invensys
EUROTHERM

Product Manual ER-1600i and ER-3200i

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.

All types are of open chassis construction for use in a suitable enclosure.
IMPORTANT. To comply with CSA certification power to this unit must be supplied via a suitable CSA certified fuse or fuses, as appropriate.

Introduction. Models ER-1600i, ER-3200i

The user selects the appropriate model depending on required power output. The ER-1600i and the ER-3200i have isolated control electronics.

DRIVE TYPE	AC SUPPLY VOLTAGE	AMERICAN OPTIONS	NOMINAL OUTPUT	MAX. CURRENT	PRODUCT DISSIPATION at full current	ISOLATION
ER-1600iLV60	60/30		48/24V	16 AMPS	50 watts	ISOLATED
ER-1600i	240/110		180/90V	16 AMPS	50 watts	ISOLATED
ER-3200iLV60	60/30		48/24V	8/16/32/48 AMPS	25/50/100/150 watts	ISOLATED
ER-3200i	415/240	240/110	320/180/V(90 US)	8/16/32/48 AMPS	25/50/100/150 watts	ISOLATED

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	speed output	+24V unregulated output
-aux input	current output	+12V regulated output
current input	ramp output	+10V precision reference
4-20mA input	demand output	-12V regulated output
0 to 10V input	zero/stall relay	-24V unregulated output

ADJUSTABLE PARAMETERS: Max speed, Min speed, Up ramp, Down ramp, Max current, IR comp, Stability

SWITCHED FUNCTIONS: Maximum current range, Relay function, Maximum feedback, Power up hold, Tacho feedback, AV feedback

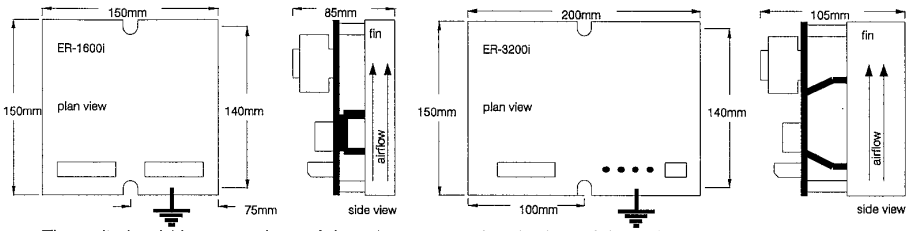
JUMPER FUNCTIONS: Torque mode, Zero reference interlock, Dual supply voltage, 4-20mA input, Phase angle limit, 50% stall threshold

PERFORMANCE FEATURES: Dual loop control, Relay driver o/ps, Precision tacho rectifier, International compatability, Compact design, Systems inputs/outputs

IOC# ER101851 ISS1

MECHANICAL DIMENSIONS

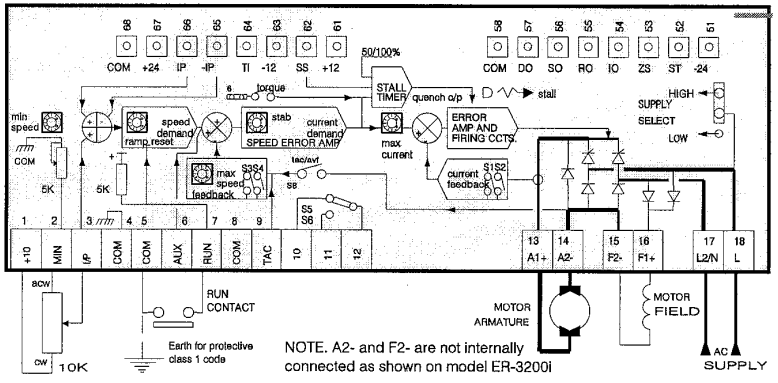
Note. Dissipation in watts is approx. 2 X arm. amps



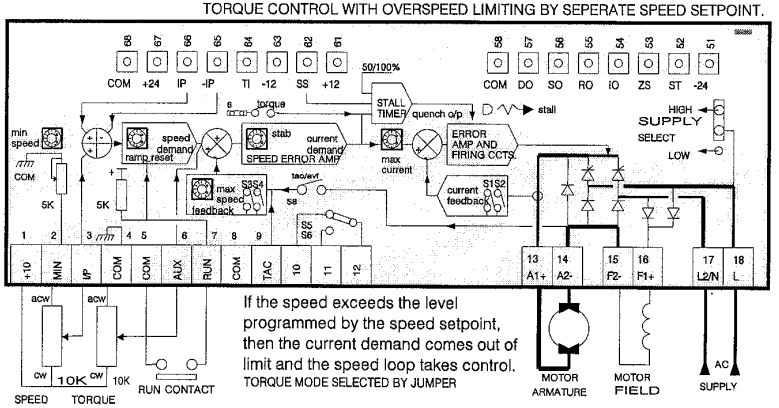
The unit should have a substantial earth connected to the heatsink earth screw provided. Employ a star washer adjacent to the heatsink for optimum earth continuity. The fixing bolts should be 5mm by 35mm for the ER-1600i and 5mm by 50mm for the ER-3200i series.

TYPICAL APPLICATIONS

BASIC CONNECTION



TORQUE CONTROL WITH OVERSPEED LIMITING BY SEPERATE SPEED SETPOINT.



INSTALLATION 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.

✱ *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

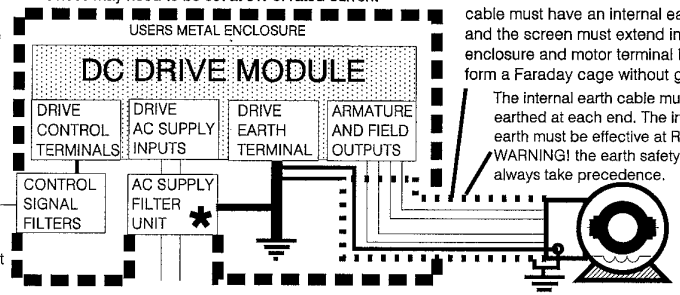
Do not run filtered and unfiltered AC supply cables together

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, drive earth 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

DANGER ELECTRIC SHOCK RISK

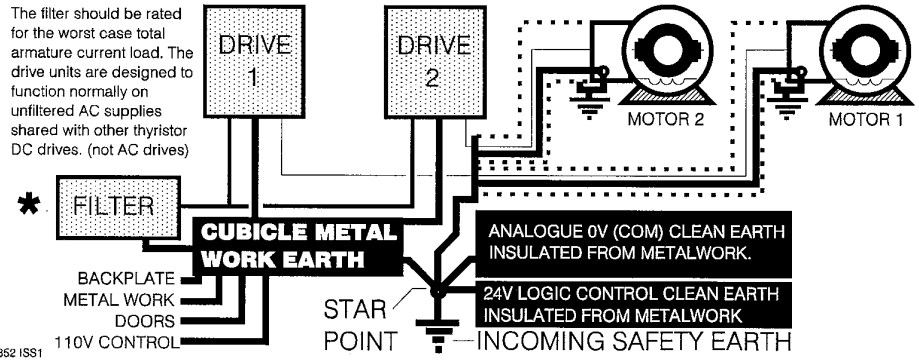
The AC supply filters must not be used on supplies that are un-balanced or float with respect to earth

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)



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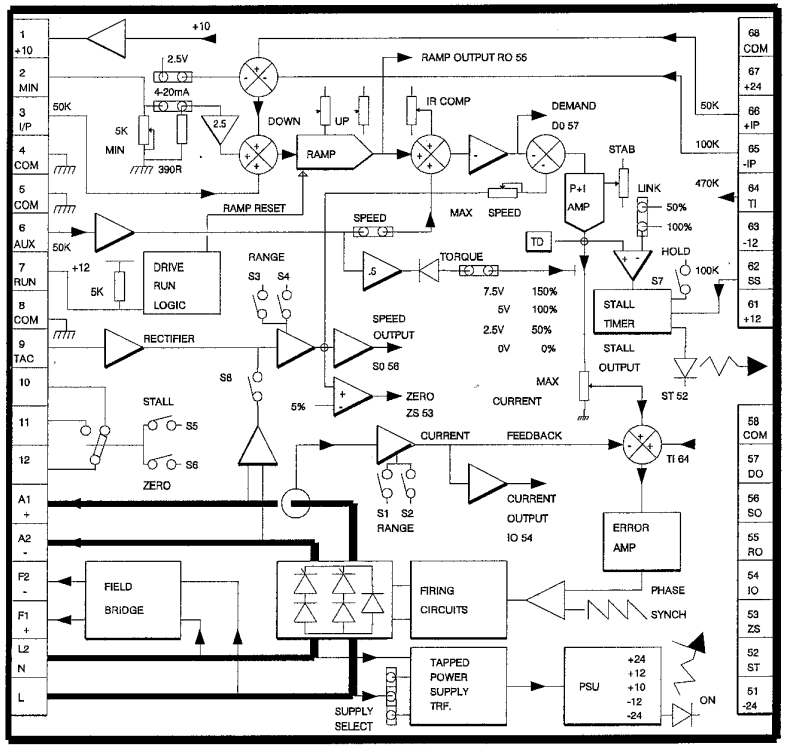
Block diagram and terminal specification.



SIGNAL PADS ON TOP EDGE (TERMINAL COMPATIBLE)

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 COMMON. (connect to earth for protective class 1)

6 AUXILIARY INPUT. ON BOARD JUMPER SELECTS DIRECT SPEED OR TORQUE MODE. 0-10V FOR 0-100% CONTROL

7 CONNECT TO COMMON TO RUN 60mS ON / 20mS OFF
(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)

8 COMMON (Internally connected to T4, T5, T58, T68)

9 TACHO INPUT 25-400V FULL SCALE. + OR - POLARITY

10 RELAY CONTACT NC

11 RELAY CONTACT NO

12 RELAY POLE

RELAY CONTACT RATING 1 AMP 240V AC
RATINGS ACCORDING TO CSA
VOLTAGE RATING OF RELAY TERMINALS 10/11/12 MUST NOT EXCEED 30V AC OR 42.4V DC.

A1+ ARMATURE OUTPUT

A2 -ARMATURE OUTPUT

F2- FIELD OUTPUT

F1+ FIELD OUTPUT

THE ER3200i HAS TWO 2A FUSES WHICH PROTECT THE FIELD AND POWER SUPPLY TRANSFORMER ONLY. FOR A HALF WAVE FIELD VOLTAGE CONNECT FIELD TO F2- AND L2/N, THIS WILL GIVE AN OUTPUT OF 0.45 TIMES THE AC SUPPLY

L2/N AC SUPPLY INPUT ACCORDING TO SUPPLY SELECT JUMPER

L AC SUPPLY INPUT ACCORDING TO SUPPLY SELECT JUMPER

68 DRIVE COMMON

67 +24V OUTPUT 25mA MAXIMUM DO NOT SHORT

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

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

64 INPUT TO CURRENT LOOP. 0-5V FOR 0-100% CURRENT

63 -12V OUTPUT 10mA MAX. DO NOT SHORT.

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

61 +12V OUTPUT 10mA MAX. DO NOT SHORT.

58 DRIVE COMMON

57 SPEED DEMAND O/P 0 TO -10V REPRESENTS 0-100% DEMAND. OUTPUT IMPEDANCE 1K OHMS

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).

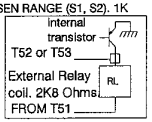
55 SETPOINT RAMP OUTPUT 0-10V. IMPEDANCE 1K OHMS

54 CURRENT OUTPUT 0-5V FOR 0-100% OF CHOSEN RANGE (S1, S2). 1K IMPEDANCE.

53 ZERO SPEED RELAY DRIVER O/P MAX 100mA Switches to -24V

52 STALL RELAY DRIVER O/P MAX 100mA Switches to -24V

51 -24V RELAY SUPPLY 25mA DO NOT SHORT



Ensure supply is disconnected before working on unit

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

FUSING
The drives MUST BE FUSED EXTERNALLY with semiconductor fuses. The fuses must be rated at 1.75 times armature current and have an I^2t rating lower than the value listed in the specification page 8. Any warranty will be invalid if the fusing is incorrect.

CONTROL SIGNALS
The ER-1600i and ER-3200i have isolated control terminals, and may be connected to other systems. 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.

PRESETS, SWITCHES, JUMPERS
Always use the correct insulated adjustment tools. Do not touch. Electric shock hazard exists!

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 drive unit and will invalidate any warranty.

INITIAL SETTINGS
The drive units are shipped to run on the highest supply option at nominal speed, in ARMATURE VOLTAGE feedback mode, in the lowest current range. To change this run through switches S1 to S8 and select accordingly.

S1 S2	Set switches to give desired current range
S3 S4	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.
S5 S6	Select according to desired relay function
S7	Normally OFF. When on, the power up inhibit function will operate. Reset with T62.
S8	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. (S1 S2 can provide 4 current ranges)

Anticlockwise	MIN SPEED UP RAMP	DOWN RAMP IR COMP
Midway	STAB	

POWER ON Check ON lamp lights

CLOSE RUN CONTACT (see note opposite)
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.

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.

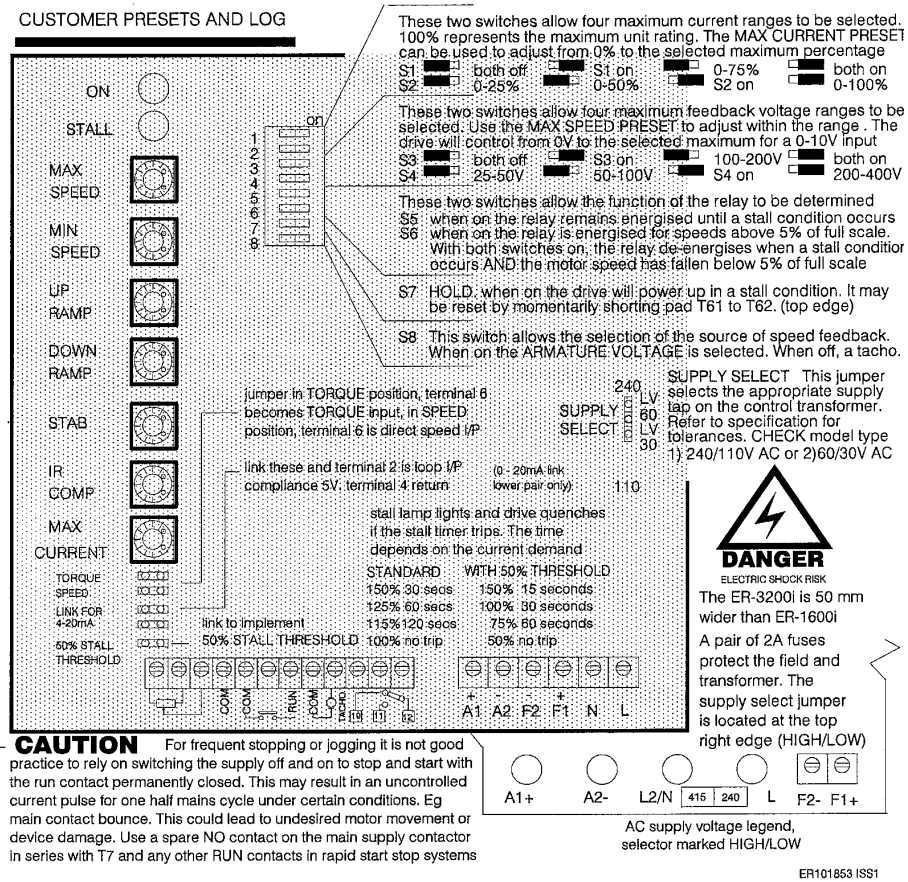
TORQUE SYSTEMS
See typical applications. In this mode the lowest setpoint has priority. Hence the speed setpoint is set to demand a speed slightly in excess of the working speed, and then the torque setpoint will always be operating as a limit. In the event of a web break for example, the motor will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

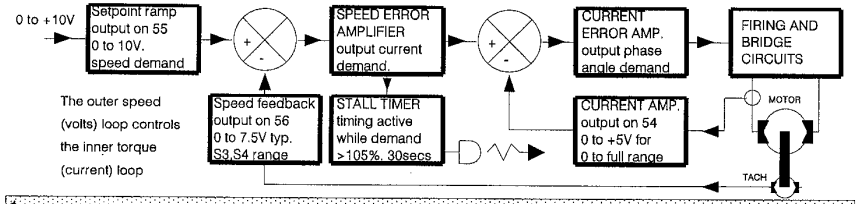
MAX SPEED	Rotate clockwise to increase speed. Change range with S3 and S4
MIN SPEED	Rotate clockwise to increase minimum speed. Use to adjust 4-20mA loop burden resistor between 0 and 390R if 4-20mA mode is selected.
UP RAMP	Rotate clockwise to increase drive acceleration. Span 1 to 30 seconds
DOWN RAMP	Rotate clockwise to increase drive deceleration. Span 1 to 30 seconds. Note, natural coast down is a limit.
STAB	Rotate clockwise to increase response. Excessive rotation may cause instability. If rated motor voltage is much lower than AC supply then anticlockwise is prefered.
IR COMP	Rotate clockwise to increase level of armature voltage droop compensation. Excessive rotation may cause instability. Always set fully anticlockwise with tacho.
MAX CURRENT	Rotate clockwise to increase current. Use S1 and S2 to select range



CAUTION 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 T7 and any other RUN contacts in rapid start stop systems

TROUBLE SHOOTING

The drive consists of 2 high accuracy feedback control loops.



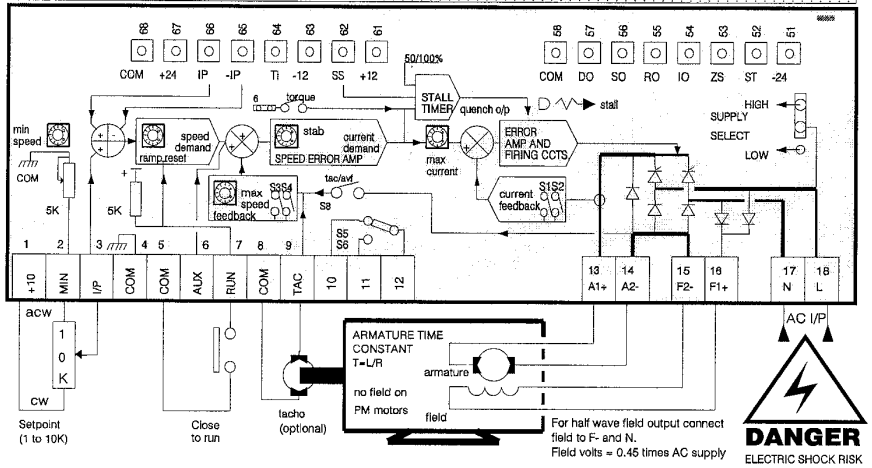
1 STALL problems shown by stall lamp coming on after running are caused by the drive unit not able to give set speed

2 Typical STALL reasons.

a) MAX CURRENT preset not correctly set, hence insufficient torque

b) Motor not powerful enough for application. Speed calibration set beyond capability of supply.

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



3 Pot wired with T2 and T1 transposed. Motor slows down instead of speeding up

4 Pot wired with T2 and T3 transposed. Motor slows down for clockwise rotation. T1 may be shorted to T2.

5 Pot wired with T1 and T3 transposed. Motor slows down for anti-clockwise rotation. T1 becomes shorted to T2.

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

7 Incorrect feedback scaling causes over or underspeeding. Calculate the desired max. tacho volts, adjust S3, S4

8 Tacho failure. Until a replacement is obtained change to AV feedback S8. Rescale with S3, S4

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

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

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

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

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

14 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	BEWARE MOTOR HEAT AT LOW SPEED
MAX TORQUE SPEED RANGE	20 : 1	100 : 1	
OVERLOAD	150% CONTINUOUS CURRENT FOR 30 seconds.		
CUSTOMER PRESETS			
MAX SPEED	25V - 400V FULL SCALE FEEDBACK		SWITCH SELECT
MIN SPEED	0-30% 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		DO NOT USE WITH TACHO
MAX CURRENT	LINEAR SETTING FROM 0-100%, 4 SWITCHED RANGES		150% OVERLOAD
SWITCH SELECTABLE			
CURRENT RANGE	FOUR RANGES OF ARMATURE CURRENT		S1, S2
SPEED RANGE	FOUR RANGES OF FEEDBACK VOLTAGE		S3, S4
RELAY FUNCTION	DRIVE STALL OR ZERO SPEED RELAY		S5, S6
POWER UP HOLD	POWER UP IN STALL OR RUN MODE		S7
TACHO/AVF	SELECT TACHO OR ARMATURE VOLTAGE FEEDBACK		S8
JUMPER FUNCTIONS			
TORQUE MODE	O-10V INPUT FOR 0-100% CURRENT WITH AUTOMATIC OVERSPEED PROTECTION.		JUMPER SELECTED
SUPPLY SELECT	DUAL SUPPLY VOLTAGE SELECTOR		
LINK FUNCTIONS			
4-20mA OR 0 -20mA LOOP	ALLOWS CURRENT LOOP SIGNAL INPUT FOR SPEED		5V COMPLIANCE
50% STALL LEVEL	ALLOWS LARGE PEAK CURRENTS		150% PEAK

SUPPLY RANGES		LV30	LV60	110	240	415	
45HZ TO 65HZ	MAX	36V	72V	130V	264V	440V	OVER FULL TEMP RANGE WITH OUTPUTS LOADED
AUTO RANGING	MIN	27V	54V	100V	200V	360V	

AC POWER UP RESET	MINIMUM OFF TIME BEFORE RE-SUPPLY	500mS
RUN LINE	60mS ON, 20mS OFF. ALWAYS USE A RUN CONTACT TO ENABLE THE DRIVE AFTER THE APPLICATION OF AC	
SIGNAL OUTPUTS	SPEED, CURRENT, RAMP, DEMAND	ALL BUFFERED
SIGNAL INPUTS	3 SPEED INPUTS -/+ RAMPED, DIRECT, ALL SUMMING	PROTECTED
RELAY OUTPUTS	STALL OR ZERO SPEED RELAY	VOLT FREE CHANGEOVER
RELAY DRIVERS	STALL , ZERO SPEED OPEN COLLECTOR PNP	FOR -24V DC 100mA MAX
RAIL OUTPUTS	-24V UNREGULATED 25mA	+/- 20%
	+12V, +10V, -12V REGULATED 10mA	0.01%/DEG C 5%
FIELD OUTPUT	0.9(0.45) TIMES AC SUPPLY. ER-1600i 1Amp, ER-3200i 2Amp	FULL(0.9) or 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	STORAGE AND OPERATING -10 to +50C	
ARMATURE TIME CONSTANT	MINIMUM 10mS. USE EXTRA ARMATURE CHOKE TO INCREASE	T = INDUCTANCE/RESISTANCE
MAX I^2t FUSING ($Amps^2Seconds$)	ER-1600i =365, ER-3200i 8/16/32 =570, ER-3200i 48 =4750	SEMICONDUCTOR FUSES REFER TO SUPPLIER