SPRINT ELECTRIC

3600XRi

Product Manual

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Sprint Electric Ltd accepts no liability whatsoever for the installation, fitness for purpose or application of its products. It is the user's responsibility to ensure the unit is correctly rated, used and installed.

The contents of this manual are accurate at the time of printing. However, the manufacturers reserve the right to change the content and product specification without notice. No liability is accepted for errors or omissions.

1 Important safety notes

Drives and process control systems are a very important part of creating better quality and value in products, but they must be designed, installed and used with great care to ensure everyone's safety. Pay particular attention to all the safety warnings in this section.



Electric shock risk! Electrical devices constitute a safety hazard. It is the responsibility of the user to ensure compliance with any acts or bylaws in force.



All personnel who will install, use or maintain this equipment must read and understand this manual before applying power to the device. If in doubt, refer to the supplier.



Only install this device if you have the skills and knowledge to use it safely.



Only use qualified personnel to design, construct, operate and maintain your systems.



Make sure that all personnel who use or maintain the equipment are aware of all the hazards that are involved in your equipment and processes.



If you have any doubts about the safety of your system or process, do not proceed without first consulting an expert.



The ac supply filters must not be used on unbalanced power supplies, or those that float with respect to earth.



The drive and ac filter (if supplied) must only be used with a permanent earth connection. Do not use plugs and sockets in the ac supply.



The ac supply filter (if supplied) contains high-voltage capacitors and should not be touched for 20 seconds after the removal of the ac supply.

This controller is an open-chassis component for use in a suitable enclosure.

2 Models

Sprint Electric offers a range of isolated dc thyristor 4-quadrant drives. In the 3600XRi model range each drive has the same features and terminals. Select the appropriate model depending on the motor current and the available supply voltage.

3600XRi drive type	**ac supply voltage** (Vac)	**Nominal output** (Vdc)	**100% amps dc output** (Adc)
4/LN	240/110	180/90	4
8/LN	240/110	180/90	8
16/LN	240/110	180/90	16
16/LL	415/240	320/180	16
32/LL	415/240	320/180	32
36/LL	415/240	320/180	36

Note: 1. Low volt versions are available, operating on 60/30 Vac supplies giving 48/24 Vdc output and 48/24 Vac supplies giving 38/18 Vdc output.

2. Top terminals can be added on request.

3. All types are of open-chassis construction with rear heatsink.

4. Nominal output is based on a maximum Form Factor (ratio of RMS ac supply current to dc output) of 1.5.

3 Description

The 3600XRi models use closed-loop control of both armature current and voltage to give precise control of the motor torque and speed. The motor and drive are thermally protected by a stall timer that automatically removes power after approximately 30 seconds if the required speed cannot be achieved.

The drives will provide up to 150% of the preset maximum current during this period, allowing high short-term torques during acceleration or shock loading.

Independent control of either the current or speed loops by external inputs allows torque or speed control applications with overspeed or overcurrent protection. The speed demand signal may be derived from a potentiometer, 0-10 V signal, 0 -20 mA or 4-20 mA loop. The current limit can be derived from a potentiometer or 0 – 10 V signal. A bipolar speed demand is only possible with a voltage input.

The speed feedback signal may be selected to be the armature voltage or a shaft mounted tacho.

The drives are chassis components and must be mounted in a suitable enclosure with a fused supply.

The fuses must be semiconductor types according to the recommendation given in the Protection section of the Technical specifications on page 23.



Failure to use the correct semiconductor fuse ratings will invalidate any warranty.

Control of shaft direction can be by linear voltage signals or pushbuttons. Direct connection to PLC logic controllers is also possible.

Braking of the motor can be fast or ramped, and facilities exist which allow choice of action dependent on direction of rotation. Braking energy is returned to the supply.

Speed and current range are selected by on board function switches and independent adjustment presets are provided for:

- Forward up ramp
- Forward down ramp
- Reverse up ramp
- Reverse down ramp.

The positive and negative current limits are also independently adjustable.

Motoring and braking torque can be adjusted independent of the direction of rotation.

There are a number of additional inputs and outputs which are all electrically isolated from the mains supply to allow simple interfacing to external sources.

4 Block diagram

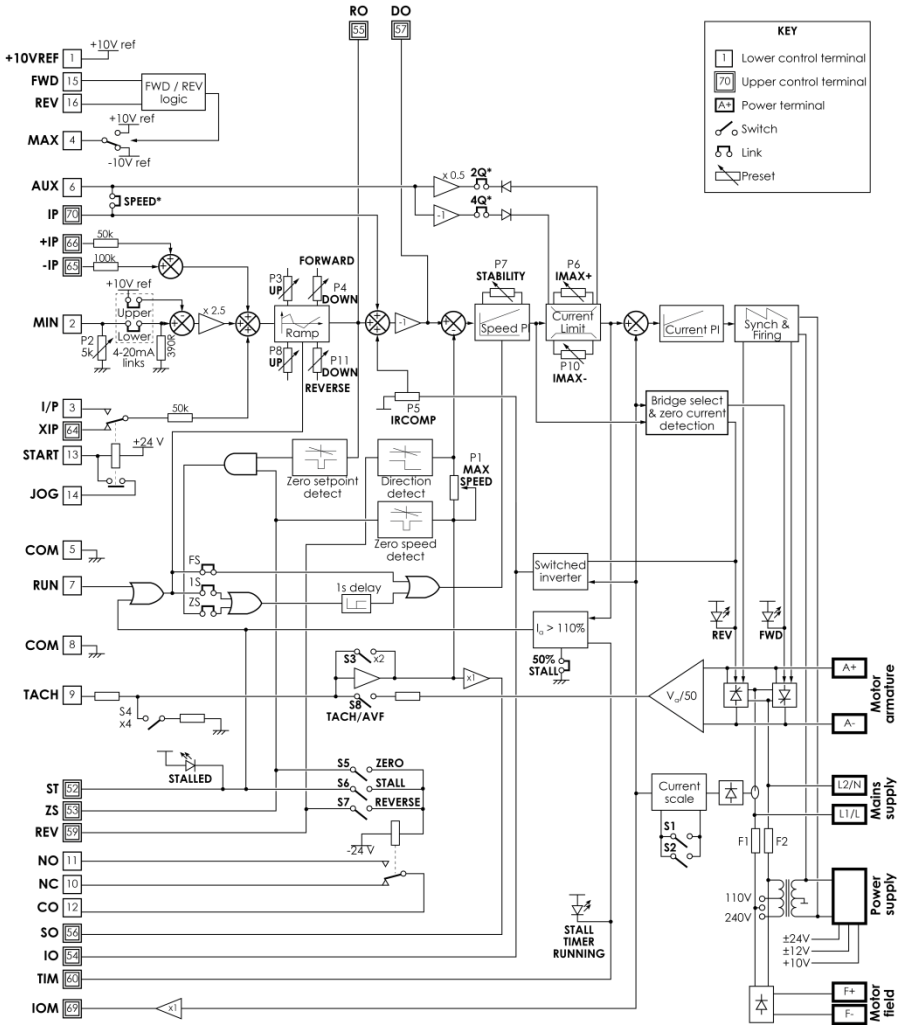


Figure 4-1: Block diagram

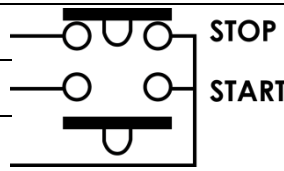
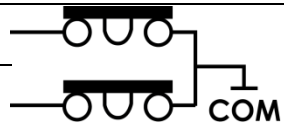
*Note: Only one of the SPEED, 2Q and 4Q links (marked with *) can be fitted at any one time.*

The terminals are described in section 4.1.

4.1 Terminal descriptions

4.1.1 Control terminals

Term.	Description
1 +10	+10 V precision reference. 10 mA maximum. Short-circuit proof.
2 MIN	Minimum (ACW) end of setpoint potentiometer, or 4 - 20 mA / 0 – 20 mA current loop input.
3 I/P	± 10 V input for speed setpoint.
4 MAX	Maximum (CW) end of setpoint potentiometer in bi-directional systems. Set by FWD/REV inputs to +10V or -10V (defaults to -10 V if T15 and T16 are unused)
5 COM	COMMON (4 - 20 mA / 0 – 20 mA return). Internally connected to T8, T58 and T68.
6 AUX	Auxiliary input. Function set by links – see section 6.3.
7 RUN	Connect to COMMON to run. Function set by links – see section 6.3. It is good practice to connect a normally open auxiliary contact of the drive's supply contactor in series with this input. ⚠ RUN is an electronic inhibit function. The field remains energised and all power terminals remain live. Do not rely on RUN to make the system safe during hazardous operations on the machine or control system.
8 COM	COMMON. Internally connected to T5, T58 and T68.
9 TACH	Tacho input 25 – 400 V. Negative for forward rotation.
10 N/C 11 N/O 12 C/O	Relay contact rating 1 A, 125 Vac. Configurable function – see section 7.1.2.

8 COM	N/C STOP pushbutton	8	
13	N/O START pushbutton	13	
14	START latch line	14	
15	N/C FORWARD pushbutton	15	
16	N/C REVERSE pushbutton	16	

4.1.2 Ancillary terminals

51 -24	-24 V relay supply. 25 mA. **NOT SHORT-CIRCUIT PROOF.**
52 ST	Stall relay driver output. Maximum 25 mA. External relay is de-energised when stall timer trips if connected as in Figure 4-2.
53 ZS	Zero speed relay driver output. Maximum 25 mA. External relay is de-energised at zero speed if connected as in Figure 4-2
54 IO	Scaled current output. ±5 V for ±100%. 1 kΩ output impedance.
55 RO	Speed setpoint ramp output. ±10 V for ±100%. 1 kΩ output impedance.
56 SO	Speed output. Full-scale reading determined by max speed preset setting. Variable between ±4 V for ±100% to ±9 V for ±100%. 1 kΩ output impedance.
57 DO	Inverted total speed demand output. +10 V for -100%; -10 V for +100%. 1 kΩ output impedance.
58 COM	COMMON. Internally connected to T5, T8 and T68.
59 REV	Relay driver. Maximum 25 mA. External relay is de-energised when the speed reverses or at zero speed if connected as in Figure 4-2.
60 TIM	Relay driver. Maximum 25 mA. External relay is de-energised when the stall timer is operating (current demand > 105%) if connected as in Figure 4-2.
61 +12	+12 V output. 10 mA maximum.
62 SS	Stop/Start input. Close to -12 V to force a stall condition. Close to +12 V to release stall condition.
63 -12	-12 V output. 10 mA maximum.
64 XIP	Input to speed setpoint ramp circuit when relay RL2 is de-energised (T3 is disconnected). ±10 V for ±100%.
65 –IP	Auxiliary inverting speed input. 0V to -10 V for 0V to +100% speed; 0V to +10 V for 0 to -100% speed.
66 +IP	Auxiliary non-inverting speed input. ±10 V for ±100%.
67 +24	+24 V output. 25 mA maximum. **NOT SHORT-CIRCUIT PROOF.**
68 COM	Drive Common. Internally connected to T5, T8 and T58.

69 IOM	Metering output, 0 to 5 Vdc representing 0 to 100% scaled armature current. See SW1 and SW2. Internally connected to T6.
70 IP	Auxiliary input to speed demand scaled ±10 V for ±100% (if the Torque/Speed link is in the SPEED position).

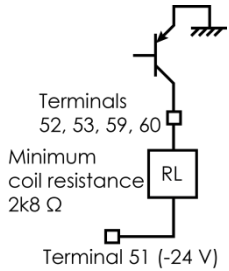


Figure 4-2: Relay circuits

4.1.3 Power terminals

A1 +	Motor armature connection (positive).
A2 -	Motor armature connection (negative).
L2/N	Line ac return; either neutral or L2.
L	Line ac supply input.
F2-	Motor field connection (negative).
F1+	Motor field connection (positive).

5 Installation

Make sure the ac power supply is disconnected before working on the unit.

The unit has two centre fixing slots for mounting.

Mount the unit to allow at least 50 mm clear above and below the unit to allow cooling air to circulate over the heatsink fins.

Make sure the heatsink is earthed with the M5 screw provided at the front edge. The earth connection should have a cross sectional area of at least 6 mm^2.

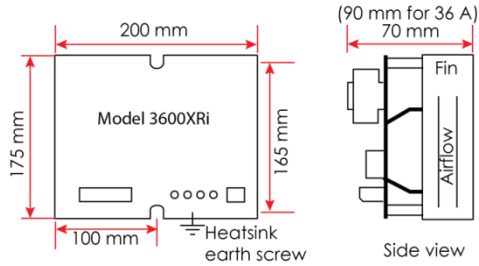


Figure 5-1: Mounting dimensions

5.1 Electrical

5.1.1 Power cables

Make sure the power cabling is correctly rated at 2x armature current with a minimum voltage rating of 600 Vac.

Note: If the motor cable is screened, it must be earthed at the motor AND the drive.

5.1.2 Fusing

Semiconductor fuses must be used in the ac supply. Failure to do so will invalidate any warranty.

Note: Recommended fuses are detailed in the Protection section of the Technical specifications on page 23.

5.1.3 Control signals

Do not run signal cables close to the power cables.

Earth any screens to a clean earth at the drive end only.

5.1.4 Suppression

The drives have excellent noise immunity. However, some installations, for example those that involve electrical welding, RF induction heating, contactor coils and sparking contacts may require further filters on the line and armature terminals. A 100Ω resistor in series with a 0.1µF capacitor is usually adequate.

5.2 Motor

Make sure the motor is correctly wired and that the motor and load are free and safe to rotate.

The motor must ideally have a minimum armature time constant of approximately 10 ms (T = L/R). For motors with lower time constants, for example servo-motors, use an armature choke in series with the motor (refer to the motor supplier for choke data). Failure to do this can cause damage.

6 Presets, switches and links

6.1 Presets

Preset	Description
MAX SPEED	Sets maximum speed for 100% demand
MIN SPEED	Sets minimum speed for application *Note: Minimum speed function only operates if the speed demand is from a 10k potentiometer connected between terminals 1 and 2 with its wiper connected to terminal 3.* *When operating with a 4 – 20 mA or 0 - 20 mA reference, the MIN SPEED preset is used to adjust the burden resistance.*
FORWARD UP RAMP	Forward acceleration
FORWARD DOWN RAMP	Forward deceleration
REVERSE UP RAMP	Reverse acceleration
REVERSE DOWN RAMP	Reverse deceleration
STAB	Stability
IR_{comp}	IR compensation
MAX CURRENT	2x current limit presets (See section 6.3 for function)

6.2 Switches

6.2.1 S1 / S2

These two switches set the maximum current as a percentage of the rated current of the unit. The MAX CURRENT presets can then adjust the maximum current between this current to zero.

S1	S2	% of rated
OFF	OFF	25%
ON	OFF	50%
OFF	ON	75%
ON	ON	100%

6.2.2 S3 / S4

These two switches set the range of the speed feedback voltage. Adjustment within the range is through the MAX Speed preset.

S3	S4	Speed Feedback Voltage
OFF	OFF	25 – 50 V
ON	OFF	50 – 100 V
OFF	ON	100 – 200 V
ON	ON	200 – 400 V

6.2.3 S5 / S6 / S7

These three switches control the function of the relay on terminals 10 - 12.

S5	S6	S7	Energised relay state
ON	OFF	OFF	Motor NOT stalled
OFF	ON	OFF	Motor speed > ±1%
OFF	OFF	OFF	Motor speed > +5% (forward)

As an example, with S6 ON and S5 and S7 OFF, when the motor speed is greater than ±1%, the relay is energised, terminals 11 and 12 are shorted, and terminals 10 and 12 are open. When the speed is less than ±1%, the relay is de-energised and the opposite is true: terminals 10 and 12 are short and terminals 11 and 12 are open.

If more than one of S5 – S7 is ON then the relay operation is the ANDing of the switch states. For example, if switches S5 and S6 are ON, the relay is only de-energised if the motor is stalled AND the speed is less than ±1%. In effect, this indicates a failure for the motor to start.

6.2.4 S8

When S8 is ON, speed feedback is taken from the armature voltage. There must be no connection to terminal T9.

When S8 is OFF speed feedback is from the TACH terminal T9.

6.3 Links

6.3.1 Supply Voltage Selector

A link is provided to configure the unit for either HIGH or LOW voltage operation. The actual operating voltage then depends on the drive model:

	HIGH	LOW
LL	415 V	240 V
LN	240 V	110 V
LV60	60 V	30 V
LV48	48 V	24 V

6.3.2 Current Limit Mode

There are three link positions which determine the function of the MAX CURRENT presets (P6 and P10).

POS I/NEG I: When the link is in this position, P6 sets the positive current limit and P10 sets the negative current limit irrespective of the direction of rotation of the motor. This is the default position.

MOTOR/BRAKE: With the link in this position, P6 sets the current limit when motoring and P10 sets the current when generating irrespective of the direction of motor rotation and the polarity of current.

FWD/REV: With the link in this position, P6 sets the current limit in the forward direction and P10 sets it for the reverse direction irrespective of the polarity of current or whether motoring or regenerating.

6.3.3 Torque/Speed Mode

There are three positions for this link which determine the function of the AUX analogue input on T6.

4Q TORQUE: When the link is in this position, the voltage on T6 sets the maximum positive and negative currents (±5V = ±100% of calibrated current).

2Q TORQUE: With the link in this position the voltage on T6 sets the maximum positive current (+10V = +100% of calibrated current). The maximum negative current is only limited by the setting of the negative current preset.

SPEED: With the link in this position the voltage on terminal 6 is an auxiliary input to the speed loop demand summing amplifier that bypasses the ramp. Positive for forward rotation.

Section 7.1.8 describes how to operate the unit in torque control mode.

6.3.4 4/20mA and 0/20mA Modes

There are two links which can be used to configure the unit for current loop operation with T2 the input and T5 the return.

If just the lower link is fitted 0 - 20mA operation is selected. With both links fitted 4 - 20mA operation is possible but only if the MIN SPEED preset is adjusted such that there is a 250Ω resistance between T2 and T5.

6.3.5 Quench Mode

There are three link positions that determine the behaviour of the quench circuit. The factory setting is for the FS and ZS links to be fitted.

Note that opening the RUN input always resets the setpoint ramp output to zero. The other effects of opening the RUN input depend on the position of the links below.

FS: With only this link fitted, the drive will be quenched immediately by a stall condition or the removal of the RUN signal on T7.

1S: With only this link fitted, the drive will be quenched one second after a stall condition or removal of the RUN signal on T7.

ZS: With only this link fitted, a stall condition or removal of the RUN signal from 7 will reset the speed ramp but will not quench the drive until one second after zero speed is reached.

The drive will also be quenched if the motor shaft is at "standstill", that is, the setpoint and speed feedback are both less than ±1%.



If no links are fitted, a stall condition or the removal of RUN from T7 will reset the speed ramp but the drive will not be quenched. Also, if only the ZS link is fitted and the motor cannot reach zero speed, neither a stall condition nor removal of RUN will quench the drive. For these reasons it is recommended that either FS or 1S is fitted at all times.

Figure 6-1 shows how the functions interact.

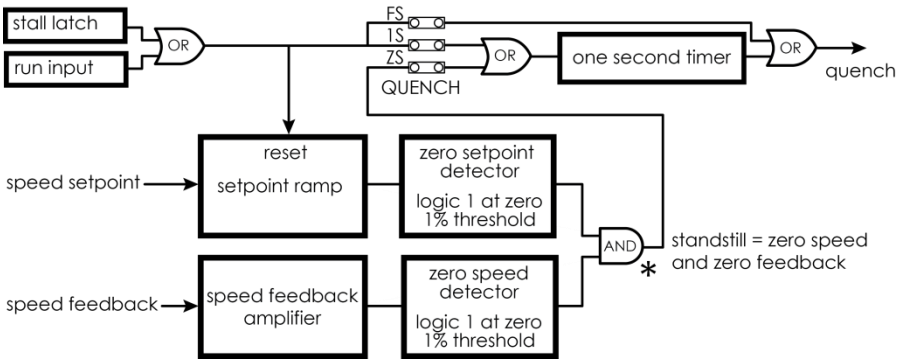


Figure 6-1: Drive quench circuit

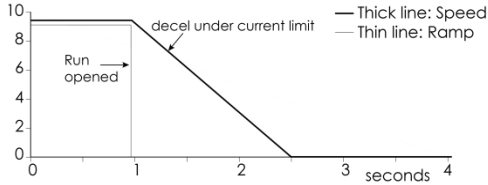
*Note: The AND gate (marked *) will not release the ZS function at zero speed until the ramp circuit has an input. If the speed input is direct via T6, the ZS link must be removed. In this case either FS or 1S MUST be fitted if stall protection or quench via the RUN input are required.*

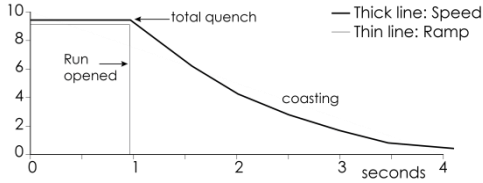
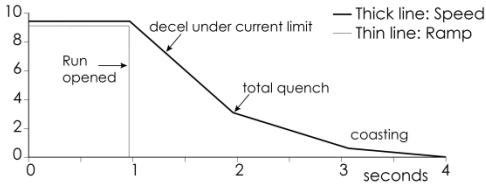
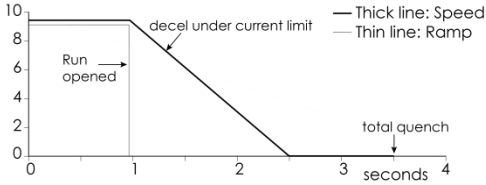
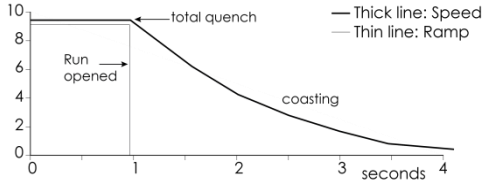
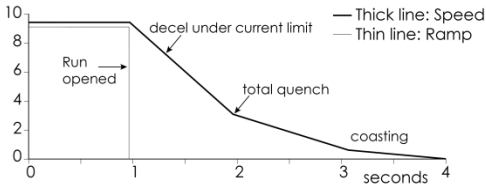
Note: The purpose of the 1 second timer is to prevent zero speed (ZS) quenching from being a nuisance during shaft reversals and to allow 1 second of regenerative braking to occur after the setpoint ramp has been reset by a stall or run command.

Note: The ZS function prevents the motor shaft from "creeping" at zero setpoint.

Note: When the RUN line operation must be rapid, but without regeneration, use the FS (fast) link.

The effect on the motor speed for each of the link positions can be seen in the graphs below. It is also possible to use links in more than one position.

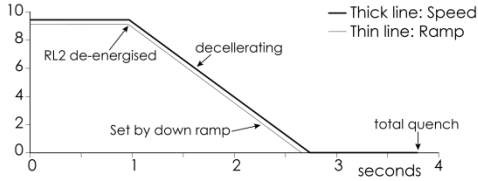
Link settings	Quench condition	Graph
	The drive will remain active at zero speed.	

Link settings	Quench condition	Graph
FS ■ 1S ○ ZS ○ QUENCH	The drive will be quenched immediately (by a stall condition or removal of RUN), ZS function disabled.	
FS ○ 1S ■ ZS ○ QUENCH	The drive will be quenched (by a stall condition or removal of RUN) after 1 second. ZS function disabled.	
FS ○ 1S ○ ZS ■ QUENCH	The drive quench occurs 1 second after the speed reaches and remains zero.	
FS ■ 1S ○ ZS ■ QUENCH	The drive will be quenched immediately (by a stall condition or removal of RUN) or 1 second after zero speed is reached.	
FS ○ 1S ■ ZS ■ QUENCH	The drive will be quenched after 1 second (by a stall condition or removal of RUN) or 1 second after zero speed is reached.	

Run is an electronic inhibit function. The field remains energised and all power terminals remain live. Do not rely on RUN to make the system safe during hazardous operations on the machine or control system.

If the START/JOG controls on T13/T14 are used to stop the motor then the quench behaviour is slightly different. When the STOP contact on T8 is opened, RL2 is de-energised and the input to the ramp circuit is disconnected from T3 and connected instead to XIP on T64. This has the effect of ramping the speed to zero at the set rate. The graph below shows the effect of operating the stop button with just the ZS link in place.

Note: Fitting the FS or 1S link will not affect this behaviour

Link settings	Quench condition	Graph
FS 1S ZS QUENCH	The drive quench occurs 1 second after speed reaches and remains zero.	

6.3.6 Stall mode

Note that stall is inhibited when 2Q or 4Q torque mode is selected, provided the torque limit applied to T6 does not exceed 105%.

The drive regulates motor speed by adjusting the demand to the current control loop to control motor armature current and hence torque.

If the torque required by the load exceeds that which the motor can produce, the motor will stall.

To detect this condition, the drive has a stall detection circuit. All the time the motor current is less than 100%, the timer in the circuit is inhibited but when it exceeds 105% the timer ramps up at a rate proportional to the difference between the overload current and the 105% level. For a 150% overload the time for the stall detection circuit to operate is around 30 seconds; for a 125% overload it is around 60 seconds etc.

Should the overload fall below 105% before the stall timer has tripped, the timer will ramp down. This characteristic of the stall circuit has the effect of limiting the average current to the motor.

In some applications, it may be required to provide protection at a lower average current but keep a high peak current (for example when the motor current rating is significantly lower than the drive current rating). In this case a feature is provided, in the form of the 50% STALL link, which reduces the threshold at which the timer starts ramping up approximately 52.5%. A 150% overload is still possible but the average is limited to 50% which gives a peak to average ratio of 3:1.

If a 50% threshold is too low then a resistor can be fitted instead of the link:

Resistor/link	Threshold	Overload	Ratio	Peak %
Link	50%	150%	1:3	300%
100 kΩ	60%	150%	1:2.5	250%
220 kΩ	70%	150%	1:2.1	210%
470 kΩ	80%	150%	1:1.87	187%
1 MΩ	90%	150%	1:1.66	166%
Open	100%	150%	1:1.5	150%

6.3.7 LEDs

There are four LEDs in the top left hand corner of the drive board.

The LEDs labelled '+' and '-' indicate the direction of armature current flow.

The other two indicate the status of the stall timer. If both are off, the stall timer is not in operation. If the TIMER LED is illuminated then the stall timer is in operation but hasn't tripped. If both the TIMER and the STALL LEDs are illuminated then the timer has tripped and the drive has been quenched (provided an appropriate quench mode has been selected – see section 6.3.4)

7 Commissioning

This procedure assumes the unit is wired as shown in Figure 9-2.

7.1 Initial settings

7.1.1 Presets

The functions of the presets are described in section 6.1. When commissioning a motor they should be set to "safe" positions: all ramps CW, MIN SPEED, MAX SPEED and IR COMP presets all ACW with STAB and MAX CURRENT mid-range.

7.1.2 Switches

The functions of the switches are described in section 6.2.

First of all, ensure that the supply voltage selector is in the appropriate position for the supply voltage (see section 6.3.1).

To minimise the risk of excessive motor speed in the commissioning process switches S1 and S2 should be OFF (sets maximum current at 25% of the rating of the unit) and S3 and S4 should also be OFF to ensure the armature voltage is limited to 50 Vdc.

Even if it is intended to run the unit with tacho feedback, switch S8 should be set ON initially to configure the unit for armature voltage feedback and the tacho should be disconnected.

Switches S5, S6 and S7 should be set according to the desired function of the relay on terminals T10, T11 and T12, as described in section 6.2.

7.1.3 Links

The functions of the links are described in section 6.3.

For commissioning, set the Torque/Speed mode to SPEED and the Current Limit mode to POS I/NEG I. Ensure the FS and ZS links are fitted.

The links can subsequently be changed to modify the behaviour of the drive and implement any extra functions.

7.1.4 Pushbutton and setpoint check

Ensure the motor is disconnected from the armature terminals.

Apply ac power to the unit and check that the correct field voltage appears between terminals F+ and F-.

If the field voltage is too high it can be reduced by connecting in half-wave configuration with the field connected across terminals L and F2-.

With no connection to FWD or REV (T15 and T16) check the voltage at T4 (MAX). This should be -10V.

Momentarily operate the FWD pushbutton to COMMON. The voltage at T4 should change to +10V. If REV is now momentarily operated, the voltage at T4 will return to -10V.

Note that the direction of rotation is determined by the polarity of the setpoint on T3.

7.1.5 Run the motor

1 Remove the power from the unit, re-connect the armature leads and re-apply power. Ensure I/P (T3) is at 0V and connect RUN to COMMON.

2 Connect START to COMMON and select FWD. The motor should begin to rotate as the setpoint is increased. If the speed is unstable, adjust the STAB preset (section 0).

Note: If the direction is wrong, remove the power supply and swap the F+ and F- connections.

3 Check the timer lamp. If it is ON, increase MAX CURRENT.

4 With I/P at +10V, progressively adjust the MAX SPEED preset and switches S3 and S4 to set the armature voltage to the rated value.



Do not exceed the drive and motor armature voltage and current ratings during this procedure.

5 Reduce the setpoint to zero. The drive should ramp the motor down to standstill.

6 Adjust MIN SPEED to the required level.

7 Run the motor up and down and adjust the FORWARD UP RAMP and FORWARD DOWN RAMP to the required rates.

8 Select REVERSE. Run the motor up and down and adjust the REVERSE UP RAMP and REVERSE DOWN RAMP to the required rates.

For systems using tacho feedback:

9 With the motor running at full speed, in armature voltage feedback mode, measure the tacho voltage and polarity. The wire going to T9 must be negative when the speed demand into T3 is positive.

10 Make sure the drive supply is off and reset S3 and S4 to approximately match the full-scale tacho output and set MAX SPEED ACW. Set S8 off for tacho feedback – this disconnects the armature voltage speed feedback.

11 Connect the tacho wire into T9, restart and fine-adjust MAX SPEED.

12 Set S1 and S2 and adjust the MAX CURRENT presets to match the motor armature current rating. These controls are linear so this setting can be made by inspection.

7.1.6 Stability

Adjust STAB to improve the response if necessary. Rotate it clockwise to give a faster response.

Note: Excessive rotation in either direction may lead to instability depending on the load.

7.1.7 IR_{comp}

Speed droop may occur under load where armature voltage feedback is used. Compensate for this by increasing the IRcomp preset clockwise.

Note: Excessive rotation may lead to instability.

IMPORTANT: Set IR_{comp} fully anti-clockwise if tacho feedback is used.

7.1.8 Torque control

Establish the correct operating limits by setting up in speed mode first. Then implement torque control by moving the SPEED / 2Q / 4Q link from SPEED to the appropriate TORQUE position (2Q or 4Q) and apply an appropriate torque control voltage to T6.

8 Technical specifications

Function	• Control action	Dual loop proportional + integral
	• Feedback method	Tachometer / Armature voltage; switch select
	• 0 – 100% regulation	0.1% typical (tacho) 2% typical (armature voltage)
	• Max. torque speed range	100:1 (tacho) 20:1 (armature voltage)
	• Overload	150% continuous current for 30 s
Inputs	Analogue: • Direct input • Ramped input • Differential input (ramped) • 4 – 20 mA input • 0 – 20 mA input • ± 10 V input	Pushbutton functions: • Forward • Reverse • Stop • Start • Jog
Outputs	Signal outputs: (all buffered) • Speed output • Current output + • Current output ± • Ramp output • Demand output	Relay driver outputs: (open collector, PNP) • Drive stall • Overload timer • Zero speed • Shaft reverse
Power rails	• ± 24 V ± 25 %	Unregulated. 25 mA
	• ± 12 V ± 5 % • 10 V ± 5 %	Unregulated. 10 mA max. Regulated. 10 mA max.

Supply ranges (45 Hz to 65 Hz auto-ranging)

	24	**30**	**48**	**60**	**110**	**240**	**415**
Max (V)	28	36	58	72	130	264	440
Min (V)	22	27	44	54	100	200	360

(Over full temperature range with outputs loaded).

AC power up reset	Minimum off-time before re-supply = 500 ms

Field output	0.9 x ac supply; 2 A max. *(half wave configuration 0.45 x ac supply – connect between L and F2-)*	
Unit dissipation	Dw (watts) = 3 x armature current (approximately)	
Vibration	0.075 mm displacement 10 – 58 Hz 1g acceleration 58 – 150 Hz	
Environment	• Altitude	3000 m maximum for full rating Derate 1% / 100m above 3000m
	• Ambient	40 °C maximum for full rating Derate 2.5% pre °C above 40 °C
	• Humidity	85% RH at 40 °C, non-condensing

Protection

Rating	Fuse	Fuseholder	Clearing I^2t
4 A	CH00608A	CP102071	35 A^2s
8 A	CH00620A	CP102071	75 A^2s
16 A	CH00730A	CP102053	265 A^2s
32 A	CH00850A	CP102054	770 A^2s
36 A	CH00850A	CP102054	770 A^2s

If the controller is connected line-to-line then a fuse is required in each ac line

Adjustable parameters	• Maximum speed	25 V to 400 V speed feedback; switch selectable
	• Minimum speed	0 to 50% of Max Speed when used with an external with 10k pot
	• Forward ramps	1 to 30 s; linear ramp; independent up and down ramps
	• Reverse ramps	1 to 30 s; linear ramp; independent up and down ramps
	• Stability	Varies speed loop gain
	• IR_{comp}	0 to 30% of armature voltage for 0 to 100% armature current
	• Max current	0 to 25%, 50%, 75% or 100%; separate max current presets for positive and negative; switch select; 3 operation modes

Switched functions	• S1, S2	Current range
	• S3, S4	Speed feedback range – 4 ranges of feedback voltage
	• S5, S6, S7	Relay function: stall / zero / reverse
	• S8	Speed feedback source: tacho / armature volts
Link functions	• Speed / torque	Sets T6 operating mode; 3 modes
	• Current loop	Allows 4 – 20 mA or 0 – 20mA loop signal operation instead of ± 10 V
	• 50% stall level	Allows peak to continuous ratios of 1.5 to 3
	• Current mode	Configuration of current limit operating mode; 3 modes
	• Quench	Sets mode of drive quench; 3 modes
	• Supply select	Dual supply voltage selector
Lamps	• Positive bridge • Negative bridge • Stall timer operating • Stalled	
Dimensions	Width 200 mm Depth 175 mm Height 70 mm (90 mm for 36 A unit)	
Fixings	4 / 8 / 16 / 32 A units 36 A unit	M5 x 35 mm bolts M5 x 50 mm bolts

9 Typical applications

To ensure the safe operation of the unit, it is important to apply the ac supply before closing the run contact. This will prevent spurious firing due to erratic mains contactor operation.

Do not remove the ac supply while the armature current is flowing - quench the drive first using the run contact.

9.1 Basic connection

This provides forward speed control via a potentiometer.

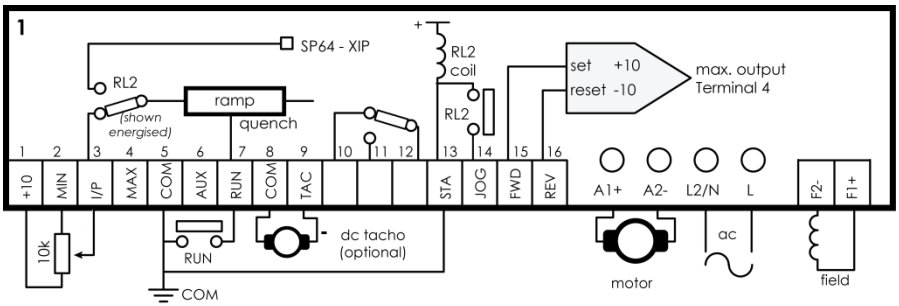


Figure 9-1: Basic connection

9.2 Start, stop, forward and reverse

This circuit provides start, stop, independent forward and reverse, and ramps to zero speed on stop.

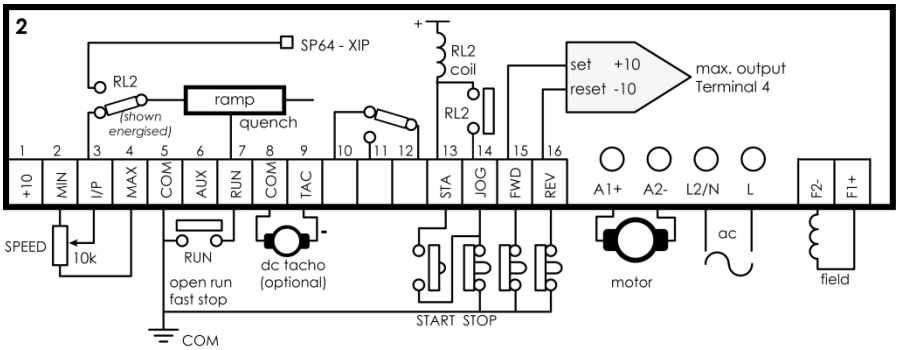


Figure 9-2: Start, stop, forward and reverse

10 Troubleshooting

Problem	Cause	Remedy
Drive will not power up, or no ON indication	• Line fuses blown • F1, F2 fuses blown • Damaged drive	• Power off, check circuits and replace fuses with the correct type (section 2). • Check the supply select link is in the correct position.
Line fuses blow on start	• Short-circuit load • Damaged unit	• Check the load circuit. • Replace unit.
Fuses blow during running	• Excessive armature voltage due to incorrect speed scaling	• Reduce armature voltage • Check speed scaling is correct.
Motor accelerates out of control with small setpoint and tacho feedback	• Tacho polarity incorrect • Tacho coupling broken or slipping • Tacho is faulty	• Swap terminals 8 and 9. • Check integrity of coupling • Replace the tacho. Temporarily change to AVF (S8) and rescale feedback voltage (S3, S4). Remove tacho connections from terminals.
Motor runs too fast or too slow	• Incorrect speed scaling (S3, S4 Max Speed)	• Refer to set-up procedure *(section 6.2)*
Stall lamp ON	• Insufficient torque • Timer lamp shows that the stall timer is integrating • No field • No armature current • Motor jammed • Demagnetised PM motor	• Recheck current settings (S1, S2, MAX CURRENT). • Check that the motor is correctly rated for the application. • Check motor field connections and fuses • Check the armature circuit. • Free motor • Replace motor

Problem	Cause	Remedy
Motor will not turn (timer / stall lamps NOT lit)	• No run circuit	• Check the run circuit T7 to T5.
	• No start circuit	• Check the start circuit T13, T14 to T5
	• No setpoint	• Check the external setpoint T3.
Motor rotates in wrong direction	• Transposed motor connections	• Swap armature or field connections
Motor noise	• Unstable drive	• Rotate STAB anti-clockwise
	• Armature voltage rating of motor does not match ac supply	• Use a more suitable motor and/or lower supply voltage
	• Armature time constant too low	• Insert a choke in series with armature
Motor response has large overshoots	• High inertia, low friction loads	• Rotate STAB anti-clockwise • Reduce ramp rates • Current is set too high – reduce the setting
Motor response has speed-related instability	• Loose tacho couplings	• Improve tacho coupling
	• Misaligned tacho	• Re-align the tacho
	• Eccentric load	• Balance the load • Rotate STAB clockwise

11 Notes

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