



**EUROTHERM
DRIVES**

570L SERIES THREE PHASE CONVERTORS

PRODUCT MANUAL

THIS MANUAL IS INTENDED FOR USE WITH THE 570 LINK PRODUCT HOWEVER THERE IS INFORMATION IN AN ADDENDUM WHICH DEFINES THE DIFFERENCES BETWEEN THE 570 LINK AND THE 590 LINK PRODUCT.

IT IS THEREFORE APPROPRIATE TO USE THIS MANUAL WITH 590 LINK PRODUCT.



**A WARNING GIVES THE READER INFORMATION WHICH
IF DISREGARDED COULD CAUSE INJURY OR DEATH**

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BEFORE RETURNING TO USE. FAILURE TO DO SO MAY CREATE A HAZARD AND RISK OF INJURY.

PACKAGING: The packaging is combustible and if disposed of in this manner incorrectly may lead to the generation of toxic fumes which are lethal.

WEIGHT: Consideration should be given to the weight of the product when handling.

REPAIRS: Repair reports can only be given if sufficient and accurate defect reporting is made by the user.

Remember, the product without the required precautions can represent an electrical hazard and risk of injury, and that rotating machinery is a mechanical hazard and risk of injury.

PROTECTIVE INSULATION:

1. All exposed metal insulation is protected by basic insulation and bonding to earth i.e. Class 1.
NOTE: Earth bonding is the responsibility of the installer.
2. All signal terminals (terminals 1-39) are SELV i.e., protected by double insulation (Class 2). The purpose of this protection is to allow safe connection to other low voltage equipment and is not designed to allow these terminals to be connected to any unisolated potential.
NOTE: Thermal sensors contained within the motor are to be double insulated.
3. This protective insulation is provided under the following condition: three phase supply, neutral earth return, single phase aux supply earth return.
4. Single fault conditions.
5. Ensure all wiring rated for highest system voltage.

CONTROLLER WARRANTY: For further details on Eurotherm Drives Controller Warranty and Repair refer to the Standard Conditions of Sale IA058393C.

]

ENCLOSURE: To maintain compliance with the European Low Voltage Directive Standards VDE 0160 (1994)/prEN50178(1995) the unit should be mounted inside a suitable control cubicle requiring a tool for opening.

RCDS: Compatible with Type B RCDs only.

EUROTHERM DRIVES RESERVE THE RIGHT TO CHANGE OR ALTER THE SPECIFICATION OF THIS PRODUCT WITHOUT NOTICE

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590L CONTROLLERS

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Eurotherm Drives Companies

Modification Record

1 Introduction

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

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

- a) High Speed Fibre Optic digital communications interface.
- b) Complex control algorithms not achievable by simple analogue circuitry.
- c) Control circuitry built around standard software blocks.

The 570L features a Fibre Optic interface which allows integration into the Eurotherm Drives LINK systems network. This is a fully programmable range of modules, designed for real time control of drives in a systems environment.

The controller is fully programmable, over the LINK network, via the Eurotherm Drives LINK configuration and diagnostic software packages.

The 570L supports an optional secondary fibre optic network. This second network allows automatic self healing, in the event of a single network failure.

All setpoints and other variables are sent as digital values over the LINK network. This gives excellent control accuracy.

All modules provide an interface for the Eurotherm Drives Microtach, for digital speed feedback. This gives greatly improved speed holding accuracy.

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

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

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

All models of the 570L series, include a field current regulator, for extended speed and constant horsepower operation. This consists of a half-controlled single phase Thyristor bridge with full transient and overload protection, together with its associated electronic control circuitry.

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

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

Standardisation of parts wherever possible throughout the range reduces the variety of spare parts required to maintain a multi-drive system. For example, the same basic control and power supply PCB's are used in all types of 570L three phase armature controllers regardless of horsepower or bridge configuration.

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

This manual covers the following models from the 570L series.

Three phase, regenerative, four quadrant armature controllers.

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

Three phase non-regenerative, two quadrant armature controllers.

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

2 PRODUCT CODE

570L Series Three phase converters.

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

Block No.	No. of Digits	Function
1	3	Basic product
2	3	Output current
3	4	Input power supply voltage
4	1	Field converter configuration
5	1	Input auxiliary supply voltage
6	1	User Language.
7	1	Speed feedback source
8	1	Not Used
9	4	Speed feedback calibration
10	3	Field voltage
11	3	Field current
12	3	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.

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

BLOCK 2570L to 577L
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

578L and
579L

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 1250 - 1125 Amps

BLOCK 3

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

0	110v	A500V
1	115v	
2	208v	
3	220v	B550V
4	240v	
5	380v	
6	415v	C600V
7	440v	
8	460v	
9	480v	D660V

— 578L / 579L
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 part product code (Blocks 10 to 16).
- 2 Internally supplied full wave rectifier.
 - 3 Internally supplied half wave rectifier.
 - 4 Externally supplied field regulator.
- Note: This digit requires a second part product code (Blocks 10 to 16).
- 5 Externally supplied full wave rectifier.
 - 6 Externally supplied half wave rectifier.
 - 7
 - 8 Internally supplied 3 phase rectifier.
 - 9

BLOCK 5

1 Digit identifying the auxiliary AC control supply voltage.

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

BLOCK 6

1 Digit code to define user interface language.

- 0 English

BLOCK 7 1 Digit code identifying the speed feedback source.

- 0 Armature Voltage.
- 1 DC Tacho.
- 2 5701 Microtach.
- 3 Wire ended encoder.
- 4 5901 Microtach

BLOCK 8 This block is not used.

BLOCK 9 4 Digits code identifying full speed.

Note: Block 9 is dependent upon Block 7

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

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

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

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

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

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

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

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

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

BLOCK 10 3 Digits identifying the DC field voltage

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

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

BLOCK 11 3 Digits identifying the DC field current

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

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

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

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

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

- BLOCK 13** 1 Digit identifying the requirement for armature current profile.
- 0 No armature current profile.
- Note: Blocks 14, 15 and 16 are not required but should be entered as zeros on the product code.
- 1 Armature current profile required.
- Note: Blocks 14, 15 and 16 are required to complete the current profile specification.
- BLOCK 14** 2 Digits identifying the motor speed at armature profile break 1.
- For example: 50% - Code 50 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.
Code 65 - 65%
- Note: Block 14 is not required if Block 13 = 0 but should be entered as zeros on the product code.
- BLOCK 15** 2 Digits identifying the motor armature current at armature profile break 2.
- The digits in this block represent the percentage of full load armature current at the second (break 2) armature current profile point. To form the code from the numbers, round to the nearest whole number with leading zeros added where necessary.
- For example: 49% - Code 49
Code 59 - 59%
- Note: Block 15 is not required if Block 13 = 0 but should be entered as zeros on the product code.
- BLOCK 16** 2 Digits identifying the motor speed at armature profile break 2.
- The digits in this block represent the percentage of motor top speed at the second (break 2) armature current profile point. To form the code from the numbers, round to the nearest whole number with leading zeros added where necessary.
- For example: 60% - Code 60
Code 90 - 90%
- Note: Block 16 is not required if Block 13 = 0 but should be entered as zeros on the product code.
- BLOCK 17** 2 Digits identifying special options (hardware)
- 00 No special options
00 to 99 Documented special options
- BLOCK 18** 3 Digits identifying special options (software).
- 000 The Basic Block Diagram
001
002
003
004
005
006
007
008
009
010 to 99 Documented Special options

3 TECHNICAL DETAILS

3.1 GENERAL

Control Circuits:	Fully isolated from power circuit.
Control Action:	Fully digital. Advanced PI with fully adaptive current loops for optimum dynamic performance. Self Tuning Current Loop utilising "Autotune" algorithm. Adjustable speed PI with integral defeat.
Speed Control:	By Armature feedback with IR compensation. By Encoder feedback or analogue tachogenerator.
Speed Range:	100 to 1 typical with tachogenerator feedback.
Steady State Accuracy:	Better than 0.01% with MICROTACH encoder.
Adjustments:	All adjustments are performed in software by the Eurotherm Drives LINK network, configuration and diagnostic software tools or on board pushbuttons and LCD display.
Protection:	Interline device networks. High energy MOV's. Overcurrent (instantaneous). Overcurrent (inverse time). Field failure. Speed feedback failure. Motor overtemperature. Thyristor Stack overtemperature (Force ventilated units). Thyristor "Trigger" failure. Zero-speed detection. Standstill logic.
Diagnostics	Fully computerised with first fault latch and automatic display. Digital LCD monitoring. Full diagnostic information available via LINK diagnostic software package. LED circuit state indication.
Operating Temperature Range:	0°C — +55°C Derate linearly above 35°C for forced cooled units. Derate linearly above 45°C for naturally cooled units.
Storage Temperature:	-25°C — +55°C
Transport Temperature:	-25°C — +70°C Protect from direct sunlight. Ensure dry, corrosive free environment.

3.2 ELECTRICAL RATINGS

Power Configuration: 570L, 572L, 574L, 576L, - Two Anti-parallel three phase Thyristor bridges.
 578L*
 571L, 573L, 575L, 577L, - One three phase fully controlled Thyristor bridge.
 579L*

* External stack options.

Power Supply: 3-Phase, 45-65 Hz, phase rotation insensitive. No adjustment required for frequency change.

Voltage ranges: 110-220v** ~ ±10%
 220-480v**~ ±10%
 480-660v ~ ±10% 578/579 only

Supply Current: (0.9 x I_{dc}) Amps AC

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

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

† On 574L/575L and 576L/577L 240 Vac fans are prohibited.

* Force ventilated units.

** Suitable for earth referenced (TN) and non earth referenced (IT) supplies.

Supply Power	}	Quiescent	30VA	fused at 400mA
		Fans	50VA when fitted	fused at 500mA
		Contactors	As contactor data sheet	fused at 3A

Output Current Ratings:(Field)	10A 570L, 571L, 572L, 573L	}	Maximum Field Supply Voltage 480V ac ± 10%
	20A 574L, 575L, 576L, 577L		
	30A 578L, 579L		

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	1.8W or 75mA
	5702/1 Repeater	1W or 40mA
	5702/2 Terminal Rail Repeater	1.2W or 50mA
	5702/3 Encoder to Fibre Optic Convertor.....	1.2W or 50mA
	5702/5 Splitter.....	1.2W or 50mA
	5702/6 Marker Pulse Repeater.....	1.7W or 70mA

3.3 OUTPUT RATINGS

	590/1									598/9						
Output Current Ratings (Armature) ¹	35A	70A	110A	150A	180A	270A	360A	450A	720A	950A	1100A	1388A	1600A	1800A	2300A	2800A
Nominal Power Rating @ 460V DC Assuming 95% Motor Efficiency	15KW (20HP)	30KW (40HP)	45KW (60HP)	60KW (80HP)	75KW (100HP)	110KW (150HP)	150KW (200HP)	190KW (250HP)	300KW (400HP)	395KW (530HP)	455KW (610HP)	575KW (770HP)	660KW (880HP)	745KW (1000HP)	950KW (1275HP)	1150KW (1550HP)
Maximum Rating Ambient ²	45°C	45°C	35°C	35°C	35°C	35°C	35°C	35°C	35°C	35°C	35°C	35°C	35°C	35°C	35°C	35°C
Cooling: Forced(F)/Natural(N) Fan: Integral(I)/Separate(S)	N -	N -	F I	F I	F I	F I	F I	F S ³	F S	F S	F S	F S	F S	F S	F S	F S
Overload Capacity Available (Armature Current) ⁴	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
Field Current Rating	10A	10A	10A	10A	10A	10A	20A	20A	20A	30A	30A	30A	30A	30A	30A	30A
Maximum Supply Voltage	500V	500V	500V	500V	500V	500V	500V	500V	500V	660V	660V	660V	660V	660V	550V ⁵	550V ⁵
Maximum Field Supply Voltage	500V	500V	500V	500V	500V	500V	500V	500V	500V	500V	500V	500V	500V	500V	500V	500V
Power Loss	105W	210W	330W	450W	540W	710W	1080W	1350W	2160W	2850W	3300W	4164W	4800W	5400W	6900W	8400W
Installation Drawing HG:	055805	055805	055806	055806	386968	055807	057208	057209	057449 ⁶	057829 ⁷	057829 ⁷	057829 ⁷	057829 ⁷	057829 ⁷	057829 ⁷	057829 ⁷

¹ Altitude derating, nominal sea level to 500 metres, derate above 500 metres at 1% per 200 metres up to maximum of 5,000 metres.

² Derate linearly at 1% per degree centigrade for temperature exceeding the maximum rating ambient. Maximum operating ambient is 55°C.

³ A lower current version limited to 360Amps is available with an integral fan (HG057208).

⁴ The standard overload capacity available is 200% for 10 seconds, 150% for 30 seconds. The 720 Amp Chassis has no overload capacity at maximum current, whereas at output currents less than 650 Amps overload capacity is as normal.

⁵ External Stack assemblies at 660V are not available above 2000 Amps without reference to Eurotherm Drives Internal Sales Department.

⁶ For Installation Drawings for 720A Stock Assembly see: HG049669 Standard Mounting / HG054248 Bracket Mounting.

⁷ Installation Drawings for External Stack Thyristor assemblies available on application to Eurotherm Drives Engineering Department.

3.4 MECHANICAL DETAILS

570L and 571L Convertors

Mounting Centres:	Vertical - 400mm (15.75") Horizontal - 200mm (7.87")	
	<u>Rating up to 32kw (40 HP)</u>	<u>Rating up to 69kw (90 HP)</u>
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:	100m ³ /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.	

572L and 573L 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:	350m ³ /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.	

574L and 575L Convertors

- Mounting Centres: Vertical - 600mm (23.6")
Horizontal - 200mm (7.87")
- Overall Width: 250mm (8.75") (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: 490m³/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.

576L and 577L 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/hr @ 8mm head for rated output.
- Control Terminations: Plug-on connectors with retaining catches.
- Power Terminations: AC Busbars with M14 screws and captive nuts.
DC M10 bolts and nuts.
- Access: Hinge-down cover for keypad.
Hinge-up cover for control circuit terminals and Option Modules.
Hinge-out Control Printed Board with its own independent cover.

Tightening Torque

The following table should be referred to when making connections to the controller.

PRODUCT	TERMINATIONS	MAXIMUM TIGHTENING TORQUE		
ALL	A1 - A9	M2.5	5-7in.lb.	0.56-0.79Nm
	B1 - B0	M2.5	5-7in.lb.	0.56-0.79Nm
	C1 - C9	M2.5	5-7in.lb.	0.56-0.79Nm
570L - 577L	D1 - D8	M3	4in.lb.	0.45Nm
570L - 571L	A+, A-, L1, L2, L3	M8	12.2lb.ft.*	16.5Nm*
	Ground	M6	5.0lb.ft.	6.8Nm
572L - 573L	A+, A-, L1, L2, L3	M8	12.2lb.ft.	16.5Nm
	Ground	M6	5.0lb.ft.	6.8Nm
574L - 575L	A+, A-,	M10	24.2lb.ft.	32.8Nm
	L1, L2, L3	M12	42.2lb.ft.	57.2Nm
	Ground	M10	24.2lb.ft.	32.8Nm
576L - 577L	A+, A-,	M10	24.2lb.ft.	32.8Nm
	L1, L2, L3	M14	67.1lb.ft.	91.0Nm
	Ground	M8	12.2lb.ft.	16.5Nm

* Note: M8 CHEESEHEAD SCREW, TIGHTENING TORQUE 8.1lb.ft 11Nm

4 Basic Installation and Wiring Instructions

4.1 INSTALLATION

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

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

Note:- The fixing centres of 570L 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 Eurotherm Drives.

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 570L 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 570L series controller are given in diagram HB059667D.

The location of the signal and LINK interface connections is given in the following section, on terminal descriptions.

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

Product Code Block 2	Fuse Rating	Eurotherm Drives Fuse Part Number	Thyristor A2t @ 125°C Junction Temperature
0010 to 0350	35A	CH110353	800A2t
0351 to 0350	75A	CH120753	8,000A2t
0701 to 0700	110A	CH120114	8,000A2t
1101 to 1500	150A	CH120154	15,000A2t
1501 to 2700	300A	CH130035	125,000A2t
2701 to 4500	-----	-----	320,000A2t
4501 to 7200	-----	-----	500,000A2t

4. A substantial ground or earth connection (Protective Earth) should be made to the earth terminal of the 570L drive, the protective earth connection being indicated by the IEC grounding symbol (as defined in IEC 417 symbol 5019) . On the 720/800A chassis two M8 terminals are provided **BOTH MUST BE** connected to protective earth/ground.
5. The motor protective earth/ground connection should be run in parallel with the motor supply conductors ideally inside the same conduit/screen/armour and be connected near to the drive to a separate independent protective earth/ground star point. **DO NOT PROTECTIVELY EARTH/GROUND THE MOTOR THROUGH THE 570L DRIVE.**
6. A 3 phase contactor should be connected in the main ac power supply connections with a rating suitable for the controller concerned. The contractor does not switch current and is primarily for isolation and sequencing of the power bridge. The main contactor must be energised directly from the controller by connecting the coil to terminals D5 (Line) and D6 (Neutral). (If the coil inrush at switch-on is likely to exceed 3A a slave relay must be used.) The main contactor coil and the slave relay, if used, must have operating voltages compatible with the controller auxiliary supply.

Note:- A dc contactor can be used but the sequencing must be adjusted to accommodate its use, an auxiliary normally open volt-free contact of the contactor must be connected in series with the "enable" input A5 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. (Eurotherm Drives 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.

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

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, its 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 Eurotherm Drives Engineering Department.

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

- i) Analogue dc tachogenerator.
- ii) Eurotherm Drives MICROTACH.
- iii) Armature Voltage feedback.

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

If an analogue tachogenerator is required this should be connected with its negative terminal connected to terminal A3 and its positive terminal connected to terminal A4. 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.

Speed feedback from an Eurotherm Drives MICROTACH is provided as a standard interface, on the 570L drives. The Microtach interface has two types of connection, a three-way conventional terminal block to provide power to the MICROTACH and a fibre optic receiver to accept the speed feedback. The power supply to the MICROTACH should be taken from terminal G2 + 24v dc, and terminal G3 power ground. The fibre optic "cable" requires a special connector for termination of the cable, these connectors are available from Eurotherm Drives as is the fibre optic cable. Two connectors are stocked one completely black, the other black with a red insert, the black is used at the receiver end the red at the transmitter end. This arrangement is to aid with the identification of incoming and outgoing signals in multiple connection systems.

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

14. If the motor is fitted with over-temperature sensing devices such as thermo-stats, microtherms or PTC thermistors these should be connected between terminals A1 and A2. If more than one temperature sensing device is fitted they should be connected in series, if none are fitted terminals A1 and A2 must be linked to allow the drive to run. Thermistors must have a working resistance of 200 Ohms or less rising to greater than 2000 Ohms at over-temperature.

15. The 570L communicates to the Eurotherm Drives LINK fibre optic network via the four fibre optic connectors located on the right hand side of terminal block A.

The fibre optic connectors are coloured red and black. This corresponds to transmit and receive respectively. The primary channel connectors are labelled F4 and F5. These correspond to receive and transmit respectively.

The LINK network should be wired using similar fibre optic cable, and connectors, as described for the Microtach above.

The right hand pair of fibre optics should always be wired into the primary channel of the LINK network. The left hand pair should be used when the optional secondary channel is used.

The secondary channel allows the LINK network to self heal, in the event of disruption of the network. The secondary channel connectors are labelled F3 and F2. These correspond to receive and transmit respectively.

16. The Enable terminal A5 must be connected to +24v terminal A9 in order to allow the drive to run. The enable input is useful to inhibit the drive without opening the main contactor to give a rapid repeat inch for example or for use with a dc contactor. However, it is not an entirely safe mode of operation as the drive dc output is only reduced to zero, if the equipment controlled by the drive is to be serviced then this method should be avoided and the drive disabled by opening the main contactor.

17. Additional terminals A7 "program stop" and A8 "coast stop" provide extra facilities for safe operation of the drive.

Terminal A8 "Coast Stop" supplies power to the main contactor control relay, located on the power board of the 570L. This terminal must be held at +24v to allow closure of the main contactor, via the electronics.

Terminal A8 "Coast stop" should be connected to A9 "+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 LINK network, but is a relay which can be operated in exceptional circumstances where human safety is of paramount importance.

Terminal A7 "program stop" provides a facility for regenerative braking on a 4 Quadrant drive such as the 570L, 572L, etc.

If the "+24v" is removed from A7 while the drive is controlling the motor under "run" conditions, the drive will cause the motor to decelerate rapidly to rest at a rate determined by the "program stop" parameters. If the signal is re-applied to A7, the motor remains stationary until a new start/run command is applied via the LINK network. Care must be taken when using the "program stop" command, if the signal is re-applied before the motor comes to rest it will accelerate back up to speed setpoint. Program stop command should be interlocked with zero speed from the drive.

Note that the program stop will only work if the drive is configured to operate as a speed controller, via the internal speed loop. If a current controller is configured, the program stop function will not operate. The coast stop always operates, irrespective of the drive configuration.

A typical scheme is shown on diagram HB059667D, to implement an emergency stop of the drive. The emergency stop relay should be connected to the drive with two contacts. A direct contact operates the program stop A7, whereas a time delay contact operates the coast stop A8. The time delay is set longer than the program stop time set on the drive.

18. Terminal A6 is provided for connecting an ammeter to the 570L series drives. For regenerative drives within the 570L series, the ammeter should be of a suitable centre zero design. The ammeter is connected between A6 and signal 0 volts A1. The ammeter scaling should be 1.1 volts for 100% armature current.

4.4 NOTES ON WIRING

1. Indicator lamps, enunciators, 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 block A 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 Eurotherm Drives Engineering Department.

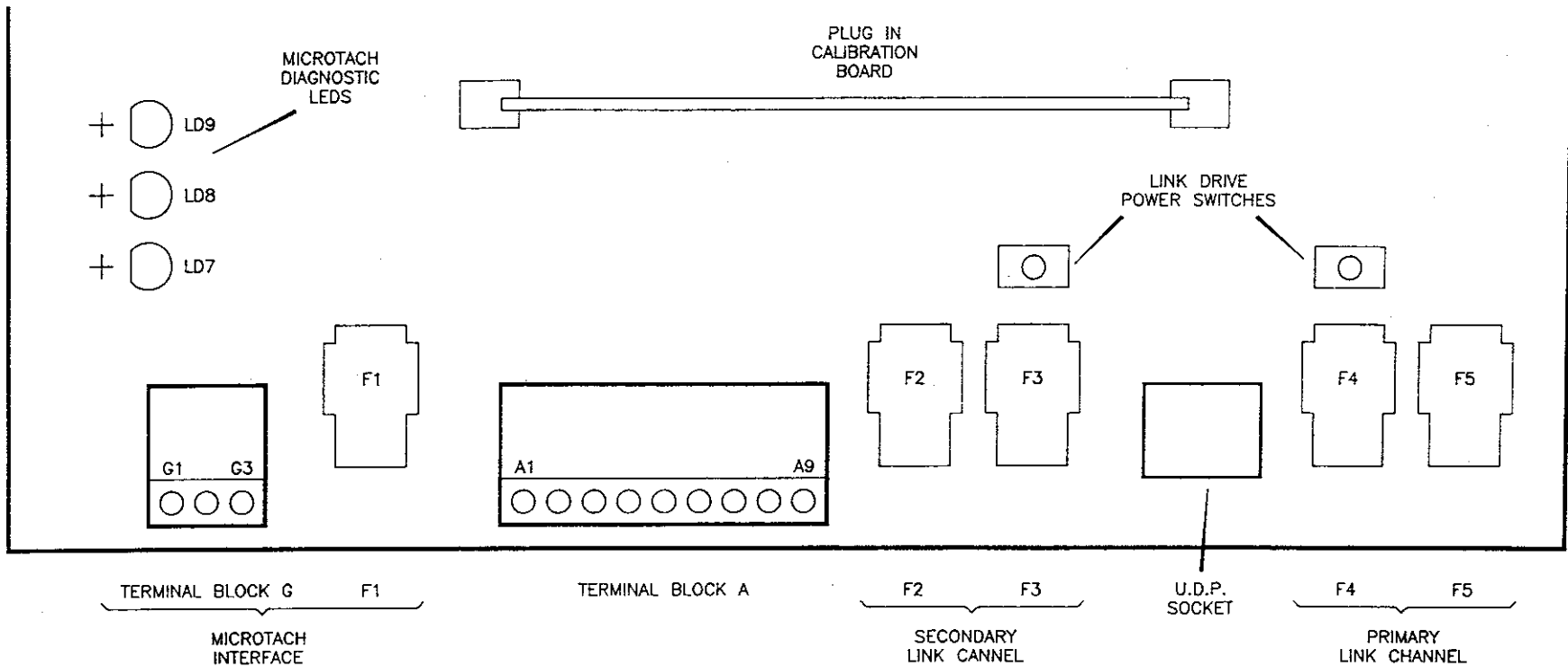
4.5 SPECIAL NOTES ON EARLY ISSUE CONTROL DOORS

1. Control door boards with issue numbering lower than 3 (the issue of the PCB is etched in copper in the lower right-hand corner by the fibre optic connectors) do not have an **Enable Input**, and terminal A5 is a spare 0V.
2. In systems using the lower issue boards any required enable signal is input in a separate LINK I/O Module and routed to the drive via the Link fibre optic network.
3. Lower than issue 3 boards utilised programmable jumpers for changing transmission power for the fibre optic network, two settings are available. Issue 3 boards incorporate toggle switches which allow for three power settings. The "Low" power settings are equivalent on all boards. The "High" settings are also equivalent.

4.6 REQUIRED WIRING CHANGE FOR USE OF SPARES

1. If an issue 3 or high board is used as a replacement for a lower issue board and terminal A5 has been used to supply 0V, then the wire to terminal A5 must be moved to either A1 or A3. Terminal A5 must be connected to 24v DC terminal A9 to enable the drive. No change to the configurations or other wiring is required.
2. Issue 3 boards must not be substituted for lower issue product, **damage to the drive may occur** by connection of terminal A5 to 24v DC.

CONTROL BOARD USER INTERFACE LAYOUT



KE058116 ISS. A

DRAWN	GR
TRACED	LT

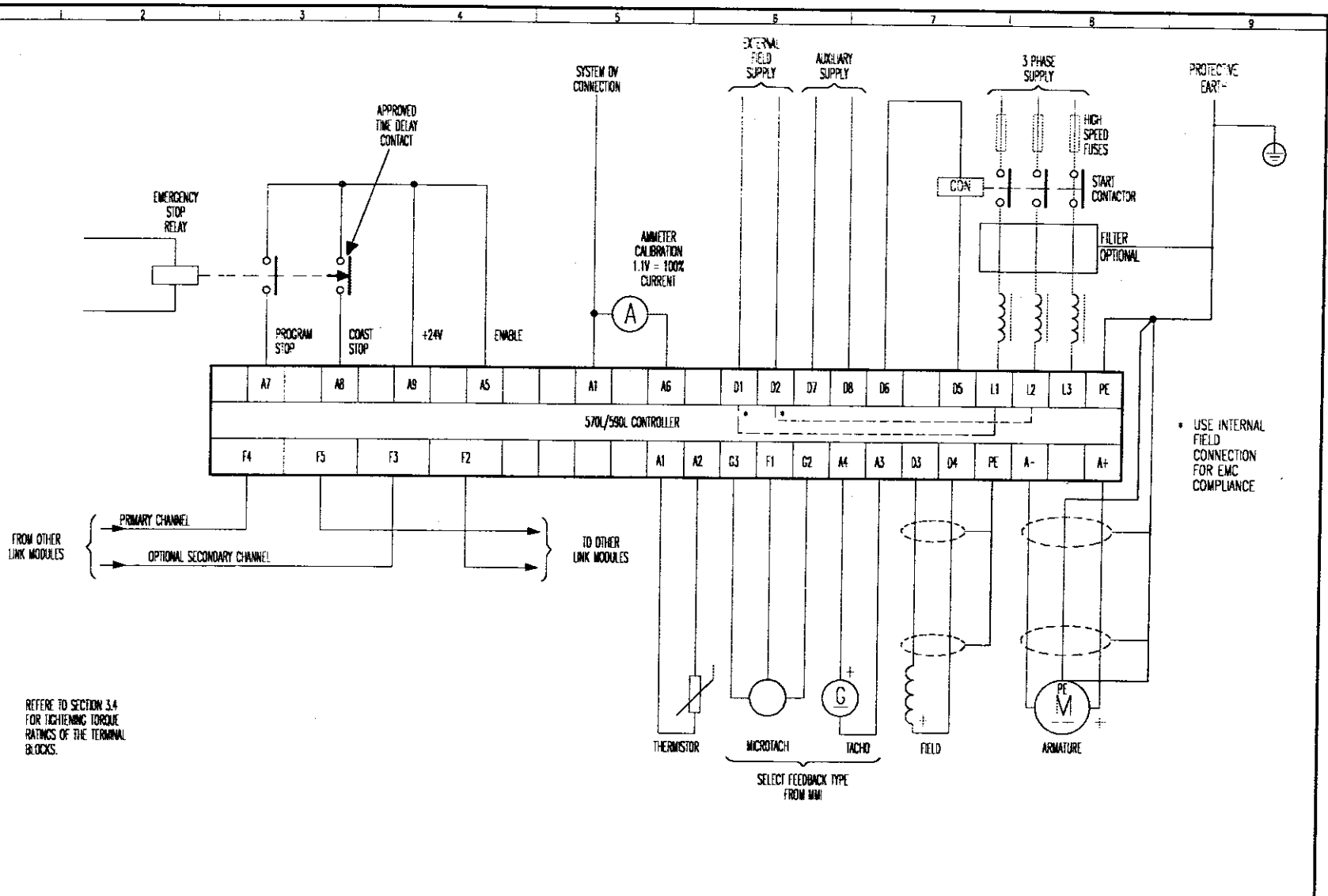
DATE	14/3/91
ISS	A

ELECTRICAL SYMBOLS GENERALLY TO BS 3939

SSD LITTLEHAMPTON ENGLAND TELEX 87142 **EO**

TITLE	CONTROL BOARD USER INTERFACE LAYOUT
-------	-------------------------------------

USED ON	570L
DRAWING NUMBER	HC 059669 D
SHT.	1
OF	1



REFER TO SECTION 3.4 FOR TIGHTENING TORQUE RATINGS OF THE TERMINAL BLOCKS.

DRAWN FEP	CHECKED MP	DATE 14-10-91	ELECTRICAL SYMBOLS GENERALLY TO BS 3838		TITLE CIRCUIT DIAGRAM FOR BASIC 570L/590L SERIES WIRING	© 1994 EURO THERM DRIVES	
			DESIGN APP.	DATE 24-10-96		USED ON 570L/590L	DRAWING NUMBER H B 059667 D
		SS A B	EUROTHERM DRIVES Ltd.				

5 Terminal Descriptions

CONTROL BOARD

Terminal blocks A, and G are located at the bottom of the control board. Block A is a 9 way, and block G is a 3 way plug-in connector.

The LINK and Microtach Fibre Optic connectors are also located at the bottom of the control board. These are plug in connectors.

The layout of these connectors can be found on drawing HC059669D.

5.1 CONTROL BOARD

These terminals are mounted at the base of the control board, underneath the bottom flap of the 570L. See installation drawings, contained in section 4.

5.1.1 Terminal Block A

This terminal block allows basic drive "housekeeping" signals to be connected.

<u>Terminal</u>	<u>Description</u>	<u>Function</u>	<u>Signal Level</u>
A1	Ov	Zero Volt reference.	
	This terminal is typically used to provide a 0 volt reference for any +24V DC system power supply, used for operating terminals A5, A7, and A8.		
A2	Thermistor/ Microtherm	Motor overtemperature protection element input.	
	It is good practice to protect DC motors against sustained thermal overloads by fitting temperature sensitive resistors or switches in the field and interpole windings on 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 above 2000 Ohms. Motor overtemperature sensors should be connected in series between terminals A1 and A2. An alarm will be activated if the external resistance between A1 and A2 exceeds 1.8k Ohms ± 200 Ohms. The controller will inhibit the Thyristor firing circuits and de-energise the main contactor control relay. The controller will not restart when the thermistor resistance falls until the overtemperature alarm is reset. The overtemperature alarm is automatically indicated on the LCD Display when it occurs. Terminals A1 and A2 must be linked if overtemperature sensors are not used.		
A3	Ov	Zero Volt reference.	
A4	Analogue Tachogenerator Input	Tachogenerator Feedback.	+200v dc Maximum at full Speed Feedback Forward. -200v dc Maximum at Full Speed Feedback Reverse.

Input resolution 10 Bits plus sign bit.
Input accuracy 9 Bits plus sign bit.

This input is intended solely for the connection of an analogue dc tachogenerator. Terminals A4 and A3 should be used for the two connections of the tachogenerator. A dc voltage of up to 200v dc maximum can be applied directly to A4 with respect to A3. Tachogenerator calibration is achieved by resistors R4 and R5 on the plug-in calibration board, the resistors being selected using the formula:-

$$R4 + R5 = (\text{Full Speed Tachogenerator Volts} - 10) \text{ K ohms.}$$

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.

<u>Terminal</u>	<u>Description</u>	<u>Function</u>	<u>Signal Level</u>
	Fine calibration of the tachogenerator feedback is performed in software and is adjusted using the MMI in the Set-up Parameters Calibration Menu, "Analog Tach Cal" (See Set-up procedure).		
	For forward motor rotation corresponding to a positive setpoint signal, the tachogenerator feedback voltage at terminal A4 must be positive with respect to OV (A3).		
	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.		
A5	Enable	Electrical armature current enable.	+20v Minimum +24v Typical
	Input resistance 4k7 Ohms.		
	The enable terminal is specifically designed for use with drive start contactors in series with the armature cables. When such a "DC Contactor" is used, an auxiliary contact should be used to enable the armature current when the contactor when it has closed.		
A6	Armature Current	Buffered Output Current.	+2.2v = 200% output Current Forward. -2.2v = 200% output current Reverse.
	Output Capacity 5mA at 2.2V output. Short circuit protected. Note, this output is not filtered.		
A7	Program Stop	Controlled Stop Input.	+24v drive run
	When the Program Stop input 0v (o/c) drive stop is held at +24v, the drive operates normally. When the Program Stop is open circuit or at zero volts, the drive causes a controlled or program stop to take place as defined by the Program Stop parameters.		
A8	Coast Stop	Uncontrolled Stop Input.	+24v drive run
	When the Coast Stop input is at +24v, the drive operates normally. When the Coast Stop is at zero volts or open circuit, the main contactor is open and the drive no longer operates. The motor coasts to rest.		
A9	+24 volt supply	Maximum output current 100mA.	

This is a +24 volt supply which can be used to activate the enable, program stop and coast stop terminals.

Note, short circuits on this terminal will not damage the power supply, but if the drive is running, damage to the thyristors may result.

5.1.2 Terminal Block G

This terminal block is specific to the Eurotherm Drives Microtach, high Accuracy speed feedback transducer.

<u>Terminal</u>	<u>Description</u>	<u>Function</u>
G1	External +24v dc Supply	Alternate external +24v Microtach power supply source input connection terminal.
G2	+24v dc Microtach Supply	This is a regulated +24v supply which can be used to power the microtach and the microtach option modules. The maximum load of the 24v supply is 250mA when supplying terminals A9, G2 and any digital outputs. If this load is likely to be exceeded an external 24v supply should be connected to G1 to supplement the internal supply.
G3	Microtach Power Supply Ground	
F1	Microtach Input	Black Fibre Optic Receiver Input Socket.

5.1.3 LINK INTERFACE

This is the LINK network interface.

F2	LINK Secondary Channel transmitter	Red Fibre optic output socket. This is connected to the optional secondary channel of the LINK fibre optic network.
F3	LINK Secondary Channel receiver	Black Fibre optic input socket. This is connected to the optional secondary channel of the LINK fibre optic network.
F4	LINK Primary Channel receiver	Black Fibre optic input socket. This is connected to the primary channel of the LINK fibre optic network.
F5	LINK Primary Channel transmitter.	Red Fibre optic output socket. This is connected to the primary channel of the LINK fibre optic network.

Note: Switches are located on the control board, to select the transmit power from the fibre optic transmitters F5 and F2. These are located behind the fibre optic receivers F3 and F4 as shown on the layout drawing HC059669D.

The switches should be set to one of three powers, dependant on the length of fibre optic from the transmitter to the next LINK module.

The switch positions are shown below:-

Switch Position	Power Level	Drive Length
Left	Medium	10 → 25m *
Mid	Low	0.5 → 10m *
Right	High	25 → 50m *

* Drive length specification is subject to change.

5.2 POWER BOARD

These terminals are mounted at the top of the controller, on the rear board.
See installation drawings contained in section 4.

5.2.1 TERMINAL BLOCK D

D1 FE
D2 FE

} External AC input to field bridge.
Controllers with field options 4, 5 and 6 in Product Code Block 4 require an AC input to these terminals. The output voltage at the field output terminals D3 and D4 will depend upon the magnitude of this applied voltage and the connection of the rectifier bridge.

For field options 4 and 5 (field regulator and full wave rectifier bridge).

Required AC Input Voltage
= 1.11 x Rated Field Voltage.

Note: The field regulator will control the field current provided that the input voltage selected gives an output voltage exceeding the field voltage by at least 10%.

For field option 6 (half wave rectifier bridge).

Required AC Input Voltage
= 2.22 x Rated Field Voltage

The external AC supply must be protected with high speed fuses to protect the field regulator or the rectifier bridge. For controllers with 10A field capability 10A fuses should be used, those with 20A field capability 20A fuses.

When using the externally supplied regulated field option it is important to have the correct phase relationship on the input. The field must always be supplied from L1 (Red) and L2 (Yellow) phases directly or indirectly through a transformer. L1 must be connected to D1 and L2 to D2.

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

D3 Field Output -
D4 Field Output +

} Motor Field Connections.
The DC output voltage at these terminals will depend upon the AC supply voltage field rectifier and the configuration.

Output Voltage for Controllers with Field Options 1 and 2 can be calculated from the following formula:-

DC Output Voltage (Full Wave Rectifier and Field Regulator)
= 0.9 x 3 phase power supply line voltage.

Note: For control of the field current to be maintained with the field regulator the field voltage should not be greater than 90% of DC output voltage.

Field Option 3 (half wave rectifier bridge)

DC Output Voltage
= 0.45 x 3 phase power supply line voltage.

Field Option 8

(Internally supplied 3 phase $\frac{1}{2}$ wave rectifier.)

DC Output Voltage
= 0.67 x 3 phase power supply line voltage.

D5 Main Contactor
Coil (L)

} The terminal is the switched output from the contactor control relay and is derived from the auxiliary supply at terminal D8. The output is internally fused at 3A hence contactor coils having a high pick-up current must be operated via a slave relay.

NOTE: The contacts of the Contactor Control Relay are suppressed by a series connected resistor (680 Ohms) and capacitor (22nF) to protect the relay contacts. Users should be aware that when the contactor Control Relay is "De-energised", a leakage current of approximately 2mA can be expected and this should be considered when interfacing to these terminals. Typically, there could be the energization of very sensitive relays.

Terminal Descriptions

D6 Main Contactor Coil (N)	}	This terminal is internally connected to the auxiliary supply neutral and provides a convenient connection point for the contactor coil neutral connection.
D7 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.

5.3 POWER CONNECTIONS AND SUMMARY

Power Connections

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

Control Board

Terminal Block A

Signal Ground	A1
Thermistor Input	A2
Signal Ground	A3
DC Tachogenerator Input	A4
Enable	A5
Buffered Current Output	A6
Program Stop Input	A7
Coast Stop Input	A8
+24v Supply	A9

Microtach Interface, Terminal Block G

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

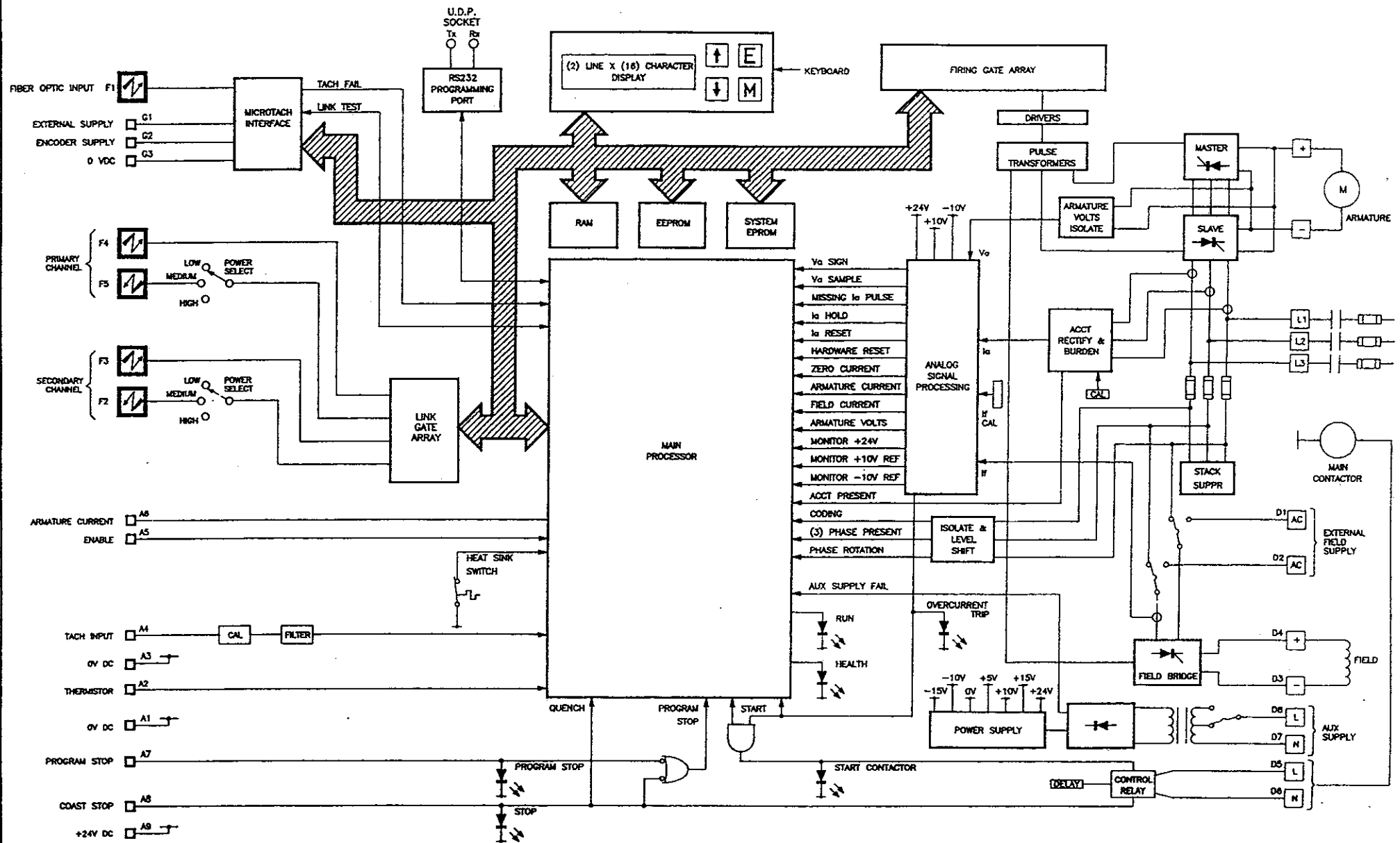
LINK Interface Fibre Optic Connectors

Primary channel Transmit	F5
Primary Channel Receive	F4
Secondary Channel Transmit	F2
Secondary Channel Receive	F3

Power Board

Terminal Block D

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



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DRAWN ANW	CHECKED CJR	DATE	ELECTRICAL SYMBOLS TO BS 3939	TITLE BLOCK DIAGRAM FOR 570L HARDWARE	USED ON 570L
TRACED	DESIGN APP.		SSD LITTLEHAMPTON ENGLAND TELEX 87142		DRAWING NUMBER HH 059668 D
					SHT. 1 OF 1

6 THE LINK INTERFACE

GENERAL

The 570L series drives communicate to the Eurotherm Drives LINK fibre optic network. This allows all variables associated with the operation of the drive, to be sent and received.

Each LINK product, including the drive, is organised by module addresses. These are defined when the drive is configured.

The LINK interface is organised as a list of "slots", where each slot can be considered as a software "terminal". Using these terminals, information can be received by the drive, from other modules on the LINK network.

The LINK system is in general configured to send data to known inputs, where these inputs are defined by the slot number.

6.1 CONFIGURING THE 570L TO SEND PARAMETERS OVER THE LINK NETWORK

All the parameters shown in the slot list, can be sent over the LINK network to other LINK modules. The required parameters to be sent over the network, is set up by configuring the 570L. The slot list is given in section 5 below.

The drive is configured by using the Eurotherm Drives LINK configuration tool, ConfigEd. See ConfigEd manual RG350672.

When the drive is configured, using ConfigEd, the local address is also set up. This allows other modules to identify the drive, within the network.

6.2 LINK NUMBER RANGE AND THE 570L

The number range for the LINK system in general, is ± 1 . This range indicates the maximum and minimum values of any number, within the LINK message data field.

The numbers within the 570L are not restrained to be within the range ± 1 . The slot list below indicates the maximum and minimum values of the various parameters.

When parameters are sent to the 570L, the indicated maximum range should be associated with +1. Similarly, the minimum indicated range should be associated with -1. This assumes that the number range is symmetrical about zero. If the indicated number range is not symmetrical about zero, the highest limit is chosen as ± 1 , and the number is clamped at the other limit.

For example:-

For a number of range 90 to 110% within the 570L.

110% would correspond to a LINK number of +1.

90% therefore corresponds to a LINK value of $90/110 = 0.818$.

NOTE: All LINK values BELOW 0.818 are clamped at 0.818.

This number range must be carefully considered when using the 570L. For example the main speed inputs and outputs have a maximum allowable range of $\pm 120\%$. This allows some overload range, to allow continuous operation of the drive, within a control loop, at 100% speed.

Therefore LINK ± 1 corresponds to 120% speed. And 100% speed corresponds to a LINK number of 0.833.

This fact is also true for numbers configured to be sent from the 570L to other modules.

6.3 THE INTERNAL BLOCK DIAGRAM OF THE 570L SERIES

Diagram HH059668D shows the internal block diagram of the 570L. Typical input slot numbers are shown, and a complete list of the slot numbers is given over.

6.4 SLOT LIST AND DESCRIPTION

This list describes the slots for the 570L. The slot number is used to send a variable to the 570L from another LINK module on the network.

The slot list is organised in sections, which group together similar functions. This grouping can be found when the drive is configured using the configuration editor.

Each slot is described and the range of the variable is given. Logic variables are assigned 0 and 1 status.

The slot list is subject to change due to the Eurotherm Drives policy of continual product improvement.

The slot number column indicates if the parameter is of Read Only status, (R/O). These parameters cannot be written to over the LINK network.

All other parameters can be written to from other LINK modules by providing the 570L address, and appropriate slot number, during configuration of these modules.

All 570L parameters can be sent out to other modules, by configuring the 570L using the configuration editor.

Since there is no reasonable restriction on the number of slots within a LINK product, a large number of parameters within the 570L can be addressed. Some of these parameters are used for setup of the drive, during commissioning. Great care must be exercised to ensure that LINK values are not sent to such setup parameters.

6.4.1 Start/Stop

These parameters control the drive start and stop modes.

Slot	Number	Description	Range
Start	52	Starts the drive. When the drive is started, the main contactor is closed and armature current is allowed to flow. This assumes that there are no drive alarms, and the current loop is enabled.	1 = Start 0 = Stop
Program Stop	1122	Forces a program stop.	1 = Program Stop 0 = Normal run
		Program stop can be activated by two means:- 1) Disconnect hardware terminal A7. 2) Set slot number 1122 to logic 0. When program stop is activated, the drive will ramp down to zero speed and stop. The ramp down time and the current limit are separately definable. The speed threshold at which the drive stops, is also definable. These parameters are described below.	
Program Stop I Limit	2129	Sets the armature current limit during a program stop.	0 - 200.00%
Program Stop Time	2132	Sets the program stop deceleration ramp time.	0.1 to 250 Seconds
Program stop zero speed	2133	Sets the speed feedback threshold at which the drive shuts down, and opens the main contactor.	0 to 10.00%
		NOTE: The above three program stop parameters operate completely independently from the main drive parameters of similar name.	
Composite Program Stop	94 R/O	Allows the status of program stop to be monitored. Operates irrespective of the method of activated triggering program stop.	0 = normal run 1 = Program stop

6.4.2 Feedback

These parameters control the setup and operation of the motor speed feedback.

Slot	Number	Description	Range
Cal Microtach RPM	2150	Sets the full scale speed calibration when the Eurotherm Drives Microtach is used.	0 to 3000RPM
Microtach Sign	109	Sets the speed loop sign when the Eurotherm Drives Microtach is used for speed feedback.	0 = Negative 1 = Positive
Microtach RPM	2074 R/O	Monitors the Microtach speed feedback, directly in RPM.	-3000 to +3000 RPM
Encoder Lines	1129	Sets the number of lines per revolution of the speed feedback encoder. Gives the correct value for slots 2150 and 2074 above.	10 to 5000 lines
Cal Analog Tach	2152	Sets the full scale speed calibration when an analog tachometer is used for speed feedback.	90 to 110.00%
Analog Tach	2101 R/O	Monitors the analog tach speed feedback.	-150 to +150%
Cal Armature Voltage	2151	Sets the full scale armature voltage for armature voltage feedback.	95 to 110.00%
Speed Feedback select	108	Selects the feedback for the speed loop.	0 = Armature voltage 1 = Analog Tach 2 = Microtach
Speed Feedback	2098 R/O	Monitors the speed loop feedback.	-120 to +120%
Speed Feedback Alarm Level	2158	Sets the speed feedback / armature volts difference threshold at which the speed feedback alarm operates.	0 to 100%
		The speed feedback alarm operates by continuously comparing the motor armature voltage, with the speed feedback. Under normal operation, these two values should be approximately the same. If there is a difference between the two values, which is greater than that set on slot 2158, the speed feedback alarm will operate. This will shut down the drive, and indicate on the display that the speed feedback alarm has failed.	
At standstill	22 R/O	Indicates when BOTH slots 69 and 70 are at zero speed.	0 = Running 1 = At standstill

6.4.3 Speed Loop

These parameters control the setup and operation of the drive speed loop.

Slot	Number	Description	Range
Armature voltage	2140 R/O	Monitors the motor armature voltage.	-200 to +200%
		The armature voltage parameter is modified by the IR compensation slot number 2126. This allows correction of the motor terminal voltage, to produce motor back EMF. Motor back EMF is used in preference to motor terminal voltage, to yield greater speed holding accuracy, when used as speed feedback.	
Speed loop P gain	2130	Sets the proportional gain of the speed loop.	0 to 100.00
Speed loop I gain		Sets the integral gain of the speed loop.	0 to 100.00
Speed loop integral defeat	76	Defeats the integral term of the speed loop	0 = Integral enabled 1 = Integral disabled
		The integral term of the drive speed loop is used to provide zero steady state error, between speed feedback and speed demand. In some instances the presence of the integral action can cause instability of the motor speed. Here, integral defeat is used to remove the integral action. When this is done however, the motor will operate at a speed error, determined by the load, and the setting of the proportional gain, slot 2130.	
Speed loop error	2075 R/O	Monitors the difference between the speed loop total demand and the speed feedback.	-120% to +120%
Speed loop output	2102 R/O	Monitors the speed loop output, before clamping by the current limits.	-200% to +200%

Speed loop zero offset	2071	Sets the motor to zero speed.	-5.00% to +5.00%
Speed loop offset is used when analog tach or armature voltage is used as speed feedback. Here, it is possible that small offsets may be present in the speed feedback signals. These offsets may cause the motor to turn slowly, even with zero speed demand. This can be corrected by setting the speed loop offset parameter.			
Total setpoint	2083 R/O	Monitors the total speed loop setpoint. This consists of the sum of the speed demand inputs.	-120% to +120%
Auxiliary current demand	2116 *	Allows additional current demand to be added to the output of the speed loop.	-200.00% to +200.00%

* Applies to issue 6.0 software and above.

6.4.4 External Enables

The external enables are logic parameters which select the main speed and current demands.

Slot	Number	Description	Range
Current demand override enable	4048	When enabled, switches the current demand to current demand override, (slot 2080).	0 = Not enabled 1 = Enables current demand override.
Speed demand override	4053	When enabled, switches the speed demand, to speed demand override, (slot 2097).	0 = Not enabled 1 = Enables speed demand override.
The override selection slots should be used with care. In operation, they switch the respective speed and current demands, from the input setpoints and the speed loop output. This could cause unpredictable behaviour of the motor speed and torque.			

6.4.5 SETPOINT RAMP

This is the main ramp for the control of the drive setpoint.

Slot	Number	Description	Range
Ramp input	2067	Main setpoint ramp setpoint input.	-120.00% to +120.00%
NOTE: The scaling of the ramp input is $\pm 120\%$. Internally to the 570L, all speed setpoints are clamped at $\pm 105\%$.			
Ramp output	2087 R/O	Monitors the output of the main setpoint ramp.	-120% to +120%
The ramp output is typically used in a cascaded line drive system, using LINK drives. Here, the master drive contains the ramp, and the ramp output is used to provide the setpoints for all the other drives in the system.			
Ramp up time	2089	Sets the main setpoint ramp up time in seconds. Modified by the 2-Quad select described above.	0.1 to 250.0 seconds
Ramp down time	2090	Sets the main setpoint ramp down time in seconds. Modified by the 2-Quad select described above.	0.1 to 250.0 seconds
Ramp hold	113	Allows the setpoint ramp to be held.	0 = Ramp enabled 1 = Ramp held
Ramp 2-Quad mode select	86	Selects the mode of the main setpoint ramp.	0 = Normal ramp 1 = 2 Quad mode
Two quadrant operation of the setpoint ramp, allows different ramp rates for motor acceleration and deceleration. Here:- Ramp up time (slot 2089) sets the motor acceleration rate Ramp down time (slot 2090) sets the motor deceleration rate The acceleration and deceleration rates apply to both forward and reverse directions of the motor. When normal mode is selected, the ramp up time parameter selects the positive ramp rate, irrespective of forward or reverse motor direction. Similarly with the ramp down time.			
S-ramps are often used to prevent control problems due to the rapid rate of change of acceleration, associated with the start and end of a linear ramp. The S-Ramp characteristic allows controlled rate of change of acceleration, at the start and end of the ramp period.			

6.4.6 SUMMING

The summing group contains all the signal processing for the two non-ramped drive setpoints.

Slot	Number	Description	Range
Speed setpoint 1	2065	Direct speed setpoint 1.	-120% to +120%
Speed setpoint 2	2066	Direct speed setpoint 2.	-120% to +120%
		NOTE: The scaling of the setpoint inputs is $\pm 120\%$. Internally to the 570L, all speed setpoints are clamped at $\pm 105\%$. Speed inputs 1 and 2 are independently scaled using the ratio parameters. They are also applied to sign changers, and then summed together to form a composite speed demand. This composite speed demand is available as an output, for cascaded line drive systems.	
Setpoint 1 sign	99	Sets the sign of setpoint input 1 (slot 2065)	0 = Negative 1 = Positive
Setpoint 2 sign	100	Sets the sign of setpoint input (slot 2066)	2 0 = Negative 1 = Positive
Setpoint 1 ratio	2095	Sets the scaling of setpoint input 1 (slot 2065)	0.00 to 5.00
Setpoint 2 ratio	2096	Sets the scaling of setpoint input 2 (slot 2066)	0.00 to 5.00
Setpoint sum output	2092 R/O	This is the sum of the scaled, signed inputs 1 and 2.	-120% to 120%
Speed demand override	2097	A single input to the speed loop. This input requires the override enable parameter to be set (slot 4053).	
		When the speed demand override enable parameter is set, the speed setpoint inputs and the ramp input, are disconnected from the speed loop. The speed demand can then be provided by slot 2097. This allows the speed inputs, and ramp, to be used independently from the speed loop.	

6.4.7 CURRENT LOOP

These parameters control the setup and operation of the drive current loop.

The current loop group contains some current demand clamps. These are, main current limit, inverse time and armature current profiles. The clamps operate, together with two independent current clamps, where the lowest value clamp limits the current demand.

Slot	Number	Description	Range
Armature current feedback	2079 R/O	Monitors the motor armature current.	-200% to +200%
Current demand override	2080	A single input to the current loop. This input requires the override enable parameter to be set (slot 4048).	-200.00% to +200.00%
		When the current demand override enable parameter is set, the speed loop is disconnected from the current demand. The current demand can then be provided by slot 2080. Since the speed loop is disconnected, this parameter, must be used with care to avoid runaway of the motor.	
Main current limit	2081	Sets the maximum and minimum excursions of the current demand. The negative clamp value is equal to the positive clamp value, on the current demand.	0.00 to +200.00%
Armature current enable	38	Allows the armature current to be disabled. Will only enable the armature current if hardware terminal A5 is at +24V.	0 = Disable 1 = Enable
Global enable flag	36 R/O	Monitors the state of the armature current enable.	0 = Disable 1 = Enable
		The armature current can be enabled and disabled from slot 38, and also the hardware terminal A5. Slot 36 monitors the state of the actual armature current enable.	
IR comp	2126	Sets up compensation for the motor armature resistance.	-20.00% to +20.00%

	<p>IR comp is used to correct the motor terminal voltage for armature voltage loss due to the armature current. The corrected terminal voltage is the effective motor back EMF. This is proportional to the motor speed, assuming constant field current. IR comp is important when armature voltage feedback is used for speed feedback. If the correction is not set up, the motor speed will drop when load is applied to the motor.</p> <p>IR compensation is also used when motor field weakening is used.</p>		
I max break 1	2135	Armature current profile. Sets the maximum value of the armature current, below speed break 1. This assumes that all other current limits are greater than this parameter.	0 to +200%
I min break 2	2136	Armature current profile. Sets the minimum value of the armature current, above speed break 2.	0 to +200%
Speed break 1	2127	Armature current profile. Sets the motor speed at which armature current profiling begins. This is normally at the field weakening point for the motor. For this speed and below, the armature current is camed below I max break 1.	0 to +100%
Speed break 2	2131	Armature current profile. Sets the motor speed at which armature current profile ends. For this speed and above, the armature current is clamped below I min break 2.	0 to +100%
	<p>The armature current profiles is used to restrict the maximum value of armature current at high speeds. Here, some motors will not commutate the rated armature current at high speeds. This is especially true when in the field weakening range, when the field strength is low. These parameters are normally fixed at commissioning time, when one motor is used on the drive.</p>		
Inverse time	2138	Sets the target current limit, at which the inverse time profiles aims for.	0 to +200%
	<p>The inverse time profiles, is designed to allow the drive to have a limited overload capability. If the armature current is at 200% of the drive calibration for more than 10 seconds, the armature current limit is reduced inversely proportional to time. The final value of the current limit is set by slot 2138.</p> <p>If the armature current is above 110%, of the calibration value, the inverse time profile will operate after a certain period of time, dependant on the value of the overload.</p> <p>NOTE: The inverse time is designed to protect the DRIVE from damage, due to overloads. The inverse time aiming point is normally set at 110%, for safe operation. This parameter must not be altered without prior consultation with Eurotherm Drives.</p>		
Inverse time current limit	2162 R/O	Monitors the inverse time current limit.	0 to 200%
Current loop P gain	2119	Sets the proportional gain of the armature current loop.	1 to 100
Current loop I gain	2120	Sets the integral gain of the armature current loop.	0.1 to 50
Dis / continuous	2122	Current loop internal parameter.	0 to 200%
Feedforward	2121	Current loop internal parameter.	0.1 to 50
	<p>The above four parameters are automatically set up to match the motor, when the current loop is autotuned. They should NOT be modified via the LINK network, when a single motor is used.</p> <p>If multiple motors are used from a single drive, each motor may be autotuned and these parameters noted. When each motor is selected, the appropriate current loop parameters can be set via the LINK network.</p>		
Autotune	101	Starts the current loop autotune function.	0 = Normal run 1 = Start autotune
	<p>NOTE: This parameter must only be used when the drive system is being commissioned, and the current loop set up. It must not be connected via the LINK network under normal run conditions.</p>		
Current loop 2-Quad	75	Sets the current loop for 2 quadrant or 4 quadrant drives. mode Internal parameter for Eurotherm Drives use only. DO NOT connect via the LINK network.	0 = 4 quadrant 1 = 2 quadrant

6.4.8 CURRENT CLAMPS

These parameters clamp the maximum and minimum values of the current demand. This limits the maximum value of the armature current. The clamps are used in conjunction with the main current limit, inverse time and current profiles. The lowest value of any of these clamps, acts on the current demand.

Slot	Number	Description	Range
Positive current clamp	2069	Sets the maximum positive excursion of the current demand.	-200.00% to +200.00%
Negative current clamp	2068	Sets the maximum negative excursion of the current demand.	-200.00% to 200.00%
<p>The current clamps allow independent control of the maximum and minimum values of the current demand. The clamps only operate as clamps if:- The positive clamp has values between 0 and +200%. The negative clamp has values between 0 and -200%. If the positive clamp becomes negative, or the negative clamp becomes positive, this value is applied as a CURRENT DEMAND to the current loop. This could cause unpredictable results of the motor speed.</p>			

6.4.9 STANDSTILL

The standstill logic is designed to shut down the armature current when both speed setpoint and feedback are below a certain threshold value.

Slot	Number	Description	Range
Enable standstill logic	24	Enables the operation of the standstill function.	0 = Normal operation 1 = Standstill enabled
Standstill threshold	2073	This parameter sets the threshold motor speed below which the standstill logic is activated.	0 to 5.00%
<p>The standstill logic can be examined further, see slot 22.</p> <p>The standstill operation is useful under certain conditions, to prevent "creeping" of the motor, when zero setpoint is applied. This is especially true for fully regenerative drives. Note, when standstill is in operation, there will be no braking torque available from the motor shaft.</p>			

6.4.10 FIELD CONTROLLER

This group of parameters controls the operation of the onboard field controller. For full instructions on the use of the field controller, see other chapters in this manual.

Slot	Number	Description	Range
Field current	2128 R/O	Monitors the motor field current. Scaled as a percentage of the field current calibration value, as defined by the field current calibration.	-200% - 200%
Field current setpoint	2141R/O	Monitors the motor field current demand. Scaled as a percentage of the field current calibration value, as defined by the field current calibration.	-200% - 200%
Field Demand	2099	Allows for an external field demand to be applied	Scaled for - 200% to 200%. Clamped at 10% and 100%
Field enable	56	Enables the motor field current. This parameter cannot be disabled when the drive is running.	0 = Disable current 1 = Enable current
<p>NOTE: Running the drive with the field current disabled, means that the motor will have no torque. Also the armature current will rise to a large value.</p> <p>If the field current is disabled, the field fail alarm must be disabled (slot 91), in order to operate the drive. The field current is disabled in order to set up the IR compensation. See elsewhere in this manual.</p>			
Field quench delay	2114	This sets the delay from armature current disable, to field current disable.	0.1 to 250 seconds

	<p>The field quench delay is typically used for dynamic braking of the motor. Here, the drive armature current is disabled, and resistors are placed across the armature. The field current must be maintained in order to allow deceleration torque during the dynamic brake time. The field quench delay is set just longer than the time taken to bring the motor to rest.</p> <p>NOTE: The main AC drive contactor must be closed in order for the field controller to operate.</p>		
Field quench mode	65	Sets the filed mode when the filed current is quenched via slot 56, and the field quench delay has expired.	0 = Full quench 1 = Standby
	<p>When the field is quenched, the field current can be in one of two states. Full quench sets the field current to zero. Standby field sets the field current to 50% of the calibration value.</p> <p>The time taken to establish filed current is normally quite long, due to the large time constant of most motor fields. Standby field is used where a rapid start of the motor is required when the armature current is enabled.</p> <p>NOTE: The main AC drive contactor must be closed in order for the field controller to operate.</p>		
Field control mode	55	Sets the field current control to either full closed loop current control, or open loop voltage control.	0 = Voltage control 1 = Current control
	Voltage control uses the ratio parameter (slot 2115) to set the open loop ratio between the input line to line supply voltage, and the field output voltage.		
Field ratio out/in	2115	Sets the ratio between the desired field voltage and the line to line supply voltage.	0 to 100%
	100% ratio specifies that the field voltage is equal to the line to line supply voltage.		
Field I cal	2154	Trims the calibration of the field current feedback. The nominal calibration is set by fitting the appropriate resistor on the calibration board.	90.00 to 110.00%
Field loop P gain	2106	Sets the proportional gain of the field current loop.	0 to 5.00
Field loop I gain	2105	Sets the integral gain of the field current loop.	0 to 5.00
	These two parameters are not normally connected via the LINK network.		
	See chapter on the field controller, for more detail.		
Field weakener enable	59	Enables the field weakener operation.	0 = Normal field 1 = field weakener.
	Field weakener operation allows the motor field to be reduced, with increasing speed, in order to control the armature voltage at its rated value.		
Field weakening range	2155	Specifies the field weakening speed range of the motor.	0.0:1.0 to 10.0:1.0
Maximum volts	2111	Sets the armature voltage at which field weakening will occur. Scaled as a percentage of the full scale armature voltage calibration.	0 to 100.00%
Minimum field current	2112	Sets the lower limit of field current. The field current will never reduce below this value even if required to do so by the field weakening action.	0 to 100.00%
EMF gain	2110	Sets the proportional gain of the field weakening voltage loop.	0 to 5.00
EMF lag	2109	Sets the integral gain of the field weakening voltage loop.	1 to 100.00
EMF lead	2108	Sets the derivative gain of the field weakening voltage loop.	0.1 to 50.00
	These three parameters are not normally connected to the LINK network.		

6.4.11 ALARMS AND HEALTH

These parameters allow the operational status of the 570L to be monitored. If the drive should fail, the particular alarm, that caused the failure is stored. The 570L will shut down and the health status flag will indicate failure.

Slot	Number	Description	Range
Health flag	29 R/O	This parameter indicates the health status of the drive. It is set to 1 when the start (slot 52) is set.	0 = Unhealthy 1 = Healthy
Unlatched health flag	40 * R/O	This is the same as slot 29, but the parameter is set when start (slot 52) is set to logic 0.	0 = Unhealthy 1 = Healthy
Slot 40 should be used in preference to slot 29, in situations where the health flag may prevent the drive from restarting.			
Health store	1121 R/O	Stores the first fault alarm as a number from 1 to 16. See following table for alarms.	1 to 16
Health store bitmap	1058 R/O	Stores the first fault alarm as a bitmap. See following table for bitmap bit positions.	Bitmap
Health word bitmap	1120 R/O	Current drive alarm status as a bitmap.	Bitmap
The health word indicates the current alarms present. When the drive is stopped, for example, more than one alarm will be present. These are all shown on the health word.			
The health store parameters only indicate one alarm, when a fault condition has taken place.			
	Alarm	Health store number	Health bitmap bit number (HEX)
	Speed feedback	1	1
	Missing pulse	2	2
	Overspeed	3	4
	Stack	4	8
	Motor temperature	5	10
	Field overcurrent	6	20
	Not used	7	40
	Microtach fail	8	80
	Field fail	9	100
	3 phase failed	10	200
	Firing synch fail	11	400
	VA overvolts	12	800
	LINK network fail	13	1000
	Overcurrent trip	14	2000
	Cal board missing	15	4000
	ACCT's not fitted	16	8000
Further details of these alarms can be found elsewhere in this manual.			
Ready flag	43 R/O	Indicates when the 570L is ready to pass armature current.	0 = Not ready 1 = Ready
When the drive is started, the main supply contactor closes. A short period of time elapses to allow the drive to synchronise to the supply. When the drive has synchronised, armature current is allowed to flow. At this point, the ready parameter is activated. The ready parameter is typically used to control mechanical brakes. Here, the brake is required to release, when armature current is about to flow.			
LINK fail stop select	115*	Specifies the drive condition if the LINK network fails.	0 = Ignore failure 1 = Regen stop 2 = Coast stop
If the LINK network should ever fail, it is possible for the drive to continue to run, with no means of stopping. It is possible to specify that the drive will stop automatically on LINK failure. NOTE: If the LINK should ever fail, it is still possible to stop the 570L via the hardware terminals, program stop (A7) and coast stop(A8). See terminal description.			
Field fail alarm enable	91	Allows the field fail alarm to be disabled. This must be done if the drive must be run without any field current.	0 = Disable alarm 1 = Enable alarm
Speed feedback alarm enable	95	Allows the speed feedback alarm to the disabled.	0 = Disable alarm 1 = Enable alarm
The speed feedback alarm compares the speed feedback with the armature voltage. If a difference occurs, which is greater than the speed feedback alarm level (slot 2158), the alarm is triggered.			

* Available on issue 6.0 software and above.

6.4.12 PARAMETERS

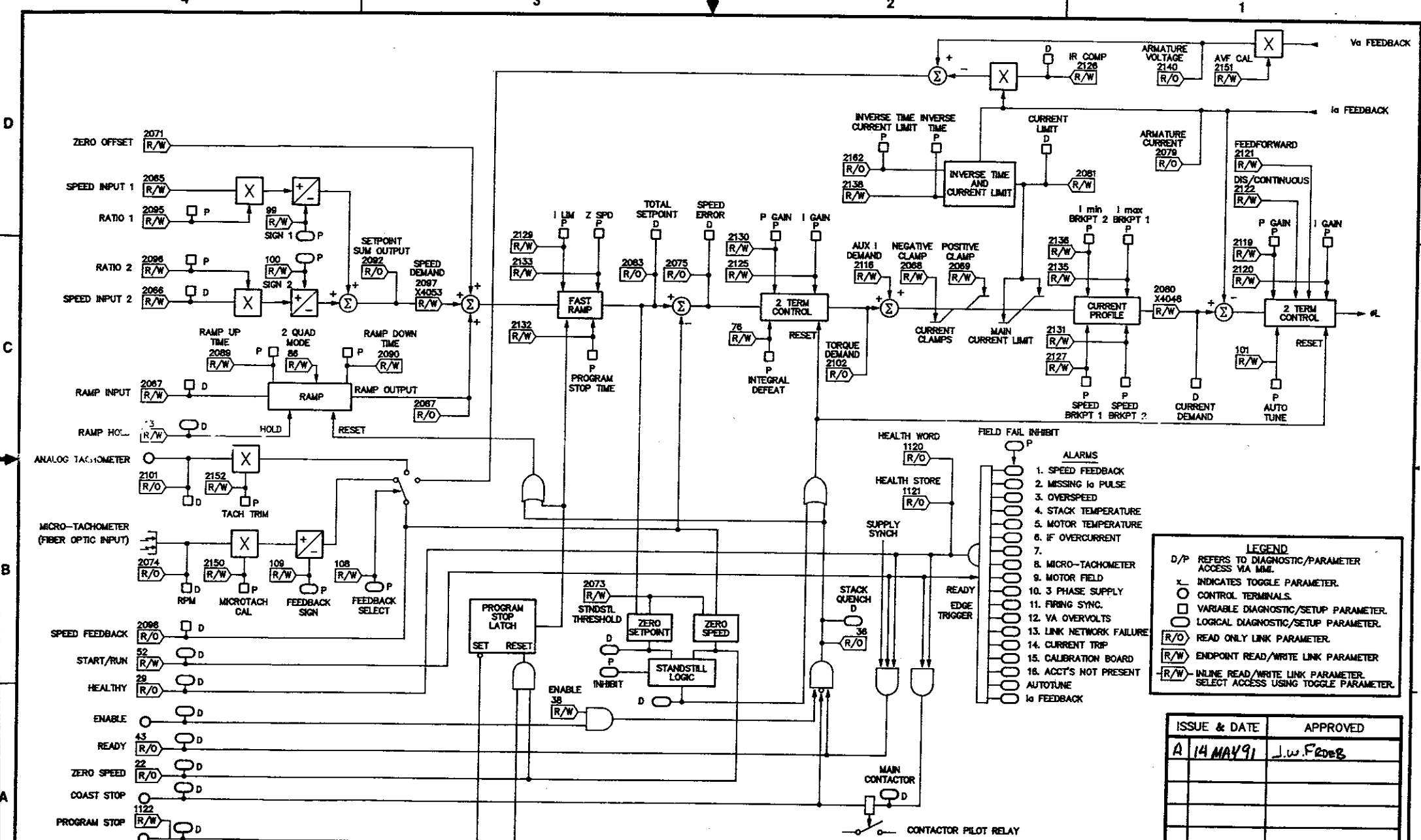
These are general data parameters.

Slot	Number	Description	Range
EEPROM save	30	Saves the setup parameters.	0 = Normal 1 = Save parameters 2 = Most recent SAVE operation has failed.
		<p>The setup parameters on the 570L are stored in non-volatile memory. When all adjustments have been made, the setup parameters must be stored into this memory. If this is not done, the adjustments will be lost, when the drive auxiliary supply is removed.</p> <p>NOTE: The setup parameters can be saved at any time. Slot 30 should be set to save. The parameter is cleared automatically, when saving is complete. Do not clear manually, or a partial parameter save will result.</p>	
Network type	16 * R/O	Monitors the type of network, to which the 570L is connected.	2 = Simple 3 = Tap 7 = Redundant 11 = Aux tap

* Available on issue 6.0 software and above.

6.4.13 PEEK

Peek address	1135	Eurotherm Drives use only.	---
Peek value	1136	Eurotherm Drives use only.	---



LEGEND

D/P REFERS TO DIAGNOSTIC/PARAMETER ACCESS VIA MMI.

X INDICATES TOGGLE PARAMETER.

○ CONTROL TERMINALS.

□ VARIABLE DIAGNOSTIC/SETUP PARAMETER.

◇ LOGICAL DIAGNOSTIC/SETUP PARAMETER.

R/O READ ONLY LINK PARAMETER.

R/W ENDPOINT READ/WRITE LINK PARAMETER.

-R/W INLINE READ/WRITE LINK PARAMETER. SELECT ACCESS USING TOGGLE PARAMETER.

ISSUE & DATE	APPROVED
A 14 MAY 91	J.W. FODOR

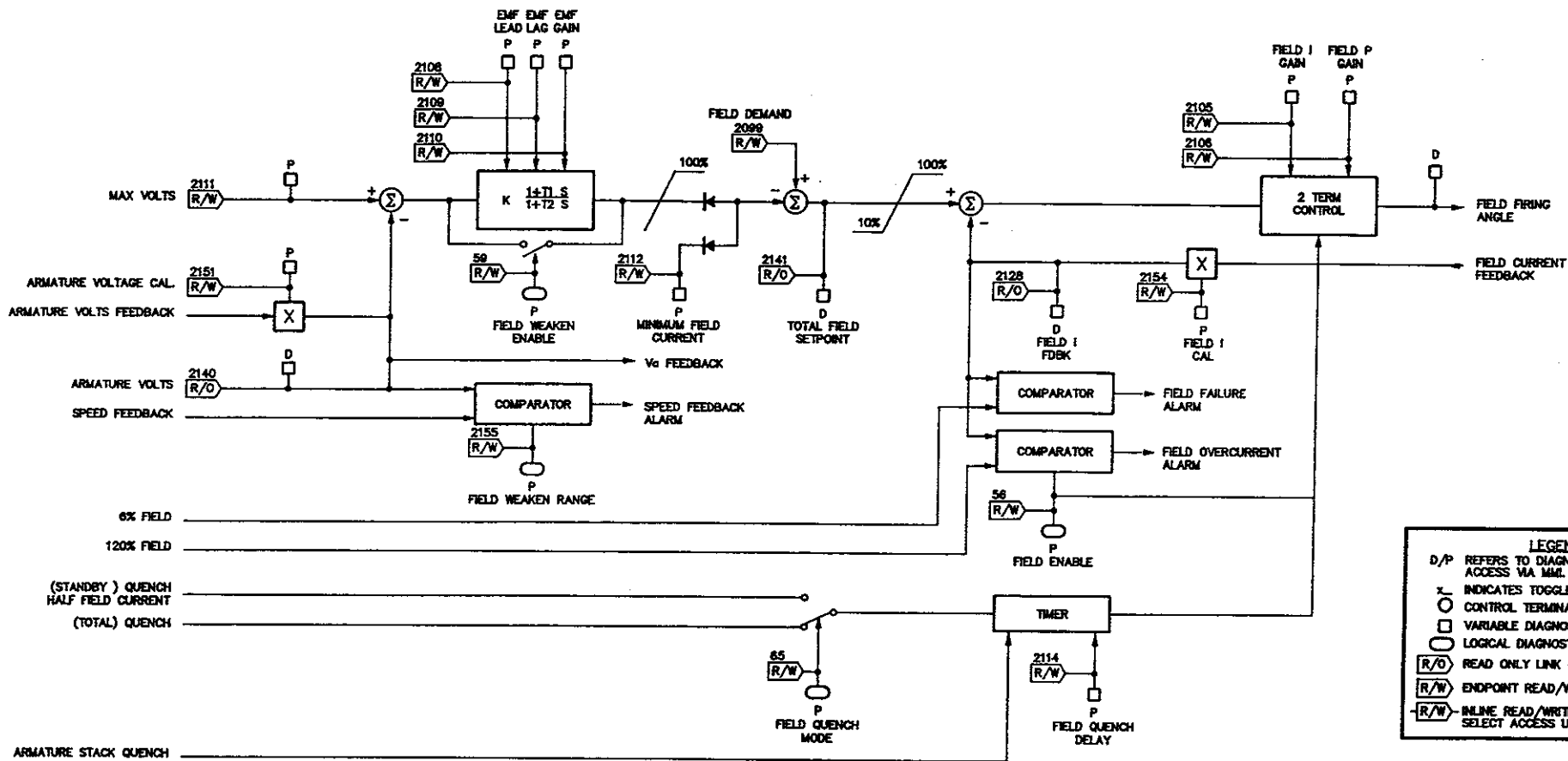
7 FIELD CONTROLLER

GENERAL INFORMATION

The 570L is supplied with a controlled-field which uses a single-phase half-controlled thyristor bridge. This gives simple and robust control of the motor's field current or voltage. The rating of the field bridge varies according to the rating of the main armature current bridge.

The motor armature voltage and field current must always be set up using calibration resistors on the plug in calibration board.

The field controller may be set up via the MMI or via the Eurotherm Drives LINK network setup tool SAM. Refer to the chapter on the MMI or the SAM manual for further information.



LEGEND

- D/P REFERS TO DIAGNOSTIC/PARAMETER ACCESS VIA MM.
- X INDICATES TOGGLE PARAMETER.
- CONTROL TERMINALS.
- VARIABLE DIAGNOSTIC/SETUP PARAMETER.
- LOGICAL DIAGNOSTIC/SETUP PARAMETER.
- R/W READ ONLY LINK PARAMETER.
- R/W ENDPOINT READ/WRITE LINK PARAMETER.
- R/W IN-LINE READ/WRITE LINK PARAMETER. SELECT ACCESS USING TOGGLE PARAMETER.

ISSUE & DATE	APPROVED
A 15 APR 91	M. SOBEL
B 18 APR 91	M. SOBEL
C 14 MAY 91	J.W. Probst



DWN H. PRUNER 19 MAR 91
CHK M. SOBEL 15 APR 91
APP

FIELD CONFIGURATION BLOCK DIAGRAM

SIZE B DWG. NO. HH351079B
ISSUE A/B/C
SCALE - SHEET 1 OF 1

7.1 FIELD VOLTAGE CONTROL

The 570L is supplied, by default, with the controlled field bridge set for voltage control. This allows the controlled field to emulate a fixed diode bridge.

The output voltage is set by the RATIO OUT/IN parameter. This sets the ratio of the input supply voltage, to the output DC voltage. The default value of this ratio is 60%. The ratio should be set to 90%, to emulate a single phase field rectifier.

The calibration resistors, for motor current, must be correctly fitted, even if the voltage control mode is selected.

7.2 FIELD CURRENT CONTROL AND FIELD WEAKENING

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

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

When the field controller is in field weakening mode, the armature voltage loop keeps the armature voltage at its rated value, by controlling the field current. This occurs above the specified field weakening speed for the motor.

7.2.1 Field Current Control

Field current regulation is used to give constant field current in the motor field. This mode of operation must be set by changing the FIELD CURRENT mode from VOLTAGE CONTROL to CURRENT CONTROL. The field current will now control at a value set by the calibration resistors.

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

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

Note, the motor armature voltage resistors must always be set up to the rated motor terminal voltage.

7.2.2 Field Weakening

This allows weakening of the motor field, to allow high speed operation of certain motors.

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

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

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

Field current ceases altogether when the main contactor is dropped out by a stop or by an alarm. Even when the field bridge is supplied externally, current will cease because firing pulses to the bridge are disabled.

8 MAN MACHINE INTERFACE (MMI)

8.1 THE L. C. DISPLAY

Featured on all 570L 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.

8.2 THE FUNCTION KEYS

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

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

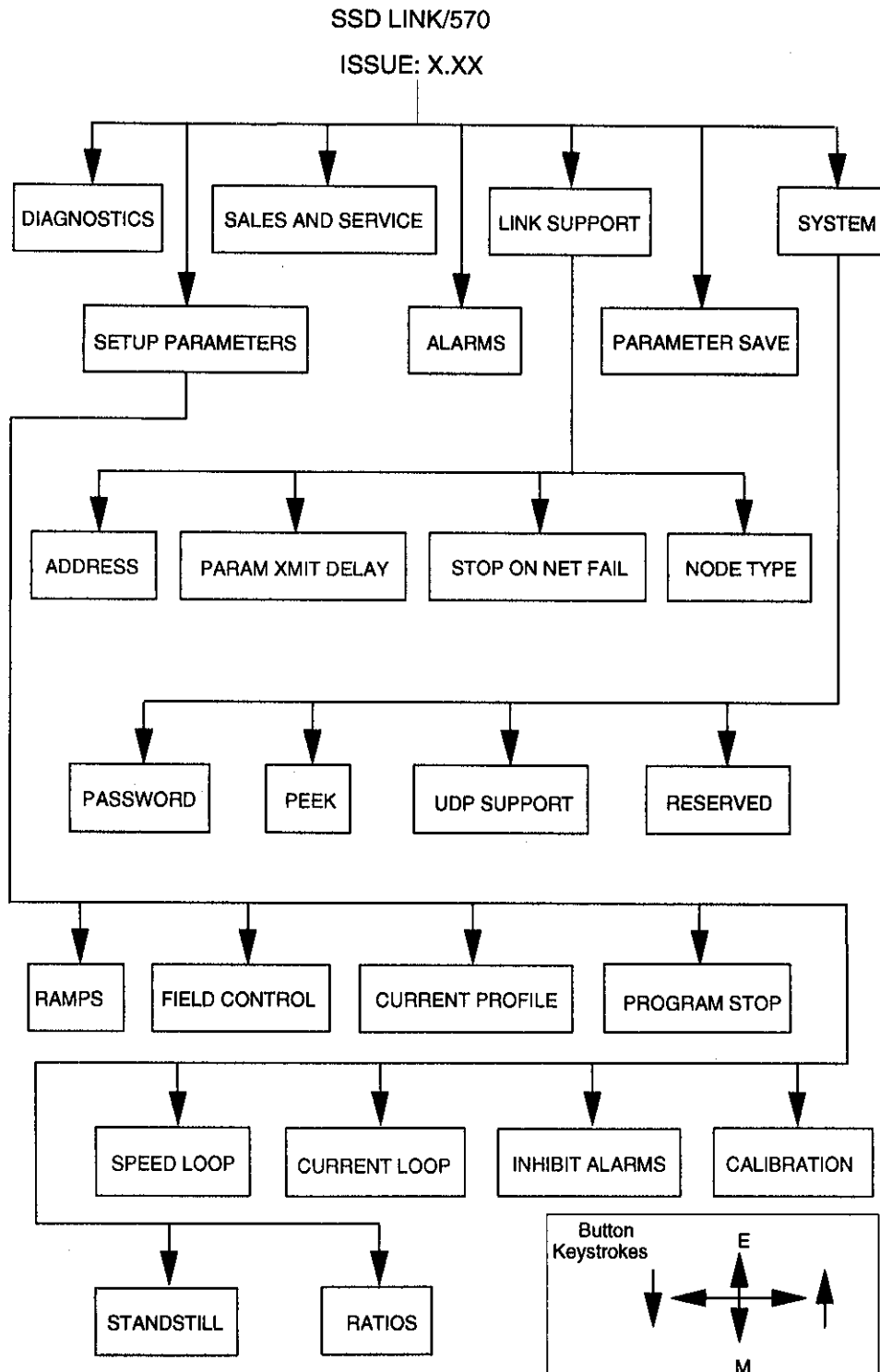
- | | |
|-----------------|--|
| (M) MENU SELECT | This allows entry to the menu or function offered in the second line of the display. Use of this key will not alter any of the stored parameters. It will toggle the displayed variable between bar graph presentation for trending and numeric value for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

8.3 THE MENU TREE STRUCTURE OF THE 570L

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

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

To progress from the Power-up default display Eurotherm Drives 570L 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.



8.4 PRIMARY DIAGNOSTICS

8.4.1 General

The primary controller diagnostics are specific monitoring points that allow the user to check that the drive is operating correctly within the LINK network. For example it is possible to check that the drive setpoints are being sent over the network.

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 INPUT 1"  
"+76.0 %" (for example)
```

The top line now contains information about the monitoring point name.

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

1. Numerical values.
2. Bar graph.

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

The following table shows the diagnostic points available on the 570L. The appropriate LINK slot number, is shown where applicable. The description for each slot number parameter is given in the LINK interface chapter, within this manual.

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

8.4.2 Diagnostic Description

DIAGNOSTIC POINT	LINK SLOT	DESCRIPTION	REF	SCALING
SPEED INPUT 1	2065	SPEED SETPOINT No. 1		± 10V
SPEED INPUT 2	2066	SPEED SETPOINT No. 2		± 10V
RAMP SETPOINT	2067	RAMPED SPEED SETPOINT		± 10V
TACH INPUT	2101	SCALED ANALOGUE TACHOGENERATOR FEEDBACK		±100%
MICROTACH	2074	MICROTACH SPEED FEEDBACK (DIRECT READING OF MOTOR SPEED ASSUMING STANDARD MICROTACH SCALING 1000PPR)		± 3000RPM
ARMATURE VOLTS	2140	SCALED ARMATURE VOLTS		± 100%
SPEED FEEDBACK	2098	SPEED LOOP FEEDBACK		± 100%
SPEED SETPOINT	2083	SPEED LOOP TOTAL SETPOINT		± 100%
SPEED ERROR	2075	SPEED LOOP ERROR		± 100%
CURRENT FEEDBACK	2079	SCALED ARMATURE CURRENT		± 200%
CURRENT DEMAND	2080	CURRENT LOOP CURRENT DEMAND(SPEED ERROR PI OUTPUT OR EXTERNAL CURRENT DEMAND CLAMPED BY ALL LIMITS)		± 200%
CURRENT LIMIT	2081	MAIN CURRENT LIMIT IS DETERMINED BY THE PRODUCT OF EXTERNAL CURRENT LIMIT (OR CURRENT VARIABLE) AND CURRENT LIMIT PARAMETER		±200%
AT ZERO SPEED	22	AT ZERO SPEED FEEDBACK		ON/OFF
AT ZERO SETPOINT	--	AT ZERO SPEED SETPOINT		ON/OFF
AT STANDSTILL	--	AT STANDSTILL, i.e. AT ZERO SPEED AND ZERO SPEED SETPOINT		ON/OFF
PROGRAM STOP I/P	Terminal A7	PROGRAM STOP INPUT WHEN OFF PROGRAM STOP SEQUENCE IS ENABLED		ON/OFF
START	52	START/RUN INPUT		ON/OFF
MAIN CONTACTOR	--	MAIN CONTACTOR STATUS		ON/OFF
STACK QUENCH	36	STATUS OF STACK QUENCH CONTROL		ON/OFF
DRIVE READY	43	DRIVE READY TO RUN		ON/OFF
DRIVE HEALTHY	29	DRIVE HEALTHY OR DRIVE OPERATIONAL		ON/OFF
RAMP HOLD ENABLE	113	SETPOINT RAMP ENABLE		
+ CURRENT CLAMP	2069	POSITIVE CURRENT CLAMP		0 to +200%
- CURRENT CLAMP	2068	NEGATIVE CURRENT CLAMP		0 to - 200%
FIELD IFBK	2128	SCALED FIELD CURRENT FEEDBACK		0 to 100%
TOTAL FIELD SETPOINT	2141	SETPOINT FOR FIELD CURRENT LOOP		0 to 100%
FLD FIRING ANGLE	--	CURRENT VALUE OF FIELD FIRING ANGLE		0 to 180°

8.5 PRIMARY SETUP PARAMETERS

8.5.1 General

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.

These setup parameters are accessible over the LINK network. This allows the setup of the drive to be changed to suit different operating conditions. Care should be taken when connecting LINK variables to these parameters. If connections are incorrectly made, unpredictable results, or damage could occur to the controller.

All setup parameters are accessible over the LINK network, via the setup and monitor program, SAM. This allows the drive to be completely commissioned over the LINK network.

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

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

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

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

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

```
MENU LEVEL
SETUP PARAMETERS
```

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

```
SETUP PARAMETERS
"RAMPS"
```

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

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

```
"RAMPS"
"RAMP UP TIME"
```

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

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

```
"RAMP UP TIME"
" X SECS"
```

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

LINK slot numbers are show for each setup parameter, where applicable.

8.5.2 Set-Up Parameter Description

PARAMETER NAME	SLOT	DESCRIPTION	RANGE	DEFAULT	REF.
<u>RAMPS</u>					
RAMP UP TIME	2089	Rate of change of increasing speed setpoint (see 2 quad mode).	0.1-250.0	1.0 seconds	
RAMP DOWN TIME	2090	Rate of change of decreasing speed setpoint (see 2 quad mode).	0.1-250.0	1.0 seconds	
2 QUAD MODE	86	In a reversing drive system with analogue ramps, ramp up time becomes ramp down time with reverse rotation. Because the ramps are implemented in software in the 570L this problem can be overcome. 2 Quad mode gives Consistent operation of the ramp settings in forward or reverse when enabled by this parameter.	ENABLED/ DISABLED	DISABLED	
S RAMP %		When 'S' Ramp mode is enabled this adjusts the amount of the intended change over which the 'S' ramp controls the transition.	0.1-50.0%	12.5%	
RAMP MODE		The ramp generator operates either as a simple linear ramp or as a complex 'S' ramp. The 'S' ramp controls the initial rate of change to give a smooth change from fixed setpoint to ramped setpoint, similarly it Controls the change from ramped setpoint to fixed setpoint.		LINEAR	
<u>FIELD VARIABLES</u>					
FIELD CONTROL MODE	55	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 CONTROL	VOLTAGE CURRENT	
<u>FIELD CURRENT VARIABLES</u>					
FIELD ENABLE	56	Allows the on board field controller to be disabled.		ENABLED	
FIELD I GAIN	2105	When the field regulator is controlling the field current a PI loop is in operation. This is the integral gain adjustment of the PI loop	0.00-5.00	0.01	
FIELD P GAIN	2106	This is the proportional gain adjustment of the field PI loop.	0.00-5.00	0.10	
FLD. WEAK ENABLE	59	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	

PARAMETER NAME	SLOT	DESCRIPTION	RANGE	DEFAULT	REF
		<u>Field Current Variables/Continued</u>			
EMF LEAD	2108	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	
EMFLAG	2109	This is the integral adjustment of the field weakening PID loop.	1.00-100.00	40.00	
EMF GAIN	2110	This is the gain adjustment of the field weakening PID loop.	0.00-5.00	0.30	
MAX. VOLTS	2111	Maximum volts is the level at which field weakening begins. The level is set relative to the 100% calibration value set by the calibration resistors and armature voltage calibration.	0.00-100.00%	100.00%	
MIN FLD CURRENT	2112	The field weakening loop reduces the field current to achieve speed control. At top speed the field reaches a minimum value. This limit is a fixed minimum value to set the absolute lower field limit.	0.00-100.00%	10.00%	
FIELD QUENCH DELAY	2114	If dynamic breaking is used the field must be maintained for a period after the drive is disabled. The field quench delay is the period of time the field is maintained.	0.1-250.0	5.0 seconds	
FIELD QUENCH MODE	65	After the field quench delay the field can be entirely quenched or put into a standby mode at minimum field level.	QUENCH/ STANDBY	Quench	
		<u>FIELD VOLTAGE VARIABLES</u>			
RATIO OUT/IN	2115	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. Should be set to 90% to emulate a single phase rectifier.	0-100%	90%	
FIELD ENABLE	56	Allows the on board field controller to be disabled.	ENABLED/ DISABLED	ENABLED	
		<u>CURRENT PROFILE</u>			
SPEED BREAK 1	2127	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%	
SPEED BREAK 2	2131	Speed break 2 is the upper speed limit at which current profiling ends.	0-100%	100%	
I. MIN BREAK 2	2136	This sets the current limit value at or above speed break point 2.	0-200%	200%	
I. MAX BREAK 1	2135	This sets the current limit value at or below speed break point 1, provided other limits are greater than its setting.	0 -200%	200%	
		<u>PROGRAM STOP</u>			
PROG. STOP TIME	2132	Time to reach zero speed from 100% set speed.	0-250 seconds	1 second	
PROG. STOP I LIM	2129	Current limit level in program stop mode provided other limits are set higher.	0-200%	50%	
PROG. STOP Z SPEED	2133	Zero speed level in program stop mode at which contactor is de-energised and the drive quenched.	0.00-10.00%	1.00%	

PARAMETER NAME	SLOT	DESCRIPTION	RANGE	DEFAULT	REF
<u>CALIBRATION</u>					
ARMATURE V CAL	2151	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.	90.00-110.00%	100.00%	
IR COMPENSATION	2126	Compensation for motor IR drop to improve regulation when using armature voltage feedback for speed control.	± 20.00%	0.00%	
MICROTACH RPM	2074	Motor top speed setting when using the 5701 microtach unit for speed feedback.	0-3000 RPM	1000 RPM	
ANALOG TACH CAL	2152	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.	90.00-110.00%	100.00%	
ENCODER LINES	1129	Sets the number of encoder lines per revolution, on the speed lines feedback encoder. Note, it is possible to use a standard encoder as speed feedback, via the Eurotherm Drives 5702 range of converter products	10 to 5000	1000	
SPDFBK ALARM LEVEL	2158	The speed feedback alarm compares speed feedback to armature voltage. The alarm level is the difference at which the alarm is set.	0-100%	50%	
FIELD I. CAL	2154	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.	90.00-110.00%	100.00%	
FLD. WEAK RANGE	2155	During field weakening the armature voltage and motor speed are not related. By setting in the field weakening speed range a compensation can be carried out to maintain functionality of the speed feedback alarm.	0.0:1.0-10.0:1.0	1.0:1.0	
<u>INHIBIT ALARMS</u>					
FIELD FAIL	91	Override for minimum field current level alarm.	ENABLED/ OVERRIDDEN	ENABLED	
SPEED FBK ALARM	95	Override for speed feedback alarm.	ENABLED/ OVERRIDDEN	ENABLED	
<u>CURRENT LOOP</u>					
CURRENT LIMIT	2081	Internal main current limit parameter. All limits operate on basis of lowest level controls.	0.00-200.00%	100.00%	
CURRENT P GAIN	2119	Proportional gain control for armature current PI loop.	1.00-100.00	1.28	
CURRENT I GAIN	2120	Integral gain control for armature current PI loop.	0.10-50.00%	1.28	
AUTOTUNE	101	Initiating control for current loop autotune adjustment. (See description at the end of table)	---	---	
- CURRENT CLAMP	2068	Sets the negative limit of the current demand.	± 200.00%	-100%	
+CURRENT CLAMP	2069	Sets the positive limit of the current demand.	± 200.00%	100%	
2 QUAD MODE		This parameter informs the control board that it is operating a 2 quad thyristor bridge option, i.e. non-reversing.	ENABLED/ DISABLED	DISABLED	

PARAMETER NAME	SLOT	DESCRIPTION	RANGE	DEFAULT	REF.
<u>SPEED LOOP</u>					
SPEED INT. GAIN	2125	Speed loop PI integral gain adjustment.	0.00-200.00	10.00	
SPEED PROP. GAIN	2130	Speed loop PI proportional gain adjustment.	0.10-100.00	15.00	
ZERO OFFSET	2071	Zero motor speed for zero setpoint input trim adjustment.	± 5.00%	0.00%	
SPEED INT. DEFEAT	76	Inhibits the integral part of the speed loop PI control to give proportional gain only speed control.	ON/OFF	OFF	
MICROTACH SIGN	109	Since the microtach feedback cannot be reversed electrically, the signal polarity must be reversed by the control software.	POS/NEG	POSITIVE	
SPEED FBK SELECT	108	Three options are available:- i) Armature voltage feedback ii) Analogue tachogenerator feedback iii) Microtach feedback. Note:- It is difficult on some versions of the software to select analogue tacho.		ARM VOLTS FBK	
<u>STANDSTILL</u>					
STANDSTILL LOGIC	24	Standstill Logic quenches drive below zero threshold.		DISABLED	
ZERO THRESHOLD	2073	Speed Level at which standstill logic is operative. Also sets the level at which zero speed (slot 22) operates.	0.00-5.00%	2.0%	
<u>RATIOS</u>					
RATIO 1	2095	Speed Input 1 Scaling	0.00-5.00	1.00	
RATIO 2	2096	Speed Input 2 Scaling	0.00-5.00	1.00	
SIGN 1	99	Speed Input 1 Polarity	POS-NEG	POSITIVE	
SIGN 2	100	Speed Input 2 Polarity	POS-NEG	POSITIVE	

8.6 ALARMS

8.6.1 General

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

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

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 healthy flags, slots 29 and 40 are set to logic 0.

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 LINK network. These are slots 1058, 1121 and 1120.

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.

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

MENU LEVEL
ALARMS

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

ALARMS
ALARM TITLE

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

ALARM TITLE
STATUS Where STATUS = OK or FAIL.

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

The controller alarms are presented below, as they appear on the LC display:-

REF	ALARM TITLE	STATUS	INHIBIT
1.	MOTOR FIELD	OK/FAILED	YES
2.	MOTOR TEMP	OK/FAILED	-
3.	CURRENT TRIP	OK/FAILED	-
4.	MISSING IA PULSE	OK/FAILED	-
5.	IA FEEDBACK	OK/FAILED	-
6.	3 PHASE SUPPLY FAILED	OK/FAILED	-
7.	PHASE LOCK	OK/FAILED	-
8.	MICROTACH ALARM	OK/FAILED	-
9.	SPEED FBK ALARM	OK/FAILED	YES
10.	STACK TEMP	OK/FAILED	-
11.	CAL BOARD FITTED	OK/FAILED	-
12.	LINK NETWORK	OK/FAILED	-
13.	AUTOTUNE ALARM	OK/FAILED	-
14.	IF OVERCURRENT	OK/FAILED	-
15.	VA OVERVOLTS	OK/FAILED	-
16.	OVERSPEED	OK/FAILED	-

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

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

8.6.2 Motor Field Alarm

If the 570L 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 570L 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.

8.6.3 Motor Temp Alarm

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

Motor overtemperature sensors should be connected in series between terminals A1 and A2. 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 570L. This rating is for a 100% current demand.

There is no motor temperature alarm inhibit: terminals A1 and A2 must be linked if overtemperature sensors are not used.

8.6.4 Current Trip Alarm

A hardware current trip is provided on the 570L 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 570L 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.

8.6.5 Missing IA Pulse Alarm

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

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

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

8.6.6 IA (Armature Current) Feedback Alarm

The motor armature current is monitored by the 570L 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.

8.6.7 Three Phase Supply Alarm

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

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

In the case of a 3 phase supply 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. 570L Series controllers are available with three supply voltage options:-

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

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

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

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

8.6.8 Phase Lock

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

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

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

8.6.9 Microtach Alarm

The 570L is designed to accept speed feedback signals from the Eurotherm Drives Microtach. This is a custom digital tachometer which communicates to the 570L 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 570L should be checked for damage. The bend radius of the fibre optic cable must not be exceeded or this may cause failure.

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

8.6.10 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.

8.6.11 Stack Temp Alarm

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

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

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

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

8.6.12 Cal Board Fitted Alarm

Calibration resistors are necessary for:-

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

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

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

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

8.6.13 LINK Network Failed

This alarm monitors the LINK network interface on the 570L. If the LINK network, transmitting to the drive fails, the alarm will operate. Similarly, if the LINK interface within the drive fails, the alarm operates.

8.6.14 Autotune Alarm

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

8.6.15 IF (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.

8.6.16 VA (Armature) 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.

8.6.17 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.

8.7 PARAMETER SAVE

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

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

1. Page through the MMI main menus using the up or down arrows to "Parameter Save".
2. Enter "Parameter Save" sub menu using "M" key to "Data Write".
3. Proceed to the final level where the Message "Save?" is displayed. Initiate the save function using the up arrow when the display will show "Saving".
4. When the save has been completed, the message "Save?" will appear.
5. Exit from Save activity by the "E" key.

Once the Parameter Save has been initiated, the drive can be used normally. It is not necessary to wait until the save has been completed.

The "Parameter Save" operation can be performed as many times as is required to ensure safe and satisfactory data storage.

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

8.8 SYSTEM PARAMETERS

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

SYSTEM
PASSWORD

The "RAISE" and "LOWER" keys may be used to select from four submenus: PASSWORD, PEEK, UDP SUPPORT and RESERVED.

8.8.1 Password

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

PASSWORD
ENTER PASSWORD

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

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

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

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

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

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

8.8.2 PEEK

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

8.8.3 UDP Support and Storing the Setup Parameters

The UDP SUPPORT menu may be selected by pressing "M". The display will read:-

UDP SUPPORT
DISABLED

The UDP function is used to allow all the setup parameters within the 570L, to be stored outside the drive, on an IBM compatible computer. This allows the setup parameters to be re-loaded into the 570L. This is important in the case of any failure of the drive.

Software supplied by Eurotherm Drives must be used to allow parameter save on an IBM computer.

The setup information is uploaded using the RS232 port on board the 570L. Connection to the computer is implemented using a lead, from the RS232 sockets on the computer and 570L.

Before setup parameters can be stored, the 570L serial link must be enabled. This is done by pressing "M" when displaying "UDP SUPPORT". Pressing the up arrow changes the displayed message from "DISABLED" to "ENABLED".

The parameters can now be uploaded to the computer.

Pressing "E", when the upload is complete, resets the 570L. Here the drive now uses the new uploaded setup parameters.

Refer to the appropriate Eurotherm Drives UDP software manual for further information.

Note, all setup can be stored in a backup file, by using LINK configuration tools ConfigEd and SAM. Here, setup parameters are extracted from the 570L, via the LINK network. This is the preferable method of parameter storage, when considering LINK systems.

8.8.4 Reserved

This menu is for Eurotherm Drives use only. There are no user adjustments available within this menu.

8.9 LINK SUPPORT

This menu allows parameters, associated with the LINK interface, to be adjusted.

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

LINK SUPPORT
ADDRESS

The "RAISE" and "LOWER" keys may be used to select from four submenus: ADDRESS, PARAM XMIT DELAY, STOP ON NET FAIL * and NODE TYPE *.

* Issue 6.0 software and above.

Note, always perform a parameter save when any adjustments are made to setup parameters.

8.9.1 Checking the 570L LINK Address

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

ADDRESS
LOCAL ADRS XXXX

Here, XXXX is the 570L LINK node address.

This address must be set up via the Eurotherm Drives LINK programming tool, ConfigEd. It is not possible to change this address using the MMI.

8.9.2 Parameter Transmit Delay

The PARAM XMIT DELAY menu may be selected by pressing "M". The display will read:-

PARAM XMIT DELAY
"RATE"

When the 570L is part of a LINK system, the drive sends out configured parameters at a regular rate, over the LINK network. This parameter allows this rate to be set.

The approximate transmit rates are given below:-

SLOW -
MEDIUM -
FAST -

These transmit rates are selected by using the raise/lower keys.

The default setting of this parameter, is SLOW. This should not be changed, unless advised by Eurotherm Drives.

8.9.3 Stop on Net Fail

The STOP ON NET FAIL menu may be selected by pressing "M". The display will read:-

STOP ON NET FAIL
"TYPE OF STOP"

In case of failure of the LINK network, the 570L can be programmed to perform one of the following actions:-

Do nothing - NONE
Regenerative stop - REGEN
Coast stop - COAST STOP

The action on LINK network fail is selected by using the raise/lower keys.

If the LINK network fails, the LINK network alarm will appear on the display. This is described above.

9 FRONT PANEL LED INDICATORS

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

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

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

HEALTH
RUN

The remaining four LEDs are driven directly by hardware:-

OVERCURRENT TRIP
START CONTACTOR
PROGRAM STOP
STOP

9.1 HEALTH

On: Drive Normal Condition Off: Drive Fault Condition.

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

- a) Field Failure.
- b) 3 phase supply.
- c) Overcurrent trip(300%).
- d) Motor over-temperature (thermistor/microtherm).
- e) Drive over-temperature (drive heatsink).
- f) Phase locked loop synch (45-65Hz).
- g) Missing current pulse.
- h) Armature current feedback.
- i) Calibration board installed.
- j) Tach fail/speed feedback fault.
- k) Microtach fail (fibre optic feedback).
- l) LINK network alarm.

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

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

9.2 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.

9.3 START CONTACTOR

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

9.4 PROGRAM STOP

- On: Program stop mode not employed. Indicates that +24 volts is applied to terminal A7.
- Off: The program stop line is open and the program stop is carried out until main contactor drop out occurs.

9.5 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.

9.6 STOP

- On: Coast Stop not active. Indicates that +24 volts is applied to terminal A8.
- Off: Coast Stop active. In this condition, the power supply has been removed from the main contactor control relay.

10 BASIC SETTING UP AND OPERATING INSTRUCTIONS

This section covers the commissioning of the 570L drive.

10.1 CHECKS BEFORE CONNECTING 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.
4. Prevent the Main 3-phase power supply and single phase auxiliary supply from becoming connected to the drive by removing the main external semiconductor fuses.

10.2 BASIC CALIBRATION

Before the 570L is commissioned the calibration resistors must be fitted. These can be defined, when the drive is ordered, via the product code. See section 2.

The calibration resistors are mounted on a small plug in board, under the bottom flap of the front cover.

The calibration resistors should be good quality 2% metal film type.

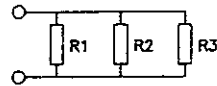
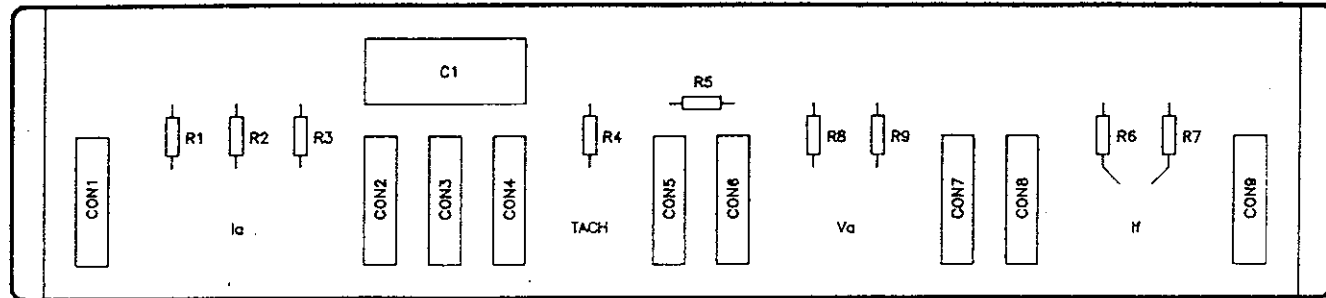
The calibration resistors calibrate the following drive parameters:-

10.2.1 Analog Tachogenerator Calibration

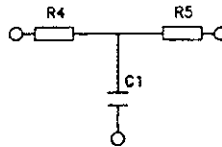
- (a) For full speed tacho voltages of up to 200 volts:

$$R4 + R5 = (\text{tacho volts} - 10)K \text{ Ohms}$$

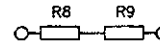
- (b) For full speed tacho voltages greater than 200 volts, an external resistor, value RE, is required in series with the tachogenerator connection to terminal B2.



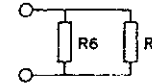
ARMATURE CURRENT CALIBRATION



ANALOG TACH CALIBRATION



ARMATURE VOLTAGE



FIELD CURRENT CALIBRATION

DRAWN ***	CHECKED
TRACED	DESIGN APP.

DATE	26/09/89
SS	A

ELECTRICAL SYMBOLS TO BS 3939

SSD LITTLEHAMPTON ENGLAND TELEX 87142 **EO**

TITLE
LAYOUT AND
CIRCUIT DIAGRAM FOR
CALCARD

USED ON	570
DRAWING NUMBER	HB 57714 D
SHT.	1
OF	1

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

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

The power dissipation of this resistor is given by the formula

$$RE = (\text{tacho volts} - 200) \times 5 \text{ milliwatts}$$

10.2.2 Armature Voltage Feedback Calibration

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

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

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

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

10.2.3 Armature Current Calibration

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

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

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

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

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

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

10.2.4 Field Current Calibration

Field current calibration is required, even if the voltage control mode option is selected. This allows the field fail mechanism to operate.

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

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

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

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

Note:- The field current calibration resistor is calculated from the formula $RF = \frac{4000}{\text{Full Field Current}}$ Ohms for an external stack controller 578L/579L.

10.3 CALIBRATING THE EURO THERM DRIVES MICROTACH FEEDBACK

Microtach feedback uses no scaling components, the required maximum motor speed is programmed into the controller from the information in the product code.

The Microtach is calibrated via the display and keypad, via the setup parameter "MICROTACH RPM". This parameter is a setup parameter, and is described in section 8.

Since the display is required, to check the Microtach calibration, this must be done when auxiliary power is connected to the drive.

10.4 CONTROLLING THE 570L DURING COMMISSIONING

The 570L is designed to be controlled via the Eurotherm Drives LINK network. The various start, stop, enable and setpoint parameters must be sent to the 570L from the network. This can be done via a suitably configured Eurotherm Drives L5101 LINK operator station, or from the Eurotherm Drives LINK setup tool, SAM.

To aid commissioning of the drive, it is recommended that the drive is isolated from the system LINK network. This will allow the drive to be easily controlled, in isolation to the system.

Here, the drive should be controlled in from a small local LINK network, consisting of an L5101 LINK operator station. This should be suitably configured to allow stop/start, enable and a speed setpoint to be sent to the 570L.

Alternatively, any other LINK systems module can be used, in a small local network with the 570L. Here, the Eurotherm Drives LINK setup tool, SAM, should be connected to the RS232 port of the systems module. The 570L can now be completely controlled from SAM. See SAM manual for further information.

10.5 DEFINING THE SET-UP PARAMETERS

1. Disconnect the load from the motor shaft if possible.
2. 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.
3. 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.
4. Now check:-
 - i) The LCD display shows the text:-
Eurotherm Drives LINK/570
ISSUE X.XX

Where X.XX is an alphanumeric code representing the software issue and release.
 - Note:- If the LCD display is not readily visible the intensity can be adjusted - at this stage using the up and down arrows.
 - ii) The LED indicators, these are the 6 LEDs under the RHS of the top covers, the HEALTH, OVERCURRENT TRIP, PROGRAM STOP and STOP LED's should be on.
 - iii) Using a digital voltmeter, with respect to terminal A1, ensure that +24V (+/-1V) is present on terminal A9.
3. Ensure that the Enable, terminal A5, is connected to +24V, terminal A9.
4. Ensure that the Program Stop and Coast Stop, terminals A7 and A8, are connected to +24V.
5. Ensure that the motor thermistors are wired to terminals A1 and A2. These terminals should be linked out, if motor thermistors are not fitted.

6. 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.

The drive speed and/or current setpoints are sent over the LINK network. Use the MMI in DIAGNOSTICS to ensure that the correct setpoints are being sent.

Note:- The sum of all the speed setpoints appears at diagnostic point "SPEED SETPOINT".

7. Check that the correct speed feedback is selected from the setup parameters SPEED FBK SELECT".

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

a) Analogue Tachogenerator:- The voltage at A4 (Diagnostic "TACH INPUT") should go positive.

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

Also check "SPEED FEEDBACK" diagnostic for the correct reading, between +/-100%.

8. 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 8.

10.6 PARAMETER CHECK LIST

SUB MENU	DISPLAY	SOFTWARE SETTINGS ¹	FACTORY SETTINGS ²	FINAL SETTING
RAMPS	RAMP UP TIME RAMP DOWN TIME 2 QUAD MODE S RAMPS % RAMP MODE	1 1 DISABLED 12.5% LINEAR		
FIELD VARIABLES	FIELD CONTROL MODE	VOLTAGE		
FIELD CURRENT VARIABLES	FIELD ENABLE FIELD I GAIN FIELD P GAIN FLD. WEAK ENABLE EMF LEAD EMF LAG EMF GAIN MAX VOLTS MIN FLD CURRENT FLD QUENCH DELAY FLD QUENCH MODE	ENABLED 0.01 0.10 DISABLED 2.00 40.00 0.30 100.00 10.00 5.00 QUENCH		
FIELD VOLTAGE VARIABLES	RATIO OUT/IN FIELD ENABLE	90% ENABLED		
CURRENT PROFILE	SPEED BRK 1 SPEED BRK 2 IMIN BRK 2 IMAX BRK 1	100% 100% 200% 200%		
PROGRAM STOP	PROGRAM STOP TIME PROGRAM STOP I LIMIT PROGRAM STOP ZERO SPEED	1 SEC 50% 1.00%		
CALIBRATION	ARMATURE VOLTAGE CAL IR COMPENSATION MICROTACH RPM ANALOGUE TACH CAL ENCODER LINES SPD FBK ALM LEVEL FIELD I CAL. FIELD WEAK RANGE	100.00% 0.00% 1000RPM 100.00% 1000 lines 50.0% 100.00% 1.0:1.0		
INHIBIT ALARMS	FIELD FAIL SPEED FBK ALARM	ENABLED ENABLED		
CURRENT LOOP	CURRENT LIMIT CURRENT P GAIN CURRENT I GAIN AUTOTUNE - CURRENT CLAMP + CURRENT CLAMP 2 QUAD MODE	100.00% Autotune Autotune OFF 100.00% -100.00% DISABLED		
SPEED LOOP	SPEED INT GAIN SPEED PROP GAIN ZERO OFFSET SPEED INT DEFEAT MICROTACH SIGN SPEED FBK SELECT	10.00% 15.00% 0.00% OFF POSITIVE ARM VOLTS FBK		
STANDSTILL	STANDSTILL LOGIC ZERO THRESHOLD	DISABLED 2.0%		
RATIOS	RATIO 1 RATIO 2 SIGN 1 SIGN 2	1.00 1.00 POSITIVE POSITIVE		

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

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

10.7 STARTING THE 570L

After setting up, the drive should be started and the current loop tuned.

All drive control signals are assumed to have been configured from an L5101 LINK operator station, or from SAM.

10.7.1 Checking The Start And Main Contactor Operation

1. Initiate START:-

The main 3 phase contactor should pull-in and latch via the control relay within the drive. After approximately 1 second, the contactor will open, and the "3 PHASE SUPPLY" alarm will be flagged.

Check that the diagnostic "START" is ON.

2. Remove START:-

Check that the diagnostic "START" is OFF.

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

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.

10.7.2 Checking the Motor Field Supply

1. 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.
2. Turn on auxiliary supply.
3. Turn on Main 3-phase supply.
4. Turn the Speed Setpoints to zero so that the total setpoint Diagnostic "SPEED SETPOINT" is zero.
5. Verify that the "Current Limit" Parameter is set to zero.
6. Initiate "Drive Start" and immediately check that the correct field voltage appears between terminals D4 and D3. Note this is high voltage DC, so proceed with caution. Do not continue if this is incorrect, switch off all supplies and re-check the product code. With voltage controlled fields, adjust the "RATIO OUT/IN" parameter to set the field voltage to the rated value.

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

- (a) Internally supplied full wave rectifier i.e. Product Code Block 4 Code 2. The output voltage will be $0.9 \times V_{ph}$ where V_{ph} is the line to line main supply voltage.
- (b) Internally supplied half wave rectifier, i.e. Product Code Block 4 Code 3. The output voltage will be $0.45 \times V_{ph}$.
- (c) This is the standard field supply on the 570L. Internally supplied field regulator, Product Code Block 4 Code 1. The maximum output voltage will be $0.6 \times V_{ph}$ as the full wave rectifier. This voltage will now depend upon the calibration of the field current loop or on the adjustment of the "RATIO OUT/IN" parameter. If no output at all is produced check that the field control is ENABLED in the FIELD VARIABLES sub menu of SET-UP PARAMETERS in the MMI. For a regulated field this is essential.

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

If the Product Code Block 4 is Code 5 the field voltage will be $0.9 \times V_{ext}$ volts dc.

Product Code Block 4 is 6, $V_{field} = 0.45 \times V_{ext}$ volts dc.

Product Code Block 4 is 4, $V_{field} = 0.9 \times V_{ext}$ volts dc maximum and will depend upon the calibration of the field loop or on the adjustment of the "Ratio" parameter. Again the field regulator must be enabled via the MMI.

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

- (e) Internally supplied 3 phase 1/2 wave rectifier Product Code Block 4 Code 8. The field voltage will be $0.67 \times V_{ph.}$, this is a special configuration more often used in the USA

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

10.7.3 First Run of the Motor

1. 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.
2. 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.

3. 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.
4. If this speed is exceeded and the motor continues to accelerate a reversed connection is implied, decrease the "CURRENT LIMIT" parameter to zero. It is possible that the alarm "SPEED FBK ALARM" may appear if the motor runs out of control. This will automatically stop the drive.

- i) Analogue Tachogenerator:-

Stop the drive and switch off all supplies, then correct the connections:-

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

- ii) MICROTACH:-

Stop the drive:-

- (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 the diagnostic position "SPEED FEEDBACK". 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 setup parameter "SPEED FBK SELECT". This could be set incorrectly allowing the drive to run open loop.

WARNING:-

Proceed further only when this test has been satisfactorily completed.

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

i) Analogue Tachogenerator:-

Reverse both field and tachogenerator connections.

ii) MICROTACH:-

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

WARNING:-

When changing Set-up Parameters such as the feedback polarity this change must be saved in the non-volatile memory before switching off the Auxiliary supply or the Set-up will be lost. It is therefore important at this stage when satisfactory operation has been achieved to STOP the drive and SAVE the parameters.

6. 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.

7. 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.

8. 4 Quadrant Drives which require reverse rotation.
Alter setpoint to -10% and check that motor runs in the reverse direction.

10.7.4 Autotuning the Current Loop

The current loop of the 570L must be autotuned in order to achieve satisfactory performance of the drive.

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

If there is field current in the motor Auto-Tune cannot be satisfactorily activated at any time.

If the motor is supplied with field current from a source, other than the on board field regulator, the field must be disconnected.

If the drive is fitted with a special option, fixed field bridge, the field must be disconnected before autotune is enabled.

With the standard option controlled field bridge, the field current is quenched automatically, when autotune is enabled

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

Initial Conditions:-

- (a) Drive START off.
- (b) Auto-Tune flag OFF.

- (c) Disable the armature current at terminal A5, or LINK "enable" parameter.
- (d) Clamp the motor shaft to prevent rotation. The motor torque will be very small, since the field current is disabled.

- 1 Start the drive.
- 2 From the set up parameters "CURRENT LOOP", set Auto-Tune ON.
- 3 Enable armature current.

Note:- The "CURRENT LIMIT" parameter must be set to at least 50%.

During autotune, the controller will then perturb the current loop adjusting the parameters in the current loop to give optimum response.

These parameters are:-

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

Parameters 3 and 4 give optimum performance of the loops cannot 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.

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

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

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.

10.7.5 Checking the Motor Speed Control and Adjusting for Zero Speed Offset

Adjustment of the zero offset is dependant on the type of drive:-

1. (a) 4 Quadrant, Non-reversing drives.
Set the Speed Setpoint to zero and adjust "ZERO OFFSET" parameter for minimum shaft rotation.
- (b) 2 Quadrant, Non-reversing drives.
Set the Speed Setpoint to zero and adjust the "ZERO OFFSET" parameter until the shaft is just rotating then reduce level until the shaft stops.
- (c) 4 Quadrant, Reversing drives.
Set the "ZERO OFFSET" parameter to balance maximum speed in forward and reverse directions.
2. Gradually increase the speed setpoint to maximum and check the shaft speed is correct. If fine adjustment is required adjust the calibration as appropriate to the speed feedback selection.
 - (a) Analogue Tachogenerator has a 10% trim, greater changes require re-calibration of external scaling components.
 - (b) The MICROTACH should give an absolute rotational speed for which adjustment is unnecessary however the motor speed may not be the relevant factor thus speed of rotation can be altered by simply adjusting the calibration.

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

10.7.6 Setting the Field Controller

1. 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.

2. Verify in the FIELD VARIABLES sub-menu of the SET-UP PARAMETERS that FIELD WEAKENING ENABLE, and RANGE are selected, and that MINIMUM FIELD is set appropriately, adjust MAXIMUM armature volts to the required scaled level.
3. Adjust calibration of FIELD WEAKENING RANGE parameter as this corrects the algorithm of the speed feedback alarm to allow for operation at constant armature voltage in the field weakening range.
4. 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 the appropriate speed feedback calibration. Trim Minimum field setting. If at any time while running the drive in speed control the SPEED FEEDBACK alarm trips the drive verify calibration of the armature volts.
5. For reversing drives. Check maximum reverse speed. Imbalance in reversing drives can only be corrected by adjusting the Zero Offset which may be to the detriment of operation at Zero Setpoint.
6. Re-set the "Current Limit" parameter to the original position which was previously noted. If in doubt set the Current Limit to 110% to correspond 110% FLC. If the current limit is set to maximum 200%, and the motor runs into an overload condition, the current is automatically reduced on an inverse time characteristic from the current limit level down to 110% FLC.

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

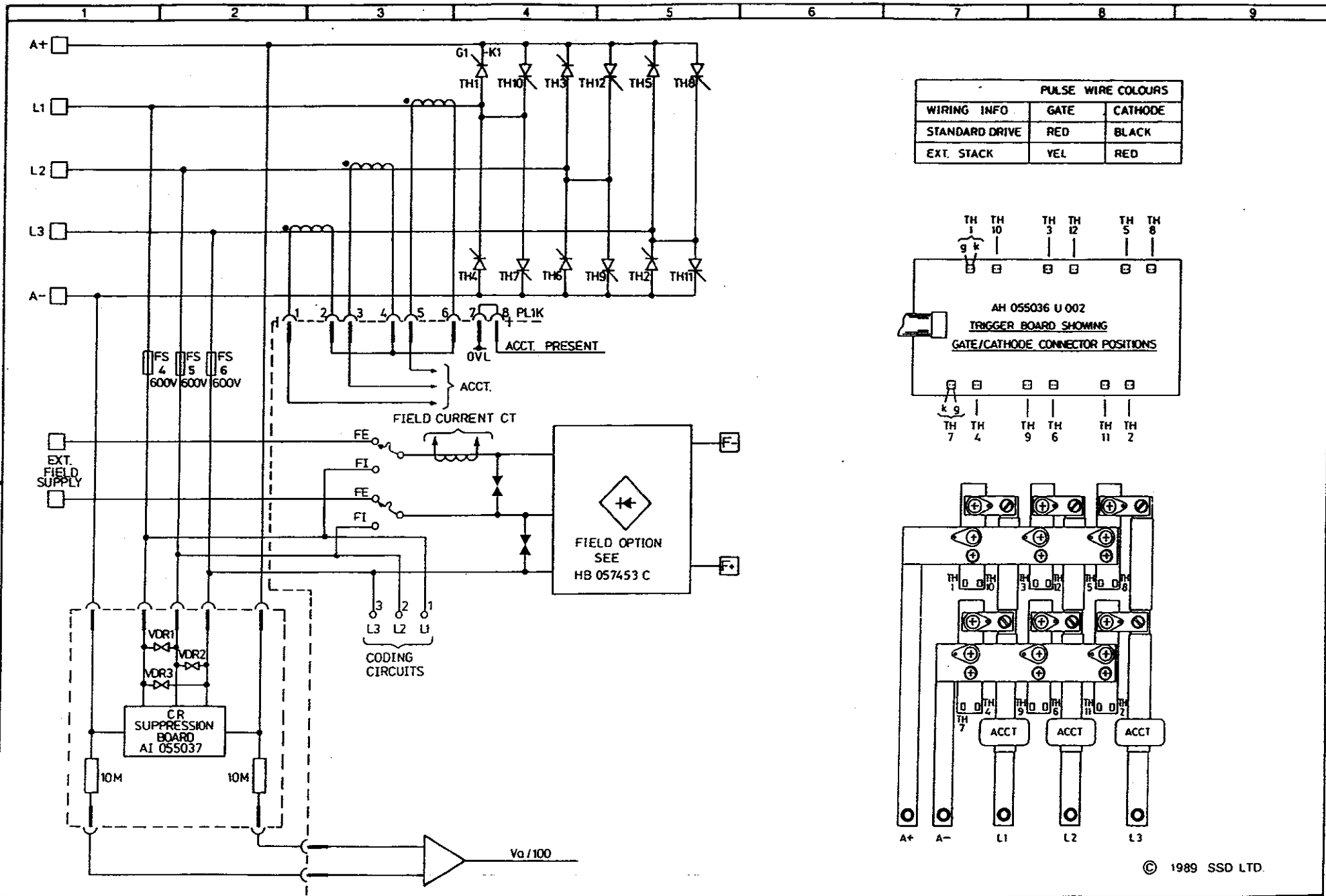
10.7.7 570L Speed Loop Performance Adjustment

The factory default parameters of "SPEED PROP GAIN" and "SPEED INT GAIN" will be satisfactory for most applications.

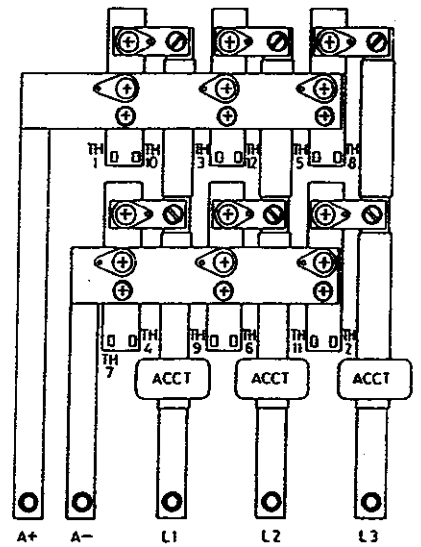
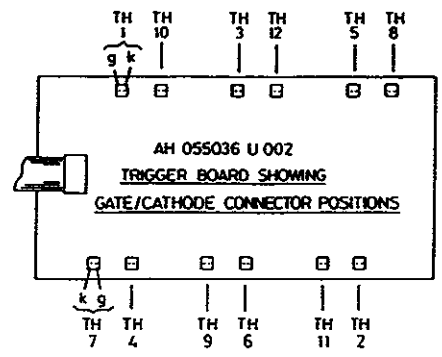
However, the performance of the speed loop should be adjusted to achieve the best performance. This should be done with the normal load applied to the motor.

The above two parameters should be carefully adjusted to give the best speed loop performance.

If the parameters are set too high, the motor will be unstable. If set too low, the speed loop will be very sluggish.

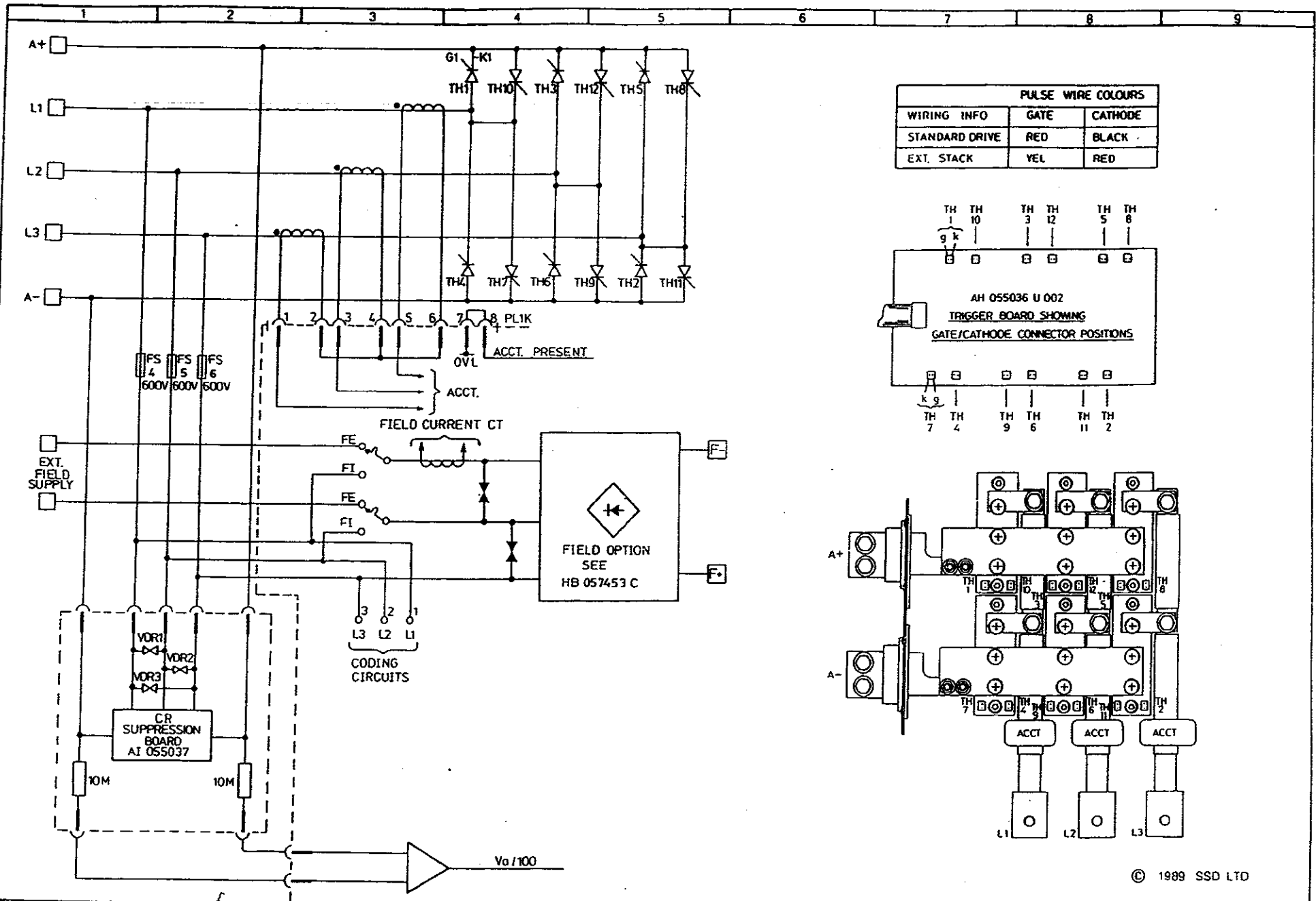


PULSE WIRE COLOURS		
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	RED	BLACK
EXT. STACK	VEL	RED

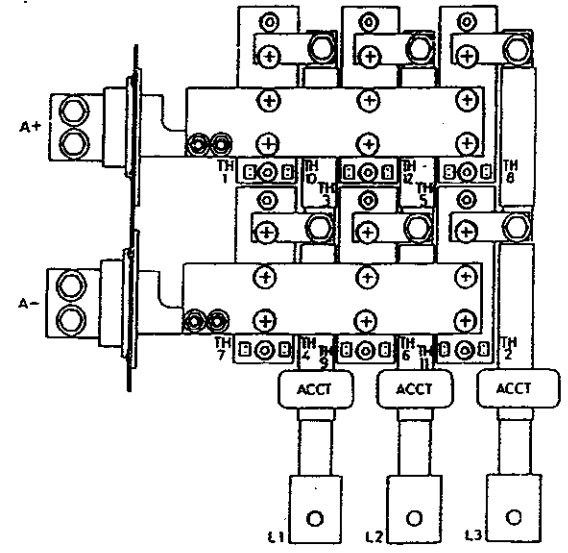
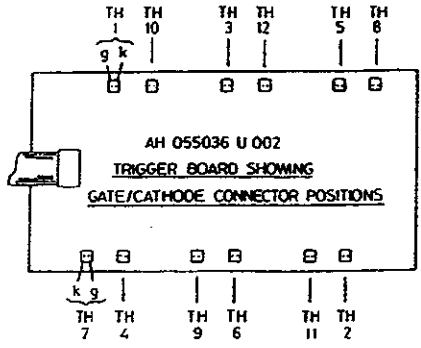


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		DATE 1.30.92			

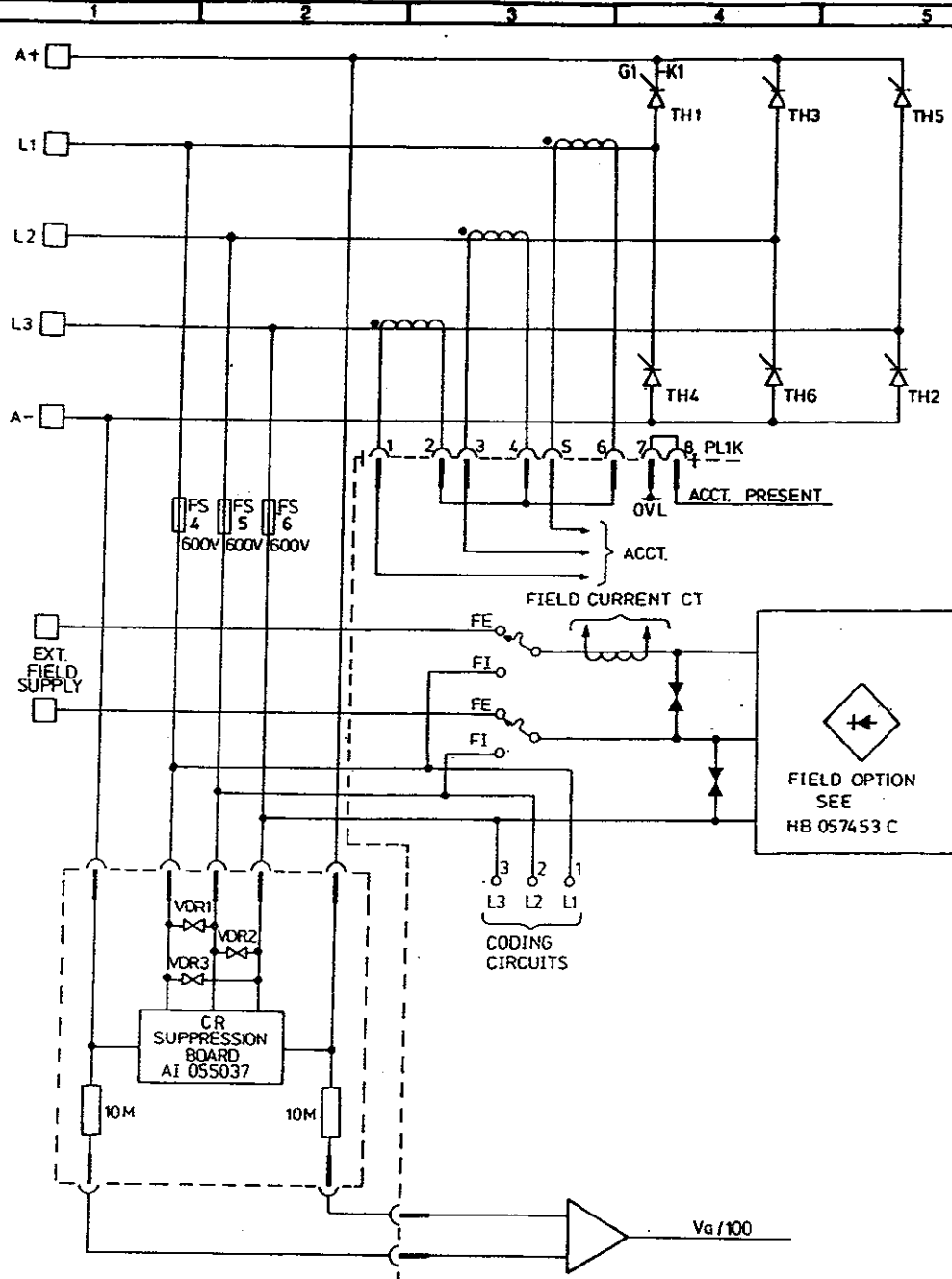


PULSE WIRE COLOURS		
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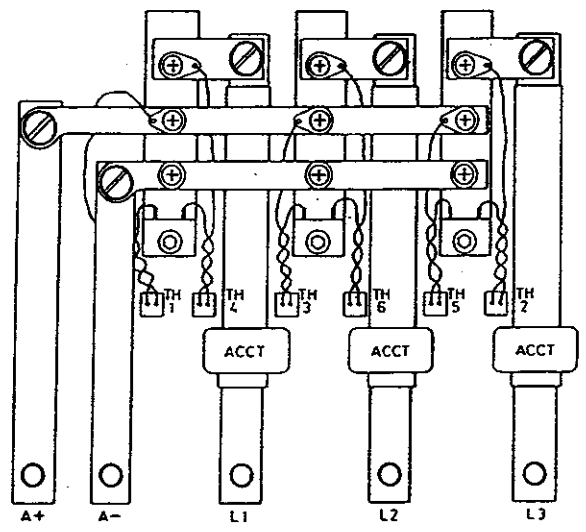
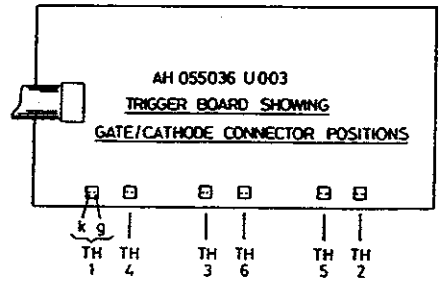


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						SHT 1 OF 1

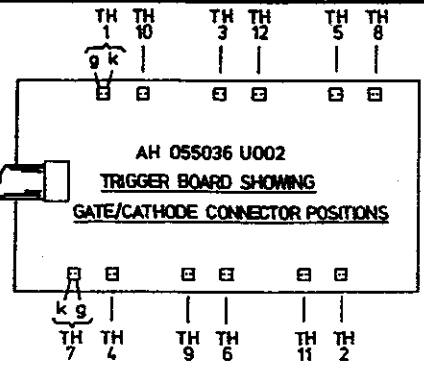
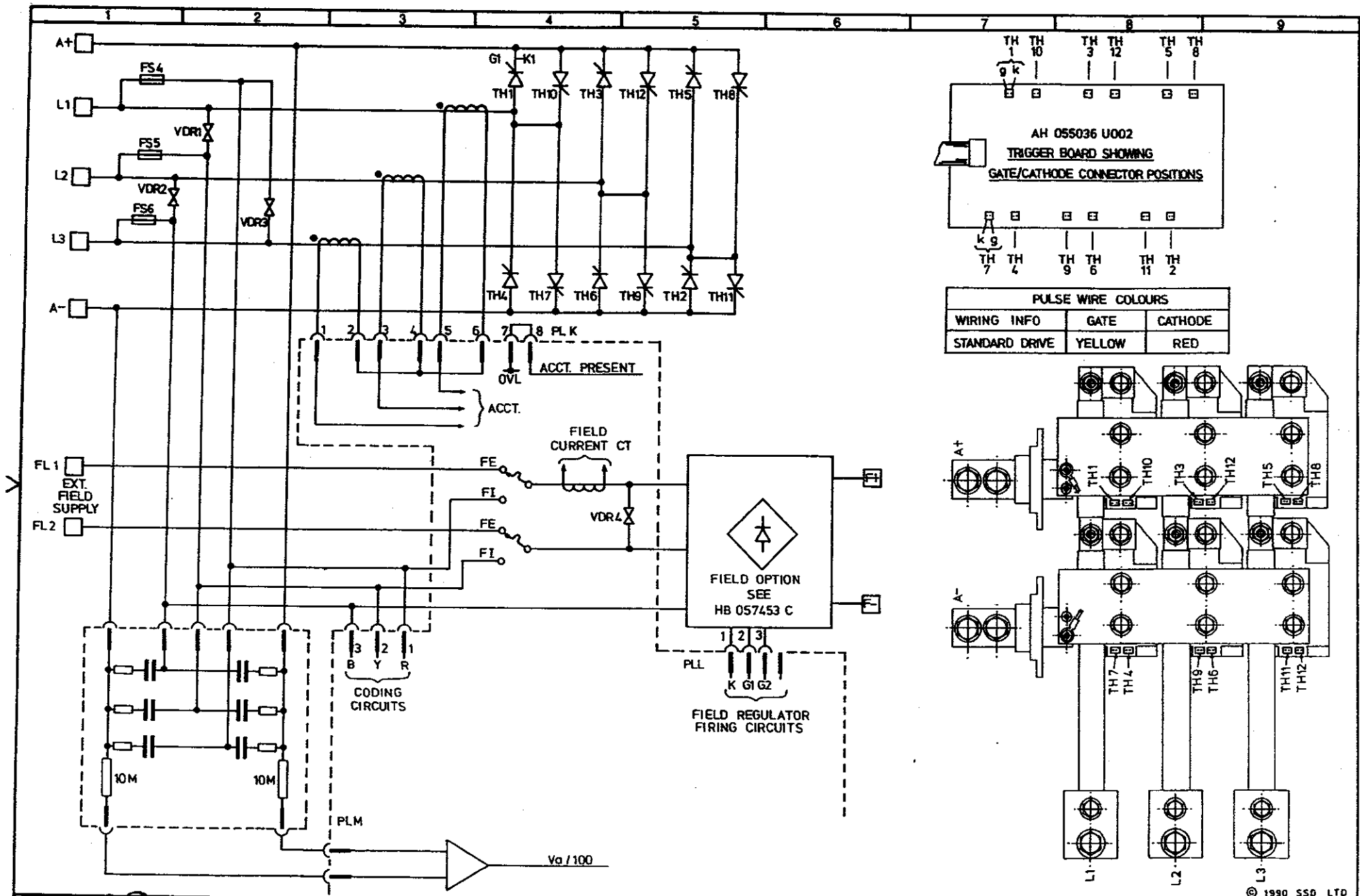


PULSE WIRE COLOURS		
WIRING INFO	GATE	CATHODE
STANDARD DRIVE	RED	BLACK
EXT. STACK	YEL	RED

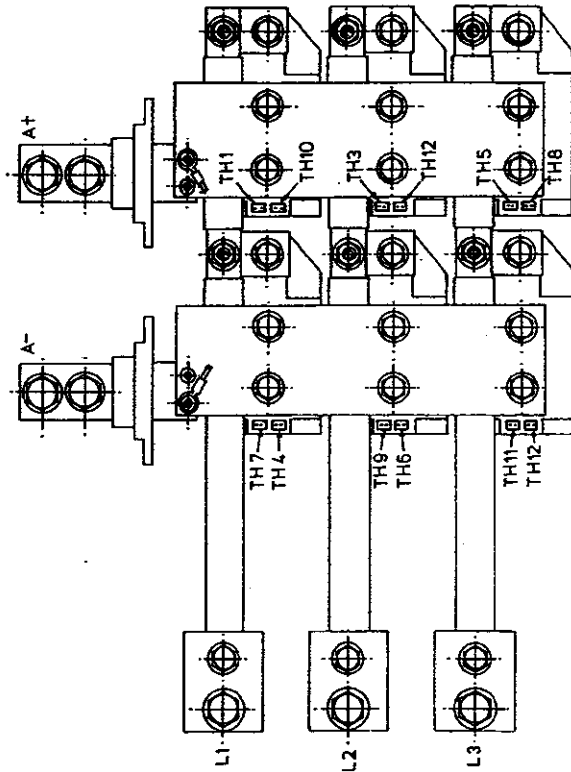


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TRACED PB/EDES			SSD LITTLEHAMPTON ENGLAND TELEX 87142		DRAWING NUMBER HJ 057471 D
					SHT 1 OF 1



PULSE WIRE COLOURS		
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STANDARD DRIVE	YELLOW	RED

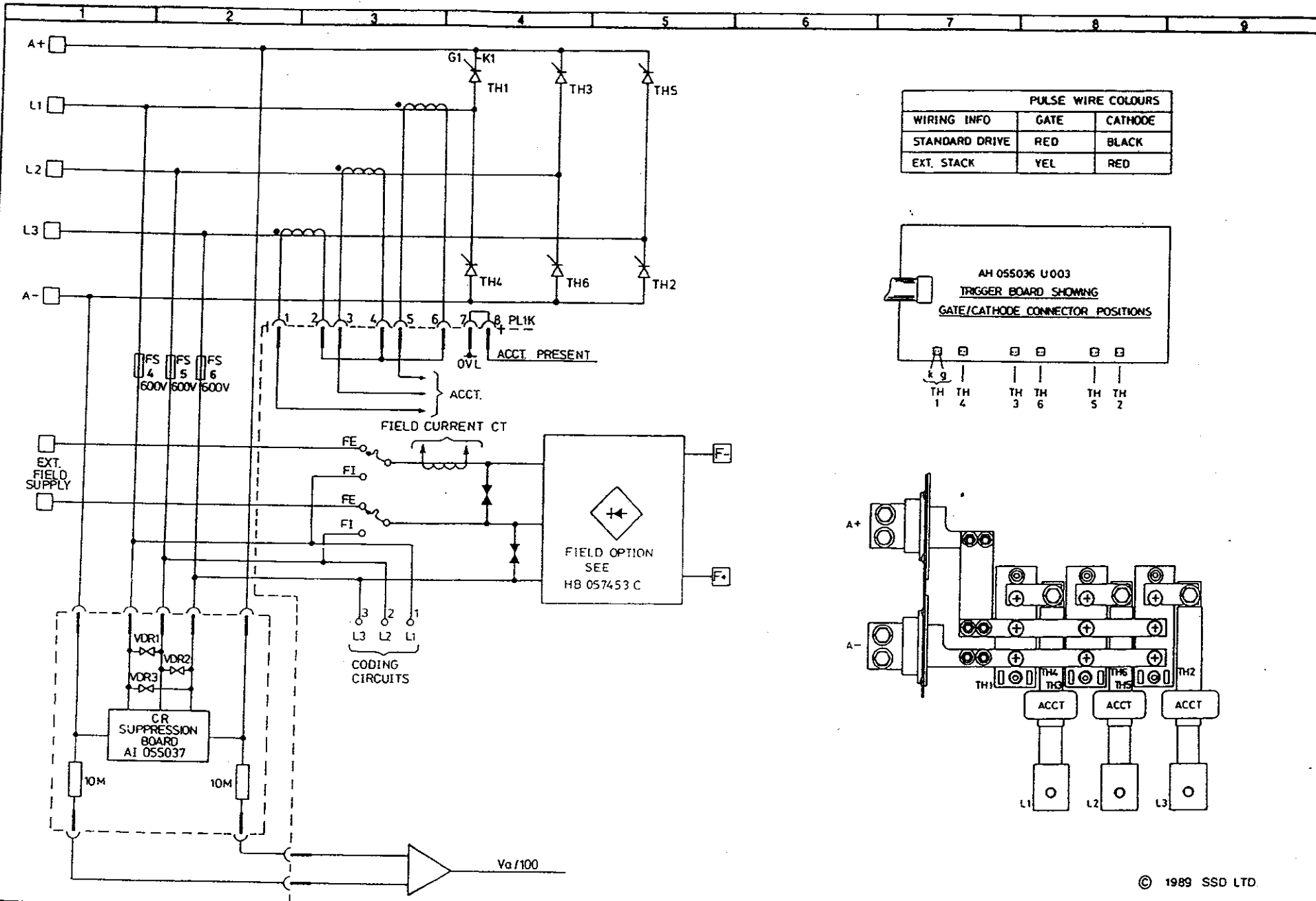


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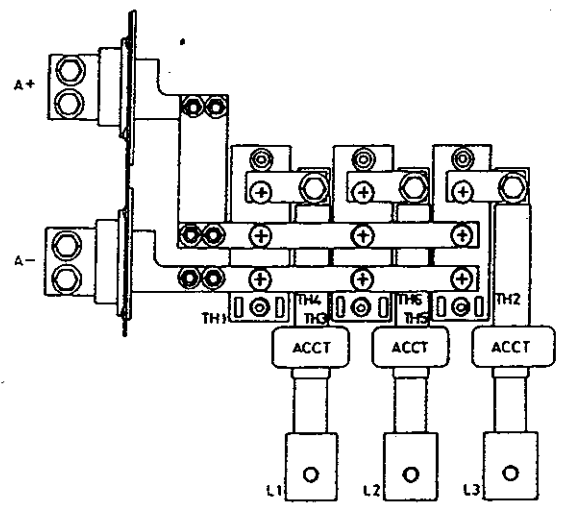
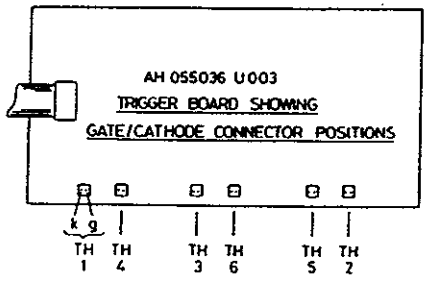
KE0485140

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SAS CRAWLEY LTD 280470/88



PULSE WIRE COLOURS		
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EXT. STACK	YEL	RED

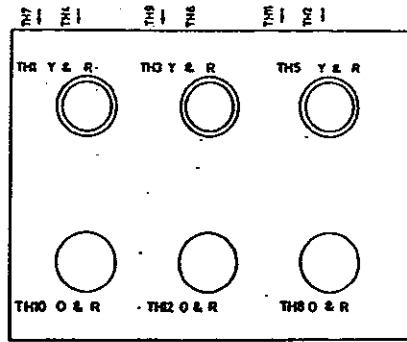
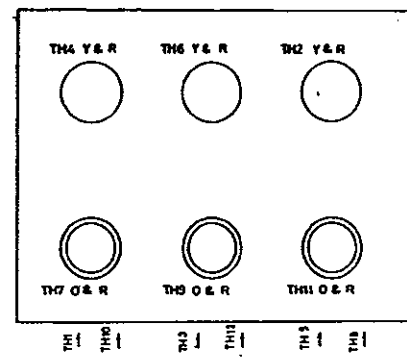
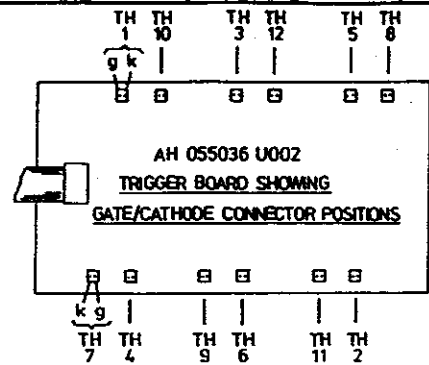
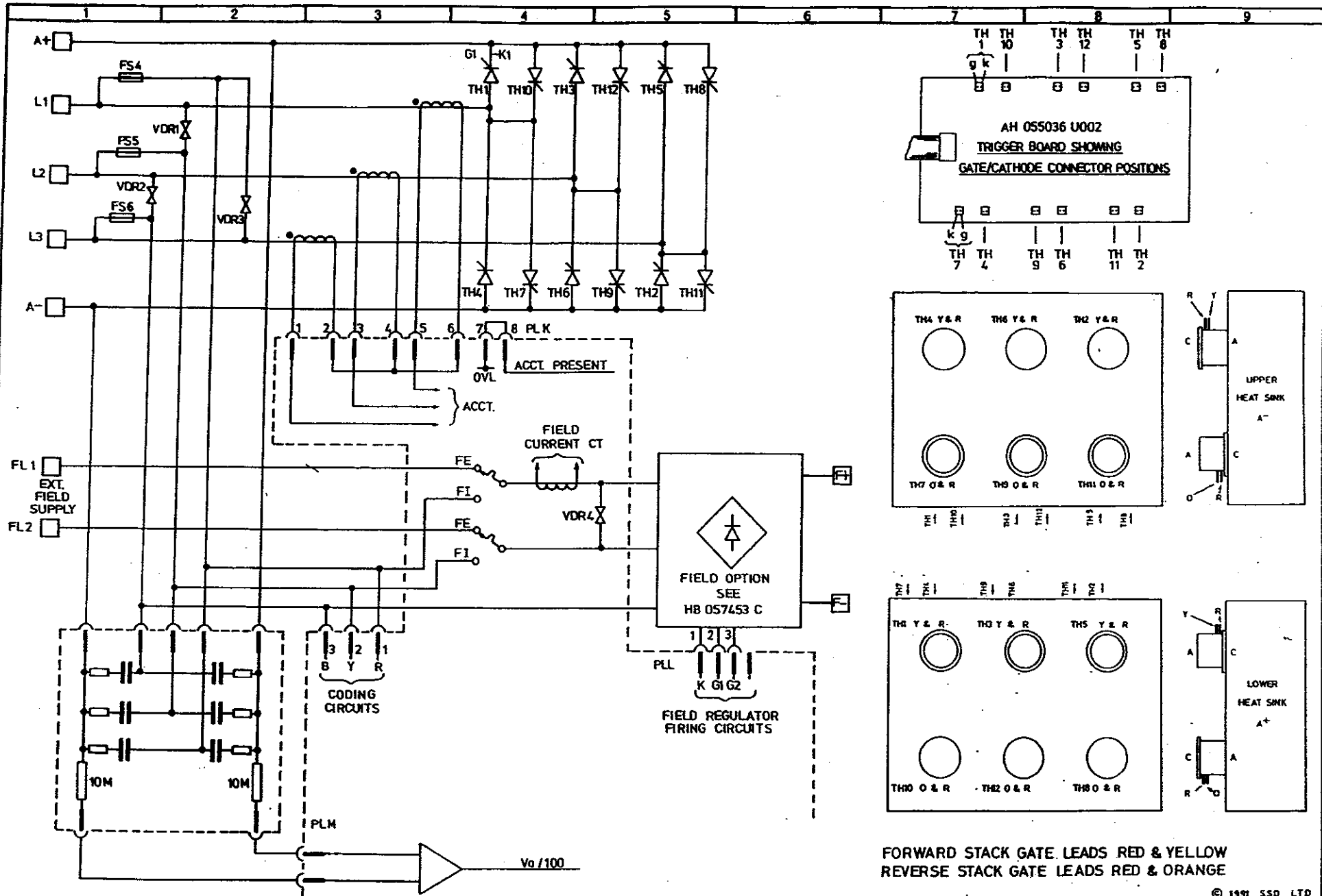


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TRACED PB/EDES			SSD LITTLEHAMPTON ENGLAND TELEX 87142		DRAWING NUMBER HJ 057473
					SHT 1 OF 1

KE048514D

SRS CRAWLEY LTD 2804700W



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

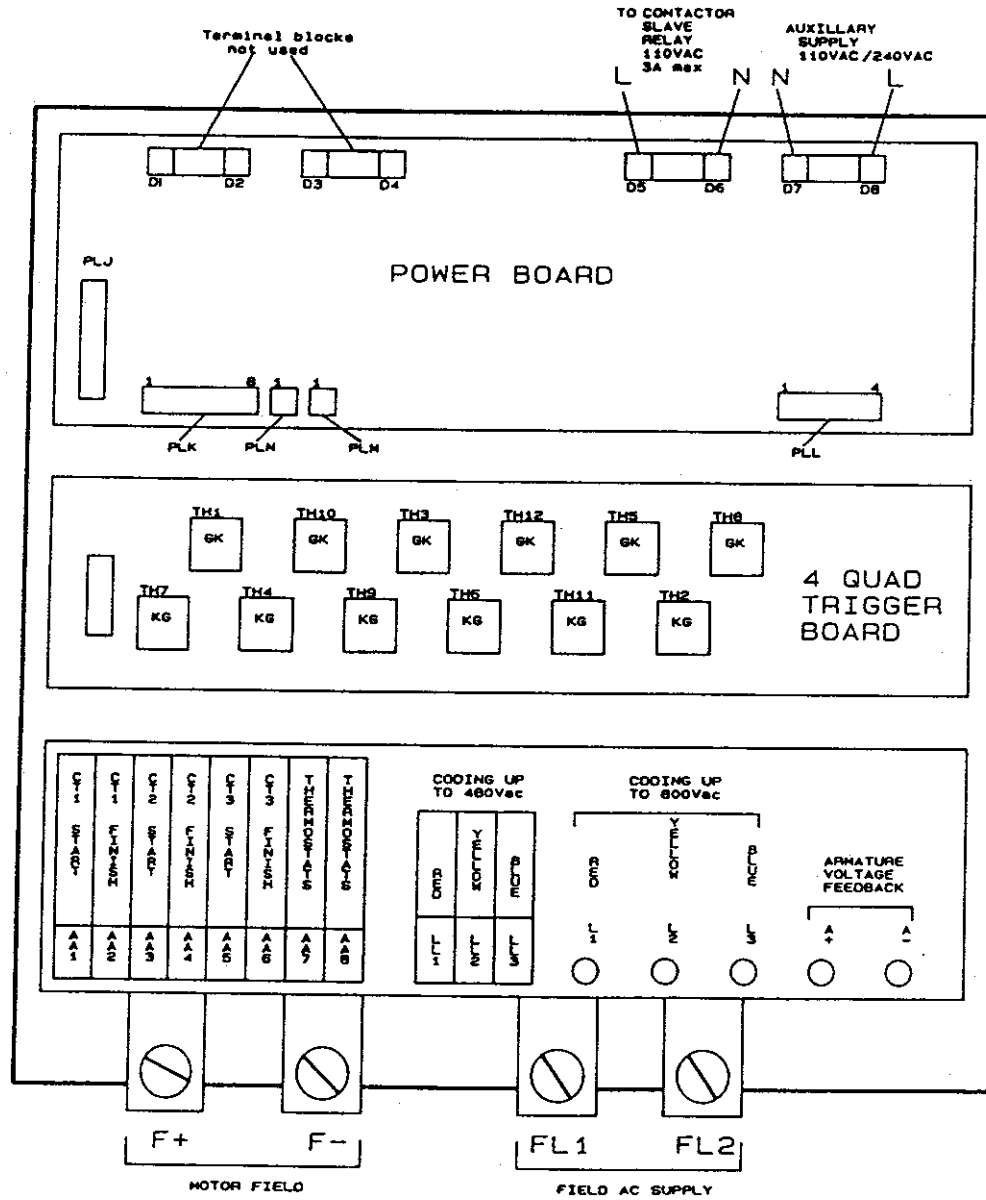
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TRACED		

ELECTRICAL SYMBOLS TO BS 3939
SSO LITTLEHAMPTON
 ENGLAND
 TELEX 87142

TITLE
 DC CONTROLLER 720A STACK
 4 QUAD POWER CIRCUIT

USED ON 570/590 SERIES	
DRAWING NUMBER HJ 059562 D	SHT 1 OF 1



CAD FILENAME: 578_3.SCH

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

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ANW	<i>GOR</i>		

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ELECTRICAL SYMBOLS TO BS 3939

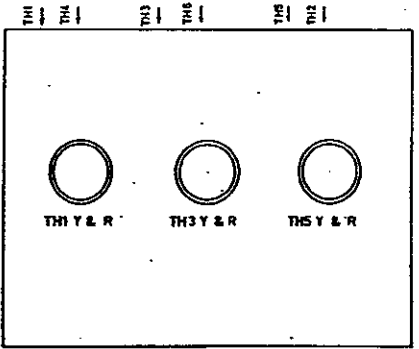
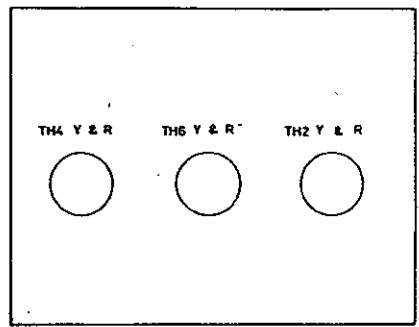
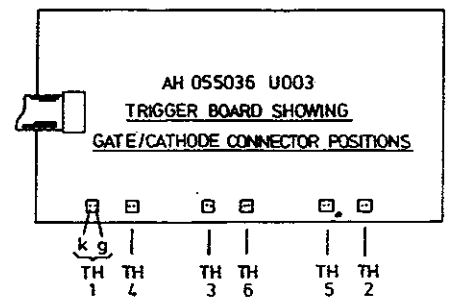
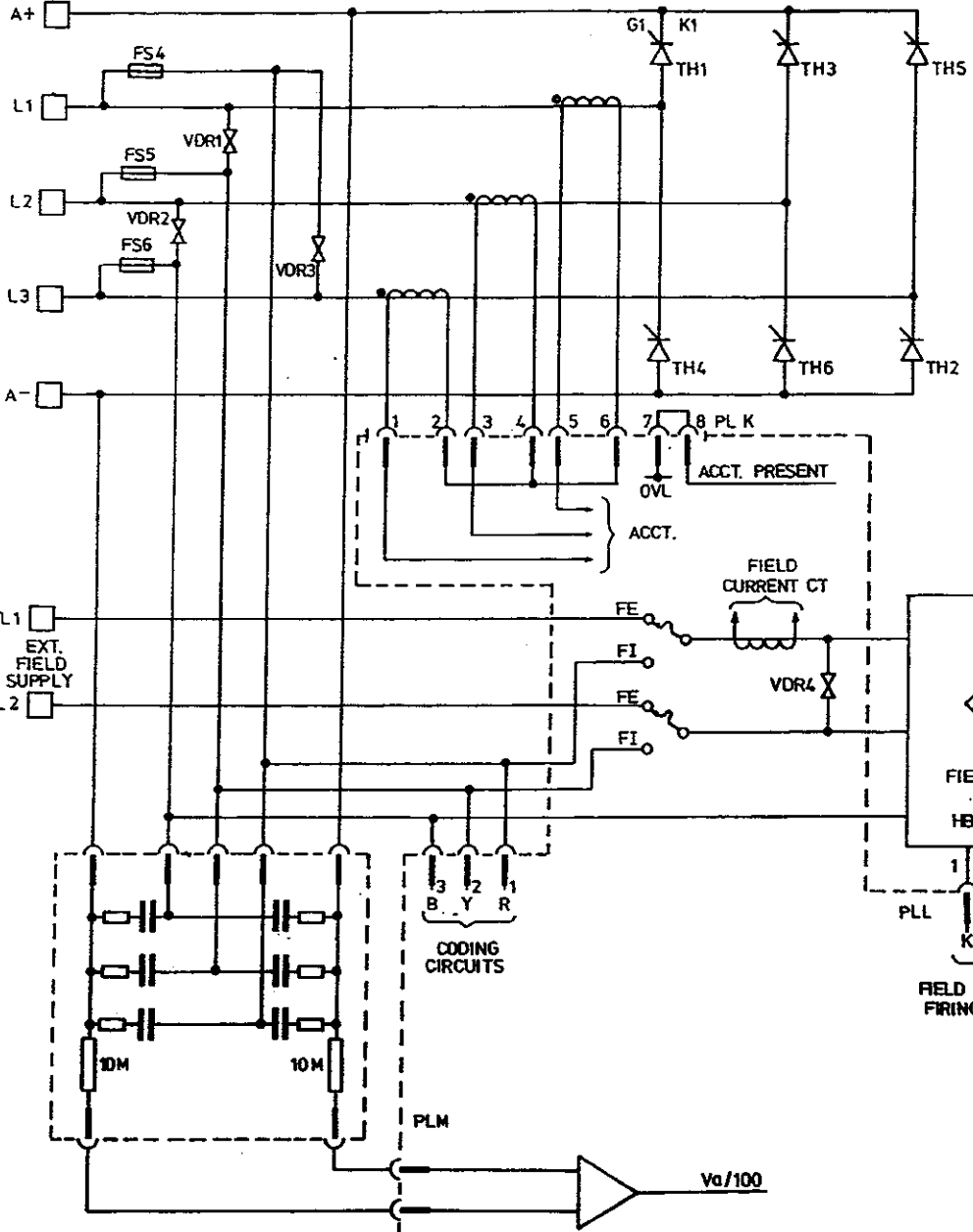
SSD LITTLEHAMPTON ENGLAND TELEX 87142

EI

TITLE

LAYOUT EXTERNAL
 STACK CONTROLLER
 4 QUAD

USED ON	SSD 19 89
DRAWING NUMBER	SHT. 2
HB058299D	OF 5



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DRAWN CRM	CHECKED GDR	DATE 14.2.91	DATE 13/1/92
TRACED		A 14.2.91	D 4.3.91
			PLM

ELECTRICAL SYMBOLS TO BS 3839

SSD LITTLEHAMPTON ENGLAND TELEX 87142

TITLE
DC CONTROLLER 720A STACK
2 QUAD POWER CIRCUIT

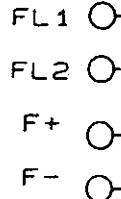
USED ON
570/590 SERIES

DRAWING NUMBER
HJ 059561 D

SHT 1
OF 1

Use external fusing.

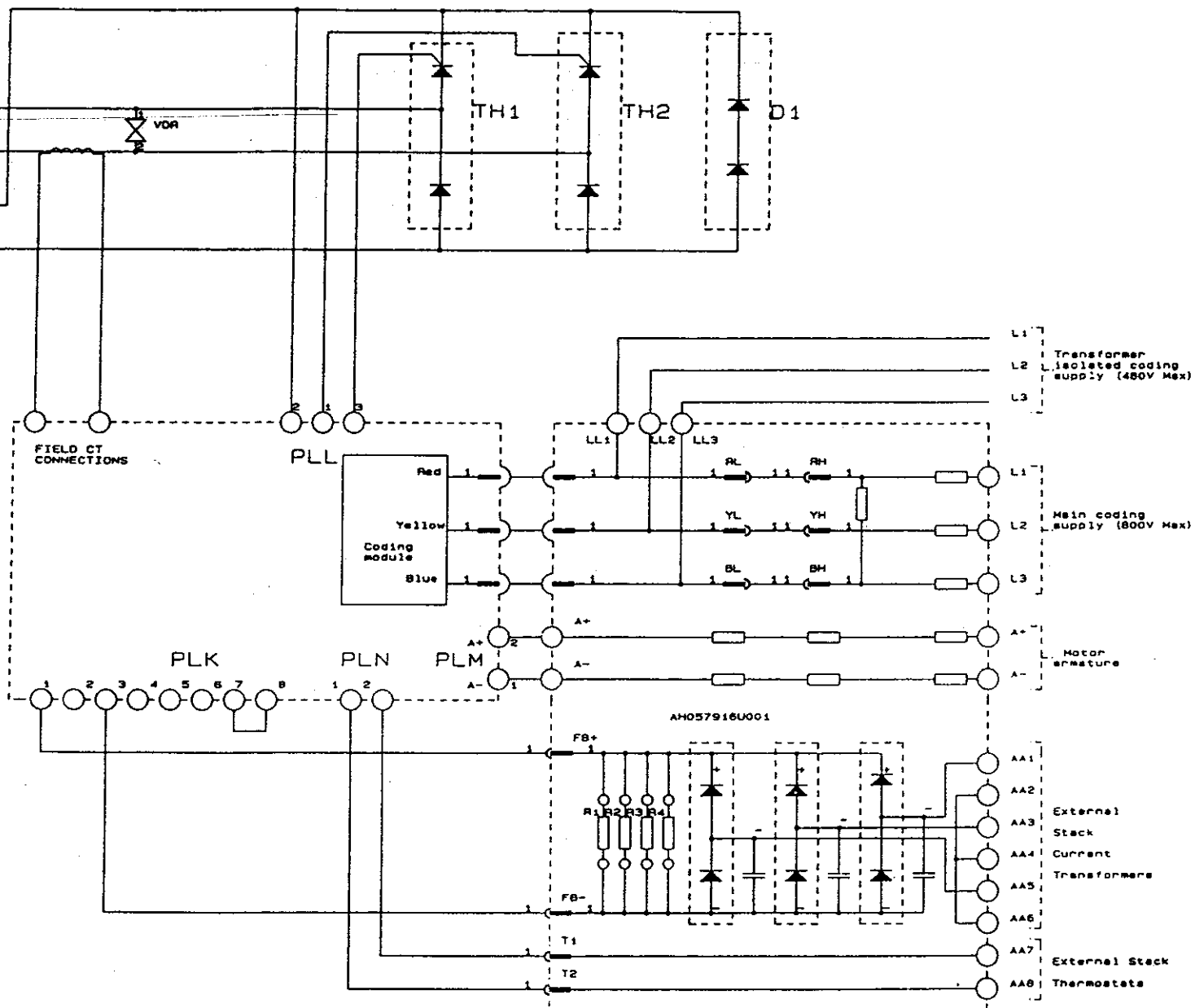
Field input
Transformer feed
NOTE PHASING



Field output.
25A Max.

Field current calibration
equation: -
 $R = \frac{4000}{I_f}$

Armature current calibration
equation: -
 $R = \frac{2200}{I_A - 1}$



CAD FILENAME: 578_1.sch NO ALTERATIONS OR ADDITIONS TO BE MADE TO THIS DIAGRAM RE-PLOT ONLY.

DRAWN ANW	CHECKED <i>OK</i>	DESIGNED 1	DESIGNED 2	DESIGNED 3	DESIGNED 4	DESIGNED 5	DESIGNED 6	DESIGNED 7	DESIGNED 8	DESIGNED 9	DESIGNED 10
C.A.D. LINK	DESIGN APP.	A	B	C	1	2					

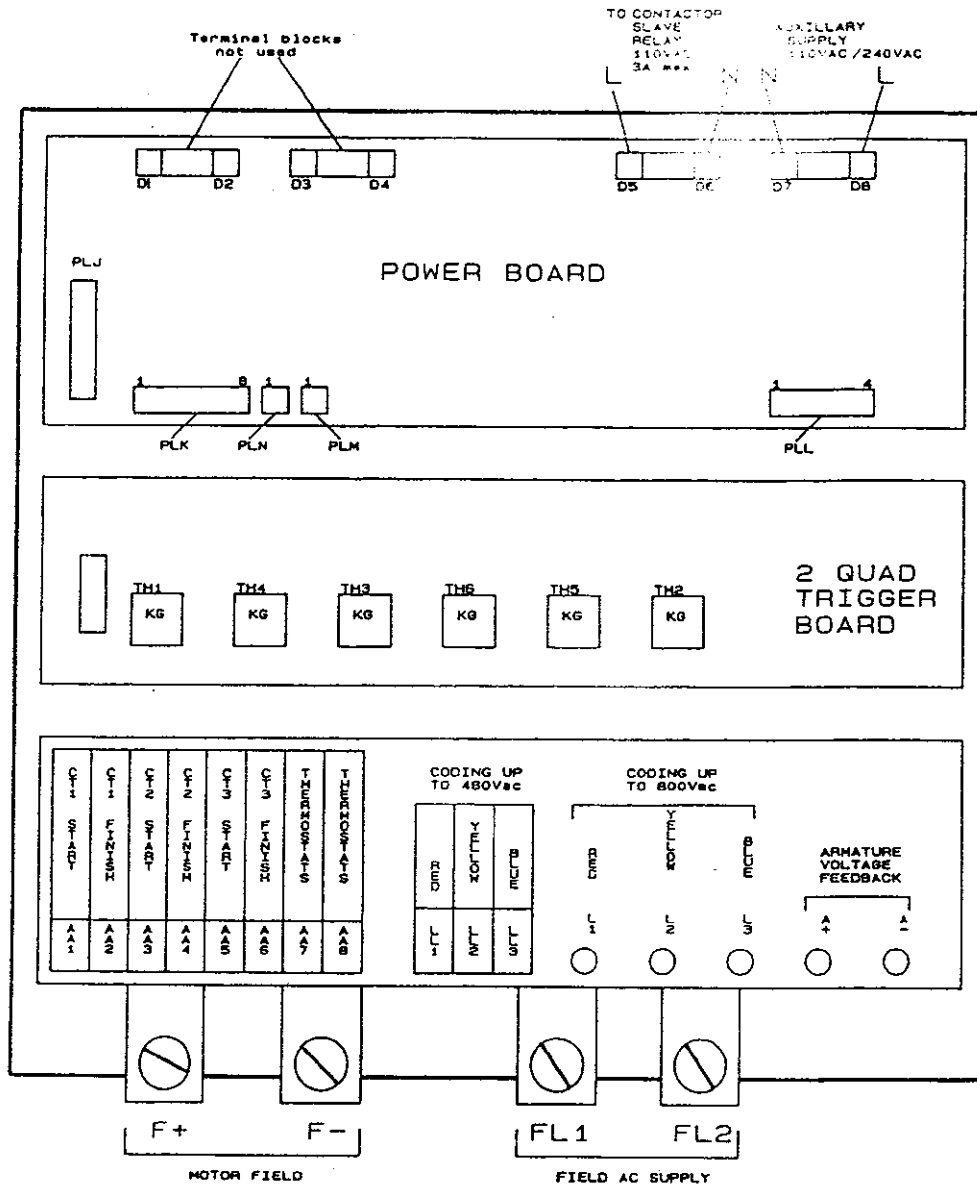
ELECTRICAL SYMBOLS TO BS 3939

SSD LITTLEHAMPTON
ENGLAND
TELEX 87142

EI

TITLE
CIRCUIT DIAGRAM
EXTERNAL STACK
CONTROLLER

USED ON	SSD 19 69
DRAWING NUMBER HB0582990	SHT. 3 OF 5



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.

DRAWN
ANW

CHECKED

ANW

C.A.D.
LINK

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ELECTRICAL SYMBOLS TO BS 3939

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LITTLEHAMPTON
ENGLAND
TELEX 87142

EI

TITLE

LAYOUT EXTERNAL
CONTROLLER 2 QUAD

USED ON

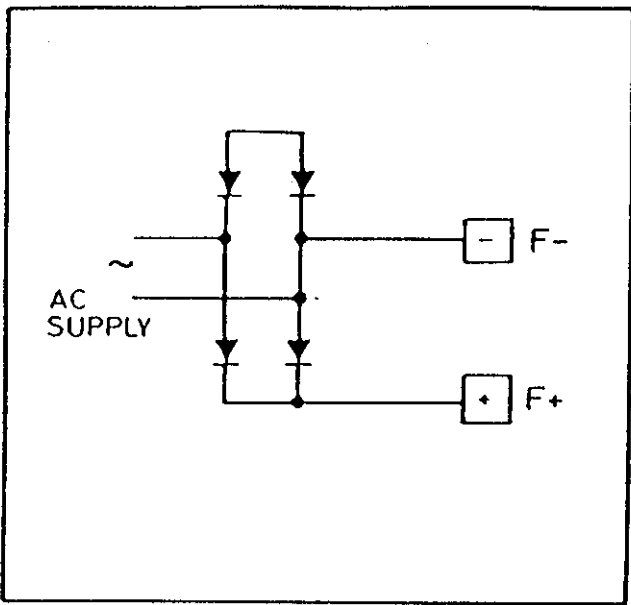
© 650 19 89

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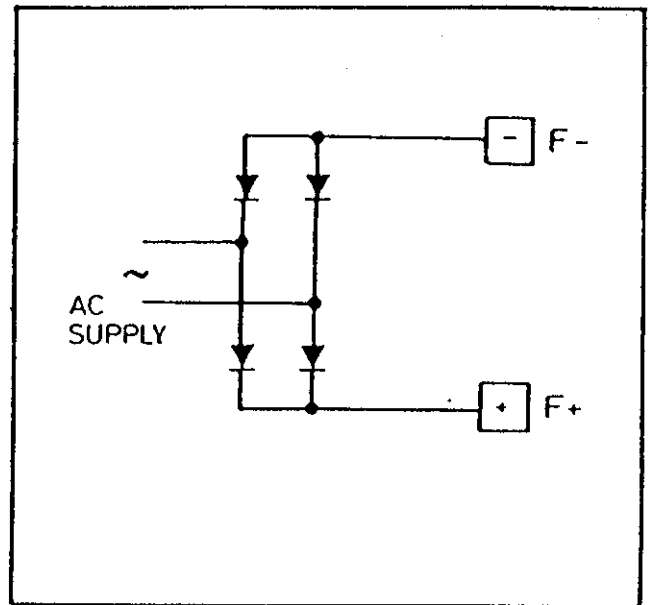
HB0582990

SHT. 5

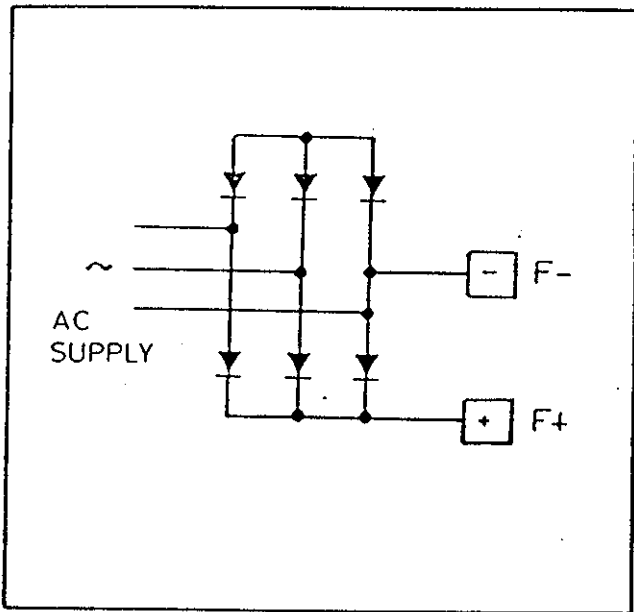
OF 5



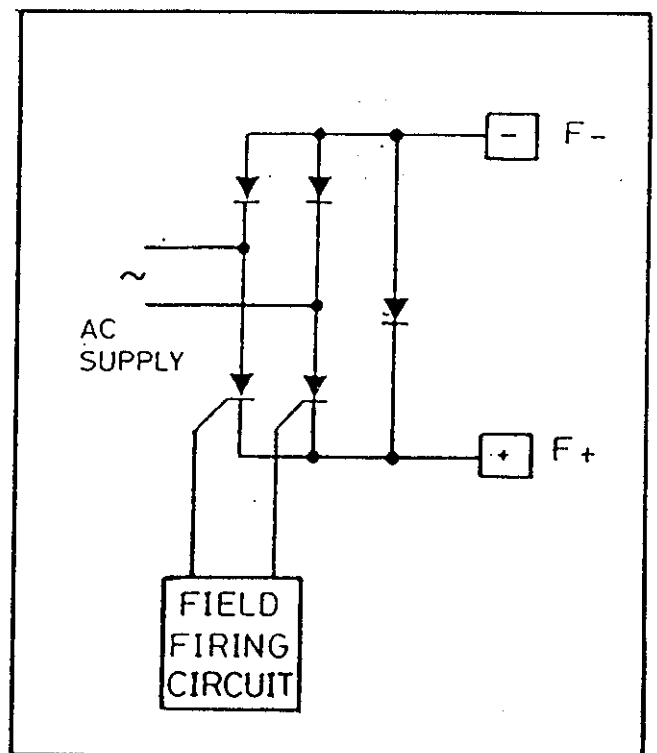
HALF WAVE RECTIFIER



FULL WAVE RECTIFIER



3 PHASE HALF WAVE RECTIFIER



FIELD FIRING CIRCUIT



**EUROTHERM
DRIVES**

Appendix A

590L Controllers

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590L CONTROLLERS

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PURPOSE

This document outlines the hardware and software differences between 570L and 590L controllers. Complete Slot lists are given.

ENVIRONMENTAL SPECIFICATION

Enclosure Rating	IP00, to be built into a suitable cubicle.
Operating Temperature	0°C - +55°C
Storage:	Minimum -25°C; maximum +55°C
Transport Temperature	Minimum -25°C; maximum +70°C
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.
Climatic Conditions	Class 3k3, as defined by prEN50178 (1995).
Pollution Degree:	2
Installation/Overtvoltage Category	3
Atmosphere:	Non-flammable, non-condensing.

PRODUCT CODE

590L SERIES THREE PHASE CONVERTERS. (FACTORY CALIBRATED)

(Products fitted with fixed component calibration cards)

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

Block No.	No. of Digits	Function
1	3	Basic product
2	3	Output current
3	4	Input power supply voltage
4	1	Field converter configuration
5	1	Input auxiliary supply voltage
6	1	User language
7	1	Speed feedback source
8	1	Not used
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.

- 590L 3 phase 4 quadrant (regenerative) converter up to 720 Amps.
- 591L 3 phase 2 quadrant (non-regenerative) converter up to 720 Amps.
- 598L 3 phase 4 quadrant (regenerative) external stack controller.
- 599L 3 phase 2 quadrant (non-regenerative) external stack controller.

BLOCK 2

590L and 591L
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

598L and
599L

5 digits identifying the DC output current rating.

The digits in this block represent a number between 0000.0 and 2800.0. 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

598L / 599L
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 part product code (Blocks 10 to 16).
- 2 Not available.
- 3 Not available.
- 4 Externally supplied field regulator.
- Note: this digit requires a second part product code (Blocks 10 to 16).

5	Not available.
6	Not available.
7	
8	Not available.
9	

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

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

BLOCK 6 1 Digit code to define user interface language.

0	English
---	---------

BLOCK 7 1 Digit code identifying the speed feedback source.

0	Armature Voltage.
1	DC Tacho.
2	5701 Plastic Fibre Microtach.
3	Wire ended encoder
4	5901 Glass Fibre Microtach.

BLOCK 8 1 Digit code identifying the main serial link port (P1).

0	No Serial Link.
1	Serial Link Fitted RS422/485
2	ProfiBus

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.

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. MICROTACH Feedback.

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

For example: 1500 RPM - Code 1500

Code 1000 - 1000 RPM

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 as base speed.

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

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

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

0 No armature current profile.

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

1 Armature current profile required.

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

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

For example: 50% - Code 50 The digits in this block represent the percentage of motor top
Code 65 - 65% speed at the first (break 1) armature current profile point. Add
leading zeros as necessary.

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

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

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

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

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

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

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

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

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

- BLOCK 17** 2 Digits identifying special options (hardware)
 - 00 No special options
 - 00 to 99 Documented special options
- BLOCK 18** 3 Digits identifying special options (software).
 - 000 The basic block diagram
 - 001 - 999 Documented special options.

590LC SERIES THREE PHASE CONVERTERS (CUSTOMER CALIBRATED)
(Products fitted with Switchable Calibration Cards)

Block No.	No. of Digits	Function
1	4	Basic product
2	4 or 5	Output current
3	1	Supply voltage (Power)
4	1	Supply voltage (Auxiliary)
5	1	User language
6	1	Speed feedback source
7	1	Serial link
8	2	Special Hardware
9	3	Special Software

The blocks are defined as follows:-

- BLOCK 1** 4 Digits identifying the basic product.
 - 590LC 3 phase 4 quadrant (regenerative) converter up to 720A.
 - 591LC 3 phase 2 quadrant (non-regenerative) converter up to 720A
 - 598LC 3 phase 4 quadrant (regenerative) external stack controller.
 - 599LC 3 phase 2 quadrant (non-regenerative) external stack controller.

BLOCK 2 590C/591LC: 4 digits identifying the maximum DC output current rating that may be calibrated for each size of product.

The following codes are valid:

Code	Max. rating
0350	35 amps
0700	70
1100	110
1500	150
1088	180
2700	270
3600	360
4500	450
7200	720

598LC/599LC: 5 digits identifying the DC output current rating.
The digits in this block represent a number between 0000.0 and 2800.0. To form a code from the numbers, the decimal point is suppressed and leading zeros are added where necessary.

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

BLOCK 3 1 digit identifying the nominal 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 598LC/599LC External Stacks only
C	600V 598LC/599LC External Stacks only
D	660V 598LC/599LC External Stacks only

BLOCK 4 1 digit identifying the auxiliary AC control supply voltage.

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

BLOCK 5 1 digit code to define the user interface language.

	Language	Note
0	English	Available
1		Reserved
2	French	Available
3	German	Available
4	Italian	See Customer services
5	Spanish	See Customer Services

BLOCK 6 1 digit identifying the speed feedback source.

590L Controllers

0	Armature Voltage.
1	DC Tacho.
2	5701 Plastic Fibre Microtach.
3	Wire-ended encoder.
4	5901 Glass Fibre Microtach.

BLOCK 7 1 digit identifying the main serial link port (P1).

0	No Serial Link.
1	Serial Link fitted RS422/485.

BLOCK 8 2 digits identifying special options (hardware).

00	No special options.
01 to 99	Documented special options.

BLOCK 9 3 digits identifying special options (software).

000	No special options.
001 to 999	Documented special options.

HARDWARE DIFFERENCES

DIAGNOSTIC TEST POINT

An additional test point (TP12) has been added beneath the lower cover flap.

This test point serves as an analog "peek" monitor point. Any item which is selected in the "SYSTEM/PEEK" menu of the MMI appears at this point as an analog voltage^(a). Note that this signal is heavily filtered, and is intended to be used for general diagnostic purposes only. The password must be used to enable the PEEK menu described above.

Note (a) The resolution of the signal at this test point is 8 bits.

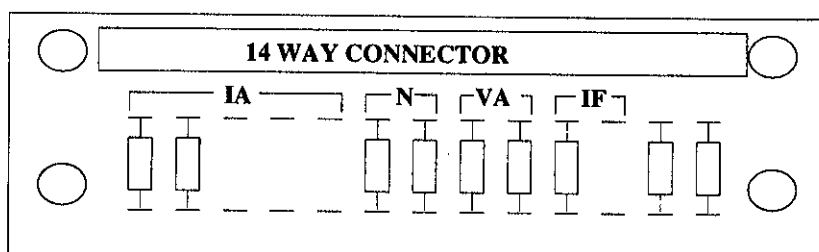
ARMATURE CURRENT OUTPUT SCALING

The armature current wave form output on terminal A6 now has a range of +/- 200% armature current. Previously, on the 570L, the voltage span was +/- 2.2 Volts.

CALIBRATION BOARDS

(A) Standard Calibration Board (Part Number AH058529U001)

1. The standard calibration board is for use on 590 Digital and 590 Link control boards.
2. The calibration board locates on the 14-way pin connector under the lower flap of the control board enclosure.
3. The following diagram illustrates the standard calibration board.



- IA: Resistors R1-R5
 N: Resistors R6-R7
 VA: Resistors R8-R9
 IF: Resistors R10-R11

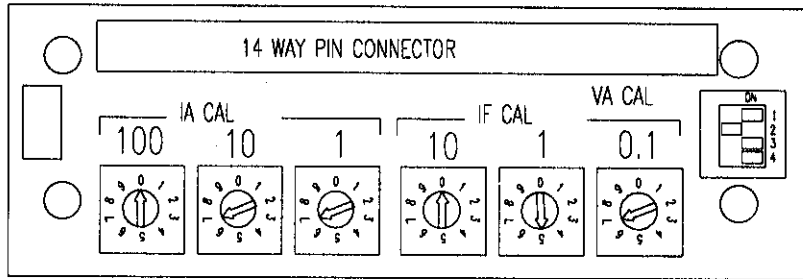
4. Armature current calibration, IA, is set by using up to 5 parallel resistors to give the required value.
5. Analog tach speed calibration, N, is set by using 2 series resistors to give the required value.
6. Armature voltage calibration, VA, is set by using 2 series resistors to give the required value.
7. Field current calibration, IF, is set by using up to 2 parallel resistors to give the required value.

(B) Switchable Calibration Boards

1. The switchable calibration boards are designed to provide quick and simple drive calibration with easy to use rotary and in-line selector switches.
2. The boards conveniently replace the standard calibration board for all 590 Digital and 590 Link control boards for use on drives up to 720 Amps.
3. Analog tacho calibration is supported by a switchable tacho calibration board. This board is not required if armature voltage or encoder feedback is to be used.

Switchable Calibration Board (Part Number AH385457U001)

1. The switchable calibration board locates on the 14 way pin connector under the lower flap of the control board enclosure.
2. The following diagram illustrates the switchable calibration board.



3. Armature current calibration, IA CAL, is set in Amps using 3 rotary switches arranged in decades (units, tens and hundreds). In the illustration the '100' is set to 0, the '10' is set to 7 and the '1' is set to 7, giving an IA CAL of 77 Amps.
4. Field current calibration, IF CAL, is set in Amps using 3 rotary switches arranged in decades (tenths, units and tens). In the illustration the '10' is set to 0, the '1' is set to 5 and the '0.1' is set to 7, giving an IF CAL of 5.7 Amps.
5. Armature voltage calibration, VA CAL, is set in volts using a 4 way switch according to the following look-up table. In the illustration VA CAL is 200 Volts.

VA Switch	Armature Volts Va (Volts)															
	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525
1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
2	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
3	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0
4	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0

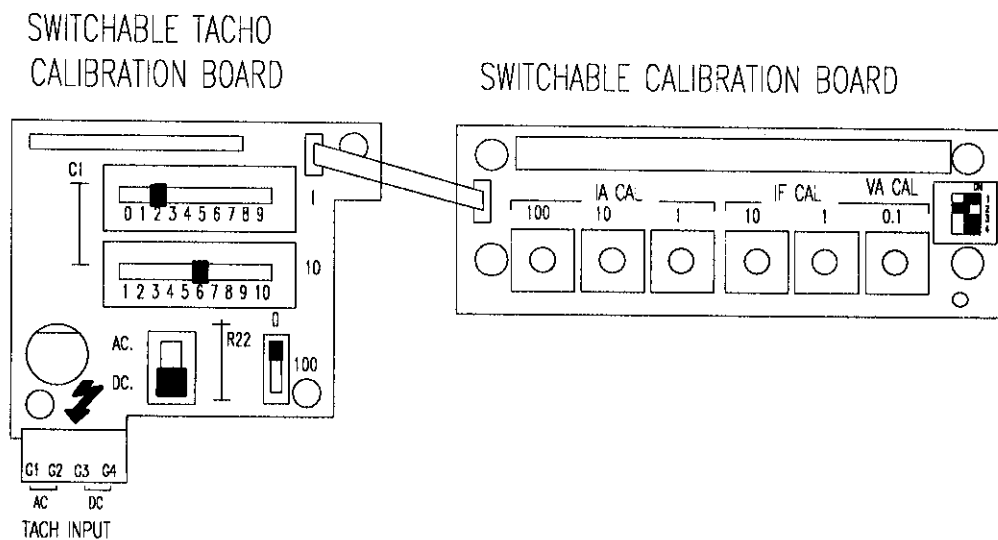
A '1' indicates that the switch is ON.

It is important that the maximum drive and motor ratings are not exceeded when calibrating the above parameters; reference should be made to the drive product code and the motor rating plate.

It is also important that none of the calibration parameters of the drive are altered when the main contactor is energised.

Switchable Tacho Calibration Board (Part Number AH385870U001)

1. The switchable tacho calibration board should be fitted on the left of the switchable calibration board on the 10 way pin connector.
2. When both boards are used, an interconnecting wire link must be fitted as shown in the following illustration.



3. The board supports both AC and DC analog tachos with a calibration range of 10 - 199 Volts.
4. All analog tacho connections must be made to terminals G1 to G4. For AC tacho feedback, use terminals G1 and G2 with the selector switch in the AC position, for DC tacho feedback use terminals G3 and G4, with the selector switch in the DC position.
5. Tacho calibration volts are set using 2, 10 way in-line switches for '1's' and '10's' and a single 1 way switch for '100's'.
6. A minimum of 10 volts can be dialled by selecting 0 on the '1's' switch and 1 on the '10's' switch. In the illustration above, tacho volts are set to 62 volts.

When using the switchable calibration board(s) the analog tacho connection cannot be made at the normal B1 and B2 control board terminals.

LCD DISPLAY CONTRAST

The contrast for the LCD display is now controlled by a potentiometer located beneath the lower cover flap. Previously, it was controlled via the MMI up and down keys while at the MMI "home" position.

MICROTACH FEEDBACK

Microtach feedback is an option on the 590L series controllers. This is similar to the 590D range of controllers and the option board is fitted on the left hand side under the bottom flap. 2 options are available here:-

- 1) 5701 Plastic fibre Microtach feedback.
- 2) Wire ended encoder. This allows a standard electrical encoder to be used for speed feedback.
- 3) 5901 Glass fibre Microtach feedback.

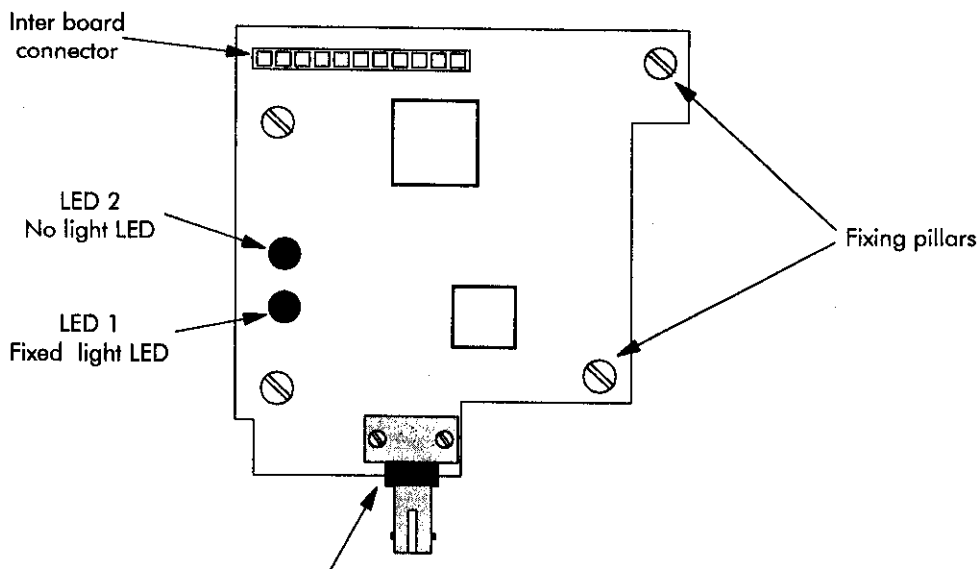
5901 UNIVERSAL RECEIVER CARD

Description

This card is designed to convert the glass fibre optic data into electrical data, suitable for pulse feedback applications on Eurotherm Drive products.

The card is suitable for mounting on a number of drive products, to provide accurate speed feedback.

The following diagram shows the layout of the universal receiver card.



The ST connector receives the fibre optic light from the 5901 at the other end of the cable. Mechanically, this connector is identical to that seen in the 5901.

Two LED's are provided which should normally be illuminated. LED 2 detects no light being received, and LED 1 detects a fixed light level. The fixed light level switch in the 5901 allows fixed light to be sent down the cable for measurement purposes. If fixed light is being sent, speed feedback is not possible and LED 1 will not be illuminated.

The card fixes to the drive control PCB using snap in pillars. The electrical interface is via an 11 way connector.

The card will usually be supplied and fitted to the appropriate drive product. If the card is supplied loose for any reason, great care must be taken in fitting to ensure that the connector pins are not bent, and the card is snapped fully home on the pillars.

Commissioning

Commissioning the receiver card is very straightforward, and has been outlined above.

Recommended Cable Systems

Two types of fibre cable are specified for use with the Microtach, and the following paragraphs provide the necessary detail. Other cables can be used, but no guarantees can be given as to transmission distance.

The manufacturers part numbers quoted are believed to be correct at the time of printing of this manual. Further information about the fibre optic systems can be obtained from the manufacturers given below.

62.5/125u Glass System

This is standard fibre optic communications cable, and is widely available.

Minimum transmission distance - 0m.

Maximum transmission distance - 150m.

System Manufacturer	Amp
Cable	Single light duty, part No. 502083-1 (a)
Min cable bend radius	45mm
ST Connector	Lightcrimp XTC No-Epoxy Part No. 504001-1
Termination kit	Part No. 503125-1

Note (a) - The glass fibre cable is available in different styles to suit the site environment. Multiple cables are also available.

200u Glass System

Due to the large cable diameter, this fibre cable is relatively simple to terminate, using the approved tool kit. The large diameter also allows a increased light coupling power to the cable, and an associated increase in maximum transmission distance.

Traditionally with glass fibre systems, the cables had to be terminated with the connectors, using a time consuming epoxy and polish method. This required skilled personnel to terminate cables. This 200u system allows connector termination without the need for epoxy and polishing techniques.

Minimum transmission distance - 0m.

Maximum transmission distance - 1000m.

System Manufacturer	Ensign Bickford
Cable	Single light duty part No. HCP-M0200T-006 (a)
Min cable bend radius	24mm
ST Connector	HCS crimp and cleave to suit cable Part No. CC-ST-230
Termination tool kit	Part No. TK6

Note (a) - The glass fibre cable is available in different styles to suit the site environment. Multiple cables are also available.

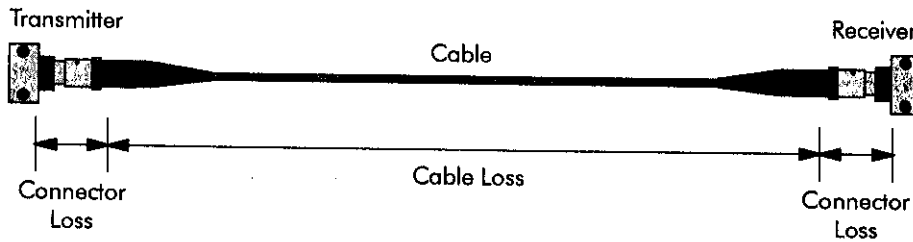
Fibre Optic System Losses

There are two types of cable specified for use with the Microtach, and this is described above. This section provides basic information for the user to specify other types of cable and connectors.

Unlike an electrical transmission system, the maximum transmission range of a fibre optic system is dependant on the various losses in the connectors and cable. These losses can be broken down into two main areas:-

- 1) Cable losses
- 2) Connector losses

These losses are shown in the following diagram



It can be seen that any simple fibre optic system has three main losses:-

- 1) Transmitter connector loss
- 2) Cable loss
- 3) Receiver connector loss

In general, the transmitter and receiver connector losses are the same. The cable loss is dependant on the type and length of cable being used. In order for the fibre optic system to work properly, the following equation must be obeyed:-

$$(\text{Min Transmit power in dBm}) - (\text{Losses in dB}) > (\text{Minimum receiver sensitivity in dBm})$$

Losses are generally specified in dB. Light power is generally specified in dBm, referred to 1mW of power. These units allow the above equation to be easily performed.

The minimum transmit power and receiver sensitivity are fixed within the design of the Microtach. This allows the maximum cable loss to be calculated, to obey the above equation.

The following table shows the maximum allowable losses for three sizes of cable. Note that the size of the cable determines the amount of light that can be coupled to the cable. The transmit and receive powers are fixed within the design of the Microtach.

Cable diameter	62.5/125µ cable	100/140µ cable	200µ cable
Min transmit power into cable (a)	-18.47 dBm	-14.4 dBm	-8 dBm
Min receive power	-25 dBm	-25 dBm	-25 dBm
Gives max allowable total loss ^(b) of	6.53 dB	10.6 dB	17 dB

Note (a) - Scaled from manufacturers data for 100/140µ cable. Here the minimum power into the cable is - 14.4 dBm

Note (b) - For both connector and cable losses.

It is not recommended to use smaller cable than 62.5/125µ. Here, the transmit power into the cable becomes unacceptably small.

The following table subtracts the connector loss for the two specified fibre optic systems. These losses are derived from manufacturers data. If other cable systems are used, this data should be used here.

Cable system	Amp 62.5/125 μ	200 μ HCS
Max allowable loss from above	6.53 dB	17 dB
Minus Loss safety factor ^(a)	5 dB	4.5 dB
Minus Transmit connector loss	0.5 dB	3 dB
Minus Receive connector loss	0.5 dB	3 dB
Gives max allowable cable loss of	0.53 dB	6.5 dB

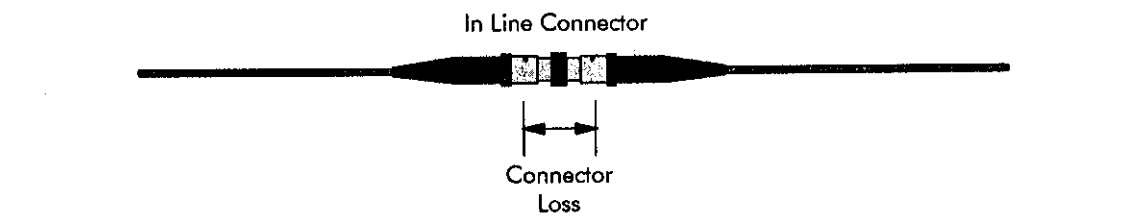
Note (a) - To allow for any unknown factors such as excessive bends in the cable and poor quality connector joints.

The following table shows the loss of the two types of specified cable at the Microtach transmitted wavelength of 850nm.

Cable system	Amp 62.5/125 μ	200 μ HCS
Cable Loss per 100 metres	0.35 dB	0.6 dB
Max cable length using above loss	150m	1083m

In line connectors

In line connectors are available for the ST system. These allow connection of fibre cables as shown in the diagram below



If these connectors are to be used, the extra loss introduced, must be subtracted from the total cable loss figures described in the above table.

590L SET-UP PARAMETERS

These set-up parameters refer to issue 3.1 software within the 590L controller.

All of these parameters are can be adjusted from the MMI.

OVERVIEW

The primary set-up 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 set-up parameters can be classified into two types:-

1. Value
2. Logic

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. (Note: If ALL 4 MMI keys are pressed simultaneously during power-up, then the default parameter set is loaded from EPROM (code memory) into RAM thereby by-passing the non-volatile EEPROM store).

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", press "M" to enter the main menus and then find the SET-UP PARAMETERS menu by operating the "RAISE" and "LOWER" arrow keys. The display will show:-

```
"MENU LEVEL"
"SET-UP PARAMETERS"
```

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

```
"SET-UP PARAMETERS"
"RAMPS"
```

i.e. it enters into the first sub menu.

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

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

```
"RAMPS"
"RAMP ACCEL TIME"
```

i.e. it enters into the first parameter of the sub menu.

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

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

```
"RAMP ACCEL TIME"
" X SECS"
```

i.e. it enters into the value or logic of the parameter of the sub menu.

At this level it is possible to modify the value of the parameter. The "RAISE" and "LOWER" arrow keys change the value displayed; the "E" key returns to the sub menu for selection of another variable. Repeated operation of the "E" key will return all the way back up to the "MENU LEVEL".

NOTE:

It is not possible to modify set-up parameters that are connected to LINK input slots during configuration. These parameters will change only if the information being sent to the slot changes.

The set-up parameters are specified with range and default values. Also specified is the corresponding LINK value range for that parameter. LINK values outside the range are clamped.

RAMPING THRESH.

Ramping flag threshold level. The threshold is used to detect whether the ramp is active as indicated by the "Ramping" Output.

Range: 0.00 to 100.00%
 Default: 0.50%
 Slot: 2253
 LINK Value Range: 0.0 to 100.00%

Ramping Definition

If (IRamp input - Ramp output) > Ramping threshold then Ramping is true

AUTO RESET

If Auto Reset is TRUE then the ramp is reset whenever System Reset is TRUE, that is each time the Speed / Current loop is unquenched.

System Reset is an internal flag that is set TRUE for one cycle after the Speed / Current loop is enabled i.e. every time the controller is started.

Range: ENABLED / DISABLED
 Default: ENABLED
 Slot: 206
 LINK Value Range: 1 / 0

EXTERNAL RESET

If External Reset is TRUE then the ramp is held in reset. External Reset does not depend on Auto Reset for its operation.

Range: ENABLED / DISABLED
 Default: DISABLED
 Slot: 207
 LINK Value Range: 1 / 0

Ramp Reset Definition

Ramp Reset = (System Reset AND Auto Reset) OR External Reset

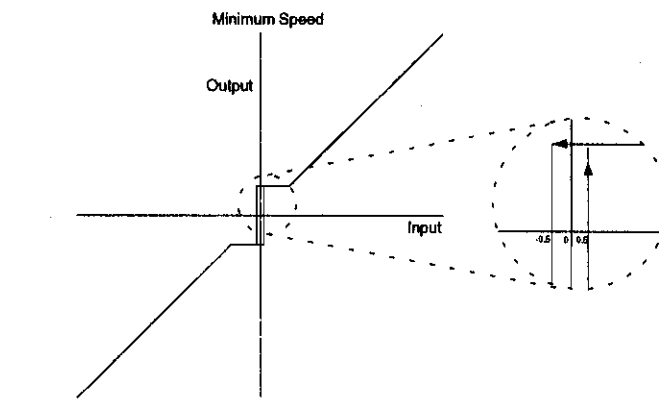
SPD. FBK. RESET

When enabled, the ramp is reset to the speed feedback value. This allows the controller to catch a spinning load smoothly ("bumpless transfer").

Range: ENABLED / DISABLED
 Default: DISABLED
 Slot: 208
 LINK Value Range: 1 / 0

MIN SPEED

The Minimum Speed Clamp is fully bi-directional and operates with a 0.5% hysteresis. This clamp operates on the input to the ramp and it can therefore be overridden by the RESET VALUE as far as the ramp output is concerned.



Range: 0.00 to 100.00%
 Default: 0.00%
 Slot: 2257
 LINK Value Range: 0.0 to 100.00%

SOFTWARE DIFFERENCES

This section describes the differences between various parameters in the 570L and 590L controllers.

Conversion utilities are available to allow conversion between existing 570L and 590L controllers.

Slot Differences between 570L and 590L software

Parameter Name	L570 Attributes	L590 Changes
Alarm Bit assignments	See later section	See later section
Current Demand Isolate	Slot 4048	Slot 4048 or slot 89
Current Loop I gain	0.1 to 50.0	0.0 to 200.0
Current Loop P gain	1 to 100	0.0 to 200.0
Analog Tach Cal	90% to 110%	0.9800 to 1.1000
Field Fail Alarm Enable	1 is alarm enabled	0 is alarm enabled
Armature Voltage Cal	95% to 110%	0.9800 to 1.1000
Digital Tach	-3000 to 3000 RPM	-6000 to 6000 RPM
Speed Feedback Select	Armature Volts /Analog Tach /Microtach	Armature Volts /Analog Tach /Encoder (a) /Encoder & Analog Tach
Encoder RPM Cal (utach)	0 to 3000 RPM	0 to 6000 RPM
Field EMF gain	0 to 5	0.00 to 100.00
Field EMF Lag	1 to 100	0.00 to 200.00
Field I Cal	90 % to 110 %	0.9800 to 1.1000
Field Loop I Gain	0 to 5	0.00 to 100.00
Field Loop P Gain	0 to 5	0.00 to 100.00
Field Quench Delay	0.1 to 250.0 seconds	0.0 to 600.0 seconds
Field Weakening Range	0.0:1.0 to 10.0:1.0	Deleted
Ramp Down (Decel) Time	0.1 to 250.0 seconds	0.1 to 600.0 seconds
Ramp Up (Accel) Time	0.1 to 250.0 seconds	0.1 to 600.0 seconds
Speed Loop I Gain	0 to 100	Deleted
Speed Loop P Gain	0 to 100	0.00 to 200.00
Program Stop Time	0.1 to 250.0 seconds	0.1 to 600.0 seconds
Program Stop Limit		0.0 to 600.0 seconds
Program Stop Zero Speed	0 % to 10 %	Deleted
Setpoint Ratio 1	0.0 to 5.0	0.0000 to 3.0000
Setpoint Ratio 2 (b)	0.0 to 5.0	0.0000 to 3.0000

Note (a) - Reference to "Encoder" implies either Microtach or Wire ended encoder, dependant on the option board fitted. See hardware differences above.

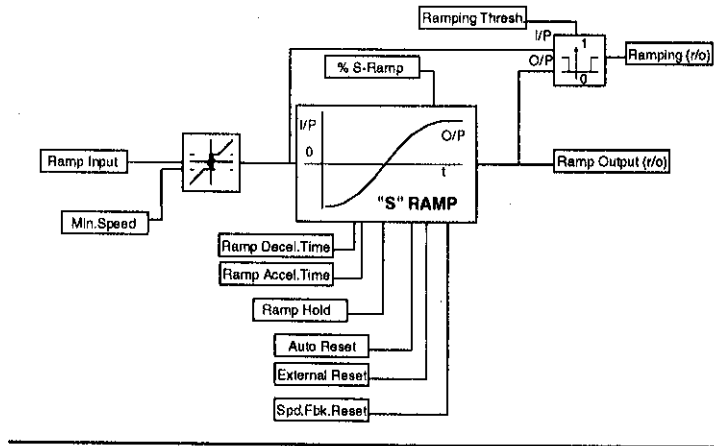
Note (b) - All references to Speed Input 2 on the LINK 570 have been changed to Speed Input 0 on the LINK 590. This includes all references to the input, including Sign, input setpoint, and ratio factor.

The default value corresponds to the actual parameter value within the controller. This is also the number that is displayed on the MMI.

All setup parameters can also be read by other LINK modules.

RAMPS

The following diagram shows the ramps block.



RAMP ACCEL TIME

Acceleration time [100% change]
 Range: 0.1 to 600.0 SECS
 Default: 10.0 SECS
 Slot: 2089
 LINK Value Range: 0.017 to 100.00%

RAMP DECEL TIME

Deceleration Time [100% Change]
 Range: 0.1 to 600.0 SECS
 Default: 10.0 SECS
 Slot: 2090
 LINK Value Range: 0.017 to 100.00%

RAMP HOLD

While TRUE the ramp output is held at its last value. This is overridden by Ramp RESET.
 Range: ON / OFF
 Default: OFF
 Slot: 113
 LINK Value Range: 1 / 0

RAMP INPUT

Main ramp input
 Ramp Input
 Range: $\pm 105.00\%$
 Default: 0.00%
 Slot: 2067
 LINK Value Range: $\pm 87.5\%$
 Note - 100% ramp input is equivalent to a LINK value of 83.333%

% S-RAMP

Percentage of ramp with S-shaped rate of change. A value of zero is equivalent to a linear ramp. Changing this value affects the ramp times.
 Range: 0.00 to 100.00%
 LINK Value Range: 0.0 to 100.00%
 Default: 5.00%
 Slot: 2252

RAMPING THRESH.

Ramping flag threshold level. The threshold is used to detect whether the ramp is active as indicated by the "Ramping" Output.

Range: 0.00 to 100.00%
 Default: 0.50%
 Slot: 2253
 LINK Value Range: 0.0 to 100.00%

Ramping Definition

If (IRamp input - Ramp output) > Ramping threshold then Ramping is true

AUTO RESET

If Auto Reset is TRUE then the ramp is reset whenever System Reset is TRUE, that is each time the Speed / Current loop is unquenched.

System Reset is an internal flag that is set TRUE for one cycle after the Speed / Current loop is enabled i.e. every time the controller is started.

Range: ENABLED / DISABLED
 Default: ENABLED
 Slot: 206
 LINK Value Range: 1 / 0

EXTERNAL RESET

If External Reset is TRUE then the ramp is held in reset. External Reset does not depend on Auto Reset for its operation.

Range: ENABLED / DISABLED
 Default: DISABLED
 Slot: 207
 LINK Value Range: 1 / 0

Ramp Reset Definition

Ramp Reset = (System Reset AND Auto Reset) OR External Reset

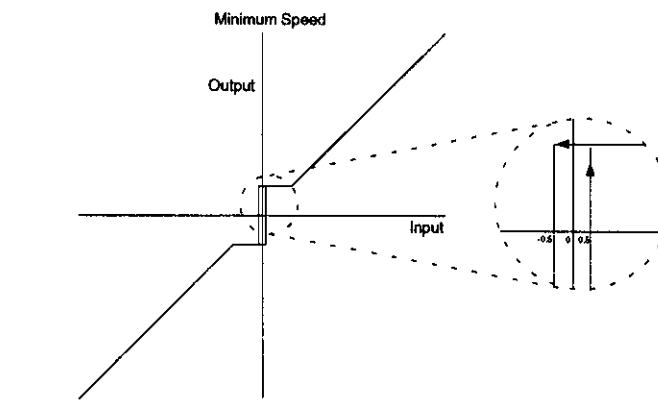
SPD. FBK. RESET

When enabled, the ramp is reset to the speed feedback value. This allows the controller to catch a spinning load smoothly ("bumpless transfer").

Range: ENABLED / DISABLED
 Default: DISABLED
 Slot: 208
 LINK Value Range: 1 / 0

MIN SPEED

The Minimum Speed Clamp is fully bi-directional and operates with a 0.5% hysteresis. This clamp operates on the input to the ramp and it can therefore be overridden by the RESET VALUE as far as the ramp output is concerned.



Range: 0.00 to 100.00%
 Default: 0.00%
 Slot: 2257
 LINK Value Range: 0.0 to 100.00%

AUX I/O**AUX START****AUX ENABLE**

These parameters are not used in the 590L controller.

FIELD CONTROL**FIELD ENABLE**

Field Enable unquenches field current loop.

Range: ENABLED/DISABLED

Default: ENABLED

Slot: 56

LINK Value Range: 1 / 0

FLD CTRL MODE IS

There are two field control modes:

- (a) Field Voltage Control is an open loop phase angle control to give a certain voltage output.
- (b) Field Current Control is a closed loop current control for accurate field control or expansion to field weakening.

Range: VOLTAGE OR CURRENT

Default: VOLTAGE CONTROL

Slot: 55

FLD VOLTAGE VARS**RATIO OUT/IN**

This parameter controls the output voltage from the open loop voltage control. The ratio is defined as the DC output voltage over the AC RMS input voltage.

Range: 0.00 to 100.00%

Default: 67.00%

Slot: 2115

LINK Value Range: 0.0 to 100.00%

FLD CURRENT VARS**SETPOINT**

Field current setpoint.

Range: 0.00 to 100.00%

Default: 100.00%

Slot: 2099

LINK Value Range: 0.0 to 100.00%

PROP. GAIN

This is the proportional gain adjustment of the field current PI loop.

Range: 0.00 to 100.00

Default: 0.10 (real gain = 10)

Slot: 2106

LINK Value Range: 0.0 to 100.00%

INT. GAIN

This is the integral gain adjustment of the field current PI loop.

Range: 0.00 to 100.00

Default: 1.28

Slot: 2105

LINK Value Range: 0.0 to 100.00%

FLD WEAK VARS

These parameters are within a sub menu under "FLD CURRENT VARS"

FLD. WEAK ENABLE

In certain applications of a DC motor controller high speeds can only be achieved by reducing the field current and therefore the resultant torque. This is termed as the Constant-Horsepower region or Field-Weakening region and the speed at which it begins is known as the Base Speed. The field weakening enable activates the additional motor back EMF PID loop for field weakening (field spillover) control.

Range: ENABLED/DISABLED
 Default: DISABLED
 Slot: 59
 LINK Value Range: 1 / 0

EMF LEAD

With field weakening control enabled a PID loop is brought into operation. This is the lead time constant adjustment of the field weakening PID loop.

Range: 0.10-50.00
 Default: 2.00 (real time constant = 200 msecs)
 Slot: 2108
 LINK Value Range: 0.0 to 100.00%

EMF LAG

This is the lag time constant adjustment of the field weakening PID loop.

Range: 0.00 to 200.00
 Default: 40.00 (real time constant = 4000 msecs)
 Slot: 2109
 LINK Value Range: 0.0 to 100.00%

EMF GAIN

This is the gain adjustment of the field weakening PID loop.

Range: 0.00 to 100.00
 Default: 0.30 (real gain = 30)
 Slot: 2110
 LINK Value Range: 0.0 to 100.00%

MIN FLD CURRENT

The field weakening loop reduces the field current to achieve speed control above base speed. At top speed the field reaches a minimum value. The Min Fld Current should be set below this minimum value to allow reasonable margin for transient control near the top speed but not lower than 6% as this could then cause the "Field Fail" alarm to operate.

Range: 0.00 to 100.00%
 Default: 10.00%
 Slot: 2112
 LINK Value Range: 0.0 to 100.00%

MAX VOLTS

Maximum volts is the voltage level at which field weakening begins. It is also known as "Spillover Bias". The default value is 100% of the nominal value as set by the calibration resistors and armature voltage calibration trim. For commissioning purposes this value can be set to another (lower) desirable level. Subsequently, it is advisable to return it to 100% for normalisation.

Range: 0.00 to 100.00%
 Default: 100.00%
 Slot: 2111
 LINK Value Range: 0.0 to 100.00%

BEMF FBK LEAD

This is the lead time constant of the back EMF feedback filter which is used for reducing armature voltage overshoots when accelerating fast through base speed.

Range: 10 - 5000
 Default: 100 (in msecs)
 Slot: 2231
 LINK Value Range: 0.0 to 50.00%

BEMF FBK LAG

This is the lag time constant of the above feedback filter. If the filter is active, the ratio of lead / lag should always be greater than 1 to give an overall lead action which reduces the voltage overshoot and less than, typically, 3 for stable control. The default values 100/100 = 1 cancel each other and make the filter inactive.

Range: 10 - 5000
 Default: 100 (in msecs)
 TAG N°: 2232
 LINK Value Range: 0.0 to 50.00%

FLD QUENCH DELAY

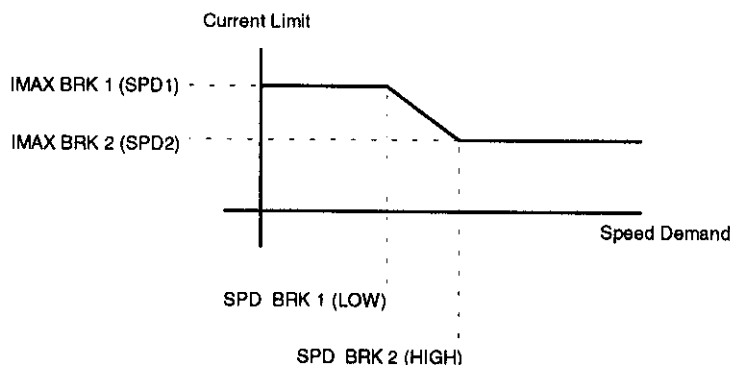
If dynamic braking is used the field must be maintained for a period after the controller is disabled. The field quench delay is the period of time which the field is maintained for.

Range: 0.0 to 600.0 SECS
 Default: 0.0 SECS
 Slot: 2114
 LINK Value Range: 0.0 to 100.00%

FLD. QUENCH MODE

After the field quench delay has expired, the field can be entirely quenched or put into a standby mode at 50% of rated current or volts depending whether in current or voltage control mode respectively.

Range: QUENCH/STANDBY
 Default: QUENCH
 Slot: 65
 LINK Value Range: 0 / 1

CURRENT PROFILE**SPD BRK 1 (LOW)**

When speed control is obtained by field weakening, the ability of the motor to commutate armature current is reduced at low field currents. Also some motors exhibit commutation limitations at higher speeds even with rated field current. Speed break-point 1 is the motor speed at which current limit profiling begins.

Range: 0.00 to 100.00%
 Default: 100.00%
 Slot: 2127
 LINK Value Range: 0.0 to 100.00%

SPD BRK 2 (HIGH)

Speed break-point 2 is the upper speed limit at which current limit profiling ends.

Range: 0.00 to 100.00%
 Default: 100.00%
 Slot: 2131
 LINK Value Range: 0.0 to 100.00%

IMAX BRK 1 (SPD1)

This sets the current limit value at or below speed break-point 1, provided the other current limits are greater than this setting.

Range: 0.00 to 200.00%
 Default: 200.00%
 Slot: 2135
 LINK Value Range: 0.0 to 100.00%

IMAX BRK 2 (SPD2)

This sets the current limit value at or above speed break-point 2, provided the other current limits are greater than this setting.

Range: 0.00 to 200.00%
 Default: 200.00%
 Slot: 2136
 LINK Value Range: 0.0 to 100.00%

INVERSE TIME PASSWORD

This sub menu requires the super-password (normally reserved for Eurotherm Drives personnel only) and changing any of these parameters may invalidate any warranty.

**Caution**

The inverse time characteristic allows the controller to supplied a limited time overload. This is designed to protect the controller only and not the motor.

AIMING POINT

Continuous overload limit level.

Range: 0.00 to 200.00%
 Default: 110.00%
 Slot: 2138
 LINK Value Range: 0.0 to 100.00%

DELAY

Time for which it will remain at 200%.

Range: 0.1 to 600.0 SECS
 Default: 10.0 SECS
 Slot: 2207
 LINK Value Range: 0.0 to 100.00%

RATE

Time to linearly reduce the overload current limit by 100%.

Range: 0.1 to 600.0 SECS
 Default: 60.0 SECS
 Slot: 2208
 LINK Value Range: 0.0 to 100.00%

STOP RATES**STOP TIME**

Time to reach zero speed from 100% set speed during normal stop.

Range: 0.1 to 600.0 SECS
 Default: 10.0 SECS
 Slot: 2226
 LINK Value Range: 0.0 to 100.00%

STOP LIMIT

Delay time limit to allow normal stop action (regenerative braking) to achieve zero speed before controller quench and coast stop. The timer is triggered by Start command (Slot 52) going low.

Range: 0.0 to 600.0 SECS

Default: 60.0 SECS

Slot: 2227

LINK Value Range: 0.0 to 100.00%

CONTACTOR DELAY

The Contactor Delay defines the time between the controller reaching "Stop Zero Speed" (Slot 2133) and the contactor being opened. This is particularly useful during a jog cycle to prevent multiple operations of the main contactor.

If the Stop Zero Speed is $\geq 0.25\%$ the controller will be quenched during the contactor delay.

The Contactor delay is overridden by Enable (Slot 38).

Maintain zero speed during contactor delay.

If the Stop Zero Speed is $< 0.25\%$ the controller will not be quenched until the Contactor Delay expires.

Range: 0.1 to 600.0 SECS

Default: 1.0 SEC

Slot: 2228

LINK Value Range: 0.0 to 100.00%

PROG STOP TIME

Time to reach zero speed from 100% set speed in program stop mode(A7 OFF)

Range: 0.1 to 600.0 SECS

Default: 0.1 SECS

Slot: 2132

LINK Value Range: 0.0 to 100.00%

PROG STOP LIMIT

Delay time limit to allow program stop action (regenerative braking) to achieve zero speed before controller quench and coast stop. The timer is triggered by Program Stop command (A7) going low.

Range: 0.0 to 600.0 SECS

Default: 60.0 SECS

Slot: 2229

LINK Value Range: 0.0 to 100.00%

PROG STOP I LIM

Main current limit level in program stop mode assuming current limit not overridden by I Profile or Inverse Time limits.

Range: 0.00 to 200.00%

Default: 100.00%

Slot: 2129

LINK Value Range: 0.0 to 100.00%

STOP ZERO SPEED

Zero speed level in program stop and normal stop modes at which the contactor delay timer starts timing-out. At the end of this delay the contactor is de-energised.

See also "Contactor Delay" above.

Range: 0.00 to 100.00%

Default: 2.00%

Slot: 2133

LINK Value Range: 0.0 to 100.00%

CALIBRATION

ARMATURE V CAL.

Trim adjustment of the motor armature volts to give exactly 100% at the required actual voltage value (e.g. 460V etc.).

Note:- Primary voltage calibration is achieved by the selection of resistors R8 and R9 on the calibration board.

Range:	0.9800 to 1.1000
Default:	1.0000
Slot:	2151
LINK Value Range:	89.00 to 100.00%

Note - Calibration 1.1 is equivalent to a LINK value of 100.00%. Other calibration values within the range use appropriately scaled LINK values. LINK values outside the range are clamped.

IR COMPENSATION

Compensation for motor IR drop to improve regulation when using armature voltage feedback as the speed feedback.

Range:	0.00 to 100.00%
Default:	0.00%
Slot:	2126
LINK Value Range:	0.0 to 100.00%

ENCODER RPM

Motor top speed setting when using encoder feedback.

Range:	0 to 6000 RPM
Default:	1000 RPM
Slot:	2150
LINK Value Range:	0.0 to 100.00%

ENCODER LINES

The Eurotherm Drives Microtach has 1000 lines per revolution as standard. Proprietary encoders of other specifications can be normalised by setting this parameter as appropriate.

Range:	10 to 5000
Default:	1000
Slot:	1129
LINK Value Range:	0.2 to 100.00%

ANALOG TACH CAL

Trim adjustment of the motor speed to give exactly 100% at the required actual speed value (e.g. 1500 RPM etc.).

Note:- Primary Tach calibration is achieved by the selection of resistors R6 and R7 on the calibration board.

Range:	0.9800 to 1.1000
Default:	1.0000
Slot:	2152
LINK Value Range:	89.00 to 100.00%

Note - Calibration 1.1 is equivalent to a LINK value of 100.00%. Other calibration values within the range use appropriately scaled LINK values. LINK values outside the range are clamped.

ANALOG TACH + CAL

Trim adjustment of the motor speed to give exactly 100% at the required actual speed value (e.g. 1500 RPM etc.) when the motor is rotating in the forward (Positive) direction.

Note:- Primary Tach calibration is achieved by the "ANALOG TACH CAL" parameter.

Range:	0.9800 to 1.1000
Default:	1.0000
Slot:	2279
LINK Value Range:	89.00 to 100.00%

Note - Calibration 1.1 is equivalent to a LINK value of 100.00%. Other calibration values within the range use appropriately scaled LINK values. LINK values outside the range are clamped.

ANALOG TACH -CAL

Trim adjustment of the motor speed to give exactly 100% at the required actual speed value (e.g. 1500 RPM etc.) when the motor is rotating in the reverse (Negative) direction.

Note:- Primary Tach calibration is achieved by the "ANALOG TACH CAL" parameter.

Range: 0.9800 to 1.1000

Default: 1.0000

Slot: 2280

LINK Value Range: 89.00 to 100.00%

Note - Calibration 1.1 is equivalent to a LINK value of 100.00%. Other calibration values within the range use appropriately scaled LINK values. LINK values outside the range are clamped.

ZERO SPD. OFFSET

If the speed feedback is not zero when the controller is stationary (possibly due to hardware offsets etc.) the setting of this parameter to the value of the offset will result in a zero reading from the speed feedback..

Range: $\pm 5.00\%$

Default: 0.00%

Slot: 2071

LINK Value Range: $\pm 100.00\%$

SPDFBK ALM LEVEL

The speed feedback alarm compares speed feedback to armature voltage. The alarm level is the threshold which the difference between the two signals should exceed for the alarm to activate.

Range: 0.0 to 100.0%

Default: 50.0%

Slot: 2158

LINK Value Range: 0.0 to 100.00%

STALL THRESHOLD

Stall comparator current feedback threshold level.

Range: 0.00 to 200.00%

Default: 95.00%

Slot: 2215

LINK Value Range: 0.0 to 100.00%

STALL TRIP DELAY

Stall comparator time-out delay before stall output becomes true.

Range: 0.1 to 600.0 SECS

Default: 10.0 SECS

Slot: 2216

LINK Value Range: 0.017 to 100.00%

OVERSPEED LEVEL PASSWORD

This sub menu requires the super-password (normally reserved for Eurotherm Drives personnel only).

**Caution**

The overspeed level allows the controller to trip if the speed feedback level exceeds a pre-defined level. Any further increase of this parameter will cause the trip to be inoperative. Overspeeds can cause severe damage to the motor.

Speed feedback level for overspeed alarm.

Range: 0.00 to 200.00%

Default: 118.00%

Slot: 2217

LINK Value Range: 0.0 to 100.00%

FIELD I CAL.

Trim adjustment of the motor field current to give exactly 100% at the required actual current value (e.g. 1.5 Amps etc.).

Note:- Primary field calibration is achieved by the selection of resistors R10 and R11 on the calibration board.

Range: 0.9800 to 1.1000
 Default: 1.0000
 Slot: 2154
 LINK Value Range: 89.00 to 100.00%

Note - Calibration 1.1 is equivalent to a LINK value of 100.00%. Other calibration values within the range use appropriately scaled LINK values. LINK values outside the range are clamped.

INHIBIT ALARMS**Caution**

The alarm trips are designed to trip the controller in the event of certain failure conditions. Disabling these trips could cause damage and may create a personnel hazard.

FIELD FAIL

Inhibits the field fail alarm.

Range: ENABLED/INHIBITED
 Default: ENABLED
 Slot: 91
 LINK Value Range: 0 / 1

LINK NETWORK

Inhibits LINK Network alarm.

Note, not yet implemented. Use slots 69, 70 and 115.

Range: ENABLED/INHIBITED
 Default: ENABLED
 Slot: 107
 LINK Value Range: 0 / 1

STALL TRIP

Inhibits the stall trip alarm from tripping the contactor out.

Range: ENABLED/INHIBITED)
 Default: INHIBITED
 Slot: 171
 LINK Value Range: 0 / 1

TRIP RESET

When this is FALSE the faults are latched permanently and the HEALTHY output remains inactive after toggling the Start input (Slot 52) off/on. The Trip Reset must then be set to TRUE for the faults to be reset and the HEALTHY output to go active (high) when Slot 52 goes low. This feature can be used in applications where the user wishes to reset the faults under his own control rather than automatically with the Start/Run command.

Range: TRUE/FALSE
 Default: TRUE
 Slot: 172
 LINK Value Range: 1 / 0

SPEED FBK ALARM

Inhibits the speed feedback alarm.

Range: ENABLED/INHIBITED
 Default: ENABLED
 Slot: 95
 LINK Value Range: 0 / 1

ENCODER ALARM

Inhibits the encoder option board alarm.
 Range: ENABLED/INHIBITED
 Default: ENABLED
 Slot: 174
 LINK Value Range: 0 / 1

CURRENT LOOP**Caution**

Most of these parameters are adjusted when an Autotune operation is performed. Further adjustment could cause damage to the controller or motor.

CUR. LIMIT/SCALER

Current limit scaler. It scales bipolar/unipolar clamps.
 Range: 0.00 to 200.00%
 Default: 100.00%
 Slot: 2081
 LINK Value Range: 0.0 to 100.00%

CURRENT LIMIT

Main current limit parameter.
 Range: 0.00 to 200.00%
 Default: 100.00%
 Slot:
 LINK Value Range: 0.0 to 100.00%

PROP GAIN

This parameter is set during the autotune.
 Proportional gain control for armature current PI loop. function.
 Range: 0.00 to 200.00
 Default: 45.00
 Slot: 2119
 LINK Value Range: 0.0 to 100.00%

INT. GAIN

This parameter is set during the autotune.
 Integral gain control for armature current PI loop. function.
 Range: 0.00 to 200.00
 Default: 3.50
 Slot: 2120
 LINK Value Range: 0.0 to 100.00%

AUTOTUNE

This is the autotune function trigger input.
 Range: ON/OFF
 Default: OFF
 Slot: 101
 LINK Value Range: 1 / 0

FEEDFORWARD

This parameter is set during the autotune.
 Feedforward gain. This parameter affects the performance of the adaptive algorithm.
 Range: 0.10 to 50.00
 Default: 2.00%
 Slot: 2121
 LINK Value Range: 0.0 to 100.00%

DISCONTINUOUS

This parameter is set during the autotune.

Discontinuous-to-continuous mean armature current boundary level. This parameter affects the performance of the adaptive algorithm.

Range: 0.00 to 200.00%
 Default: 12.00%
 Slot: 2122
 LINK Value Range: 0.0 to 100.00%

ADDITIONAL DEM

Additional current demand input.

Range: $\pm 200\%$
 Default: 0.00%
 Slot: 2116
 LINK Value Range: $\pm 100.00\%$

BIPOLAR CLAMPS

Select input for bipolar (asymmetric) or unipolar (symmetric) current clamps for the 4 quadrants of operation.

Range: ENABLED/DISABLED
 Default: DISABLED (i.e. unipolar clamps selected)
 Slot: 162
 LINK Value Range: 1 / 0

REGEN MODE

Select input for regenerative (4-quadrant) or non-regenerative (2-quadrant) mode of operation. If the stack is a 2-quadrant (only one thyristor bridge) this parameter should be set to Disabled. This parameter is factory set to suit the thyristor stack fitted within the controller.

Range: ENABLED / DISABLED
 Default: ENABLED
 Slot: 75
 LINK Value Range: 1 / 0

POS. I CLAMP

Positive current clamp in Bipolar Clamp mode.

Range: $\pm 200.00\%$
 Default: 100.00%
 Slot: 2069
 LINK Value Range: $\pm 100.00\%$

NEG. I CLAMP

Negative current clamp in Bipolar Clamp mode.

Range: $\pm 200.00\%$
 Default: -100.00%
 Slot: 2068
 LINK Value Range: $\pm 100.00\%$

Note on bipolar current clamps:

These clamps in bipolar mode can cross-over onto the same quadrant as long as the POS. I CLAMP is always greater (algebraically) than the NEG. I CLAMP.

I DMD. ISOLATE

Speed loop bypass; the current demand is taken from the "Current Demand" parameter (Slot 2080).

Range: ENABLED / DISABLED
 Default: DISABLED
 Slot: 4048 or Slot 89
 LINK Value Range: 1 / 0

SPEED LOOP

PROP. GAIN

Speed loop PI proportional gain adjustment.
 Range: 0.00 to 200.00
 Default: 10.00
 Slot: 2130
 LINK Value Range: 0.0 to 100.00%

INT. TIME CONST.

Speed loop PI integral gain adjustment.
 Range: 0.001 to 30.000 SECS
 Default: 0.500 SECS
 Slot: 2125
 LINK Value Range: 0.0 to 100.00%

INT. DEFEAT

Inhibits the integral part of the speed loop PI control to give proportional only control.
 Range: ON/OFF
 Default: OFF
 Slot: 76
 LINK Value Range: 1 / 0

ENCODER SIGN

Since the encoder feedback cannot be reversed electrically, the signal polarity can be reversed by the control software.
 Range: POSITIVE/NEGATIVE
 Default: POSITIVE
 Slot: 109
 LINK Value Range: 1 / 0

SPEED FBK SELECT

Four options are available:-
 0 - ARM VOLTS FBK
 1 - ANALOG TACH
 2 - ENCODER
 3 - ENCODER/ANALOG
 Range: 0 TO 3
 Default: ARM VOLTS FBK
 Slot: 108
 LINK Value Range: 0 to 3

The ENCODER/ANALOG option allows an increased controller speed loop performance, while maintaining digital accuracy. Here, a combination Tach / encoder must be used.

ADVANCED

Adaption

The adaptive features allow an increased controller response for certain types of load. The speed loop gain and integral constants can be changed dependant on adaptive breakpoints described below. A mode parameter allows different sources for the adaption stimulus.

Note - for most common types of motor load, the speed loop adaptive features are not necessary.

MODE

0 - Adaption Disabled
 1 - Speed Feedback Dependent adaption
 2 - Speed Error Dependent adaption
 3 - Current Demand Dependent adaption
 Range: 0 to 3
 Default: 0
 Slot: 210
 LINK Value Range: 0 to 3

SPD BRK 1 (LOW)

IF MODE = 1 Then BRK-points correspond to speed feedback.
 ELSE IF MODE = 2 Then BRK-points correspond to speed error.
 ELSE IF MODE = 3 Then BRK-points correspond to current demand.
 Range: 0.00 to 100.00%
 Default: 1.00%
 Slot: 2259
 LINK Value Range: 0.0 to 100.00%

SPD BRK 2 (HIGH)

Range: 0.00 to 100.00%
 Default: 5.00%
 Slot: 2260
 LINK Value Range: 0.0 to 100.00%

PROP. GAIN

Prop gain used below SPD BRK 1 (LOW)
 Range: 0.00 to 200.00
 Default: 5.00
 Slot: 2261
 LINK Value Range: 0.0 to 100.00%

INT. TIME CONST.

Integral time constant used below SPD BRK 1 (LOW)
 Range: 0.001 to 30.000 SECS
 Default: 0.500 SECS
 Slot: 2262
 LINK Value Range: 0.0 to 100.00%

Above SPD BRK 2 (HIGH) the normal gains (as per main menu above) prevail.
 Between the two break-points a linear variation of the gains is implemented.

I GAIN IN RAMP

While the "RAMPING" flag is TRUE the integral gain is scaled by I GAIN IN RAMP. This can be used to help prevent integral wind-up while the controller is ramping (particularly high inertia loads).

Range: 0 to 2.0000
 Default: 1.0000
 Slot: 2263
 LINK Value Range: 0.0 to 100.00%

POS. LOOP P GAIN

This parameter is not used. Do not adjust.

I COMP

This parameter is not used. Do not adjust.

ZERO SPD. QUENCH

Similar to Standstill logic (i.e. it stops making current but keeps the contactor in) except that the speed loop remains enabled and will cause the current loop to unquench very quickly.

ZERO SPD. LEVEL

The threshold for speed demand and speed feedback below which the quench will activate, providing the condition below is met as well.

Range: 0 to 200.00%
 Default: 0.50%
 Slot: 2266
 LINK Value Range: 0.0 to 100.00%

Definition

IF (Speed Demand AND Speed feedback) < ZERO SPD. LEVEL THEN quench.

ZERO IAD LEVEL

The threshold for current demand below which the quench will activate, providing the condition below is met as well.

Range:	0 to 200.00%
Default:	1.50%
Slot:	2267
LINK Value Range:	0.0 to 100.00%

Definition

IF (Current Demand) < ZERO IAD. LEVEL THEN quench.

NOTES**1) Speed Loop PI Output:**

The PI output is accessible via Slot 2102. This point is before the I Limit clamps and the summing of the additional current demand.

This Slot is not visible on the MMI.

2) Speed Loop PI with Current Demand Isolate:

The speed loop output is still valid (active) with Current Demand Isolate (Slot 4048, 89) ON.

3) The speed loop is still reset by unquenching the speed loop / current loop.

4) Current Demand Isolate is overridden by PROGRAM STOP.

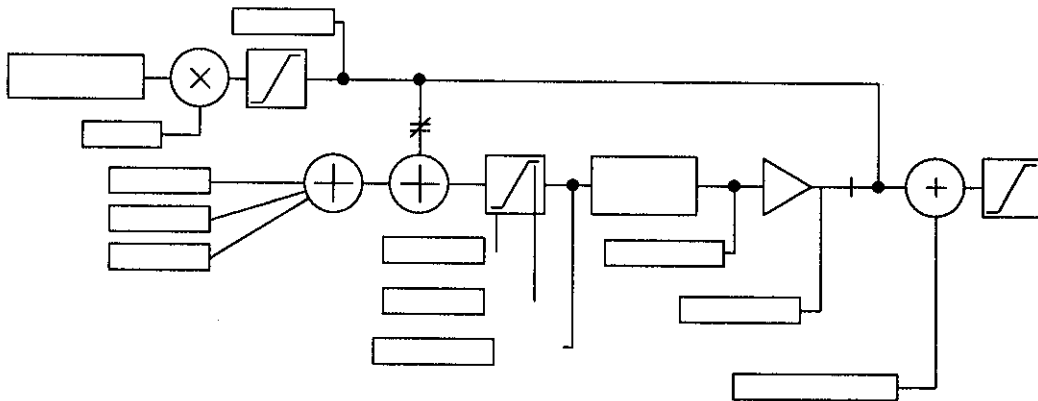
5) The speed loop PI is holding the integral term as soon as the PI output reaches current limit. This is true even in Current Demand Isolate mode where it may interfere depending on the way the speed PI is used. This feature currently is not suppressible.

SETPOINTS**105% Speed Demands:**

5% overspeed is built in to the speed set points. This allows some overspeed for external loop control purposes.

100% speed setpoint is equivalent to a LINK value of 83.333%. Therefore the maximum allowable LINK value is 87.5%.

All LINK speed setpoint values above this, are clamped at 87.5%.

**SETPOINT 1**

This is connected permanently to the setpoint sum output described below. This parameter cannot be adjusted from the MMI or over the LINK network.

Range:	± 105%
Default:	0.00%
Slot	N/A
LINK Value Range:	N/A

SIGN 2

Fast Speed Demand Input polarity.

Range: POSITIVE/NEGATIVE
 Default: POSITIVE
 Slot: 221
 LINK Value Range: 0 / 1

RATIO 2

Speed Setpoint 2 Ratio

Range: ± 3.0000
 Default: 1.0000
 Slot: 2270
 LINK Value Range: $\pm 100.00\%$

SETPOINT 2

This is connected permanently to the Speed Demand Fast Input described below. This parameter cannot be adjusted from the MMI or over the LINK network.

Range: $\pm 105\%$
 Default: 0.00%
 Slot: N/A
 LINK Value Range: N/A

SETPOINT 3

This is permanently connected to the Ramp Output as described above. This parameter cannot be adjusted from the MMI or over the LINK network.

Range: $\pm 105\%$
 Default: 0.00%
 Slot: N/A
 LINK Value Range: N/A

SETPOINT 4

Speed setpoint input

Range: $\pm 105\%$
 Default: 0.00%
 Slot: 2273
 LINK Value Range: $\pm 87.5\%$

MAX DEMAND

Maximum speed demand clamp

Range: 0 to 105.00%
 Default: 105.00%
 Slot: 2274
 LINK Value Range: 0.0 to 87.5%

MIN DEMAND

Minimum speed demand clamp

Range: -105.00 to 0%
 Default: -105.00%
 Slot: 2275
 LINK Value Range: 0.0 to -87.5%

STANDSTILL**STANDSTILL LOGIC**

Standstill Logic inhibits the controller at zero setpoint and zero speed, i.e. at standstill. The main contactor remains in and the "RUN" LED. remains ON.

Range: ENABLED/DISABLED
 Default: DISABLED
 Slot: 24
 LINK Value Range: 1 / 0

ZERO THRESHOLD

Threshold level which defines zero setpoint and zero speed diagnostic outputs and also controls the zero speed relay output.

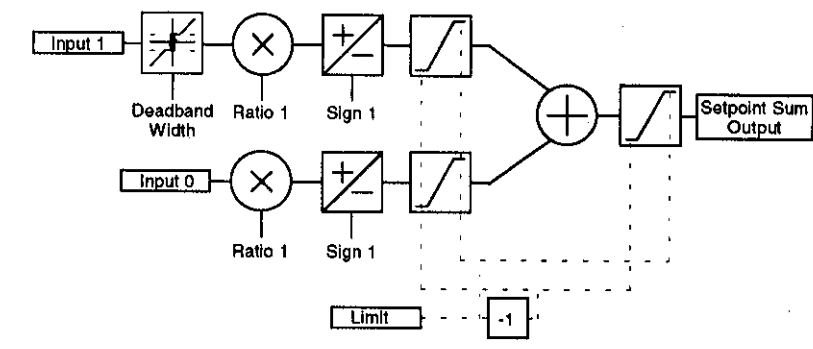
Range: 0.00 to 100.00%
 Default: 2.00%
 Slot: 2073
 LINK Value Range: 0.0 to 100.00%

SETPOINT SUM**105% Speed Demands:**

5% overspeed is built in to the speed set points. This allows some overspeed for external loop control purposes.

100% speed setpoint is equivalent to a LINK value of 83.333%. Therefore the maximum allowable LINK value is 87.5%.

All LINK speed setpoint values above this, are clamped at 87.5%.

**RATIO 1**

Input 1 speed setpoint scaling.

Range: ± 3.0000
 Default: 1.0000
 Slot: 2095
 LINK Value Range: $\pm 100.00\%$

RATIO 0

Input 0 speed setpoint scaling. This used to be Ratio 2 on the 570L

Range: ± 3.0000
 Default: 1.0000
 Slot: 2096
 LINK Value Range: $\pm 100.00\%$

SIGN 1

Analog input 1 polarity.

Range: POSITIVE / NEGATIVE
 Default: POSITIVE
 Slot: 99
 LINK Value Range: 1 / 0

SIGN 0

Input 0 polarity. This used to be sign 2 on the 570L

Range: POSITIVE / NEGATIVE
 Default: POSITIVE
 Slot: 100
 LINK Value Range: 1 / 0

DEADBAND WIDTH

Input 1 deadband width.
 Range: 0.0 to 100.0%
 Default: 0.0%
 Slot: 2234
 LINK Value Range: 0.0 to 100.00%

LIMIT

The setpoint Sum programmable limit is symmetrical and has the range 0.00% to 200.00%. The limit is applied both to the intermediate results of the RATIO calculation and the total output.

Range: 0 to 200.00%
 Default: 105.00%
 Slot: 2235
 LINK Value Range: 0.0 to 100.00%

INPUT 1

Input 1 value.
 Range: $\pm 105.00\%$
 Default: 0.00%
 Slot: 2065
 LINK Value Range: 0.0 to 87.5%
 Note - 100% speed setpoint is equivalent to a LINK value of 83.333%

INPUT 0

Input 0 value. This used to be Input 2 on the 570L
 Range: $\pm 105.00\%$
 Default: 0.00%
 Slot: 2066
 Note - 100% speed setpoint is equivalent to a LINK value of 83.333%
 LINK Value Range: 0.0 to 87.5%

LINK SUPPORT

The network support section of the MMI, allows the setup of the LINK network interface to be established. These parameters cannot be set from the MMI interface. They are set up via the LINK programming tools.

NETWORK ADDRESS

Address of the controller on the LINK network. This is set at configuration time, using the programming tools.
 Range: 1 to 3000
 Default: N/A
 Slot: N/A
 LINK Value Range: N/A

STOP ON NET FAIL

Specifies how the controller will respond, if a failure of the LINK network is detected.

Three options are available:-

0 - NO STOP

1 - REGEN STOP

2 - COAST STOP

Range: 0 to 2
 Default: REGEN STOP
 Slot: 115
 LINK Value Range: 0 to 2

STOP ON MODULE FAIL

Specifies how the controller will respond, if a failure of the controller is detected..

**Caution**

If the controller has suffered a failure, it may be incapable of performing the options specified below.

Three options are available:-

0 - NO STOP

1 - REGEN STOP

2 - COAST STOP

Range: 0 to 2

Default: REGEN STOP

Slot: 69

LINK Value Range: 0 to 2

STOP ON MODULE RCFG

Specifies how the controller will respond, during a reconfiguration of other modules on the LINK network..

**Caution**

Reconfiguring any LINK module when controllers are running, can present a damage and safety hazard.

Three options are available:-

0 - NO STOP

1 - REGEN STOP

2 - COAST STOP

Range: 0 to 2

Default: REGEN STOP

Slot: 70

LINK Value Range: 0 to 2

NODE TYPE

Specifies the LINK network node type of the controller. This can only be set up during configuration. The network type can be monitored only from the LINK network.

Three options are available:-

2 - SIMPLE

3 - TAPPED

7 - REDUNDANT

11- AUX TAP

Range: As specified

Default: SIMPLE

Slot: N/A

LINK Value Range: As specified

Refer to other LINK documentation about LINK network types.

PARAMETER SAVE

All the setup parameters are used from volatile memory when the controller is operating. This means that they are lost when the power is removed. In order for this not to happen, the parameters are saved to non-volatile memory before the power is removed.

The parameter save must be done when any setup parameter is changed on a permanent basis. The parameter save can be done from either the MMI keys, or over the LINK network using the LINK programming tools.

SAVE

This parameter forces parameter save.

It can have three values:-

0 - Not saving

1 - Requested to save

2 - Save operation failed

Range: 0 to 2

Default: 0

Slot: 30

LINK Value Range: 0 to 2

If the save is performed over the LINK network, slot 30 should be set to 1. This parameter will then set to either 0 or 2 upon completion. This can be read from the LINK network, to decide upon a suitable course of action.

NETWORK ACCESS

These parameters allow the display and key pad on the controller to adjust LINK variables outside the controller. They are useful where a LINK variable may have to be adjusted without using the LINK programming tools.

Outbound parameters

Connect to a LINK variable outside the controller.

Outbound parameter -> LINK variable

Allows the controller keypad to adjust a LINK variable.

Inbound parameter

Connected to from an external LINK variable.

LINK variable -> Inbound parameter

Allows the controller display to monitor an external LINK variable.

Two general types of network access parameters are available:-

Logic parameter

Value parameter

logic inbound parameters**Logic Parameter #1**

Controller display parameter

Range: TRUE/FALSE

Default: FALSE

Slot: 126

Logic Parameter #2

Controller display parameter

Range: TRUE/FALSE

Default: FALSE

Slot: 127

Logic Parameter #3

Controller display parameter

Range: TRUE/FALSE

Default: FALSE

Slot: 128

Logic Parameter #4

Controller display parameter

Range: TRUE/FALSE

Default: FALSE

Slot: 129

Logic Parameter #5

Controller display parameter
Range: TRUE/FALSE
Default: FALSE
Slot: 130

Logic Parameter #6

Controller display parameter
Range: TRUE/FALSE
Default: FALSE
Slot: 131

Logic Parameter #7

Controller display parameter
Range: TRUE/FALSE
Default: FALSE
Slot: 132

Logic Parameter #8

Controller display parameter
Range: TRUE/FALSE
Default: FALSE
Slot: 133

Logic Parameter #9

Controller display parameter
Range: TRUE/FALSE
Default: FALSE
Slot: 134

Logic Parameter #10

Controller display parameter
Range: TRUE/FALSE
Default: FALSE
Slot: 135

logic outbound parameters

Note, These parameters do not affect the display. If feedback to the display is required, an inbound parameter must be used, connected from the affected parameter.

Logic Parameter #1

Controller keypad parameter
Range: TRUE/FALSE
Default: FALSE

Logic Parameter #2

Controller keypad parameter
Range: TRUE/FALSE
Default: FALSE

Logic Parameter #3

Controller keypad parameter
Range: TRUE/FALSE
Default: FALSE

Logic Parameter #4

Controller keypad parameter
Range: TRUE/FALSE
Default: FALSE

Logic Parameter #5

Controller keypad parameter

Range: TRUE/FALSE

Default: FALSE

Logic Parameter #6

Controller keypad parameter

Range: TRUE/FALSE

Default: FALSE

Logic Parameter #7

Controller keypad parameter

Range: TRUE/FALSE

Default: FALSE

Logic Parameter #8

Controller keypad parameter

Range: TRUE/FALSE

Default: FALSE

Logic Parameter #9

Controller keypad parameter

Range: TRUE/FALSE

Default: FALSE

Logic Parameter #10

Controller keypad parameter

Range: TRUE/FALSE

Default: FALSE

Value Inbound parameters**Value Parameter #1**

Controller display parameter

Range: $\pm 100\%$

Default: 0%

Slot: 2164

Value Parameter #2

Controller display parameter

Range: $\pm 100\%$

Default: 0%

Slot: 2165

Value Parameter #3

Controller display parameter

Range: $\pm 100\%$

Default: 0%

Slot: 2166

Value Parameter #4

Controller display parameter

Range: $\pm 100\%$

Default: 0%

Slot: 2167

Value Parameter #5

Controller display parameter

Range: $\pm 100\%$

Default: 0%

Slot: 2168

Value Parameter #6

Controller display parameter
Range: $\pm 100\%$
Default: 0%
Slot: 2169

Value Parameter #7

Controller display parameter
Range: $\pm 100\%$
Default: 0%
Slot: 2170

Value Parameter #8

Controller display parameter
Range: $\pm 100\%$
Default: 0%
Slot: 2171

Value Parameter #9

Controller display parameter
Range: $\pm 100\%$
Default: 0%
Slot: 2172

Value Parameter #10

Controller display parameter
Range: $\pm 100\%$
Default: 0%
Slot: 2173

Value outbound parameters

Note, These parameters do not affect the display. If feedback to the display is required, an inbound parameter must be used, connected from the affected parameter.

Value Parameter #1

Controller keypad parameter
Range: $\pm 100\%$
Default: 0%

Value Parameter #2

Controller keypad parameter
Range: $\pm 100\%$
Default: 0%

Value Parameter #3

Controller keypad parameter
Range: $\pm 100\%$
Default: 0%

Value Parameter #4

Controller keypad parameter
Range: $\pm 100\%$
Default: 0%

Value Parameter #5

Controller keypad parameter
Range: $\pm 100\%$
Default: 0%

Value Parameter #6

Controller keypad parameter

Range: $\pm 100\%$

Default: 0%

Value Parameter #7

Controller keypad parameter

Range: $\pm 100\%$

Default: 0%

Value Parameter #8

Controller keypad parameter

Range: $\pm 100\%$

Default: 0%

Value Parameter #9

Controller keypad parameter

Range: $\pm 100\%$

Default: 0%

Value Parameter #10

Controller keypad parameter

Range: $\pm 100\%$

Default: 0%

OTHER INPUT SLOTS

These parameters are not accessible from the MMI.

PROGRAM STOP

This slot forces the controller to perform a program stop.

**Caution**

If the program stop is used as part of an emergency stop system, it is recommended to use the hardwired program stop input (Terminal A7). The LINK program stop may not operate if the network has failed. This could cause a safety hazard.

Range: TRUE/FALSE

Default: FALSE

Slot: 1122

LINK Value Range: 1 / 0

When this slot is set to TRUE (1), a program stop will take place.

SPEED DEMAND FAST INPUT

This speed demand input is sampled each Time the speed loop is executed. This equates to approximately every 3.3mS on a 50Hz supply. This is at least a factor of 2 faster sampling than the other speed inputs. This speed input should be used if a very high performance controller is required for external control loops.

Range: $\pm 105.00\%$

Default: 0.00%

Slot: 2085

LINK Value Range: 0.0 to 87.5%

Note - 100% speed setpoint is equivalent to a LINK value of 83.333%

CURRENT DEMAND

Direct current demand input.

Range: $\pm 200.00\%$
Default: 0.00%
Slot: 4048 or Slot 89
LINK Value Range: $\pm 100.00\%$

START

Main controller start.

While TRUE, this input pulls in the contactor and starts the controller (If "ENABLE" slot 38 is also TRUE)

Range: ON / OFF
Default: OFF
Slot: 52
LINK Value Range: 1 / 0

ARMATURE CURRENT QUENCH

Main controller enable.

While TRUE, this input allows armature current to pass. (If "START" slot 52 is also TRUE).

This input does not affect the controller start contactor.

Range: ON / OFF
Default: ON
Slot: 38
LINK Value Range: 1 / 0

590L ALARM BITS

The alarm bit word within the 590L is different to the same word within the 570L. The following table shows the 590L alarm bit allocation within the 16 bit health word:-

Description	Bit number
Speed Feedback Fail	1
Missing Pulse Alarm	2
Overspeed	3
Fin Overtemperature	4
Motor Overtemperature	5
Field Overcurrent	6
Tacho Fail	7
Microtach Alarm	8
Field Fail	9
Three Phase Present	10
Phase Lock	11
Armature Overvolts	12
LINK Network Fail	13
Overcurrent Trip	14
Calibration Board Missing	15
ACCT's not connected	16

APPENDIX B

1 590 "ALL-IN-ONE" POWER BOARD

REF: AH058426U002/U003

1.1 DESCRIPTION

A new 590 Power Board has been introduced that includes in one single PCB all the circuits of the previous split-in-three power board (referred to next as the "old" board), namely the power supplies, trigger and snubber circuits.

The salient differences between the two boards are described below.

1.1.1 Power Supplies and Fans

The power supplies for the controller are generated from the single-phase auxiliary supply via a direct-on-line SMPS operating over a wide voltage range of 110Vac to 240Vac +/-10% and frequency of 40Hz to 70Hz.

Therefore there is no need to make an auxiliary tap change as per "old" board.

However, on stacks fitted with fans, an appropriate choice of fan connections is still required (in series for 240V aux. or in parallel for 110V aux.) to fit the fan rating (110V).

There is also more power available from this supply up to 17W externally, i.e. in addition to powering the control electronics and the trigger pulses for the armature and field circuits.

1.1.2 Coding

Thyristor stack synchronisation and phase rotation signals are generated on the main power supply PCB rather than on a daughter board as before.

1.1.3 Fuses

There is only one 2A slow-blow fuse that protects the auxiliary circuits, varistors, contactor coil and fan circuits. The power supply is self-limiting and does not require a separate fuse as before with the "old" board.

1.1.4 Feedback Circuits

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.

(i) Armature Current Feedback

This is achieved by means of 2 (rather than 3 as per "old" board/chassis) ac current transformers with the third ac line current being derived from the measured two. The ac feedback is rectified and fitted with a selected burden to yield the desired voltage signal for a given current level as per "old" board.

(ii) Armature Voltage Feedback with DC Contactor

This is derived as before via a high-impedance differential amplifier. However, new "staging posts" EXA+ and EXA- have been added such that an external voltage measurement (e.g. from the motor terminals in the case of a DC contactor) can be brought in instead. To implement this, the fastons connected to A+ and A- should be moved to EXA+ and EXA- respectively AND the external connections also brought into EXA+ and EXA-.

1.1.5 Field Current Feedback

This is via a similar ACCT as before with the only difference that the ACCT is now mounted on the chassis rather than the power board and therefore it requires a two-pin plug for connection (plug PLL, see Drawing HC387068/9D).

1.2 CONTACTOR SUPPLY (See Circuit Diagram HJ387175D)

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 by default (as per "old" board). This is achieved (see Drawing attached) by a brown wire connection from "COIL LIVE" (F28) to "RELAY" (F25) and a blue wire connection from "COIL NEUTRAL(F21)" to "CONTACTOR RETURN(F26)". However, if an alternative supply is required for the contactor coil, then the brown wire should be "parked" to itself (F22) AND the blue wire should be moved from "COIL NEUTRAL(F21)" to "RELAY" (F25). Then the external coil supply can be switched via a volt-free contact between terminals D5 and D6.

1.3 EXTERNAL FIELD SUPPLY CONNECTIONS

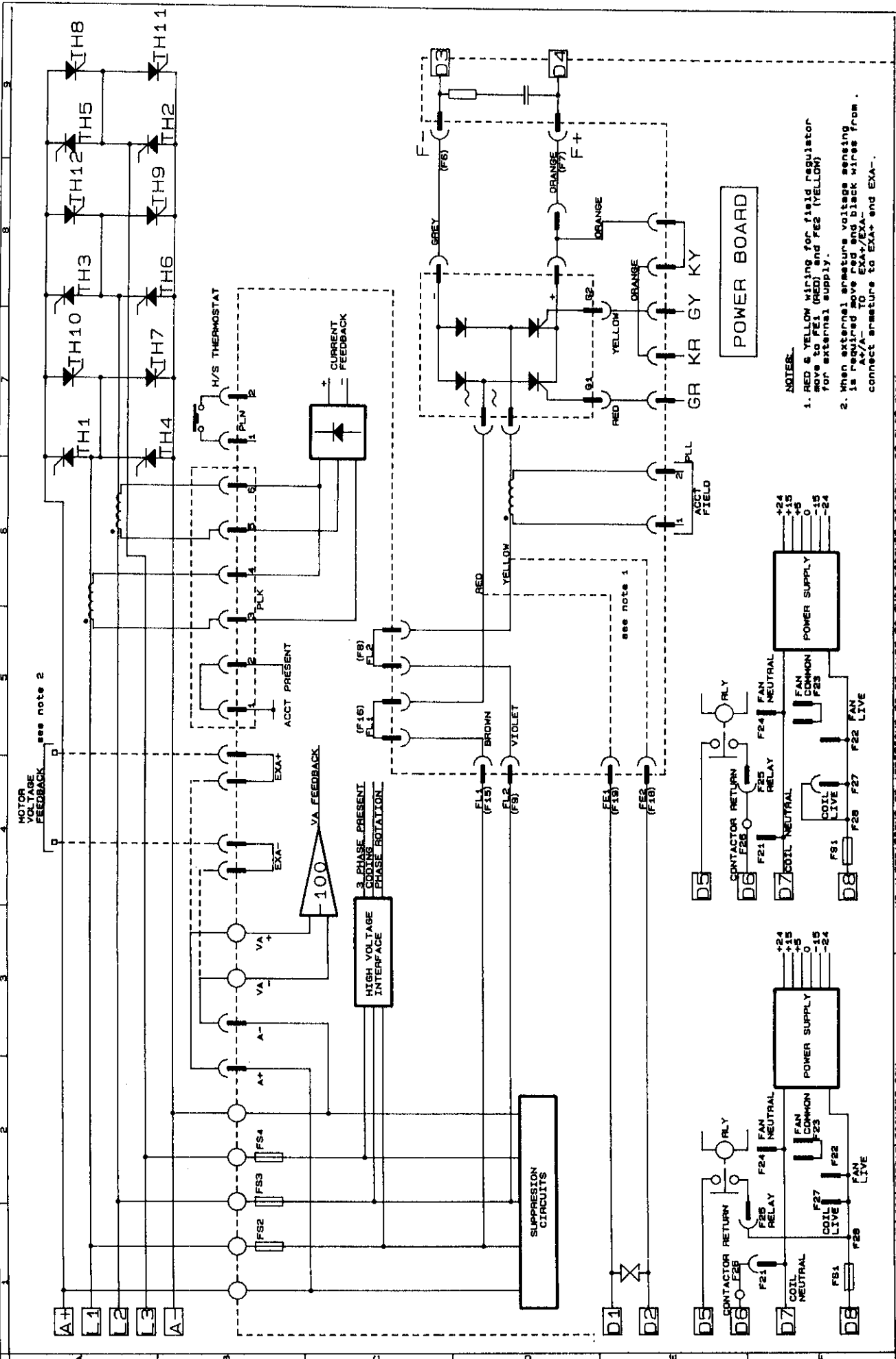
There are now two new "staging posts" FL1 and FL2 (F8 and F16) which act as the intermediate connection between L1, L2 and the integral field controller bridge (see Drawing attached). If an external field ac connection is required, then this should be brought into Terminals D1(line L1) and D2(line L2) AND the red and yellow faston wires should now be moved from FL2 (F8) and FL1 (F16) into FE1 (F19) and FE2 (F18) respectively.

1.4 TRIGGER PLUGS

There are new moulded plugs for the trigger connections to the thyristor gate/cathode terminals. This allows the trigger pulses to be removed from the thyristor pack end rather than the pulse transformer end as per "old" board. Otherwise the trigger circuits remain exactly the same.

1.5 COOLING FAN CONNECTIONS

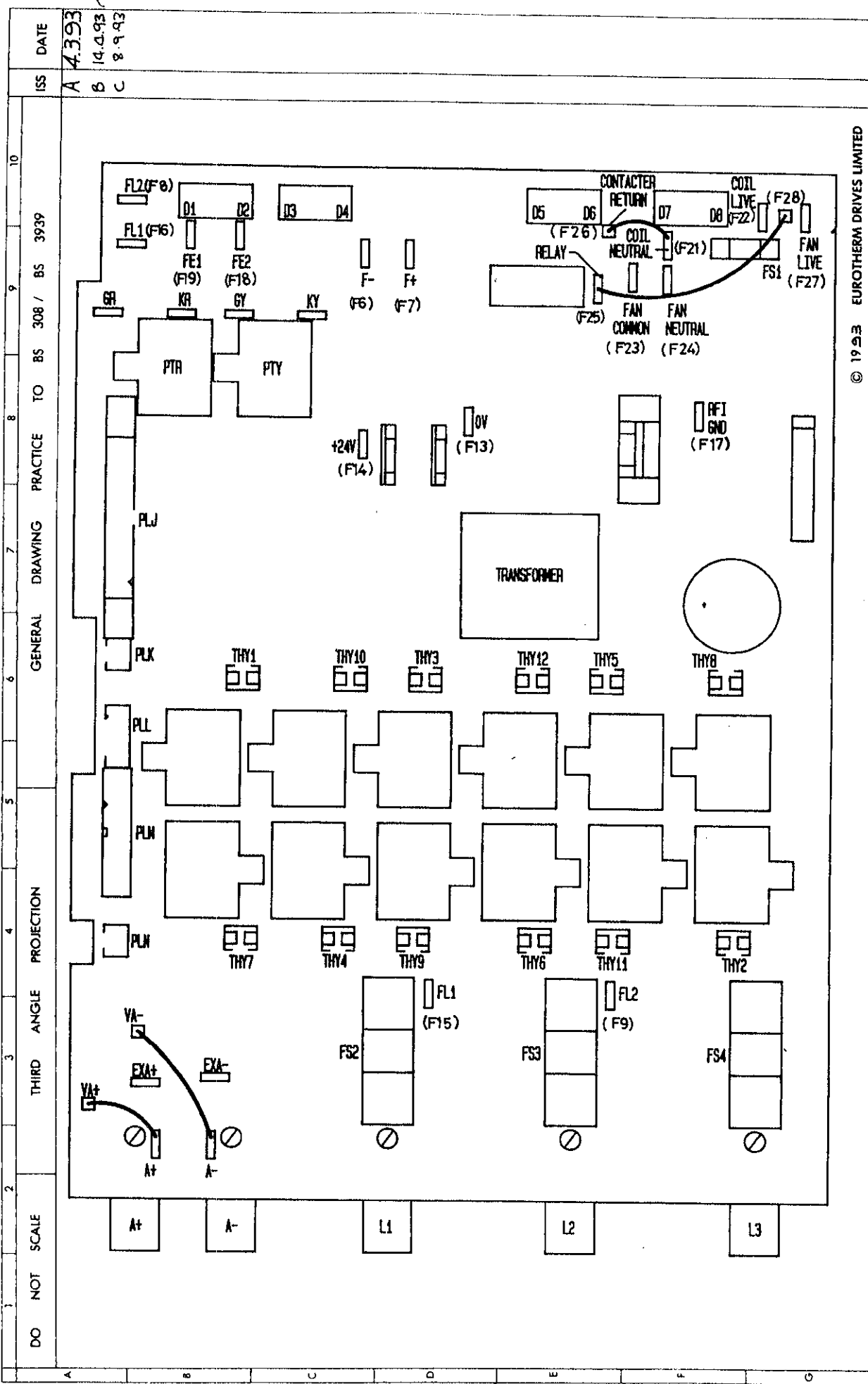
When the controller is fitted with heatsink cooling fans then these fans are connected to FAN LIVE (F27) FAN NEUTRAL (F24) and where appropriate FAN COMMON (F23). If the auxiliary supply is 110/115V and two cooling fans are fitted, the two fans are connected in parallel to FAN LIVE (F27) and FAN NEUTRAL (F24) and, similarly, if the auxiliary supply is 220/240V then the two fans are connected in series, the FAN COMMON (F23) providing the centre point. Where a single fan is used this is matched to the auxiliary supply and therefore always connected to FAN LIVE (F27) and FAN NEUTRAL (F24)



POWER BOARD

- NOTE:
1. RED & YELLOW wiring for field regulator move to FE1 (RED) and FE2 (YELLOW) for external supply.
 2. When external armature voltage sensing is required move red and black wires from A+/A- to EXA+/EXA- connect armature to EXA+ and EXA-.

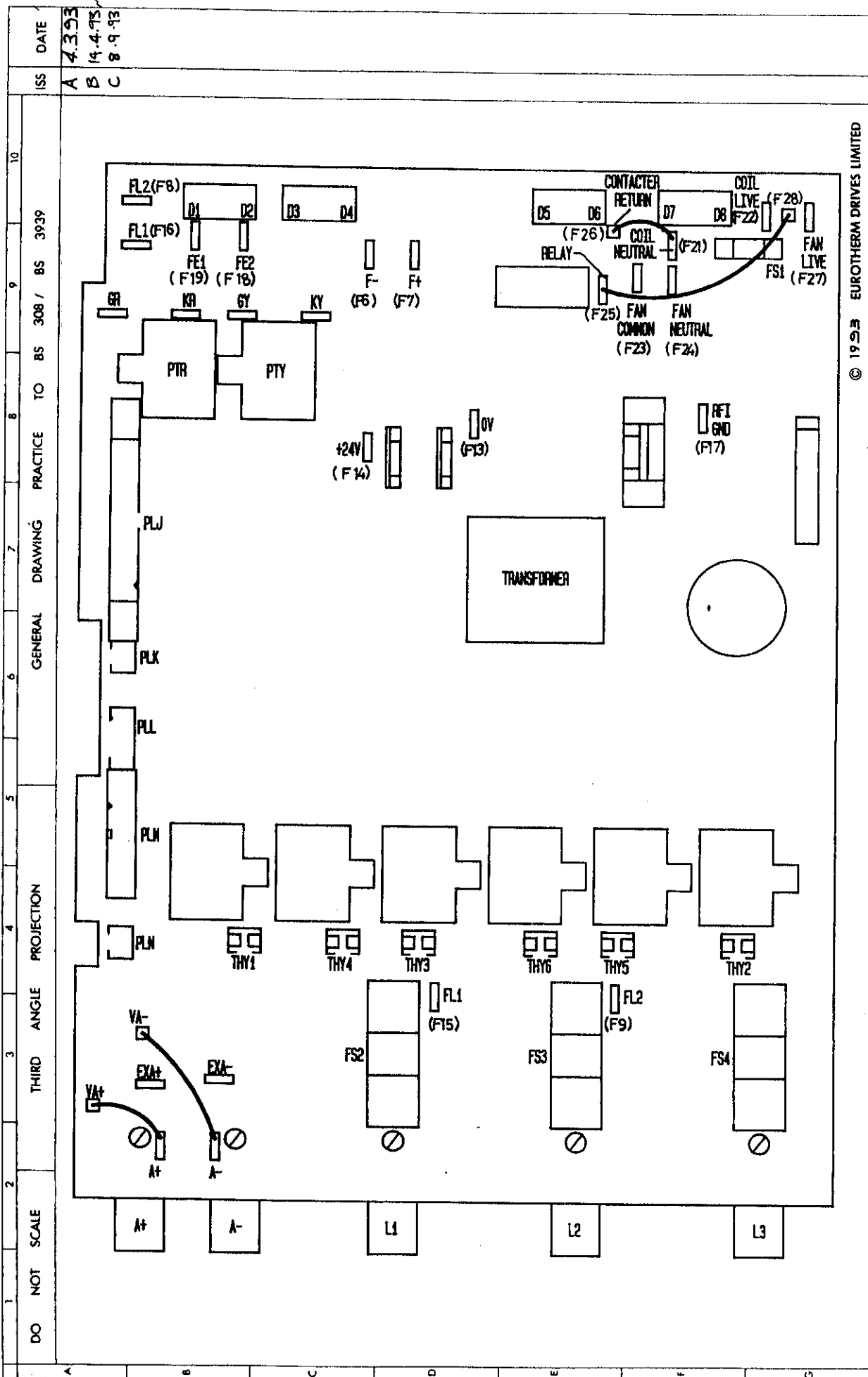
CAD FILENAME: P:\990\PCB\CAD\580WIRE.SCH		NO ALTERATIONS OR ADDITIONS TO BE MADE TO THIS CIRCUIT DIAGRAM. RE-PLLOT ONLY	
DRWN	SB	TITLE	4 QUAD PWR CIRCUIT DC CONTROLLER 35/70/110/150/180A (SINGLE Bd. CONSTRUCTION)
CHECKED	<i>[Signature]</i>	STD OR SMT	EUROTHERM DRIVES 19 93
DATE	04/09/93	DRAWING NUMBER	HJ387075 D
REV	01	SMT.	1
REV	02	OF	1
REV	03		
REV	04		
REV	05		
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REV	29		
REV	30		



ISS	A	DATE	4.3.93
	B		14.4.93
	C		8.9.93
GENERAL DRAWING PRACTICE TO BS 308 / BS 3939		TITLE POWER BOARD LAYOUT FOR 4Q	
ASSEMBLED ON 590		SCALE N.T.S.	
DIMS. IN M.M. APPLY OVER FINISH (EXCEPT FOR PAINT AND LACQUER)		DRAWING NUMBER HC387069D	
GENERAL TOLERANCE X ± 0.4 XX ± 0.2 XXX ± 0.1		SHT. 1 OF 1	
Holes: φ 7 mm 0.02 - 0.07		DATE 6/3/92	
DRAWN E. J. T.		ISSUE 2	
CHECKED <i>gpe</i>		ISSUE 2	
MATERIAL		K043008D	
FINISH		EUROTHERM DRIVES	

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14058361D ISSUE 2



DO NOT SCALE	THIRD ANGLE PROJECTION	GENERAL DRAWING PRACTICE TO BS 308 / BS 3939	ISS DATE
1	2	3	A 4.3.93
4	5	6	B 14.4.93
7	8	9	C 8.9.93
10			
ASSEMBLED ON 590 SCALE N.T.S. © 1993 EUROTHERM DRIVES LIMITED			TITLE POWER BOARD LAYOUT FOR 2Q
DIMS. IN M.M. APPLY OVER FINISH (EXCEPT FOR PAINT AND LACQUER)			DRAWING NUMBER HC3870680 SHT. 1 OF 1
GENERAL TOLERANCE = ± 0.4 XX = ± 0.2 XXX = ± 0.1 HOLES < ø 7 mm .002 ± 0.07			
MATERIAL DRAWN E.J.T. CHECKED <i>[Signature]</i>			
FINISH			

Product Type

590/7200 (4Q 720amp)

591/7200 (2Q 720amp)

Subject of enhancement

Power Board now updated to AH385621U001 (Sep 1995)

This item has been updated to include improvements including:

Surface Mount Technology

Revised SMPS (as 590/592)

Removal of Coding Module

Compatibility

This part does not allow upgrading of existing Power Board (AH055050/385128). Repair/Service of existing product will continue to use identical parts as originally fitted.

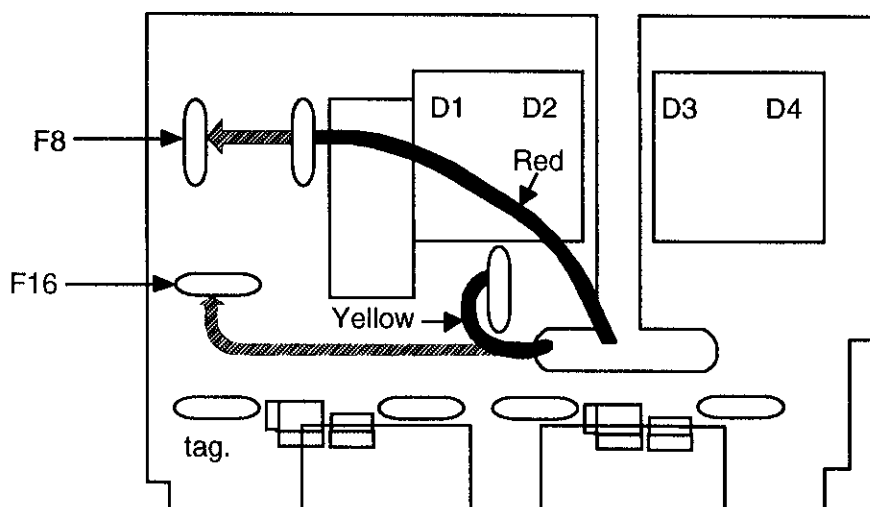
Additions to Technical Manual

Subject-External Supply Terminals D1 & D2

These terminals are used for the External AC Supply connection (for the Motor Field Supply) when the Internal AC Supply is unused. The following actions must be taken:

- 1) These terminals are now **energised** when "Internal Field Supply" option is used, and the 3 phase supply (L1/2/3) is energised. Protection is available via the on-board Field supply fuses FS2, FS3.
- 2) When utilising the "External AC Supply" connection, internal wiring links **must** be removed and connected to staging posts provided.
The internal wiring links (Red and Yellow) are identified by the following procedure
 - a) Isolate the Drive
 - b) Loosen control board fixing screws (2 off) and orientate control board to allow access to power board.
 - c) Identify internal field supply link (colour-Red) where it is connected by "Faston" at the left hand side of Terminal D1. Remove this link from the faston connection and place on staging post "F8" located to the left. *(To enable positive identification of the correct link, Faston F8 should now be connected to FS2, and L1. Verify by continuity test)*
 - d) Identify internal field supply link (colour-Yellow) where it is connected by "Faston" at the mid-point below terminals D1 & D2. Remove this link from the faston connection and place on staging post "F16" located to the left. *(To enable positive identification of the correct link, Faston F16 should now be connected to FS3, and L2. Verify by continuity test)*
 - e) The External Field Supply can now be connected via externally mounted fast acting 20 Amp fuses. *(Note that the phase of D1 must be derived from L1, and the phase of D2 must be derived from L2).*

POWER BOARD AH385621



2 UL LISTING

2.1 SCOPE

The 590 Product is both UL and C-UL listed. However, this authorisation only currently applies to the controllers in the current range 35A to 720A.

2.2 ADDITIONAL REQUIREMENTS

The Product has been listed subject to a number of additional requirements.

(i) Motor Overload

An external running motor overload protective device must be provided by the installer. However, the controller provides motor overload protection by means of a thermal device in the motor winding. This protection cannot be evaluated by UL hence it is the responsibility of the installer/and or the local inspector to determine whether the overload protection is in compliance with the National Electric Code or Local Code requirements.

(ii) Short Circuit Protection

Semiconductor fuses must be installed in the supply circuit to the controller to provide short-circuit protection. A range of suitable fuses is given in Table 4 on page 9. The semiconductor fuses are acceptable as Branch circuit short-circuit protection for the solid-state motor controllers only.

3 Phase Supply Capacity

These products are suitable for use on a circuit capable of delivering not more than (Table 1) RMS symmetrical amperes at 500 VAC maximum. As required by UL508 para 66.2 the specified fuse selection as defined on page 9 in Appendix B must be strictly adhered to in order to provide short circuit protection.

Table 1

PRODUCT	OUTPUT CURRENT	OUTPUT KW	POWER HP	SUPPLY CAPACITY RMS SYMMETRICAL AMPS
590/1	35	15	20	5,000
590/1	70	30	40	5,000
590/1	110	45	60	10,000
590/1	150	60	80	10,000
590/1	180	75	100	10,000
592/3	270	110	150	10,000
594/5	360	150	200	18,000
594/5	450	190	250	18,000
596/7	720	300	400	30,000

(iii) Grounding

The protective ground connection to the controller is indicated by the standard

IEC grounding symbol



2.3 TERMINALS

2.3.1 Tightening Torque

The following table should be referred to when making connections to the controller.

Table 2

PRODUCT	TERMINATIONS	MAXIMUM TIGHTENING TORQUE		
ALL	A1 -A9	M2.5	5-7 in.lb.	0.56-0.79 Nm
	B1 -B0	M2.5	5-7 in.lb.	0.56-0.79 Nm
	C1 - C9	M2.5	5-7 in.lb.	0.56-0.79 Nm
35 - 720 Amps	D1 - D8	M3	4 in.lb.	0.45 Nm
35 - 180 Amps	A+, A-, L1, L2, L3	M8	12.2 lb.ft.*	16.5 Nm*
	Ground	M6	5.0 lb.ft.	6.8 Nm
270 Amps	A+, A-, L1, L2, L3	M8	12.2 lb.ft.	16.5 Nm
	Ground	M6	5.0 lb.ft.	6.8 Nm
360 -450 Amps	A+, A-	M10	24.2 lb.ft.	32.8 Nm
	L1, L2, L3	M12	42.2 lb.ft.	57.2 Nm
	Ground	M10	24.2 lb.ft.	32.8 Nm
720 Amps	A+, A-	M10	24.2 lb.ft.	32.8 Nm
	L1, L2, L3	M14	67.1 lb.ft.	91.0 Nm
	Ground	M8	12.2 lb.ft.	16.5 Nm

* Note: M8 CHEESEHEAD SCREW, TIGHTENING TORQUE 8.1lb.ft. 11Nm

2.3.2 Terminations

UL/CSA Compression Lug Kits are available for the controllers which provide correct tooling as described in the Installation Instructions supplied with each kit.

The following terminal kits are available for the connection of Power cabling.

Table 3

Kit Part Number	Controller Rating	Number of Lugs	Purpose	Wire Size
LA386000U035	35 Amps	5	AC/DC	8 AWG (8.4 mm ²)
LA386000U070	70 Amps	5	AC/DC	4 AWG (21. 2 mm ²)
LA386000U110	110 Amps	3	AC	2 AWG (33.6 mm ²)
		2	DC	1/0 AWG (53.5 mm ²)
LA386000U150	150 Amps	3	AC	1/0 AWG (53.5 mm ²)
		2	DC	3/0 AWG (85 mm ²)
LA386000U180	180 Amps	3	AC	3/0 AWG (85 mm ²)
		2	DC	4/0 AWG (107.5 mm ²)
LA386000U240	240 Amps	10 *	AC/DC	1/0 AWG (53.5 mm ²)
LA386000U270	270 Amps	6 *	AC	1/0 AWG (53.5 mm ²)
		4 *	DC	2/0 AWG (67.5 mm ²)
LA386000U320	320 Amps	10 *	AC/DC	3/0 AWG (85 mm ²)
LA386000U450	450 Amps	6 *	AC	250kcmil (127 mm ²)
LA386000U450	450 Amps	4 *	DC	300kcmil (152 mm ²)
LA386000U720	720 Amps	10 *	AC/DC	600kcmil (304 mm ²)

* Note: On these kits 2 cables and lugs are required per terminal.

**AMERICAN STYLE FUSES
FOR USE WHERE COMPLIANCE TO UL STANDARDS ARE REQUIRED**

Table 4

HP	CONTROLLER RATING AMPT	THYRISTOR I ² T @		SEMICONDUCTOR FUSES		
		MAX. JUNCTION	25°C	RATING	I ² T	PART NO.
						LITTLEFUSE OR EQUIVALENT
20	35	800	1,100	40	1,000	L50S 40
40	70	8,000	11,000	80	5,000	L50S 80
60	110	8,000	11,000	125	10,000	L50S 125
80	150	15,000	20,000	175	20,000	L50S 175
100	180	15,000	20,000	175	20,000	L50S175
150	270	125,000	145,000	300	60,000	L50S 300
200	360	320,000	405,000	400	110,000	L50S 400
250	450	320,000	405,000	500	175,000	L50S 500
400	720	500,000	660,000	800	450,000	L50S 800

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APPENDIX C

EMC INSTALLATION GUIDELINES

Introduction

This section provides installation guidelines for drive modules and systems to maximise their 'Electro Magnetic compatibility' (EMC) in their intended operating environment. All installers must read this section and apply the advice which is relevant to their application. **Pass on this information to others as is appropriate.**

All power drive systems have the potential to produce electrical emissions, both radiated and conducted back into the AC supply. This is due to the inherent operation of all drives by switching large voltages and currents rapidly in order to control the motor. Because the drives internal control electronics operates continuously in very close proximity to the electrically noisy power switching elements, drives are inherently immune to any additional external electrical noise.

Great care has been taken in the design and selection of suitable EMC filters to provide the correct level of interface suppression, ease of installation and to ensure that electrical safety is not compromised. The EMC performance can only be guaranteed to be within the limits specified when the 590 drive modules are installed together with the recommended EMC filters and line chokes in accordance with the following instructions.

The subject of EMC is explored in more detail in a separate Eurotherm Application Manual entitled "EMC Installation Guidelines for Modules and Systems", part number HA388879, available from your local Eurotherm office.

EMC Filters to Reduce Line Conducted Noise

An EMC supply filter may be used with each 590 drive module to reduce the line conducted noise. For higher current product 300 amp filter modules will be used in parallel. The 590 range of industrial DC drives can be supplied with filters to meet the 'industrial' Class A EMC environment when used with the specified 2% minimum line chokes as listed below.

Table A - AC Supply Filter and Line Choke Part Numbers for Conformance with EN55011 Class A.

Eurotherm Product	Armature Current Rating	Eurotherm Filter Part No.	Eurotherm EMC Line Reactor
590 / A, D, L	35 Amp	1 off CO388965U035	CO463036
"	70 Amp	1 off CO388965U110	CO463037
"	110 Amp	1 off CO388965U110	CO463038
"	150, 180 Amps	1 off CO388965U180	CO463039
"	270 Amps	1 off CO389456	CO057960
"	360 Amps	1 off CO389456	CO057961
"	450 Amp	2 off CO389456	CO057962
"	720 Amp	2 off CO389456	CO057963
"	800 Amp	3 off CO389456	CO057963

Table B - AC Supply Filter Part Numbers for 'non CE marked' Product.

Eurotherm Product	Armature Current Rating	Eurotherm Filter Part No.	Line Choke Requirement
590 / A, D, L	950, 1100 Amps	3 off CO389456	2 % minimum, refer to Eurotherm Drives
"	1388 Amps	4 off CO389456	
"	1600, 1800 Amps	5 off CO389456	
"	2300 Amp	7 off CO389456	
"	2800 Amp	8 off CO389456	

Figure C.1 Filter Mounting Details Part No. CO388965U035 for 590 35amp

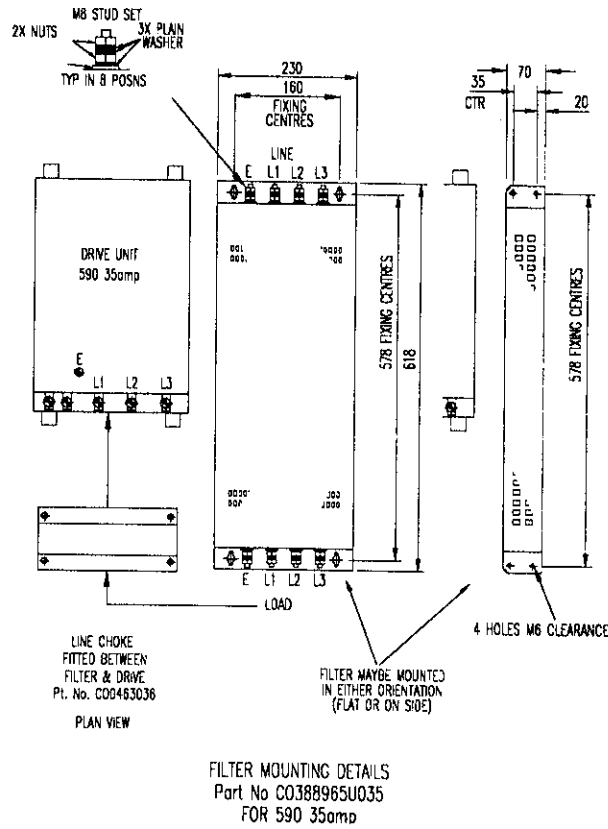


Figure C.2 Filter Mounting Details Part No. CO388965U110 for 590 70 & 110amp

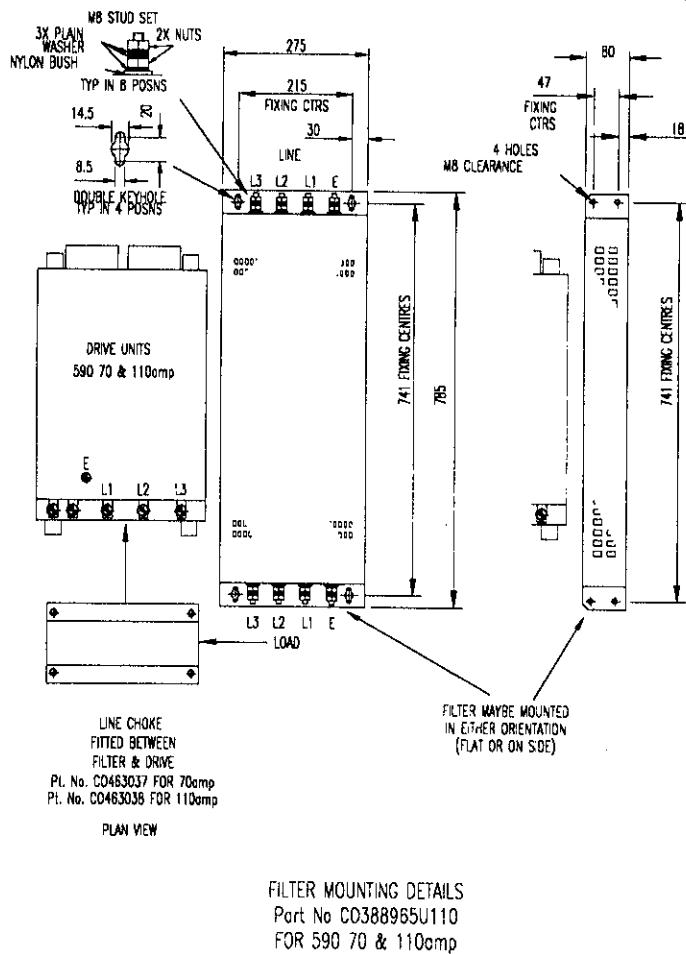
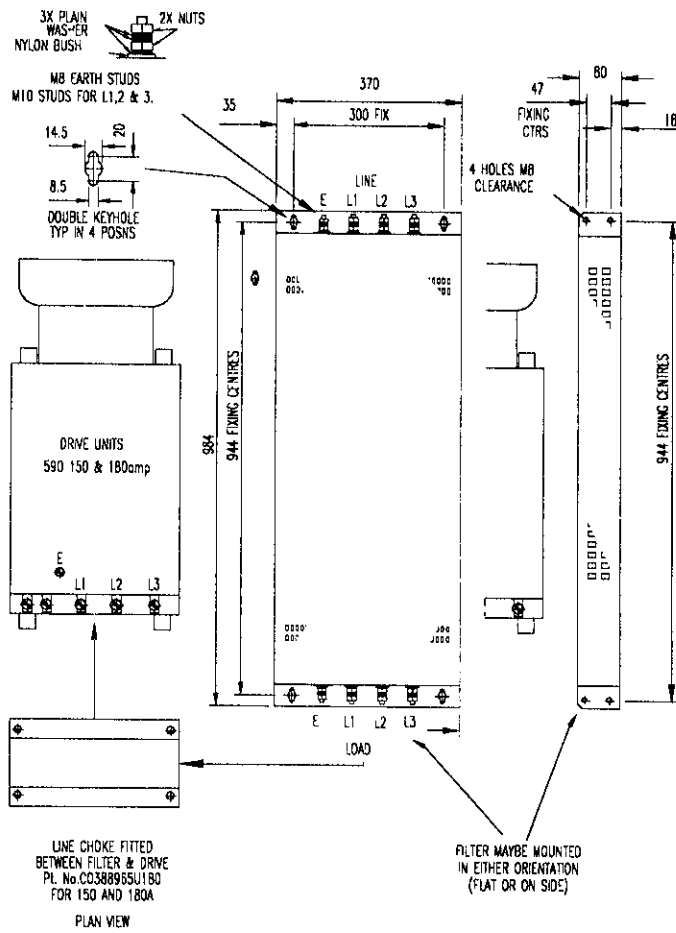
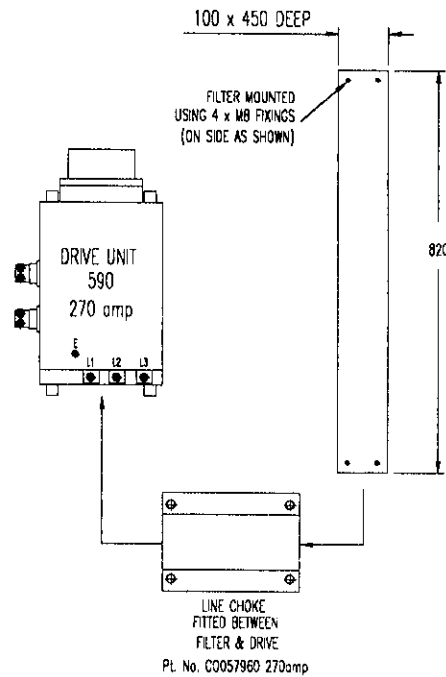


Figure C.3 Filter Mounting Details Part No. CO388965U180 for 590 150 & 180amp



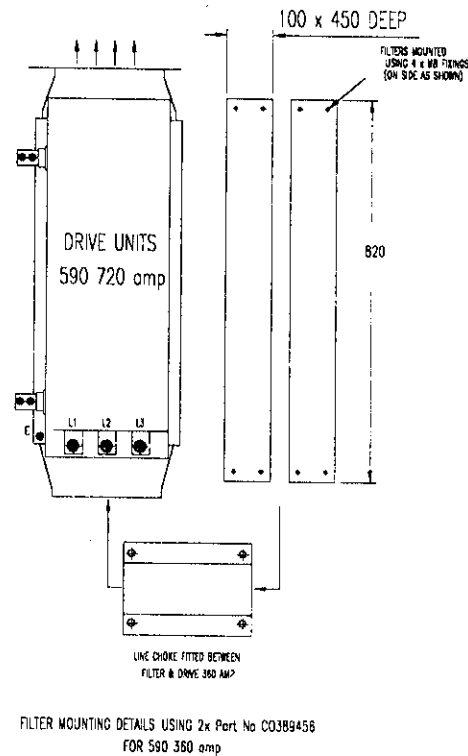
FILTER MOUNTING DETAILS
Part No CO388965U180
FOR 590 150 & 180amp

Figure C.4 Filter Mounting Details Part No. CO389456 for 590 270 amp



FILTER MOUNTING DETAILS
Part No CO389456
FOR 590 270amp amp.

Figure C.5 Filter Mounting Details using 2x Part No. CO389456 for 590 360amp



These filters and chokes may be mounted to the left, right, above, below or spaced behind the product, but can be mounted in two orientations i) flat against the wall or ii) projecting out from the wall, mounting arrangements are shown in figures C.1 - C.5. When filters CO389456 are mounted in parallel, they should be spaced 40mm apart for ventilation.

The CO389456 filter flying leads may reach 100°C under normal operating conditions and should be separated by at least one cable diameter and be adequately ventilated. Never bunch the leads together.

Note: For 590 drives the specified EMC line choke in table A or B must still be used between the 590 and its filter. This is to ensure reliability of both the filter and the drive.

The EMC filter and line choke should be mounted as close to the 590 drive module as possible. The connection between the 590, choke and filter must always be as short as possible taking care not to obstruct any ventilation spacing and be segregated from all other cables. If this cable/busbar exceeds 0.6m in length then it must be replaced with a screened/armoured cable, with the screen/armour earthed at both the filter, choke and inverter ends with large-area contact surfaces, preferably with metal cable glands. The routing of the cables/busbars between the filter, choke and drive module should be chosen to ensure their close proximity. Failure to achieve this will result in **increased conducted emissions**. The connection between the 590 drive module and the motor must be installed away from all other cables or wires. Ideally the filter and choke will be mounted onto the same metallic panel as the drive. The RF connection between the drive, filter and panel should be enhanced as follows:-

- Remove any paint/insulation between the mounting points of the EMC filter, choke and 590 drive module and panel.
- Liberally apply petroleum jelly over the mounting points and securing threads to prevent corrosion. alternatively conducting paint could be used on mounting panels.
- If the proceeding is not possible, then the RF earth bond between the filter and 590 drive module is usefully improved by making an additional RF earth connection using wire braid of at least 10 mm² cross sectional area (due to skin effect).

NOTE: Metal surfaces such as eloxized or yellow chromed e.g. with cable mounting or 35 mm DIN rails, screws and bolts have a high RF impedance which can be very detrimental for EMC performance.

A low RF impedance path must be provided between the motor frame and back panel on which the drive, choke and EMC filters are mounted. This low impedance RF path should follow the path of the motor cables in order to minimise the loop area. **Failure to do so will result in increased conducted emissions.**

This will normally be achieved by:-

1. Bonding the armour of the motor supply cables at one end to the motor frame and at the other to the cubicle back panel. Ideally 360° bonding is required, which can be achieved with cable glands.
2. Ensuring that conduit containing the motor supply cables are bonded together using braid. The conduit shall also be bonded to the motor frame and the cubicle back panel.

Care should be taken to ensure that the protective earth (PE) conductor exiting from the filter is connected to the protective earth connection of the choke and 590 drive module. Any additional RF earth such as a cable screen is **not a protective earth**. The EMC filter must be **permanently earthed** to prevent the risk of electric shock under abnormal operating instances (such as the loss of one phase of the AC supply). Permanent earthing can be achieved by either:

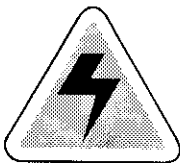
- Using a copper protective earth conductor of at least 10 mm² or
- Installing a second conductor in parallel connection with the protective conductor to a separate protective earth terminal.

Each conductor shall on its own meet the requirements for a protective earth conductor. On all recommended EMC filters two protective earth connections are provided for permanent earthing.

The recommended EMC filters are designed to operate from normal three-phases supplies which are balanced with respect to earth (earth referenced supplies). This minimises the earth leakage current due to the filter capacitors between phase and earth. On some specific customer sites the supply may not be balanced with respect to earth (non-earth referenced supplies). The earth leakage currents would increase and interfere with the operation of any earth-fault monitoring equipment. In addition the EMC performance of the filter will be degraded. Eurotherm Drives do not recommend the use of AC supply filters on non earth-referenced supplies.

As with all power electronic drives the conducted emissions increase with motor cable length. EMC conformance to the stringent limits is only guaranteed up to a cable length of 50. This length can be increased. Refer to Eurotherm Drives for more information.

If one EMC filter is to be used in an enclosure, then this filter should be mounted as close to the incoming AC supply to the enclosure as possible.



The CO389451 filter flying leads may reach 100°C under normal operating conditions. Leads should be separated to at least one cable diameter and adequately ventilated. **Never bunch leads together.**



IMPORTANT WARNINGS !

The recommended EMC filters are designed to work with supplies which are balanced with respect to earth (i.e. earthed referenced supplies). On some specific customer sites the supply may not be balanced with respect to earth. The recommended standard EMC filters are not recommended be used on such supplies. Refer to Eurotherm Drives for more information.

The EMC filters contain capacitors phase-to-phase and phase-to-earth. Discharge resistors are fitted, but the filters, terminals and wiring must not be touched for a period of 5 minutes after the removal of the AC supply. **Not adhering to this warning can result in electric shock.**

The EMC filter must only be used with a **permanent earth** connection using one of the following alternatives:

- a) Using a copper protective earth conductor of at least 10 mm² or
- b) Installing a second conductor in parallel with the protective conductor to a separate protective earth terminal on the filter or inverter. The conductor on its own shall meet the requirements for a protective earth conductor.

Refer to the following section regarding safety considerations with earth-fault detection systems.

Interaction With Earth-fault Monitoring Systems and Safety Considerations

Due to the EMC filter internal capacitors between phase and earth, on initial connection of the AC supply a pulse of current will flow in the earth. This has been minimised in the recommended EMC filters, but may still trip out any RCD (Resident Current Detector) in the earth system. In addition high frequency and DC components of earth leakage currents will flow under normal operating conditions. Under certain fault conditions, larger DC protective earth currents may flow. The protective function of some RCDs cannot be guaranteed under such operating

conditions. Eurotherm Drives do not recommend the use of RCDs, but where their use is mandatory, they should be capable of correct operation with DC and AC protective earth currents (such as type B RCDs as in amendment 2 of IEC755) and have adjustable trip amplitude and time characteristics, to prevent nuisance tripping on initial power connection. RCDs used with 590 drive modules and other similar equipment are **not suitable for personnel protection**. Another means of providing personal safety must be provided for, see prEN50178/VDE0160.

Minimising Radiated Emissions

All 590 drive modules can be made to comply with the most stringent radiated emission limits of EN55011 (1991) Class B by simply mounting inside an enclosure with 10 dB attenuation between 30 and 100 MHz (which would typically be the attenuation provided by a metal cabinet with no aperture greater than 0.15m) and screening any control and signal cabling outside of the enclosure. The control and signal cables should be terminated at the entrance to the enclosure. Outside of the enclosure all cables must be screened. Inside the enclosure the radiated magnetic and electric fields will be high, due to proximity, and any components fitted inside the enclosure must be sufficiently immune. Remember that the EN55011 radiated emission measurements are made between 30 MHz and 1 GHz in the far field, at a distance of between 10m and 30 m. No limits are specified lower than 30 MHz, or in close proximity. Emissions from individual components tend to be additive.

The cable between the enclosure and the motor must be screened or armoured (both field and armature) and should also contain the motor protective earth connection. The screen/armour must be earthed at both ends by connecting it to both the motor frame and the entrance to the cubicle, ideally in 360° termination's via cable glands (to meet the most stringent emission requirements). Screen to earth connections via 360° bonding is 75% more effective than earthing via pigtailed (Note some motor gland boxes and conduit glands are made of plastic, if this is the case then braid must be connected between the screen and the chassis, in addition at the motor end ensure that the screen is electrically connected to the motor frame since some terminal boxes are insulated from the frame by gasket/paint). Often the screens are terminated on a power screen rail at the entrance to the enclosure using 'u' clips to achieve a near 360° screen band. The integrity of the screen must be maintained over the entire length of the cable between the enclosure and motor. If the cable is broken to insert terminals, contactors, chokes, fuses etc., then the screen must be connected over the shortest possible distance. Note some hazardous area installations may preclude direct earthing at both ends of the screen, in this case earth the other end via a 1 μ F, 50VAC capacitor. The motor protective earth should be connected to the drive module motor protective earth connection.

If a shielded cable is not available, lay unshielded motor cables in a metal conduit which will act as a shield. The conduit must be continuous with a direct electrical contact to the drive module and motor housing. If links are necessary, use braid with a minimum cross sectional area of 10 mm².

Safety earthing always takes precedence over EMC earthing.

The use of screened cable without an EMC filter is not recommended, as line-conducted interference will increase substantially and the capacitive coupling of the output cable to earth will result in high earth-leakage currents.

To ensure the correct operation of the 590 drive module, some control and signal cables (encoder, all analogue inputs and communications) have to be screened back to the drive terminals inside the enclosure. The screen integrity must be continuous right back to the drive if not connected to the cubicle. Always minimise the length of screen stripped back to make this connection. The screen should only be connected at the drive end. If high frequency noise is still a problem, earth at the non drive end via a 0.1 μ F capacitor.

Screening and Earthing When Mounted in an Enclosure

Make sure the requirements of EN60204 are adhered to with electrical equipment for machines. Satisfactory EMC performance is only achievable when the 590 drive module, filter, choke and associated equipment is mounted on a conducting metal mounting panel. Beware of constructions using insulating mounting panels or undefined mounting structures. A single point earthing strategy should be followed as closely as possible for a single drive module mounted in an enclosure as shown in figure C-6. The protective earth connection (PE) to the motor must run inside the screened cable between the motor and 590 drive module, where it is to be connected near to the motor protective earth terminal on the drive module as shown in figure 4-6. (Note in accordance with EN60204 only one protective earth conductor is permitted at each earth terminal contacting point). Local wiring regulations may require the protective-earth connection of the motor to be connected locally but this will not cause shielding problems due to the relatively high RF impedance of the local earth connection.

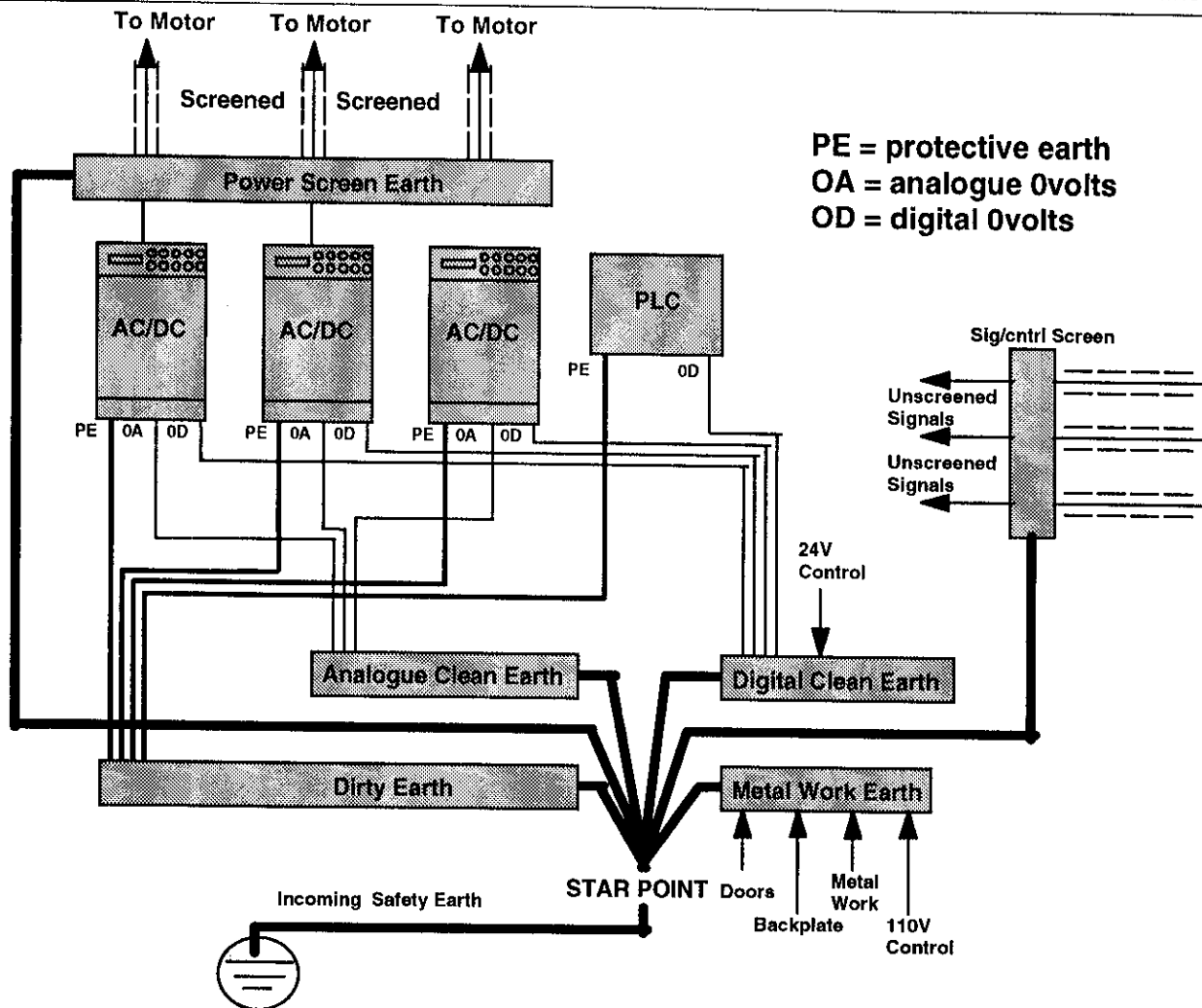


Fig. 4-7: Implementation of star-point earthing policy for multi-drive installation

Other Layout Considerations

The proximity between the source and victim circuit has a large effect on radiated coupling. The electromagnetic fields produced by drive modules falls off rapidly with distance from the cabling/enclosure. It should be remembered that the radiated fields from EMC compliant drive systems are measured at least 10m from the equipment over the frequency band 30 to 1000 MHz (as required by EN55011, referenced by the generics and the drive product specific standard). Any equipment placed closer to the drive system than this will see larger magnitude fields, particularly very close to the drive. No magnetic/electric field sensitive equipment should be placed within 0.25m of the following parts of a drive system:

- 590 Drive module
- EMC output filters
- Input or output chokes/transformers
- Cable between 590 Frequency Inverter and Motor (even when screened/armoured)
- Connections to external braking chopper and resistor (even when screened/armoured)
- AC/DC brushed motors (due to commutation)
- DC link connections (even when screened/armoured)
- Relays and contactors (even if they are suppressed)

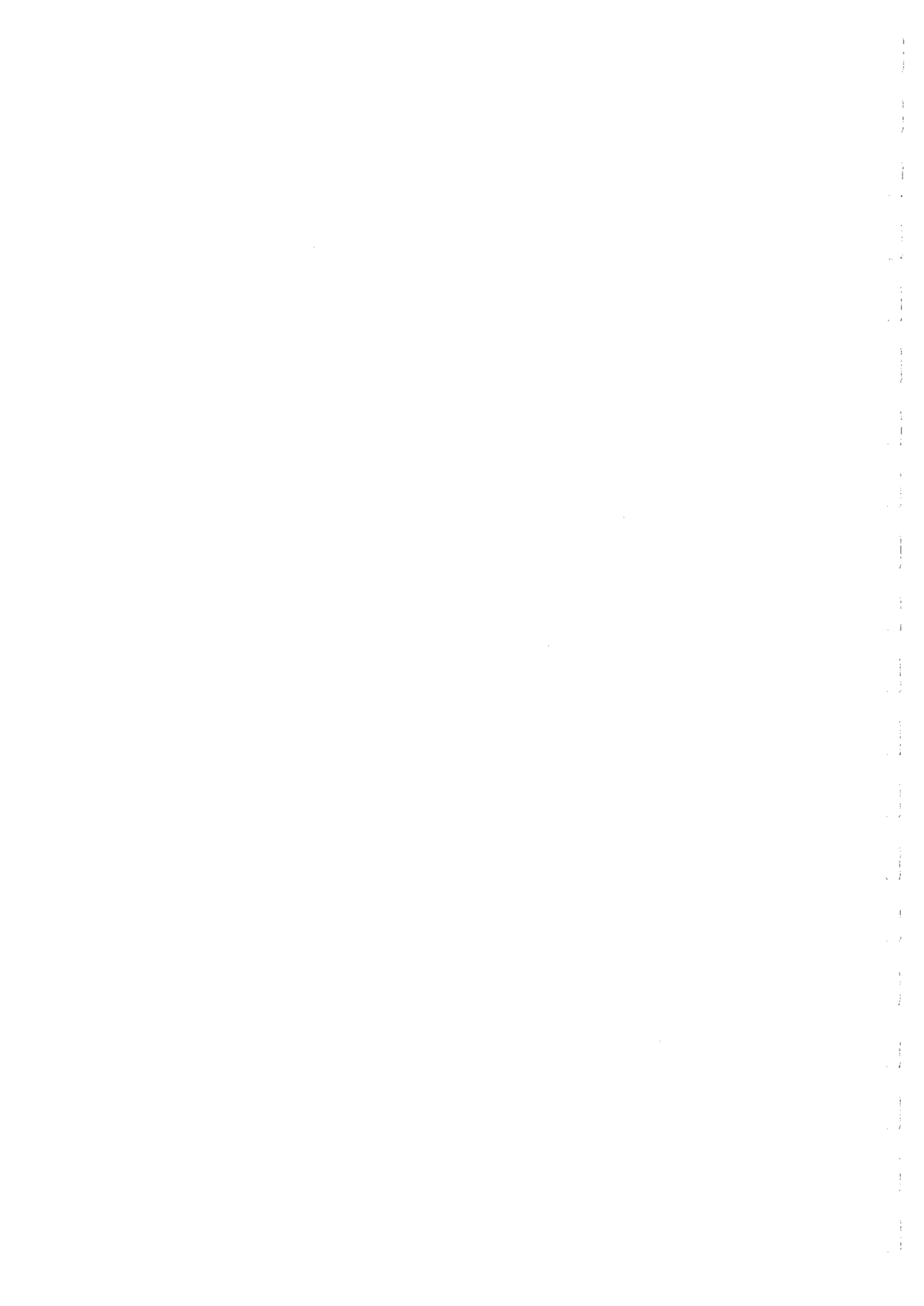
Often the coupling between electrically 'noisy' and 'sensitive' cables is a problem. This can be minimised by separating parallel runs by at least 0.25m, and minimising the length of parallel runs. For long parallel runs (>10 m) the separation should be increased proportionally. For example if the parallel runs were 50 m then the separation would be $(50/10) \times 0.25 \text{ m} = 1.25 \text{ m}$.

In addition the coupling between two cables which must cross is minimised if they cross over at 90°. Hence sensitive cables should cross the cables to the motor, DC link and braking chopper circuit at 90°, and should never be run close to them or in parallel for any great length.

Never run supply, DC link or motor cables in the same bundle as the signal/control and feedback cables, even if they are screened.

From experience the following equipment is defined as particularly sensitive and care must be taken in the installation:

- Any transducers which produce low level analogue outputs (<1 volt) e.g. load cells, strain gauges, thermocouples, piezoelectric transducers, anometers, LVDT's
- A.M. radios (long and medium wave only)
- Video cameras and closed circuit TV
- Office personal computers
- Capacitive devices such as proximity sensors and level transducers
- Mains borne communication systems
- Equipment not suitable for operation in the intended EMC environment i.e. with insufficient immunity to new EMC standards



APPENDIX D

THE EUROPEAN DIRECTIVES AND THE 'CE' MARK

CEMEP

Until recently each European drives manufacturer and importer has been interpreting the EMC directive and 'CE' marking requirements differently. This has led to considerable confusion and frustration in the market place. To provide a unified approach, the European machines and drives manufactures, via their national trade associations have formed the 'European Committee of Manufacturers of Electrical Machines and Power Electronics', termed CEMEP. This committee has produced a document entitled "Recommendations for Application of Power Drive Systems (PDS), European Council Directives - CE Marking and Technical Standardisation", which will be followed by all major European Drives manufacturer. A copy is available from your local trade association or from your local Eurotherm Drives office.

EMC DIRECTIVE

'CE' EMC responsibility

The subject of CE marking and EMC is explored in more detail in a separate Eurotherm Application manual entitled 'EMC Installation Guidelines for modules and systems', part number HA388879, available from your local Eurotherm Drives office. The following sections are the minimum necessary for basic understanding.

Eurotherm Drives are adhering to the CEMEP recommendations on 'CE' marking for EMC. According to SI No. 2372, implementing the EMC directive into UK law, the requirement to CE mark for EMC, applies only to **relevant apparatus** that has '**intrinsic function**' to the **end user** and which is placed on the market (**supplied**). The majority of drive modules/systems sold by Eurotherm Drives will be incorporated into a higher system/apparatus or machine which includes (at least) the motor, cable and a driven load before providing intrinsic function to the end user. As such the majority of Eurotherm Drives products are categorised as **components** (CEMEP validity field 2) and it would be incorrect for Eurotherm Drives to apply the CE mark or produce an EC Declaration of Conformity in respect of EMC. It is the manufacturer/supplier/installer of the relevant apparatus (with the intrinsic function to the end user) who must demonstrate conformance to the EMC directive

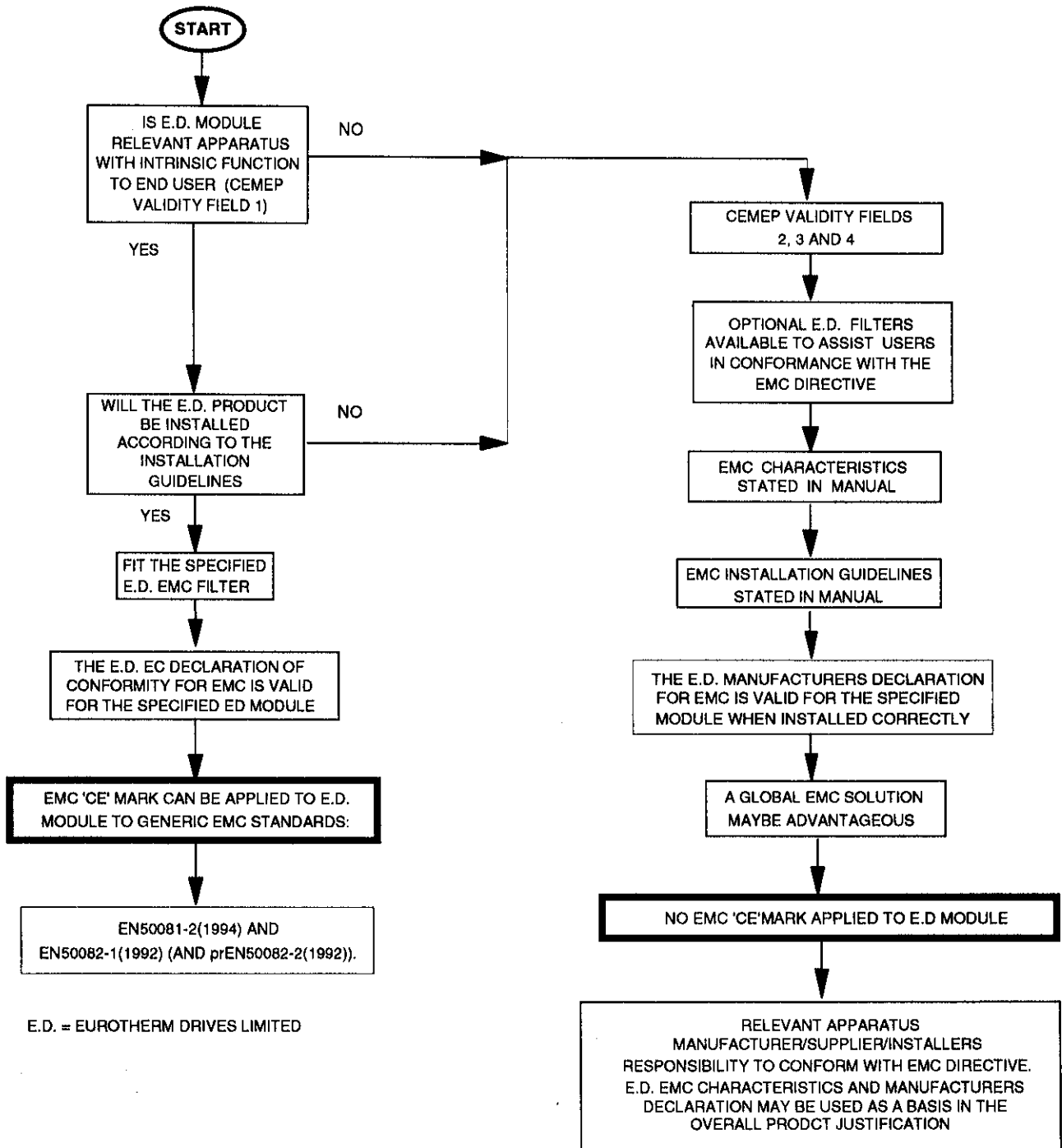
However, in a minority of cases, single drives may have intrinsic function to the end user. An example is that of '**add on**' intrinsic function, where an existing fixed speed motor application (such as a fan or a pump) is converted to variable speed with an **add on** drive module (CEMEP validity field 1). In this application Eurotherm Drives CE mark its drive module and issue an EC declaration of conformity. Because the validity of the 'CE' mark for EMC is not known when the product is manufactured, the 'CE' mark will be applied via the product manual, and will not be on the product label. From 1997, when the 'CE' mark for the Low Voltage Directive becomes mandatory, the CE mark will appear on the product label, but its validity for EMC can only be identified from the product manual.

The validity of the 'CE' mark can be identified from the flowchart in figure D.1, refer to SI No. 2372 for clarification of relevant apparatus.

To assist manufacturers/suppliers/installers of relevant apparatus, Eurotherms 590 drive modules are EMC compliant to EN50081-2 (1994) and prEN50082-2 (1992), when fitted with the specified filter and choke and installed according to these instructions, (as confirmed by the Manufacturers EMC declaration to be found at the end of this chapter). Manufacturers/suppliers/installers of relevant apparatus (CEMEP validity fields 3 & 4) may use this compliance as a basis for their own justification of overall compliance with the EMC Directive.

It must be clearly understood by the customer before installation commences who is legally responsible for conformance with the EMC Directive. Misappropriation of the CE mark is a criminal offence.

Figure D - 1. Eurotherm EMC 'CE' Mark Validity Chart



CONSIDERATION OF EMC ENVIRONMENT

When considering the relevant EMC emission and immunity standards it is important to distinguish between the following classes of EMC environments:

	Residential, supplied directly from public electricity supply		Commercial and light industry, supplied directly from public electricity supply		Industrial installation with a separate transformer station	
	RF emission	Immunity	RF emission	Immunity	RF emission	Immunity
Basic and Generic Standards	EN5011 (Class B) or EN50081-1(1992)	EN50082-1(1992) see below for referenced standards	EN5011 (Class B) or EN50081-1(1992)	EN50082-1(1992) see below for referenced standards	EN55011 (Class A) or EN50081-2(1994)	EN50082-2 (1992) see below for referenced standards
New EMC Product Standard (draft) for Power Drive Systems IEC-22G/31/FDIS+ (will become EN 61800-3)	Unrestricted distribution (CEMPEP-1): < 25 A Class B > 25 A Class A Restricted distribution (CEMPEP-2) Class A	see below	EMC measures do not have to be implemented If interference in a neighbouring installation occurs, the operator is responsible for taking measures to prevent interference. In this case the required emission levels must be adhered to at the point of supply to the effected neighbouring installation.	see below	EMC measures do not have to be implemented If interference in a neighbouring installation occurs, the operator is responsible for taking measures to prevent interference. In this case the required emission levels must be adhered to at the point of supply to the effected neighbouring installation.	see below
<p>* This new Product Standard Draft has not yet been finally passed and more important, is not EC approved. An EC Declaration of Conformity for EMC can only be issued with the approval of a "Competent Body". It is anticipated this standard will be officially released during Q 3/4 1996.</p> <p>* New standards to be introduced in the near future</p>						
<p>Standards for immunity: IEC801-2 (IEC1000-4-2*): Electrostatic discharge (e.g. from electrostatically charged persons) IEC801-3 (IEC1000-4-3/6*): Electromagnetic fields (e.g. from portable telephones) IEC801-4 (IEC1000-4-4*): Fast electrical transients (burst) (e.g. from opening contacts in inductive circuits) IEC801-5 (IEC1000-4-5): Voltage surges (e.g. on local lightning strikes).</p>						

Figure D-2: EMC Emission and Immunity Standards applicable to 590 drive modules and similar equipment

When using the generic EMC standards, the 'Residential, commercial and light industry' emission limits (Class B) are more stringent than the 'Industrial' (class A) limits, and so equipment which meets EN50081-1(1992) automatically meets EN50081-2(1994). Similarly, the 'Industrial' immunity requirements are more stringent than the 'Residential, commercial and light industry' requirements, and equipment which meets prEN50082-2(1992) automatically meets EN50082-1(1992).

More and more Product Specific standards are being released with less onerous EMC requirements than the Generic Standards. When the new EMC Drive Product Standard for Power Drive System (EN61800-3) becomes available (Q 3/4 1996), EMC filters will only be **mandatory** in 'residential' type EMC environments (if this is the most appropriate standard to use for demonstrating conformance of the relevant apparatus). EMC competent bodies are today using the draft EMC Drive Product Standard to demonstrate conformance using the technical construction file route. The EMC Drive Product Standard as CEMEP is discussed in more detail in the Eurotherm Application manual entitled 'EMC Installation Guidelines for modules and systems', part number HA388879, available from your local Eurotherm Drives office.

It is important for the customer to identify what EMC standards are to be applied to the final machine/system and in what EMC environment it will operate, so that any additional compliance costs can be minimised. It should be remembered that when two or more EMC compliant components are combined to form the final machine/system, the resulting machine/system may not be compliant. Emissions from combined components tend to be additive, whilst the immunity remains constant.

FILTER AND LINE CHOKE SELECTION

590 drive modules can be 'CE' marked (as in CEMEP validity field 1) when used with the specified specially designed EMC filters to comply with the mains terminal limits of EN55011 Class A (or EN50081-2) as indicated previously, and when installed in accordance with the **EMC installation instructions** in this Product Manual (chapter 4). The Class A limit allows product to be used in 'industrial' EMC environments. Refer to **Consideration of EMC environments**, in this chapter for more details. The specified EMC filters for the 590 drive modules are summarised in table A and B in the section in Chapter 4 on EMC Installation Guidelines. The fitment of the specified EMC filter and line chokes is **mandatory** where 'CE' marking is applied.

If the customer is treating the 590 drive module as a **component for supply to EMC competent professional assemblers** (CEMEP validity field 2) and is taking the EMC responsibility, then the filters are optional and may assist the customer in achieving EMC compliance. In this situation the customer may also achieve compliance by less expensive more global measures depending on the limits to be achieved, such as the use of a combination of global or local filtering and screening methods, natural mitigation through distance or use of distributed parasitic elements of the existing installation.

FILTER INSTALLATION

The required EMC emission and immunity performance, and 'CE' marking of 590 drive modules can only be achieved when the **EMC installation instructions** in Chapter 4 are adhered to.

SPECIFICATION OF ACHIEVABLE EMC EMISSION AND IMMUNITY

590 drive modules with the option to be 'CE' marked meet the following EMC emission limits provided they are installed with the specified EMC filters and line chokes for 'CE' marking in accordance with the EMC installation instructions.

Port	Phenomenon	Basic standard	Level	Generic standard
Enclosure Port	radiated	EN55011 (1991)	Class B (cubicle mount)	EN50081-1 (1992)
AC Power Port	conducted (with specified filter)	EN55011 (1991)	Class A	EN50081-2 (1992)
AC Power Port	conducted (no filter)	EN55011 (1991)	130dB μ V @ 150kHz* (common mode) 130dB μ V @ 150kHz* (differential mode) Reducing with frequency by 20dB/decade	

* 50 metres screened motor cable.

All 590 drive modules meet the following EMC immunity performance criteria as defined in prEN50082-2 (1992) when installed and used as recommended.

Port	Phenomenon	Test Standard	Level	Acceptance Criterion	Generic Standard
Enclosure Port	ESD	IEC 1000-4*	6 kV CD, 8 kV AD	self recovery	EN50082-1 (1992) Draft prEN50082-2 (1992)
	RF Field	IEC 1000-4	10 V/m, 1 kHz AM	no change	
Power Ports	Fast Transient	IEC 1000-4,	2 kV	self recovery	
	Burst, Surge	IEC 1000-4	1 kV (P-P), 2 kV (P-E) available late 1996	self recovery	
Signal & Control	Fast Transient Burst	IEC 1000-4	2 kV	self recovery	
Power Interfaces	Fast Transient Burst	IEC 1000-4	2 kV	self recovery	

* only for cubicle mount.

The EMC filters for 590 drive modules may be flash tested in circuit up to DC 2850 V for 1 min. Ensure all other equipment that may be damaged by such flash testing has been suitably isolated/removed/short circuited as applicable. Due to the internal capacitors between phase and earth, the DC voltage should be wound up slowly, to prevent excessive earth current. For similar reasons AC flash testing cannot be performed due to the excessive earth leakage current. Repeated flash testing is not recommended as it may degrade the insulation.

EMC RESPONSIBILITY OF MANUFACTURERS/SUPPLIERS/INSTALLERS

For end users of 590 drive modules, a correctly installed power drive system (PDS) created from the supplied 590 will be compliant with the generic emission standards EN50081-2(1994) and for immunity prEN50082-2(1992) as previously indicated. Manufacturers/suppliers/installers of relevant apparatus may use this compliance as a basis for their own justification of overall compliance with the EMC Directive.

If it is the responsibility of the manufacturer/supplier/installer to establish EMC conformity and to 'CE' mark. There are three methods of demonstrating conformity:

- 1) Self certification to a relevant standard
- 2) Third party testing to a relevant standard
- 3) Writing a technical construction file stating the technical rationale as to why the relevant apparatus is compliant. An EMC "competent body" must then assess this and issue a technical report or certificate to demonstrate compliance.

Upon demonstrating EMC compliance an EC-Declaration of Conformity for the apparatus or machine may be issued and a 'CE' mark applied.

Professional end users with EMC expertise who are using drive modules and cubicle systems defined as components who supply, place on the market or install the relevant apparatus must take responsibility for demonstrating EMC conformance and applying the 'CE' mark and issuing an EC Declaration of Conformity.

Eurotherm Guide

More information is available in a separate Eurotherm Guide entitled "Short Form Overview of European Directives for Variable Speed Drives and Applications" part number HA389770 available from your local Eurotherm Drives office.

Manufacturers EMC Declaration



MANUFACTURERS EMC DECLARATION

In accordance with the EEC Directive 89/336/EEC,
Article 10 and Annex 1, (EMC DIRECTIVE)

We Eurotherm Drives Ltd, address as below, declare under our sole responsibility that the following
electronic products

590L (35 - 800 Amp)

when installed and used in accordance with the instructions in the product manual (provided with
each piece of equipment) and using the specified EMC filters and line chokes to which this
declaration refers is in conformity with the following standards:-

BSEN50081-2 (1994) (conducted emissions)

.....
Dr Martin Payn,
Conformance Officer
Eurotherm Drives Ltd

.....
Dr Dan Slattery,
Technical Director
Eurotherm Drives Ltd

31st October 1996

.....
Date


EUROTHERM DRIVES LIMITED

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		 EUROTHERM DRIVES	590L Manufacturers EMC Declaration	

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Machinery Directive



MANUFACTURER'S DECLARATION

The following Electronic Products
590A/D/L (35 - 800 Amps)
 are components to be incorporated into machinery and may not be operated alone.

The complete machinery or installation using this equipment may only be put into service when the safety considerations of the Directive 89/392/EEC are fully adhered to.

Particular reference should be made to EN60204-1 (Safety of Machinery - Electrical Equipment of Machines).

All instructions, warnings and safety information of the Product Manual must be adhered to.

.....
 Dr Martin Payn,
 Conformance Officer
 Eurotherm Drives Ltd

.....
 Dr Dan Slattery,
 Technical Director
 Eurotherm Drives Ltd

9th December 96

.....
 Date

EUROTHERM DRIVES LIMITED

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EC Declaration of Conformity for Electrical Safety



EC DECLARATION OF CONFORMITY

In accordance with the EEC Directive 73/23/EEC and amended by 93/68/EEC,
Article 13 and Annex III, (LOW VOLTAGE DIRECTIVE)

We Eurotherm Drives Limited, address as below, declare under our sole responsibility that the following Electronic Products

590A/D/L (35-800 Amps)

When installed and used in accordance with the instructions in the Product Manual (provided with each piece of equipment) is in Conformity with the following standard:-

VDE0160(1994)/prEN50178(1995)

Following provisions of EEC-Directive
73/23/EEC with amendment 93/68/EEC

9th December 96

.....
Dr Martin Payn,
Conformance Officer
Eurotherm Drives Ltd

.....
Dr Dan Slattery,
Technical Director
Eurotherm Drives Ltd

.....
Date

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A	Initial Issue.		05.03.91	GDR	GDR
B	Re-formatted.		13.03.91	GDR	GDR
C	Corrections and amendments.		05.04.91	GDR	GDR
D	Sections 4.5 and 4.6 added.		23.05.91	GDR	GDR
1	Release manual for production.	7229	30.01.92	GDR	GDR
2	Add Appendix 1 - Differences between the LINK 570 and the LINK 590 DC Digital Drives. Change SSD to Eurotherm Drives.	8105	26.01.93	GDR	GDR
3	New front cover to include 590L. Added note to front page. Replaced drawings:- HJ057470, 1,2,3,4,5, HJ059562,1, issue B with issue 1. HB058299 sheets 2,3,5 issue C with issue 2. Replaced Appendix A.				
4	Page 2-3 added 3 & 4 to Block 7. Page 3-5 added Tightening Torque table. Appendix A:- Added Product Codes for factory calibrated & customer calibrated. Added Calibration Board. Added 3 to Microtach Feedback. Added 5901 Universal Receiver Card. Added Recommended Cable Systems. Appendix B:- Table 1 added RMS. Tightening Torque table consistent with page 3-5.	8676	15.11.94	GDR	GDR
5	Changes to reflect introduction of 271-450A versions. Page 5-4 added "NOTE" after 5D Main Contactor. UL revision requirements - contents page and pages 3-1, B-7, B-8, B-9 Added 8.6.8. "Phase Lock". Added "Program Stop Limit" to Appendix A - 17. Appendix B - 6 included HA389475. Appendix B - 7 changes to paragraph (ii). Added Appendix C - EMC Installation Guidelines, & Appendix D - The European Directives and the 'CE' Mark. Bar code added to back cover.	10210 10475 10246 10382 10615 10467 10673 10878 11026	30.10.96	FEP	
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6	Page 3-3 Added column 360A in table. Page 3-2 Added "*Suitable ... supplies". Appendix C LVD Requirements amendments. Appendix D Added EC Declaration of Conformity for Electrical Safety	11219 11388 11454	16.12.96	FEP	MP
7	Page C-1 corrections to Table A.	11548	22.04.97	FEP	<i>MP</i>
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