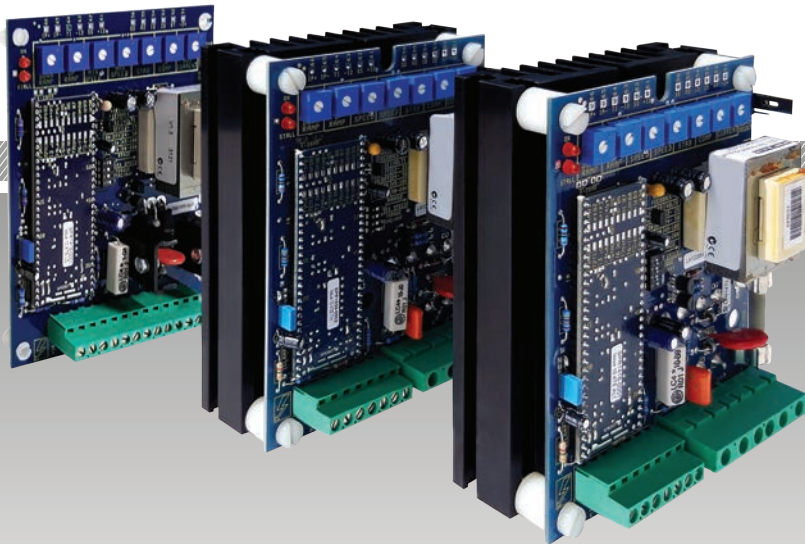


World Class Design | World Class Function | 30 Years Expertise in Industrial Motor Control

DC THYRISTOR DRIVE

400 / 800 / 1200



SPRINT ELECTRIC

Please read this information before installing or using the product.

Install, use and maintain this product following the procedures provided.

The manual(s) cannot provide all details, variations and contingencies required for your installation, operation and maintenance of this product or the apparatus with this product installed. For further help or information, refer to your local Supplier sales office.

Application area

The equipment described is intended for industrial (non-consumer) motor speed control.

Intended users

To safely enable the user to obtain maximum benefit from the equipment:

- Ensure this information is available to all persons required to install, configure or service the described equipment or any other associated operation.
- Always store the manual in a conveniently accessible area for quick reference.
- Make it available for the next user/owner of the product.

This product is of the restricted sales distribution class according to IEC 61800-3 and has a "professional equipment" designation as defined in EN 61000-3-2.

Safety

Ensure all users and operators understand the included WARNINGS, CAUTIONS and NOTES, which alert the user to safety issues. COMPLY WITH WARNINGS AND CAUTIONS AT ALL TIMES. Each of these carries a special meaning and should be read carefully:



WARNING!

A WARNING is given when non-compliance with the warning may result in personal injury and/or equipment damage.



CAUTION!

A CAUTION is given when non-compliance with the caution may result in permanent equipment damage.

NOTE A note provides specific information to make important instructions clear.

Symbols

 Attention	 Electrostatic Discharge (ESD)	 Electric Shock Hazard
See the instructions for use. Specific warnings not found on the label.	This equipment contains ESD sensitive parts. Observe static control precautions when handling, installing and servicing this product.	Disconnect the mains supply before working on the unit. Do not touch presets, switches and jumpers! Always use the correct insulated adjustment tools.



WARNING!

Only qualified personnel must install, operate and maintain this equipment.

A qualified person is someone technically competent and familiar with all safety information, established safety practices, installation, operation, maintenance and the hazards involved with this equipment and any associated machinery.

Hazards

This equipment can endanger life through rotating machinery and high voltages.



WARNING!

PERSONAL INJURY AND/OR ELECTRICAL SHOCK HAZARD

- Always isolate all power supplies from the equipment before starting any work.
- Never perform high voltage resistance checks on the wiring without first disconnecting the product from the circuit under test.
- Use guarding and additional safety systems to prevent injury and electric shock.
- Metal parts may reach 90°C during operation.



CAUTION!

EQUIPMENT DAMAGE HAZARD

- We thoroughly test our products. However, before installation and start-up, inspect all equipment for transit damage, loose parts, packing materials, etc.
- Installation must observe the required environmental conditions for safe and reliable operation.
- In a domestic environment, this product may cause radio interference, requiring adequate measures to be taken. Obtain the permission of the supply authority before connecting to the low voltage supply.

General risks

Installation

- Ensure mechanically secure fixings are in use as recommended.
- Ensure cooling airflow around the product is as recommended.
- Ensure cables/wire terminations are as recommended and are torqued correctly.
- Ensure the product rating is correct - do not exceed the rating.

Application risk

Electromechanical safety is the responsibility of the user. The integration of this product into other apparatus or systems is not the manufacturer's or distributor of the product's responsibility. It is the user's responsibility to ensure the compliance of the installation with any regulations in force.

Health and safety at work

Electrical devices can constitute a safety hazard. Thorough personnel training is an aid to SAFETY and productivity. SAFETY awareness not only reduces the risk of accidents and injuries in your plant but also has a direct impact on improving product quality and costs. If you have any doubts about the SAFETY of your system or process, consult an expert immediately. Do not proceed without doing so. If in doubt, refer to the Supplier.

Weight

Consideration should be given to the weight of our heavier products when handling.

Risk assessment

Under fault conditions or conditions not intended: the motor speed may be incorrect; the motor speed may be excessive; the direction of rotation may be incorrect; the motor may be energised.

In all situations, the user should provide sufficient guarding and/or additional redundant monitoring and safety systems to prevent risk of injury.

NOTE: During a power loss event, the product will commence a sequenced shut-down procedure. Therefore, the system designer must provide suitable protection for this case.

Maintenance

Only qualified personnel should maintain and effect repair using only the recommended spares, alternatively return the equipment to the factory for repair. The use of unapproved parts may create a hazard and risk of injury.



WARNING!

PERSONAL INJURY AND/OR EQUIPMENT DAMAGE HAZARD

When replacing a product, all user-defined parameters that define the product's operation must be installed correctly before returning to use. Failure to do so may create a hazard and risk of injury.

The packaging is inflammable and incorrect disposal may lead to the generation of lethal toxic fumes.

Repairs

Repair reports can only be given if the user makes sufficient and accurate defect reporting. Remember that the product without the required precautions can represent an electrical hazard and risk of injury, and that rotating machinery is a mechanical hazard.

Protective insulation

Non-isolated product



WARNING!

The motor must be connected to an appropriate safety earth.

Failure to do so presents an electrical shock hazard. Exposed metal work in this equipment is protected by basic insulation and bonding to a safety earth.

This product is classified as a component and must be used in a suitable enclosure.

1. **There is no isolation between the Power and Control Circuits. ALL connections to the Drive are HAZARDOUS. Mount the drive in an earthed enclosure.**
2. **The Installer MUST provide Protection for the End User** by using Double or Re-reinforced Insulation. The drive's Control signal terminals operate at the output voltage of the drive. Therefore, User controls **MUST** be made safe by the use of suitably insulated components, i.e. Potentiometer, Run Switch.
3. **DO NOT** connect these Control signal terminals to low voltage equipment or any non-isolated potential as this will cause significant damage to both the Drive and attached equipment.

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Disposal

This product contains materials that are consignable waste under the Hazardous Waste Regulations 2005. Metal and plastic materials can be recycled, however, disposal of the printed circuit board requires compliance with all valid environmental control laws.



Products that must be recycled in accordance with the WEEE Regulations are marked with the symbol opposite. Contact us when recycling the product.



1 Introduction

APPLICATION AREA: Industrial (non-consumer) "Motor speed control utilising DC Motors".

DRIVE MODEL	AC SUPPLY VOLTAGE (V)	NOMINAL OUTPUT VOLTAGE (V)	MAXIMUM CURRENT (A)	NOMINAL POWER OUTPUT	DISSIPATION AT RATED CURRENT (W)	ISOLATION
400/LV60	60/30	48/24	4	200 W	12	non-isolated
400	240/110	180/190	4	0.55 kW	12	non-isolated
800/LV60	60/30	48/24	8	400 W	24	non-isolated
800	240/110	180/90	8	1.2 kW	24	non-isolated
1200/LV60	60/30	48/24	12	600 W	36	non-isolated
1200	240/110	180/90	12	2.0 kW	36	non-isolated

- All models are of open chassis construction. Enclosed versions are available as follows: 400E, 400ER, 800E, 800ER, 1200E, 1200ER. E = enclosed; R = reversing.
- Closed-loop control of both armature current and feedback voltage for precise control of motor torque and speed.
- Motor and drive are protected by a stall timer that automatically removes power after 30 seconds if the required speed is not achievable.
- Provides for up to 150% of the preset maximum current for up to 30 seconds allowing for high, short-term torques, for example, during acceleration.
- Independent control of either the current or speed loops by external inputs allows for torque or speed control applications with overspeed or overcurrent protection.
- Derive the demand signal from a potentiometer, 0-10 V signal or 4-20 mA loop.
- Speed feedback signal selection: ARMATURE VOLTAGE, or shaft-mounted TACHOMETER.

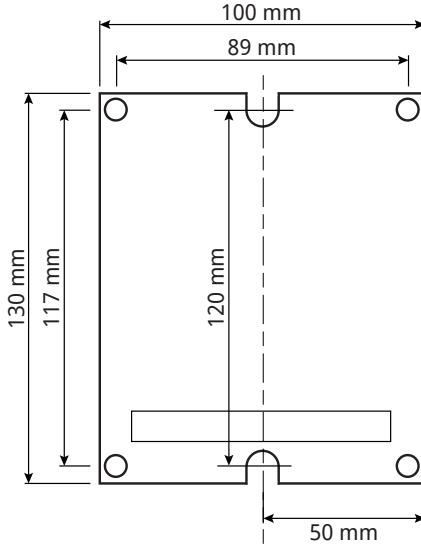
Input and outputs	+aux input	speed output	rail outputs
	-aux input	current output	+12 V regulated output
	current input	ramp output	+10 V precision reference
	4-20 mA input	stall relay driver	-12 V regulated output
	0 to 10 V input	zero speed driver	-24 V unregulated output
Adjustable parameters	Max speed	Up ramp	Max current
	Min speed	Down ramp	IR comp
			Stability
Switched functions	Max feedback	Tacho feedback	
	Torque control	AV feedback	
Jumper functions	Dual supply voltage	Phase angle limit	
	4-20 mA input	50% stall threshold	
Performance features	Dual loop control	Precision tacho rectifier	Compact design
	Relay driver outputs	International compatibility	Integral fusing

2 Mechanical dimensions



WARNING!
PERSONAL INJURY AND/OR
EQUIPMENT DAMAGE HAZARD

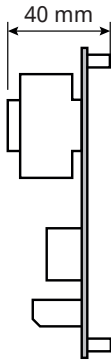
The drives are NON-ISOLATED.
Do not allow contact of the enclosure with the drive card electronics.



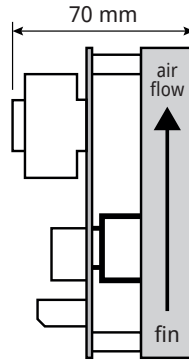
Fixings

Model 400:
has four corner
fixings suitable for
M4 x 20 mm bolts

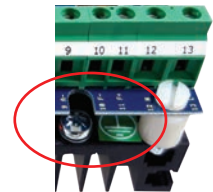
Models 800 & 1200:
has two centre
fixings suitable for
M5 x 35 mm bolts



Model 400



Model 800/1200



IMPORTANT: The heatsink
MUST be earthed using the
screw provided.

Figure 1 Mechanical dimensions

3 Guide for systems used in the EU

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.

* EN618003 specifies two 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 AC supply 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 that supplies buildings used for domestic purposes.

4 Multiple drives

The arrangement shown below is for multiple drives with one filter, showing the star point earthing method.

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).

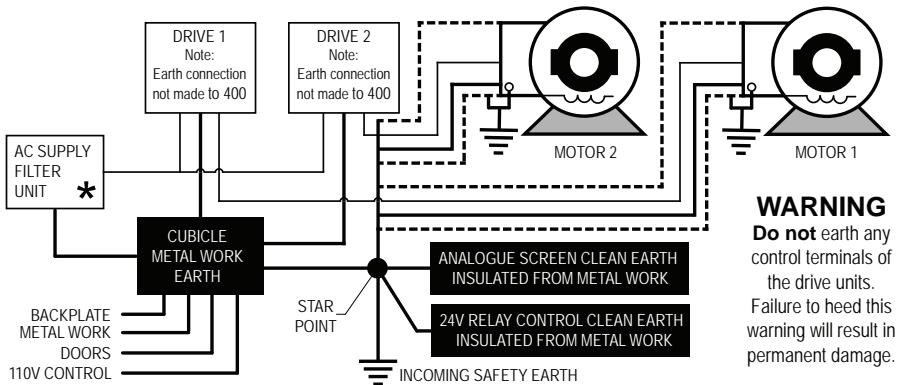


Figure 2 Star point connections for multiple drives

5 Requirements for EMC compliance

- Keep parallel runs of power and control cables at least 0.3 metres apart. Cross-overs must be at right angles.
- Keep sensitive components at least 0.3 metres from the drive and power supply cables.
- The AC connections from the filter to the drive must be less than 0.3 metres or, if longer, correctly screened.
- Do not run filtered and unfiltered AC supply cables together.
- Control signals must be filtered or suppressed, e.g. 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 AC input filter has earth leakage currents. Earth RCD devices may need to be set at 5% of rated current.
- The metal enclosure will be RF ground. The AC filter, drive earth and motor cable screen should connect directly to the metal cabinet for best performance.
- 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.
- (1) 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.
- (2) 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.



WARNING!
ELECTRIC SHOCK HAZARD

AC supply filters must not be used on supplies that are unbalanced 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 at least 20 seconds after the removal of the AC supply.

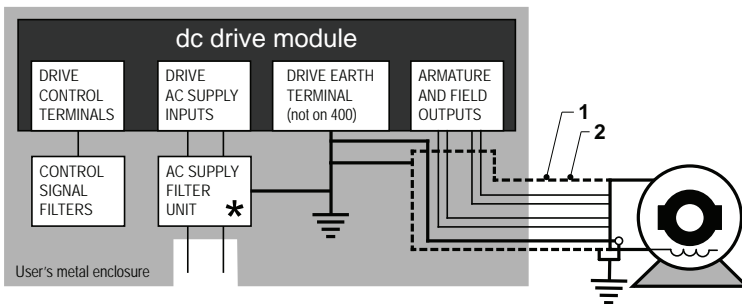


Figure 3 Connections for EMC compliance

6 Installation



WARNING!

ELECTRIC SHOCK HAZARD

Disconnect the mains supply before working on the unit. **DO NOT TOUCH PRESETS, SWITCHES AND JUMPERS!** Always use the correct insulated adjustment tools.

6.1 Motor installation

- Foot-mounted motors must be level and secure.
- Ensure accurate alignment of the motor shaft and couplings.
- Do not hammer pulleys or couplings onto the motor shaft.
- Protect the motor from ingress of foreign matter during installation.

Earthing: Connect the motor to the system enclosure earth.

6.2 Drive Installation

Requirements during installation and operation:

HEATSINK AIRFLOW: Optimise the heatsink airflow.

- Avoid vibration.
- Protect the drive from pollutants.
- The ambient operating temperature must be within -10°C and +40°C.

POWER CABLING: Use correctly rated cable: minimum 600 Vac, 2 x armature current

FUSING: The drives have built-in line fuses for wiring protection:

- 400 6.3 A HRC
- 800 15 A HRC
- 1200 15 A HRC

Protect the drive thyristor bridge by fitting external semiconductor fuses. Refer to "7 Typical applications" on page 6.

CONTROL SIGNALS: All control inputs to these 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 additional filters on the line and armature terminals. Contactor coils and sparking contacts may also require suppression. A 100 Ω resistor in series with a 0.1 μF capacitor is usually adequate in these situations. Refer to page 4 for EMC guidelines.



CAUTION! EQUIPMENT DAMAGE HAZARD

Reversing systems: do not transpose the armature connections until the motor has stopped, otherwise damage will occur.

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 drive unit and will invalidate any warranty.



CAUTION! EQUIPMENT DAMAGE HAZARD

For frequent stopping, it is not good practice to rely on switching the supply off and on again to stop and start the drive with the run contact permanently closed. This practice may result in an uncontrolled current pulse for one half mains cycle under certain conditions, e.g. main contact bounce, and might lead to undesired motor movement or device damage.

In rapid start-stop systems, use a spare normally-open contact on the main supply contactor in series with T5 and any other RUN contacts.

7 Typical applications

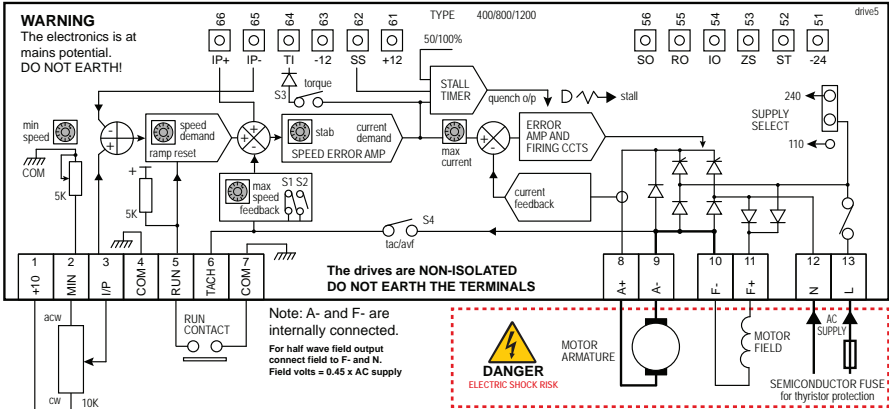


Figure 4 Basic connection

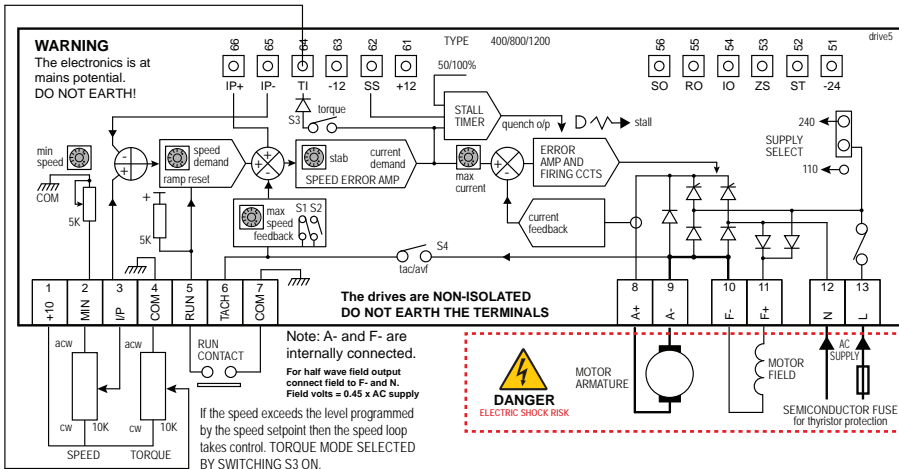


Figure 5 Torque control with overspeed limiting by separate setpoint

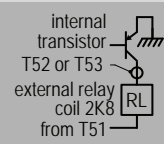
	Drive model	Rating	Semiconductor fuse	A ² s
Fuses	400	8 A	CH006 08A	35
	800	12 A	CH006 12A	75
	1200	20 A	CH006 20A	259

SPRINT ELECTRIC LTD. does not accept any liability whatsoever for the installation, fitness for purpose or application of its products. It is the users responsibility to ensure that the unit is correctly used and installed.

Health and Safety at Work
Devices constitute a safety hazard. It is the responsibility of the user to ensure compliance with any Acts or By-Laws in force. **ONLY skilled persons should install this equipment.**

8 Terminal descriptions

1	+10 V precision reference. 10 mA maximum. Short circuit proof
2	Minimum end of setpoint potentiometer or 4-20 mA current loop I/P
3	Speed demand input, 0-10 V for 0-100% speed
4	Common - 4-20 mA return
5	Connect to COMMON to run 60 ms ON / 20 ms OFF (5 kΩ pull-up to +12 V) 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 12-200 V full scale, + or - polarity
7	Common
8	A+ armature output
9	A- armature output
10	F- field output
11	F+ field output
12	N Neutral AC supply input according to supply select jumper
13	L Line AC supply input according to supply select jumper
66	Auxiliary speed input, 0 to +10 V for 0-100% direct speed
65	Auxiliary inverting speed input, 0 to -10 V for 0-100% ramped speed
64	Torque input, 0 to +10 V for 0 to 100% current
63	-12 V output 10 mA maximum - do not short
62	Stop/start input: close to -12 V to activate stall condition close to +12 V to release stall condition
61	+12 V output, 10 mA maximum - do not short
56	Speed output - typically 7.5 V full scale adjustment of maximum speed preset will alter the full scale reading from 4 V (anti-clockwise) to 9 V (clockwise) 0 V to full scale represents 0 to 100% Impedance: 1 kΩ
55	Setpoint ramp output, 0-10 V, impedance 1 kΩ
54	Current output, 0-5 V for 0-100% of chosen range (S1, S2), 1 kΩ impedance
53	Zero speed relay driver output, maximum 100 mA, switches to -24 V
52	Stall relay driver output, maximum 100 mA, switches to -24 V
51	-24 V relay supply, 25 mA - do not short



9 Block diagram

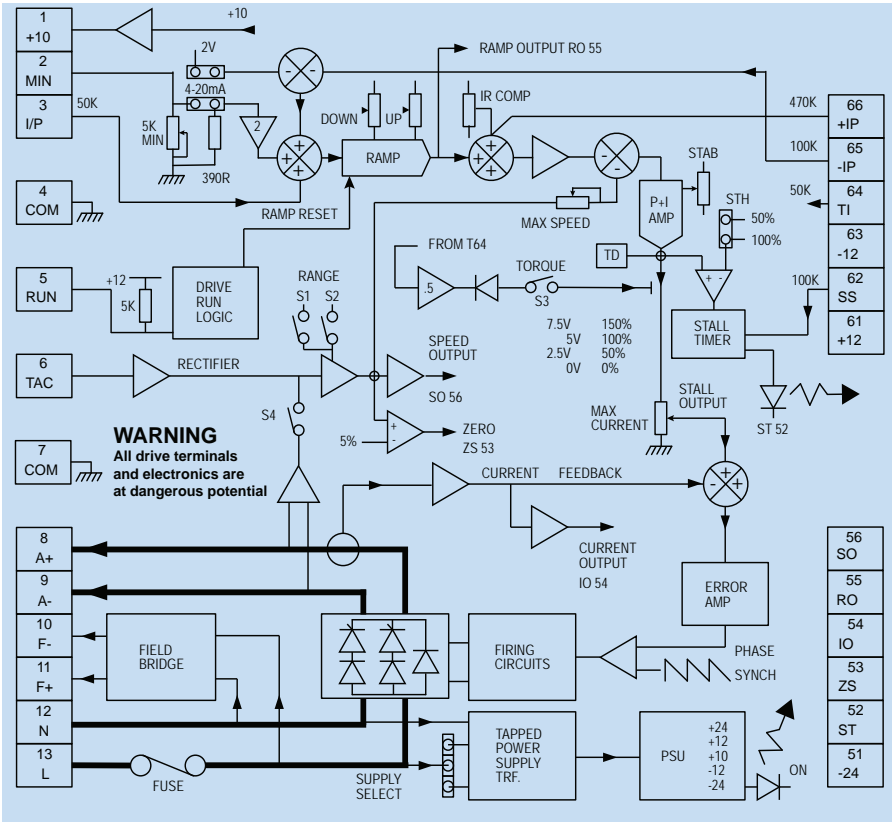


Figure 6 Block diagram



WARNING! PERSONAL INJURY HAZARD

This product is non-isolated, so ALL terminals and electronics are at dangerous line potential with power applied to the drive. Remember, all wires, potentiometers, contacts, etc., connected to the terminals will be floating at mains potential.

10 Commissioning

10.1 Initial settings - without power

The suggested Commissioning strategy starts in the safest possible mode of operation and progressively exercises each element of the system to achieve full functionality. For this reason, we ship all drive units to run using:

- the highest supply option
 - at nominal speed
 - ARMATURE VOLTAGE feedback mode
1. **To avoid damage, ensure the supply selection jumper on the drive matches the incoming ac supply: 240 Vac or 110 Vac (60 Vac or 30 Vac for LV60 models).**
 2. Ensure switch S3 is set to OFF and S4 is set to ON to select AVF.
 3. Switches S1 and S2 select the range of the full-scale feedback voltage, e.g. if the armature voltage is 180 V, set S1 and S2 to ON; if 90 V, set S1 to OFF and S2 to ON.
 4. For an initial start, adjust the following presets for safety:

DOWN RAMP	Fully anti-clockwise
UP RAMP	Fully anti-clockwise
MIN SPEED	Fully anti-clockwise
MAX SPEED	Fully anti-clockwise
STABILITY	Mid-way
IR COMP	Fully anti-clockwise
MAX CURRENT	Set the MAX CURRENT from your motor rating plate. Clockwise rotation of the potentiometer gives 0-100% of the drive current rating, e.g. 50% rotation provides 50% of the drive current rating.

10.2 Pre-operation motor checklist

5. **With no power applied, complete the following checklist:**
 - All power and control connections are secure.
 - Check for the correct insulation between individual motor elements and between these elements and the earthed motor frame. Disconnect all drive cables before testing. The motor elements are: armature winding, temperature sensors*, tachogenerator* (* where applicable).
 - Check inside the motor connection box for foreign objects, damaged terminals, etc.
 - Check that motor brushes are in good condition, correctly seated and free to move in brush boxes.
 - Check for the correct action of brush springs.
 - Check that motor vents are free of any obstruction and remove any protective covers.



WARNING! **PERSONAL INJURY HAZARD**

This product is non-isolated, so ALL terminals and electronics are at dangerous line potential with power applied to the drive.
Ensure that connected items (e.g. speed potentiometer, Tacho etc.) are NOT earthed and have sufficient dielectric strength to avoid breakdown.



WARNING!

When power is applied to the drive,
ALWAYS use an insulated tool when adjusting the presets.



DANGER ELECTRIC SHOCK RISK

AC power is applied when lit.

To implement the 50% THRESHOLD, link the two points marked STH. Drive quenches when lit if stall timer trips - the time depends upon the current demand:

STANDARD

150%	30 secs
125%	60 secs
115%	120 secs
100%	no trip

WITH 50% THRESHOLD

150%	15 secs
100%	30 secs
75%	60 secs
50%	no trip

The suggested Commissioning strategy starts in the safest possible mode of operation and progressively exercises each element of the system to achieve full functionality.

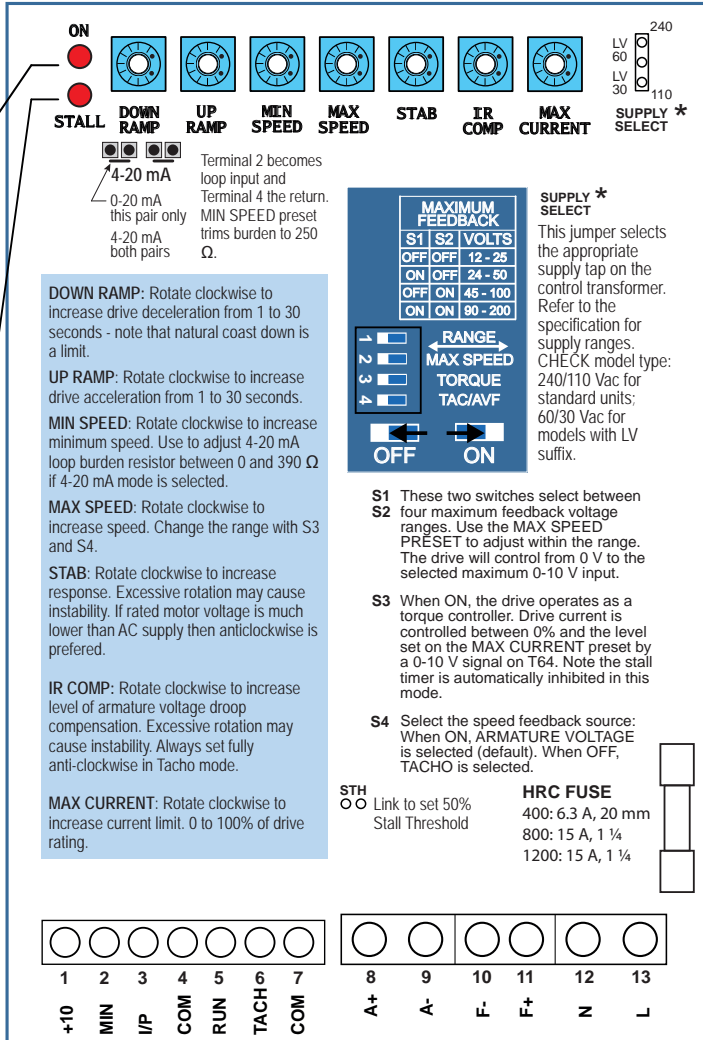


Figure 7 User adjustments

10.3 Operating the drive



WARNING! **PERSONAL INJURY HAZARD**

RUN is an electronic inhibit function. The field remains energised, and all power terminals 'live'. During hazardous operations, remove the power source to the system. **RUN must not be relied on to ensure the machine is stationary.** The motor FIELD output remains energised with RUN open, so please beware of overheating the motor when stopped (does not apply to permanent magnet motors).

6. **For this initial start, disconnect and insulate the (optional) Tacho connection to Terminal 6** as the drive will be using **Armature Voltage** feedback.
 7. Note the Rated Armature Volts from the motor rating plate.
 8. **Apply power to the drive.** The drive's ON lamp will light.
 9. Operate the RUN switch to turn the motor.
 10. Slowly increase the external speed potentiometer to start the motor rotating. The motor will ramp up slowly to a nominal or base speed. **DO NOT exceed the motor's rated voltage.**
 11. **Is the motor turning in the required direction?** If not, reverse the system by transposing the A+ and A- motor armature connections.
-



CAUTION!

When reversing the system: To prevent damage, do not transpose the motor armature connections until the motor has stopped rotating.

12. **MAX SPEED:** Increase the external setpoint further to ramp up to full speed. Fine adjust using the **MAX SPEED** preset to achieve the armature voltage stated on the motor rating plate.
13. Reduce the external setpoint to ramp the drive to zero. The motor will stop rotating.
14. **MIN SPEED:** Adjust the **MIN SPEED** preset to provide a speed preset (for use where an external setpoint is not in use).
15. **RAMP UP/RAMP DOWN:** Run the motor speed up and down while adjusting the **RAMP UP** and **RAMP DOWN** presets.
16. **STABILITY:** Adjust the **STAB** preset to improve response. Clockwise rotation gives a faster response (excessive rotation in either direction may lead to instability, depending on load).
17. **IR COMP:** Speed droop may occur where **ARMATURE VOLTAGE** feedback mode is used (default). Compensate for this by rotating the **IR COMP** preset clockwise (excessive rotation may lead to instability).

The drive is now fully commissioned in ARMATURE VOLTAGE feedback mode.

10.4 DC Tachogenerator Feedback

NOTE: DO NOT use IR compensation with Tachogenerator feedback - set the IR COMP preset fully anti-clockwise.

1. For systems using Tach Feedback, first, measure the full speed tacho voltage while in AVF mode and determine the polarity - the wire to T9 must be negative when the speed demand into T3 is positive:
 1. Having measured the Tach voltage at maximum speed, **TURN OFF THE POWER.**
 2. Set switch S4 to OFF to select TACHO operation.
 3. Set switches S1 and S2 to select a speed range encompassing the tacho voltage measured under AVF operation. For example, if the tachogenerator is 60 V/1000 rpm and the motor speed is 1500 rpm, then the tacho voltage is 90 V, and this is within the voltage range 50-100 V provided by setting S1 to OFF and S2 to ON.
 4. Adjust the MAX SPEED preset to approximately match the full-scale Tach output or mid-position. For example, for a 90 V tacho input using the 50-100 V range, the preset's position would be 80% rotation.
 5. Re-connect T9, **TURN ON THE POWER**, run the drive, and finely adjust MAX SPEED. Increase the MAX CURRENT preset to correspond to the motor armature current.
2. **STABILITY:** Adjust the **STAB** preset to improve response. Clockwise rotation gives a faster response (excessive rotation in either direction may lead to instability, depending on load).

The drive is now fully commissioned in TACHO feedback mode.

11 Options

Consider the following changes to tune/improve the performance of the drive/system.

TORQUE CONTROL MODE: When ON, switch S3 allows a Torque signal to enter via signal pad 64 (TI). The pad is on the top edge of the board.

TORQUE (0-10 V input on T64):

Refer to "7 Typical applications" on page 6 and "Figure 6 Block diagram" on page 8.

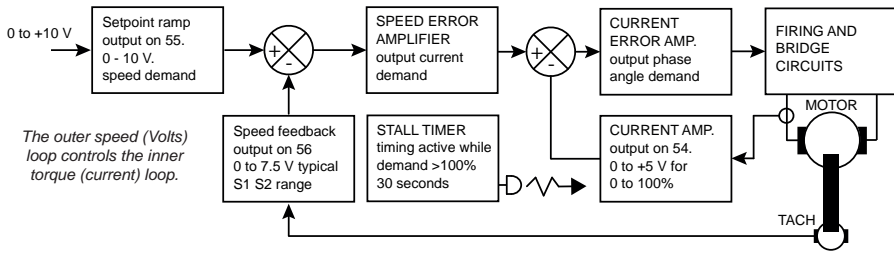
ON for Torque Control mode

OFF (normally off).

In Torque Control mode, the lowest setpoint has priority. Hence, the speed setpoint sets a demand for speed slightly in excess of the system's working speed, meaning the torque setpoint always operates as the limit. For example, in the event of a web break, the motor will only run-up to the level set on the speed potentiometer.

12 Trouble shooting

The drive consists of two highly accurate feedback control loops.



WARNING! PERSONAL INJURY AND/OR EQUIPMENT DAMAGE HAZARD

This drive is NON-ISOLATED:

Do not connect the electronics to earth or other non-isolated voltage. Connecting to other instruments, e.g. a panel meter: ensure the instrument can float safely at high voltage.

Remember, all wires, potentiometers, contacts, etc., connected to the terminals will be floating at mains potential.

- 1 STALL problems, indicated by the STALL lamp coming on after running, are caused by the drive unit being unable to give the set speed.
- 2 Typical STALL reasons:
 - a. MAX CURRENT preset not correctly set, hence insufficient torque.
 - b. Motor not powerful enough for the application. Speed calibration is set beyond the capability of supply.
 - c. Any factor which prevents the motor from rotating at set speed, e.g. jammed load; low supply voltage.
- 3 Pot wiring T2 and T1 transposed. Motor slows down instead of speeding up.
- 4 Pot wiring T2 and T3 transposed. Motor slows down for clockwise rotation. T1 may be shorted to T2.
- 5 Pot wiring T1 and T3 transposed. Motor slows down for anti-clockwise rotation. T1 becomes shorted to T2.
- 6 Any pot wire or internal electrical part of pot earthed. This causes critical damage. Check before power-on.
- 7 Loose or intermittent tacho coupling causes instability or overspeeding. Make sure coupling is secure and non-elastic.
- 8 Incorrect feedback scaling causes overspeeding. Calculate the desired maximum tacho volts - adjust S1, S2.
- 9 Tacho failure. Until a replacement is fitted, change to ARMATURE VOLTAGE feedback, S4. Rescale with S1, S2.
- 10 Armature resistance should usually be a few ohms. The armature time constant must be greater than 10 milliseconds.
- 11 Shorted turn on motor armature can cause power device failure. Check resistance through 360° rotation.
- 12 Brushes should be in good condition, correctly seated, and free to move in brush boxes.
- 13 Field resistance should usually be a few hundred Ohms. Isolate the field from the earth and the armature.
- 14 Do not open-circuit the field. Do not open-circuit the armature unless opening RUN first.
- 15 The AC supply must lie within the limits specified on page 15. Ensure the selection jumper is correct.

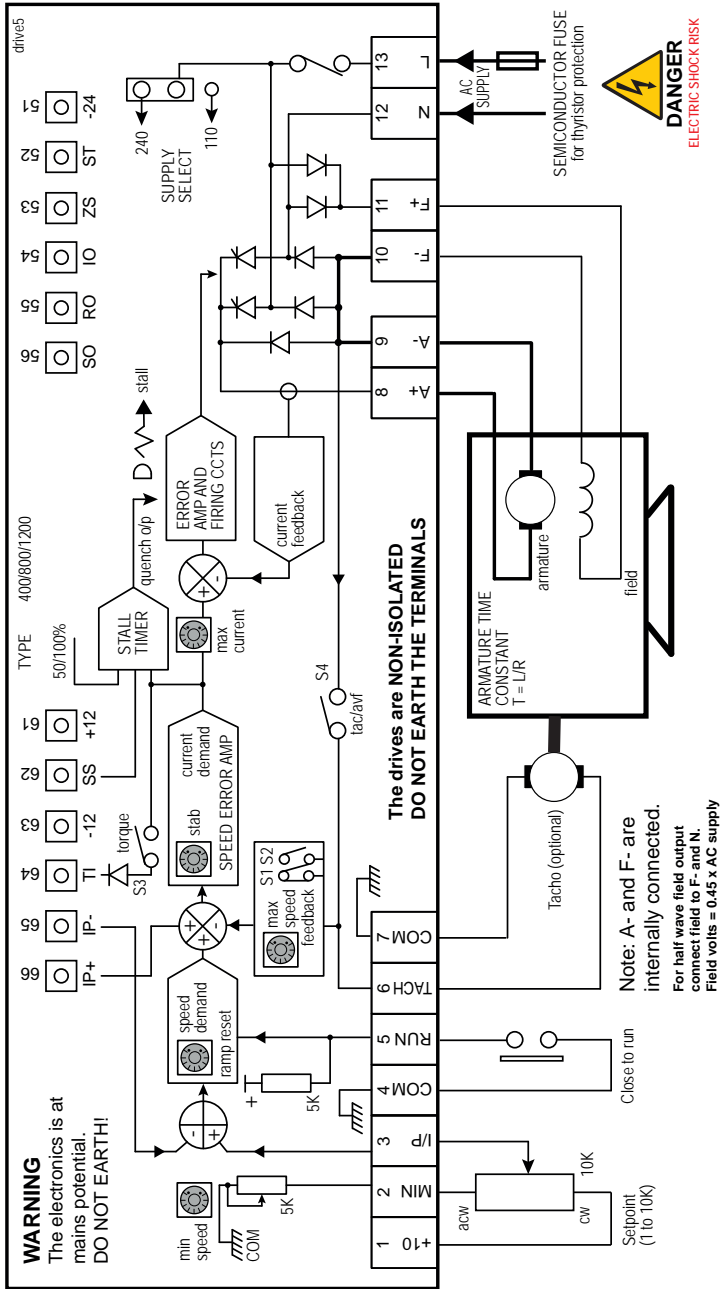


Figure 8 Alternative wiring option showing the addition of the tacho.

13 Specifications

Function	Specification	Comments															
CONTROL ACTION FEEDBACK METHOD 0-100% REGULATION MAX TORQUE SPEED RANGE OVERLOAD	DUAL LOOP PROPORTIONAL + INTEGRAL ARMATURE VOLTS 2% TYPICAL 20 : 1 150% CONTINUOUS CURRENT FOR 30 SECONDS	TACHOMETER 0.1% TYPICAL 100 : 1 SWITCH SELECTABLE BEWARE MOTOR HEAT AT LOW SPEED															
Customer Presets MAX SPEED MIN SPEED UP/DOWN RAMPS STABILITY IR COMPENSATION MAX CURRENT	12 - 200 V FULL SCALE FEEDBACK 0-50% OF MAX SPEED INDEPENDENTLY ADJUSTABLE 1-30 SECONDS VARIES SPEED LOOP GAIN 0-30% OF ARMATURE VOLTAGE LINEAR SETTING FROM 0-100%	SWITCH SELECTABLE NON-INTERACTIVE LINEAR RAMPS DO NOT USE WITH TACHO 150% OVERLOAD															
Switch Selectable SPEED RANGE TORQUE MODE TACHO/AVF	FOUR RANGES OF FEEDBACK VOLTAGE 0-10 V INPUT FOR 0-100% CURRENT WITH AUTOMATIC OVERSPEED PROTECTION SELECT TACHO OR ARMATURE VOLTAGE FEEDBACK	S1, S2 S3 S4															
Jumper Functions SUPPLY SELECT	DUAL SUPPLY VOLTAGE SELECTOR	JUMPER SELECTABLE															
Link Functions 4-20 mA OR 0-20 mA LOOP 50% STALL LEVEL (STH LINK)	ALLOWS CURRENT LOOP SIGNAL INPUT FOR SPEED ALLOWS LARGE PEAK CURRENTS	5 V COMPLIANCE 150% PEAK															
SUPPLY RANGES 45 Hz to 65 Hz AUTO RANGING	<table border="1"> <thead> <tr> <th></th> <th>LV30</th> <th>LV60</th> <th>110</th> <th>240</th> </tr> </thead> <tbody> <tr> <td>MAX</td> <td>36 V</td> <td>72 V</td> <td>130 V</td> <td>264 V</td> </tr> <tr> <td>MIN</td> <td>27 V</td> <td>54 V</td> <td>100 V</td> <td>200 V</td> </tr> </tbody> </table>		LV30	LV60	110	240	MAX	36 V	72 V	130 V	264 V	MIN	27 V	54 V	100 V	200 V	OVER THE FULL TEMP RANGE WITH OUTPUTS LOADED
	LV30	LV60	110	240													
MAX	36 V	72 V	130 V	264 V													
MIN	27 V	54 V	100 V	200 V													
SIGNAL OUTPUTS RELAY OUTPUTS RAIL OUTPUTS	SPEED, CURRENT, RAMP STALL, ZERO SPEED RELAY DRIVERS -24 V UNREGULATED 25 mA +12 V, +10 V, -12 V REGULATED 10 mA	ALL BUFFERED FOR -24 VDC +/- 20% 0.01%/°C 5%															
FIELD OUTPUT IP RATING ALTITUDE HUMIDITY FORM FACTOR TEMPERATURE MAX I ² t FOR EXTERNAL FUSING (Amps ² Seconds)	0.9 (0.45) x AC SUPPLY. 0.5 A MAXIMUM IP00 3000 METRES MAXIMUM FOR FULL RATING 85% R.H. AT 40°C, NON-CONDENSING TYPICAL 1.5 AT MAXIMUM OUTPUT STORAGE AND OPERATING -10 TO +50°C AMBIENT MODELS 400/800 = 50 I ² t. MODEL 1200 = 365 I ² t	FULL (0.9) OR HALF WAVE (0.45) DE-RATE 1%/100 m SEMICONDUCTOR FUSES - REFER TO SUPPLIER															

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