Product manual 400, 800, 1200

Please read and understand this manual prior to installing the unit. Please obtain expert help if you are not qualified to install this equipment. Make the safety of your installation a priority. This component is hazardous.

Introduction

Sprint Electric offers a family of D.C. THYRISTOR drive modules all with the same features and terminals. The user selects the appropriate model depending on required power output. The drives are all NON-ISOLATED.

DRIVE TYPE	AC SUPPLY VOLTAGE	NOMINAL OUTPUT	MAX. CURRENT	NOMINAL POWER
400LV	30/60	24/48V	4 AMPS	200 W
400	110/240	90/180V	4 AMPS	0.55 KW
800LV	30/60	24/48V	8 AMPS	400 W
800	110/240	90/180V	8 AMPS	1.2 KW
1200LV	30/60	24/48V	12 AMPS	600 W
1200	110/240	90/180	12 AMPS	2.0 KW

All types are of open chassis construction. Enclosed versions available as follows. 400E, 400ER, 800E, 800ER, 1200E, 1200ER. E=enclosed, R=reversing

GENERAL DESCRIPTION

The units employ closed loop control of both armature current and feedback voltage to give precise control of the motor torque and speed. The motor and drive are protected by a stall timer which automatically removes power after 30 seconds if the required speed cannot be achieved. The drives will provide up to 150% of the preset maximum current for up to 30 seconds allowing high short term torques during acceleration etc. Independant control of either the current or speed loops by external inputs allows torque or speed control applications with overspeed or overcurrent protection. The demand signal may be derived from a potentiometer, 0-10V signal or 4-20mA loop. The speed feedback signal may be selected to be the ARMATURE VOLTAGE or a shaft mounted TACHOMETER.

INPUTS AND OUTPUTS

+aux input
-aux input
current input
4-20mA input
0 to 10V input

speed output
current output
ramp output
stall relay driver
zero speed driver

rail outputs
+12V regulated output
+10V precision reference
-12V regulated output
-24V unregulated output

ADJUSTABLE PARAMETERS

Max speed, Min speed, Up ramp, Down ramp, Max current, IR comp, Stability

SWITCHED FUNCTIONS

Maximum feedback, Torque control, Tacho feedback, AV feedback

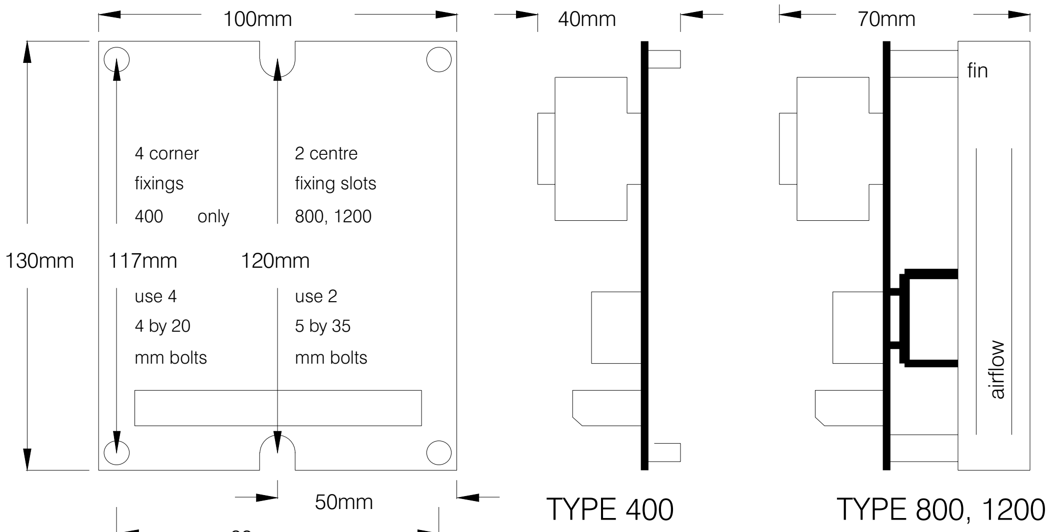
JUMPER FUNCTIONS

Dual supply voltage, 4-20mA input, Phase angle limit, 50% stall threshold

PERFORMANCE FEATURES

Dual loop control, Relay driver o/ps, Precision tacho rectifier, International compatability, Compact design, Integral fusing

MECHANICAL DIMENSIONS



Dissipation at full current

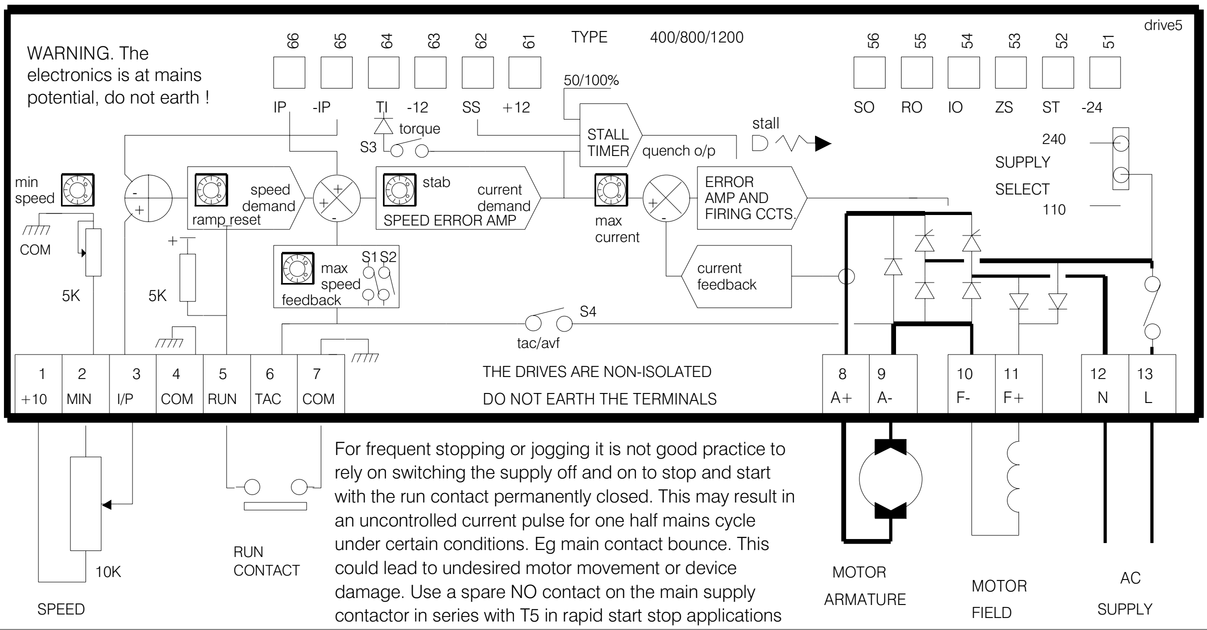
400	12 watts
800	25 watts
1200	35 watts

WARNING. THE DRIVES ARE NON ISOLATED. DO NOT ALLOW CONTACT OF THE ENCLOSURE WITH THE DRIVE CARD ELECTRONICS

TYPE 800/1200 HEATSINK MUST BE EARTHED VIA SCREW PROVIDED

TYPICAL APPLICATIONS

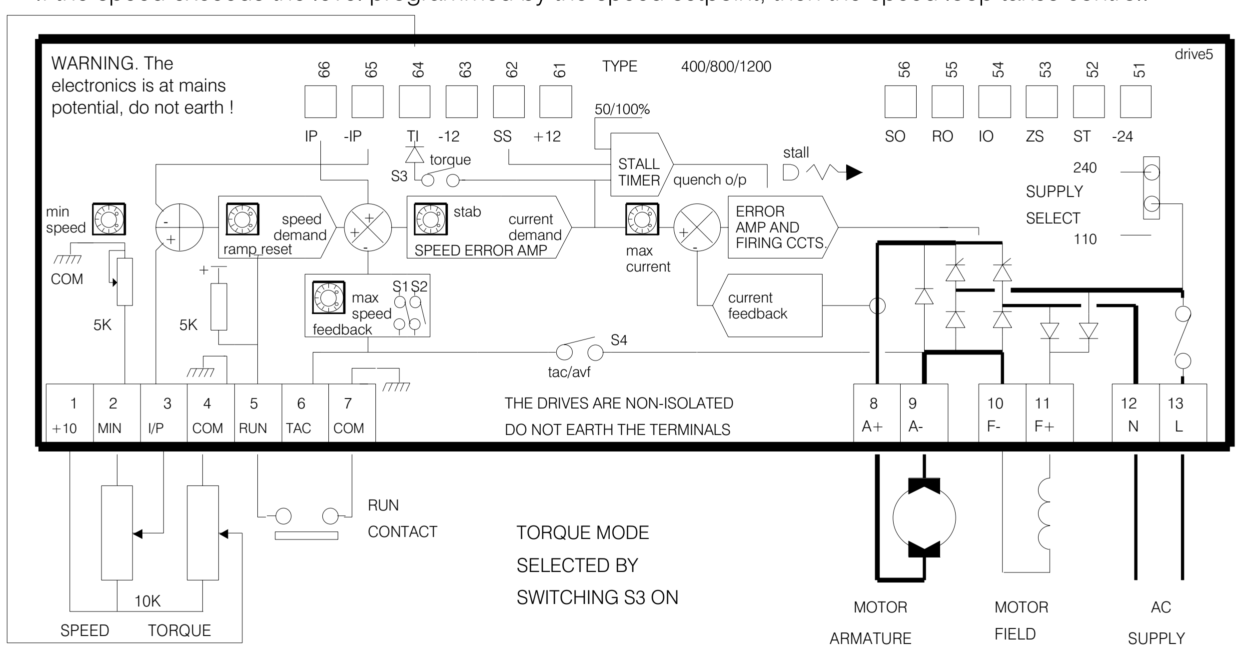
BASIC CONNECTION.



For frequent stopping or jogging it is not good practice to rely on switching the supply off and on to stop and start with the run contact permanently closed. This may result in an uncontrolled current pulse for one half mains cycle under certain conditions. Eg main contact bounce. This could lead to undesired motor movement or device damage. Use a spare NO contact on the main supply contactor in series with T5 in rapid start stop applications

TORQUE CONTROL WITH OVERSPEED LIMITING BY SEPARATE SPEED SETPOINT.

If the speed exceeds the level programmed by the speed setpoint, then the speed loop takes control.



INSTALLATION GUIDE FOR SYSTEMS USED IN THE EUROPEAN UNION

Special consideration must be given to installations in member states of the European Union regarding noise suppression and immunity. According to IEC 1800-3 (EN61800-3) the drive units are classified as complex components only for professional assemblers, with no CE marking for EMC. The drive manufacturer is responsible for the provision of installation guidelines. The resulting EMC behaviour is the responsibility of the manufacturer of the system or installation. The units are subject to the LOW VOLTAGE DIRECTIVE 73/23/EEC and are CE marked accordingly.

Following the procedures outlined below will normally be required for the drive system to comply with the European regulations, some systems may require different measures. Installers must have a level of technical competence to correctly install. Although the drive unit itself is not subject to the EMC directive, considerable development work has been undertaken to ensure that the noise emissions and immunity are optimised.

* *EN61800-3 specifies 2 alternative operating environments. These are the domestic (1st environment) and industrial (2nd environment). There are no limits specified for conducted or radiated emissions in the industrial environment, hence it is usual for the filter to be omitted in industrial systems*.

Definition of an industrial environment. All establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes.

DRIVE INSTALLATION REQUIREMENTS FOR EMC COMPLIANCE

Keep parallel runs of power and control cables at least 0.3m apart. Crossovers must be at right angles

Keep sensitive components at least 0.3m from the drive and power supply cables

The AC connections from the filter to the drive must be less than 0.3m or if longer correctly screened

Do not run filtered and unfiltered AC supply cables together

Control signals must be filtered or suppressed eg control relay coils and current carrying contacts. The drive module has built in filters on signal outputs

The AC supply filter must have a good earth connection to the enclosure back plane. Take care with painted metal to ensure good conductivity.

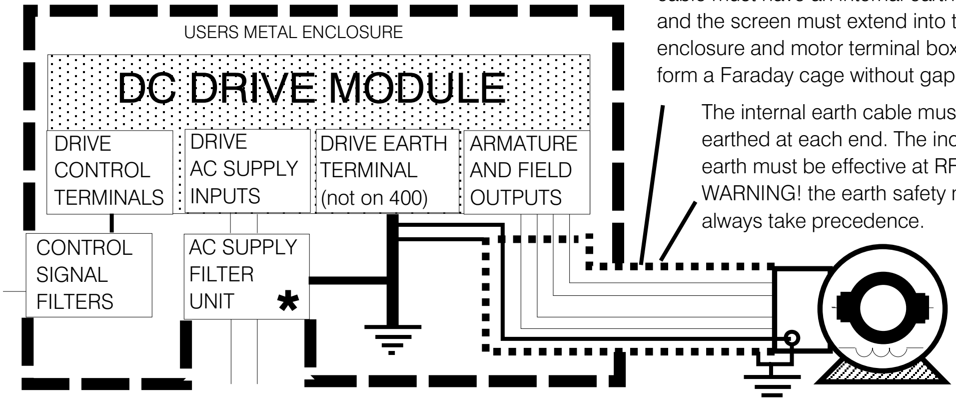
The metal enclosure will be the RF ground. The AC filter and motor cable screen should connect directly to the metal of the cabinet for best performance

The AC input filter has earth leakage currents. Earth RCD devices may need to be set at 5% of rated current

Linear control signal cables must be screened with the screen earthed at the drive end only. Minimise the length of screen stripped back and connect it to an analogue earth point

The motor cable must be screened or armoured with 360 degree screen terminations to earth at each end. The cable must have an internal earth cable and the screen must extend into the enclosure and motor terminal box to form a Faraday cage without gaps

The internal earth cable must be earthed at each end. The incoming earth must be effective at RF. WARNING! the earth safety must always take precedence.



IMPORTANT SAFETY WARNINGS

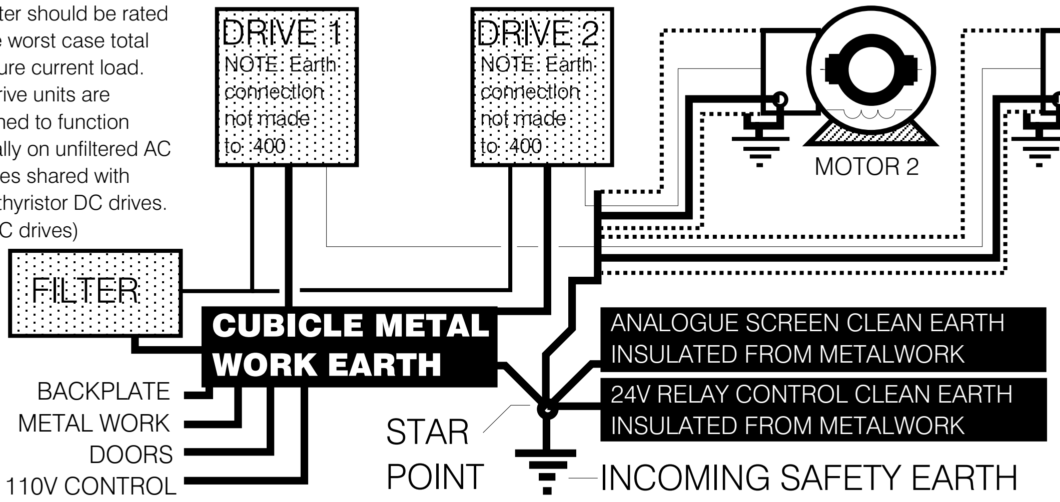
The AC supply filters must not be used on supplies that are un-balanced or float with respect to earth

The drive and AC filter must only be used with a permanent earth connection. No plugs/sockets are allowed in the AC supply

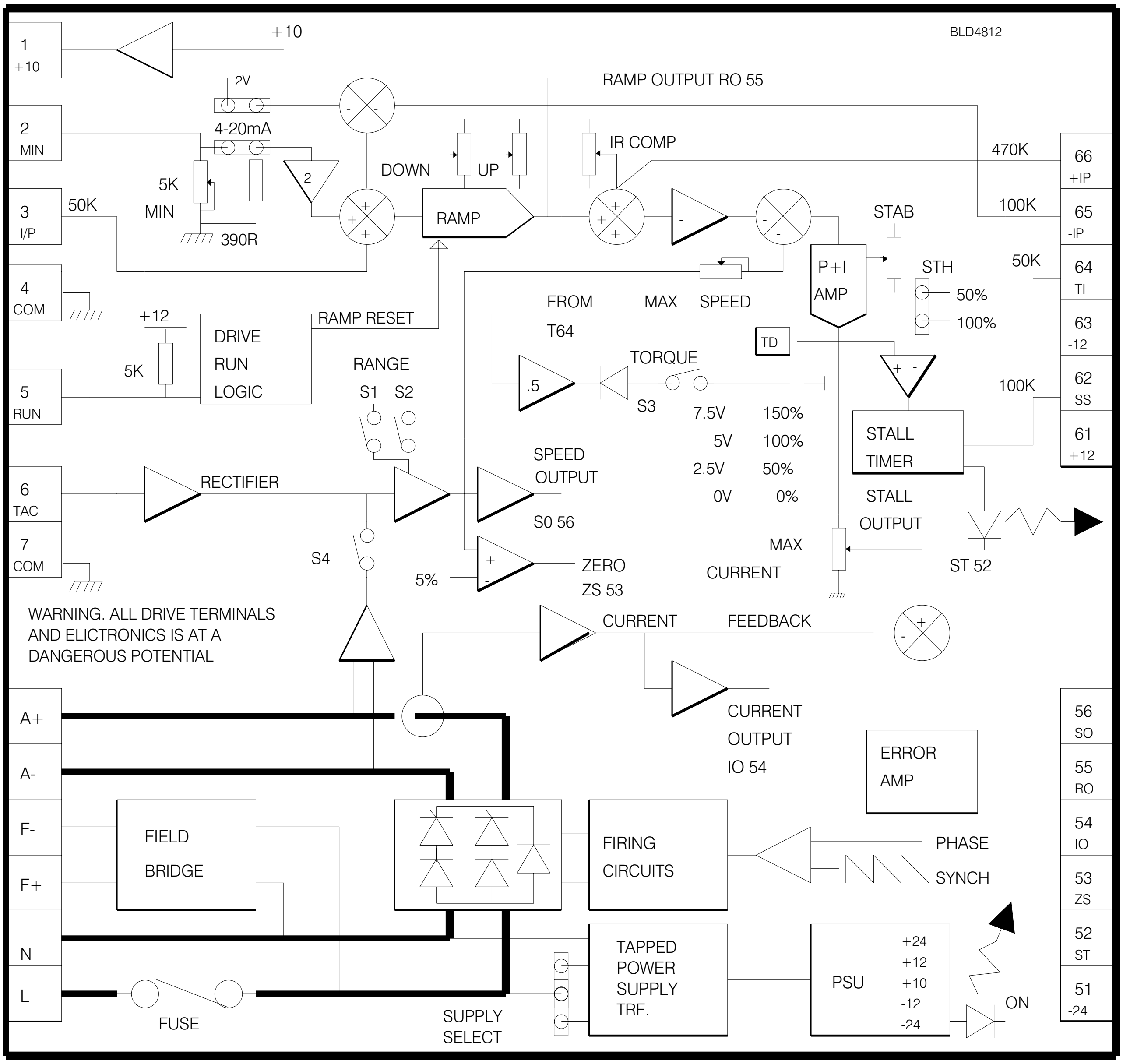
The AC supply filter contains high voltage capacitors and should not be touched for a period of 20 seconds after the removal of the AC supply

MULTIPLE DRIVES WITH ONE FILTER AND EARTHING METHODS

The filter should be rated for the worst case total armature current load. The drive units are designed to function normally on unfiltered AC supplies shared with other thyristor DC drives. (not AC drives)



WARNING
DO NOT EARTH ANY CONTROL TERMINALS OF THE DRIVE UNITS. FAILURE TO HEED THIS WARNING WILL RESULT IN PERMANENT DAMAGE



1 +10V PRECISION REFERENCE 10mA MAX. SHORT CCT. PROOF

2 MINIMUM END OF SETPOINT POT OR 4-20 mA CURRENT LOOP I/P

3 SPEED DEMAND INPUT 0-10V FOR 0-100% SPEED

4 COMMON. (4-20mA RETURN)

5 CONNECT TO COMMON TO RUN 60mS ON /20mS OFF (5K ohm pull up to +12V)

(WARNING. RUN is an electronic inhibit function. The field remains energised, and all power terminals remain 'live'. RUN must not be relied upon during hazardous operations)

6 TACHO INPUT 12-200V FULL SCALE. + OR - POLARITY

7 COMMON

8 A1+ ARMATURE OUTPUT

9 A2- ARMATURE OUTPUT

10 F 2- FIELD OUTPUT

11 F1+ FIELD OUTPUT

12 N NEUTRAL AC SUPPLY I/P

13 L LINE AC SUPPLY INPUT

SIGNAL PADS ON TOP EDGE

66 AUXILIARY SPEED INPUT 0 TO 10V FOR 0-100% DIRECT SPEED

65 AUX INVERTING SPEED INPUT 0 TO -10V FOR 0-100% RAMPED SPEED

64 TORQUE INPUT. 0 TO +10V FOR 0-100% CURRENT

63 -12V OUTPUT 10mA MAX

62 STOP/START INPUT. CLOSE TO -12V TO ACTIVATE STALL CONDITION. CLOSE TO +12V TO RELEASE STALL CONDITION

61 +12V OUTPUT 10mA MAX

56 SPEED OUTPUT. TYPICALLY 7.5V FULL SCALE. ADJUSTMENT OF MAX SPEED PRESET WILL ALTER THE FULL SCALE READING FROM 4V (ACW) TO 9V (CW). 0V TO FULL SCALE REPRESENTS 0-100%. IMPEDANCE 1K

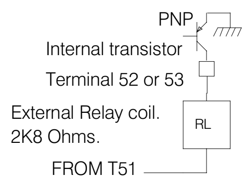
55 SETPOINT RAMP OUTPUT 0-10V IMPEDANCE 1K OHMS

54 CURRENT OUTPUT 0-5V FOR 0-100% CURRENT. IMPEDANCE 1K

53 ZERO SPEED RELAY DRIVER O/P MAX 100mA

52 STALL RELAY DRIVER O/P MAX 100mA

51 -24V RELAY SUPPLY 25mA MAX. DO NOT SHORT



INSTALLATION AND COMMISSIONING

Ensure supply is disconnected before working on unit

POWER CABLING
Use correctly rated cable minimum 600V AC 2 times armature current

FUSING
The drives have built in line fuses for wiring protection. 400 6.3A HRC, 800 15A HRC, 1200 15A HRC. The drive thyristor bridge can only be protected by fitting external semiconductor fuses. see page 8 for details.

CONTROL SIGNALS
All control inputs to the drives are NON-ISOLATED. Do not connect any of the terminals to earth or other low voltage. A common HAZARD is accidental earthing of the external pot and contact wiring. Avoid running signal cables close to power cables.

SUPPRESSION
The drives have excellent noise immunity. However installations involving electrical welding or RF induction heating may require further filters on the line and armature terminals. Contactor coils and sparking contacts may also require suppression. A 100R in series with 0.1uF cap. is usually adequate in these situations. Refer to page 3 for EMC guidelines.

SELECTOR SWITCHES AND JUMPERS
Must not be touched with power on.

MECHANICAL
Optimise heatsink airflow. Avoid vibration and ambient temps outside -10C and +40C. Protect the drive from pollutants.

MOTOR
Foot mounted motors must be level and secure. Protect motors from ingress of foreign matter during installation. Ensure accurate alignment of motor shaft with couplings. Do not hammer pulleys or couplings onto the motor shaft. Before running the motor complete the following check list.

1) Correct insulation resistance between all windings and earth with all drive cables disconnected
2) Check inside connection box for foreign objects, damaged terminals etc.
3) Check that brushes are in good condition, correctly seated and free to move in brush boxes. Check correct action of brush springs.
4) Motor vents must be freed of any obstruction or protective covers prior to running.
5) WARNING reversing systems. Do not transpose the armature connections until the motor has stopped. Failure to heed this warning will cause damage.

SUPPLY
Please ensure that the supply selection jumper on the drive matches the incoming supply. Failure to do this may result in permanent damage to the unit.

INITIAL SETTINGS
The drive units are shipped to run on the highest supply option at nominal speed in ARMATURE VOLTAGE feedback mode. To change this run through switches S1 to S4 and select accordingly.

S1 S2	SPEED. Calculate desired full scale feedback voltage and select range. Adjust within the range by using the MAX SPEED preset. Feedback may be tacho OR armature.
S3	Normally off. This switch allows a Torque signal to be entered when on via signal pad 64 (TI) on top edge. Refer to block diagram on page 4.
S4	ON for Armature voltage feedback. OFF for Tacho feedback.

PRESET POT SETTINGS
MAX CURRENT. cw rotation gives 0 to 100% current limit. eg. 50% rotation gives 50% current limit. Check motor rating plate to find correct limit.

Anticlockwise	MIN SPEED UP RAMP	DOWN RAMP IR COMP
Midway	STAB	

POWER ON
Check ON lamp lights

CLOSE RUN CONTACT
Gradually increase external setpoint, check motor rotation. If the direction is wrong, TURN OFF and swap A+, A-

INCREASE SETPOINT.
Drive should ramp up to full speed. Fine adjust with MAX SPEED preset. Do not exceed armature voltage rating. Reduce setpoint, drive should ramp down to zero. Adjust MIN SPEED to desired level. Run motor up and down and adjust RAMPS.(DOWN ramp is limited by coast down rate)

STABILITY
Adjust STAB to improve response if necessary. Clockwise rotation gives faster response. Excessive rotation in either direction may lead to instability depending on load.

IR COMP
Speed droop may occur where armature voltage feedback is used. This is compensated for by clockwise rotation of IR COMP preset. Excessive rotation may lead to instability. No IR COMP is required for systems with tacho feedback.

TORQUE SYSTEMS
See typical applications. In this mode the lowest setpoint has priority. Hence the speed setpoint is set to demand a speed slightly in excess of the working speed, and then the torque setpoint will always be operating as a limit. In the event of a web break for example, the motor will only run up to the level set on the speed pot.

LAMPS

ON On indicates AC power is applied

STALL Stall lamp lights and drive quenches if stall timer trips. see below for description of timer characteristics.

PRESETS

DOWN RAMP Rotate clockwise to increase drive deceleration. Span 1 to 30 seconds. Note, natural coast down is a limit.

UP RAMP Rotate clockwise to increase drive acceleration. Span 1 to 30 seconds

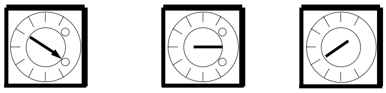
MIN SPEED Rotate clockwise to increase minimum speed. Use to adjust 4-20mA loop burden resistor between 0 and 390R if 4-20mA mode is selected.

MAX SPEED Rotate clockwise to increase speed. Change range with S1 and S2

STAB Rotate clockwise to increase response. Excessive rotation may cause instability. If rated motor voltage is much lower than AC supply anticlockwise is best.

IR COMP Rotate clockwise to increase level of armature voltage droop compensation. Excessive rotation may cause instability

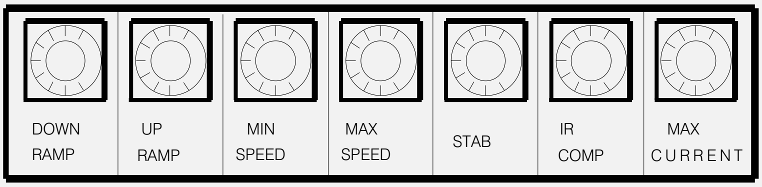
MAX CURRENT Rotate clockwise to increase current.



CUSTOMER PRESETS AND LOG

ON

STALL



SUPPLY SELECT
240
LV60
LV30
110

Current signal loop links.
4-20mA both pairs
0-20mA this pair only

Terminal 2 becomes loop input and terminal 4 return. MIN SPEED preset trims burden to 250 ohms.

SUPPLY SELECT

This jumper selects the appropriate supply tap on the control transformer. Refer to specification for tolerances. CHECK model type a) 240/110V AC for standard units or b) 60/30V AC for models with LV suffix

ON
1
2
3
4

S1 S2 These two switches allow four maximum feedback voltage ranges to be selected. Use the MAX SPEED PRESET to adjust within the range. The drive will control from 0V to the selected maximum for a 0-10V input.

12-25V	25-50V	50-100V	100-200V
Both off	S1 on, S2 off	S1 off, S2 on	Both on

S3 This allows the unit to operate as a torque controller. When ON the drive current will be controlled between 0% and the level set on the MAX CURRENT preset by a 0-10V signal on T64. NOTE the stall timer will be automatically inhibited in this mode.

S4 This switch allows the selection of the source of speed feedback. When ON the ARMATURE VOLTAGE is selected. When OFF, a tacho.

STH

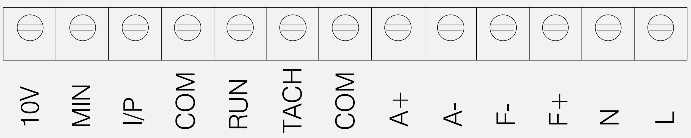
Stall Threshold

To implement the 50% stall threshold link the two points marked STH. Stall lamp lights and drive quenches if the stall timer trips. The time depends on the current demand

STANDARD		WITH 50% THRESHOLD	
150%	30 secs	150%	15 seconds
125%	60 secs	100%	30 seconds
115%	120 secs	75%	60 seconds
100%	no trip	50%	no trip

HRC FUSE

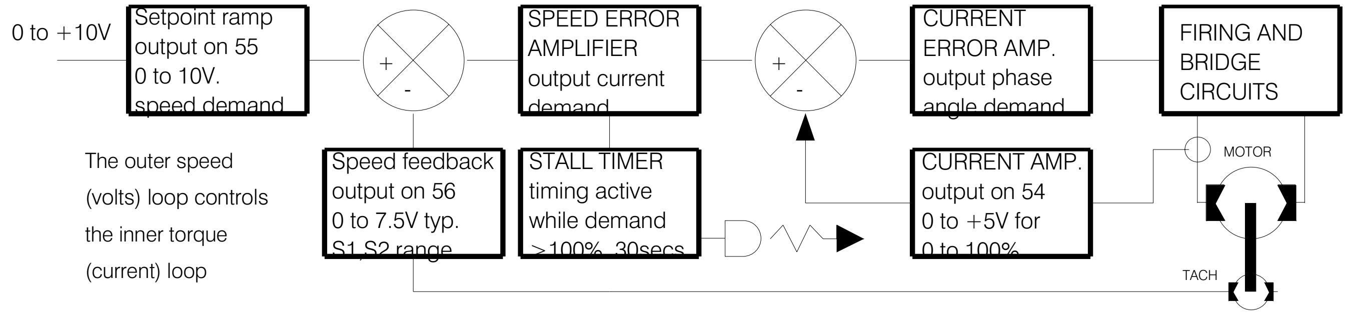
400 6.3A 20mm
800 15A 1 1/4
1200 15A 1 1/4



HEALTH AND SAFETY AT WORK. ELECTRICAL DEVICES CONSTITUTE A SAFETY HAZARD. IT IS THE RESPONSIBILITY OF THE USER TO ENSURE COMPLIANCE WITH ANY ACTS OR BYLAWS IN FORCE. ONLY SKILLED PERSONS SHOULD INSTALL THIS EQUIPMENT.

TROUBLE SHOOTING.

The drive consists of 2 high accuracy feedback control loops.



1 These units are NON isolated. DO NOT connect the electronics to earth or other low voltage.

2 If you need to connect to other instuments, eg panel meter. Ensure that the instrument can float safely at high voltage

3 For systems involving connection to other controllers, it is essential to use isolated drive models 400i or 1600i

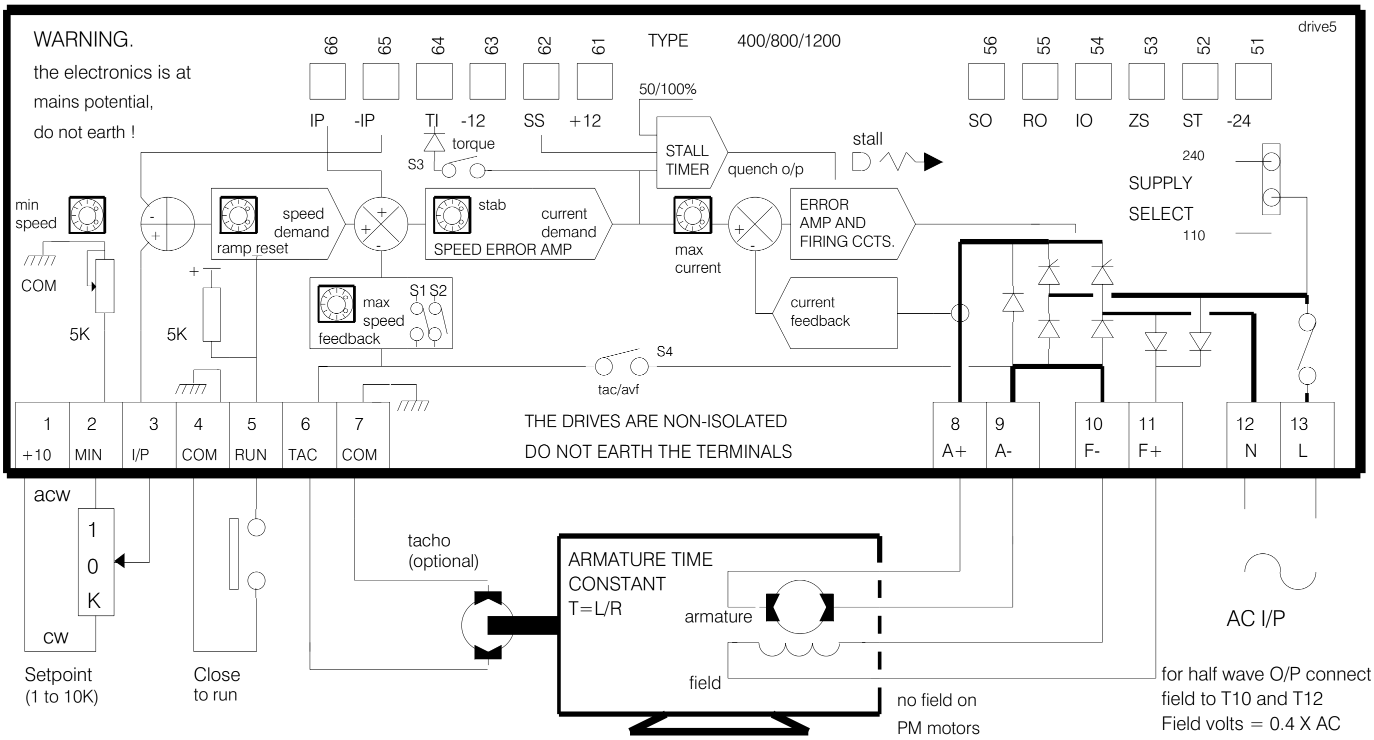
4 Remember, all the wires, pots, contacts etc. that are connected to the terminals will be floating at mains potential.

5 STALL problems shown by stall lamp coming on after running are caused by the drive unit not able to give set speed

6 Typical STALL reasons. MAX CURRENT preset not correctly set, hence insufficient torque

7 Motor not powerful enough for application or speed calibration set beyond capability of supply.

8 Any factor which prevents motor from rotating at set speed, eg. jammed load, low supply voltage.



9 Pot wired with wiper connected to T2 instead of T3. Motor slows down instead of speeding up

10 Wires to T2 and T3 transposed. Motor slows down for clockwise rotation

11 Any pot wire or internal electrical part of pot earthed. This causes critical damage. Double check before power on.

12 Loose or intermittent tacho coupling causes instability or overspeeding. Make sure coupling is secure and non-elastic

13 Incorrect feedback scaling causes over or underspeeding. Calculate the desired max. tacho volts, adjust S1, S2

14 Tacho failure. Until a replacement is obtained change to AV feedback S4. Rescale with S1, S2

15 Armature resistance should normally be a few ohms. The armature time constant must be greater than 10 msecs

16 Shorted turn on motor armature can cause power device failure. Check resistance through 360 deg rotation

17 Brushes should be in good condition, correctly seated, and free to move in brush boxes.

18 Field resistance should normally be a few hundred ohms. The field must be isolated from earth and the armature

19 Do not open circuit the field. Do not open circuit the armature unless RUN is opened first.

20 The AC supply must lie within the limits specified on page 8. Ensure the selection jumper is correct.

SPECIFICATION

FUNCTION	SPECIFICATION					COMMENTS
CONTROL ACTION	DUAL LOOP PROPORTIONAL + INTEGRAL					
FEEDBACK METHOD	ARMATURE VOLTS				TACHOMETER	SWITCH SELECT
0-100% REGULATION	2% TYPICAL				0.1% TYPICAL	
MAX TORQUE SPEED RANGE	20 : 1				100 : 1	BEWARE MOTOR HEAT AT LOW SPEED
OVERLOAD	150% CONTINUOUS CURRENT FOR 30 seconds.					
<u>CUSTOMER PRESETS</u>						
MAX SPEED	12V - 200V FULL SCALE FEEDBACK					SWITCH SELECT
MIN SPEED	0-50% OF MAX SPEED					NON-INTERACTIVE
UP/DOWN RAMPS	INDEPENDANTLY ADJUSTABLE 1-30secs					LINEAR RAMPS
STABILITY	VARIES SPEED LOOP GAIN					
IR COMPENSATION	0-30% OF ARMATURE VOLTAGE					
MAX CURRENT	LINEAR SETTING FROM 0-100%					150% OVERLOAD
<u>SWITCH SELECTABLE</u>						
SPEED RANGE	FOUR RANGES OF FEEDBACK VOLTAGE					S1, S2
TORQUE MODE	O-10V INPUT FOR 0-100% CURRENT WITH AUTOMATIC OVERSPEED PROTECTION.					S3
TACHO/AVF	SELECT TACHO OR AV. FEEDBACK					S4
<u>JUMPER FUNCTIONS</u>						
SUPPLY SELECT	DUAL SUPPLY VOLTAGE SELECTOR					
<u>LINK FUNCTIONS</u>						
4-20mA LOOP	ALLOWS 4-20mA LOOP SIGNAL INPUT					5V COMPLIANCE
50% STALL LEVEL (STH LINK)	ALLOWS LARGE PEAK CURRENTS					150% PEAK
SUPPLY RANGES		LV30	LV60	110	240	OVER FULL TEMP
45HZ TO 65HZ	MAX	36V	72V	130V	264V	RANGE WITH
AUTO RANGING	MIN	27V	54V	100V	200V	OUTPUTS LOADED
SIGNAL OUTPUTS	SPEED, CURRENT, RAMP					ALL BUFFERED
RELAY OUTPUTS	STALL , ZERO SPEED RELAY DRIVERS					FOR -24V DC
RAIL OUTPUTS	-24V UNREGULATED 25mA +12V, +10V, -12V REGULATED 10mA					+/- 20% 0.01%/DEG C 5%
FIELD OUTPUT	0.9 (0.45) TIMES AC SUPPLY. 0.5 AMP MAX					FULL WAVE (0.9), HALF WAVE (0.45)
ALTITUDE	3000 METRES MAX FOR FULL RATING					DERATE 1%/100M
HUMIDITY	85% R.H AT 40 C, NON-CONDENSING					
FORM FACTOR	TYPICAL 1.5 AT MAX. OUTPUT					
TEMPERATURE	OPERATING and STORAGE -10 to +50 ambient					
MAX I^2t FOR EXTERNAL FUSING	MODELS 400/800 50 I^2t, MODEL 1200 365 I^2t					CONTACT SUPPLIER TO OBTAIN SUITABLE SEMI-CONDUCTOR FUSES FOR ALL MODELS

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