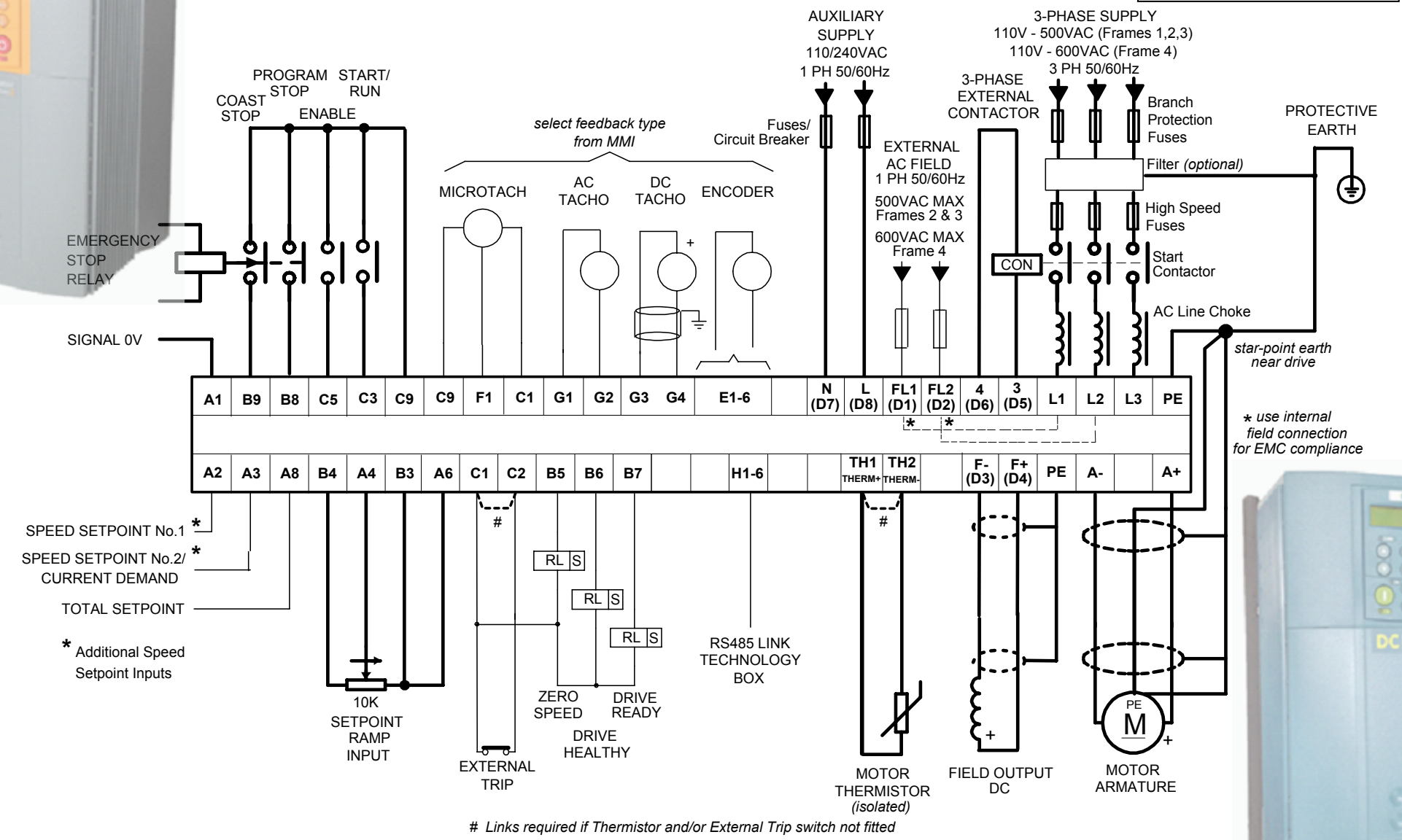
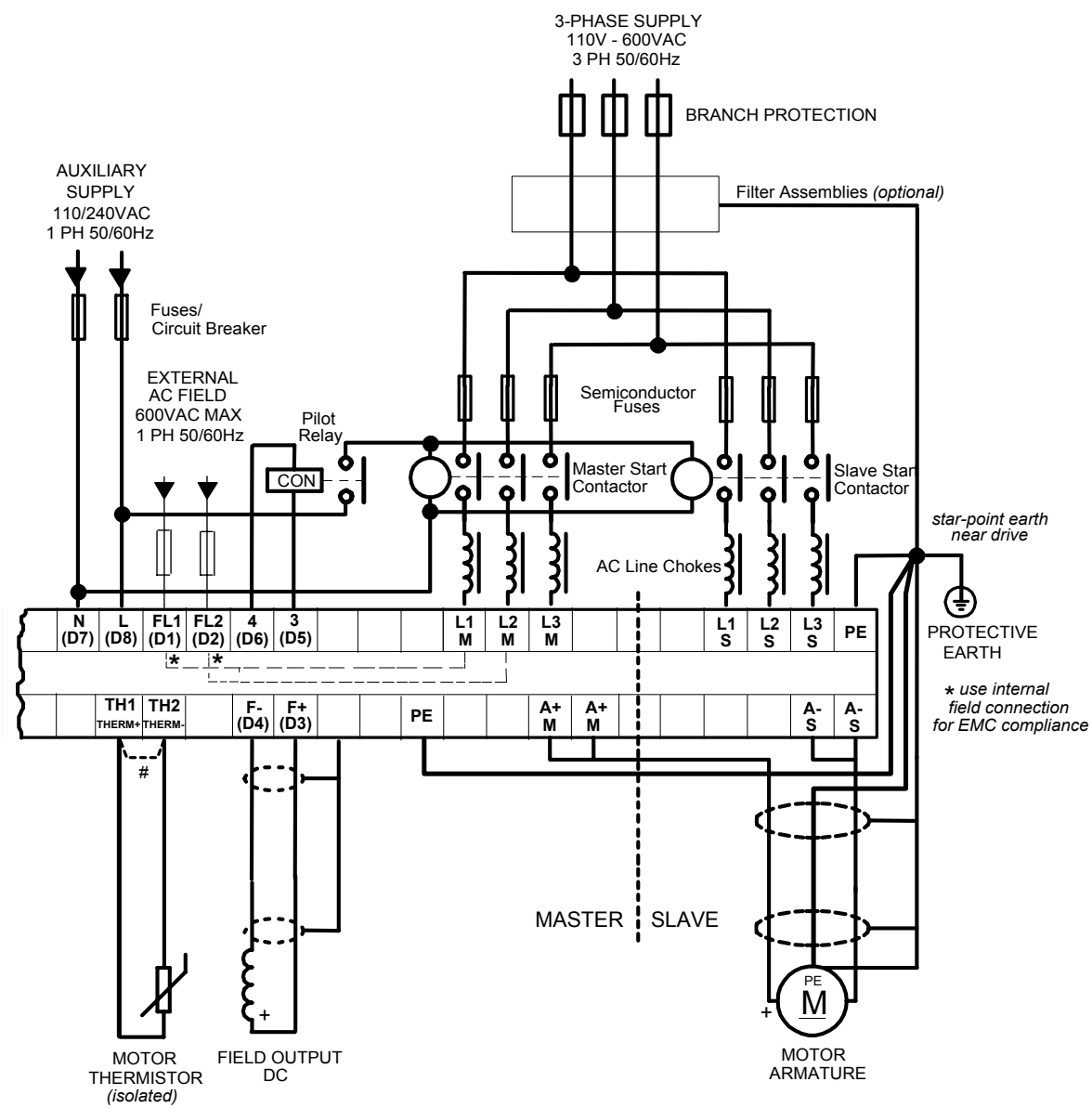
Connection Diagrams

FRAMES 1, 2, 3 & 4
Bold lines indicate "minimum connections"

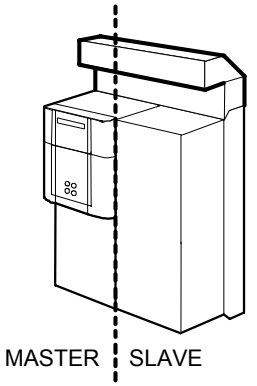


 # Links required if Thermistor and/or External Trip switch not fitted

Figure 3- 8 Power Connections: Frames 1, 2, 3 & 4 (`general purpose' configuration)



FRAME 5
Bold lines indicate "minimum connections"



Notes:

a) You must use two identical line chokes to guarantee sharing of motor current

b) One or two Start Contactors can be used

c) Use separate semiconductor fuses for Master and Slave

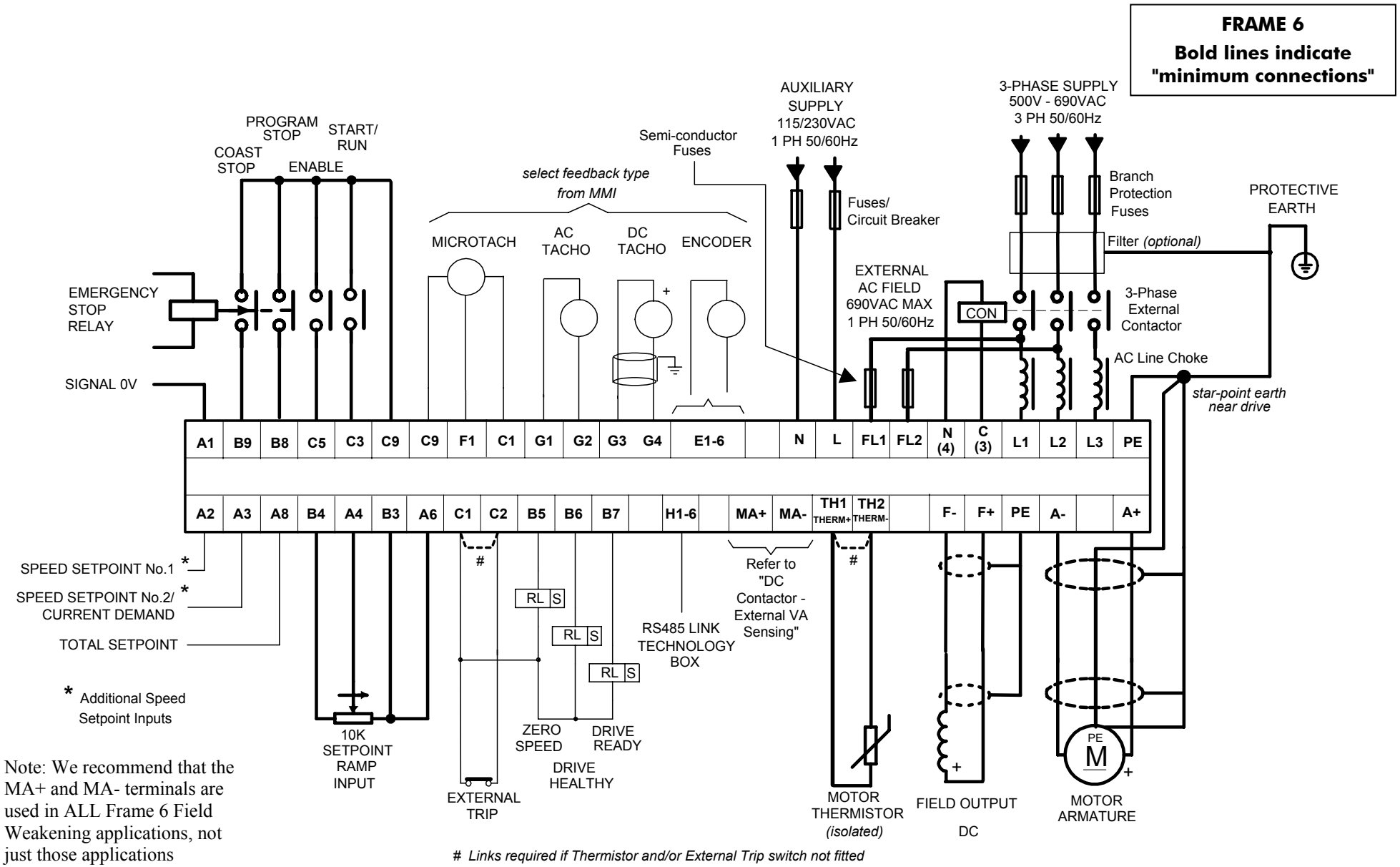
d) L1M, L2M & L3M are the Master AC Input Busbars
L1S, L2S & L3S are the Slave AC Input Busbars
There are two A+M Master DC Output Busbars
There are two A-S Slave DC Output Busbars

e) Use both of the A+M terminals, and also both A-S terminals

f) PE connections MUST be made to both the Master and Slave drives

g) A single dc contactor can be fitted but MUST be used with an interlock to enable input C5

Figure 3- 9 Power Connections: Frame 5 (`general purpose' configuration)



Note: We recommend that the MA+ and MA- terminals are used in ALL Frame 6 Field Weakening applications, not just those applications involving an external DC contactor.

Figure 3- 10 Power Connections: Frame 6 (`general purpose' configuration)

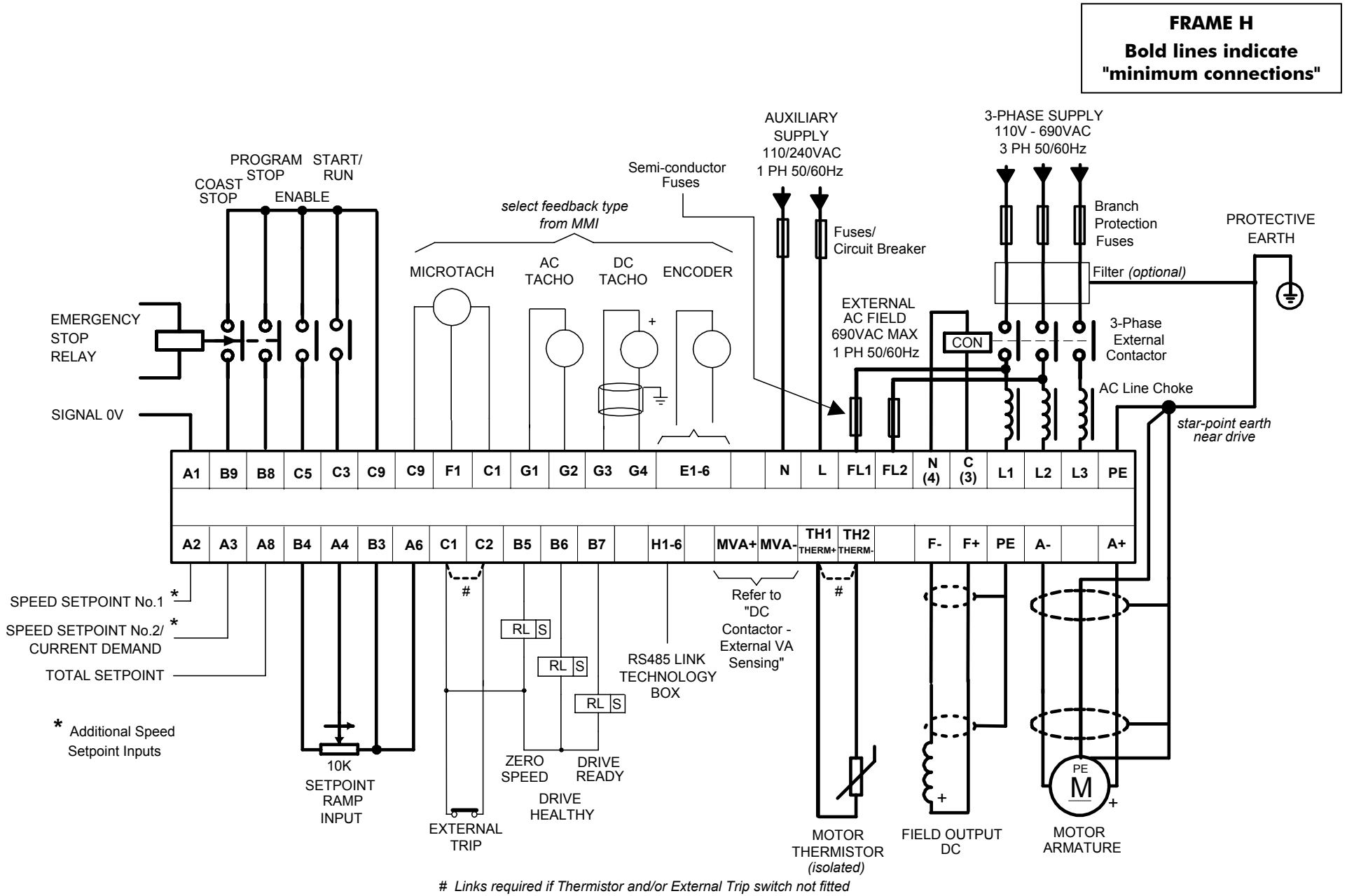


Figure 3- 11 Power Connections: Frame H (`general purpose' configuration)

3-Phase Supply, 3-Phase External Contactor

L1
L2
L3
3
4

Connect the main ac power to busbar terminals L1, L2 & L3 via the Branch Protection, AC Filter (optional), 3-Phase External Contactor, and AC Line Choke.

Connect the contactor coil to terminals 3 (Line) and 4 (Neutral).

Frame 3: Terminals 3 & 4 = D5 & D6 : Frame H & Frame 6: Terminals 3 & 4 = C & N

Main AC Power

There is no specific phase connection to terminals L1, L2 and L3 as the controller is phase rotation independent.

Branch Protection

AC current = 0.83 x DC Armature Current

You must provide branch circuit protection using a suitable fuse or Type 2 circuit breaker (RCD, ELCB, GFCI circuit breakers are not recommended, refer to "Earth Fault Monitoring Systems", page 3-62). Also refer to Appendix B: "Certification" - Conditions for Compliance with UL508c.

Semi-Conductor Protection

Frame H drives contain high speed semi-conductor fuses. For all other frame sizes, always provide high-speed thyristor fusing to protect the thyristor stack in the case of direct output short circuits. Semiconductor fuses may be used as Branch Protection on single-drive systems.

IMPORTANT ***If a motor becomes completely short-circuited, the current trip (OVER I TRIP)*** *will not* ***protect the Drive.***

Refer to Appendix E: "Technical Specifications" - External Power Semiconductor Protection Fuses.

AC Filter (optional)

Refer to "External AC Supply EMC Filter Installation", page 3-60.

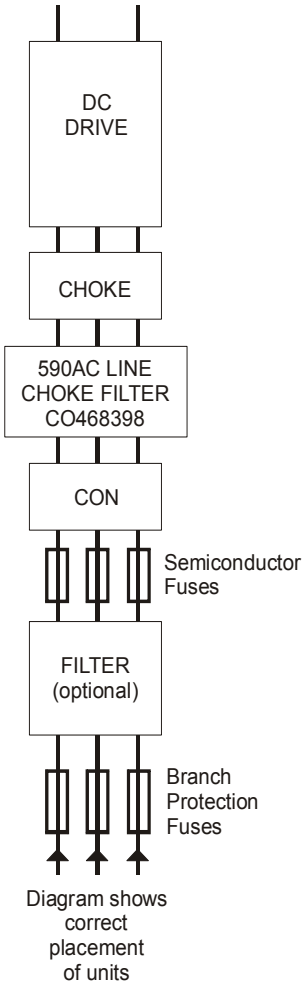


Diagram shows correct placement of units

Power Connections continued

3-Phase Supply, 3-Phase External Contactor continued

3-Phase External Contactor

The contactor does not switch current and is primarily for disconnection and sequencing of the power bridge. It must be energised directly from the controller by a coil with a rating suitable (AC1) for the controller concerned. No additional series contacts or switches are permitted since they will interfere with the sequencing of the controller and cause unreliability and possible failure.

Connect to main contactor terminals Con L and Con N only as described in Appendix E, otherwise unreliable or dangerous operation may occur - do not connect to a PLC input or sensitive relay.

Slave Relay : If the 3-phase contactor has a coil with an inrush greater than 3A, a slave relay **MUST** be used to drive the contactor coil. The contactor and slave relay (if required) **MUST** have coil voltages compatible with the controller auxiliary supply voltage.

DO NOT use a slave relay with a coil current less than 25mA as it may be energised by the contact suppression network.

Frames 4 & 5 : A relay jumper (CONN1) is provided on the power board enabling terminals 3 & 4 to be powered (auxiliary supply - default position), or to be volt-free (for customers own contactor supply). Refer to "AH466701U001, U002, U003 (Frames 4 & 5)", page 3-46.

DC Contactor : A DC contactor can be used but the sequencing must be adjusted to accomodate its use: an auxilliary normally open volt-free contact of the contactor must be connected in series with the "ENABLE" input (C5) to disable the drive until after the contactor is closed.

AC Line Choke

IMPORTANT ***Always fit the recommended choke. Refer to Appendix E: "Technical Specifications" - AC Line Choke.***

We can provide suitable chokes, designed to connect directly to the drive terminals. Refer to Appendix E: "Technical Specifications" - AC Line Choke.

PE Protective Earth Connections ☐✔

Connect the drive's PE terminal to an independent earth/ground star point.

Connect this earth/ground star point to Protective Earth.

IMPORTANT ***The drive and filter (if fitted) must be*** *permanently earthed.* ***Each conductor used for permanent earthing must*** **individually** ***meet the requirements for a protective earth conductor.***

For installations to EN 60204 in Europe:

- For permanent earthing, the drive requires either two individual incoming protective earth conductors (<10mm² cross-section), or one conductor (≥10mm² cross-section) connected to an independent protective earth/ground point near the drive.
- Run the motor protective earth/ground connection in parallel with the motor supply conductors, ideally in the same conduit/screen/armour, and connect to an independent protective earth/ground point near the drive.

Refer to Appendix B: "Certification" - EMC General Installation Considerations.

Caution

On the Frame 5, both the Master and Slave drives must be individually earthed.

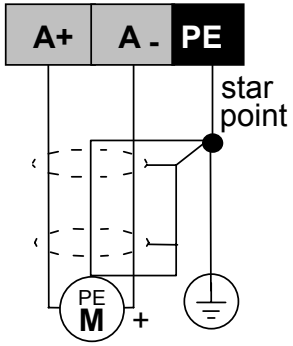
A+ A- Motor Armature ☐✔

Connect the motor armature to terminals A+ and A-.

Connect the cable screen to the motor's PE terminal and the earth/ground star point.
Connect the motor's PE terminal to the earth/ground star point.

For cable information refer to Appendix B: "Certification" - Recommended Wire Sizes.

NOTE **If the drive is to operate in regenerating mode for long periods, it is advisable to fit a dc fuse or high speed circuit breaker in the armature circuit. If in doubt consult Parker SSD Drives.**



Power Connections continued

F- F+ Motor Field

Connect the motor field (-) to terminal F-, and connect field (+) to terminal F+.

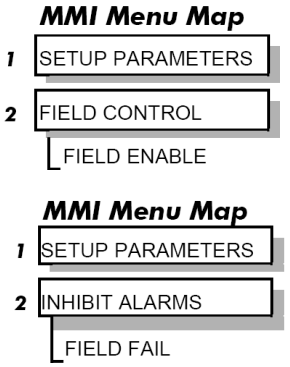
Frame 3: Terminals F- & F+ = D3 & D4

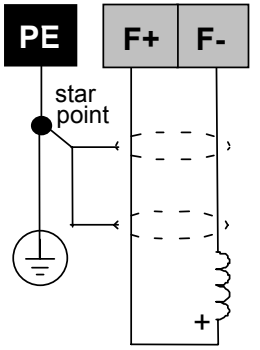
Connect the cable screen to the independent earth/ground point.
If the motor has no field connections, is a permanent magnet motor, or if the field is derived externally, you must either:

disable the FIELD ENABLE parameter (Tag No. 170) later during Set-up (disables the Field Fail alarm automatically)

or

disable the Field Fail alarm





Th1 Th2 Motor Thermistor

Connect the motor thermistor to terminals Th1 and Th2

or

link terminals if sensors are not fitted.

Frames 3, 6 & H: Terminals Th1 & Th2 = THERM1 & THERM 2

Terminals Th1 and Th2 must be linked if motor sensors are not fitted.

(Thermistor terminals for Frames 3, 6 & H are on the Control Door Board).

We recommend that you protect the dc motor against overtemperature by the use of temperature sensitive resistors or switches in the field and interpole windings of the machine. When the motor is fitted with over-temperature sensing devices, such as thermostats or PTC thermistors, these should be connected (in series) between terminals TH1 and TH2.

- Thermistors must have a combined working resistance of 750Ω or less, rising to 4kΩ at over-temperature. These thermistors are classified by IEC34-II as Mark A.
- Temperature switches must be normally closed, and open at rated temperature.

The over temperature alarm will activate at 3kΩ. It is latched in software and must be reset by re-starting the Drive.

NOTE **The motor temperature alarm (THERMOSTAT) cannot be inhibited in software.**

FL1
FL2

External AC Field

These terminals must be used on Frame 6 and Frame H drives ☐ ✔

Connect the external field supply to terminals FL1 and FL2.

Frame 3: Terminals FL1 & FL2 = D1 & D2

(Not available on Frame 1 units)

Used if an external field supply is required to the controller for application reasons. The magnitude of this voltage is determined by the desired field voltage. The supply must be protected externally with suitable fuses.

IMPORTANT ***The connection of the controller and the external field supply must be consistent when using an externally supplied field regulator. Always derive the 1phase, 50/60Hz supply from the L1 (Red) and L2 (Yellow) phases of the main power supply, directly or indirectly through a single-phase transformer, with the Red phase connected to terminal FL1 and the Yellow phase to terminal FL2.***

NOTE **You must provide branch circuit and overload protection.**

To change the drive from an internal to an external field type refer to "Motor Field Options", page 3-30.

L
N

Auxiliary Supply

☐ ✔

Connect the control supply to terminals L (Live) and N (Neutral).

Frame 3: Terminals L & N = D8 & D7

Single phase, 110/240V ac, 50/60Hz.

Note: **The auxiliary supply chosen must equate to the contactor coil voltage used.**

IMPORTANT ***The auxiliary supply terminals must be connected directly to the incoming supply via a fuse or circuit breaker. No series sequencing switches or contacts are permitted without consultation from SSD Drives.***

Use 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. (Frame H fans are powered separately).

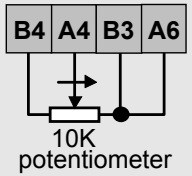
Refer to Appendix E: “Technical Specifications” - Power Supply Fuses.

Control Connections

A1 A4 B3 B4

Ramp Speed Setpoint

Connect a 10k potentiometer between terminals A1 and B3. Connect the wiper to A4.

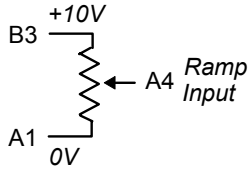


Speed Demand Controls the speed of the motor

Uni-directional Speed Setpoint

This connection provides a Uni-Directional Speed Setpoint for non-reversing applications and the 2 Quadrant controller (591+):

Maximum forward speed setpoint (+100%) = Terminal B3, +10V input
Zero speed setpoint (0%) = Terminal B1, 0V input

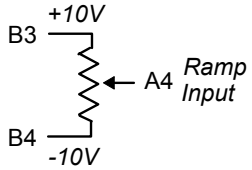


Thus, zero speed is at the **left** (anti-clockwise) position on the potentiometer.

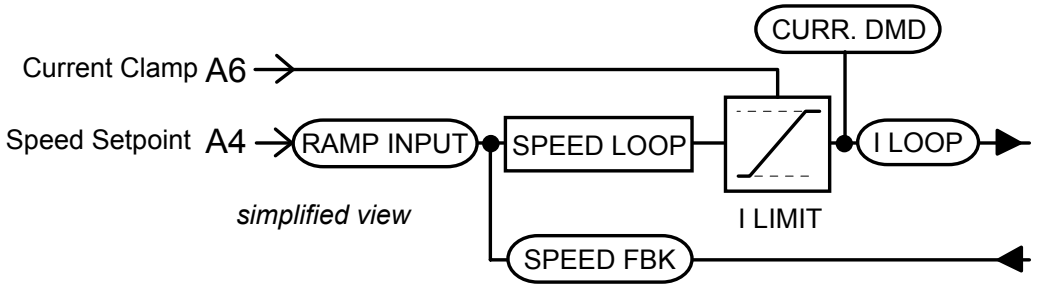
Bi-directional Speed Setpoint

Alternatively, substitute A1 for terminal B4 to scale the input such that:

Maximum forward speed setpoint (+100%) = Terminal B3, +10V input
Maximum reverse speed setpoint (-100%) = Terminal B4, -10V input



Thus, zero speed demand is at the **centre** position on the potentiometer.



In both cases, the Current Limit is controlled via terminal A6 (ANIN5).

NOTE **Terminals A1, B1 and C1 (Signal 0V) are the common reference points for all analog signals used in the drive.**

A6 Current Limit

B3

Connect terminal A6 to B3.

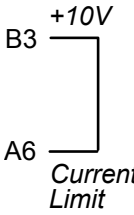
Current Limit Controls the available motor torque

This connection provides control of the Positive and Negative Current Clamps and hence the Current Demand via terminal A6 (ANIN5). The "ANIN 5 (A6)" function block contains parameters to set up maximum/minimum values for the analog input, and a scaling ratio.

Adjust the main current limit using the MAIN CURR. LIMIT parameter [Tag No. 15]. Refer to Appendix D: "Programming" - CURRENT LOOP.

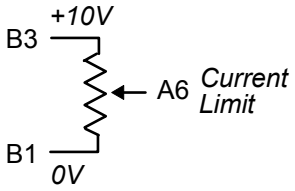
Fixed Current Limit

For normal operation of the main current limit, connect Terminal A6 (ANIN5) to Terminal B3 (+10V reference) and set the CURR.LIMIT/SCALER parameter to 200%. This allows the MAIN CURR.LIMIT parameter to adjust the current limit between 0 and 200% full load current.



Variable Current Limit

If external control of the current demand is required, an additional 10K potentiometer connected between Terminal B3 (+10V Ref) and Terminal B1(0V), with the wiper connected to Terminal A6 (Analog I/P5) gives 0 to 200% of full load current provided that the MAIN CURR. LIMIT and CUR. LIMIT/SCALER parameters are set to 200%.

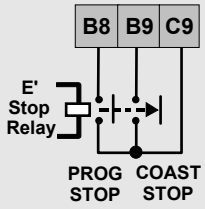


B8 Program Stop/Coast Stop

B9

C9

Connect terminals B8 & B9 to C9 via an Emergency Stop relay.



These connections provide a Program Stop (B8), and a Coast Stop (B9).
Refer to Chapter 4: "Operating the Drive" - Starting and Stopping Methods.

The "Emergency Stop" relay (normally-open, delay on de-energisation) should not be part of the normal sequencing system which is implemented via the Start contacts, but is a relay which can be operated in exceptional circumstances where human safety is of paramount importance.

- Removing 24V from B9 opens the main contactor via the relay
- Removing 24V from B8 provides regenerative braking for 4 Quadrant DC590+ drives

A regenerative drive can be stopped using a *Normal Stop*, a *Program Stop,* or an *Emergency Stop.* However, a non-regenerative drive can only be made to stop faster than friction and loading will allow by Dynamic Braking.

Control Connections continued

C5 / C9 — Enable ☐✔

Connect terminal C5 to C9.

Terminal C5 (Enable) must be connected to C9 (+24V) to allow the drive to run.

Connection via a switch is useful to inhibit the drive without opening the main contactor, however, it is not a 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 and isolated.
It is important that more than one stop input (ENABLE C5, START/RUN C3, COAST STOP B9, PROG STOP B8) is always used to ensure stopping of the drive under single fault conditions .

C3 / C9 — Start/Run ☐✔

Connect terminal C3 to C9 via a switch.

When the single contact between C3 and C9 is closed the drive will run provided that:

- B8 & B9 are TRUE (+24V) - see "Emergency Stop" above
- C5 is TRUE (+24V) - see "Enable" above

When the single contact between C3 and C9 is opened the drive will decelerate the motor to zero speed at a rate determined by the STOP TIME parameter's value and the MAIN CURR. LIMIT value. Refer to Appendix D: "Programming" - STOP RATES for further details.

NOTE **If Enable C5 is opened during a Normal Stop sequence, the drive is disabled, the contactor opens, and the drive will Coast To Stop.**

C4 / C9 — Jog/Slack ☐✔

Connect terminal C4 to C9 via a switch or pushbutton.

- If the drive is stationary this switch provides a Jog facility.
- If the drive is running, this switch provides a Take-Up Slack facility.

For other user-definable operating modes, refer to Appendix D: "Programming" - JOG/SLACK for further details.

C1 C2	**External Trip** ☐✔	
	Connect terminal C1 to C2, or link terminals if not required.	**Terminals C1 and C2 must be linked if an External Trip interlock is not required.** This input terminal provides an external trip facility to any normally-closed trip switch , e.g. for vent fan overload protection.
C1 B6	**Drive Healthy** ☐✔	
	Connect terminal C1 to B6 via a lamp (for example).	This is one of three digital output terminals that provide a +24V dc output signal under certain conditions. They allow for the connection of relays which, in conjunction with the Enable, Start/Run and Emergency Stop relay, can be used to enhance the safe starting and stopping of the controller. The drive is "healthy" (TRUE) if there is no Start command. These are configurable outputs and can be used as required in the control system design, i.e. cubicle door lamps, connection to a suitable PLC.
B5 B6 B7	**Digital Outputs**	
	User connection to external equipment.	There are three digital output terminals that provide a +24V dc output signal under certain conditions. They allow for the connection of relays which, in conjunction with the Enable, Start/Run and Emergency Stop relay, can be used to enhance the safe starting and stopping of the controller. These are configurable outputs and can be used as required in the control system design, i.e. cubicle door lamps, connection to a suitable PLC. The default actions are: • B5 = Zero Speed Detected • B6 = Drive Healthy • B7 = Drive Ready Refer to Appendix E: "Technical Specifications" - Terminal Information - Control Board, also Chapter 6: "The Keypad" - DIAGNOSTICS.

Control Connections continued

A2 A3 C8 Direct Speed Setpoints

Connect your external setpoint(s) to terminal A2 and/or A3.

Speed Setpoint No. 1 (A2)

This input is configurable.Terminal A2 (Analog Input 1) is a direct speed demand by-passing the "Setpoint Ramp Generator", and should be used if direct control is required.

Speed Setpoint No. 2 / Current Demand (A3)

This input is **not** configurable. Terminal A3 (Analog Input 2) is a dual function terminal (either "Speed Setpoint No. 2" or "Current Demand") as selected by mode switch control "Current Demand Isolate", Terminal C8. As a speed setpoint, it can be used in the same way as Terminal A2.

If more than one speed setpoint is used, they are additive. Also refer back to A4, Ramp Speed Setpoint, page 22.

A5 B4 C6 C9 Auxiliary Current Clamp (-ve)

Connect terminal A5 to B4 to provide -10V, or supply externally.

Connect terminal C6 to C9 to enable bipolar current clamps.

Used to allow separate control of positive and negative Main Current Clamps, for example, in Winder applications.

Enable bipolar current clamps by providing 24V at terminal C6. Terminal A5 (ANIN4) is an Auxiliary Current Clamp (-ve), 0 to -10V.

NOTE **If driven positive, it will form a current demand.**

The "ANIN 4 (A5)" function block contains parameters to set up maximum/minimum values for the analog input, and a scaling ratio.

With 24V at terminal C6, Terminal A6 (ANIN 5) acts only as the Auxiliary Current Clamp (+ve), 0 to +10V.

A7 **A8**	**Analog Outputs**	
	User connection to external equipment.	These are configurable outputs and can be used as required in the control system design, i.e. connection to a meter, for cascading to another drive. • Terminal A7, Analog Output 1 provides a Speed Feedback value, -10V to +10V • Terminal A8, Analog Output 2 provides a Total Speed Setpoint value, -10V to +10V The "ANOUT1" and "ANOUT2" function blocks contain parameters to configure the values.
A9	**Current Meter Output**	
	User connection to external equipment.	This connection is for a Current Meter. The "ARMATURE I (A9)" parameter is used to select either unipolar or bipolar output. Refer to Appendix D: "Programming" - CALIBRATION. This ouput is **not** configurable. It is driven directly by hardware.
C6	**Digital Inputs**	
C7 **C8**	**User connections to the drive.**	These configurable 24V dc digital inputs are used to control the drive. The default configurations are: • C6 : Current Clamp Select (see **A5** and **A6**) • C7 : Ramp Hold • C8 : Current Demand Isolate (see **A3**) Refer to Appendix E: "Technical Specifications" - Terminal Information - Control Board, also Appendix D: "Programming" - DIGITAL INPUTS.

Control Connections continued

G1 G2 G3 G4 Analog Tachometer

User connection to external equipment.

Fit the Tacho Calibration Option Board to the Drive.

This provides terminals G1 to G4.

Refer to Optional Equipment, page 3-53, for further information.

An Analog Tachometer is connected to the Drive using a screened twisted pair cable throughout its entire length to provide speed feedback via the Tacho Calibration Option Board. This provides facility for an AC or DC tachometer. The screen is grounded or earthed only at the drive end, any other grounding arrangement may cause problems.

- Terminals G1 & G2 are for AC tacho connections.
- Terminals G3 & G4 are for DC tacho connections.

NOTE **The speed loop is set-up for an analog tacho by the SPEED FBK SELECT parameter in the SPEED LOOP function block. Select ANALOG TACH for this parameter.**

If an AC tachogenerator is used the output is rectified to produce the dc feedback to the speed loop. Consequently, the controller can only be used with a positive setpoint.

Refer to Chapter 4: "Operating the Drive" for set-up information.

F1 C1 C9 Microtach

User connection to external equipment.

Fit the Microtach Option Board to the Drive.

This provides the fibre optic terminal F1.

Refer to Optional Equipment, page 3-53, for further information.

The Parker SSD Drives MICROTACH is available in two versions:

- 5701 Plastic Fibre Microtach
- 5901 Glass Fibre Microtach

A Microtach can be connected to provide speed feedback via the Microtach Option Board using the international standard "ST" fibre optic system.

F1 is the fibre optic receiver input socket. Terminals C9 (+24V dc) and C1 (0V) are used to provide the supply and return respectively.

NOTE **The speed loop is set-up for the Microtach by the SPEED FBK SELECT parameter in the SPEED LOOP function block. Select ENCODER for this parameter.**

The maximum Microtach frequency is 50kHz, thus with a standard 1000 lines per revolution Microtach the motor speed cannot exceed 3000 rpm.

For specification and connection information refer to Parker SSD Drives or the appropriate Technical Manual.

E1 E2 E3 E4 E5 E6 Wire-Ended Encoder

User connection to external equipment.

Fit the Encoder Option Board to the Drive.

This provides terminals E1 to E6.

Refer to Optional Equipment, page 3-53, for further information.

The wire-ended encoder is connected to the Drive using a screened cable throughout its entire length to provide speed feedback.

Terminals E1 (0V) and E2 (+24V dc) are the return and supply respectively.

NOTE **The speed loop is set-up for the Encoder by the SPEED FBK SELECT parameter in the SPEED LOOP function block. Select ENCODER for this parameter.**

The maximum allowable encoder frequency is 100kHz, thus with a standard 1000 lines per revolution encoder the motor speed cannot exceed 6000 rpm.

For specification and connection information refer to Parker SSD Drives or the appropriate Technical Manual.

H1 H2 H3 H4 H5 H6 Technology Box Option

User connection to external equipment.

Fit the Technology Box Option to the Drive.

This provides terminals H1 to H6.

The Technology Box Option allows drives to be linked together to form a network. We can supply Options for most protocols. Refer to Appendix D: "Programming" - TEC OPTION for information about Technology Box Option types.

For detailed information, refer to the appropriate Technical Manual supplied with the Technology Box.