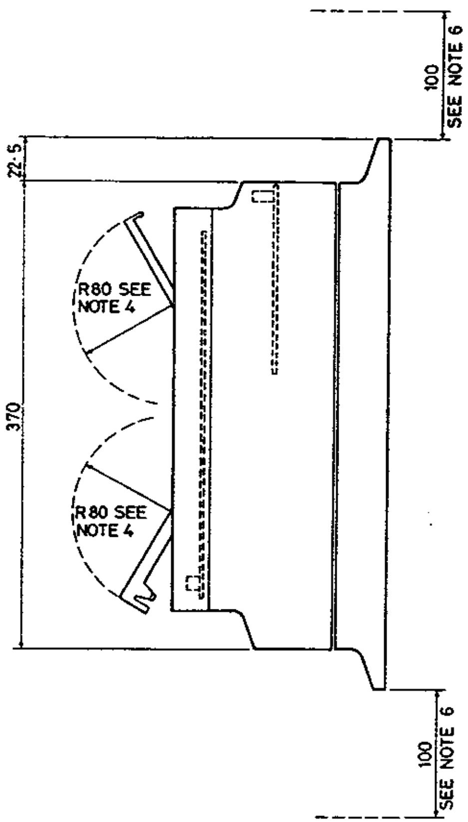
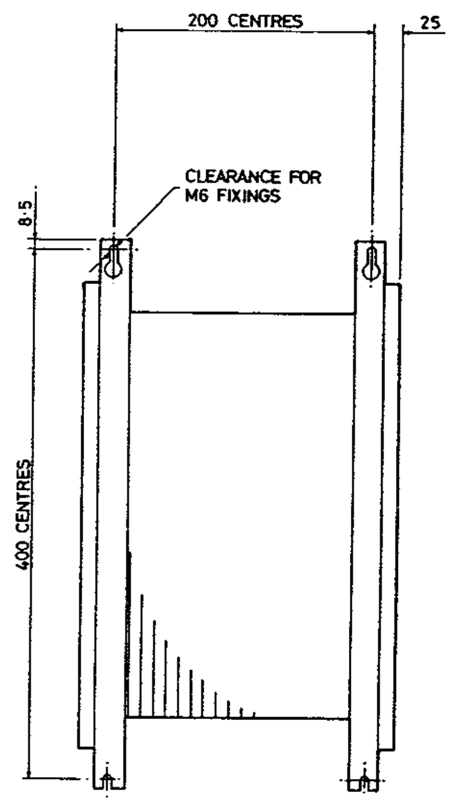






REAR VIEW FIXING CENTRES

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.

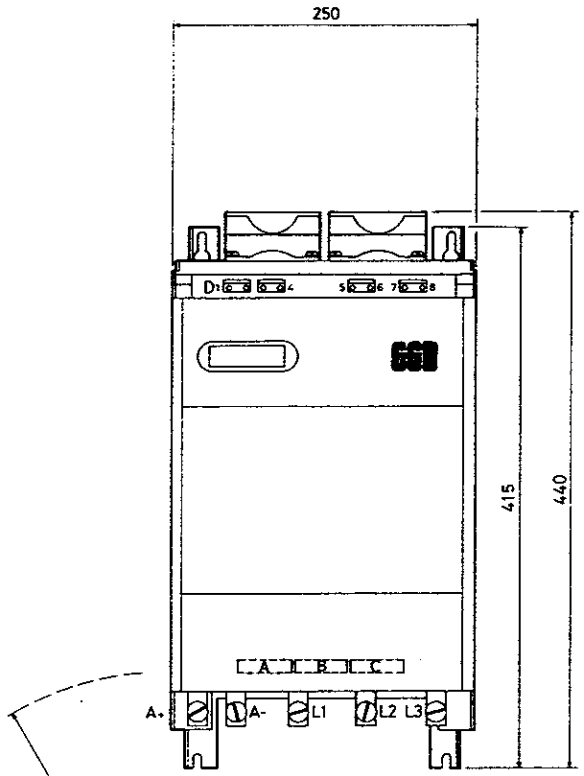
DATE		
C	11 4 88	TRACED
D	17 5 88	A+ A- L1-3 ADDED TERMINAL BLKS WERE D8-D9 21 4 89
E	30 / 9 / 92	

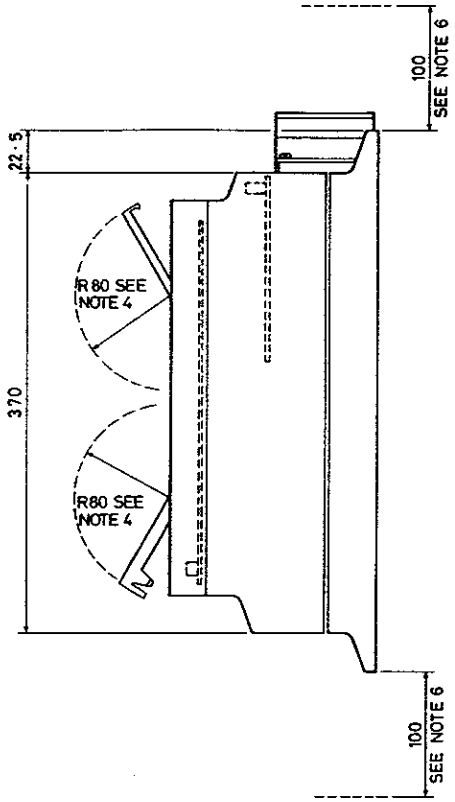
DRAWN CRM | MATERIAL | FINISH | DIMS. IN MM. APPLY OVER FINISH | ASSEMBLED ON 570 / 590 SERIES | SCALE 1 : 2 | SSD LITTLEHAMPTON ENGLAND TELEX 87142 | EI

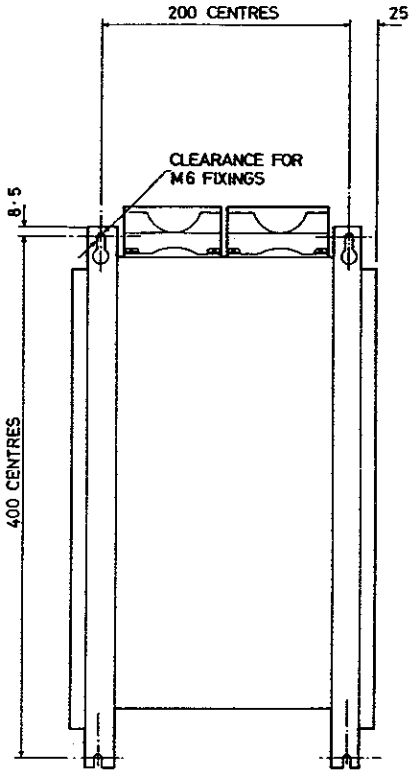
TITLE DC DIGITAL DRIVES 35A & 70A STACK ASSY.

DRAWING NUMBER HG 055805 F

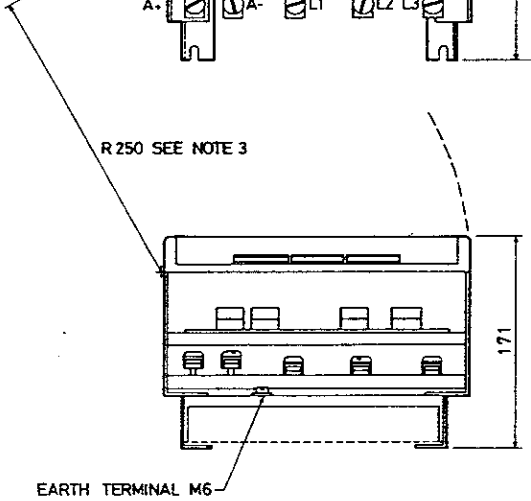
DO NOT SCALE | THIRD ANGLE PROJECTION | GENERAL DRAWING PRACTICE TO BS 308 · BS 3939







REAR VIEW FIXING CENTRES



NOTES.

1. CONNECTIONS A,B & C ARE PLUG-IN STYLE TERMINALS CAPABLE OF ACCEPTING 1·5mm^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.

DATE		
11 4 88	C	TRACED
17 5 88	D	ADDED L1,L2,L3 ADDED TERMINAL BLKS WERE DET'D
21 4 89		

1 SHEET 1 OF 1 SHEET 2

DRAWN CRM | CHECKED | DESIGN APPROVAL | MAIN APPROVAL | MATERIAL | FINISH

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

ASSEMBLED ON 570/590 SERIES | SCALE 1:2

SSD LITTLEHAMPTON ENGLAND TELEX 87142

TITLE DC DIGITAL DRIVES 110A & 150A STACK ASSYS.

DRAWING NUMBER HG 055806 F

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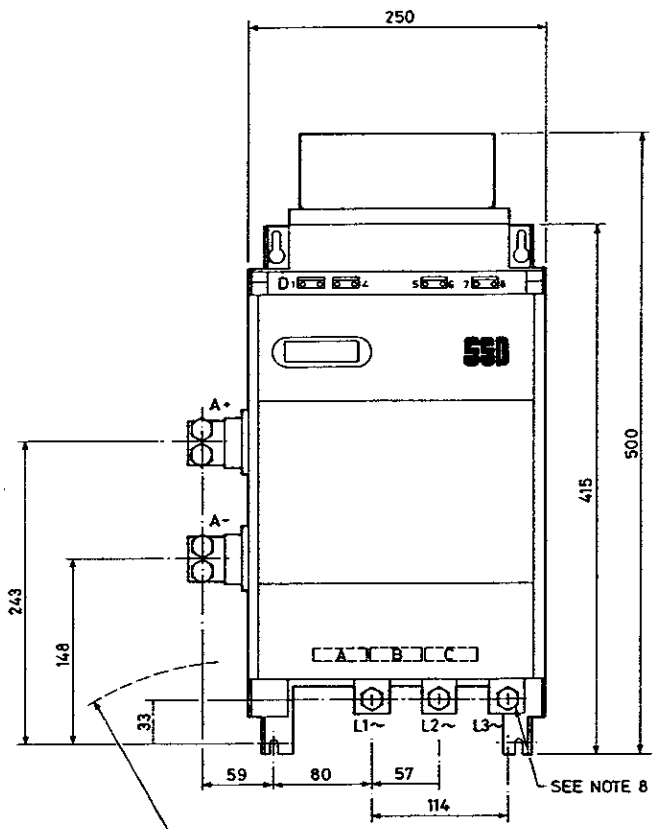

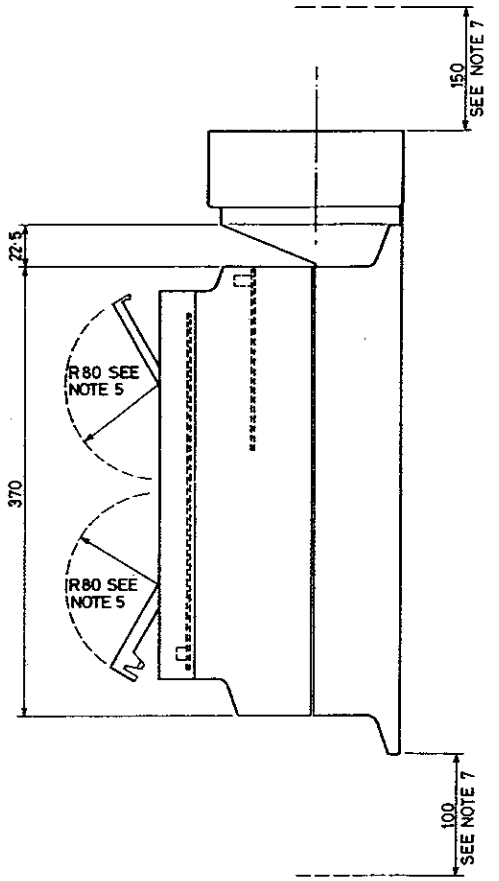

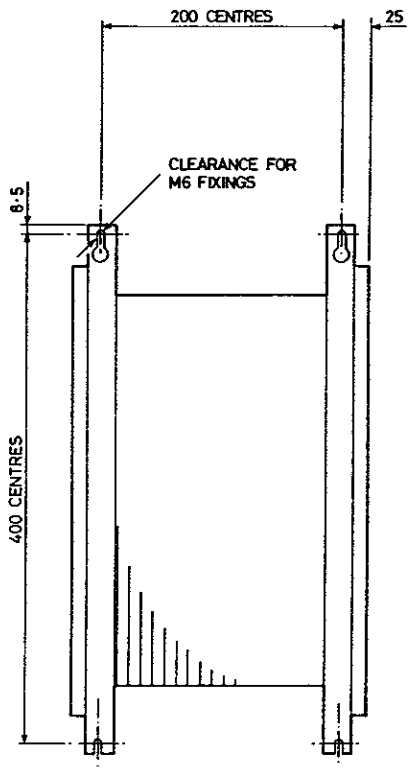

REAR VIEW FIXING CENTRES

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	11-4-88 TRACED
D	17-8-88 TERM. BARS WERE DEFG
4	30 1 92

DRAWN CRM | CHECKED | DESIGN APPROVAL | QUALITY APPROVAL | MATERIAL | FINISH

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

ASSEMBLED ON 570 / 590 SERIES | SCALE

SSD LITTLEHAMPTON ENGLAND TELEX 87142

TITLE DC DIGITAL DRIVES 270A STACK ASSY.

DRAWING NUMBER HG 055807 F | SHT | OF SHTS

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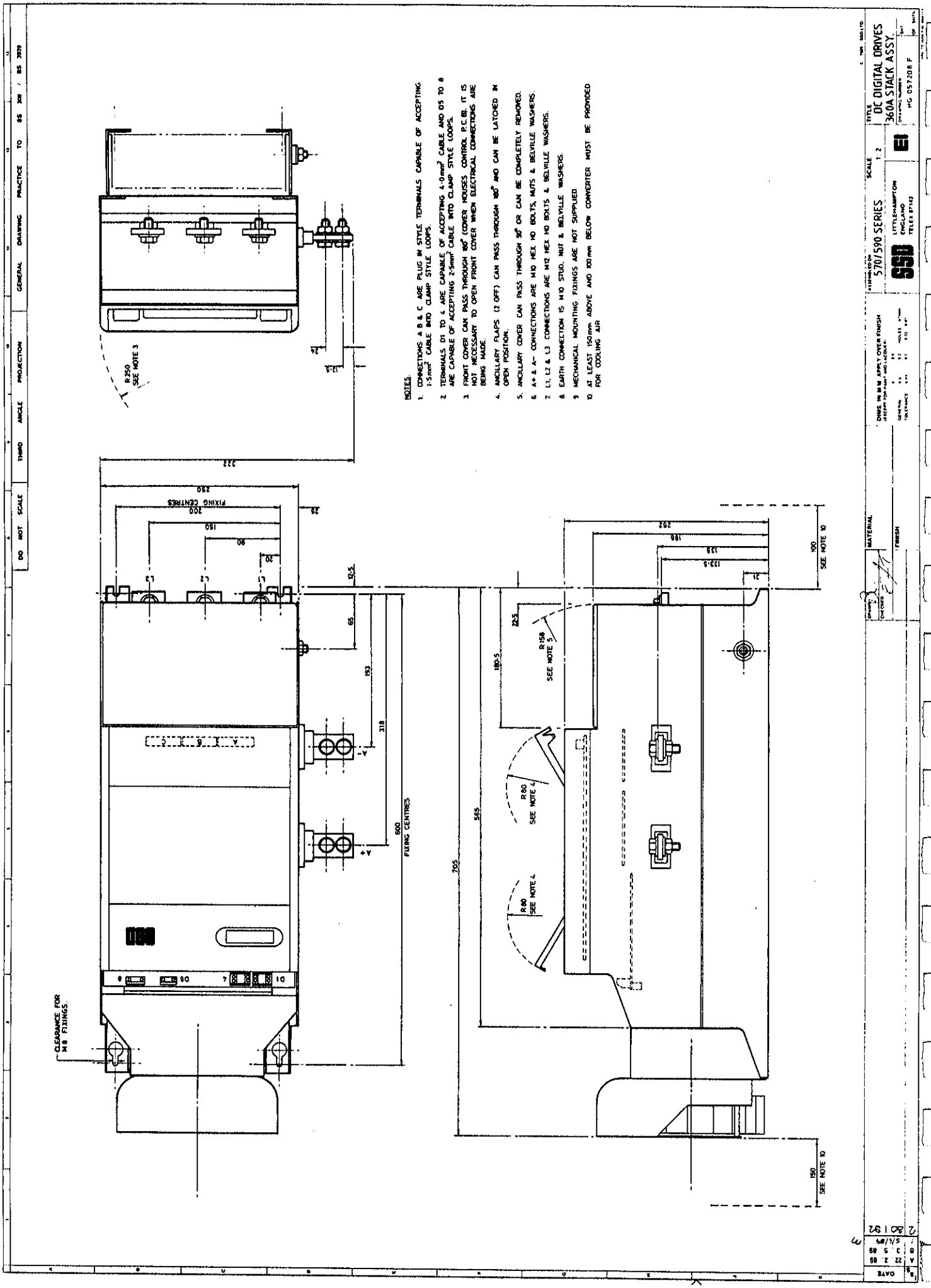

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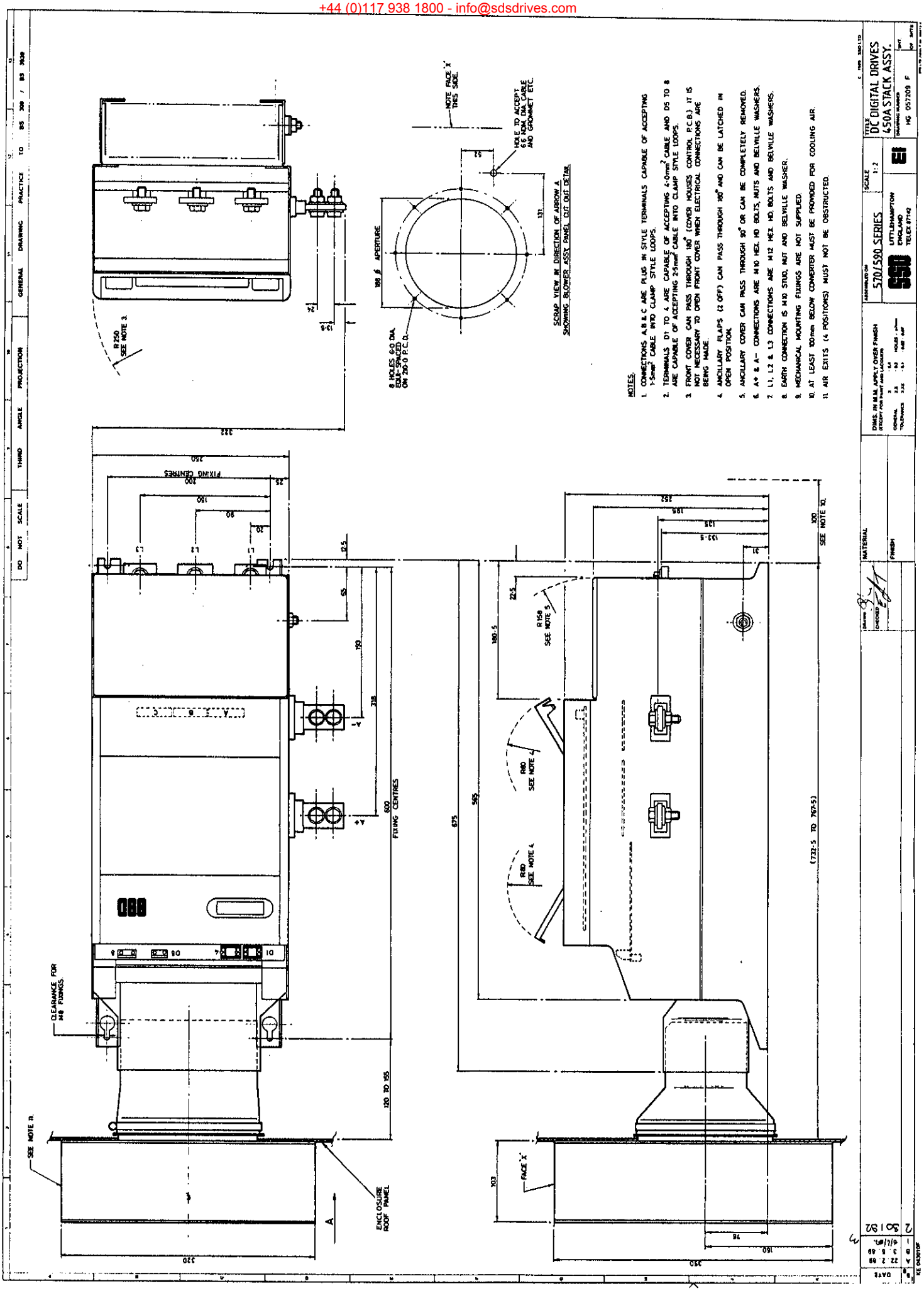
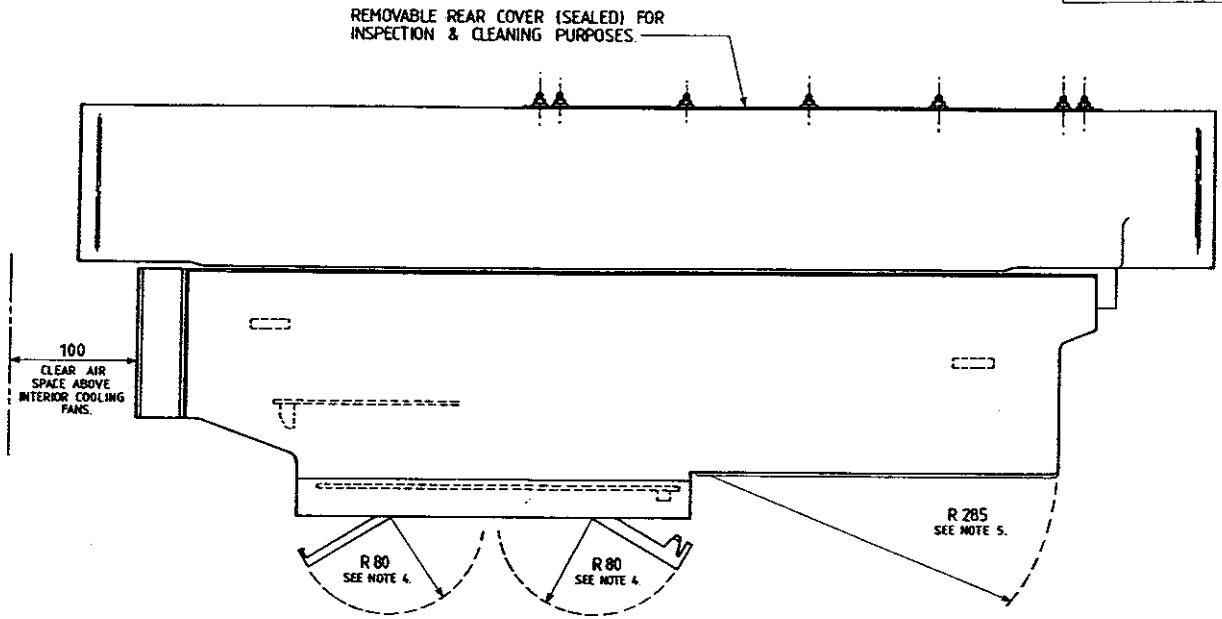
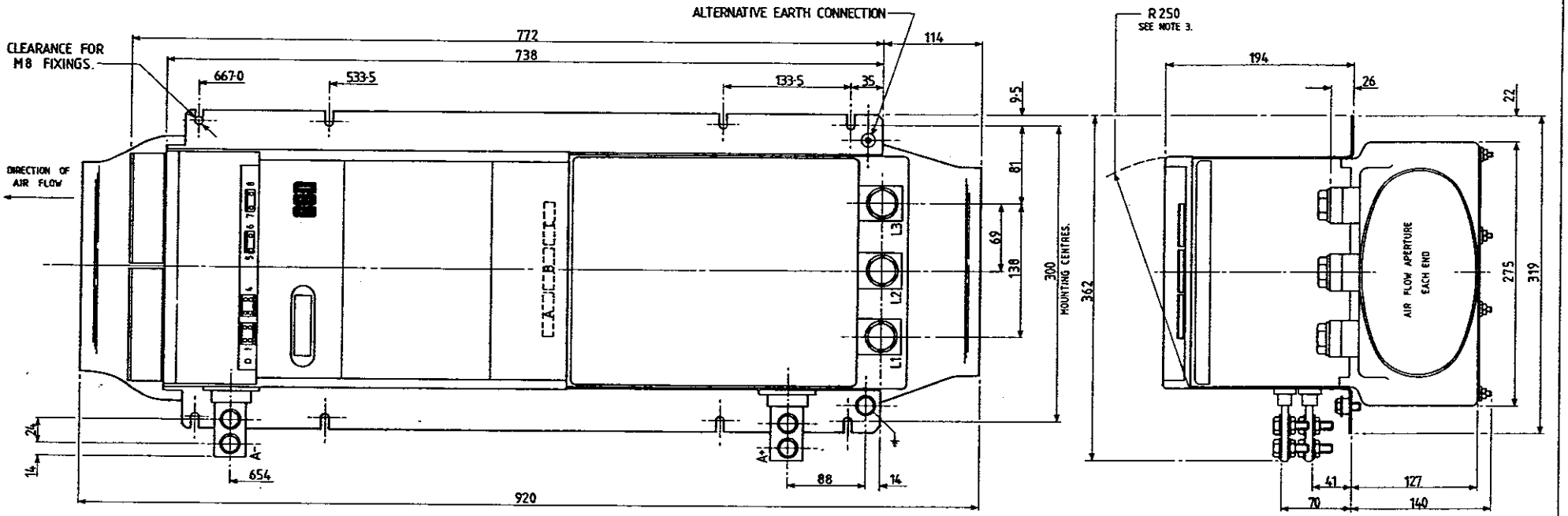


DO NOT SCALE | THIRD ANGLE PROJECTION | GENERAL DRAWING PRACTICE TO BS 308 / BS 3838



NOTES

1. CONNECTIONS A,B & C ARE PLUG IN STYLE TERMINALS CAPABLE OF ACCEPTING 1·5mm² CABLE INTO CLAMP STYLE LOOPS.
2. TERMINALS 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 M14 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 049669 F FOR TYPICAL INSTALLATION.
    SEE HG 054248 F FOR ALTERNATIVE TOP OF PANEL MOUNTING.



DATE		
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Drawn P.A.W. Checked EJT | MATERIAL | FINISH | DIMS. IN M.M. APPLY OVER FINISH (EXCEPT FOR PAINT AND LACQUER)

ARRANGED ON 570/590 SERIES | SCALE 1:2 | TITLE DC DIGITAL DRIVES 720A STACK OUTLINE DRG. | DRAWING NUMBER HG 057449 F | SHT 1 OF 2 SHTS

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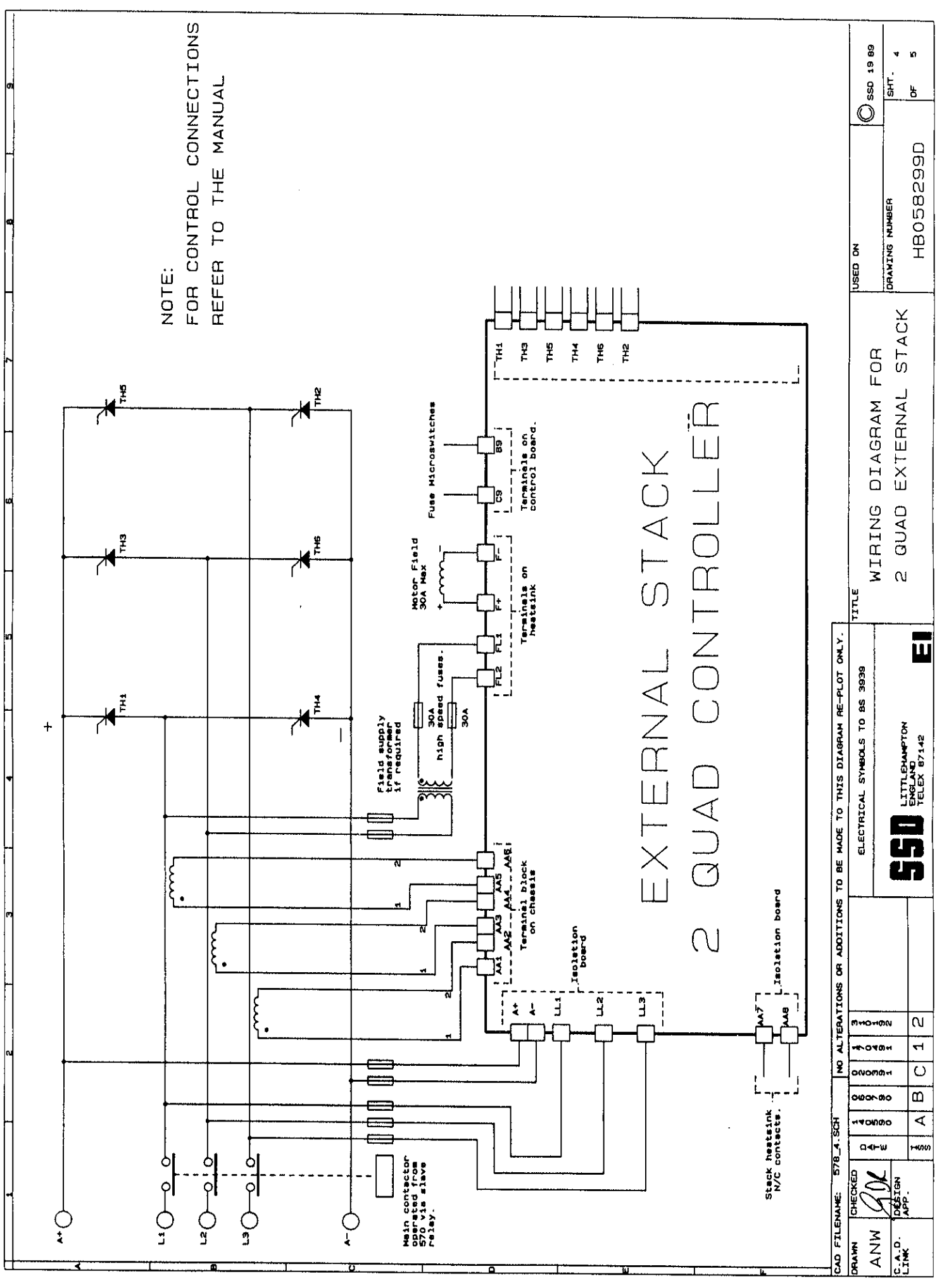
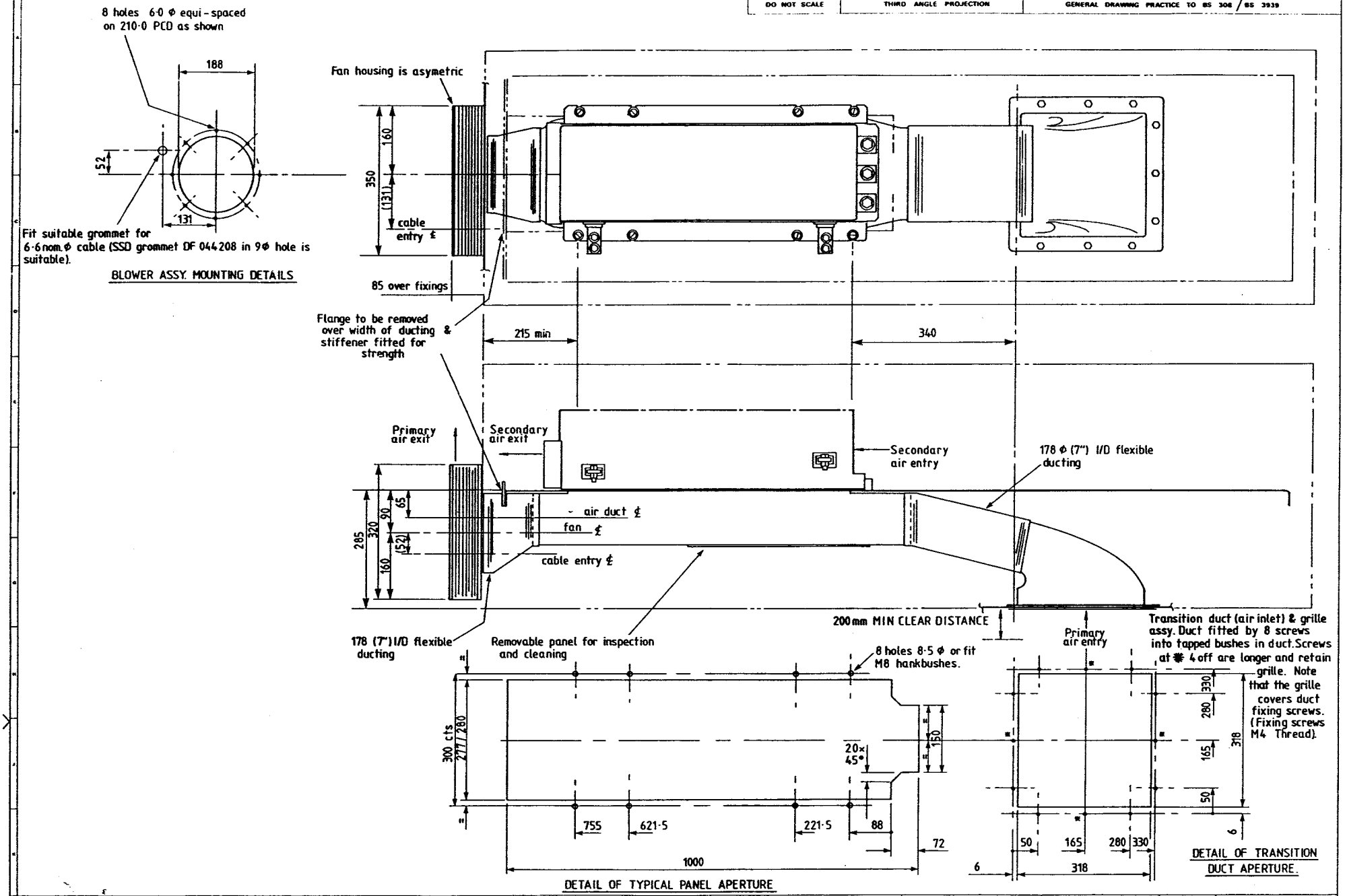


DO NOT SCALE | THIRD ANGLE PROJECTION | GENERAL DRAWING PRACTICE TO BS 308 / BS 3939



DATE	
A	13·6·83
B	7/8/85
C	16·7·86
1	4·8·86
2	22·9·88
3	30/1/92

DRAWN JM | CHECKED | SCHEME APPROVAL | QUALITY APPROVAL | MATERIAL | FINISH

DIMS. IN M.M. APPLY OVER FINISH EXCEPT FOR PAINT AND LACQUERS

ASSEMBLIES ON 545/570/590 SERIES | SCALE 1:4

Shackleton system drives

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DRAWING NUMBER HG 049669 F | ISS. 1 | SHT. 1 OF 1 SHTS.

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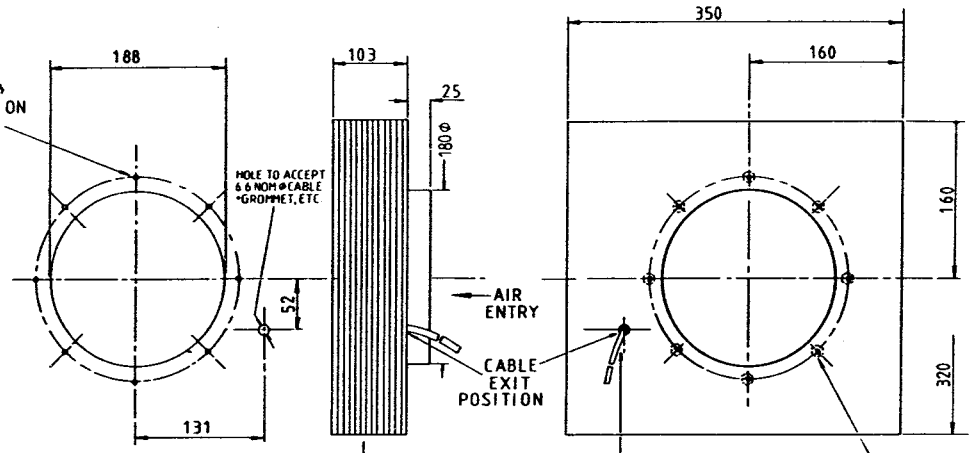
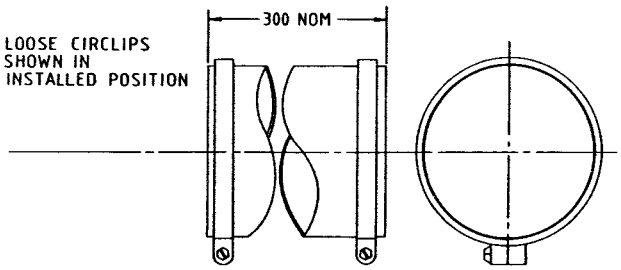


DETAILS OF BLOWER MOUNTING

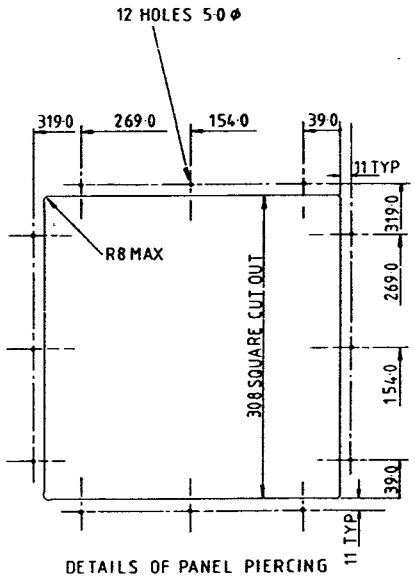
AIR EXIT MUST NOT BE OBSTRUCTED

2 METER LENGTH 3 CORE CABLE SUPPLIED

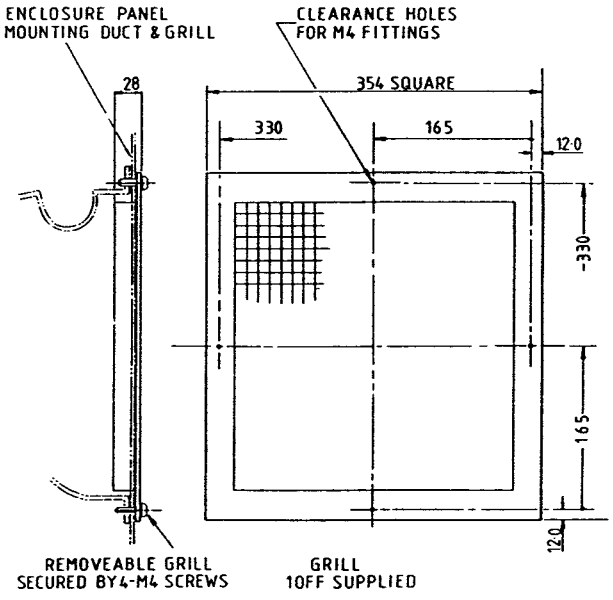
8 HOLES THREADED M5 EQUI-SPACED ON 210·0 Ø P.C.D AS SHOWN.



AIR FLOW DUCT
1 OFF SUPPLIED WITH TRANSITION DUCT.
1 OFF SUPPLIED WITH BLOWER.

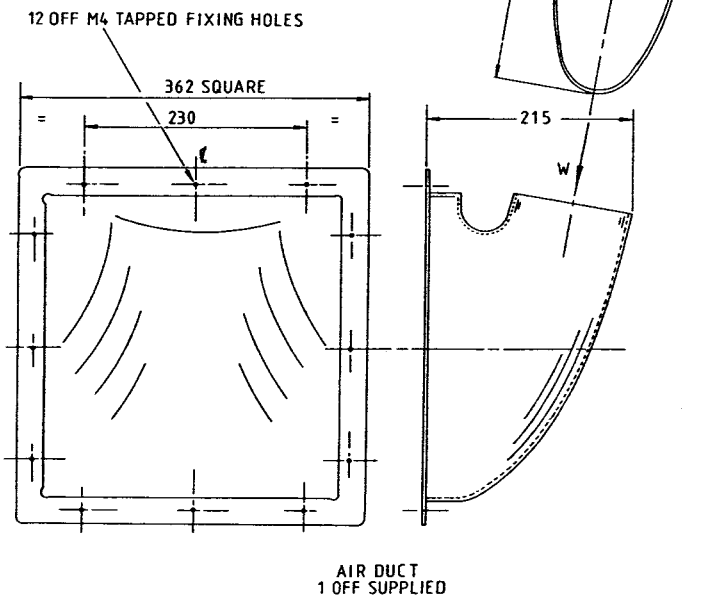


DETAILS OF PANEL PIERCING



REMOVEABLE GRILL SECURED BY 4-M4 SCREWS

GRILL 1 OFF SUPPLIED



AIR DUCT 1 OFF SUPPLIED

DATE	BY	CHECKED	DESIGN APPROVAL	MAIN APPROVAL
A 22.5.89				
3 30/1/92				

MATERIAL

FINISH

DIMS. IN M.M. APPLY OVER FINISH (EXCEPT FOR PAINT AND LACQUER)
GENERAL TOLERANCE .X ±0.4 .XX ±0.2 .XXX ±0.1 HOLES Ø 7mm 0.02 - 0.07

ASSIGNED TO 570/590 SERIES

SCALE

Shackleton system drives

TITLE DC DIGITAL DRIVES 720A STACK OUTLINE DRG.

DRAWING NUMBER HG 057449 F

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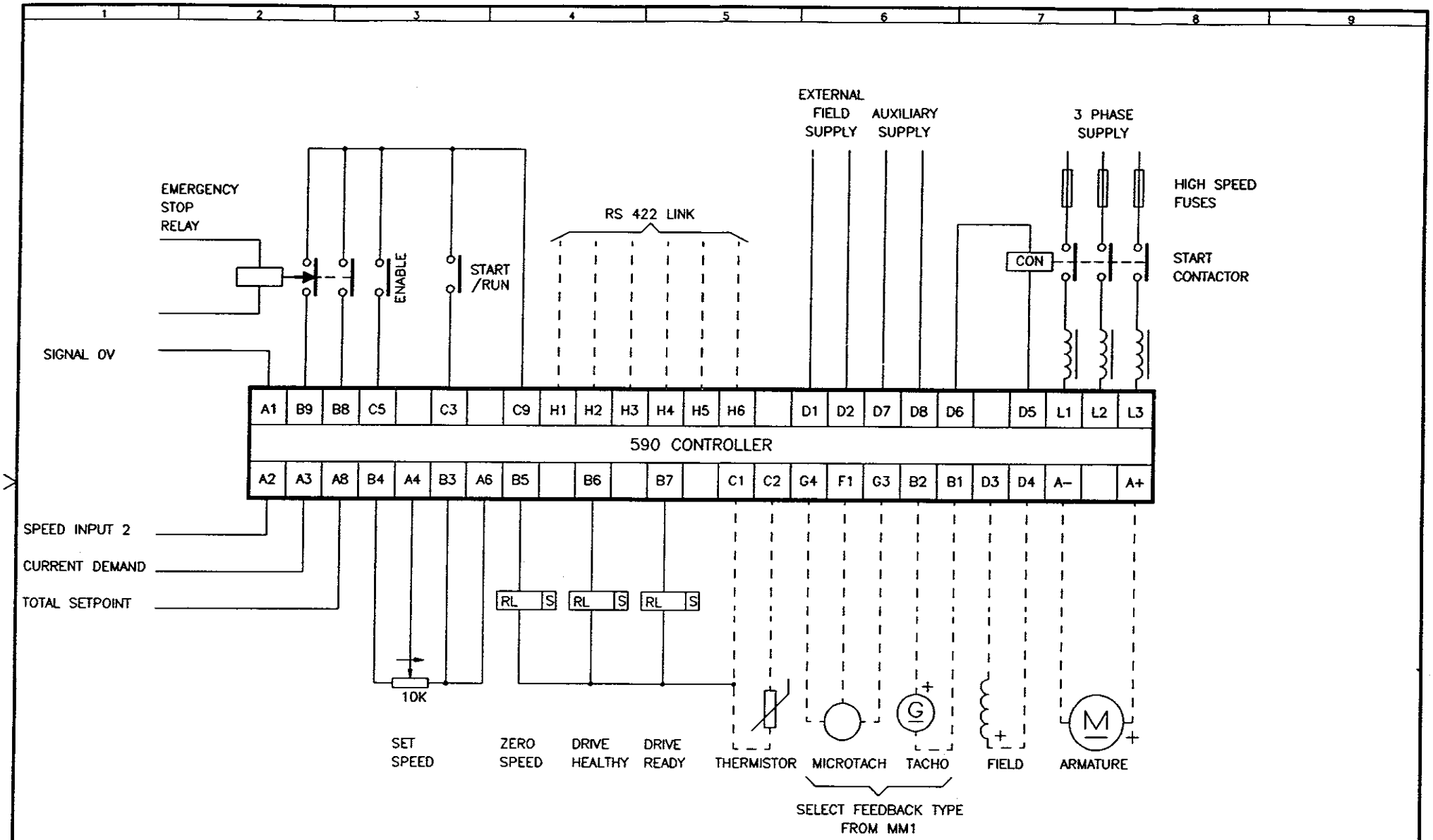

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DRAWN GDR	CHECKED	DATE 16/04/91	ELECTRICAL SYMBOLS GENERALLY TO BS 3939	TITLE CIRCUIT DIAGRAM FOR 590 MANUAL	USED ON 590
TRACED LT	DESIGN APP.	ISS A	SSD LITTLEHAMPTON ENGLAND TELEX 87142		DRAWING NUMBER HB 59771 D
					SHT. 1 OF 1

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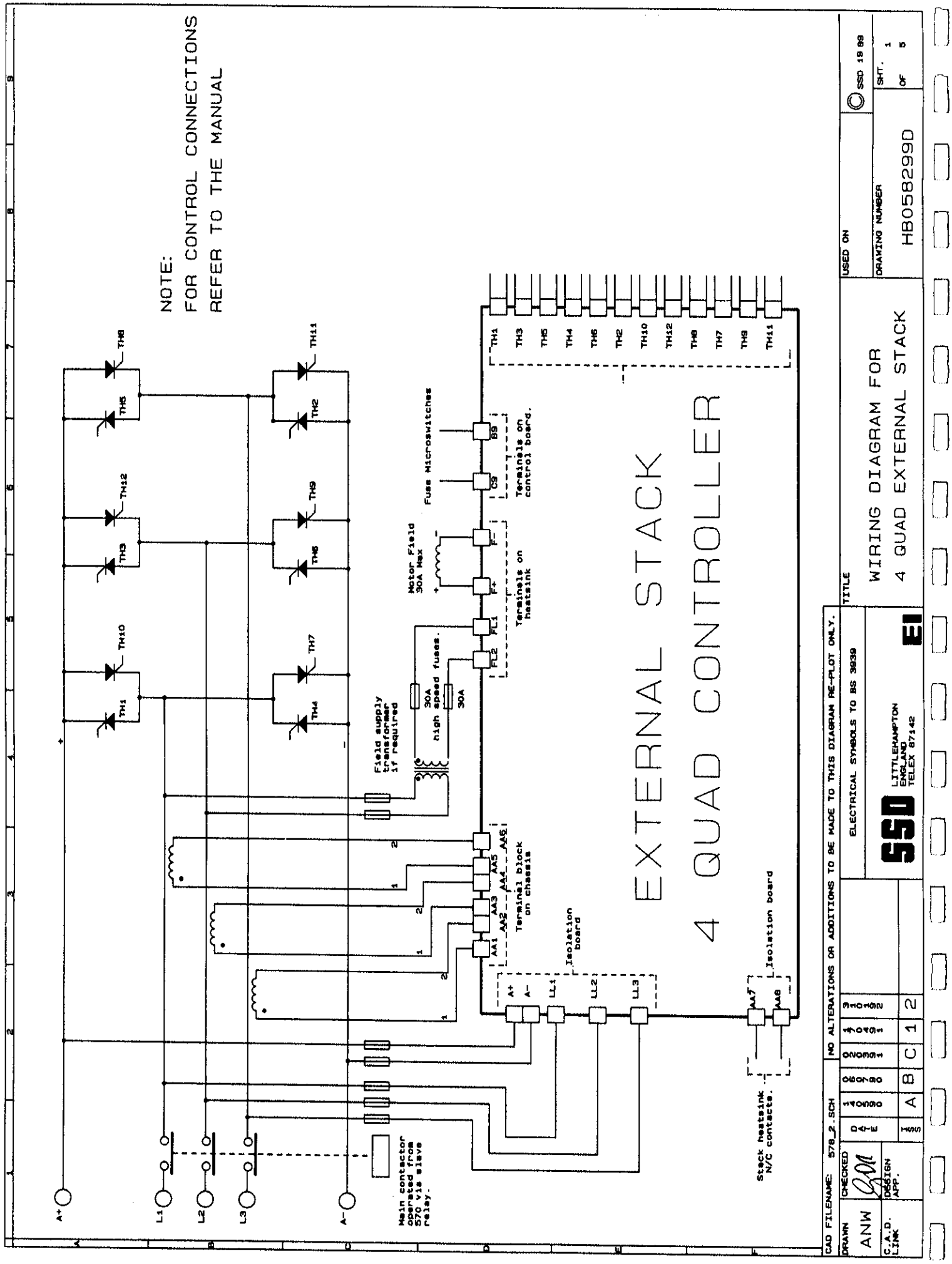

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5 TERMINAL DESCRIPTIONS

5.1 CONTROL BOARD

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	Configurable
A1	Ov(Signal Ground)	Zero Volt reference		N/A
A2	Analogue Input No.1	Speed Setpoint.	+10v = Full Speed Setpoint Forward. -10v = Full Speed Setpoint Reverse.	No
A3	Analogue Input No.2	Auxiliary Speed Setpoint or Current Demand. The Function of this input is determined by Digital Input No. 3 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 = 100% positive current demand. -10v = 100% reverse current demand.	Yes
A4	Analogue Input No.3	Ramped Speed Setpoint	+10v = Full Speed Setpoint. -10v = Full Speed Setpoint Reverse.	Yes
A5	Analogue Input No.4	Auxiliary Current Clamp Negative.	+10v = 200% positive current demand -10v = 200% reverse current clamp.	Yes
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.1 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.	No
A7	Analogue Output No.1	Speed Feedback output.	+10v = Full Speed Feedback Forward. -10v = Full Speed Feedback Reverse.	Yes
A8	Analogue Output No.2	Total Speed Setpoint.	+10v = Full Speed Setpoint Forward. -10v = Full Speed Setpoint Reverse.	Yes
A9	Current Meter Output	Buffered Armature Current Feedback. The output can be selected as either Bipolar or Unipolar by the Armature I parameter.	Bipolar Mode +10v = 200% output current Forward. -10v = 200% output current Reverse. Unipolar Mode +10v = 200% output current.	No

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Analogue Input/Output Specifications.

Input/Output Resolution	10 Bit plus sign i.e. 10mV. 0.1% of Full Scale Deflection.
Input Impedance	25K ohm with a 1 millisecond filter.
Maximum Input Sample Rate	5 milliseconds (typically) Analogue I/P4, 5, 6 15msec.
Input Overload Capability	10% i.e. Maximum Recognisable voltage 11v. Tach Input B2 only.
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	Configurable
B1	Ov(Signal Ground)	Zero Volt reference for analogue signals only specifically the analogue tachogenerator.		N/A
B2	Analogue Tachogenerator Input	Tachogenerator Feedback	+200v dc Maximum at Full Speed Feedback Forward. -200v dc Maximum at Full Speed Feedback Reverse.	No

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 R6 and R7 on the plug-in calibration board, the resistors being selected using the formula:-

R6 + R7 = (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 "Analog Tach Cal" Parameter (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.	N/A
B4	-10v Reference	Negative Reference Supply	-10v at 10mA short circuit protected.	N/A
B5	Digital Output No.1	Zero Speed Detected. The operating level of this output can be modified by the standstill zero threshold parameter to give the desired accuracy of operation.	+24v at zero speed.	Yes
B6	Digital Output No.2	Drive Healthy (Drive Operational) This output is true when the controller is Healthy.	+24v when Healthy	Yes

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B7	Digital Output No.3	Drive Ready. This output is true when the controller is ready to function.	+24v when Ready	Yes

Digital Output Definition

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. A free-wheel diode is included in the output to protect the output transistor when switching inductive loads such as relays.

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 controller provides a controlled or program stop as defined by the Program Stop parameters. (See Note 1)	+24v drive run 0v (o/c) drive stop Threshold + 12v	No
B9	Coast Stop	Uncontrolled Stop Input. When the Coast Stop input is at +24v, the controller 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. Threshold +12v	No
C1	0v (Power Ground)	Control and Relay Ground		N/A
C2	Thermistor/ Microtherm	Motor overtemperature protection element input.		No

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 greater than 2000 Ohms. Motor overtemperature sensors should be connected in series between terminals C1 and C2. A motor overtemperature alarm will be indicated if the external resistance between C1 and C2 exceeds 1.8k Ohms ± 200 Ohms.
Terminals C1 and C2 must be linked if overtemperature sensors are not used.

C3	Start/Run	Start/Run Input When an input is applied to this terminal the controller will operate provided there are no alarms, program stop/coast stop signals are true and the controller is enabled. When the input is removed the controller will perform a regenerative stop to zero speed. (See Note 1)	+24v = True/Run 0v = False/Stop Threshold + 12v	No

Note 1: A regenerative stop can only be achieved by a 4 quad regenerative controller, the 2 Quad non-regenerative controller will coast to zero speed.

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C4	Reserved			No
C5	Enable	Enable Input The enable input provides a means of electronically inhibiting controller operation. If the enable input is not true all control loops will be inhibited and the controller will not function.	+24v = True/Enable +0v = False/Inhibit Threshold + 12v	No
C6	Digital Input No.1	Selection Control No. 1 This input alters the configuration of the current clamps, with no connection i.e. false Analogue I/P 5 provides a single current limit. When true Analogue ± I/P 5 is the positive current clamp Analogue I/P 4 is the negative current clamp.	+24v = True/Bipolar Clamp +0v = False/Unipolar Clamp Threshold + 12v	Yes
C7	Digital Input No.2	Ramp Hold If the input is held true the Ramp Generator output is frozen at that value irrespective of the Ramped Setpoint Input. When false the Ramp Output follows the Ramped Setpoint Input with a delay determined by the Acceleration and Deceleration Ramp time paramaters.	+24v = True/Hold +0v = False/Ramp Threshold + 12v	Yes
C8	Digital Input No.3	Current Demand Isolate. This input alters the drive operation from Speed Control to Current Control. When digital input No.3 is true, analogue input No.2 provides the current demand and the speed loop is disconnected. When false the speed loop is in control and analogue input No.2 is an auxiliary speed setpoint.	+24v = True/Current +0v = False/Speed Threshold + 12v	Yes
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.		N/A

Digital Input Definition

Nominal Input Voltage	-	24v DC
Maximum Input Voltage	-	30v DC
Input Impedance	-	47k Ω
Sample Time	-	5 milliseconds
Threshold	-	12v Typical
V input low	<	6v
V input high	>	18v

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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	Current Meter Output	A9

Signal Ground	0v	B1
Tach Input	DC Tachogenerator Input	B2
External +10v Reference	+10v DC Reference	B3
External -10v Reference	-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	Program Stop Input	B8
Coast Stop	Coast Stop Input	B9

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

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TERMINAL BLOCK G

G1	Not Used	
G2	External +24v dc Supply	Alternate external +24v Microtach power supply source input connection terminal.
G3	+24v dc Microtach Supply	This is a regulated +24v supply which can be used to power the microtach. 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 G2 to supplement the internal supply.
G4	Microtach Power Supply Ground	Power supply return terminal.
F1	Microtach Input	Fibre Optic Receiver Input Socket.

TERMINAL BLOCK H *

H1	XMT -	Serial Communications Port P1 Transmit Terminals.
H2	XMT +	Balanced Line Driver outputs compatible with RS422 signal levels.
H3	0v	Serial Communication Port
H4	Isolated	Signal ground with galvanic isolation from controller signal ground or power ground.
		Signal Screen ground point
		Note the signal screen must also be grounded at the host.
H5	RCV -	Serial Communications Port P1 Receive Terminals
H6	RCV +	Balance Line Receiver input compatible with RS422 signal levels.

NOTE: Where more than 8 serial communications option boards are interconnected on one system, the line termination resistor fitted to the option board causes excessive loading on the system. This resistor should be removed on boards daisy chained in the serial wiring not those at the beginning or end of the system. Refer to SSD Engineering Department if in doubt.

5.2 POWER BOARD

TERMINAL BLOCK D

Terminal Block D is located on the power board.

D1	FE	External AC input to field bridge.
D2	FE	

Required AC Input Voltage = 1.11 x Nominal DC Output.

The field regulator will control the field current provided that the Nominal DC Output voltage exceeds the field voltage by at least 10%.

i.e.	V_{AC}	= 1.11	x	V_{DC}
and	V_{DC}	= 1.1	x	V_{FIELD}
therefore	V_{AC}	= 1.22	x	V_{FIELD}

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.

Note:- When using the an external ac input it is important to have the correct phase relationship on the terminals. The supply must be derived 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	Field Output -	Motor Field Connections.
D4	Field Output +	The DC output voltage at these terminals will depend upon the AC supply voltage and the mode of field control.

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Voltage Control

The output voltage will be determined by the ratio parameter in the field variables. The relationship between the dc output voltage and ac input voltage is determined by the equation:-

$$Vdc = \frac{Vratio \times Vac}{100}$$

The default value of Vratio is 90% hence the dc output voltage will be the same as for a full wave rectifier.

The ratio can be adjusted over a range of 10 to 1 hence the voltage can be adjusted to suit the dc motor rating plate.

Current Control

The working output voltage will be determined by the calibrated output current and the load impedance and will vary as the motor field warms up.

If the current calibration resistors are incorrectly selected or the field output terminals are open circuit the voltage will rise to a maximum value determined by the equation:-
Vdc = 0.9 x Vac.

D5 Main Contactor Coil(L)
D6 Main Contactor Coil (N)

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.

This terminal is internally connected to the auxiliary supply neutral and provides a convenient connection point for the contactor coil neutral connection.

D7 Auxiliary Supply (N)
D8 Auxiliary Supply (L)

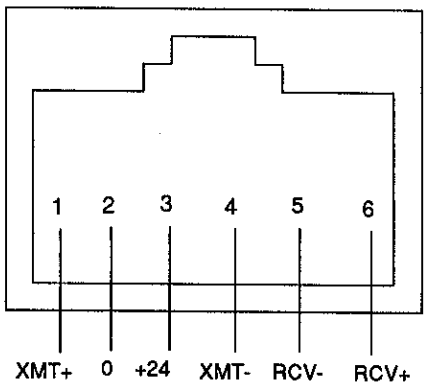
These terminals are the mains input connections for control supply transformer, contactor control relay supply and cooling fan supply (when force cooled). The voltage applied to these terminals is Product Code dependant, ensure that the input voltage tapping coincides with both the applied voltage and the Product Code. Failure to do so may cause the supply fuse to fail and may cause permanent damage.

AUXILIARY CONNECTORS

SERIAL PORT P2

P2/1 - XMT +
P2/2 - 0V
P2/3 - + 24V
P2/4 - XMT -
P2/5 - RCV -
P2/6 - RCV +

POWER OUTPUT
P2 SERIAL LINK OUTPUT
P2 SERIAL LINK INPUT

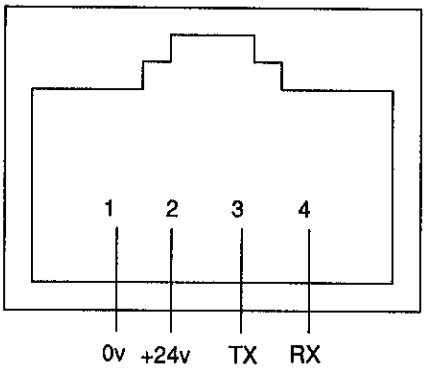


P2

SERIAL PORT P3

P3/1 - 0V
P3/2 - + 24V
P3/3 - TX
P3/4 - RX

POWER OUTPUT
P3 SERIAL LINK INPUT/OUTPUT



P3

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CONTROL BOARD OPTION MODULE TERMINAL ALLOCATION

Microtach Option Module

Not Used	G1
External +24VDC Supply	G2
+24V DC Supply	G3
0 volt power	G4
Fibre Optic Input Socket	F1

RS422 Serial Link Option Module

XMT -	H1
XMT +	H2
0V Isolated	H3
0V Shield Screen	H4
RCV -	H5
RCV +	H6

POWER BOARD TERMINAL ALLOCATION

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

POWER TERMINALS

Three phase supply 110 - 500 VAC	L1
Three phase supply 110 - 500 VAC	L2
Three phase supply 110 - 500 VAC	L3
Armature connection positive	A+
Armature connection negative	A-

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6 HARDWARE OVERVIEW

6.1 CONTROL CIRCUITS

6.1.1 Microcontroller

A single 16 bit Microcontroller performs the majority of the control functions with additional hardware either providing support to the Microcontroller or providing interfacing and scaling to the input/output data.

The functions performed by the Microcontroller are as follows:-

a) Analog to Digital conversion;
b) Current Loop;
c) Speed Loop;
d) Field Loops;
e) Sequencing;
f) Alarm recognition and first fault indication;
g) MMI display and keypad;
h) LED Diagnostics;
i) P3 Port;
j) P1 and P2 Ports via intelligent peripheral;
k) Thyristor firing algorithms
l) Digital to Analogue output via 10/12 bit D/A convertor.

The support circuitry falls into five categories:-

a) Microcontroller Data and Program storage
b) Microcontroller Peripherals
c) Signal scaling and conditioning
d) Power Supplies
e) Coding

6.1.2 Program and Data Storage

The Microcontroller has three forms of memory in which to carry information:-

a) 64K bytes of EPROM
b) 16K bytes of RAM
c) 8K bytes of EEPROM

The **EPROM** is concerned primarily with program storage although a large area is concerned with messages and text for the MMI display and a list of default values for the parameters.

The **RAM** is used for working data such as instantaneous values of speed and current as well as pointers and vectors used in the general housekeeping of the Microcontroller. The working parameters and configuration data is stored in the RAM and used from this location during normal operation. The working parameters are loaded from the EEPROM during normal power-up sequencing and the save operation puts any altered data into the EEPROM for non-volatile storage. The default values stored in the EPROM can be loaded into the RAM by holding the 4 MMI keys depressed during power-up. This operation is normally carried out at the factory but can be performed on site in exceptional circumstances.

The **EEPROM** as previously indicated provides permanent storage for the customers parameters and configuration data. Unlike the RAM the EEPROM is non-volatile, i.e. it retains data after power down, the EPROM is also non-volatile but cannot be written under normal circumstances.

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6.1.3 Peripherals

There are three peripheral integrated circuits which perform complex functions on behalf of the Microcontroller. They are:-

a) the firing gate array
b) the LCD display driver
c) the UART or Universal Aysychronous Receiver and Transmitter

The firing gate array is a custom integrated circuit which determines which Thyristors are to be firing in master or slave stack according to instructions from the Microcontroller. The firing gate array also controls the field bridge.

The LCD display driver as the name implies receives data from the Microcontroller and displays this information. The driver will maintain the data on display until given new information, the Microcontroller is thus relieved of the complex task of multiplexing the LCD segments.

The UART controls the flow of data down the two primary serial data lines ports P1 and P2. The Microcontroller instructs the UART to send data at a specific data rate and the UART converts the data to serial link format adding any additional information as required by the protocol. Similarly incoming data is converted from serial to parallel data and the Microcontroller flagged that data has arrived.

The UART also has a number of Parallel Port pins which are connected to incoming digital data such as the heatsink overtemperature trip, the Microcontroller reads the data from the UART much as it would read a memory location.

6.1.4 Signal Scaling and Conditioning

All the incoming signals analogue or digital are scaled to w[illegible] the operating limits of the Microcontroller by means of external circuitry. In the case of digital inputs the input signal levels are within strict limits and the scaling can be fixed. Similarly analogue inputs such as speed setpoint are within known and controlled limits and have fixed scaling. There are, however, a number of signals which can vary over a wide range, these signals are:-

a) Armature current
b) Analog tacho (Speed Feedback)
c) Field current
d) Armature voltage
e) Field voltage

These parameters are scaled by means of external calibration resistors which are calculated according to the use of the controller.

The equations required to calculate the calibration resistors is given in the Setting-Up Instructions at Section 8.

Output signals digital or analogue are buffered and scaled by external circuitry to normalised levels, which are compatible with these for the digital and analogue input signals.

6.1.5 Power Supplies

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.

6.1.6 Coding

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 500 Vac, 500 Vac to 660 Vac with 220/500 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.

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6.2 POWER CIRCUITS

6.2.1 Armature Bridge

The armature is controlled by either
a) 4 Quad six pulse thyristor bridge which is fully regenerative
b) 2 Quad six pulse thyristor bridge which non-regenerative.

In the case of the 2 Quad thyristor bridge, six thyristors are provided in 3 modules thus forming a full wave bridge. Each thyristor is controlled independently from the firing gate array with pulse transformers for voltage isolation. The bridge has two forms of suppression, a RC network to limit the rate of rise of volts across the thyristor thus reducing the possibility of false triggering, and a VDR or voltage dependent resistor to keep the maximum applied voltage within the limits of the thyristor rating.

The 4 Quad thyristor bridge has an additional bridge in reverse parallel of the same configuration as the 2 Quad stack to provide the regenerative capability and the possibility of reverse operation. No additional suppression is provided since thyristors in the two bridges are in reverse parallel.

The armature bridge is not fitted with any protection by semi-conductor fuses, these should be provided externally. The bridge is electronically protected from overload conditions by the control circuits but the fuses should be provided for back-up protection.

6.2.2 Field Bridge

The field is normally produced by a half controlled thyristor regulator, which can control the field by two methods. Either a simple phase angle control where the output is effectively a variable voltage source or by closed loop current control. The phase angle control gives a simple mechanism by which the field regulator can be made to operate like a field rectifier. By fixing the firing angle a full wave, half wave or 3-phase half wave bridge arrangement can be simulated.

Current control allows the field current to be precisely regulated thus preventing variation in current with mains voltage variation. Current control must be used if the controller is also intended to provide an extended speed operating range via field weakening.

Voltage control is a simple method for producing field control but suffers from the possibility of overfluxing the motor thus preventing operation of the motor at maximum speed.

6.2.3 Feedback

The controller gives closed loop control of all the parameters required by the motor. Since these parameters are controlled feedback must be provided to the controller. The primary form of feedback is armature current, this is achieved by means of 3 ac current transformers monitoring the phase currents to the thyristor bridge. The ac feedback is rectified and fitted with a selected burden to give the desired current level.

Speed feedback is provided by either:-

a) a dc tachogenerator
b) a microtach/encoder
c) armature voltage

The dc tachogenerator, microtach and encoder are external items fitted to the dc machine, within the controller there is a mechanism to scale the speed feedback. Armature voltage feedback used for speed control and field weakening is an internal circuit which provides an isolated signal via a precision high impedance potential divider chain into standard amplifier circuitry.

The field also has two feedback paths current and volts, current is again a current transformer monitoring ac supply current and volts a similar potential divider chain to the armature voltage sensing.

All forms of feedback have internal calibration resistors mounted on the calibration board to allow scaling of these signals to the required user levels.

6.2.4 Auxiliary Supply and Main Contactor

The controller power supplies are derived from an ac auxiliary supply input which generates low voltage supplies via a transformer rectifier arrangement. The auxiliary supply must be powered at all times when control action is required, no additional switches should be fitted between incoming ac and the auxiliary supply terminals.

The controller needs a power contactor, dc or ac, in series with the main power path to ensure correct power-up sequencing. This contactor is directly initiated by the Microcontroller via an isolating relay, the isolating relay drives the contactor coil with the same voltage as that of the auxiliary supply.

No additional contacts should be connected in series with the contactor coil as this may cause controller sequencing problems. If a dc contactor is used, an ancillary contact of the dc contactor should be connected into the "enable" input to ensure correct sequencing.

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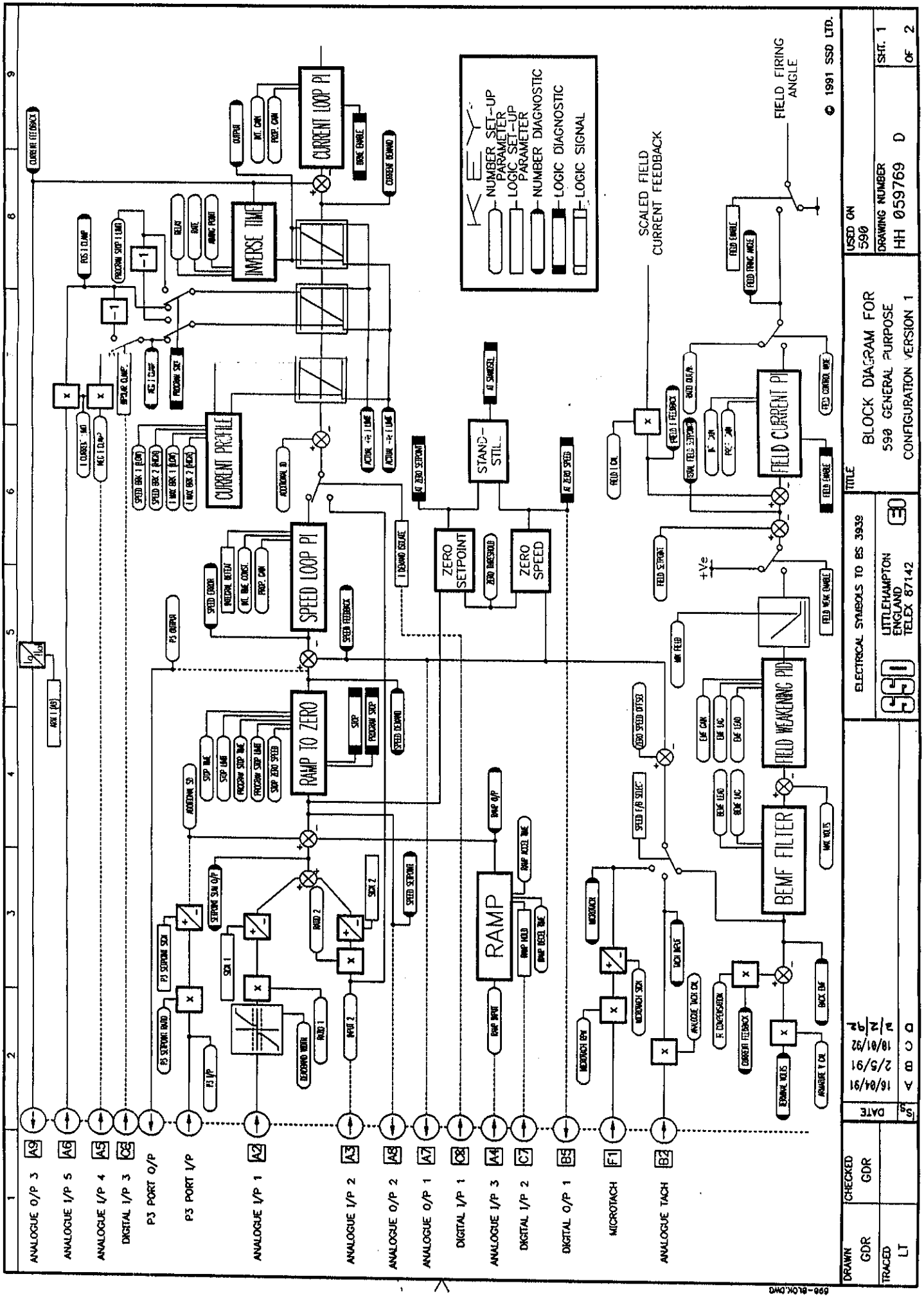

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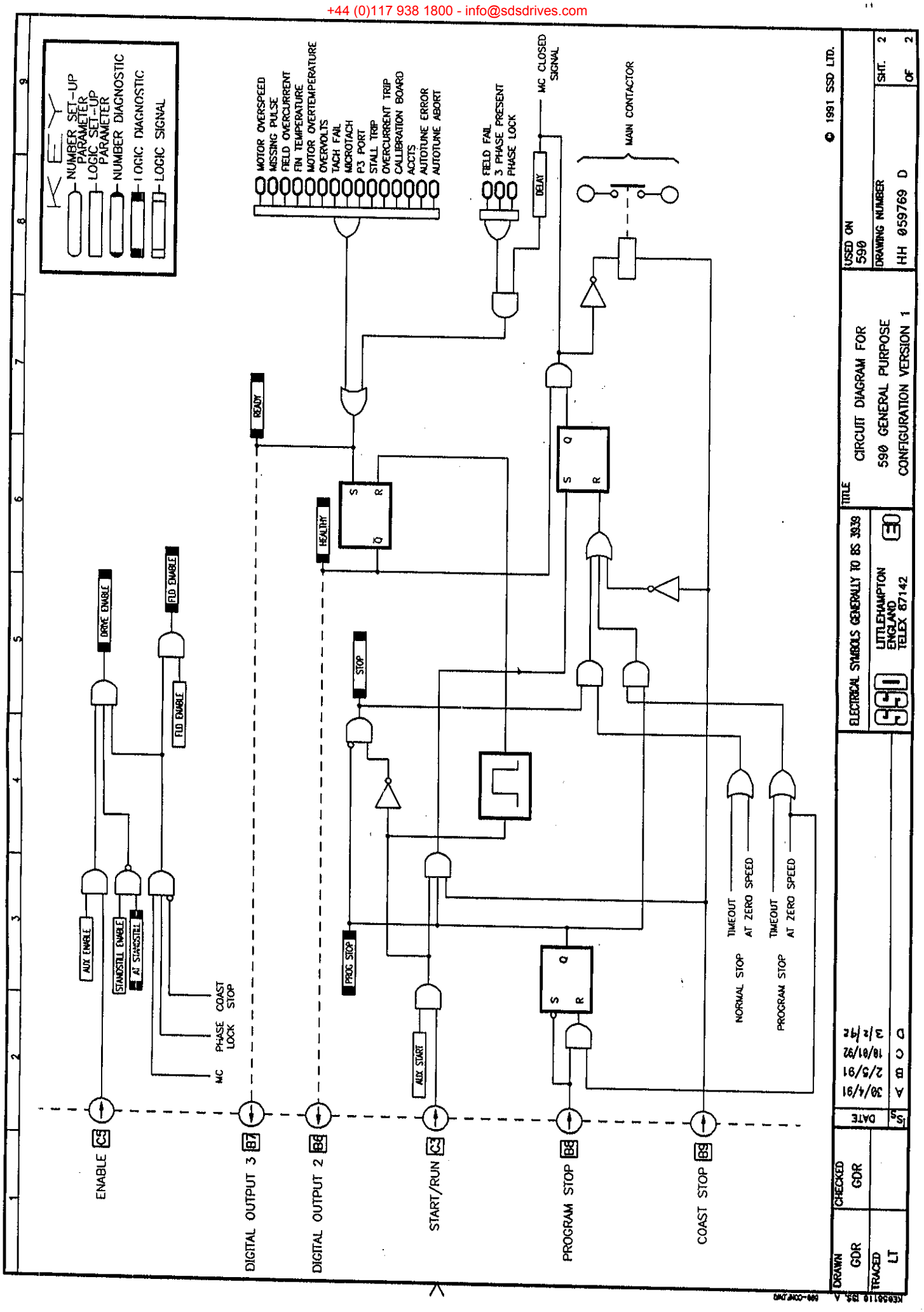

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8 BASIC SETTING UP AND OPERATING INSTRUCTIONS

A. INSTALLATION CHECK LIST:

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 all 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: (If Analogue Tachogenerator Used)

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

R6 + R7 = (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.

When maximum values of R6 and R7 are fitted giving 200v on terminal B2 i.e. R6 = 120K, R7 = 68K.

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

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Armature Voltage 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.

$$R8+R9=\frac{(\text{Armature Volts-100})}{10}\text{KOhms}$$

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 scaled for the motor at rated volts even if armature voltage feedback is not used. The speed feedback alarm is based upon speed feedback and armature voltage signals.

Microtach/Encoder 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.

The scaling does however assume a 1000 lines per revolution encoder if an alternate part is supplied the appropriate set-up parameter (ENCODER LINES) must be amended.

Armature Current Calibration

The armature current is scaled by the parallel resistor network consisting of resistors R1, R2, R3, R4 and R5. 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.

$$\frac{1}{RA}=\frac{1}{R1}+\frac{1}{R2}+\frac{1}{R3}+\frac{1}{R4}+\frac{1}{R5}$$

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 field control mode is selected to "current".

The field current is scaled by the parallel resistor network consisting of Resistors R10 and R11. 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 R10 and R11 can be verified from the formula:-

$$RF=\frac{R10\times R11}{R10+R11}$$

When the field is in voltage control mode the resistor value is selected on the basis of a notional field current of 200mA.

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

Note:- When an external stack controller is used the field current calibration resistor is calculated from the formula:-

$$RF=\frac{4000}{\text{Full Field Current}}\text{Ohms}$$

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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 590 DC DRIVE
   ISS X.XX

   Where X.XX is a numeric code representing the software issue and release.

   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.

   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 "Speed Setpoint" and is also output at terminal A8.

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") should go positive.

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

   Also check "Speed Feedback" diagnostic for a positive reading.

   If there is no feedback signal from the "Microtach" verify that all 3 LED's are illuminated. If one or more of these LED's is extinguished check that 24v is applied to the Microtach and all ancillary products and that the fibre optic transmission length is not exceeded.

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.

   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 10.12.

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CHECK LIST

SOFTWARE RELEASE 1

SUB MENU	DISPLAY	SOFTWARE SETTINGS[1]	FACTORY SETTING[2]	FINAL SETTING[3]
RAMPS	RAMP ACCEL TIME	10.0 SECS		
	RAMP DECEL TIME	10.0 SECS		
	MINIMUM SPEED	0.00%		
	RAMP HOLD	*		
	RAMP MODE	LINEAR		
	RAMP INPUT			
AUX I/O [4]	AUX START	ON		
	AUX ENABLE	ON		
	DIGOUT 1	OFF		
	DIGOUT 2	OFF		
	DIGOUT 3	OFF		
	ANOUT 1	0.00%		
	ANOUT 2	0.00%		
FIELD CONTROL	FIELD ENABLE	ENABLED		
	FLD CTRL MODE IS	VOLTAGE CONTROL		
FIELD VOLTAGE VARS	RATIO OUT/IN	90.0%		
FIELD CURRENT VARIABLES	SETPOINT	100.00%		
	PROP. GAIN	0.10		
	INT. GAIN	1.28		
FIELD WEAK VARIABLES	FLD. WEAK ENABLE	DISABLED		
	EMF LEAD	2.00		
	EMF LAG	40.00		
	EMF GAIN	0.30		
	MIN FLD CURRENT	10.00%		
	MAX VOLTS	100.00%		
	BEMF FBK LEAD	100		
	BEMF FBK LAG	100		
FIELD QUENCH CONTROLS	FLD QUENCH DELAY	10.0 SECS		
	FLD QUENCH MODE	QUENCH		
CURRENT PROFILE	SPEED BRK 1	100.0%		
	SPEED BRK 2	100.0%		
	IMAX BRK 1	200.0%		
	IMAX BRK 2	200.0%		
INVERSE TIME	OUTPUT	200.00%		
	DELAY	10.0 SEC		
	RATE	60.0 SEC		
	AIMING POINT	110%		
STOP RATES	STOP TIME	10 SECS		
	STOP LIMIT	60.0 SECS		
	PROGRAM STOP TIME	0.1 SECS		
	PROGRAM STOP LIMIT	60.0 SECS		
	PROGRAM STOP I LIM	100.00%		
	STOP ZERO SPEED	2.00%		
CALIBRATION	ARMATURE V CAL	1.0000%		
	IR COMPENSATION	0.00%		
	MICROTACH RPM	1000 RPM		
	ANALOGUE TACH CAL	1.0000		
	ENCODER LINES	1000		
	ARMATURE I (A9)	BIPOLAR		
	SPD FBK ALM LEVEL	50.0%		
	FIELD I CAL.	1.0000		

Continued over/...

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SUB MENU	DISPLAY	SOFTWARE SETTINGS[1]	FACTORY SETTING[2]	FINAL SETTING[3]
INHIBIT ALARMS	FIELD FAIL	ENABLED		
	5703 RCV ERROR	ENABLED		
	STALL TRIP	INHIBITED		
	SPEED FBK ALARM	ENABLED		
	MICROTACH ALARM	INHIBITED		
CURRENT LOOP	CURRENT LIMIT	100.00%		
	P GAIN	45.00		
	I GAIN	3.50		
	AUTOTUNE	OFF		
	FEED FORWARD	2.00		
	DIS/CONTINUOUS	12.00%		
	ADDITIONAL DEM	0.00%		
	BIPOLAR CLAMPS	DISABLED		
	REGEN MODE	ENABLED		
	NEG I CLAMP	*		
	IDEM ISOLATE	DISABLED		
SPEED LOOP	PROP GAIN	20.00		
	INT. TIME CONST.	1000 msec		
	ZERO SPD. OFFSET	0.00%		
	ADDITIONAL DEM	0.00%		
	INT. DEFEAT	OFF		
	MICROTACH SIGN	POSITIVE		
	SPEED FBK SELECT	ARM VOLTS FBK		
STANDSTILL	STANDSTILL LOGIC	DISABLED		
	ZERO THRESHOLD	1.00%		
RATIOS	RATIO 1	1.0000		
	RATIO 2	1.0000		
	SIGN 1	POSITIVE		
	SIGN 2	POSITIVE		
	DEADBAND WIDTH	0.0%		
	INPUT 2	*		

[1] The software settings are a series of values carried in the 590 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, and should reflect the calibration as required by the product code.

[3] The final settings are those set by the user to optimise system performance.

[4] Auxiliary I/O are additional Input/Output Locations (Tags) which can be activated by either the Serial Communications, Reconfigured Inputs or Outputs, or the MMI. Since they can be changed via the MMI they are displayed in the Set-up Parameters Sub Menu.

* These parameters are connected by the default configuration to terminals. If the terminals are re-configured to other locations or tags these parameters can be controlled from the serial link or the MMI and are hence in the Set-up Parameters Sub-Menu.

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7. Check that the "Coast Stop" B9 and "Program Stop" B8 are true.

Apply the "Start/Run" command to C3.

The main 3 phase contactor should pull-in and remain energised.

Remove the "Start/Run" command from C3.

The main 3 phase contactor should drop-out and remain de-energised.

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 or zero volts on "Current Clamp I/P" A6.

13. Initiate "Start/Run" and check that 3-phase mains is applied to L1, L2 and L3. Initiate "Enable" C5 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.

If the field voltage is not correct then make the following checks:-

13.1 Internally supplied field.

a) Check that 3-phase is applied to terminals L1, L2 and L3 when main contactor closed.

b) Check that the 3 coding fuses are healthy.

c) Is the Field Regulator "Enabled" in Set-Up Parameters?.

d) Is it set to voltage or current control?
If voltage control check "Ratio" parameter.
If current control check calibration resistor.

e) Is the field volts maximum in current control then check field continuity.

Note: If the regulator is in current control mode, the field volts will initially be lower than the rated value due to a cold field.

13.2 Externally supplied field.

a) Check the voltage applied to terminals D1 and D2.

b) Check the phasing of voltage applied to D1 and D2. D1 must be connected directly or indirectly to the Red phase on main power terminal L1. D2 must be connected directly or indirectly to the Yellow phase on main power terminal L2.

c) Check Set-Up Parameters as detailed for internally supplied field.

d) Check that 3-phase is applied to terminals L1, L2 and L3.

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.

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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.

16.1 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.

16.2 MICROTACH/Encoder:-

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.

17.1 Analogue Tachogenerator:-

Reverse both field and tachogenerator connections.

17.2 MICROTACH/Encoder:-

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.

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 Speed Offset" parameter.

(a) 4 Quadrant, Non-reversing drives.

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

(b) 2 Quadrant, Non-reversing drives.

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

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(c) 4 Quadrant, Reversing drives.

Set the Zero Speed 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/Encoder 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.

24. For reversing drives. Check maximum reverse speed. Imbalance in reversing drives can only be corrected by adjusting the Zero Speed 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:-

a) If the motor is overloaded the controller will reduce the current to 110% of the current limit setting. If the motor continues to rotate it may overheat and thermal protection should be provided.

b) If the motor is overloaded and the current provided by the controller is not enough to maintain rotation i.e. it is stalled, the controller will trip out showing "Stall Trip" alarm.

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 10.7 Optimum performance of the controller cannot be expected unless the Autotune function has been performed with each individual controller motor combination. A badly turned current loop may lead to high current transients and subsequently an overcurrent trip alarm.

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/Encoder feedback then speed response can be monitored by observing speed feedback on terminal A7 of the controller.

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9 FRONT PANEL INDICATORS & MONITOR POINTS

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) Fin over-temperature (controller heatsink)
g) Phase locked loop synch (45-65Hz)
h) Missing current pulse
i) Armature current feedback
j) Calibration board installed
k) Tach fail/speed feedback fault
l) Microtach fail (fibre optic feedback)
m) Motor overspeed
n) Field Overcurrent
o) Motor overvolts
p) P3 Port
q) Stall Trip

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).

To Reset Health:
1) power up or remove and re-apply auxiliary supply
or 2) re-start (stop-then start) i.e. remove the Start/Run signal C3 and re-apply

[the removal of the Start/Run Signal resets the system, applying the Start/Run Signal clears the display]

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.

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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.

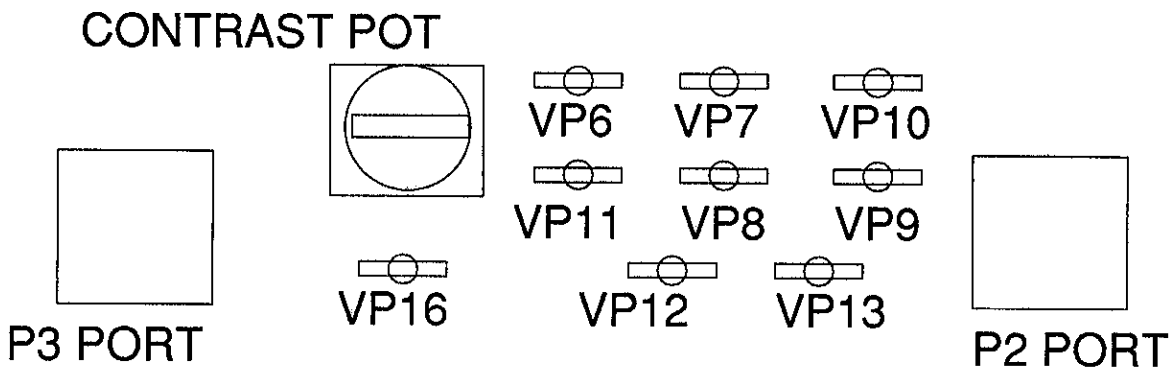
Off: Armature current has exceeded 300% full load. In this condition the over current alarm is set, the drive becomes "unhealthy" and the start contactor will be automatically tripped. The display will also show an alarm condition. The entire system must be checked thoroughly for the cause of failure.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

MONITOR POINT DEFINITION



VP6	TP1	Armature current +/- 2.2 V = +/- 200%
VP7	TP2	Buffered analogue tach +/- 10 V = +/- 100%
VP8	TP5	Field volts
VP9	TP6	Overcurrent trip 15 V to 0 V transition on a trip
VP10	TP3	Armature volts
VP11	TP4	Field current
VP12	TP7	Peek software Internal diagnostic for SSD use
VP13	TP8	Reserved for future use
VP16	0V	0 V

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10 MAN MACHINE INTERFACE (MMI)

10.1 OVERVIEW

DISPLAY

Featured on all 590 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.
(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.

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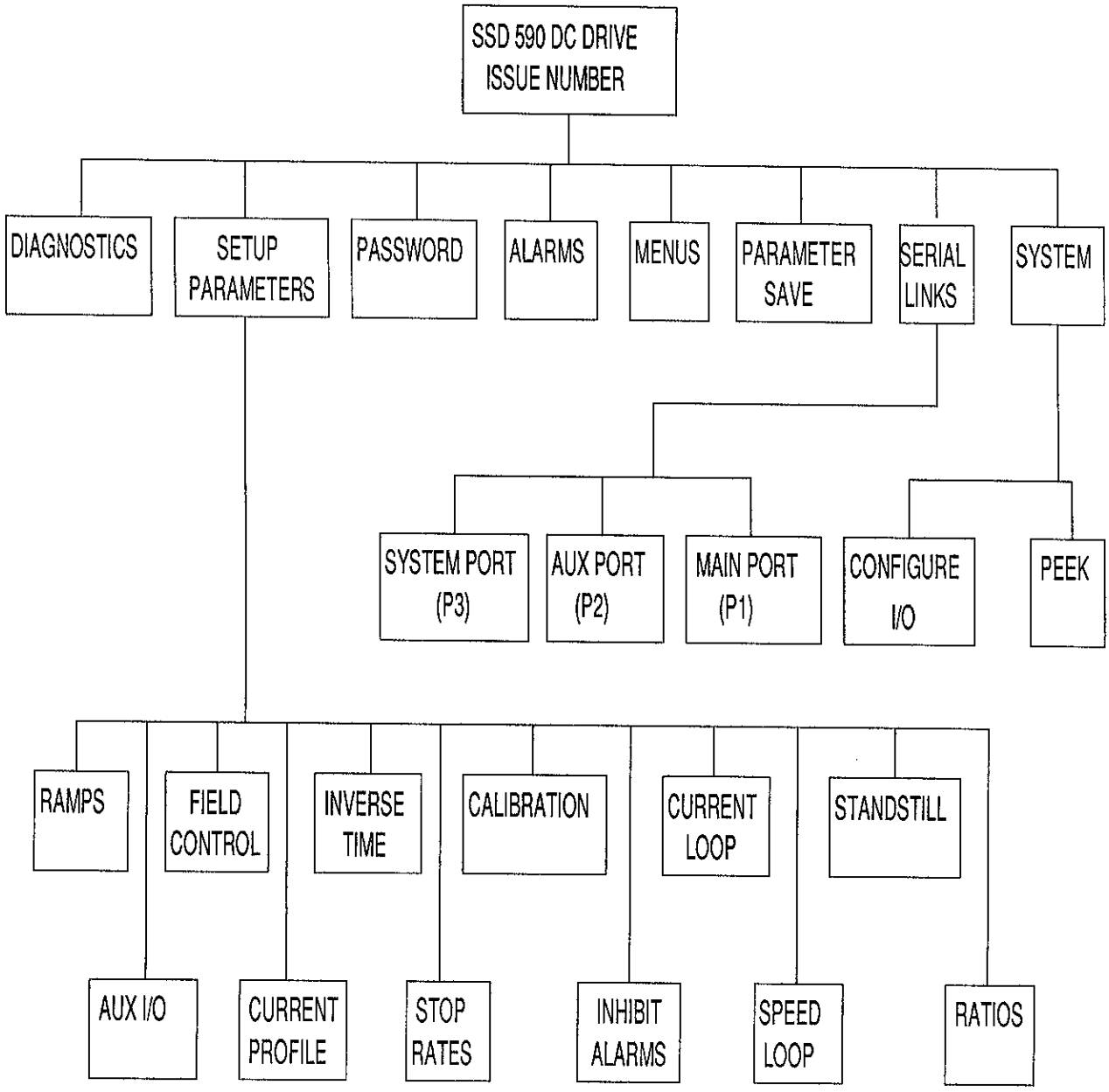
10.2 THE MENU TREE STRUCTURE

The menu tree structure employed in all 590 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 seven 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 590 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.



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10.3 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:-

"SPEED DEMAND"
"+76.0 %" (for example)

The top line now contains information about:-

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

The bottom line displays the value and units.

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

Display at value level is the lowest level of the menu system, operation of the "E" key will move pointer back up to the higher menu levels.

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10.4 DIAGNOSTIC DESCRIPTIONS

DIAGNOSTIC POINT	TAG	DESCRIPTION	SCALING
SPEED DEMAND	89	SPEED LOOP TOTAL SETPOINT	± 100%
SPEED FEEDBACK	62	SPEED LOOP FEEDBACK	± 100%
SPEED ERROR	64	SPEED LOOP ERROR	± 100%
CURRENT DEMAND	66	CURRENT LOOP CURRENT DEMAND (SPEED ERROR PI OUTPUT OR EXTERNAL CURRENT DEMAND CLAMPED BY ALL LIMITS)	± 200%
CURRENT FEEDBACK	65	SCALED ARMATURE CURRENT	± 200%
POS I CLAMP	87	POSITIVE CURRENT CLAMP	± 200%
NEG I CLAMP	88	NEGATIVE CURRENT CLAMP	± 200%
ACTUAL POS I LIM	67	OVERALL POSITIVE CURRENT LIMIT VALUE	± 200%
ACTUAL NEG I LIM	61	OVERALL NEGATIVE CURRENT LIMIT VALUE	± 200%
CURRENT LIMITED	42	CURRENT DEMAND RESTRAINED BY OVERALL CURRENT LIMIT	TRUE/FALSE
AT ZERO SPEED	77	AT ZERO SPEED FEEDBACK	TRUE/FALSE
AT ZERO SETPOINT	78	AT ZERO SPEED SETPOINT	TRUE/FALSE
AT STANDSTILL	79	AT STANDSTILL, i.e. AT ZERO SPEED AND ZERO SPEED SETPOINT	TRUE/FALSE
STALL TRIP	112	MOTOR CURRENT LIMITED AND AT ZERO SPEED	OK
PROGRAM STOP	80	PROGRAM STOP INPUT WHEN OFF PROGRAM STOP SEQUENCE IS ENABLED	TRUE/FALSE
DRIVE START	82	CONTROLLER START/RUN COMMAND	ON/OFF
DRIVE ENABLE	84	DRIVE CONTROL LOOP ENABLE	ENABLED/ DISABLED
FIELD ENABLE	169	DRIVE FIELD LOOP ENABLE	ENABLED/ DISABLED
FIELD DEMAND	183	FIELD CURRENT DEMAND	0 to +100%
FIELD I FBK	181	SCALED FIELD CURRENT FEEDBACK	0 to 100%
FLD FIRING ANGLE	184	CURRENT VALUE OF FIELD FIRING ANGLE	0 to 180^0
ANIN 1 [A2]	50	SPEED SETPOINT No. 1	± 10V
ANIN 2 [A3]	51	SPEED SETPOINT No. 2/CURRENT DEMAND *	± 10V
ANIN 3 [A4]	52	RAMPED SPEED SETPOINT *	± 10V
ANIN 4 [A5]	53	NEGATIVE CURRENT CLAMP *	± 10V
ANIN 5 [A6]	54	EXTERNAL CURRENT LIMIT/POSITIVE CURRENT CLAMP *	± 10V

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Continued/...

DIAGNOSTIC POINT	TAG	DESCRIPTION	SCALING
ANOUT 1 [A7]	55	SPEED SPEEDBACK *	± 10V
ANOUT 2 [A8]	56	TOTAL SPEED SETPOINT *	± 10V
START [C3]	68	START/RUN INPUT	ON/OFF
RESERVED [C4]	69	NO FUNCTION	OFF
ENABLE [C5]	70	ELECTRONIC ENABLE INPUT	ON/OFF
DIGIN 1 [C6]	71	CONFIGURATION INPUT No. 1 * SINGLE CURRENT CLAMP/BIPOLAR CURRENT CLAMPS	ON/OFF
DIGIN 2 [C7]	72	RAMP HOLD INPUT *	ON/OFF
DIGIN 3 [C8]	73	CONFIGURATION INPUT No. 2 * CURRENT DEMAND ISOLATE, GIVING SPEED OR CURRENT OPERATION	ON/OFF
DIGOUT 1 [B5]	74	AT ZERO SPEED *	ON/OFF
DIGOUT 2 [B6]	75	DRIVE HEALTHY (DRIVE OPERATIONAL) *	ON/OFF
DIGOUT 3 [B7]	76	READY * DRIVE READY TO RUN ALL ALARMS HEALTHY	ON/OFF
SETPOINT SUM OP	86	SETPOINT SUBTOTAL OF DIRECT INPUTS	± 100%
RAMP OUTPUT	85	SETPOINT RAMP OUTPUT	± 100%
SPEED SETPOINT	63	SPEED LOOP TOTAL SETPOINT INC. RAMP	± 100%
TERMINAL VOLTS	57	SCALED TERMINAL VOLTS	± 100%
BACK EMF	60	CALCULATED MOTOR BACK EMF	± 100%
TACH INPUT [B2]	58	SCALED ANALOGUE TACHOGENERATOR FEEDBACK	± 100%
MICROTACH	59	MICROTACH SPEED FEEDBACK (DIRECT READING OF MOTOR SPEED ASSUMING STANDARD MICROTACH SCALING 1000PPR)	± 3000RPM

* Notes:- The function indicated under description is the default function of the software, actual function is determined by the setting of the source tag selection in the configuration menu.

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10.5 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 ACCEL TIME"

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

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

"RAMP ACCEL 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; and the "E" key returns to the Submenu for selection of another variable.

NOTE: TAGS

It is not possible to modify setup parameters that are connected to analog and digital inputs, these parameters will change if the input changes.

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10.6 SET-UP PARAMETER DESCRIPTIONS

PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	TAG
	RAMPS			
RAMP ACCEL TIME	ACCELERATION TIME	0.1-600	10.0 seconds	2
RAMP DECEL TIME	DECELERATION TIME	0.1-600	10.0 seconds	3
MIN SPEED	MINIMUM SPEED OFFSET	± 100%	0.00%	126
RAMP HOLD	RAMP HOLD TAG	ON/OFF	—	118
RAMP MODE	RAMP MODE		LINEAR	46
RAMP INPUT	RAMP INPUT TAG	± 100%	—	5
	AUX I/O *			
AUX START	SOFTWARE START/RUN COMMAND	ON/OFF	ON	161
AUX ENABLE	SOFTWARE ENABLE COMMAND	ON/OFF	ON	168
AUX DIG OUTPUT 1	SOFTWARE DIGITAL TAG NO. 1	ON/OFF	OFF	94
AUX DIG OUTPUT 2	SOFTWARE DIGITAL TAG NO. 2	ON/OFF	OFF	95
AUX DIG OUTPUT 3	SOFTWARE DIGITAL TAG NO. 3	ON/OFF	OFF	96
AUX ANOUT 1	SOFTWARE ANALOGUE TAG NO. 1	± 100%	0.00%	128
AUX ANOUT 2	SOFTWARE ANALOGUE TAG NO. 2	± 100%	0.00%	129
	FIELD CONTROL			
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/ DISABLED	ENABLED	170
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	209
	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	210

* Notes:- The auxiliary I/O are parameters which can be controlled either via the serial communications or by reconfiguration of other internal parameters. In the case of auxiliary command signals "auxiliary start" and "auxiliary enable" the input will be the result of the "And" of the normal signal with the auxiliary signal.

The software digital and analogue tags are internal memory locations which can be attached by configuration to the digital or analogue output and controlled by the serial communications or the MMI.

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PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	TAG
	FIELD CONTROL/Continued...			
	FIELD CURRENT VARIABLES			
SETPOINT	Field current setpoint.	0 - 100%	100%	171
PROP. GAIN	This is the proportional gain adjustment of the field PI loop.	0.00-5.00	0.10	173
INT. 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	1.28	172
	FIELD WEAK VARIABLES			
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.	ENABLED/ DISABLED	DISABLED	174
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	175
EMF LAG	This is the integral adjustment of the field weakening PID loop.	1.00-100.00	40.00	176
EMF GAIN	This is the gain adjustment of the field weakening PID loop.	0.00-5.00	0.30	177
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%	179
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%	178
BEMF FBK LEAD		10 - 5000	100	191
BEMF FBK LAG		10 - 5000	100	192
	FIELD QUENCH CONTROLS			
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.	0.1-600 seconds	10.0 seconds	185
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/ STANDBY	QUENCH	186
	CURRENT PROFILE			
SPEED BREAK 1 (LOW)	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%	32

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PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	TAG
	CURRENT PROFILE/Continued			
SPEED BREAK 2 (HIGH)	Speed break 2 is the upper speed limit at which current profiling ends.	0-100%	100%	31
IMAX BREAK 1 (LOW)	This sets the current limit value at or below speed break point 1, provided other limits are greater than its setting.	0-200%	200%	93
IMAX BREAK 2 (HIGH)	This sets the current limit value at or above speed break point 2.	0-200%	200%	33
	INVERSE TIME			
OUTPUT *	Overload Limit.	0-200%	200%	203
DELAY	Time at Current Limit.		10 seconds	199
RATE			60 seconds	200
AIMING POINT	Final Overload Limit Level.	0 to 200%	110%	204
	STOP RATES			
STOP TIME	Time to reach zero speed from 100% set speed in normal stop mode.	0.1-600 seconds	10 seconds	27
STOP LIMIT	Delay time limit to allow normal stop action before drive quench and coast stop.	0-600 seconds	60 seconds	217
PROG STOP TIME	Time to reach zero speed from 100% set speed in program stop mode.	0.1-600 seconds	0.1 secs	26
PROG STOP LIMIT	Delay time limit to allow program stop action before drive quench and coast stop.	0-600 seconds	60 secs	216
PROG STOP I LIM	Current limit level in program stop mode provided other limits are set higher.	0-200%	100.00%	91
STOP ZERO SPEED	Zero speed level in program stop + normal stop mode at which contactor is de-energised and the drive quenched.	0.00-10.00%	2%	29
	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.	0.9500 to 1.1000	1.0000	20
IR COMPENSATION	Compensation for motor IR drop to improve regulation when using armature voltage feedback for speed control.	0-100%	0.00%	21
MICROTACH RPM	Motor top speed setting when using the 5701 microtach unit for speed feedback.	0-3000 RPM	1000 RPM	22
ANALOG TACH CAL	Trim adjustment of the motor speed at 100% speed demand. Note:- Primary tacho calibration is achieved by the selection of resistors R4 and R5 on the calibration board.	0.9800 to 1.1000	1.0000	23

* Diagnostic Parameter only.

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PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	TAG
	CALIBRATION /Continued ...			
ENCODER LINES	The SSD Microtach has 1000 lines per revolution as standard, proprietary encoders of other specifications can be normalised by setting this parameter as appropriate.	10 TO 5000	1000	24
ARMATURE I (A9)	Sets operation of current meter output, either bipolar or unipolar.	UNIPOLAR/ POLAR	BIPOLAR	25
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%	180
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.	0.9500 to 1.1000	1.0000	182
	INHIBIT ALARMS			
FIELD FAIL	Minimum field current level alarm.	ENABLED/ INHIBITED	ENABLED	19
5703 RCV ERROR	5703 Serial communications receive error.	ENABLED/ INHIBITED	ENABLED	111
STALL TRIP	Motor stalled alarm.	ENABLED/ INHIBITED	INHIBITED	28
SPEED FBK ALARM	Speed feedback alarm.	ENABLED/ INHIBITED	ENABLED	81
MICROTACH ALARM	Microtach option board alarm.	ENABLED/ INHIBITED	ENABLED	92
	CURRENT LOOP			
CURRENT LIMIT	Internal main current limit parameter.	0.00-200.00%	100.00%	15
PROP GAIN	Proportional gain control for armature current PI loop. This parameter is normally set during the autotune function.	1.00-100.00	45.00	16
INT GAIN	Integral gain control for armature current PI loop. This parameter is normally set during the autotune function.	0.10-50.00	3.50	17
AUTOTUNE	Initiating control for current loop autotune adjustment. (See description at the end of table)	—	OFF	18
FEED FORWARD	Autotune control parameter. Set by autotune algorithm. Do not adjust independently.	0.10-50.00	2.00	136
DIS/CONTINUOUS	Autotune control parameter. Set by autotune algorithm. Do not adjust independently.	0.00-200.00%	12.00%	137
ADDITIONAL DEM	Additional Current Demand Input.	± 200%	0.00%	30
BIPOLAR CLAMPS	Select Bipolar/Unipolar Clamps.	ENABLED/ DISABLED	DISABLED	90
REGEN MODE	Single ended or Regen Stack.	ENABLED/ DISABLED	ENABLED	201
NEG I CLAMP	Negative clamp in Bipolar Clamp Mode.	+ 200%	—	48
IDEM ISOLATE	Speed Demand or Current Demand.	ENABLED/ DISABLED	DISABLED	119

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PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	TAG
	SPEED LOOP			
PROP. GAIN	Speed loop PI proportional gain adjustment.	0-200	20.00	14
INT. TIME CONST.	Speed loop PI integral gain adjustment.	1-6000 msec	1000 msec	13
ZERO SPEED OFFSET	Zero motor speed for zero setpoint input trim adjustment.	± 5.00%	0.00%	10
ADDITIONAL DEM	Additional Speed Demand.	± 100.00%	0.00%	41
INT. DEFEAT	Inhibits the integral part of the speed loop PI control to give proportional gain only speed control.	ON/OFF	OFF	202
MICROTACH SIGN	Since the microtach feedback cannot be reversed electrically, the signal polarity must be reversed by the control software.	POSITIVE/ NEGATIVE	POSITIVE	49
SPEED FBK SELECT	Three options are available:- i) Armature voltage feedback ii) Analogue tachogenerator feedback iii) Microtach feedback.	ARMATURE VOLTS/ ANALOG TACH/ MICROTACH	ARM VOLTS FBK	47
	STANDSTILL			
STANDSTILL LOGIC	Standstill Logic inhibites the controller at zero setpoint and zero speed, i.e. standstill.	ENABLED/ DISABLED	DISABLED	11
ZERO THRESHOLD	Signal Level which determines zero setpoint, zero speed threshold and zero speed relay output [BS]	0.00-5.00%	1.00%	12
	RATIOS			
RATIO 1	Speed Input 1 Scaling	± 3.0000	1.0000	6
RATIO 2	Speed Input 2 Scaling	± 3.0000	1.0000	7
SIGN 1	Speed Input 1 Polarity	POS-NEG	POSITIVE	8
SIGN 2	Speed Input 2 Polarity	POS-NEG	POSITIVE	9
DEADBAND WIDTH	Analogue Input 2 Deadband	0.0 to 100.0%	0.0%	131
INPUT 2	Analogue Input 2	± 100.00%	——	101

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10.7 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.

10.7.1 If there is field current in the motor Auto-Tune cannot be satisfactorily activated at any time, this can be overcome in two 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 a field regulator no action need be taken provided the correct sequence is operated from the stop condition.

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

10.7.2 Initial Conditions:-

(a) Main Contactor open, no "START/RUN" signal on C3.
(b) Auto-Tune flag OFF.
(c) Controller Disabled at terminal C5.
(d) Program Stop [B8] and Coast Stop [B9] inputs true.

Note: (i) The motor shaft may require to be clamped to prevent rotation during the autotune operation.

(ii) When using a permanent magnet motor the shaft must be clamped.

10.7.3 Sequence:-

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

10.7.4 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) Discontinuous
4) Feed Forward

Parameters 3 and 4 give optimum performance of the loops but should not be adjusted 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.

10.7.5 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. Removal of the START/RUN or ENABLE commands will stop the controller action immediately in both cases the main-contactor is opened.

10.7.6 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.

10.7.7 Restore field connections if disconnected and remove mechanical clamp before proceeding further.

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10.8 PASSWORD

In order to ensure security of the Set-Up Parameters and Configuration data the controller is "Password" protected.

The Password Sub-Menu consists of three simple entries:-

a) Enter Password
b) Change Password
c) Clear Password

At Power-up the "Display Password" is automatically cleared to zero. If the "Controller Password" is set to a value which is non zero then the MMI is in a restricted access mode and Set-up values are only displayed and cannot be altered.

If the user goes to the "Enter Password" sub-menu level and changes the "Displayed Password" to the "controller Password" then restricted access is lifted as long as the display value and the controller password coincide.

The user can put the MMI back into restricted access mode by simply going to the "Clear Password" sub-menu level pressing the enter key "E" and the "Displayed value" will be cleared.

In the general access mode with "Displayed Password" and "Controller Password" coincident the "Controller Password" can be changed to any value by use of the "Change Password" sub-menu here the "Controller Password" value can be altered by the up or down keys. On leaving the menu on prompt "Please Remember" draws attention to the fact that the value is changed.

In order to allow immediate access to the controller set-up parameters the default value of "Controller Password" is set to zero hence the "Displayed Value" and the "Controller Password" value coincide at initial power-up.

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10.9 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.

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.

Operation of the "E" key will move the display back to the previous position.

The alarm condition may be reset by opening and closing the main contactor.

The controller alarms are presented below:-

	ALARM	DESCRIPTION	INHIBIT
1.	OVERSPEED	MOTOR OVERSPEED	—
2.	MISSING PULSE	MISSING ARMATURE CURRENT PULSE	—
3.	FIELD OVERCURRENT	MOTOR FIELD OVERCURRENT	—
4.	FIN TEMPERATURE	FIN OVERTEMPERATURE	—
5.	MOTOR TEMPERATURE	MOTOR OVERTEMPERATURE	—
6.	OVERVOLTS	MOTOR OVERVOLTS	—
7.	TACH FAIL	SPEED FEEDBACK FAIL	YES
8.	MICROTACH	MICROTACH SIGNAL FAILURE	YES
9.	FIELD FAIL	FIELD FAIL	YES
10.	3 PHASE PRESENT	3 PHASE SUPPLY PRESENT	—
11.	PHASE LOCK	AC SYNCRONISATION FAILED	—
12.	P3 PORT	P3/5703 RECEIVE ERROR	YES
13.	STALL TRIP	MOTOR STALL STRIP	YES
14.	OVERCURRENT TRIP	ARMATURE OVERCURRENT	—
15.	CAL. BOARD	CAL. BOARD NOT FITTED	—
16.	ACCTS FITTED	ACCTS NOT CONNECTED	—
17.	AUTOTUNE ERROR	AUTOTUNE OPERATIONAL ERROR	—
18.	AUTOTUNE ABORT	AUTOTUNE EXTERNAL ABORT	—

1. A delay of about 60 seconds takes place before the missing pulse alarm is latched into the health logic.
2. The microtach alarm and comms link alarms are disabled automatically when microtach feedback is not selected or the serial link is disabled.

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HEALTH WORD / STORE

BIT	ALARM	VALUE
0	OVERSPEED	1
1	MISSING PULSE	2
2	FIELD OVERCURRENT	4
3	FIN OVERTEMPERATURE	8
4	MOTOR OVERTEMPERATURE	1Ø
5	MOTOR OVERVOLTS	2Ø
6	SPEED FEEDBACK	4Ø
7	MICROTACH FAIL	8Ø
8	FIELD FAIL	1ØØ
9	THREE PHASE	2ØØ
10	PHASE LOCKED LOOP	4ØØ
11	P3 PORT	8ØØ
12	STALL STRIP	1ØØØ
13	OVERCURRENT TRIP	2ØØØ
14	CAL BOARD	4ØØØ
15	ACCTS	8ØØØ

After an alarm has occurred the Health Store shows the first alarm which has occurred and caused the trip condition. The Health Word will show the current status of all the alarms.

Hence if the controller trips on P3 Port alarm the Health Store will show Ø8ØØ while the Health Word will show the Hexadecimal sum of P3 Port alarm and Three Phase alarm, Ø8ØØ and Ø2ØØ which is ØAØØ.

If the controller trips on Motor Overtemperature the Health Store shows ØØ1Ø and the Health Word shows Motor Overtemperature and Three Phase which is Ø21Ø.

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10.10 ALARM DESCRIPTION

General

The following alarm outputs are used to protect the 590 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. 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.

2. Missing 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.

3. Field 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.

4. Fin Temperature Alarm

Higher horsepower versions of the model 590 (above 70 amp bridge rating) are equipped with blowers to force extra cooling air over the heatsink of the product. These 590 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 1A quick blow.

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

5. Motor Temperature 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 (125°c), above this, their resistance rises rapidly to greater than 2000 Ohms. Temperature switches are usually normally closed, opening at about 105°c.

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 590. 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.

6. 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.

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7. Speed Feedback 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.

8. Microtach Alarm

The 590 is designed to accept speed feedback signals from the SSD Microtach. This is a custom digital tachometer which communicates to the 590 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 590 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 operate over the range 5 to 40 meters (15 to 120 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 590.

The SSD Microtach is optional to the 590 Series controller. If the module is not fitted the Microtach alarm is automatically inhibited.

9. Motor Field Fail

If the 590 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 590 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.

10. Three Phase Supply Present

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.

590 Series controllers are available with three supply voltage options:-

1. 110 to 220VAC.
2. 220 to 500VAC.
3. 500 to 660VAC 598/599 (External Stack Only).

The voltage option is specified in the product code which is shown on the rating label. 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.

11. Phase Lock Alarm

The 590 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.

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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.

12. P3 Port Alarm

The P3 serial data port receives and transmits information to other controllers and computers during the receive cycle it checks that the data received is valid. If invalid it raises an alarm.

13. Stall Trip Alarm

A dc motor is not capable of carrying full load current when stationary if the controller is in current limit and the motor is stationary the controller will generate a stall trip alarm.

14. Overcurrent Trip

A hardware current trip is provided on the 590 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 590 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.

15. 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 590 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.

16. ACCTS Present Alarm

The motor armature current is monitored by the 590 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.

17. Autotune Error

The controller will flag an "autotune error" if there is an overcurrent trip fault or if the motor rotates during the autotune activity.

18. Autotune Abort

The controller will abort the autotune function if the enable or start/run terminals are disabled.

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10.11 MENUS

The overall Menu structure for the complete set of sub-menu levels consists of more entries than are required during normal operation. In recognition of this the MMI Menu structure can be put into a reduced Menu mode giving only commonly used diagnostics and set-up parameters.

The reduced Menu structure is invoked by disabling the Full Menu.

The response delay or button delay of the MMI can also be altered. By increasing the number in the "Delay" parameter the MMI response time is increased, by decreasing the parameter the response time is decreased.

10.12 PARAMETER SAVE

Whenever parameters are adjusted or altered to settings other than those previously stored in the non-volatile memory, it is important to save 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. Go to "Parameter Save" Sub Menu.

2. Enter sub-menu with "M" key where the display will show "Up to Action".

3. Press "Up" arrow key and the display changes to "Saving" to indicate that the save activity is progressing.

4. Wait until the Display shows "Finished" before trying to Exit from the routine. Premature exit is prevented by the controller software.

   Parameter save function can be performed when the motor is running.

Note:

If a Parameter Save is performed after running the auto-tune algorithm, 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.

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10.13 SERIAL LINKS

The 590 Controller supports three separate serial communication channels each of which has a separate system function.

These Serial Link Ports are:-

a) The Main Port P1, which enables the Controller to communicate with a Host computer, other controllers and Eurotherm group products.

b) The Auxiliary Port P2, which enables the controller to communicate to auxiliary products such as the 5721 operator station.

c) The P3 Port, which enables the controller to communicate set-up data and configuration data to a support computer system.

The Main Port P1 and Auxiliary Port P2 provide full system support using the Eurotherm Bisynch. Communications protocol. Both ports include hardware which provides balanced line driver and line receiver signal levels although the P1 Port has the advantage of including completely isolated output signals.

The additional P3 Port is not intended for full systems use it is a simple RS232 port giving unbalanced no isolated output signals.

The P3 Port has three functions:-

a) 5703 support giving controller to controller transfer of speed setpoint or speed feedback values.

b) Upload/Download of controller configuration and parameters. *

c) Parameter dump of controller MMI entries to a compatible printer or support computer.

* Not available on Issue 1 software.

SERIAL LINK PARAMETERS

PARAMETER	DESCRIPTION	RANGE	DEFAULT	TAG	
				MAIN PORT P1	AUXILIARY PORT P2
SERIAL LINK ENABLE	ENABLE PORT OPERATION	ENABLE/ DISABLE	DISABLED	146	147
GROUP ID	EUROTHERM PROTOCOL GROUP IDENTITY	0 - 7	00	138	140
UNIT ID	EUROTHERM PROTOCOL UNIT IDENTITY	0 - F (15)	00	139	141
ASCII/BINARY	EUROTHERM PROTOCOL SELECTION OF EITHER ASCII OR BINARY	ASCII/ BINARY	ASCII	148	149
BAUD RATE	SERIAL COMMUNICATIONS TRANSMIT AND RECEIVE DATA RATE	300 - 19200	9600	150	151
ESP SUP. (ASCII)	ESP SUPPORT ENABLE	ENABLE/ DISABLE	DISABLED	152	153
CHANGEBAND (BIN)	CHANGE IN VALUE TO TRIGGER BINARY ENQUIRY POLL UPDATE	0.00% to 100.00%	0.00%	144	145
ERROR REPORT				158	159
PNO.7	CONTROL WORD FOR MULTIPARAMETER POLLING	0 to FFFF	0	142	143

SYSTEM PORT	5703 (P3)			TAG
PARAMETER	DESCRIPTION	RANGE	DEFAULT	SYSTEM PORT
SETPOINT RATIO	INPUT SCALER	0 to 3.0000	0.0000	132
SETPOINT SIGN	INPUT SIGN	POSITIVE/NEGATIVE	POSITIVE	133
5703 INPUT	5703 INPUT DIAGNOSTIC	± 300.00%	—	187
5703 OUTPUT	5703 OUTPUT DIAGNOSTIC	± 300.00%	—	189
5703 MODE	5703 STATUS	DISABLE/MASTER/ SLAVE	DISABLE	130
DUMP MMI → P3	DUMP COMPLETE MMI DATA TO P3 PORT			
P3 BAUD RATE	P3 TRANSMIT/RECEIVE DATA RATE	300 → 19200 57600	9600	198

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10.14 SYSTEM

FUNCTION	DESCRIPTION	RANGE	DEFAULT	TAG
	CONFIGURE I/O			
CONFIGURE ENABLE	PERMIT I/O CONFIGURATION FLAG [1]	ENABLED/ DISABLED	DISABLED	39
	ANALOG INPUTS			
ANIN 1 (A2)				
CALIBRATION	ANALOG INPUT SCALING DETERMINING VALUE ≡ 100%	0.0000 -3.0000	1.0000	230
MAX VALUE	MAXIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	+ 100.00%	231
MIN VALUE	MINIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	- 100.00%	232
ANIN 2 (A3)				
CALIBRATION	ANALOG INPUT SCALING DETERMINE VALUE = 100%	0.0000 -3.0000	1.0000	233
MAX VALUE	MAXIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	+ 100.00%	234
MIN VALUE	MINIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	- 100.00%	235
DESTINATION TAG	DESTINATION OF SCALED ANALOG INPUT VALUE		101	247
ANIN 3 (A4)				
CALIBRATION	ANALOG INPUT SCALING DETERMINE VALUE = 100%	0.0000 -3.0000	1.0000	236
MAX VALUE	MAXIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	+ 100.00%	237
MIN VALUE	MINIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	- 100.00%	238
DESTINATION TAG	DESTINATION OF SCALED ANALOG INPUT VALUE		5	249
ANIN 4 (A5)				
CALIBRATION	ANALOG INPUT SCALING DETERMINE VALUE = 100%	0.0000 -3.0000	1.0000	239
MAX VALUE	MAXIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	+ 100.00%	240
MIN VALUE	MINIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	- 100.00%	241
DESTINATION TAG	DESTINATION OF SCALED ANALOG INPUT VALUE		48	250
ANIN 5 (A6)				
CALIBRATION	ANALOG INPUT SCALING DETERMINE VALUE = 100%	0.0000 -3.0000	1.0000	242
MAX VALUE	MAXIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	+ 100.00%	243
MIN VALUE	MINIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	- 100.00%	244

[1] During the process of reconfiguration there is a danger that "Tags" will be connected to wrong parameters. To avoid this possibility all configuration links must be temporarily "disconnected" during the configuration process and the flag set to "enabled" to allow the activity. Failure to reset the flag to "disabled" after reconfiguration will cause an Alarm to be generated, "Configure Enabled", which will prevent drive operation. (In early versions of software the alarm may read F200)

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FUNCTION	DESCRIPTION	RANGE	DEFAULT	TAG
	ANALOG OUTPUTS			
ANOUT 1 (A7)				
% TO GET 10V	VALUE WHICH PRODUCES 10V OUTPUT	0 - 300.00%	100.00%	245
SOURCE TAG	SOURCE OF OUTPUT VALUE		62	251
ANOUT 2 (A8)				
% TO GET 10V	VALUE WHICH PRODUCES 10V OUTPUT	0 - 300.00%	100.00%	248
SOURCE TAG	SOURCE OF OUTPUT VALUE		63	252
	DIGITAL INPUTS			
DIGIN 1 (C6)				
VALUE FOR TRUE	VALUE OF TAG ASSUMED WHEN INPUT IS TRUE	± 100.00%	0.01%	103
VALUE FOR FALSE	VALUE OF TAG ASSUMED WHEN INPUT IS FALSE	± 100.00%	0.00%	104
DESTINATION TAG	DESTINATION OF ASSUMED TAG VALUE		90	102
DIGIN 2 (C7)				
VALUE FOR TRUE	VALUE OF TAG ASSUMED WHEN INPUT IS TRUE	± 100.00%	0.01%	106
VALUE FOR FALSE	VALUE OF TAG ASSUMED WHEN INPUT IS FALSE	± 100.00%	0.00%	107
DESTINATION TAG	DESTINATION OF ASSUMED TAG VALUE		118	105
DIGIN 3 (C8)				
VALUE FOR TRUE	VALUE OF TAG ASSUMED WHEN INPUT IS TRUE	± 100.00%	0.01%	109
VALUE FOR FALSE	VALUE OF TAG ASSUMED WHEN INPUT IS FALSE	± 100.00%	0.00%	110
DESTINATION TAG	DESTINATION OF ASSUMED TAG VALUE		119	108
	DIGITAL OUTPUTS			
DIGOUT 1 (B5)				
THRESHOLD (>)	THRESHOLD WHICH VALUE MUST EXCEED TO SET OUTPUT TRUE	0-100.00%	0.00%	195
MODULUS	OUTPUT SET TRUE FOR ABSOLUTE OR MODULUS OF TAG VALUE	TRUE/ FALSE	TRUE	43
SOURCE TAG	SOURCE OF TAG VALUE USED TO SET OUTPUT		77	97
DIGOUT 2 (B6)				
THRESHOLD (>)	THRESHOLD WHICH VALUE MUST EXCEED TO SET OUTPUT TRUE	0-100.00%	0.00%	196
MODULUS	OUTPUT SET TRUE FOR ABSOLUTE OR MODULUS OF TAG VALUE	TRUE/ FALSE	TRUE	44
SOURCE TAG	SOURCE OF TAG VALUE USED TO SET OUTPUT		122	98
DIGOUT 3 (B7)				
THRESHOLD (>)	THRESHOLD WHICH VALUE MUST EXCEED TO SET OUTPUT TRUE	0-100.00%	0.00%	197
MODULUS	OUTPUT SET TRUE FOR ABSOLUTE OR MODULUS OF TAG VALUE	TRUE/ FALSE	TRUE	45
SOURCE TAG	SOURCE OF TAG VALUE USED TO SET OUTPUT		125	99
	CONFIGURE 5703			
OUTPUT SOURCE TAG	5703 OUTPUT SOURCE TAG		89	134
INPUT DESTINATION TAG	5703 INPUT DESTINATION TAG		41	135

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10.15 TAGS

Each Parameter in the 590 has a unique tag number associated with it.

Eg. RAMP ACCEL TIME HAS A TAG "2"

The reason for giving each parameter a number is to identify it for use in reconfiguring the 590's IO.

10.15.1 590 IO

Overview

The 590 user IO consists of 18 terminals situated at the base of the product. These include 5 Analog inputs, 3 Analog outputs, 6 Digital inputs and 3 digital outputs.

Type	Terminal	Fixed	Default Function
Analog Input 1	A2	Yes	Setpoint Sum Input 1.
Analog Input 2	A3	No	Setpoint Sum Input 2.
Analog Input 3	A4	No	Ramp Input.
Analog Input 4	A5	No	Negative Current Limit.
Analog Input 5	A6	Yes	Main / Positive Current Limit.
Analog Output 1	A7	No	Speed Feedback
Analog Output 2	A8	No	Speed Demand
Analog Output 3	A9	Yes	Uni/Bipolar Current Feedback
Digital Input 1	C6	No	Uni/Bipolar Current Clamps
Digital Input 2	C7	No	Ramp Hold
Digital Input 3	C8	No	Current Demand Isolate
Digital Output 1	B5	No	Zero speed
Digital Output 2	B6	No	Healthy
Digital Output 3	B7	No	Ready

10.15.2 Reconfiguring IO

All the IO that is not fixed can be reassigned, therefore it is possible to reconfigure Analog output 1 to output Ramp Output or any other of the drives parameter.

In the same way inputs can be reconfigured, although only to a subset of the 590's parameters. This is to prevent analog input being connected to Read Only parameters etc.

10.15.3 Examples

10.15.3.1 Analog Outputs

There are no restrictions to where an analog outputs may be assigned. Associated with each output is a scalar, this sets the percentage of the variable to give 10v at the terminal. This can assume positive and negative values which will set the sign of the output.

Example 1 Connecting Field Current Feedback to Analog Output 1

1. Find the tag number associated with Field Current Feedback.
2. Enter 181 into "ANALOG OUTPUTS / ANOUT 1 (A7) / SOURCE TAG = 181"
3. Enter 100% into "ANALOG OUTPUTS / ANOUT 1 (A7) / % TO GET 10v = 100%

Example 2 Connecting Current Demand to Analog Output 2

1. Find the tag number associated with Current Demand
2. Enter 66 into "ANALOG OUTPUTS / ANOUT 2 (A8) / SOURCE TAG = 66"
3. Enter 200% into "ANALOG OUTPUTS / ANOUT 2 (A8) / % TO GET 10v = 200%
   We have entered 200% so for 100% current feedback we will get 5 volts.

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Example 3 Connecting Serial Link to Analog Output 1

1. Find the tag number associated with AUX ANOUT 1
2. Enter 128 into "ANALOG OUTPUTS / ANOUT 1 (A7) / SOURCE TAG = 128"
3. Enter 100% into "ANALOG OUTPUTS / ANOUT 1 (A7) / % TO GET 10v = 100%
4. Analog Output 1 is now accessible over the serial link as PNO 55 (ASCII 3B)

10.15.3.2 Digital Outputs

Digital Outputs can be connected to any tag. If a digital output is connected to an analog parameter the threshold must also be set.

IF MODULUS = TRUE

IF |source TAG| > THRESHOLD

THEN output = TRUE

ELSE output = FALSE

ELSE IF MODULUS = FALSE

IF source TAG > THRESHOLD

THEN output = TRUE

ELSE output = FALSE

Example 1 Connecting Speed feedback to Digital Output 1

1. Find the tag number associated with speed feedback
2. Enter 62 into "DIGITAL OUTPUTS / DIGOUT 1 (B5) / SOURCE TAG = 62"
3. Enter 50% into "DIGITAL OUTPUTS / DIGOUT 1 (B5) / THRESHOLD (>) = 50.00%"
4. Enter TRUE into "DIGITAL OUTPUTS / DIGOUT 1 (B5) / MODULUS = TRUE"

   The output will become HIGH or TRUE when the speed feedback is greater than 50% in either direction.

10.15.3.3 Inputs

Before any Input can be reassigned the configure enable flag must be enabled. This disconnects all the inputs from the block diagram to prevent incorrect data being written while the tags are being changed.

10.15.3.4 Analog Inputs

These can be connected to a subset of parameters, defined in appendix A.
Each input has a scalar and a pair of clamps associated with it.

Example 1 Connecting Field Setpoint to Analog Input 2

1. Set CONFIGURE I/O CONFIGURE ENABLE = ENABLE
2. Find the tag number associated with Field Setpoint.
3. Enter 171 in " ANIN 1 (A2) / DESTINATION TAG = 171"
4. Set Calibration to 1.0000
5. Set MAX CLAMP to 100.00 %
6. Set MIN CLAMP to 10.00 %
7. Set CONFIGURE I/O CONFIGURE ENABLE = DISABLE
8. Analog Input 1 now controls the field setpoint at 100% for 10v and clamped at 10% for 1v.

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10.15.3.5 Digital Inputs

These can be connected to the same subset of parameters as analog inputs.

IF digital input is HIGH

destination TAG = VALUE FOR TRUE

ELSE IF digital input is LOW

destination TAG = VALUE FOR FALSE

Example 1 Connecting Digital Input 1 to speed loop Prop Gain

1. Set CONFIGURE I/O CONFIGURE ENABLE = ENABLE
2. Find the tag number associated with speed loop Prop. Gain
3. Enter 114 in " DIGIN 1 (C6) / DESTINATION TAG = 14"
4. Set VALUE FOR TRUE = 10.00
5. Set VALUE FOR FALSE = 30.00
6. Set CONFIGURE I/O CONFIGURE ENABLE = DISABLE
7. When Digital Input 1 is high the speed loop prop gain is set to 10.00 when the input is low the speed loop prop gain is set to 30.00

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11 SERIAL COMMUNICATIONS

OVERVIEW

General Description

Supervision and monitoring of SSD 590 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.

The 590 supports both ASCII and Binary Communications.

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 ASCII COMMUNICATIONS

Multi Drop Supervisory Link

Transmission Standard	: RS485(RS422)(bi-directional)
Protocol	: ANSI-X3.28-2.5-B1
Data Rates	: 300,600,1200,2400,4800, 9600 or 19200 baud
Character Format (300 to 9600 baud)	: ASCII + 1 start, 1 parity and 1 stop bit. [10 BIT]
Parity	: Even

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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	

11.1.1 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 590 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:-

10 the analogue input 1
0F the instrument health word
09 the drive speed demand

Full tables of the 590 mnemonics are given in Serial Link Mnemonics and Parameter Number Allocation 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.

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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:-

23, speedloop error a number in the range ± 100.00%
0B, current demand a number in the range ± 200.00%
22, Digital tach a number in the range ± 3000 RPM

Examples of status information are:-

0F 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 Serial Link Mnemonics and Parameter Number Allocation Section.

Data Format

The 590 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, and trailing zeros may be omitted.

i.e.	1	can be sent as	1.00, 1.0, 1. or 1
	-2.2	can be sent as	-2.20 or -2.2
	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)

ii) Setting parameters (known as selection)

a. Single parameter update
b. Continuous updating of one or more individual parameters

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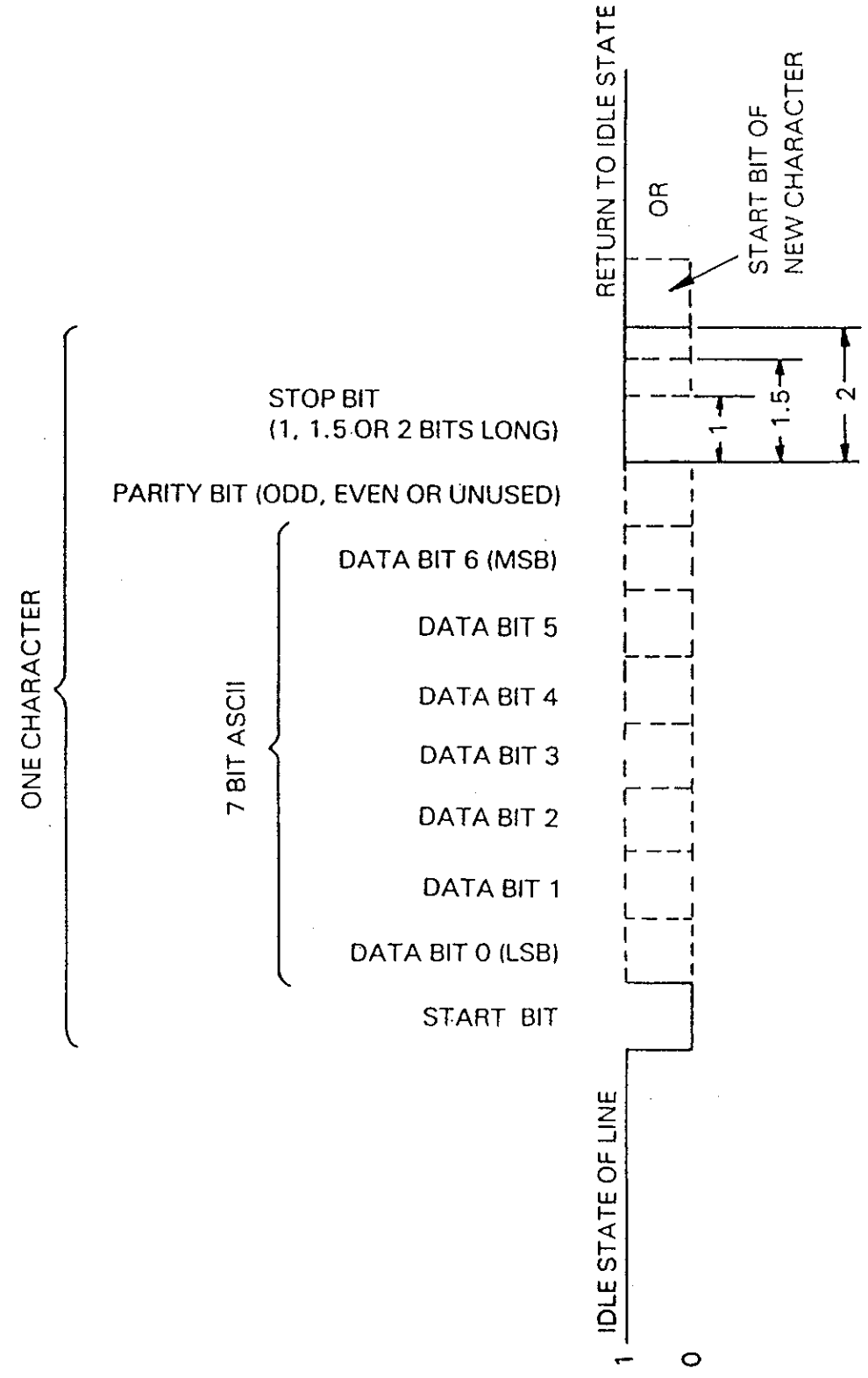
Serial Data Transmission

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, 590 instruments use 300 to 9600 baud.



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11.1.2 Sequence to Read Information from the 590 by Computer

Enquiry

The computer initially has master status, with the 590 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 590.

Valid Response of the 590 to this Message

After the message has been sent, the computer adopts slave status and expects to receive a reply from the 590. In so doing, the 590 assumes Master status and providing the 590 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). The 590 responds with the shortest message which represents the data value. If the data value is an integer (decimal part is 0), then it does not send a decimal point. Trailing zeros in the decimal part are not sent.

(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).

e.g. in a message with (D1 - DN) is 5 characters
(BCC) = (C1) EOR (C2) EOR (D1) 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 590 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 590 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 an (ACK) after a 'valid reply', it causes the 590 to fetch the next parameter from the parameter list. This facility enables the computer to continuously sequence through all the parameters of the 590.

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iii) Terminate Communication (EOT)

The termination procedure is entered when the selection of a particular instrument is no longer required or when a 590 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 590. This could be due to any of the following reasons:-

i) Group/Unit address identifiers not recognized.

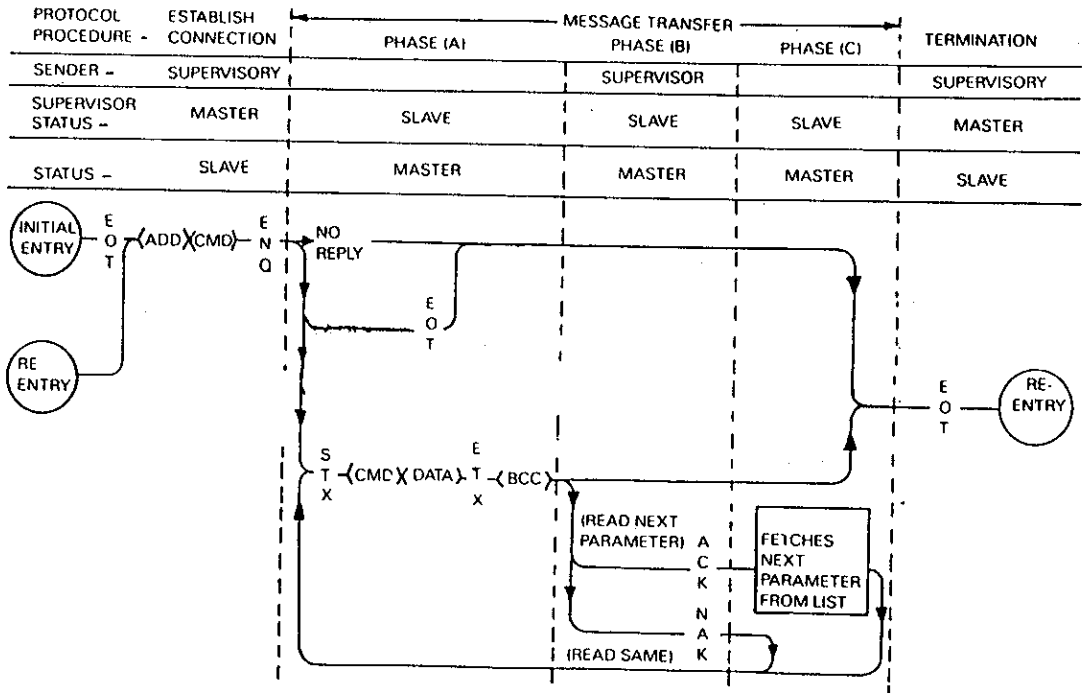
ii) An error (e.g. parity) is found in one or more of the characters up to and including ENQ.

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.

POLL SEQUENCE FOR TRANSMITTING DATA FROM THE 590 CONTROLLER TO THE SUPERVISOR.



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11..1.3 Sequence to Send information to the 590 from the Computer

Establish Connection

Connection is established with a particular 590 by sending
(EOT) (GID) (GID) (UID) (UID) followed immediately by the data transfer
(STX) (C1) (C2) (D1) (D2) (D3).....(DN) (ETX) (BCC)
(Note that the data transfer message is identical to that transmitted by a 590 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 590 responds to it by sending (ACK), (NAK) or by giving no reply.

i) Positive acknowledgement (ACK)

When the 590 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 590 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 590 sends (NAK) response to the computer. This signifies that the message received by the 590 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 returns NAK and is discarded.

iii) No Reply

Under certain circumstances, the computer may not receive a response from the 590. 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.

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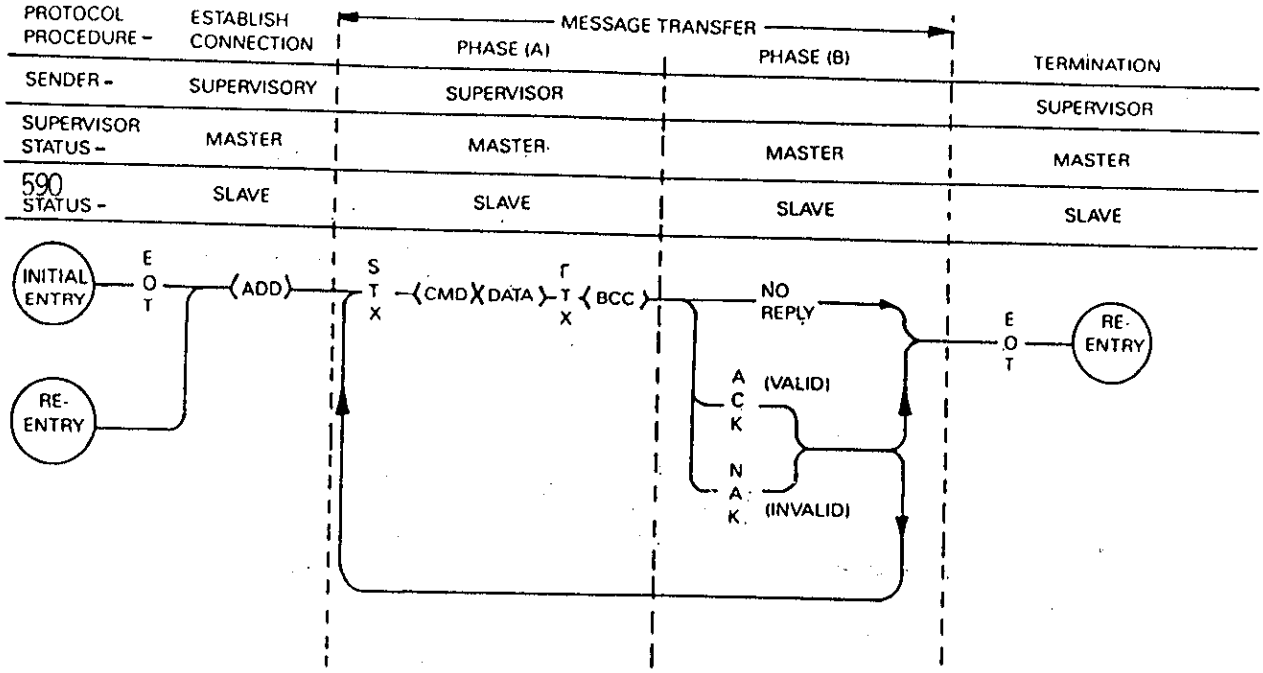
Termination

The termination procedure is used if the computer wishes to stop selecting a particular 590 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 TRANSMITTING DATA
FROM THE SUPERVISOR TO THE 590 CONTROLLER



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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 control characters, and set in data characters. The format is represented 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 text 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 text character. It is followed by another character containing the checksum.
(ETB)	:	This is the end of block character. It is sent by the 590 drive instead of the (ETX) when it wishes to reply to a multi parameter enquiry. The (ETB) indicates the end of a block, but not the end of a message. Each block contains information on up to eight parameters. 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)	:	Verification digit which is the character generated by taking the exclusive OR of the ASCII values of all character transmitted after and excluding (STX) up to and including (ETX)

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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.

(EOT) (INO) (CCC) (STX) (PNO) (D1) (D2) (D3) (ETX) (BCC)

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.

(EOT) (INO) (PNO) (CCC) (ENQ)

3. Enquiry Polling:

The supervisor requests to read all those parameters in block 1 that have changed since the last read by an amount greater than or equal to changeband (PNO 4).

(EOT) (INO) (CCC) (ENQ)

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, in blocks of up to 8 parameters.

(EOT) (INO) (PNO) (CNO) (CCC) (ENQ)

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.

If PNO is the first in a block (i.e. 0, 8, 16, etc.) and CNO = 8, then a pseudo - enquiry poll is performed on the block, controlled by PNO 7. Section 11.3.2 gives details.

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 a multi-parameter poll.
   (ACK)

2. Repeat : (repeat last reply)
   Only valid if sent following any type of poll. It requests a repetition of the previous reply.
   (NAK)

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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

Number format is:

0 = XXXX
1 = XXX.X
2 = XX.XX
3 = X.XXX
4 = .XXXX

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 seven values, these are:
300, 600, 1200, 2400, 4800, 9600, 19200 baud

11.2.5 Serial Transmission

During serial communications, the 590 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:

(STX) (PNO) (D1) (D2) (D3) (ETX) (BCC)

In case of 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.

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11.3 SERIAL LINK MNEMONICS AND PARAMETER NUMBER ALLOCATION

11.3.1 Eurotherm Group Standard Parameters

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

Mnemonic	Description	Access	Function
BL	Buffer length	R/O	Returns 4646_{16} indicating that both transmit and receive buffers are 46_{16} bytes long.
CI	Configuration Information	R/O	Returns $4CCC_{16}$ indicating that the drive supports both fixed and variable length data formats, and that the drive is a single-function device.
EE	Error report	R/W	Returns one of the following to indicate the status of serial link transmissions : 00C0 No errors 01C7 Unknown mnemonic 02C2 Block check character fail 03C1 Parity error on received data 03C2 Framing or overrun error 05C8 Attempt to write to a read-only mnemonic 07C7 Invalid message format 08C8 Value in selection message out of range. Writing any value to mnemonic EE resets it to 00C0.
II	Instrument Identifier	R/W	Returns the value of a parameter, the default value of which is 5900.
MN	Mode Number	R/O	Returns a fixed value 08C1 (the full Eurotherm standard is not supported).
VO	Version Number	R/O	Returns the issue number in the upper two characters, and the release number in the lower two characters. For example issue 2.4 returns 0204.

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.

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11.3.2 Mnemonic Tables

Block 0: (Binary Protocol Only)

<table>
<tr><th>PNO</th><th>Access</th><th colspan="3">Description</th></tr>
<tr><td>0</td><td>R/O</td><td colspan="3">Instrument Identifier. Same as ASCII mnemonic II.</td></tr>
<tr><td>1</td><td>R/W</td><td colspan="3">Error report. Same as ASCII mnemonic EE</td></tr>
<tr><td>2</td><td></td><td colspan="3">Reserved</td></tr>
<tr><td>3</td><td></td><td colspan="3">Reserved</td></tr>
<tr><td>4</td><td>R/W</td><td colspan="3">Changeband. In an enquiry poll or pseudo-enquiry poll (see PNO 7), a value must have changed by an amount equal to or greater than the hysteresis before it will be reported. Hysteresis is measured in the smallest units applicable to each parameter. For example, if hysteresis = 10, then a parameter with one decimal point must change by 1.0, and a parameter with two decimal points must change by 0.10 before they will be reported.</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">R/W</td><td colspan="3">Serial link configuration.</td></tr>
<tr><td>Bit nos.</td><td colspan="2">Description</td></tr>
<tr><td>0 - 3</td><td>Baud rate[1]</td><td>0 = 300
1 = 600
2 = 1200
3 = 2400
4 = 4800
5 = 9600 (default)
6 = 19200</td></tr>
<tr><td>4 - 15</td><td colspan="2">Reserved</td></tr>
<tr><td>6</td><td></td><td colspan="3">Reserved.</td></tr>
<tr><td>7</td><td>R/W</td><td colspan="3">Control word for multi-parameter polling. For the purpose of multi-parameter polling, the PNOs are arranged in 16 blocks of 8. Bit 0 of this parameter controls block 0 (PNO 0 to 7), bit 1 controls block 1 (PNO 8 to 15) .... bit 15 controls block 15 (PNO 120 to 127).
When a bit is 1 (default), a multi-parameter poll on this block operates normally [2]
When a bit is 0, a multi-parameter poll on this block with PNO = multiple of 8, and CNO = 8 performs an enquiry poll instead (a pseudo-enquiry poll).</td></tr>
</table>

PNO Allocation

PNOs 0 to 7 (block 0) are defined on page 11 - 14. This section defines PNOs 8 to 127. The ASCII mnemonics are case sensitive, Parameters in Block 0 are undefined in ASCII mode.

NOTES:-

[1] When writing to PNO5 in order to change baud rates, the 590 changes its baud rate after receiving the terminating EOT.

[2] Refer to Bisync Manual HA

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Block 1 :

PNO	ASCII mnemonic	Tag No.	Access	Bit number	ASCII data format	Binary data format	Limits	Description
8	08	063	R/O	-	21	xxx.xx	-	Speed Setpoint
9	09	089	R/O	-	21	xxx.xx	-	Speed Demand
10	0A	062	R/O	-	21	xxx.xx	-	Speed Feedback
11	0B	066	R/O	-	21	xxx.xx	-	Current Demand
12	0C	065	R/O	-	21	xxx.xx	-	Current Feedback
13	0D	183	R/O	-	21	xxx.xx	-	Field Demand
14	0E	181	R/O	-	21	xxx.xx	-	Field Feedback
15	0F	115	R/O	-	23	xxxxx	-	Health Word
	-	-		0			-	Over Speed
	-	-		1			-	Missing Pulse
	-	-		2			-	Field Over Current
	-	-		3			-	Fin Over Temperature
	-	-		4			-	Motor Over Temperature
	-	-		5			-	Over Volts
	-	-		6			-	Speed Feedback
	-	-		7			-	uTach Fail
	-	-		8			-	Field Fail
	-	-		9			-	Three Phase
	-	-		10			-	Phase Lock Loop
	-	-		11			-	P3 Port
	-	-		12			-	Stall Trip
	-	-		13			-	Over Current Trip
	-	-		14			-	Cal Card
	-	-		15			-	ACCTS Failed.

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Block 2 :

PNO	ASCII mnemonic	Tag No.	Access	Bit number	ASCII data format	Binary data format	Limits	Description
16	10	050	R/O	-	21	xxx.xx	-	Analogue I/P 1
17	11	051	R/O	-	21	xxx.xx	-	Analogue I/P 2
18	12	052	R/O	-	21	xxx.xx	-	Analogue I/P 3
19	13	053	R/O	-	21	xxx.xx	-	Analogue I/P 4
20	14	054	R/O	-	21	xxx.xx	-	Analogue I/P 5
21	15	067	R/O	-	21	xxx.xx	-	Actual +ve Current Limit
22	16	061	R/O	-	21	xxx.xx	-	Actual -ve Current Limit
23	17	040	R/O	-	23	xxxxx	-	
	-	068		0			-	Start Input
	-	069		1			-	Digital Input 2
	-	070		2			-	Enable Input
	-	071		3			-	Digital Input 4
	-	072		4			-	Digital Input 5
	-	073		5			-	Digital Input 6
	-	-		6			-	Program Stop Input
	-	-		7			-	Coast Stop Input
	-	074		8			-	Digital Output 1
	-	075		9			-	Digital Output 2
	-	076		10			-	Digital Output 3
	-	-		11 - 15			-	Reserved

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Block 3 :

PNO	ASCII mnemonic	Tag No.	Access	Bit number	ASCII data format	Binary data format	Limits	Description
24	18	030	R/W	-	21	xxx.xx	-200.00 +200.00	Additional Current Demand
25	19	015	R/W	-	21	xxx.xx	0 +200.00	Current Limit Scale
26	1A	087	R/O	-	21	xxx.xx	0 +200.00	+ve Current Clamp
27	1B	088	R/O	-	21	xxx.xx	0 +200.00	-ve Current Clamp
28	1C	016	R/W	-	21	xxx.xx	0 +200.00	Current Loop P Gain
29	1D	017	R/W	-	21	xxx.xx	0 +200.00	Current Loop I Gain
30	1E	171	R/W	-	21	xxx.xx	0 +100.00	Field Current Setpoint
31	1F	116	R/O	-	23	xxxxx		Health Store
	-	-		0				Over Speed
	-	-		1				Missing Pulse
	-	-		2				Field Over Current
	-	-		3				Fin Over Temperature
	-	-		4				Over Temperature
	-	-		5				Field Over Volts
	-	-		6				Speed Feedback
	-	-		7				uTach Fail
	-	-		8				Field Fail
	-	-		9				Three Phase
	-	-		10				Phase Lock Loop
	-	-		11				P3 Port
	-	-		12				Stall Trip
	-	-		13				Over Current Trip
	-	-		14				Cal Card
	-	-		15				ACCTS Failed.

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Block 4 :

PNO	ASCII mnemonic	Tag No.	Access	Bit number	ASCII data format	Binary data format	Limits	Description
32	20	060	R/O	-	21	xxx.xx	-	Armature Volts
33	21	058	R/O	-	21	xxx.xx	-	Analogue Tach
34	22	059	R/O	-	21	xxxxx	-	uTach
35	23	064	R/O	-	21	xxx.xx	-	Speed Error
36	24	132	R/W	-	21	x.xxxx	-3.0000 +3.0000	P3 Setpoint Ratio
37	25	014	R/W	-	21	xxx.xx	0 +200.00	Speed Loop P Gain
38	26	013	R/W		21	xxx.xx	1 +6000	Speed Loop Time Constant (mS)
39	27	-	-		23	xxxxx		
	-	161	R/W	0			0 → 1	Aux Start
	-	168	R/W	1			0 → 1	Aux Enable
	-		-	2 - 15				Reserved

Block 5 :

PNO	ASCII mnemonic	Tag No.	Access	Bit number	ASCII data format	Binary data format	Limits	Description
40	28	006	R/W	-	21	x.xxxx	-3.0000 +3.0000	Ratio 1
41	29	007	R/W	-	21	x.xxxx	-3.0000 +3.0000	Ratio 2
42	2A	086	R/O	-	21	xxx.xx	-	Set Point Sum Output
43	2B	002	R/W	-	21	xxx.x	0.1 600.0	Ramp Accel Time
44	2C	003	R/W	-	21	xxx.x	0.1 600.0	Ramp Decel Time
45	2D	085	R/O	-	21	xxx.xx	-	Ramp Output
46	2E	041	R/W		21	xxx.xx	-100.00 +100.00	Additonal Speed Demand
47	2F	-	-		23	xxxxx		
	-	082	R/O	0				Drive Start
	-	084	R/O	1				Drive Enable
	-	122	R/O	2				Health Flag
	-	125	R/O	3				Ready
	-	-	-	4 - 7				Reserved
	-	079	R/O	8				At Standstill
	-	-	-	9 - 15				Reserved

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Block 6 :

PNO	ASCII mnemonic	Tag No.	Access	Bit number	ASCII data format	Binary data format	Limits	Description
48	30	026	R/W	-	21	xxx.x	0.1 600.0	N-Stop time
49	31	027	R/W	-	21	xxx.x	0.1 600.0	P-Stop time
50	32	091	R/W	-	21	x.xx	0 +200.00	P-Stop Current Limit
51	33	029	R/W	-	21	x.xx	0 +100.00	Stop Zero Speed Threshold
52	34	005	R/W	-	21	xxx.xx	-100.00 +100.00	Ramp Input
53	35	100	R/W	-	21	xxx.xx	-	Setpoint Sum Input 1
54	36	101 in Iss 1.6 309 in Iss 2.1	R/W	-	21	xxx.xx	-100.00 +100.00	Setpoint Sum Input 2 in Iss 1.6 Setpoint Sum Input 0 in Iss 2.1
55	37	-			23	xxxxx		
	-	94	R/W	0			0 → 1	Aux Digital Output 1
	-	95	R/W	1			0 → 1	Aux Digital Output 2
	-	96	R/W	2			0 → 1	Aux Digital Output 3
		-		3 - 15				Reserved

Block 7 :

PNO	ASCII mnemonic	Tag No.	Access	Bit number	ASCII data format	Binary data format	Limits	Description
56	38	055	R/O	-	21	xxx.xx	-	Analogue Output 1
57	39	056	R/O	-	21	xxx.xx	-	Analogue Output 2
58	3A	128	R/W	-	21	xxx.xx	-100.00 +100.00	Aux Analogue Output 1
59	3B	129	R/W	-	21	xxx.xx	-100.00 +100.00	Aux Analogue Output 2

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TABLE

ASCII CODES

ASCII CODES			ASCII-HEX
STX	-	Start of Text	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				

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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 590 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.

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 590 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.

The 5703/1 can be configured to point to any relevant parameter in the block diagram, the default connections are such that the scaled input is connected to the "additional speed demand" and the output to the "speed demand".

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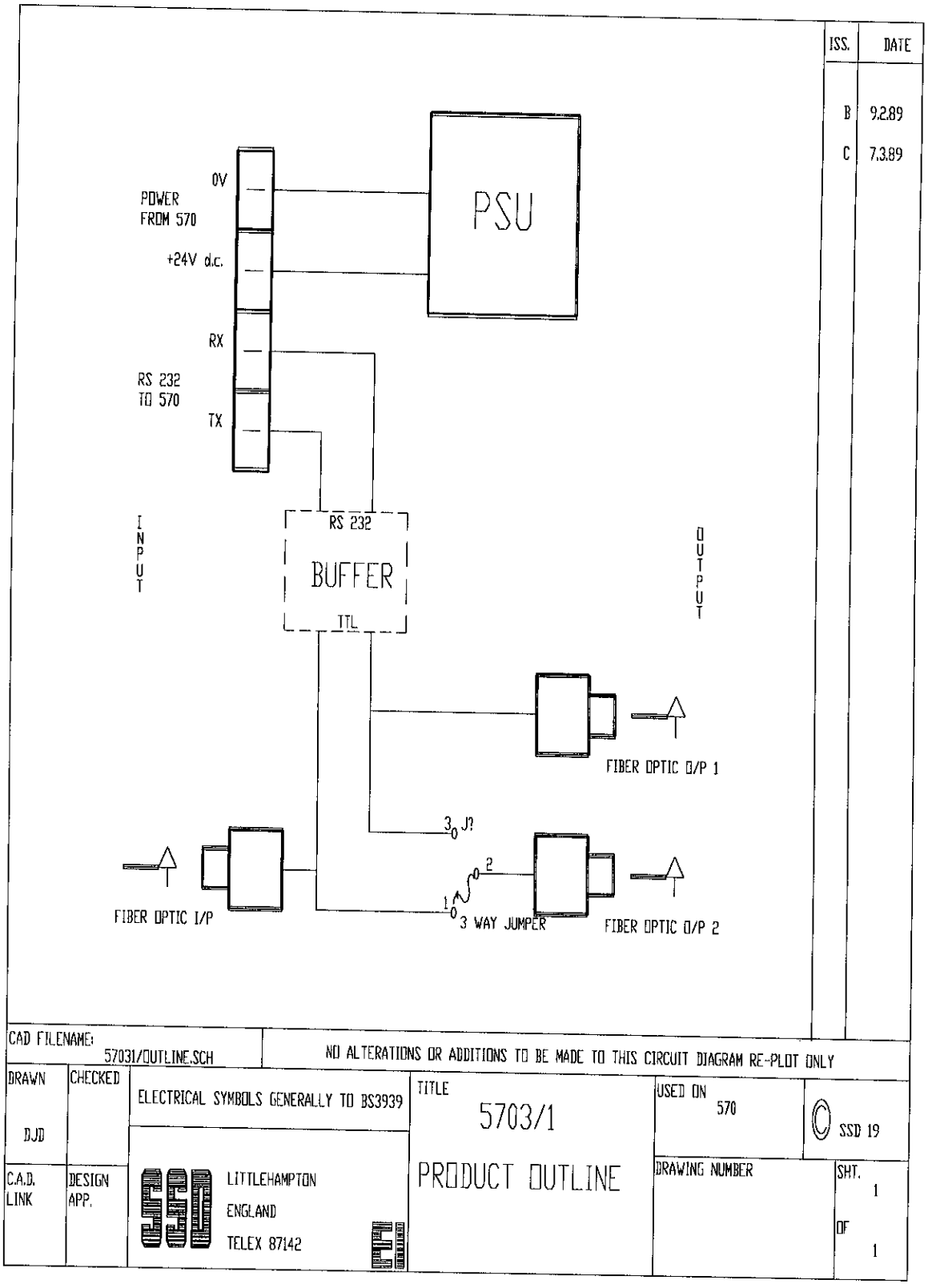

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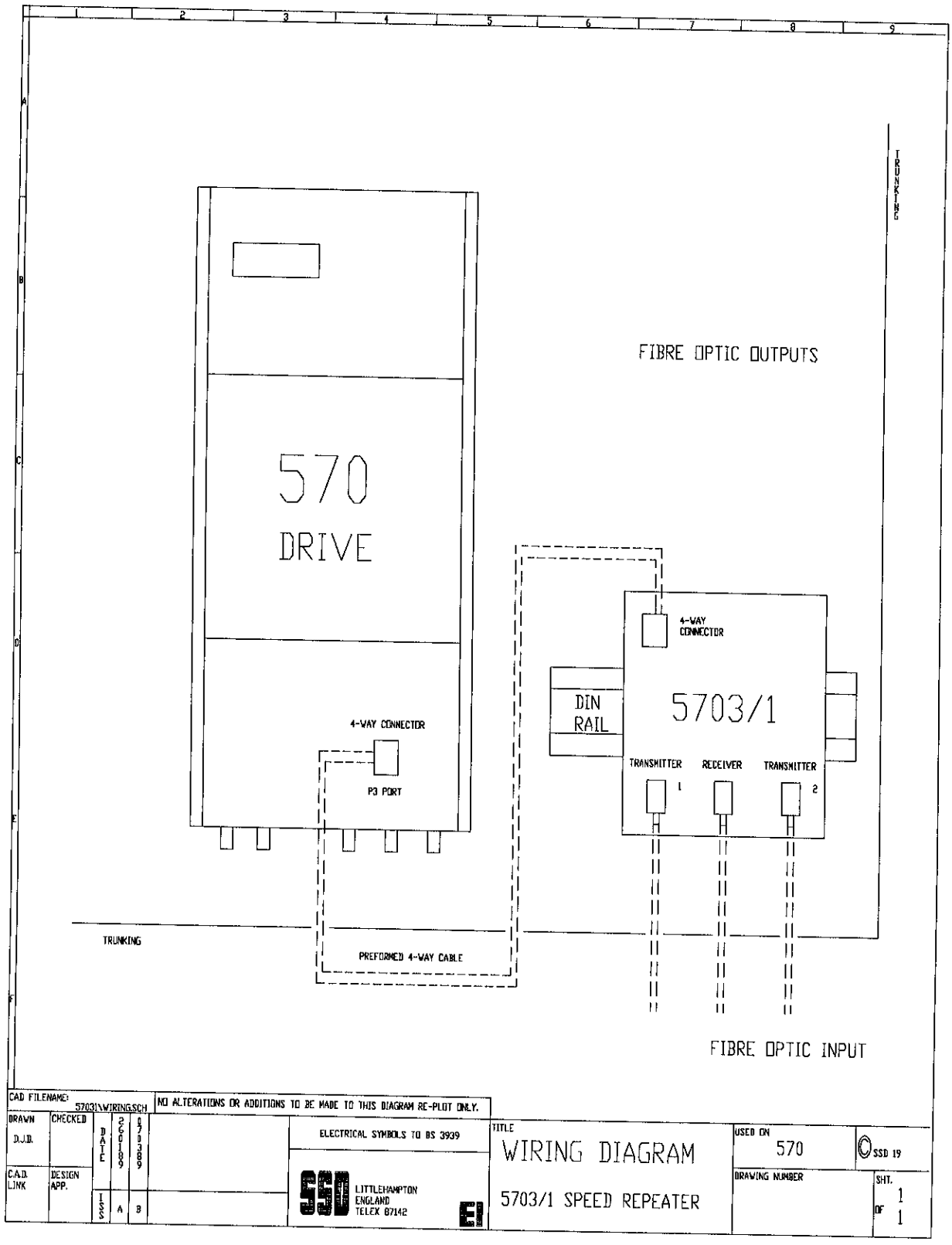

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12.3 COMMISSIONING THE 5703/1

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 590 Series drive (drawing number HH059769D) and to the block diagram of the 5703/1 function.

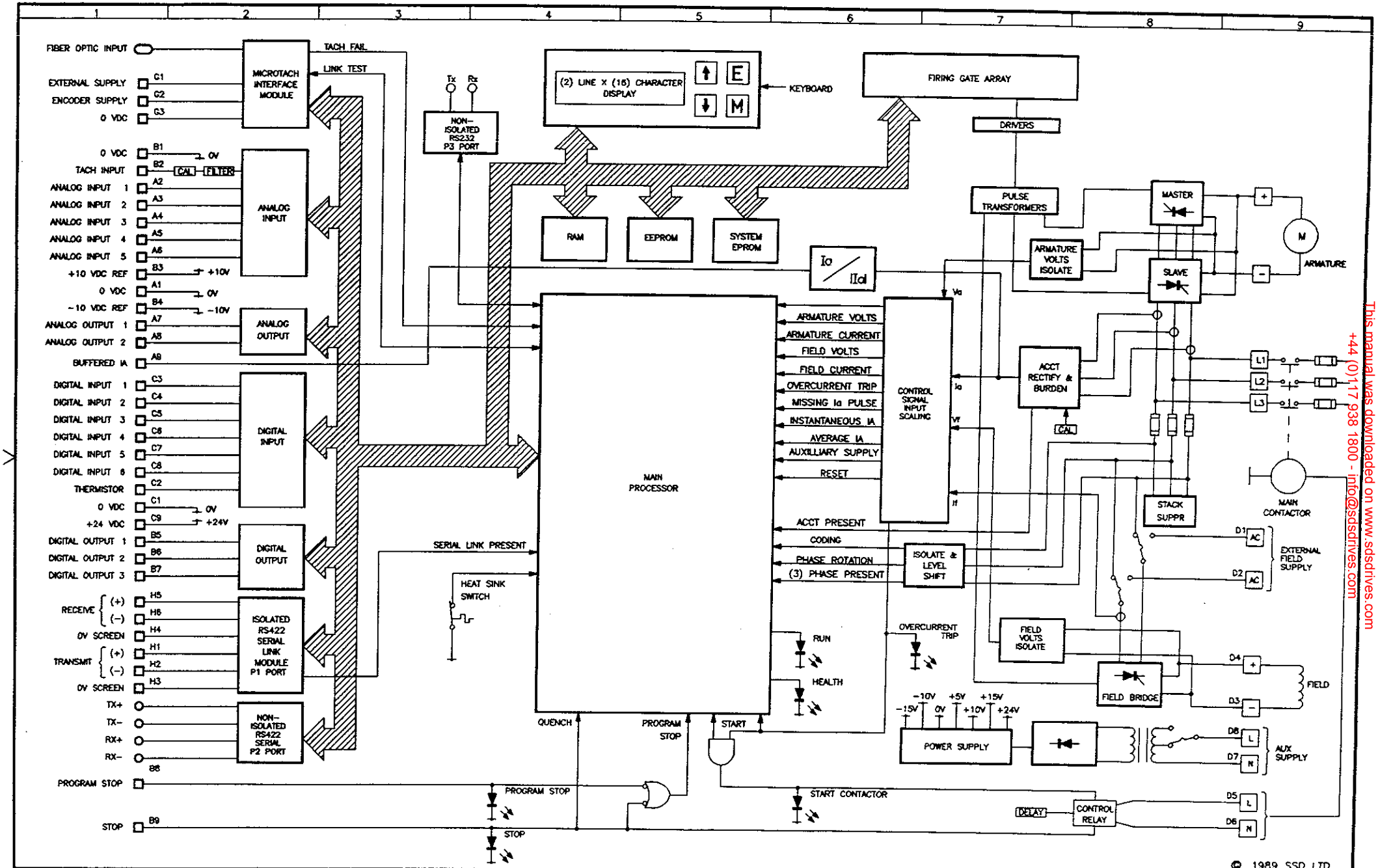
The Inputs of the Drive

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.



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GDR	GDR	26/09/89	SSD LITTLEHAMPTON ENGLAND TELEX 87142	BLOCK DIAGRAM FOR HARDWARE	590
TRACED LT		A			DRAWING NUMBER HH 059770 D SHT. 1 OF 1

590-WARE.DWG

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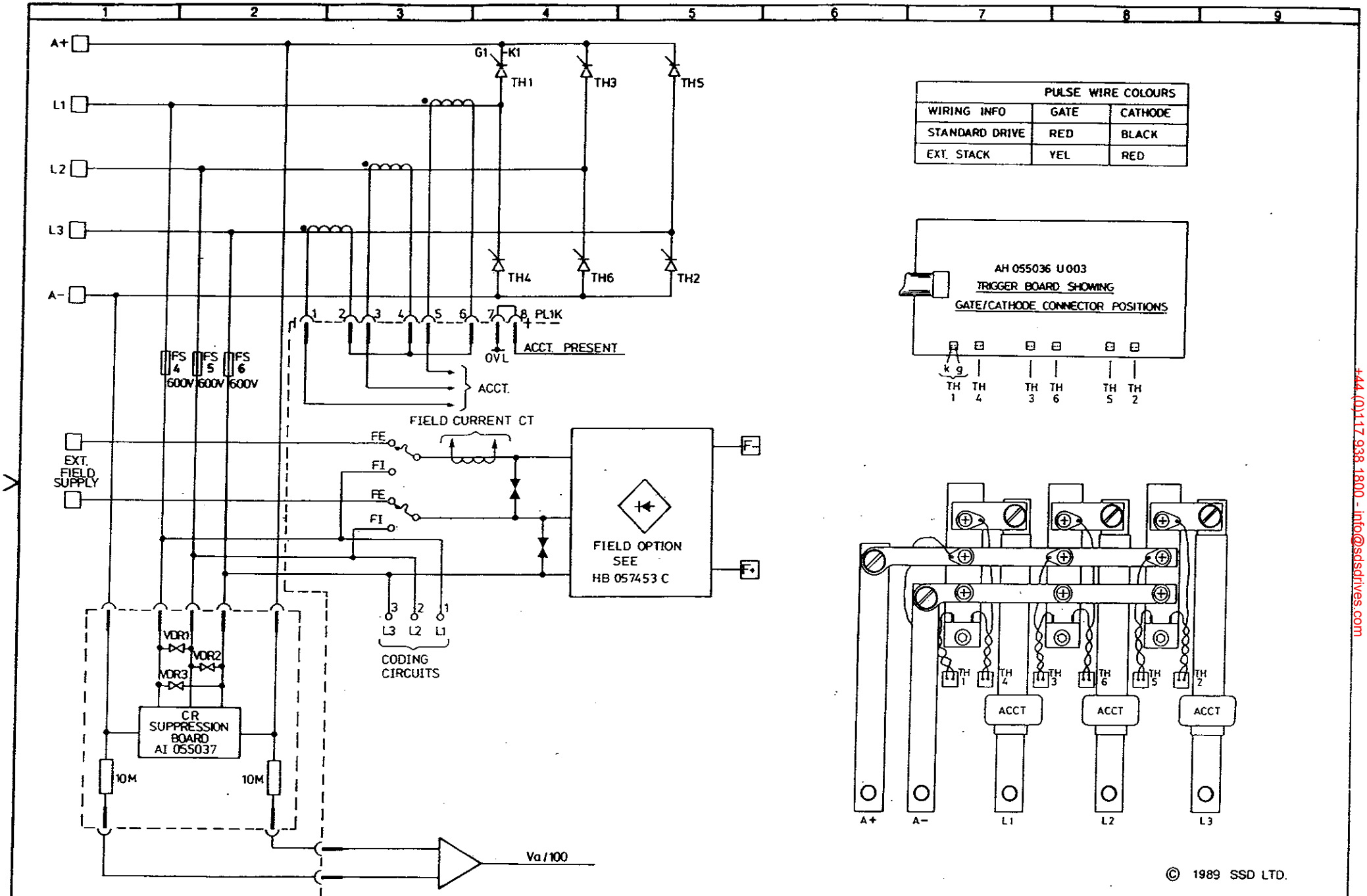

PULSE WIRE COLOURS		
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	RED	BLACK
EXT. STACK	YEL	RED

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DRAWN WS	CHECKED GRP	DATE	A 13.6.89		ELECTRICAL SYMBOLS TO BS 3939	TITLE DC CONTROLLER 35/70/110/150A	USED ON 570/590 SERIES
TRACED PB/EDES			B 4.3.91		SSD UTTLEHAMPTON ENGLAND TELEX 87142	2 QUAD POWER CIRCUIT	DRAWING NUMBER HJ 057471 D
			1 30/1/92				SHT 1 OF 1

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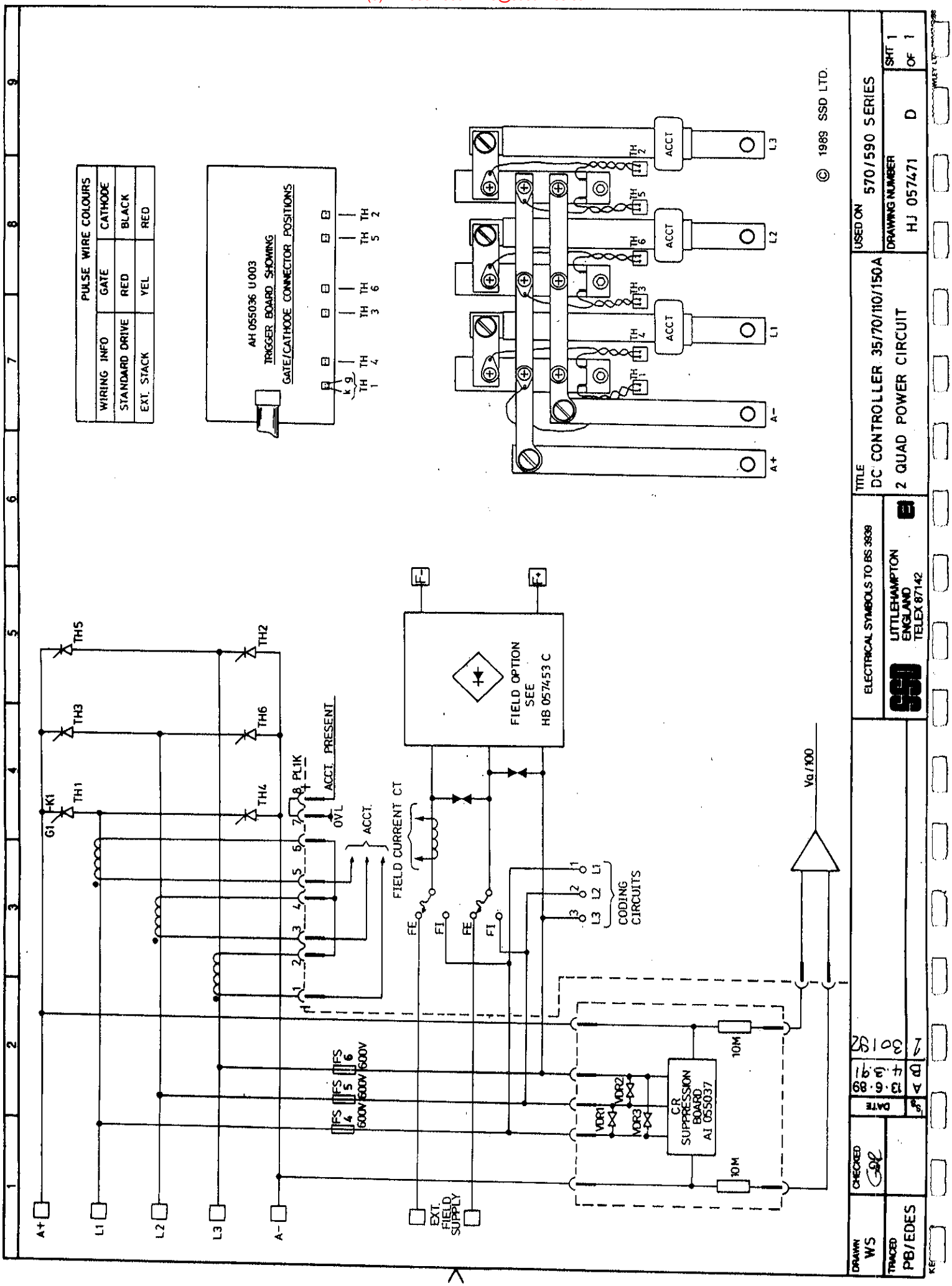

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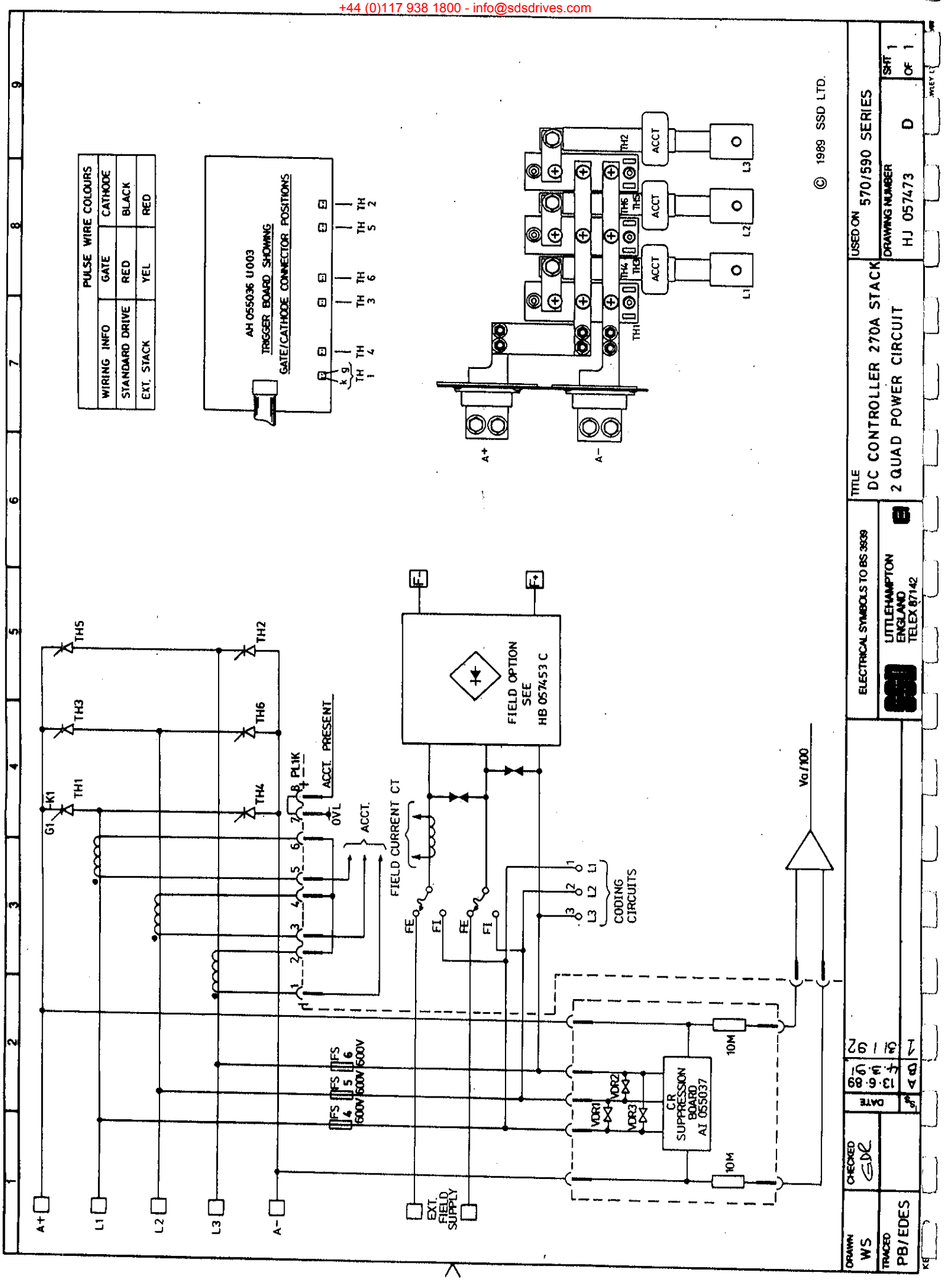

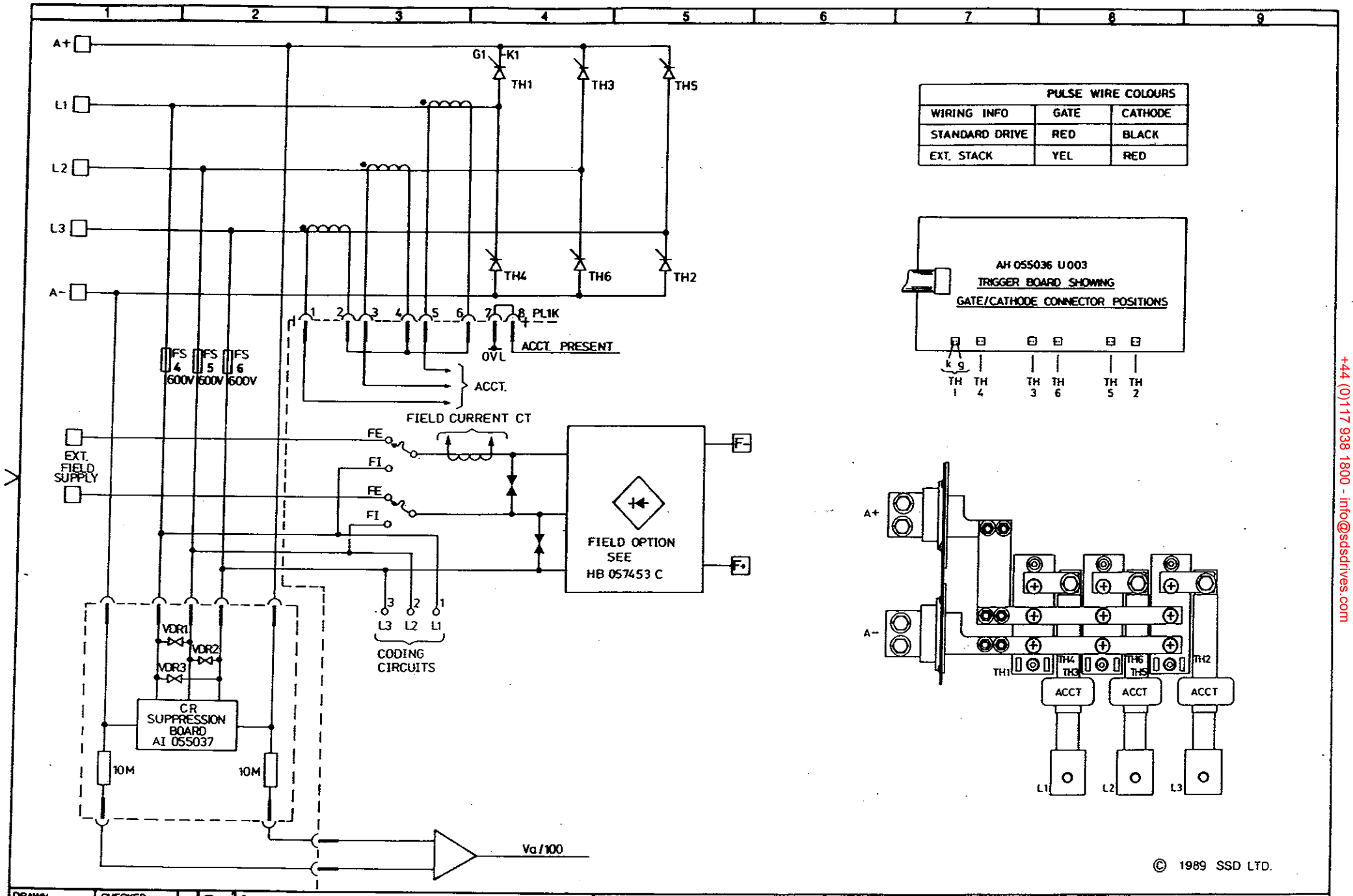

PULSE WIRE COLOURS		
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	RED	BLACK
EXT. STACK	YEL	RED

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TRACED PB/EDES		A 13·6·89 B 4·3·91	LITTLEHAMPTON ENGLAND TELEX 87142		DRAWING NUMBER HJ 057473 D
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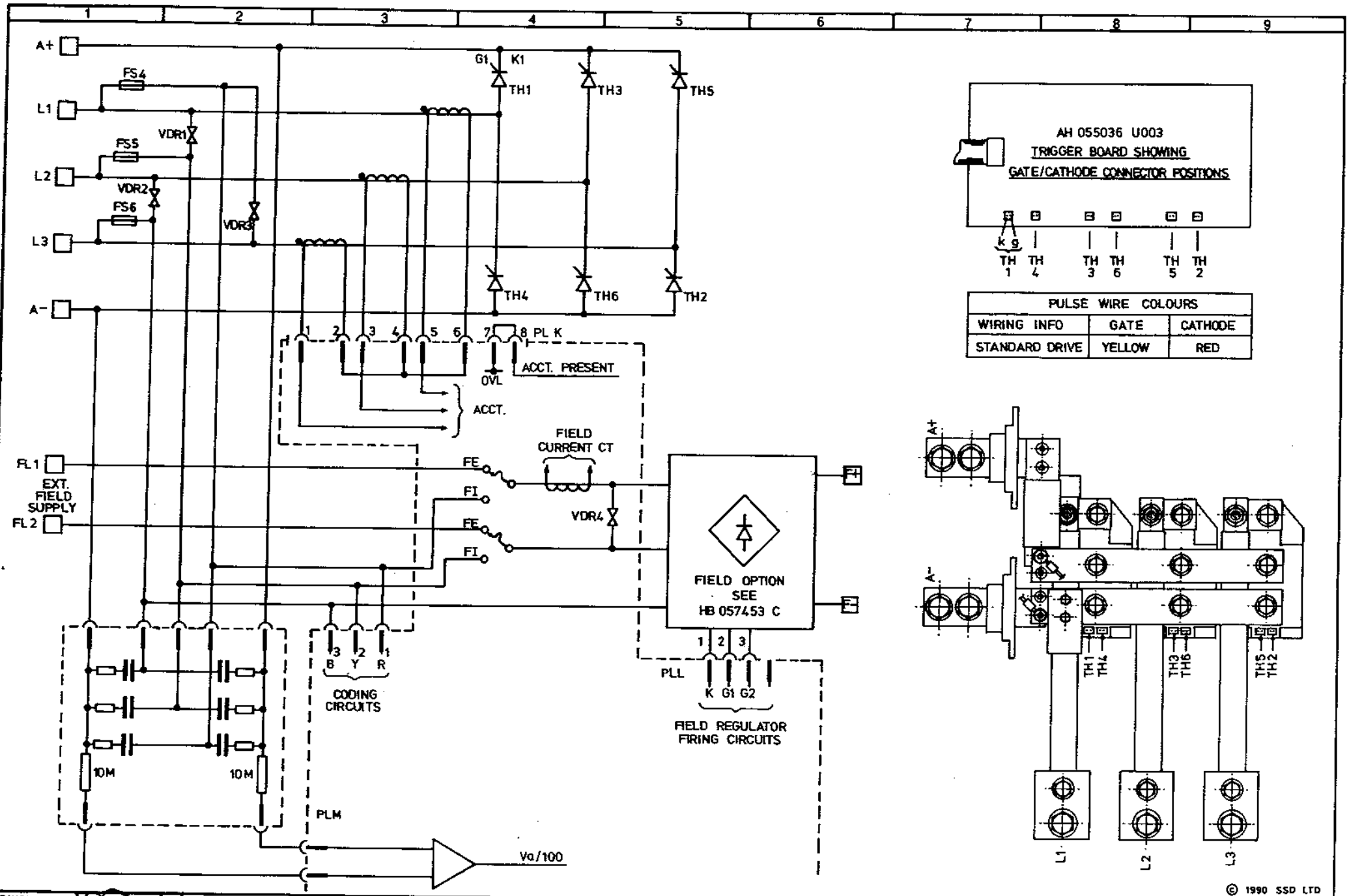

PULSE WIRE COLOURS		
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	YELLOW	RED

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TRACED PB/EDES		A 16.3.92	
KE0486140		1 31/1/92	

SSD LITTLEHAMPTON ENGLAND TELEX 87142

TITLE
DC CONTROLLER 450A STACK
2 QUAD POWER CIRCUIT

USED ON
570/590 SERIES

DRAWING NUMBER
HJ 059045 D

SHT 1 OF 1

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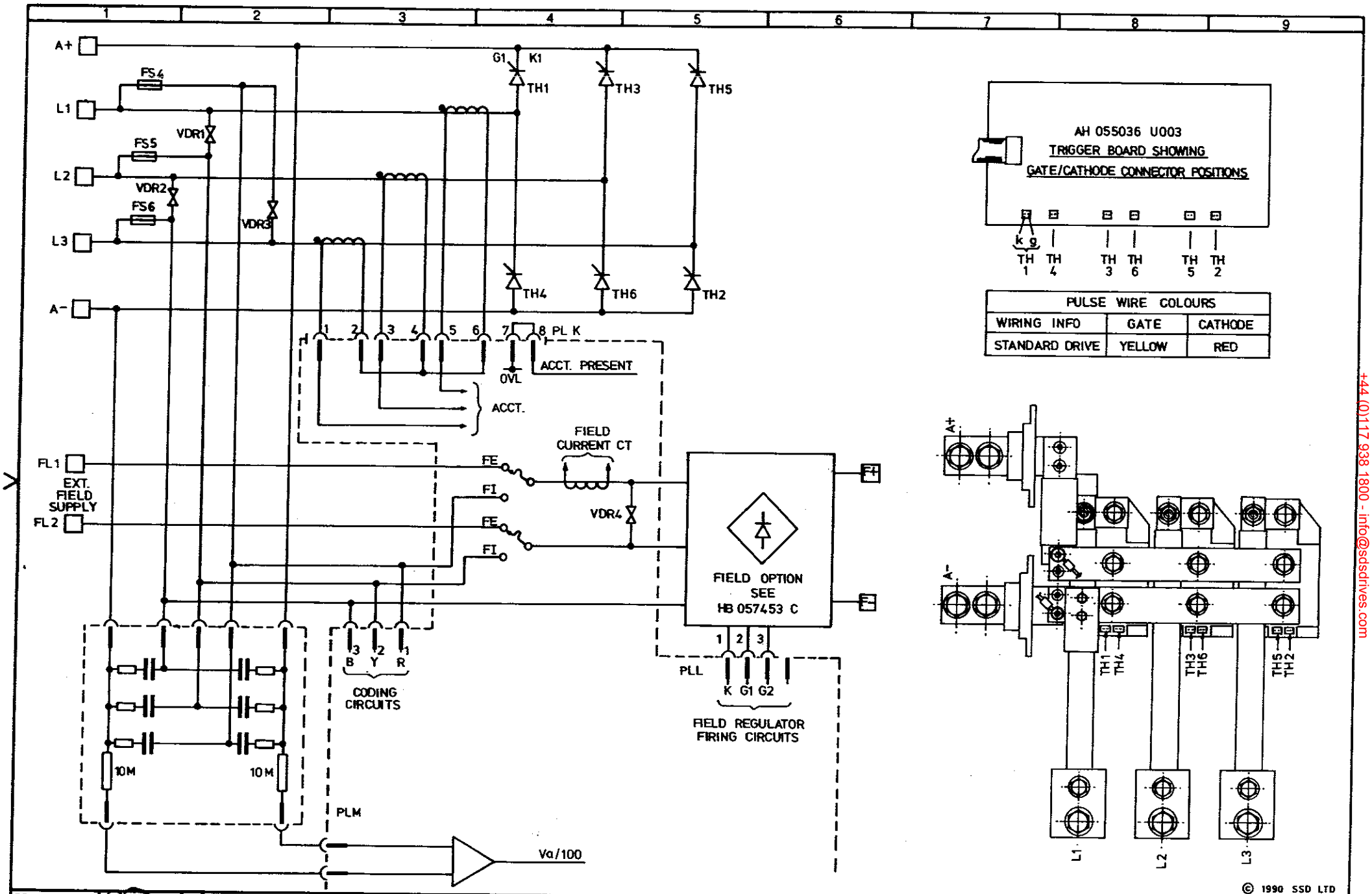

AH 055036 U003
TRIGGER BOARD SHOWING
GATE/CATHODE CONNECTOR POSITIONS

PULSE WIRE COLOURS		
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	YELLOW	RED

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TRACED PB/EDES		A 31/92	SSD LITTLEHAMPTON ENGLAND TELEX 87142

TITLE
DC CONTROLLER 450A STACK
2 QUAD POWER CIRCUIT

USED ON
570/590 SERIES

DRAWING NUMBER
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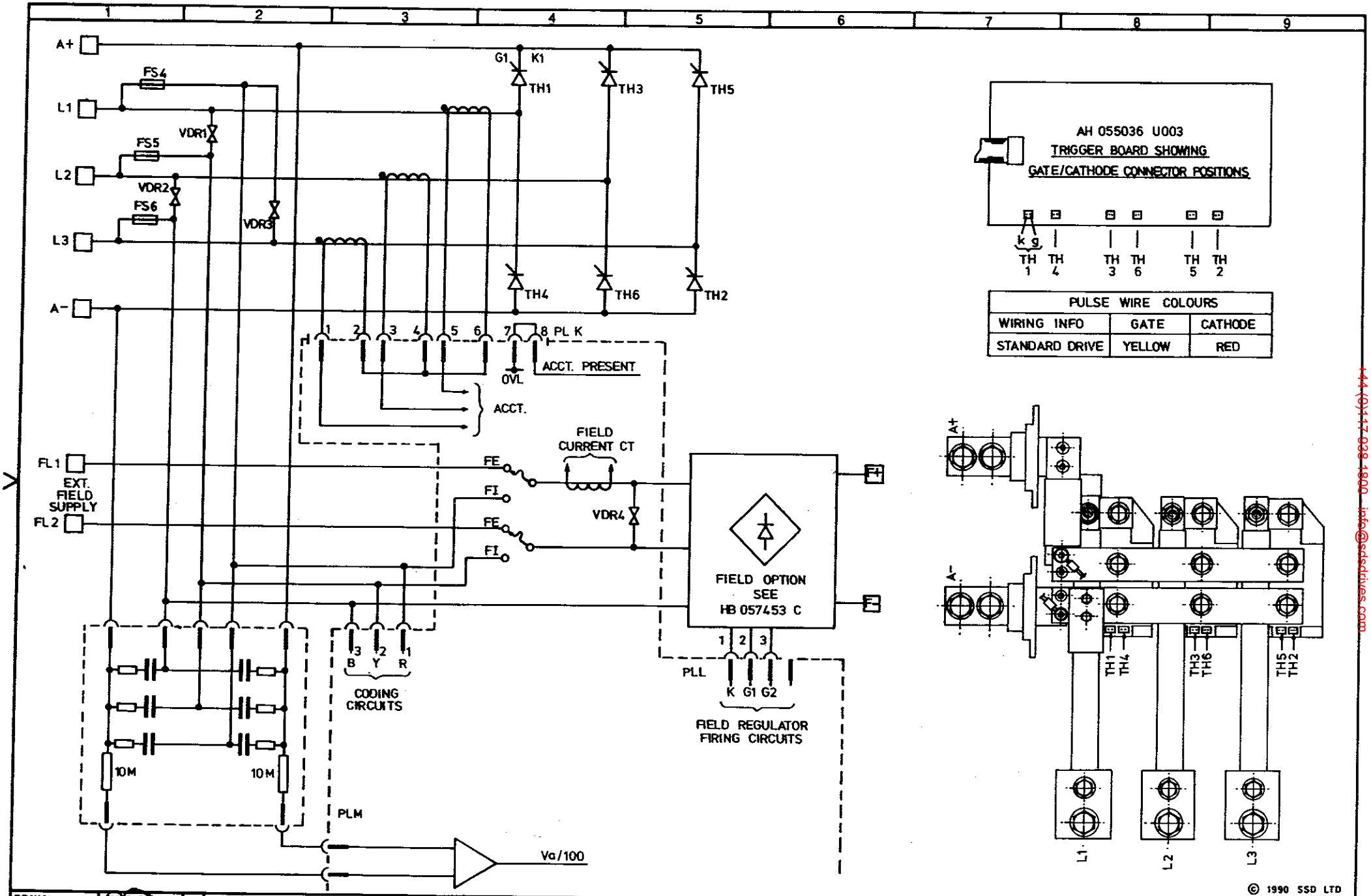

PULSE WIRE COLOURS		
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	YELLOW	RED

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TRACED PB/EDES		ISS A B	SSD LITTLEHAMPTON ENGLAND TELEX 87142

TITLE
DC CONTROLLER 450A STACK
2 QUAD POWER CIRCUIT

USED ON 570/590 SERIES

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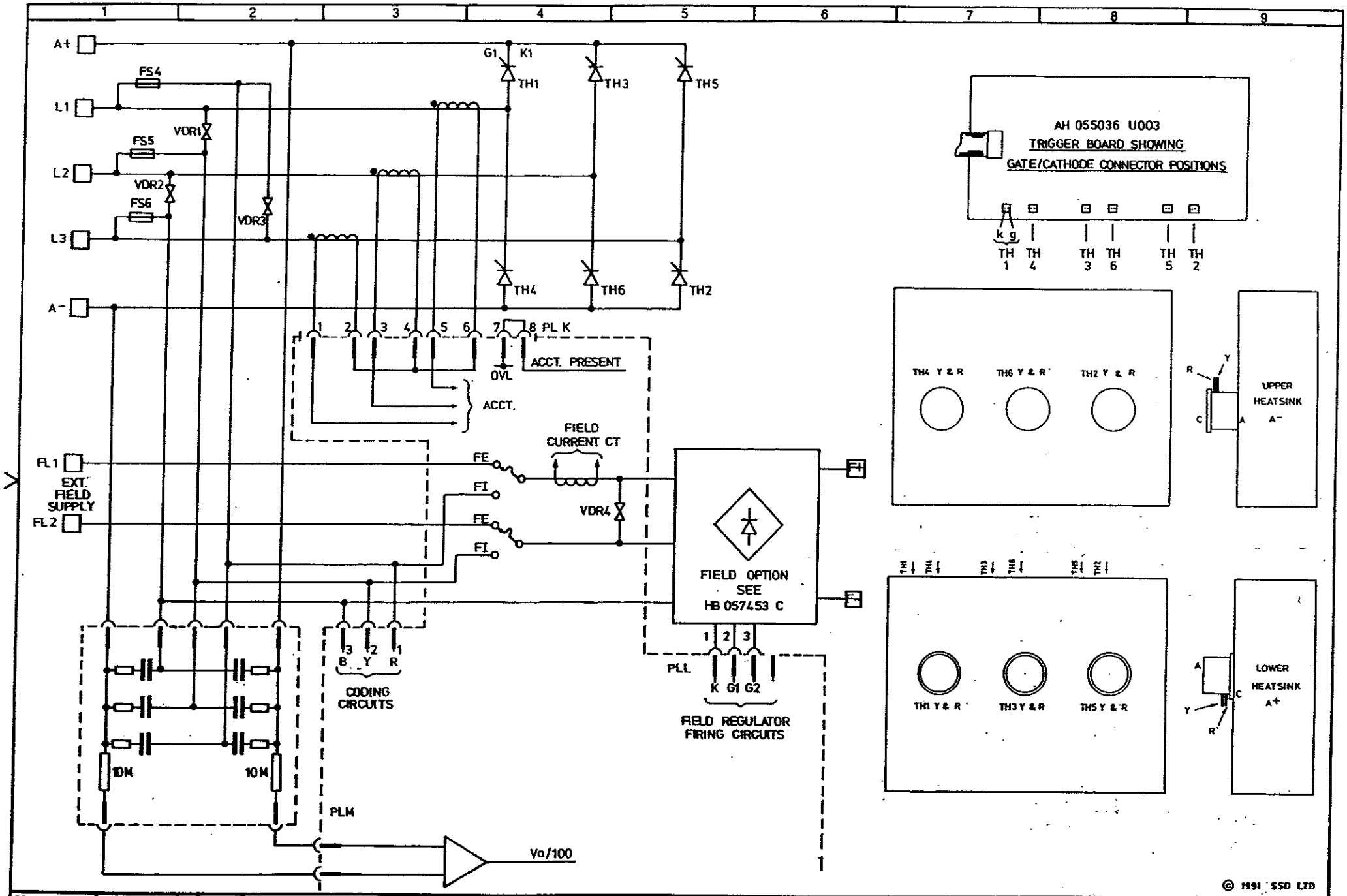

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TRACED —	—		B 4.3.91	SSD LITTLEHAMPTON ENGLAND TELEX 87142		DRAWING NUMBER HJ 059561 D
KE0486514D			1 31/1/92			SHT 1 OF 1

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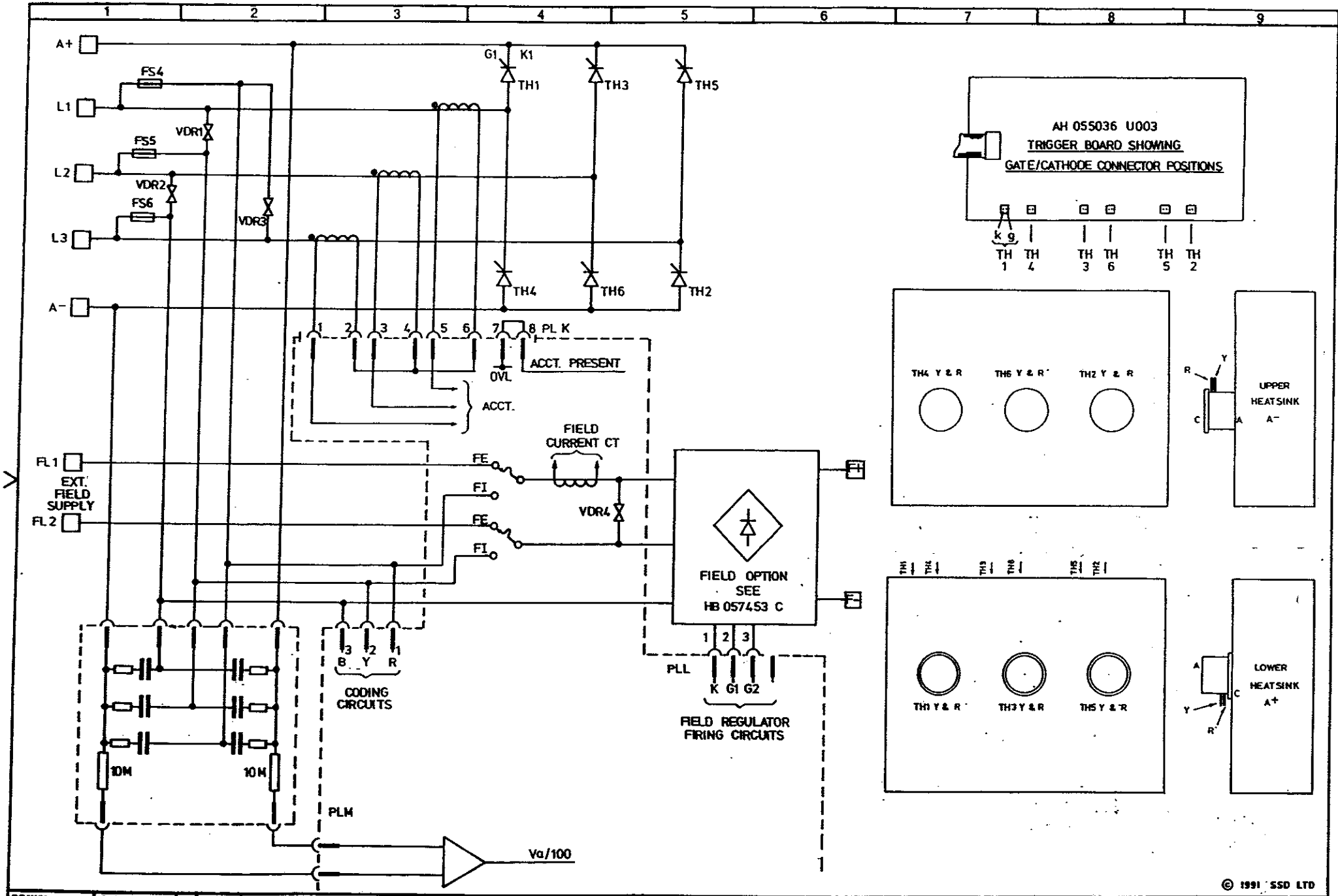

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TRACED —	—		B 4.3.91	SSD LITTLEHAMPTON ENGLAND TELEX 87142	2 QUAD POWER CIRCUIT	DRAWING NUMBER HJ 059561 D	SHT 1 OF 1
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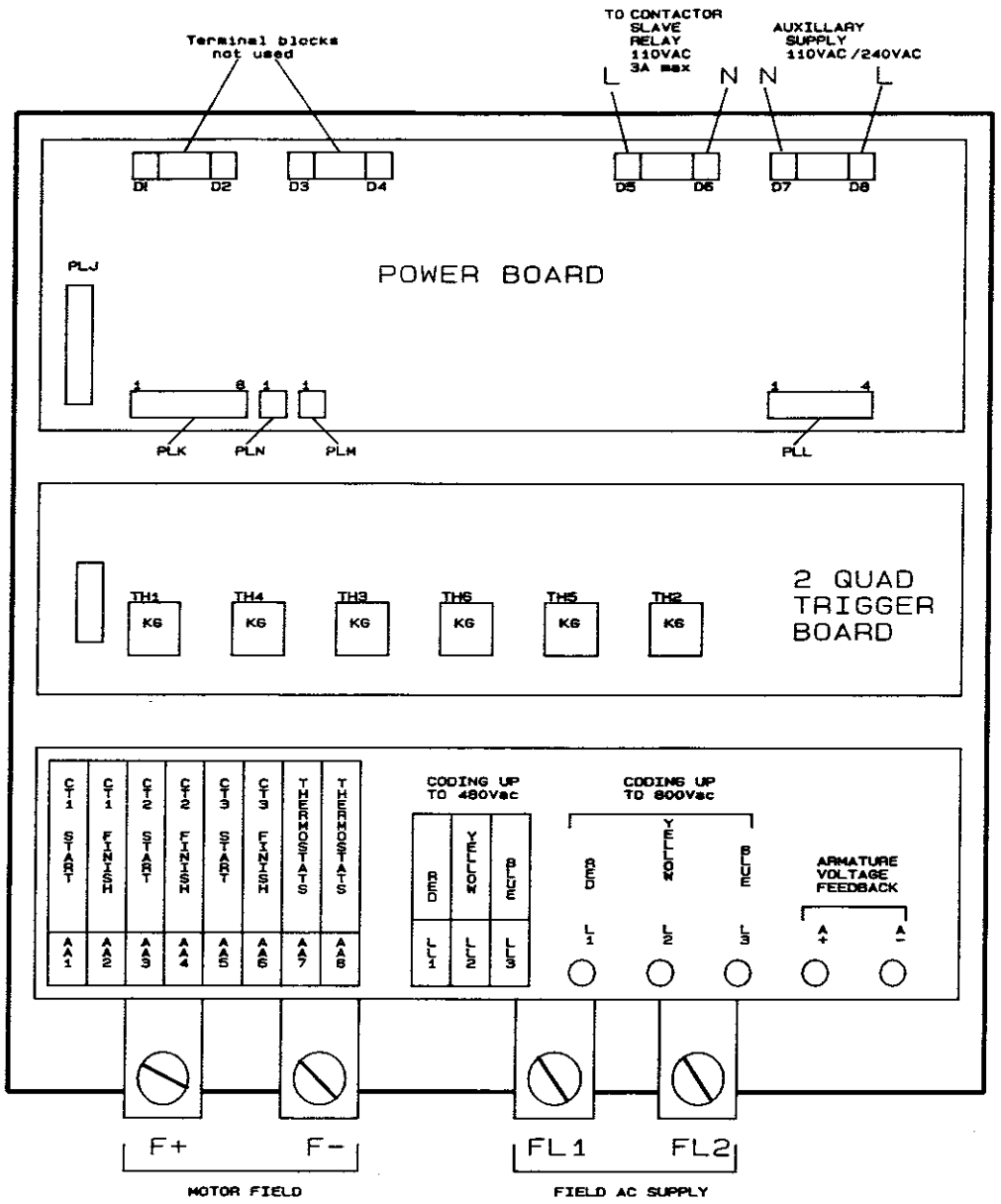

Socket identification.

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

CAD FILENAME: 578_5.SCH

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

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ANW	DESIGN APP.	ISS	A	B	C	1	2

C.A.O. LINK

ELECTRICAL SYMBOLS TO BS 3939

SSD LITTLEHAMPTON ENGLAND TELEX 87142

EI

TITLE

LAYOUT EXTERNAL CONTROLLER 2 QUAD

USED ON

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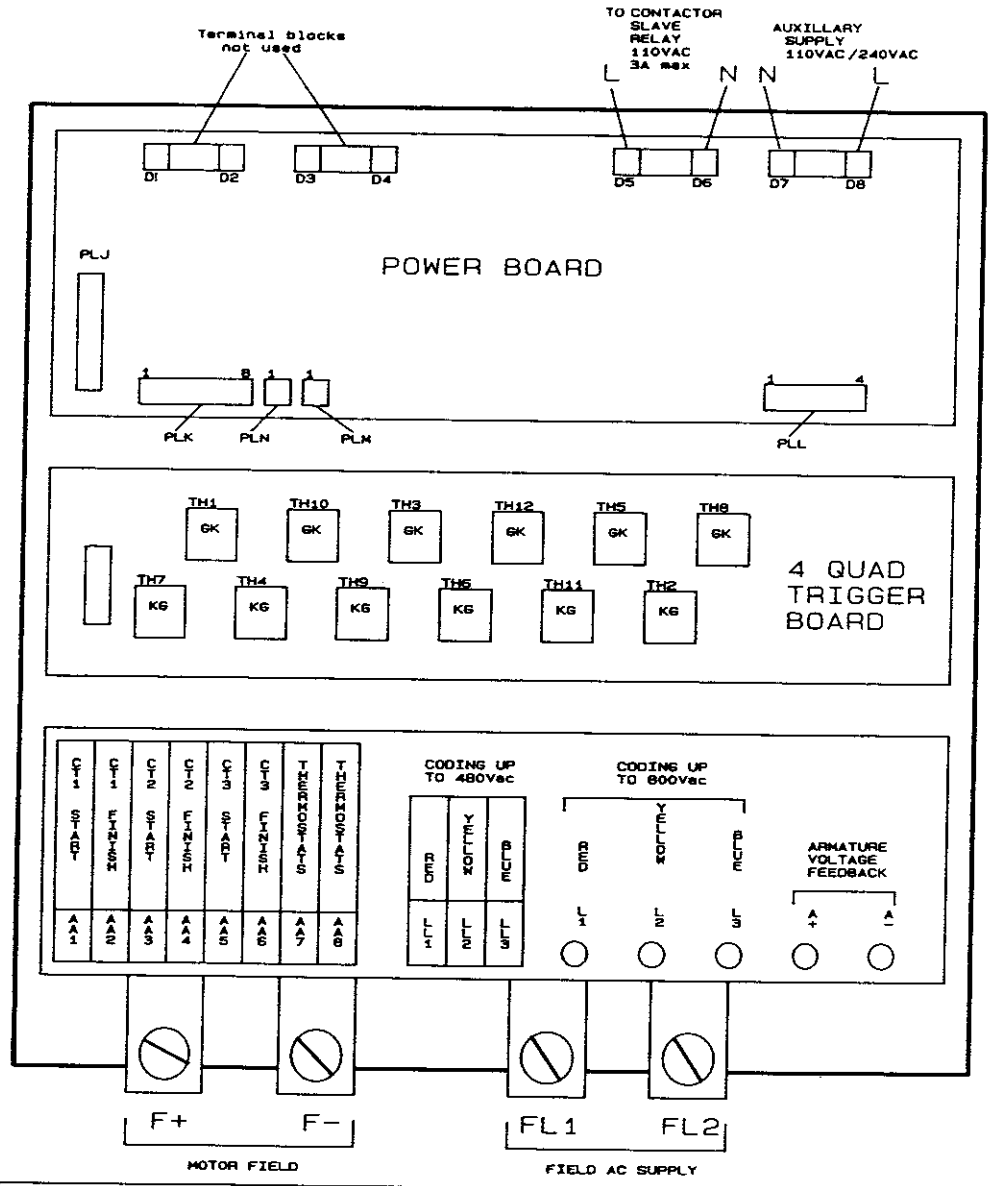

Socket identification.

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

CAD FILENAME: 578_3.SCH

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

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ANW	GDR	ISS	A	B	C	1	2
C.A.D. LINK	DESIGN APP.						

ELECTRICAL SYMBOLS TO BS 3939

SSD LITTLEHAMPTON ENGLAND TELEX 87142

TITLE

LAYOUT EXTERNAL
STACK CONTROLLER
4 QUAD

USED ON

© SSD 19 89

DRAWING NUMBER

HB058299D

SHT. 2 OF 5

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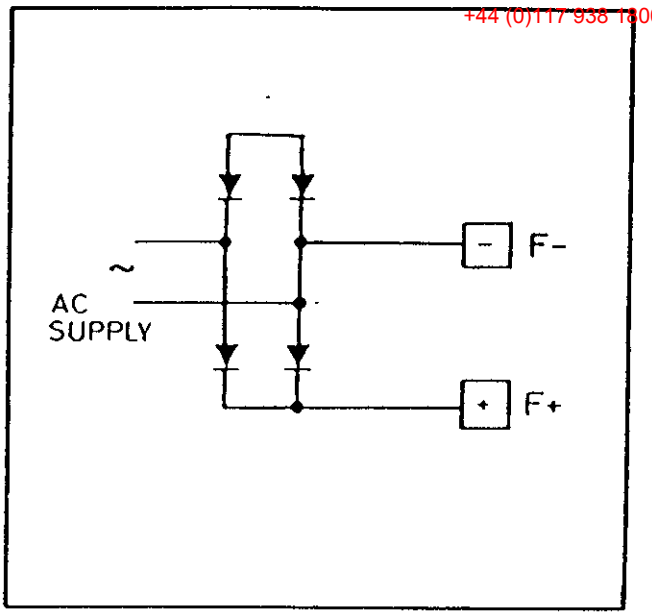
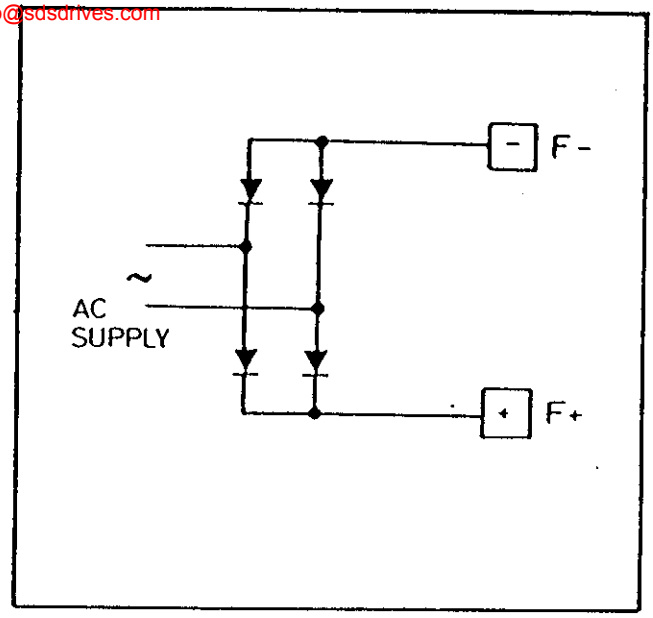


HALF WAVE RECTIFIER



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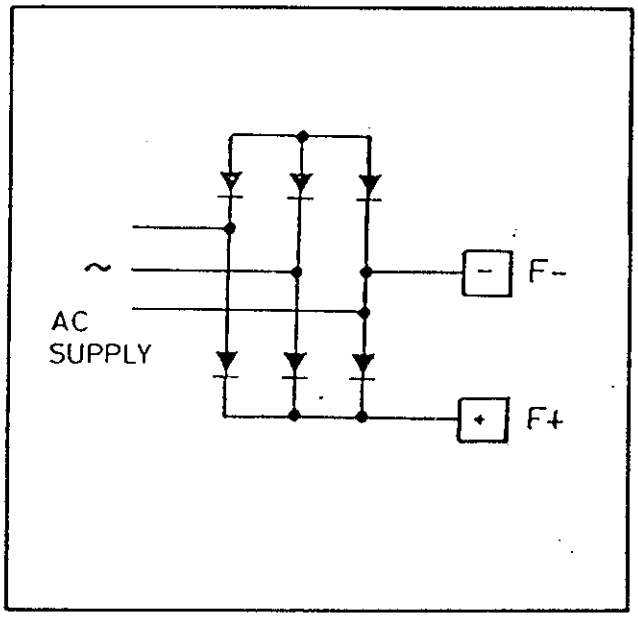
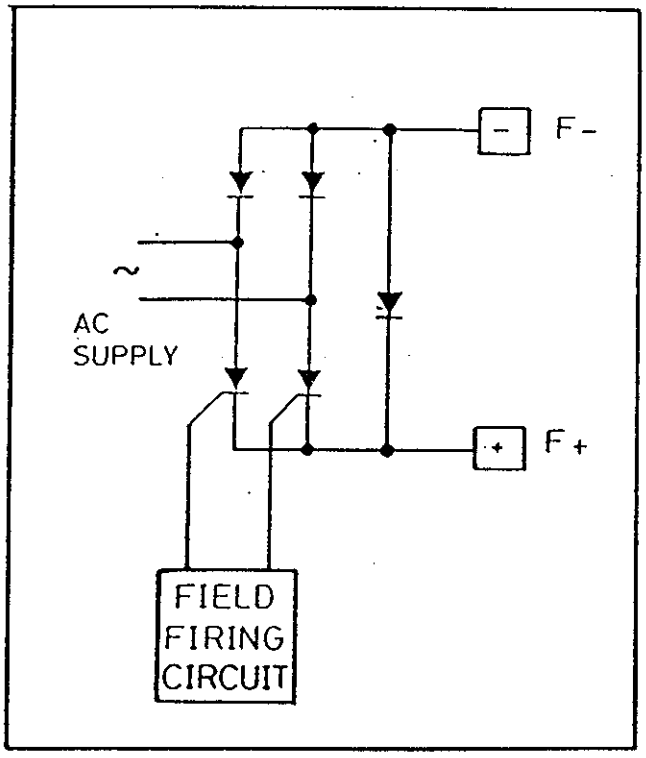


3 PHASE HALF WAVE RECTIFIER



FIELD FIRING CIRCUIT

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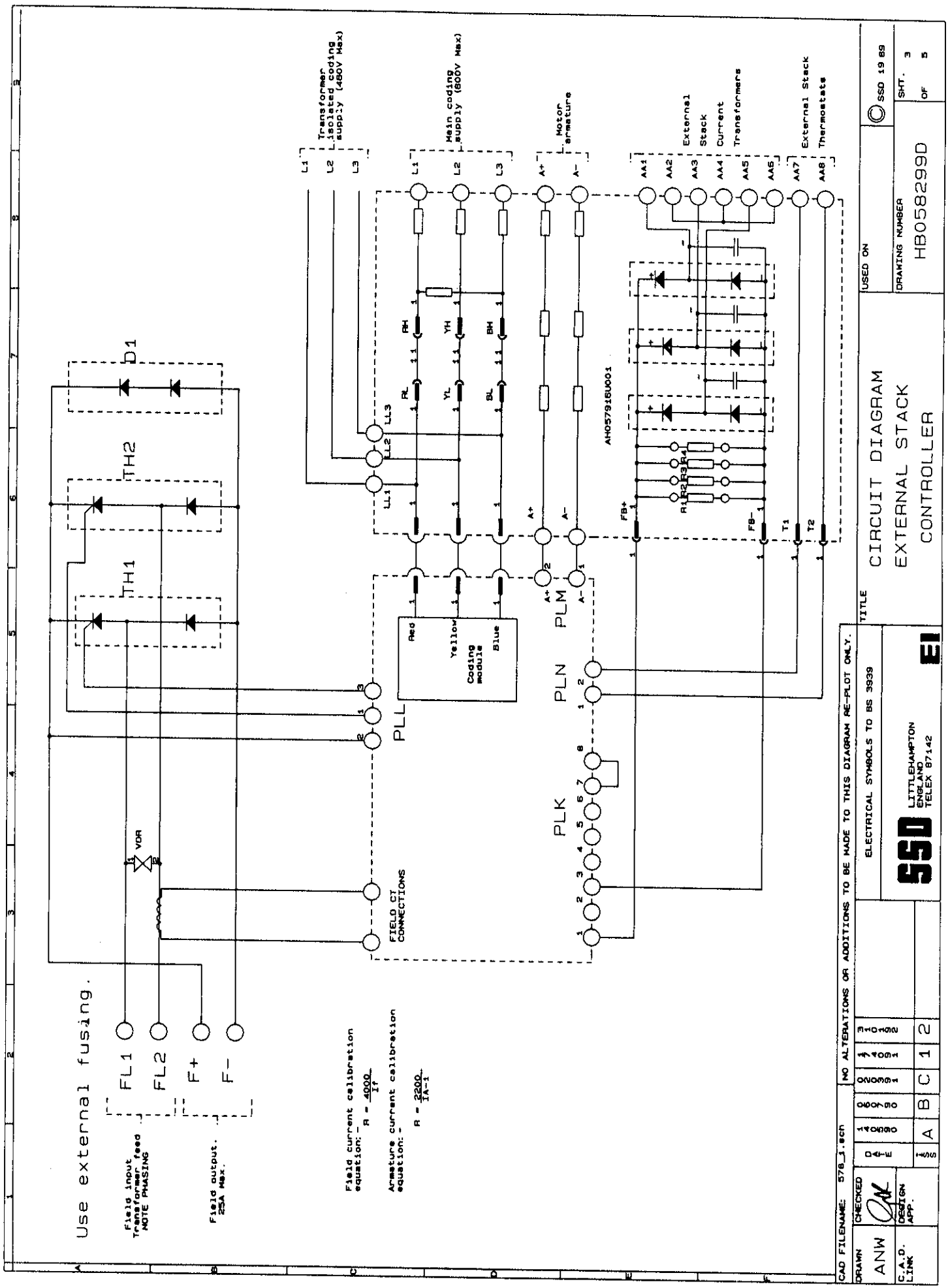

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590 TAG LIST VERSION 1 - APPENDIX A

TAG	NAME	R/O R/W	CONNECT TO INPUT	MIN. VALUE	MAX. VALUE	CHANGE WHILE THE DRIVE IS RUNNING	PASS WORD LEVEL
0	Null Operation Tag Useful for parking inputs and outputs not required in a specific configuration.						
1	EEprom Version No	R/W	NOCFG	0	FFFF	UNRESTRICT	PW1
2	Ramp up time	R/W	RECFG	0.1	600.0	UNRESTRICT	PW1
3	Ramp down time	R/W	RECFG	0.1	600.0	UNRESTRICT	PW1
4	Ramp mode	R/W	NOCFG	DISABLED	ENABLED	UNRESTRICT	PW1
5	Ramp input	R/W	RECFG	-100.00	+100.00	UNRESTRICT	PW1
6	Ratio 1	R/W	RECFG	0	3.0000	UNRESTRICT	PW1
7	Ratio 2	R/W	RECFG	0	3.0000	UNRESTRICT	PW1
8	Sign 1	R/W	NOCFG	NEG	POS	UNRESTRICT	PW1
9	Sign 2	R/W	NOCFG	NEG	POS	UNRESTRICT	PW1
10	Zero Offset	R/W	NOCFG	-5.00	+5.00	UNRESTRICT	PW1
11	Standstill Logic	R/W	NOCFG	DISABLED	ENABLED	RESTRICTED	PW1
12	Zero Threshold	R/W	NOCFG	0.00	5.00	UNRESTRICT	PW1
13	Speed Loop Time Constant	R/W	RECFG	0.001	1.000	UNRESTRICT	PW1
14	Speed Loop Proportional Gain	R/W	RECFG	0.00	200.00	UNRESTRICT	PW1
15	Current Limit Scale	R/W	RECFG	0.00	200.00	UNRESTRICT	PW1
16	Current Loop Proportional Gain	R/W	RECFG	0.00	200.00	UNRESTRICT	PW1
17	Current Loop Integral Gain	R/W	RECFG	0.00	200.00	UNRESTRICT	PW1
18	Autotune I Loop	R/W	NOCFG	OFF	ON	UNRESTRICT	PW1
19	Inhibit Field Fail Alarm	R/W	NOCFG	INHIBITED	ENABLED	UNRESTRICT	PW1
20	Armeture Voltage Calibration	R/W	NOCFG	0.9800	1.1000	UNRESTRICT	PW1
21	IR Compensation	R/W	NOCFG	0.00	100.00	UNRESTRICT	PW1
22	Microtach Calibration	R/W	NOCFG	0	6000	UNRESTRICT	PW1
23	Analog Tach Calibration	R/W	NOCFG	0.9800	1.1000	UNRESTRICT	PW1
24	Number of Encoder Lines	R/W	NOCFG	10	5000	RESTRICTED	PW1
25	Meter Drive (A9) Bi/Unipolar	R/W	NOCFG	UNIPOLAR	BIPOLAR	UNRESTRICT	PW1
26	Stop Rate P-Stop	R/W	NOCFG	0.1	600.0	UNRESTRICT	PW1
27	Stop Rate N-Stop	R/W	NOCFG	0.1	600.0	UNRESTRICT	PW1
28	Stall Trip Inhibit	R/W	NOCFG	INHIBITED	ENABLED	UNRESTRICT	PW1
29	Stop Zero Speed Threshold	R/W	NOCFG	0.00	100.00	UNRESTRICT	PW1
30	Additional Current Demand	R/W	RECFG	-200.00	200.00	UNRESTRICT	PW1
31	Imax Speed	R/W	NOCFG	0.00	100.00	RESTRICTED	PW1
32	Imin Speed	R/W	NOCFG	0.00	100.00	RESTRICTED	PW1
33	Profile Imin	R/W	NOCFG	0.00	200.00	RESTRICTED	PW1
34	Field Backstop	R/W	NOCFG	0	1000	UNRESTRICT	PW1
35	Field Ffrstop	R/W	NOCFG	0	10000	UNRESTRICT	PW1
36	Field Iffb Delay	R/W	NOCFG	0	255	UNRESTRICT	PW1
37	Menu Full	R/W	NOCFG	DISABLED	ENABLED	UNRESTRICT	PW1
38	Menu Speed	R/W	NOCFG	0	65536	UNRESTRICT	PW1
39	Configure Inhibit	R/W	NOCFG	DISABLED	ENABLED	RESTRICTED	PW1
40	System I/O	R/O	N/A	0	65536	N/A	N/A
41	Additional Speed Demand	R/W	RECFG	-100.00	+100.00	UNRESTRICT	PW1
42	Current Demand Clamped	R/O	NOCFG	FALSE	TRUE	UNRESTRICT	PW1
43	Digital Output 1 / Absolute	R/O	NOCFG	FALSE	TRUE	UNRESTRICT	PW1
44	Digital Output 2 / Absolute	R/O	NOCFG	FALSE	TRUE	UNRESTRICT	PW1
45	Digital Output 3 / Absolute	R/O	NOCFG	FALSE	TRUE	UNRESTRICT	PW1
46	Linear / S-Ramp	R/W	NOCFG	LINEAR	PROFILED	UNRESTRICT	PW1
47	Speed Feedback Select	R/W	NOCFG	ARM.VOLTS FBK/ ANALOGTACH/MICROTACH		RESTRICTED	PW1
48	Neg Output Clamp	R/W	RECFG	-200.00	+200.00	UNRESTRICT	PW1
49	Microtach Sign	R/W	NOCFG	NEG	POS	RESTRICTED	PW1
50	Analog Input 1 A2	R/O	NOCFG	-10.00	+10.00	UNRESTRICT	DIAG
51	Analog Input 2 A3	R/O	NOCFG	-10.00	+10.00	UNRESTRICT	DIAG
52	Analog Input 3 A4	R/O	NOCFG	-10.00	+10.00	UNRESTRICT	DIAG
53	Analog Input 4 A5	R/O	NOCFG	-10.00	+10.00	UNRESTRICT	DIAG
54	Analog Input 5 A6	R/O	NOCFG	-10.00	+10.00	UNRESTRICT	DIAG
55	Analog Output 1 A7	R/O	NOCFG	-11.00	+11.00	UNRESTRICT	DIAG
56	Analog Output 2 A8	R/O	NOCFG	-11.00	+11.00	UNRESTRICT	DIAG
57	Armature Volts Raw	R/O	NOCFG	N/A	N/A	UNRESTRICT	N/A
58	Analog Tacho Feedback	R/O	NOCFG	-110.00	+110.00	UNRESTRICT	DIAG
59	MicroTach Feedback	R/O	NOCFG	0	6000	UNRESTRICT	DIAG
60	Armature Volts Feedback (Terminal Volts)	R/O	NOCFG	-125.00	+125.00	UNRESTRICT	DIAG
61	Actual Negative Current Limit	R/O	NOCFG	-200.00	+200.00	UNRESTRICT	DIAG
62	Total Feedback	R/O	NOCFG	-110.00	+110.00	UNRESTRICT	DIAG
63	Total Setpoint	R/O	NOCFG	-100.00	+100.00	UNRESTRICT	DIAG
64	Speedloop Error	R/O	NOCFG	-150.00	+150.00	UNRESTRICT	DIAG

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TAG	NAME	R/O R/W	CONNECT TO INPUT	MIN. VALUE	MAX. VALUE	CHANGE WHILE THE DRIVE IS RUNNING	PASS WORD LEVEL
65	Current Feedback	R/O	NOCFG	-280.00	+280.00	UNRESTRICT	DIAG
66	Current Demand	R/O	NOCFG	-200.00	+200.00	UNRESTRICT	DIAG
67	Actual Positive Current Limit	R/O	NOCFG	-200.00	+200.00	UNRESTRICT	DIAG
68	Start Input	R/O	NOCFG	OFF	ON	UNRESTRICT	DIAG
69	Reserved						
70	Enable	R/O	NOCFG	OFF	ON	UNRESTRICT	DIAG
71	Dg In 1	R/O	NOCFG	OFF	ON	UNRESTRICT	DIAG
72	Dg In 2	R/O	NOCFG	OFF	ON	UNRESTRICT	DIAG
73	Dg In 3	R/O	NOCFG	OFF	ON	UNRESTRICT	DIAG
74	Dg Out 1	R/O	NOCFG	OFF	ON	UNRESTRICT	DIAG
75	Dg Out 2	R/O	NOCFG	OFF	ON	UNRESTRICT	DIAG
76	Dg Out 3	R/O	NOCFG	OFF	ON	UNRESTRICT	DIAG
77	At Zero Speed	R/O	NOCFG	FALSE	TRUE	UNRESTRICT	DIAG
78	At Zero Setpoint	R/O	NOCFG	FALSE	TRUE	UNRESTRICT	DIAG
79	At Standstill	R/O	NOCFG	FALSE	TRUE	UNRESTRICT	DIAG
80	Program Stop	R/O	NOCFG	FALSE	TRUE	UNRESTRICT	N/A
81	Speed Feedback Alarm Inhibit	R/W	NOCFG	INHIBITED	ENABLED	UNRESTRICT	PW1
82	Drive Start	R/O	NOCFG	OFF	ON	UNRESTRICT	DIAG
83	Main Contactor						
84	Drive Enable	R/O	NOCFG	DISABLED	ENABLED	UNRESTRICT	DIAG
85	Ramp Output	R/O	NOCFG	-100.00	+100.00	UNRESTRICT	DIAG
86	Setpoint Sum Output	R/O	NOCFG	-100.00	+100.00	UNRESTRICT	DIAG
87	Pos Current Clamp	R/O	NOCFG	-200.00	+200.00	UNRESTRICT	DIAG
88	Neg Current Clamp	R/O	NOCFG	-200.00	+200.00	UNRESTRICT	DIAG
89	Speed Demand.	R/O	NOCFG	-100.00	+100.00	UNRESTRICT	DIAG
90	spdlopd.clamp_mode						
91	Program Stop Current Limit	R/W	NOCFG	0	200.00	UNRESTRICT	PW1
92	Microtach Alarm Inhibit	R/W	NOCFG	INHIBITED	ENABLED	UNRESTRICT	PW1
93	Current Profile Imax	R/W	NOCFG	0	200.00	RESTRICTED	PW1
94	Aux_Dg_Output1	R/W	RECFG	OFF	ON	UNRESTRICT	PW1
95	Aux_Dg_Output2	R/W	RECFG	OFF	ON	UNRESTRICT	PW1
96	Aux_Dg_Output3	R/W	RECFG	OFF	ON	UNRESTRICT	PW1
97	Dgout_Source 1	R/W	NOCFG	0	255	RESTRICTED	PW1
98	Dgout_Source 2	R/W	NOCFG	0	255	RESTRICTED	PW1
99	Dgout_Source 3	R/W	NOCFG	0	255	RESTRICTED	PW1
100	Ratio Sum Input 1	R/O	NOCFG	-100	+100	RESTRICTED	PW1
101	Ratio Sum Input 2	R/W	RECFG	-200	+200	UNRESTRICT	PW1
102	Dgin 1 Dest Tag	R/W	N/A	0	255	RESTRICTED	PW1
103	Dgin 1 True Value	R/W	RECFG	-300	+300	UNRESTRICT	PW1
104	Dgin 1 False Value	R/W	RECFG	-300	+300	UNRESTRICT	PW1
105	Dgin 2 Dest Tag	R/W	N/A	0	255	RESTRICTED	PW1
106	Dgin 2 True Value	R/W	RECFG	-300	+300	UNRESTRICT	PW1
107	Dgin 2 False Value	R/W	RECFG	-300	+300	UNRESTRICT	PW1
108	Dgin 3 Dest Tag	R/W	N/A	0	255	RESTRICTED	PW1
109	Dgin 3 True Value	R/W	RECFG	-300	+300	UNRESTRICT	PW1
110	Dgin 3 False	R/W	RECFG	-300	+300	UNRESTRICT	PW1
111	5703 RCV Error Inhibit	R/W	NOCFG	INHIBITED	ENABLED	UNRESTRICT	PW1
112	Stalled	R/O	NOCFG	OK	ACTIVE	UNRESTRICT	N/A
113	Reserved						
114	Reserved						
115	Health Word	R/O	NOCFG	0	FFFF	UNRESTRICT	DIAG
116	Health Store	R/O	NOCFG	0	FFFF	UNRESTRICT	DIAG
117	Health Inhibit	R/O	NOCFG	OFF	ON	UNRESTRICT	PW1
118	Ramp Hold	R/W	RECFG	OFF	ON	UNRESTRICT	PW1
119	I Demand Isolate	R/W	RECFG	DISABLED	ENABLED	UNRESTRICT	PW1
120	Password	R/W	NOCFG	0	FFFF	UNRESTRICT	PW0
121	Stored Password	R/W	NOCFG	0	FFFF	UNRESTRICT	PW1
122	Health Flag	R/O	NOCFG	FALSE	TRUE	UNRESTRICT	PW1
123	Peek Address	R/W	NOCFG	0	FFFF	UNRESTRICT	PW1
124	Peek Scale	R/W	NOCFG	0	FFFF	UNRESTRICT	PW1
125	Ready Flag	R/O	NOCFG	FALSE	TRUE	UNRESTRICT	PW1
126	Minimum Speed Offset	R/W	RECFG	-100.00	+100.00	UNRESTRICT	PW1
127	Dump Enable	R/O	NOCFG	DISABLED	ENABLED	RESTRICTED	PW1
128	Aux Analog Output1	R/W	RECFG	-100.00	+100.00	UNRESTRICT	PW1
129	Aux Analog Output2	R/W	RECFG	-100.00	+100.00	UNRESTRICT	PW1

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TAG	NAME	R/O R/W	CONNECT TO INPUT	MIN. VALUE	MAX. VALUE	CHANGE WHILE THE DRIVE IS RUNNING	PASS WORD LEVEL
130	P3 Mode	R/W	NOCFG	NOT CONNECTED/MASTER/ SLAVE		UNRESTRICT	PW1
131	Deadband Width	R/W	NOCFG	0	100.00	UNRESTRICT	PW1
132	P3 Setpoint Scaling P3	R/W	RECFG	-3.0000	+3.0000	UNRESTRICT	PW1
133	P3 Setpoint Sign	R/W	NOCFG	NEG	POS	UNRESTRICT	PW1
134	P3 Output Slot	R/W	NOCFG	0	255	RESTRICTED	PW1
135	P3 Input Slot	R/W	NOCFG	0	255	RESTRICTED	PW1
136	Feedforward	R/W	NOCFG	1.00	50.00	UNRESTRICT	PW1
137	Dis/Continuous boundary	R/W	NOCFG	0	200.00	UNRESTRICT	PW1
138	Serial P1 GID	R/W	NOCFG	0	7	UNRESTRICT	PW1
139	Serial P1 UID	R/W	NOCFG	0	15	UNRESTRICT	PW1
140	Serial P2 GID	R/W	NOCFG	0	7	UNRESTRICT	PW1
141	Serial P2 UID	R/W	NOCFG	0	15	UNRESTRICT	PW1
142	Serial P1 Pno 7	R/W	NOCFG	0	65535	UNRESTRICT	PW1
143	Serial P2 Pno 7	R/W	NOCFG	0	65535	UNRESTRICT	PW1
144	Serial P1 Hysteresis	R/W	NOCFG	0	32767	UNRESTRICT	PW1
145	Serial P2 Hysteresis	R/W	NOCFG	0	32767	UNRESTRICT	PW1
146	Serial P1 Enable	R/W	NOCFG	DISABLED	ENABLED	UNRESTRICT	PW1
147	Serial P2 Enable	R/W	NOCFG	DISABLED	ENABLED	UNRESTRICT	PW1
148	Serial P1 Ascii/Bin	R/W	NOCFG	ASCII	BINARY	UNRESTRICT	PW1
149	Serial P2 Ascii/Bin	R/W	NOCFG	ASCII	BINARY	UNRESTRICT	PW1
150	Serial P1 Baud	R/W	NOCFG	0	FFFF	UNRESTRICT	PW1
151	Serial P2 Baud	R/W	NOCFG	0	FFFF	UNRESTRICT	PW1
152	Serial P1 Esp	R/W	NOCFG	DISABLED	ENABLED	UNRESTRICT	PW1
153	Serial P2 Esp	R/W	NOCFG	DISABLED	ENABLED	UNRESTRICT	PW1
154	Instrument Identity (II)	R/W	NOCFG	0	FFFF	UNRESTRICT	PW1
155	Version Number (VO)	R/O	NOCFG	0	FFFF	UNRESTRICT	PW1
156	Config Information (CI)	R/O	NOCFG	0	FFFF	UNRESTRICT	PW1
157	Block Length (BL)	R/O	NOCFG	0	FFFF	UNRESTRICT	PW1
158	Serial P1 Error Report (EE)	R/W	NOCFG	0	FFFF	UNRESTRICT	PW1
159	Serial P2 Error Report (EE)	R/W	NOCFG	0	FFFF	UNRESTRICT	PW1
160	Mode No (MN)	R/O	NOCFG	0	FFFF	UNRESTRICT	PW1
161	Aux Start	R/W	NOCFG	OFF	ON	UNRESTRICT	PW1
162	Min Cycle Time	R/W	NOCFG	0	FFFF	UNRESTRICT	PW1
163	I Loop PI Mode	R/W	NOCFG	0 / 1 / 2		RESTRICTED	PW1
164	Toggle Rate	R/W	NOCFG	0	FFFF	UNRESTRICT	PW1
165	Toggle Ref 1	R/W	NOCFG	-3.0000	+3.0000	UNRESTRICT	PW1
166	Sel. Ref	R/W	NOCFG	INTERNAL/CURRENT/ SPEED		RESTRICTED	PW1
167	Toggle Ref2	R/W	NOCFG	-3.0000	+3.0000	UNRESTRICT	PW1
168	Aux Enable	R/W	NOCFG	OFF	ON	UNRESTRICT	PW1
169	System Field Enable	R/O	NOCFG	DISABLED	ENABLED	UNRESTRICT	PW1
170	Field Enable	R/W	NOCFG	DISABLED	ENABLED	RESTRICTED	PW1
171	Field Setpoint	R/W	RECFG	0.00	100.00	UNRESTRICT	PW1
172	Field Loop I Gain	R/W	NOCFG	0.00	100.00	UNRESTRICT	PW1
173	Field Loop P Gain	R/W	NOCFG	0.00	100.00	UNRESTRICT	PW1
174	Select Fld Weakening	R/W	NOCFG	DISABLED	ENABLED	RESTRICTED	PW1
175	Emf Lead Time Const	R/W	NOCFG	0.10	50.00	UNRESTRICT	PW1
176	Emf Lag Time Const	R/W	NOCFG	0.00	200.00	UNRESTRICT	PW1
177	Emf Gain	R/W	NOCFG	0.00	100.00	UNRESTRICT	PW1
178	Emf Const V Level	R/W	NOCFG	0	100.00	UNRESTRICT	PW1
179	Field Weakening Limit	R/W	NOCFG	0	100.00	RESTRICTED	PW1
180	Spdfeedback Alarm Window	R/W	NOCFG	0	100.00	UNRESTRICT	PW1
181	Field Current Feedback.	R/O	NOCFG	-150.00	+150.00	UNRESTRICT	PW1
182	Field Current Ratio.	R/W	NOCFG	0.9800	1.1000	UNRESTRICT	PW1
183	Total Field Setpoint.	R/O	NOCFG	0	100.00	UNRESTRICT	PW1
184	Field Firing Angle.	R/W	NOCFG	5	154	UNRESTRICT	PW1
185	Field Quench Delay.	R/W	NOCFG	0.1	600.0	UNRESTRICT	PW1
186	Field Quench Mode.	R/W	NOCFG	QUENCH	STANDBY	UNRESTRICT	PW1
187	P3 Unratioed Output	R/O	RECON	-300.00	+300.00	UNRESTRICT	PW1
188	Over Speed	R/W	NOCFG	0	200.00	UNRESTRICT	PW1
189	P3 Output	R/O	NOCFG	-300.00	+300.00	UNRESTRICT	DIAG
190	Peak Hardware Delay	R/W	NOCFG	0	65535	RESTRICTED	PW1
191	Bemf Fbk Lead	R/W	NOCFG	10	5000	UNRESTRICT	PW1
192	Bemf Fbk Lag	R/W	NOCFG	10	5000	UNRESTRICT	PW1
193	Tick Length	R/O	NOCFG	0	65535	UNRESTRICT	PW1
194	Disc_Adapt_Pot	R/W	NOCFG	0	100.00	RESTRICTED	PW1

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195	Dgout 1 Threshold	R/W	NOCFG	-300	300	RESTRICTED	PW1
196	Dgout 2 Threshold	R/W	NOCFG	-300	300	RESTRICTED	PW1
197	Dgout 3 Threshold	R/W	NOCFG	-300	300	RESTRICTED	PW1
198	P3 Baud Rate	R/W	NOCFG	0	FF	RESTRICTED	PW1
199	Inverse Time Delay	R/W	NOCFG	0.1	600.0	RESTRICTED	PW2
200	Inverse Time Rate	R/W	NOCFG	0.1	600.0	RESTRICTED	PW2
201	Current Loop 2 Quad Mode	R/W	NOCFG	DISABLED	ENABLED	RESTRICTED	PW1
202	Speed Loop Integral Defeat	R/W	RECFG	OFF	ON	UNRESTRICT	PW1
203	Inverse Time Output	R/O	NOCFG	0	200.00	RESTRICT	PW2
204	Inverse Time Aiming Point	R/W	NOCFG	0	200.00	RESTRICTED	PW2
205	PLL Int	R/W	NOCFG	0	200	UNRESTRICT	PW1
206	PLL Prop	R/W	NOCFG	0	200	UNRESTRICT	PW1
207	Reserved						
208	Reserved						
209	Field Loop Mode	R/W	NOCFG	CURRENT	VOLTAGE	RESTRICTED	PW1
210	Field Voltage Ratio	R/W	NOCFG	0	100.00	UNRESTRICT	PW1
211	System Health Inhibit	R/W	NOCFG	0	FFFF	RESTRICTED	PW1
212	Reserved						
213	Reserved						
214	Reserved						
215	Load Meter	R/O	NOCFG	-200.00	+200.00	UNRESTRICT	PW1
216	Program Stop Delay Time	R/W	NOCFG	0	600.00	UNRESTRICT	PW1
217	Stop Time Delay	R/W	NOCFG	0	600.0	UNRESTRICT	PW1
218	Reserved						
219	Reserved						
220	DAC 12 Bit Select	R/W	NOCFG	DISABLED	ENABLED	RESTRICTED	PW1
221	di/dt	R/W	NOCFG	0	200.00	UNRESTRICT	PW1
222	Reserved						
223	Reserved						
224	Stall Trip Delay	R/W	NOCFG	0.1	600.0	RESTRICTED	PW1
225	Reserved						
226	Arm End Stop	R/W	NOCFG	0	200.00	RESTRICTED	PW1
227	Reserved						
228	Reserved						
229	Precision Check	R/W	NOCFG	FALSE	TRUE	RESTRICTED	PW1
230	Analog I/P 1 / Cal	R/W	NOCFG	0	3.0000	UNRESTRICT	PW1
231	Analog I/P 1 / Max	R/W	NOCFG	-300	+300	UNRESTRICT	PW1
232	Analog I/P 1 / Min	R/W	NOCFG	-300	+300	UNRESTRICT	PW1
233	Analog I/P 2 / Cal	R/W	NOCFG	0	3.0000	UNRESTRICT	PW1
234	Analog I/P 2 / Max	R/W	NOCFG	-300	+300	UNRESTRICT	PW1
235	Analog I/P 2 / Min	R/W	NOCFG	-300	+300	UNRESTRICT	PW1
236	Analog I/P 3 / Cal	R/W	NOCFG	0	3.0000	UNRESTRICT	PW1
237	Analog I/P 3 / Max	R/W	NOCFG	-300	+300	UNRESTRICT	PW1
238	Analog I/P 3 / Min	R/W	NOCFG	-300	+300	UNRESTRICT	PW1
239	Analog I/P 4 / Cal	R/W	NOCFG	0	3.0000	UNRESTRICT	PW1
240	Analog I/P 4 / Max	R/W	NOCFG	-300	+300	UNRESTRICT	PW1
241	Analog I/P 4 / Min	R/W	NOCFG	-300	+300	UNRESTRICT	PW1
242	Analog I/P 5 / Cal	R/W	NOCFG	0	3.0000	UNRESTRICT	PW1
243	Analog I/P 5 / Max	R/W	NOCFG	-300	+300	UNRESTRICT	PW1
244	Analog I/P 5 / Min	R/W	NOCFG	-300	+300	UNRESTRICT	PW1
245	Anout 1 / Cal	R/W	NOCFG	0	300.00	UNRESTRICT	PW1
246	Analog I/P 1 / Dest	R/W	NOCFG	0	255	RESTRICTED	PW1
247	Analog I/P 2 / Dest	R/W	NOCFG	0	255	RESTRICTED	PW1
248	Anout 2 / Cal	R/W	NOCFG	0	300.00	UNRESTRICT	PW1
249	Analog I/P 3 / Dest	R/W	NOCFG	0	255	RESTRICTED	PW1
250	Analog I/P 4 / Dest	R/W	NOCFG	0	255	RESTRICTED	PW1
251	Anout 1 / Source	R/W	NOCFG	0	255	RESTRICTED	PW1
252	Anout 2 / Source	R/W	NOCFG	0	255	RESTRICTED	PW1
253	Reserved						
254	Reserved						

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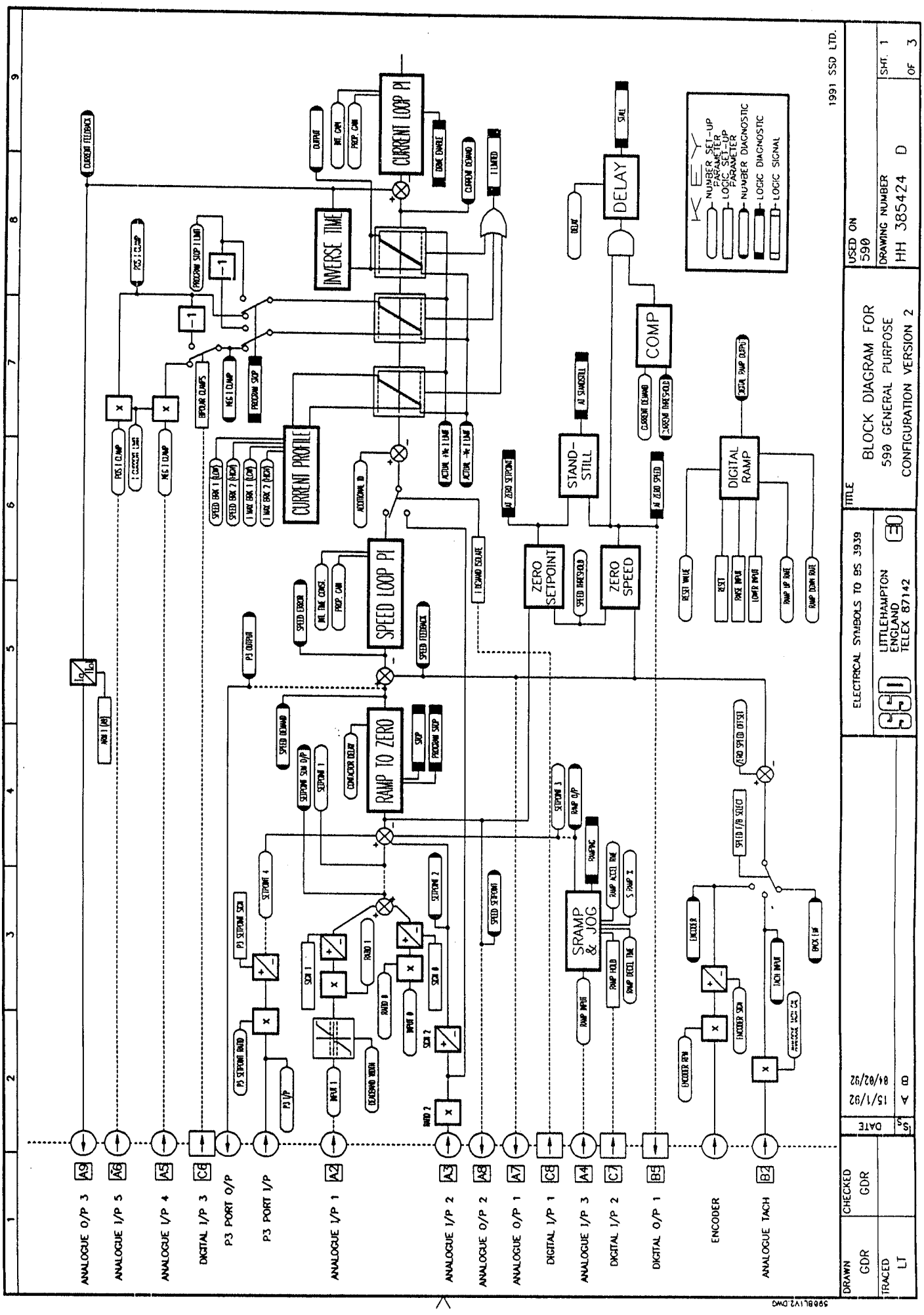

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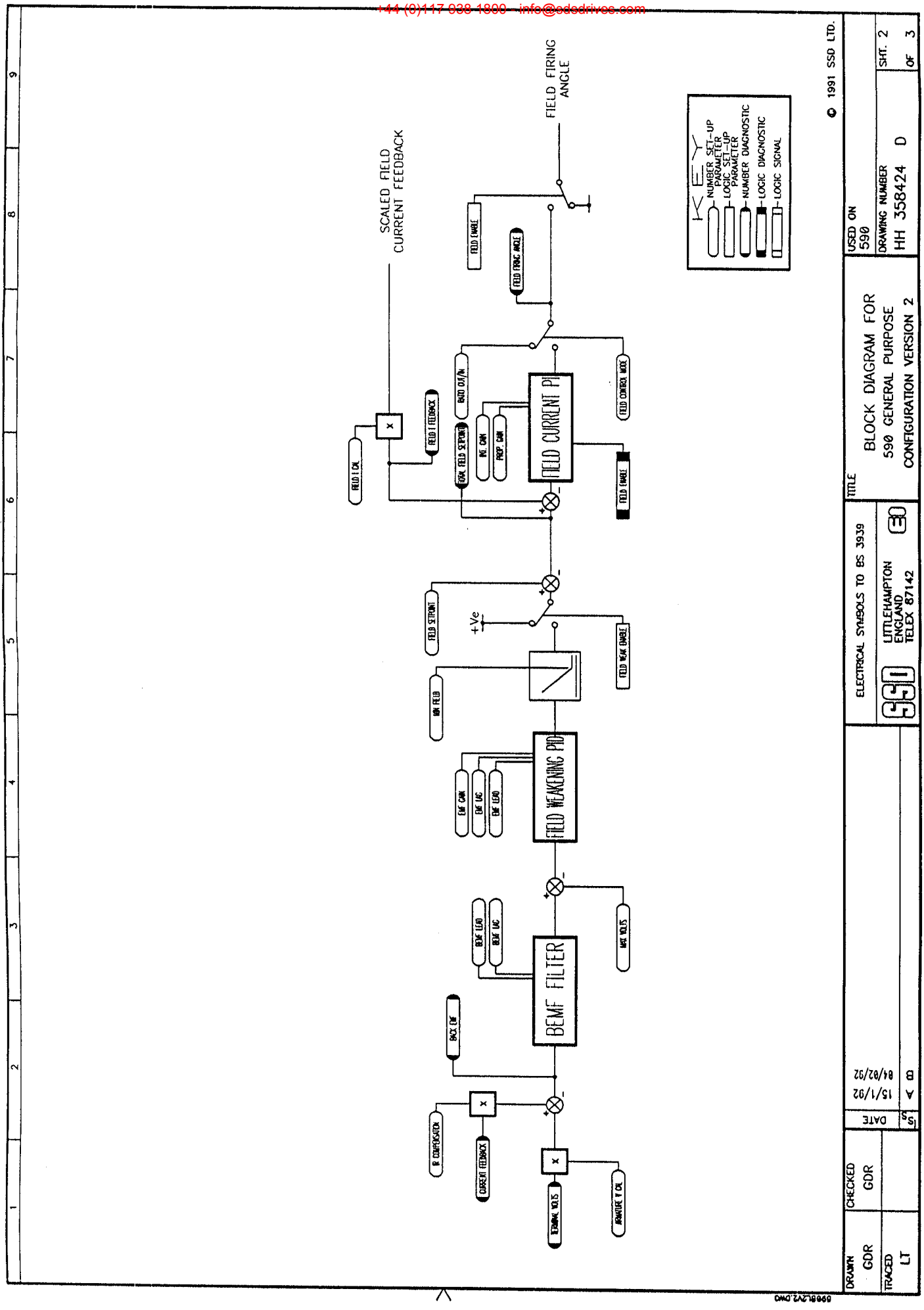

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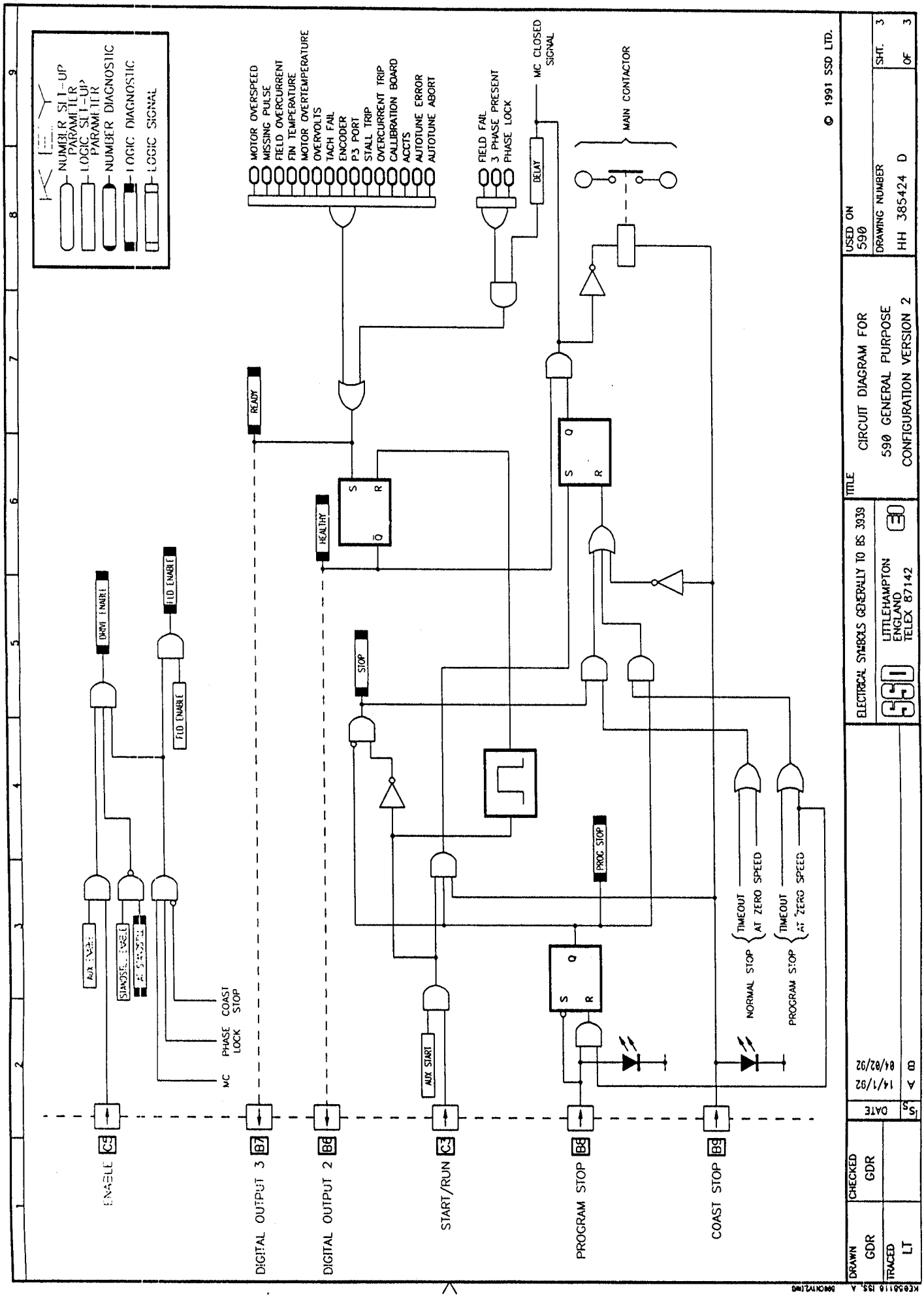

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APPENDIX B

Version 2 Software
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1 DIAGNOSTIC DESCRIPTIONS

DIAGNOSTIC POINT	TAG	DESCRIPTION	SCALING
SPEED DEMAND	89	SPEED LOOP TOTAL SETPOINT	± 100%
SPEED FEEDBACK	296	SPEED LOOP FEEDBACK	± 150%
SPEED ERROR	297	SPEED LOOP ERROR	± 150%
CURRENT DEMAND	299	CURRENT LOOP CURRENT DEMAND (SPEED ERROR PI OUTPUT OR EXTERNAL CURRENT DEMAND CLAMPED BY ALL LIMITS)	± 150%
CURRENT FEEDBACK	298	SCALED ARMATURE CURRENT	± 150%
POS I CLAMP	87	POSITIVE CURRENT CLAMP	± 200%
NEG I CLAMP	88	NEGATIVE CURRENT CLAMP	± 200%
ACTUAL POS I LIM	67	OVERALL POSITIVE CURRENT LIMIT VALUE	± 200%
ACTUAL NEG I LIM	61	OVERALL NEGATIVE CURRENT LIMIT VALUE	± 200%
INVERSE TIME O/P	203	INVERSE TIME CLAMP OUTPUT LEVEL	0 to 200%
AT CURRENT LIMIT	42	CURRENT DEMAND RESTRAINED BY OVERALL CURRENT LIMIT	TRUE/FALSE
AT ZERO SPEED	77	AT ZERO SPEED FEEDBACK	TRUE/FALSE
AT ZERO SETPOINT	78	AT ZERO SPEED SETPOINT	TRUE/FALSE
AT STANDSTILL	79	AT STANDSTILL, i.e. AT ZERO SPEED AND ZERO SPEED SETPOINT	TRUE/FALSE
STALL TRIP	112	MOTOR CURRENT ABOVE STALL THRESHOLD AND AT ZERO SPEED BUT NOT AT ZERO SPEED DEMAND	OK/TRIP
RAMPING	113	RAMP OUTPUT CHANGING TO NEW SETPOINT i.e. THE DIFFERENCE BETWEEN THE RAMP INPUT AND THE RAMP OUTPUT IS GREATER THAN THE RAMP THRESHOLD	TRUE/FALSE
PROGRAM STOP	80	PROGRAM STOP TERMINAL	TRUE/FALSE
DRIVE START	82	CONTROLLER START/RUN COMMAND	ON/OFF
DRIVE ENABLE	84	DRIVE CONTROL LOOP ENABLE	ENABLED/ DISABLED
OPERATING MODE	212	OPERATING MODE	[3]
FIELD ENABLE	169	DRIVE FIELD LOOP ENABLE	ENABLED/ DISABLED
FIELD DEMAND	183	FIELD CURRENT DEMAND	0 to +200%
FIELD I FBK	181	SCALED FIELD CURRENT FEEDBACK	± 150%
FLD FIRING ANGLE	184	CURRENT VALUE OF FIELD FIRING ANGLE	0 to 180^0
ANIN 1 [A2]	50	SPEED SETPOINT No. 1 *	± 10V
ANIN 2 [A3]	51	SPEED SETPOINT No. 2/CURRENT DEMAND	± 10V
ANIN 3 [A4]	52	RAMPED SPEED SETPOINT *	± 10V
ANIN 4 [A5]	53	NEGATIVE CURRENT CLAMP *	± 10V
ANIN 5 [A6]	54	EXTERNAL CURRENT LIMIT/POSITIVE CURRENT CLAMP *	± 10V

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Continued/...

DIAGNOSTIC POINT	TAG	DESCRIPTION	SCALING
ANOUT 1 [A7]	55	SPEED SPEEDBACK *	± 10V
ANOUT 2 [A8]	56	TOTAL SPEED SETPOINT *	± 10V
START [C3]	68	START/RUN TERMINAL	ON/OFF
JOG INPUT [C4]	69	JOG/TAKE-UP SLACK TERMINAL	ON/OFF
ENABLE [C5]	70	ELECTRONIC ENABLE TERMINAL	ON/OFF
DIGIN 1 [C6]	71	CONFIGURATION INPUT No. 1 * SINGLE CURRENT CLAMP/BIPOLAR CURRENT CLAMPS	ON/OFF
DIGIN 2 [C7]	72	RAMP HOLD INPUT *	ON/OFF
DIGIN 3 [C8]	73	CONFIGURATION INPUT No. 2 * CURRENT DEMAND ISOLATE, GIVING SPEED OR CURRENT OPERATION	ON/OFF
DIGOUT 1 [B5]	74	AT ZERO SPEED *	ON/OFF
DIGOUT 2 [B6]	75	DRIVE HEALTHY (DRIVE OPERATIONAL) *	ON/OFF
DIGOUT 3 [B7]	76	READY * DRIVE READY TO RUN ALL ALARMS HEALTHY	ON/OFF
RAISE/LOWER OUTPUT	264	RAISE/LOWER BLOCK OUTPUT VALUE	± 100%
SETPOINT SUM OP	86	SETPOINT SUBTOTAL OF DIRECT INPUTS	± 100%
RAMP OUTPUT	85	SETPOINT RAMP OUTPUT	± 100%
SPEED SETPOINT	63	SPEED LOOP TOTAL SETPOINT INC. RAMP [SUM SPEED SETPOINT BEFORE RAMP TO ZERO]	± 150%
TERMINAL VOLTS	57	SCALED TERMINAL VOLTS	± 150%
BACK EMF	60	CALCULATED MOTOR BACK EMF INCLUDING IR COMPENSATION	± 150%
TACH INPUT [B2]	58	SCALED ANALOGUE TACHOGENERATOR FEEDBACK	± 110%
ENCODER	295	ENCODER SPEED FEEDBACK	± 6000 RPM

* Notes:- The function indicated under description is the default function of the software, actual function is determined by the setting of the source tag selection in the configuration menu.

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2 SET-UP PARAMETER DESCRIPTIONS

PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	TAG
	RAMPS			
RAMP ACCEL TIME	ACCELERATION TIME [100% CHANGE]	0.1 to 600.0	10.0 SECS	2
RAMP DECEL TIME	DECELERATION TIME [100% CHANGE]	0.1 to 600.0	10.0 SECS	3
†CONSTANT ACCEL	CONSTANT ACCELERATION IN BOTH QUADRANTS	ENABLED/ DISABLED	ENABLED	4
RAMP HOLD	RAMP HOLD TAG	ON/OFF	OFF	118
RAMP INPUT	RAMP INPUT TAG	±100.00%	0.00%	5
% S-RAMP [1]	PERCENTAGE OF RAMP WITH ADDITIONAL RATE OF CHANGE	0.00 to 100.00%	5.00%	266
RAMPING THRESHOLD	RAMPING FLAG THRESHOLD LEVEL	0.00 to 100.00%	0.5%	286
AUTO RESET	RAMP RESET BY DRIVE ENABLE TRANSISTION	ENABLED/ DISABLED	ENABLED	287
EXTERNAL RESET	TAG FOR EXTERNAL RAMP RESET [AUTO RESET MUST BE DISABLED]	ENABLED/ DISABLED	DISABLED	288
SPD.FBK.RESET	RAMP RESETS TO CURRENT VALUE OF SPEED FEEDBACK	ENABLED/ DISABLED	DISABLED	303
MIN SPEED	MINIMUM SPEED CLAMP	± 100.00%	0.00%	126
	AUX I/O [2]			
AUX START	SOFTWARE START/RUN COMMAND	ON/OFF	ON	161
AUX JOG	SOFTWARE JOG COMMAND	ON/OFF	ON	227
AUX ENABLE	SOFTWARE ENABLE COMMAND	ON/OFF	ON	168
AUX DIG OUTPUT 1	SOFTWARE DIGITAL TAG NO. 1	ON/OFF	OFF	94
AUX DIG OUTPUT 2	SOFTWARE DIGITAL TAG NO. 2	ON/OFF	OFF	95
AUX DIG OUTPUT 3	SOFTWARE DIGITAL TAG NO. 3	ON/OFF	OFF	96
ANOUT 1	SOFTWARE ANALOGUE TAG NO. 1	±100.00%	0.00%	128
ANOUT 2	SOFTWARE ANALOGUE TAG NO. 2	±100.00%	0.00%	129

† **Password Dependant**

NOTES

[1] If "% S-Ramp" parameter is set to zero, the ramp is linear.
Actual Ramp Time = Ramp Time x $\left[\frac{3.5}{100}x(\%SRAMP)+1\right]$

[2] The auxiliary I/O are parameters which can be controlled either via the serial communications or by reconfiguration of other internal parameters. In the case of auxiliary command signals "auxiliary start", "auxiliary jog" and "auxiliary enable" the input will be the result of the "And" of the normal signal with the auxiliary signal.

The software digital and analogue tags are internal memory locations which can be attached by configuration to the digital or analogue output and controlled by the serial communications or the MMI.

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PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	TAG
	JOG/SLACK			
JOG SPEED 1	JOG SPEED 1 SETPOINT.	± 100.00%	5.00%	218
JOG SPEED 2	JOG SPEED 2 SETPOINT.	± 100.00%	- 5.00%	219
TAKE UP 1	TAKE-UP SLACK SPEED SETPOINT 1.	± 100.00%	5.00%	253
TAKE UP 2	TAKE-UP SLACK SPEED SETPOINT 2.	± 100.00%	-5.00%	254
CRAWL SPEED	CRAWL SPEED.	± 100.00%	10.00%	225
MODE	JOG/SLACK OPERATING MODE [3].	TRUE/FALSE	FALSE	228
	RAISE/LOWER			
RESET VALUE	OUTPUT VALUE WHEN RESET.	± 300.00%	0.00%	255
INCREASE RATE	RATE OF CHANGE OF INCREASING OUTPUT VALUE.	0.1 to 600.0 SECS	10.0 SECS	256
DECREASE RATE	RATE OF CHANGE OF DECREASING OUTPUT VALUE.	0.1 to 600.0 SECS	10.0 SECS	257
RAISE INPUT	RAISE OUTPUT VALUE COMMAND.	TRUE/FALSE	FALSE	261
LOWER INPUT	LOWER OUTPUT VALUE COMMAND.	TRUE/FALSE	FALSE	262
MIN VALUE	MINIMUM RATE/LOWER RAMP VALUE.	± 300.00%	-100.00%	258
MAX VALUE	MAXIMUM RAISE/LOWER RAMP VALUE.	± 300.00%	100.00%	259
EXTERNAL RESET	EXTERNAL RESET TAG ONE SHOT RESET	TRUE/FALSE	FALSE	288

NOTES

[3] A combination of the Mode Parameter, Jog Input [C4] and the Run Input [C3] determines the setpoint value input to the Setpoint Ramp.

OPERATING MODE	MODE	C3	C4	SETPOINT INPUT	CONTACTOR
STOP	FALSE	OFF	OFF	SETPOINT	OFF
STOP	TRUE	OFF	OFF	SETPOINT	OFF
RUN	FALSE	ON	OFF	SETPOINT	ON
TAKE-UP SLACK 1	FALSE	ON	ON	SETPOINT + TAKE-UP SLACK 1	ON
TAKE-UP SLACK 2	TRUE	ON	OFF	SETPOINT + TAKE-UP SLACK 2	ON
INCH/JOG 1	FALSE	OFF	ON	SJOG SETPOINT 1	ON
INCH/JOG 2	TRUE	OFF	ON	JOG SETPOINT 2	ON
CRAWL	TRUE	ON	ON	CRAWL SETPOINT	ON

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PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	TAG
	FIELD CONTROL			
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/ DISABLED	ENABLED	170
FIELD CONTROL MODE IS	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	209
RATIO OUT/IN	FIELD VOLTAGE VARIABLES 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.	0.00 to 100.00%	90.00% singlephase rectifier	210
SETPOINT	FIELD CURRENT VARIABLES Field current setpoint.	0.00 to 100.00%	100.00%	171
PROP. GAIN	This is the proportional gain adjustment of the field PI loop.	0.00 to 100.00	0.10	173
INT. 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 to 100.00	1.28	172
FLD. WEAK ENABLE	FIELD WEAK VARIABLES 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/ DISABLED	DISABLED	174
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	175
EMF LAG	This is the integral adjustment of the field weakening PID loop.	0.00 to 200.00	40.00	176
EMF GAIN	This is the gain adjustment of the field weakening PID loop.	0.00 to 100.00	0.30	177
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 to 100.00%	10.00%	179
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 to 100.00%	100.00%	178
BEMF FBK LEAD		10 - 5000	100	191
BEMF FBK LAG		10 - 5000	100	192
FIELD QUENCH DELAY	FIELD QUENCH CONTROLS 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.	0.0 to 600.0 SECS	10.0 SECS	185
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/ STANDBY	QUENCH	186

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PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	TAG
	CURRENT PROFILE			
SPD BRK 1 (LOW)	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.	0.00 to 100.00%	100.00%	32
SPD BRK 2 (HIGH)	Speed break 2 is the upper speed limit at which current profiling ends.	0.00 to 100.00%	100.00%	31
IMAX BRK 1 (SPD1)	This sets the current limit value at or below speed break point 1, provided other limits are greater than its setting.	0.00 to 200.00%	200.00%	93
IMAX BRK 2 (SPD2)	This sets the current limit value at or above speed break point 2.	0.00 to 200.00%	200.00%	33
	INVERSE TIME			
†AIMING POINT	Final Overload Limit Level.	0 to 200%	110.00%	204
†DELAY	Time at Current Limit.	0.1 to 600 SECS	10.0 SECS	199
†RATE	Rate of reduction of overload current limit.	0.1 to 600 SECS	60.0 SECS	200
	STOP RATES			
STOP TIME	Time to reach zero speed from 100% set speed in normal stop mode.	0.1-600.00 SECS	10.0 SECS	27
STOP LIMIT	Delay time limit to allow normal stop action before drive quench and coast stop.	0-600.00 SECS	60.0 SECS	217
CONTACTOR DELAY	Time delay to opening contactor after zero speed value reached.	0.00 to 600.00 SECS	5.0 SECS	302
PROG STOP TIME	Time to reach zero speed from 100% set speed in program stop mode.	0.1 to 600.00 SECS	0.1 SECS	26
PROG STOP LIMIT	Delay time limit to allow program stop action before drive quench and coast stop.	0 to 600.00 SECS	60.0 SECS	216
PROG STOP I LIM	Main current limit level in program stop mode assuming limits not constrained by I Profile or Inverse Time.	0.00 to 200.00%	100.00%	91
STOP ZERO SPEED	Zero speed level in program stop + normal stop mode at which contactor is de-energised and the drive quenched.	0.00 to 100.00%	2.00%	29

* Diagnostic Parameter only.

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PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	TAG
	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.	0.9800 to 1.1000	1.0000	20
IR COMPENSATION	Compensation for motor IR drop to improve regulation when using armature voltage feedback for speed control.	0.00 to 100.00%	0.00%	21
ENCODER RPM	Motor top speed setting when encoder feedback.	0 to 6000 RPM	1000 RPM	22
ENCODER LINES	The SSD Microtach has 1000 lines per revolution as standard, proprietary encoders of other specifications can be normalised by setting this parameter as appropriate.	10 to 5000	1000	24
ANALOG TACH CAL	Trim adjustment of the motor speed at 100% speed demand. Note:- Primary tacho calibration is achieved by the selection of resistors R4 and R5 on the calibration board.	0.9800 to 1.1000	1.1000	23
ZERO SPEED OFFSET	Zero motor speed for zero setpoint input trim adjustment.	± 5.00%	0.00%	10
ARMATURE I (A9)	Sets operation of current meter output, either bipolar or unipolar.	UNIPOLAR/ POLAR	BIPOLAR	25
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.	0.00 to 100.00%	50.00%	180
STALL THRESHOLD	Stall comparator threshold level.	0.00 to 200.00%	95.00%	263
STALL TRIP DELAY	Delay stall detected to stall output.	0.1 to 600.0 SECS	10.0 SECS	224
† OVER SPEED LEVEL	Speed feedback level for alarm.	0 to 200%	125.00%	188
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.	0.9800 to 1.1000	1.0000	182
	ALARMS			
	INHIBIT			
FIELD FAIL	Minimum field current level alarm.	ENABLED/ INHIBITED	ENABLED	19
5703 RCV ERROR	5703 Serial communications receive error. Only active in Slave Mode.	ENABLED/ INHIBITED	ENABLED	111
STALL TRIP	Motor stalled alarm.	ENABLED/ INHIBITED	INHIBITED	28
TRIP RESET	Faults latched when False.	TRUE/FALSE	TRUE	305
SPEED FBK ALARM	Speed feedback alarm. Speed feedback alarm operation. a) Aramture Voltage (fixed field) (i) Different signs (ii) Speed Feedback and Armature Voltage differ by more than Speed Feedback Alarm level. b) Field Weakening If armature voltage is greater than 50% and Speed Feedback is less than 10% then Speed Feedback Alarm active.	ENABLED/ INHIBITED	ENABLED	81
ENCODER ALARM	Encoder option board alarm.	ENABLED/ INHIBITED	ENABLED	92

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PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	TAG
	CURRENT LOOP			
CURRENT LIMIT	Internal main current limit parameter.	0.00 to 200.00%	100.00%	15
PROP GAIN	Proportional gain control for armature current PI loop. This parameter is normally set during the autotune function.	0.00 to 200.00	45.00	16
INT GAIN	Integral gain control for armature current PI loop. This parameter is normally set during the autotune function.	0.00 to 200.00	3.50	17
AUTOTUNE	Initiating control for current loop autotune adjustment. (See description at the end of table)	ON/OFF	OFF	18
† FEED FORWARD	Autotune control parameter. Set by autotune algorithm. Do not adjust independently.	0.10-50.00	2.00	136
DISCONTINUOUS	Autotune control parameter. Set by autotune algorithm. Do not adjust independently.	0.00 to 200.00%	12.00%	137
ADDITIONAL DEM	Additional Current Demand Input.	± 200%	0.00%	30
BIPOLAR CLAMPS	Select Bipolar/Unipolar Clamps.	ENABLED/ DISABLED	DISABLED	90
REGEN MODE	Regen mode Enable.	ENABLED/ DISABLED	ENABLED	201
POS I CLAMP	Positive clamp in Bipolar Clamp Mode.	± 200.00%	100.00%	301
NEG I CLAMP	Negative clamp in Bipolar Clamp Mode.	± 200.00%	-100.00%	48
I DMD ISOLATE	Speed Demand or Current Demand.	ENABLED/ DISABLED	DISABLED	119
	SPEED LOOP			
PROP. GAIN	Speed loop PI proportional gain adjustment.	0.00 to 200.00	10.00	14
INT. TIME CONST.	Speed loop PI integral gain adjustment.	0.001 to 30.000 SECS	0.500 SECS	13
INT. DEFEAT	Inhibits the integral part of the speed loop PI control to give proportional gain only speed control.	ON/OFF	OFF	202
ENCODER SIGN	Since the encoder feedback cannot be reversed electrically, the signal polarity must be reversed by the control software.	POSITIVE/ NEGATIVE	POSITIVE	49
SPEED FBK SELECT	Three options are available:-		ARM VOLTS FBK	47
	i) Armature voltage feedback	ARM VOLTS FBK		
	ii) Analogue tachogenerator feedback	ANALOG TACH		
	iii) Encoder feedback.	ENCODER		
	iv) Analogue/Encoder feedback	ENCODER/ ANALOG		
ADVANCED ADAPTION				
MODE	0 - Disabled 1 - Speed Feedback Dependant 2 - Speed Error Dependant 3 - I Demand Dependant	0 to 3	0	268
SPD BRK 1 (LOW)	For further information	0.00 to 100.00%	1.00%	269
SPD BRK 2 (HIGH)	please refer to the	0.00 to 100.00%	5.00%	270
PROP. GAIN	Engineering Department at	0.00 to 200.00	5.00	271
INT. TIME CONST.	SSD Limited	0.001 to 30.000 SECS	0.500 SECS	272

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PARAMETER NAME	DESCRIPTION	RANGE	DEFAULT	TAG
	SPEED LOOP /Continued			
I GAIN IN RAMP	Integral Gain Scaling during Ramping period	0.00001 to 2.0000	1.0000	274
† POS LOOP P GAIN	Position Loop Proportional Gain	0.00 to 200.00%	0.00%	273
† I COMP	Additional I Demand during Ramping Period	± 100.00%	0.00%	275
ZERO SPD. QUENCH				
ZERO SPD. LEVEL	Thresholds for scan override.	0.00 to 200.00%	0.50%	284
ZERO IAD LEVEL		0.00 to 200.00%	1.50%	285
SETPOINTS				
SETPOINT 1	SPEED SETPOINT 1 [Default sum O/P]	± 100%	0.00%	289
SIGN 2 (A3)	SPEED SETPOINT 2 SIGN	POSITIVE/ NEGATIVE	POSITIVE	9
RATIO 2 (A3)	SPEED SETPOINT 2 RATIO	± 3.0000	1.0000	7
SETPOINT 2 (A3)	SPEED SETPOINT 2 - Fixed Setpoint	± 100%	0.00%	290
SETPOINT 3	SPEED SETPOINT 3 [Default Ramp O/P]	± 100%	0.00%	291
SETPOINT 4	SPEED SETPOINT 4 [Default 5703 I/P]	± 100%	0.00%	41
	STANDSTILL			
STANDSTILL LOGIC	Standstill Logic inhibites the controller at zero setpoint and zero speed, i.e. standstill.	ENABLED/ DISABLED	DISABLED	11
ZERO THRESHOLD	Signal Level which determines zero setpoint and zero speed threshold. [Zero Speed Relay Threshold]	0.00-5.00%	2.00%	12
† SOURCE TAG	Speed Demand Source	0 to 255	89	306
	SETPOINT SUM			
RATIO 1	Analogue Input 1 Scaling	± 3.0000	1.0000	6
RATIO 0	Analogue Input Ø Scaling	± 3.0000	1.0000	7
SIGN 1	Analogue Input 1 Polarity	POS-NEG	POSITIVE	8
SIGN 0	Analogue Input 0 Polarity	POS-NEG	POSITIVE	292
DEADBAND WIDTH	Analogue Input 1 Deadband	0.0 to 100.0%	0.0%	131
INPUT 1	Analogue Input 1 Value	± 100%	0.00%	100
INPUT 0	Analogue Input Ø Value	± 100%	0.00%	309

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2.1 SERIAL LINK PARAMETERS

PARAMETER	DESCRIPTION	RANGE	DEFAULT	TAG	
				MAIN PORT P1	AUXILIARY PORT P2
SERIAL LINK ENABLE	ENABLE PORT OPERATION	ENABLE/ DISABLE	DISABLED	146	147
GROUP ID (GID)	EUROTHERM PROTOCOL GROUP IDENTITY	0 - 7	0	138	140
UNIT ID (UID)	EUROTHERM PROTOCOL UNIT IDENTITY	0 - 15	0	139	141
ASCII/BINARY	EUROTHERM PROTOCOL SELECTION OF EITHER ASCII OR BINARY	ASCII/ BINARY	ASCII	148	149
BAUD RATE	SERIAL COMMUNICATIONS TRANSMIT AND RECEIVE DATA RATE	300 - 19200	9600	150	151
ESP SUP. (ASCII)	ESP SUPPORT ENABLE	ENABLE/ DISABLE	DISABLED	152	153
CHANGEBAND (BIN)	CHANGE IN VALUE TO TRIGGER BINARY ENQUIRY POLL UPDATE	0.00% to 100.00%	0.00%	144	145
ERROR REPORT			00C0	158	159
PNO.7	CONTROL WORD FOR MULTIPARAMETER POLLING	0 to FFFF	FFFF	142	143

SYSTEM PORT (P3)				TAG
PARAMETER	DESCRIPTION	RANGE	DEFAULT	SYSTEM PORT
5703 SUPPORT				
SETPOINT RATIO	INPUT SCALER	± 3.0000	0.0000	132
SETPOINT SIGN	INPUT SIGN	POSITIVE/NEGATIVE	POSITIVE	133
5703 INPUT	5703 INPUT DIAGNOSTIC	± 300.00%	0.00%	187
5703 OUTPUT	5703 OUTPUT DIAGNOSTIC	± 300.00%	0.00%	189
5703 MODE	5703 STATUS	DISABLED/MASTER/ SLAVE	DISABLE	130
DUMP MMI → P3	DUMP COMPLETE MMI TEXT DATA TO P3 PORT			
UDP XFER ← P3	INPUT BINARY DATA FROM PC TO PRESET "SET-UP PARAMETERS"			
UDP XFER → P3	DUMP BINARY DATA TO PC FOR STORAGE OF "SET-UP PARAMETERS"			
P3 BAUD RATE	P3 TRANSMIT/RECEIVE DATA RATE	300 → 57600	9600	198

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2.2 SYSTEM PARAMETERS

FUNCTION	DESCRIPTION	RANGE	DEFAULT	TAG
	CONFIGURE I/O			
CONFIGURE ENABLE	PERMIT I/O CONFIGURATION FLAG [1]	ENABLED/ DISABLED	DISABLED	39
ANIN 1 (A2)	**ANALOG INPUTS**			
CALIBRATION	ANALOG INPUT SCALING DETERMINING VALUE ≡ 100%	± 3.0000	1.0000	230
MAX VALUE	MAXIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	+ 100.00%	231
MIN VALUE	MINIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	- 100.00%	232
DESTINATION TAG	DESTINATION OF SCALED ANALOG INPUT VALUE	0 to 255 [2]	100	246
ANIN 2 (A3)				
CALIBRATION	ANALOG INPUT SCALING DETERMINE VALUE = 100%	± 3.0000	1.0000	233
MAX VALUE	MAXIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	+ 100.00%	234
MIN VALUE	MINIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	- 100.00%	235
ANIN 3 (A4)				
CALIBRATION	ANALOG INPUT SCALING DETERMINE VALUE = 100%	± 3.0000	1.0000	236
MAX VALUE	MAXIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	100.00%	237
MIN VALUE	MINIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	- 100.00%	238
DESTINATION TAG	DESTINATION OF SCALED ANALOG INPUT VALUE	0 to 255 [2]	5	249
ANIN 4 (A5)				
CALIBRATION	ANALOG INPUT SCALING DETERMINE VALUE = 100%	± 3.0000	1.0000	239
MAX VALUE	MAXIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	+ 100.00%	240
MIN VALUE	MINIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	- 100.00%	241
DESTINATION TAG	DESTINATION OF SCALED ANALOG INPUT VALUE	0 to 255 [2]	48	250
ANIN 5 (A6)				
CALIBRATION	ANALOG INPUT SCALING DETERMINE VALUE = 100%	± 3.0000	1.0000	242
MAX VALUE	MAXIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	100.00%	243
MIN VALUE	MINIMUM VALUE OF SCALED ANALOG INPUT	± 300.00%	- 100.00%	244
DESTINATION TAG	DESTINATION OF SCALED ANALOG INPUT VALUE	0 to 255 [2]	301	247

[1] During the process of reconfiguration there is a danger that "Tags" will be connected to wrong parameters. To avoid this possibility all configuration links must be temporarily "disconnected" during the configuration process and the flag set to "enabled" to allow the activity. Failure to reset the flag to "disabled" after reconfiguration will cause an Alarm to be generated, "Configure Enabled", which will prevent drive operation. (In early versions of software the alarm may read F200)

[2] Destination Tags are limited to valid points i.e. An analogue input cannot be connected to a digital output.

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FUNCTION	DESCRIPTION	RANGE	DEFAULT	TAG
	ANALOG OUTPUTS			
ANOUT 1 (A7)				
% TO GET 10V	VALUE WHICH PRODUCES 10V OUTPUT	± 300.00%	100.00%	245
SOURCE TAG	SOURCE OF OUTPUT VALUE	0 to 255 [2]	62	251
ANOUT 2 (A8)				
% TO GET 10V	VALUE WHICH PRODUCES 10V OUTPUT	± 300.00%	100.00%	248
SOURCE TAG	SOURCE OF OUTPUT VALUE	0 to 255 [2]	63	252
	DIGITAL INPUTS			
DIGIN 1 (C6)				
VALUE FOR TRUE	VALUE OF TAG ASSUMED WHEN INPUT IS TRUE	± 300.00%	0.01%	103
VALUE FOR FALSE	VALUE OF TAG ASSUMED WHEN INPUT IS FALSE	± 300.00%	0.00%	104
DESTINATION TAG	DESTINATION OF ASSUMED TAG VALUE	0 to 255 [2]	90	102
DIGIN 2 (C7)				
VALUE FOR TRUE	VALUE OF TAG ASSUMED WHEN INPUT IS TRUE	± 300.00%	0.01%	106
VALUE FOR FALSE	VALUE OF TAG ASSUMED WHEN INPUT IS FALSE	± 300.00%	0.00%	107
DESTINATION TAG	DESTINATION OF ASSUMED TAG VALUE	0 to 255 [2]	118	105
DIGIN 3 (C8)				
VALUE FOR TRUE	VALUE OF TAG ASSUMED WHEN INPUT IS TRUE	± 300.00%	0.01%	109
VALUE FOR FALSE	VALUE OF TAG ASSUMED WHEN INPUT IS FALSE	± 300.00%	0.00%	110
DESTINATION TAG	DESTINATION OF ASSUMED TAG VALUE	0 to 255 [2]	119	108
	DIGITAL OUTPUTS			
DIGOUT 1 (B5)				
THRESHOLD (>)	THRESHOLD WHICH VALUE MUST EXCEED TO SET OUTPUT TRUE	± 300.00%	0.00%	195
MODULUS	OUTPUT SET TRUE FOR ABSOLUTE OR MODULUS OF TAG VALUE	TRUE/ FALSE	TRUE	43
SOURCE TAG	SOURCE OF TAG VALUE USED TO SET OUTPUT	0 to 255 [2]	77	97
DIGOUT 2 (B6)				
THRESHOLD (>)	THRESHOLD WHICH VALUE MUST EXCEED TO SET OUTPUT TRUE	± 300.00%	0.00%	196
MODULUS	OUTPUT SET TRUE FOR ABSOLUTE OR MODULUS OF TAG VALUE	TRUE/ FALSE	TRUE	44
SOURCE TAG	SOURCE OF TAG VALUE USED TO SET OUTPUT	0 to 255 [2]	122	98
DIGOUT 3 (B7)				
THRESHOLD (>)	THRESHOLD WHICH VALUE MUST EXCEED TO SET OUTPUT TRUE	± 300.00%	0.00%	197
MODULUS	OUTPUT SET TRUE FOR ABSOLUTE OR MODULUS OF TAG VALUE	TRUE/ FALSE	TRUE	45
SOURCE TAG	SOURCE OF TAG VALUE USED TO SET OUTPUT	0 to 255 [2]	125	99

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FUNCTION	DESCRIPTION	RANGE	DEFAULT	TAG
	CONFIGURE 5703			
SOURCE TAG	5703 OUTPUT SOURCE TAG	0 to 255 [2]	89	134
DESTINATION TAG	5703 INPUT DESTINATION TAG	0 to 255 [2]	41	135
	BLOCK DIAGRAM			
RAISE/LOWER DEST	RAISE LOWER SOFTWARE BLOCK OUTPUT DESTINATION	0 to 255 [2]	0	260
RAMP O/P DEST	ANALOGUE RAMP OUTPUT DESTINATION	0 to 255 [2]	291	293
SPT SUM O/P DEST	SETPOINT SUM OUTPUT DESTINATION	0 to 255 [2]	289	294

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SYMBOLIC ALARM MESSAGES

These are generally internal software or hardware errors and therefore have no obvious meaning to the end user. If these should occur, please investigate or contact Eurotherm Drives Technical Support as appropriate in each case.

No.	Description	Action
0xF003	Pre-Ready Fault	Coding not present. Replace power board or chassis. (If an External Stack, check coding supply first).
0xF100	CAM full	Call Technical Support
0xFF01	Internal software error in slot_read()	Call Technical Support
0xFF02	Unimplemented micro opcode	Call Technical Support
0xFF03	Aux Power Fail	Check Aux Supply and/or Mains Input
0xFF04	"TRAP" Software Interrupt	Call Technical Support
0xFF05	Internal software error in slot_read_pass()	Call Technical Support
0xFF06	Internal software error in slot_write()	Call Technical Support

Tag	MMI Text	Variable Name 'C'	R/W	ReConfig	Type	Min	Max	Restricted	Serial Format	Default	User	Tag
0	Rubish Bin	r0	YES	YES	Special	-	-	-	-			0
1		eprom_version	NO	NO	HEX	-	-	-	-			1
2	RAMP ACCEL TIME	srd.rd.ramp_up_time	YES	YES	SECS1	1	600	NO	S_DEC10			2
3	RAMP DECEL TIME	srd.rd.ramp_down_time	YES	YES	SECS1	1	600	NO	S_DEC10			3
4	CONSTANT ACCEL	srd.rd.mode	YES	NO	ENABLED_DISABLED	0	1	NO	S_BIN			4
5	RAMP INPUT	jog.input	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			5
6	RATIO 1	sumd.ratio1	YES	YES	RATIO3	-300	300	NO	S_DEC10000			6
7	RATIO 2	anin_scale[1]	YES	YES	RATIO3	-300	300	NO	S_DEC10000			7
8	SIGN 1	sumd.sign1	YES	YES	POS_NEG	0	1	NO	S_BIN			8
9	SIGN 2	spdlopd.speed_setpoint2_sign	YES	YES	POS_NEG	0	1	NO	S_BIN			9
10	ZERO SPD. OFFSET	spdlopd.spdfbkd.zero_spd	YES	NO	PERCENTAGE2	-5	5	NO	S_DEC100			10
11	STANDSTILL LOGIC	standstilld.enable	YES	YES	ENABLED_DISABLED	0	1	NO	S_BIN			11
12	ZERO THRESHOLD	standstilld.zero_threshold	YES	YES	PERCENTAGE2	0	5	NO	S_DEC100			12
13	INT. TIME CONST.	spdlopd.spid.int_gain	YES	YES	MSEC	1	300	NO	S_DEC100			13
14	PROP. GAIN	spdlopd.spid.prop_gain	YES	YES	NONE2	0	200	NO	S_DEC100			14
15	CURRENT LIMIT	spdlopd.clamp_scale	YES	YES	PERCENTAGE2	0	200	NO	S_DEC100			15
16	PROP. GAIN	prp_gain	YES	YES	NONE2	0	200	NO	S_DEC100			16
17	INT. GAIN	int_gain	YES	YES	NONE2	0	200	NO	S_DEC100			17
18	AUTOTUNE	autotune_mmi	YES	NO	ON_OFF	0	1	NO	S_BIN			18
19	FIELD FAIL	motor_field.inhibit	YES	YES	ENABLE_INHIBITED	0	1	NO	S_BIN			19
20	ARMATURE V CAL	spdlopd.spdfbkd.avf.vascale	YES	NO	RATIO3	98	110	NO	S_HEX			20
21	IR COMPENSATION	spdlopd.spdfbkd.avf.rascale	YES	YES	PERCENTAGE2	0	10	NO	S_DEC100			21
22	ENCODER RPM	spdlopd.spdfbkd.utach.hnd_pct	YES	NO	RPM0	0	600	NO	S_HEX			22
23	ANALOG TACH CAL	anin_scale[5]	YES	NO	RATIO3	98	110	NO	S_HEX			23
24	ENCODER LINES	spdlopd.spdfbkd.utach.plsrev	YES	NO	DEC	0.1	50	YES	S_HEX			24
25	ARMATURE I (A9)	meter_drive	YES	YES	UNIPOLAR_BIPOLAR	0	1	NO	S_BIN			25
26	PROG STOP TIME	stopd.rd2.ramp_down_time	YES	YES	SECS1	1	600	NO	S_DEC10			26
27	STOP TIME	stopd.rd3.ramp_down_time	YES	YES	SECS1	1	600	NO	S_DEC10			27
28	STALL TRIP	stall_trip.inhibit	YES	YES	ENABLE_INHIBITED	0	1	NO	S_BIN			28
29	STOP ZERO SPEED	stop_0_spd_thresh	YES	YES	PERCENTAGE2	0	10	NO	S_DEC100			29
30	ADDITIONAL DEM	spdlopd.additional_i_demand	YES	YES	PERCENTAGE2	-200	200	NO	S_DEC100			30
31	SPD BRK2 (HIGH)	spdlopd.profile.n2	YES	YES	PERCENTAGE1	0	10	YES	S_DEC100			31
32	SPD BRK1 (LOW)	spdlopd.profile.n1	YES	YES	PERCENTAGE1	0	10	YES	S_DEC100			32
33	IMAX BRK2(SPD2)	spdlopd.profile.imin	YES	YES	PERCENTAGE1	0	200	YES	S_DEC100			33
34	FIELD FBKSTOP	fbkstop	YES	NO	DEC	0	10	NO	S_DEC			34
35	FIELD FFRSTOP	ffrstop	YES	NO	DEC	0	10	NO	S_DEC			35
36	IFFB DELAY	iffb_delay	YES	NO	DEC	0	0xFF	NO	S_DEC			36
37	FULL MENUS	mmi_data.full_menus	YES	NO	ENABLED_DISABLED	0	1	NO	S_BIN			37
38	MENU DELAY	mmi_data.value_delay	YES	NO	DEC	0	0xFFFF	NO	S_DEC			38
39	CONFIGURE ENABLE	cfg_inhibit	YES	NO	ENABLED_DISABLED	0	1	YES	S_BIN			39
40		sys_io	NO	NO	HEX	0	0xFFFF	NO	S_HEX			40
41	SETPOINT 4	spdlopd.speed_setpoint4	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			41
42	CURRENT LIMITED	spdlops.spis.saturated	NO	NO	TRUE_FALSE	0	1	NO	S_BIN			42
43	MODULUS DG IN 1 (C6)	dgout_abs[0]	YES	YES	TRUE_FALSE	0	1	NO	S_BIN			43
44	MODULUS DG IN 2 (C7)	dgout_abs[1]	YES	YES	TRUE_FALSE	0	1	NO	S_BIN			44
45	MODULUS DG IN 3 (C8)	dgout_abs[2]	YES	YES	TRUE_FALSE	0	1	NO	S_BIN			45
46		r0	YES	YES	TRUE_FALSE	0	1	NO	S_BIN			46
47	SPEED FBK SELECT	spdlopd.spdfbkd.fbk_select	YES	YES	ANLG_MICRO_ARMV	0	3	YES	S_HEX			47
48	NEG I CLAMP	spdlopd.neg_output_clamp	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			48
49	ENCODER SIGN	spdlopd.spdfbkd.utach.sign	YES	NO	POS_NEG	0	1	YES	S_BIN			49
50	ANIN 1 (A2)	anin_raw[0]	NO	NO	VOLTS1	-100	100	NO	S_DEC100			50
51	ANIN 2 (A3)	anin_raw[1]	NO	NO	VOLTS1	-100	100	NO	S_DEC100			51
52	ANIN 3 (A4)	anin_raw[2]	NO	NO	VOLTS1	-100	100	NO	S_DEC100			52
53	ANIN 4 (A5)	anin_raw[3]	NO	NO	VOLTS1	-100	100	NO	S_DEC100			53

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Tag	MMI Text	Variable Name 'C'	R/W	ReConfig	Type	Min	Max	Restricted	Serial Format	Default	User	Tag
54	ANIN 5 (A6)	anin_raw[4]	NO	NO	VOLTS1	-100	100	NO	S_DEC100			54
55	ANOUT 1 (A7)	anout_s[0]	NO	NO	VOLTS1	-100	100	NO	S_DEC100			55
56	ANOUT 2 (A8)	anout_s[1]	NO	NO	VOLTS1	-100	100	NO	S_DEC100			56
57	TERMINAL VOLTS	arm_volts	NO	NO	PERCENTAGE1	0	0xFFFF	NO	S_DEC100			57
58	TACH INPUT (B2)	spdlops.spdfbks.tach	NO	NO	PERCENTAGE1	-150	150	NO	S_DEC100			58
59	R.P.M.	spdlops.spdfbks.rpm	NO	NO	RPM0	0	600	NO	S_DEC			59
60	BACK EMF	spdlops.spdfbks.avf	NO	NO	PERCENTAGE1	-150	150	NO	S_DEC100			60
61	ACTUAL NEG I LIM	spdlops.actual_neg_clamp	NO	NO	PERCENTAGE1	-150	150	NO	S_DEC100			61
62	SPEED FBK	spdlops.spdfbks.speed_fbk	NO	NO	PERCENTAGE2	-150	150	NO	S_DEC100			62
63	SPEED SETPOINT	spdlops.total_speed_setpoint	NO	NO	PERCENTAGE2	-150	150	NO	S_DEC100			63
64	SPEED ERROR	spdlops.error	NO	NO	PERCENTAGE2	-150	150	NO	S_DEC100			64
65	CURRENT FBK	scaled_iafbk	NO	NO	PERCENTAGE1	-150	150	NO	S_DEC100			65
66	CURRENT DEMAND	spdlops.i_demand	NO	NO	PERCENTAGE1	-300	300	NO	S_DEC100			66
67	ACTUAL POS I LIM	spdlops.actual_pos_clamp	NO	NO	PERCENTAGE1	-300	300	NO	S_DEC100			67
68	START (C3)	dgin_s[0]	NO	NO	ON_OFF	0	1	NO	S_BIN			68
69	JOG INPUT (C4)	dgin_s[1]	NO	NO	ON_OFF	0	1	NO	S_BIN			69
70	ENABLE (C5)	dgin_s[2]	NO	NO	ON_OFF	0	1	NO	S_BIN			70
71	DIGIN 1 (C6)	dgin_s[3]	NO	NO	ON_OFF	0	1	NO	S_BIN			71
72	DIGIN 2 (C7)	dgin_s[4]	NO	NO	ON_OFF	0	1	NO	S_BIN			72
73	DIGIN 3 (C8)	dgin_s[5]	NO	NO	ON_OFF	0	1	NO	S_BIN			73
74	DIGOUT 1 (B5)	dgout_s[0]	NO	NO	ON_OFF	0	1	NO	S_BIN			74
75	DIGOUT 2 (B6)	dgout_s[1]	NO	NO	ON_OFF	0	1	NO	S_BIN			75
76	DIGOUT 3 (B7)	dgout_s[2]	NO	NO	ON_OFF	0	1	NO	S_BIN			76
77	AT ZERO SPEED	standstilld.spds.a_eq_b	NO	NO	TRUE_FALSE	0	1	NO	S_BIN			77
78	AT ZERO SETPOINT	standstilld.spts.a_eq_b	NO	NO	TRUE_FALSE	0	1	NO	S_BIN			78
79	AT STANDSTILL	standstills.standstill	NO	NO	TRUE_FALSE	0	1	NO	S_BIN			79
80	PROGRAM STOP	p_stop	NO	NO	TRUE_FALSE	0	1	NO	S_BIN			80
81	SPEED FBK ALARM	speed_feedback.inhibit	YES	NO	ENABLE_INHIBITED	0	1	NO	S_BIN			81
82	DRIVE START	start	NO	NO	ON_OFF	0	1	NO	S_BIN			82
83		main_contactor	NO	NO	ENABLED_DISABLED	0	1	NO	S_BIN			83
84	DRIVE ENABLE	quench_flag	NO	NO	ENABLED_DISABLED	0	1	NO	S_BIN			84
85	RAMP OUTPUT	srs.rs.output	NO	NO	PERCENTAGE2	-100	100	NO	S_DEC100			85
86	SETPOINT SUM OP	sums.output	NO	NO	PERCENTAGE2	-100	100	NO	S_DEC100			86
87	POS I CLAMP	spdlops.pos_clamp	NO	NO	PERCENTAGE1	0	200	NO	S_DEC100			87
88	NEG I CLAMP	spdlops.neg_clamp	NO	NO	PERCENTAGE1	0	200	NO	S_DEC100			88
89	SPEED DEMAND	spdlops.speed_demand	NO	NO	PERCENTAGE2	-100	100	NO	S_DEC100			89
90	BIPOLAR CLAMPS	spdlopd.clamp_mode	YES	YES	ENABLED_DISABLED	0	1	NO	S_BIN			90
91	PROG STOP I LIM	spdlopd.program_stop_i_lim	YES	YES	PERCENTAGE2	0	200	NO	S_DEC100			91
92	ENCODER ALARM	microtach.inhibit	YES	NO	ENABLE_INHIBITED	0	1	NO	S_BIN			92
93	IMAX BRK1(SPD1)	spdlopd.profile.imax	YES	YES	PERCENTAGE1	0	200	YES	S_DEC100			93
94	AUX DIGOUT 1	aux_dg_output1	YES	YES	ON_OFF	0	1	NO	S_BIN			94
95	AUX DIGOUT 2	aux_dg_output2	YES	YES	ON_OFF	0	1	NO	S_BIN			95
96	AUX DIGOUT 3	aux_dg_output3	YES	YES	ON_OFF	0	1	NO	S_BIN			96
97	SOURCE TAG DG OUT 1 (B5)	dgout_source[0]	YES	NO	DEC	0	0xFF	YES	S_DEC			97
98	SOURCE TAG DG OUT 2 (B6)	dgout_source[1]	YES	NO	DEC	0	0xFF	YES	S_DEC			98
99	SOURCE TAG DG OUT 2 (B7)	dgout_source[2]	YES	NO	DEC	0	0xFF	YES	S_DEC			99
100	SETPOINT SUM INPUT 1	sum_input1	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			100
101	MIN BS DEAD TIME	minimum_dead_time	YES	NO	DEC	0	0xFFFF	NO	S_DEC100			101
102	DESTINATION TAG (C6)	dgin_dest_slot[0]	YES	NO	DEC	Special	Special	YES	S_DEC			102
103	VALUE FOR TRUE (C6)	dgin_true[0]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			103
104	VALUE FOR FALSE (C6)	dgin_false[0]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			104
105	DESTINATION TAG (C7)	dgin_dest_slot[1]	YES	NO	DEC	Special	Special	YES	S_DEC			105
106	VALUE FOR TRUE (C7)	dgin_true[1]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			106
107	VALUE FOR FALSE (C7)	dgin_false[1]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			107

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Tag	MMI Text	Variable Name 'C'	R/W	ReConfig	Type	Min	Max	Restricted	Serial Format	Default	User	Tag
108	DESTINATION TAG	dgin_dest_slot[2] (c8)	YES	NO	DEC	Special	Special	YES	S_DEC			108
109	VALUE FOR TRUE	dgin_true[2] (c8)	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			109
110	VALUE FOR FALSE	dgin_false[2] (c8)	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			110
111	5703 RCV ERROR	p3.inhibit	YES	NO	ENABLE_INHIBITED	0	1	NO	S_BIN			111
112	STALL TRIP	stalled	NO	NO	OK_ACTIVE	0	1	NO	S_BIN			112
113	RAMPING	srs.rs.ramping	NO	NO	TRUE_FALSE	0	1	NO	S_BIN			113
114	SEQUENCE STATE	current_state	NO	NO	HEX	0	0xFFFF	NO	S_HEX			114
115	HEALTH WORD	health_word	NO	NO	HEX	0	0xFFFF	NO	S_HEX			115
116	HEALTH STORE	health_store	NO	NO	HEX	0	0xFFFF	NO	S_HEX			116
117		health_inhibit	NO	NO	HEX	0	0xFFFF	NO	S_HEX			117
118	RAMP HOLD	srd.rd.hold	YES	YES	ON_OFF	0	1	NO	S_BIN			118
119	I DMD. ISOLATE	spdlopd.mode	YES	YES	ENABLED_DISABLED	0	1	NO	S_BIN			119
120	ENTER PASSWORD	mmi_password	YES	NO	HEX	0	0xFFFF	NO	S_HEX			120
121	CHANGE PASSWORD	password	YES	NO	PASS_WORD	0	0xFFFF	NO	S_HEX			121
122		health_led	NO	NO	TRUE_FALSE	0	1	NO	S_BIN			122
123	PEEK DATA	peek_address	YES	NO	PEEK	Special	Special	NO	S_HEX			123
124	PEEK SCALE	peek_scale	YES	NO	NONE2	0	0xFFFF	NO	S_DEC100			124
125		ready	NO	NO	HEX	0	1	NO	S_BIN			125
126	MIN SPEED	msd.min_speed	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			126
127		dump_en	NO	NO	ENABLED_DISABLED	0	1	YES	S_BIN			127
128	ANOUT 1	aux_an_output1	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			128
129	ANOUT 2	aux_an_output2	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			129
130	5703 MODE	p3_task_data.mode	YES	YES	MASTER_SLAVE	0	3	NO	S_BIN			130
131	DEADBAND WIDTH	dbd.width	YES	YES	PERCENTAGE1	0	10	NO	S_DEC100			131
132	SETPT. RATIO	p3_task_data.setpoint_scale	YES	YES	RATIO3	-300	300	NO	S_DEC10000			132
133	SETPT. SIGN	p3_task_data.setpoint_sign	YES	YES	POS_NEG	0	1	NO	S_BIN			133
134	SOURCE TAG	p3_task_data.output_select	YES	NO	DEC	Special	Special	YES	S_DEC			134
135	DESTINATION TAG	p3_task_data.input_select	YES	NO	DEC	Special	Special	YES	S_DEC			135
136	FEED FORWARD	iaff_gain	YES	NO	NONE2	0.1	50	NO	S_DEC100			136
137	DIS/CONTINUOUS	iacnds_mmi	YES	NO	PERCENTAGE2	0	200	NO	S_DEC100			137
138	GROUP ID (GID)	main_gid	YES	NO	DEC	0	7	NO	S_HEX			138
139	UNIT ID (UID)	main_uid	YES	NO	DEC	0	0xF	NO	S_DEC			139
140	GROUP ID (GID)	aux_gid	YES	NO	DEC	0	7	NO	S_DEC			140
141	UNIT ID (UID)	aux_uid	YES	NO	DEC	0	0xF	NO	S_DEC			141
142	PNO. 7	main_mpoll_control	YES	NO	HEX	0	0xFFFF	NO	S_DEC			142
143	PNO. 7	aux_mpoll_control	YES	NO	HEX	0	0xFFFF	NO	S_DEC			143
144	CHANGEBAND (BIN)	main_hysteresis	YES	NO	PERCENTAGE2	0	32767	NO	S_DEC			144
145	CHANGEBAND (BIN)	aux_hysteresis	YES	NO	PERCENTAGE2	0	32767	NO	S_DEC			145
146	SRL LINK ENABLE	main_serial_enable	YES	NO	ENABLED_DISABLED	0	1	NO	S_BIN			146
147	SRL LINK ENABLE	aux_serial_enable	YES	NO	ENABLED_DISABLED	0	1	NO	S_BIN			147
148	ASCII / BINARY	main_serial_mode	YES	NO	ASCII_BIN	0	1	NO	S_BIN			148
149	ASCII / BINARY	aux_serial_mode	YES	NO	ASCII_BIN	0	1	NO	S_BIN			149
150	BAUD RATE	main_baud	YES	NO	BAUD	0	0xFFFF	NO	S_HEX			150
151	BAUD RATE	aux_baud	YES	NO	BAUD	0	0xFFFF	NO	S_HEX			151
152	ESP SUP. (ASCII)	main_esp_enable	YES	NO	ENABLED_DISABLED	0	1	NO	S_BIN			152
153	ESP SUP. (ASCII)	aux_esp_enable	YES	NO	ENABLED_DISABLED	0	1	NO	S_BIN			153
154	II	inst_ident	YES	NO	HEX	0	0xFFFF	NO	S_HEX			154
155		serial_version_number	NO	NO	HEX	0	0xFFFF	NO	S_HEX			155
156		serial_config_info	NO	NO	HEX	0	0xFFFF	NO	S_HEX			156
157		serial_buffer_length	NO	NO	HEX	0	0xFFFF	NO	S_HEX			157
158	ERROR REPORT	main_ee	YES	NO	HEX	0	0xFFFF	NO	S_HEX			158
159	ERROR REPORT	aux_ee	YES	NO	HEX	0	0xFFFF	NO	S_HEX			159
160		serial_mode_number	NO	NO	HEX	0	0xFFFF	NO	S_HEX			160
161	AUX START	aux_start	YES	YES	ON_OFF	0	1	NO	S_BIN			161

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Tag	MMI Text	Variable Name 'C'	R/W	ReConfig	Type	Min	Max	Restricted	Serial Format	Default	User	Tag
162	MIN MMI CYCLE TM	min_cycle_time	YES	NO	HEX	0	0xFFFF	NO	S_HEX			162
163	ILOOP PI MODE	enable_pi_boost	YES	NO	HEX	0	2	YES	S_HEX			163
164	TOGGLE PERIOD	1_rate	YES	NO	HEX	0	0xFFFF	NO	S_HEX			164
165	TOGGLE REF 1	1_ref1	YES	NO	PERCENTAGE2	-300	300	NO	S_DEC100			165
166	SEL. INT/CUR/SPD	sel_lad_source	YES	NO	HEX	0	2	YES	S_HEX			166
167	TOGGLE REF 2	1_ref2	YES	NO	PERCENTAGE2	-300	300	NO	S_DEC100			167
168	AUX ENABLE	aux_enable	YES	YES	ON_OFF	0	1	NO	S_BIN			168
169	FIELD ENABLE D	start_field	NO	NO	ENABLED_DISABLED	0	1	NO	S_HEX			169
170	FIELD ENABLE	enable_field	YES	YES	ENABLED_DISABLED	0	1	YES	S_HEX			170
171	SETPOINT	ifd_mmi	YES	YES	PERCENTAGE2	0	10	NO	S_DEC100			171
172	INT. GAIN	fki	YES	YES	NONE2	0	10	NO	S_DEC100			172
173	PROP. GAIN	fkp	YES	YES	NONE2	0	10	NO	S_DEC100			173
174	FLD. WEAK ENABLE	sel_fid_weaken	YES	YES	ENABLED_DISABLED	0	1	YES	S_HEX			174
175	EMF LEAD	fld_lead	YES	NO	NONE2	0.1	50	NO	S_DEC100			175
176	EMF LAG	fld_lag	YES	NO	NONE2	0	200	NO	S_DEC10000			176
177	EMF GAIN	spillover_gain	YES	NO	NONE2	0	10	NO	S_DEC100			177
178	MAX VOLTS	spillover_bias	YES	NO	PERCENTAGE2	0	10	NO	S_DEC100			178
179	MIN FLD CURRENT	fld_weak_limit	YES	NO	PERCENTAGE2	0	10	YES	S_DEC100			179
180	SPDFBK ALM LEVEL	spdlopd.spdfbkd.spdfbk_alarm_window	YES	NO	PERCENTAGE1	0	10	NO	S_DEC100			180
181	FLD Current FBK	iffb_mmi	NO	NO	PERCENTAGE2	-150	150	NO	S_DEC100			181
182	FIELD I CAL	fld_cur_ratio	YES	NO	RATIO3	98	110	NO	S_DEC10000			182
183	FIELD DEMAND	ifd	NO	NO	PERCENTAGE2	0	200	NO	S_DEC100			183
184	FLD.FIRING ANGLE	ffa_mmi	NO	NO	DEG0	-150	150	NO	S_HEX			184
185	FLD QUENCH DELAY	quench_delay	YES	YES	SECS1	0	600	NO	S_DEC10			185
186	FLD. QUENCH MODE	field_standby	YES	YES	QUENCH_STANDBY	0	1	NO	S_HEX			186
187	5703 INPUT	p3_unratioed_output	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			187
188	OVER SPEED LEVEL	spdlopd.spdfbkd.over_speed_level	YES	YES	PERCENTAGE2	0	200	NO	S_DEC100			188
189	5703 OUTPUT	xmit_word	NO	NO	PERCENTAGE2	-300	300	YES	S_DEC100			189
190	PEAK HW SLOPE	peak_hw_delay	YES	NO	HEX	0	0xFFFF	YES	S_DEC			190
191	BEMF FBK LEAD	bemf_lead	YES	NO	DEC	0.1	50	NO	S_DEC			191
192	BEMF FBK LAG	bemf_lag	YES	NO	DEC	0.1	50	NO	S_DEC			192
193	TICK LENGTH	tick_length	NO	NO	DEC	0	0xFFFF	NO	S_DEC			193
194	DISC ADAPT POT	disc_adapt_pot	YES	NO	DEC	0	10	NO	S_DEC100			194
195	THRESHOLD (>)	dgout_threshold[0]	YES	YES	PERCENTAGE2	-300	300	YES	S_DEC100			195
196	THRESHOLD (>)	dgout_threshold[1]	YES	YES	PERCENTAGE2	-300	300	YES	S_DEC100			196
197	THRESHOLD (>)	dgout_threshold[2]	YES	YES	PERCENTAGE2	-300	300	YES	S_DEC100			197
198	P3 BAUD RATE	p3_baud	YES	NO	BAUD	0	0xFF	YES	S_HEX			198
199	DELAY	spdlopd.inv_time.delay	YES	NO	SECS1	1	600	YES	S_DEC10			199
200	RATE	spdlopd.inv_time.rate	YES	NO	SECS1	1	600	YES	S_DEC10			200
201	REGEN MODE	two_quad	YES	YES	ENABLED_DISABLED	0	1	YES	S_HEX			201
202	INT. DEFEAT	spdlopd.spid.int_defeat	YES	YES	ON_OFF	0	1	NO	S_HEX			202
203	OUTPUT	spdlopd.inv_time.output	NO	NO	PERCENTAGE2	0	200	YES	S_DEC100			203
204	AIMING POINT	spdlopd.inv_time.aiming_point	YES	NO	PERCENTAGE2	0	200	YES	S_DEC100			204
205	di/dt (I Dmd.)	spdlopd.di_dt	YES	NO	PERCENTAGE2	0	200	NO	S_HEX			205
206			YES	NO	RATIO3	-300	300	NO	S_HEX			206
207			YES	NO	RATIO3	0	200	NO	S_HEX			207
208	RATIO 0	sumd.ratio2	YES	YES	RATIO3	-300	300	NO	S_DEC10000			208
209	FLD CTRL MODE IS	select_fld_i_control	YES	YES	FLD_MODE	0	1	YES	S_HEX			209
210	RATIO OUT/IN	fld_volts_ratio	YES	YES	PERCENTAGE1	0	10	NO	S_DEC100			210
211	HEALTH INHIBIT	sys_health_inhibit	YES	NO	HEX	0	0xFFFF	YES	S_HEX			211
212	MODE	jog.mode	NO	NO	JOG_MODE	0	7	NO	S_HEX			212
213	ZERO CUR OFFSET	zero_cu0ffset	NO	NO	HEX	0	0xFFFF	NO	S_HEX			213
214	ZCD THRESHOLD	zcd_threshold	YES	NO	HEX	0	0xFFFF	NO	S_HEX			214
215		g_l_load_meter	NO	NO	PERCENTAGE2	-200	200	NO	S_DEC100			215

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216	PROG STOP LIMIT	stopd.p_stop_time_delay	YES	YES	SECS1	0	600	NO	S_DEC10			216
217	STOP LIMIT	stopd.stop_time_delay	YES	YES	SECS1	0	600	NO	S_DEC10			217
218	JOG SPEED 1	jog.jog_setpoint1	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			218
219	JOG SPEED 2	jog.jog_setpoint2	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			219
220	12 BIT DAC	dac_10_12	YES	NO	ENABLED_DISABLED	0	1	YES	S_BIN			220
221	UTACH ALRM DELAY	microtach.delay	YES	NO	HEX	0	0xFFFF	NO	S_HEX			221
222	PRED STEP	pred_step	YES	NO	HEX	0	0xFFFF	YES	S_HEX			222
223	SCAN THRESHOLD	scan_threshold_level	YES	NO	HEX	0	0xFFFF	YES	S_HEX			223
224	STALL TRIP DELAY	stall_trip.delay	YES	NO	DEC	1	600	YES	S_DEC			224
225	CRAWL SPEED	jog.crawl_speed	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			225
226	PEAK HW OFFSET	peak_hw_offset	NO		DEC	0	200	YES	S_HEX			226
227	AUX MODE 0	jog.aux_mode_0	YES	YES	TRUE_FALSE	0	1	NO	S_BIN			227
228	MODE 1	jog.mode_1	YES	YES	TRUE_FALSE	0	1	NO	S_BIN			228
229	PRECISION CHK.	precision_check	YES	NO	TRUE_FALSE	0	1	YES	S_HEX			229
230	ANIN1 CALIBRATION (A2)	anin_scale[0]	YES	YES	RATIO3	-300	300	NO	S_DEC100			230
231	ANIN1 MAX VALUE (A2)	anin_max[0]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			231
232	ANIN1 MIN VALUE (A2)	anin_min[0]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			232
233	ANIN2 CALIBRATION (A3)	anin_scale[1]	YES	YES	RATIO3	-300	300	NO	S_DEC10			233
234	ANIN2 MAX VALUE (A3)	anin_max[1]	YES	YES	PERCENTAGE2	-200	200	NO	S_DEC100			234
235	ANIN2 MIN VALUE (A3)	anin_min[1]	YES	YES	PERCENTAGE2	-200	200	NO	S_DEC100			235
236	ANIN3 CALIBRATION (A4)	anin_scale[2]	YES	YES	RATIO3	-300	300	NO	S_DEC10			236
237	ANIN3 MAX VALUE (A4)	anin_max[2]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			237
238	ANIN3 MIN VALUE (A4)	anin_min[2]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			238
239	ANIN4 CALIBRATION (A5)	anin_scale[3]	YES	YES	RATIO3	-300	300	NO	S_DEC10			239
240	ANIN4 MAX VALUE (A5)	anin_max[3]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			240
241	ANIN4 MIN VALUE (A5)	anin_min[3]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			241
242	ANIN5 CALIBRATION (A6)	anin_scale[4]	YES	YES	RATIO3	-300	300	NO	S_DEC10			242
243	ANIN5 MAX VALUE (A6)	anin_max[4]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			243
244	ANIN5 MIN VALUE (A6)	anin_min[4]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			244
245	ANOUT1 % TO GET 10V (A7)	anout_scale[0]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			245
246	ANIN1 DESTINATION TAG (A2)	anin_dest_slot[0]	YES	NO	DEC	Special	Special	YES	S_DEC			246
247	ANIN5 DESTINATION TAG (A6)	anin_dest_slot[4]	YES	NO	DEC	Special	Special	YES	S_DEC			247
248	ANOUT2 % TO GET 10V (A8)	anout_scale[1]	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			248
249	ANIN3 DESTINATION TAG (A4)	anin_dest_slot[2]	YES	NO	DEC	Special	Special	YES	S_DEC			249
250	ANIN4 DESTINATION TAG (A5)	anin_dest_slot[3]	YES	NO	DEC	Special	Special	YES	S_DEC			250
251	ANOUT1 SOURCE TAG (A7)	anout_source[0]	YES	NO	DEC	0	0xFF	YES	S_DEC			251
252	ANOUT2 SOURCE TAG (A8)	anout_source[1]	YES	NO	DEC	0	0xFF	YES	S_DEC			252
253	TAKE UP 1	jog.slack_setpoint1	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			253
254	TAKE UP 2	jog.slack_setpoint2	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			254
255	RESET VALUE	rld.reset_value	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			255
256	INCREASE RATE	rld.rd.ramp_up_time	YES	YES	SECS1	1	600	NO	S_DEC100			256
257	DECREASE RATE	rld.rd.ramp_down_time	YES	YES	SECS1	1	600	NO	S_DEC100			257
258	MIN VALUE	rld.min	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			258
259	MAX VALUE	rld.max	YES	YES	PERCENTAGE2	-300	300	NO	S_DEC100			259
260	RAISE/LOWER DEST	rld.dest	YES	NO	DEC	-100	100	NO	S_DEC100			260
261	RAISE INPUT	rld.raise	YES	YES	TRUE_FALSE	0	1	NO	S_DEC100			261
262	LOWER INPUT	rld.lower	YES	YES	TRUE_FALSE	0	1	NO	S_DEC100			262
263	STALL THRESHOLD	stall_threshold	YES	YES	PERCENTAGE2	0	200	NO	S_DEC100			263
264	OUTPUT	rls.rs.output	NO	NO	PERCENTAGE2	-300	300	NO	S_DEC100			264
265	ANALOG IP OFFSET	zero_offset_cal	YES	NO	DEC	-300	300	NO	S_DEC100			265
266	% S-RAMP	srd.s_ramp_percent	YES	YES	PERCENTAGE2	0	10	NO	S_DEC100			266
267		r0	YES	YES	PERCENTAGE2	0	200	NO	S_DEC100			267
268	MODE	spdlopd.adapt.mode	YES	YES	DEC	0	3	NO	S_HEX			268
269	SPD BRK1 (LOW)	spdlopd.adapt.break1	YES	YES	PERCENTAGE2	0	10	NO	S_DEC100			269

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Tag	MMI Text	Variable Name 'C'	R/W	ReConfig	Type	Min	Max	Restricted	Serial Format	Default	User	Tag
270	SPD BRK2 (HIGH)	spdlopd.adapt.break2	YES	YES	PERCENTAGE2	0	10	NO	S_DEC100			270
271	PROP. GAIN	spdlopd.adapt.p_gain	YES	YES	NONE2	0	200	NO	S_DEC100			271
272	INT. TIME CONST.	spdlopd.adapt.i_gain	YES	YES	MSEC	1	300	NO	S_DEC100			272
273	POS LOOP	spdlopd.pos_loop.gain	YES	YES	PERCENTAGE2	0	200	NO	S_DEC100			273
274	I TIME IN RAMP	spdlopd.spid.int_gain_scale	YES	YES	RATIO3	0	200	NO	S_DEC100			274
275	I COMP	spdlopd.i_comp_scale	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			275
276	PLL PROP	pll_prp	YES	NO	DEC	0	200	NO	S_HEX			276
277	PLL INT	pll_int	YES	NO	DEC	0	200	NO	S_HEX			277
278	PLL ERROR	pererr	NO	NO	DEC	-100	100	NO	S_HEX			278
279	ARM ENDSTOP	ES_CM_ang	YES	NO	DEC	0	200	YES	S_HEX			279
280	CO IAD HYSTER	iad_hyster	YES	NO	DEC	0	200	NO	S_DEC			280
281	CO FILTER TC	hyster_tc	YES	NO	DEC	0	200	NO	S_DEC			281
282	BEMF THRESHOLD	bemf_threshold	YES	NO	DEC	0	200	NO	S_DEC			282
283	SCAN TC	scan_tc	YES	NO	DEC	0	200	NO	S_DEC			283
284	ZERO SPD. LEVEL	quench_threshold	YES	NO	PERCENTAGE2	0	200	NO	S_DEC100			284
285	ZERO IAD LEVEL	zero_speed_i_threshold	YES	NO	PERCENTAGE2	0	200	NO	S_DEC100			285
286	RAMPING THRESH.	srd.rd.threshold	YES	YES	PERCENTAGE2	0	10	NO	S_DEC100			286
287	AUTO RESET	srd.reset_mode	YES	YES	ENABLED_DISABLED	0	1	NO	S_BIN			287
288	RESET	srd.external_reset	YES	YES	ENABLED_DISABLED	0	1	NO	S_BIN			288
289	SETPOINT 1	spdlopd.speed_setpoint1	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			289
290	SETPOINT 2	spdlopd.speed_setpoint2	NO	NO	PERCENTAGE2	-100	100	NO	S_DEC100			290
291	SETPOINT 3	spdlopd.speed_setpoint3	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			291
292	SIGN 0	sumd.sign2	YES	YES	POS_NEG	0	1	NO	S_BIN			292
293	RAMP O/P DEST	srd.dest_tag	YES	NO	DEC	Special	Special	YES	S_DEC			293
294	SETPOINT SUM.O/P. DEST	sumd.dest_tag	YES	NO	DEC	Special	Special	YES	S_DEC			294
295	ENCODER	dt_fbk_filter.result	NO	NO	RPM0	0	600	NO	S_DEC			295
296	SPEED FEEDBACK	spd_fbk_filter.result	NO	NO	PERCENTAGE2	-150	150	NO	S_DEC100			296
297	SPEED ERROR	spd_err_filter.result	NO	NO	PERCENTAGE2	-150	150	NO	S_DEC100			297
298	CURRENT FEEDBACK	ifbk_filter.result	NO	NO	PERCENTAGE2	-150	150	NO	S_DEC100			298
299	CURRENT DEMAND	idmd_filter.result	NO	NO	PERCENTAGE2	-150	150	NO	S_DEC100			299
300	FIELD I FBK	ifld_fbk_filter.result	NO	NO	PERCENTAGE2	-150	150	NO	S_DEC100			300
301	POS I CLAMP	spdlopd.main_output_clamp	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			301
302	CONTACTOR DELAY	stopd.stop_contactor_delay	YES	YES	SECS1	1	600	NO	S_DEC10			302
303	Ramp SPD. FBK. RESET	srd.reset_source_select1	YES	YES	ENABLED_DISABLED	0	1	NO	S_BIN			303
304	LANGUAGE	mmi_data.language	YES	NO	DEC	0	1	YES	S_BIN			304
305	TRIP RESET	external_trip_reset	YES	YES	ENABLED_DISABLED	0	1	NO	S_BIN			305
306	SOURCE TAG Standstill Demand	standstilld.source	YES	NO	DEC	Special	Special	YES	S_DEC			306
307	RESET Raise Lower	rld.rd.reset	YES	YES	TRUE_FALSE	0	1	NO	S_BIN			307
308	ANALOG TACH	filtered_tach	NO	NO	PERCENTAGE1	-150	150	NO	S_DEC100			308
309	SETPOINT SUM INPUT 0	sum_input1	YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			309
310	DISABLE AUTOCAL	auto_cal	YES	NO	ENABLED_DISABLED	0	1	NO	S_BIN			310
311	IAINST OFFSET	iainst_offset	YES	NO	DEC	0	200	NO	S_DEC			311
312			YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			312
313			YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			313
314			YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			314
315			YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			315
316			YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			316
317			YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			317
318			YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			318
319			YES	YES	PERCENTAGE2	-100	100	NO	S_DEC100			319

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ISS.	MODIFICATION	CP.NO.	DATE	APPROVAL
A	Initial Issue		27.03.91	
B	General amendments and additions		17.04.91	
C	Corrections to MMI Section, 10.6 Alarms pages 13 - 16.		22.04.91	
D	Various alterations.		26.4.91	
E	Global change SLOT now called TAG.		2.05.91	
F	Global changes and amendments.		3.05.91	
1	General release and circulation.	6556	7.05.91	
2	General amendments and alterations to coincide with up-to-date information.	6921	22.01.92	
3	Addendum incorporated as Appendix 2 and other general corrections.	7616	20.05.92	

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