



Slip Ring Drive product manual JL / JLX 130 - 1680

Use in conjunction with PL/X manual

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This manual should be read in conjunction with the PL / PLX Digital DC Drive Manual. (Parts 1, 2 and 3)
Important. See section 2 in main PL / PLX Digital DC Drive Manual for WARNINGS

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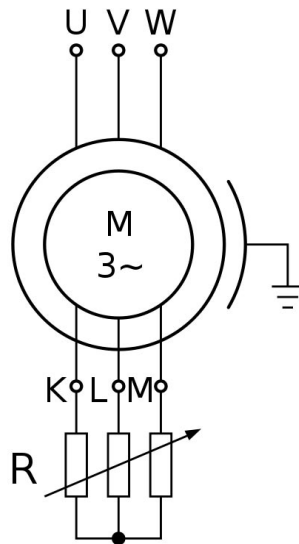
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2 Introduction

A slip ring motor is a type of induction motor having a wound rotor connected to slip rings. The stator (U, V, W) is phase angle controlled by the JL/X in a closed loop with speed feedback derived from a tachogenerator or encoder mounted on the motor shaft. The motor speed/torque characteristic is modified by resistors connected to the rotor slip rings, controlled by JL/X relay output drivers. Four resistor control outputs are provided. Generally, only one or two would be used for applications such as slew, yaw or X/Y travel. Hoist applications might use three or four.

For hoist applications, lowering at speeds above synchronous speed is detected and under this circumstance rotor resistance is minimised for maximum regeneration into the supply. An additional digital output is provided for this purpose.

Provision is made for selection of analogue or progressive joystick switch (two raise, two lower speeds) speed demand. Analogue outputs representing speed, torque and power are supplied in the standard configuration.



The JL/X range of slip ring motor drives is a derivation of the PL/X Digital DC drive product range. It shares the same software and hardware platforms and delivers the same precise digital control functionality enjoyed by users of the established range of DC Drives. The main difference between the PL/X and JL/X range is that the thyristor stack configuration has been designed to provide a firing angle controlled 3 phase output (U, V, W) suitable for controlling slip ring motors in either 2 or 4 Quadrant modes. All the fieldbus options and configuration software packages used with the PL/X are also available for the JL/X range.

The JL/X range covers output currents from 130 to 1650 Amps and is available in 3 frame sizes with standard supply voltage inputs up to 480VAC. (Frame 2, 4 and 5). Frame 4 and 5 also have the option of being supplied as HV units that are able to accept AC supply voltages up to 690 VAC for higher voltage applications. The JL/X range has an overload capability of 150% for 25 seconds.

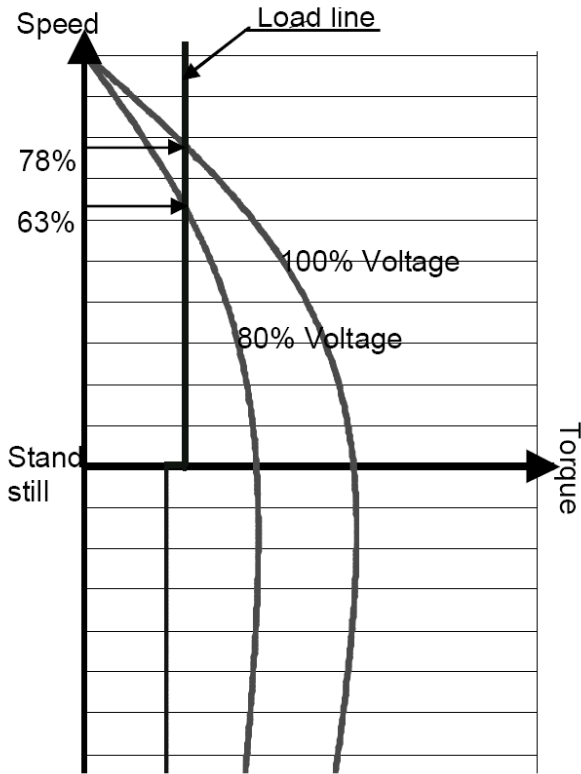
There is a high duty range called the JL/XHD which has an overload capability of 250% for 25 seconds.

All models have the high current 3 phase supply terminals in standard top entry, with the motor connections at the bottom of the unit.

2.1 Operation of Slip Ring Motor

2.1.1 Stator Voltage Control

The Speed / Torque curve for a Slip Ring Motor is shown in the diagram below for the case where the Rotor resistors are static.



The curved lines represent the Speed / Torque relationship at 100% and 80% Stator voltage.

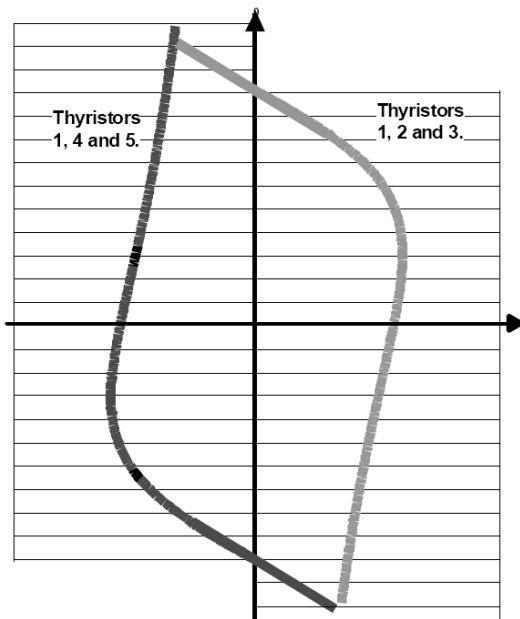
The voltage on the Stator is controlled by adjusting the phase angle of the 3 phase thyristor stack within the JL/X. This is controlled with reference to the speed setpoint and speed feedback.

In this case it is possible to alter the speed of the motor for a given load, requiring the same torque, by adjusting the Stator voltage.

A reduced Stator voltage will reduce the the peak torque by approximately the square of the voltage reduction.

Here a reduction in Stator voltage from 100% to 80% will reduce the speed from 78% to 63%

2.1.2 Bi-directional control using the JLX



The JL model has a single 3 phase stack with 3 pairs of anti-parallel thyristors which provide a phase controlled 3 phase ouput driving the Stator. Thyristor pairs are 1, 2 and 3

The JLX model has 2 further pairs of anti-parallel thyristors (4 and 5) which allow the direction of the Stator phase rotation to be reversed. In this case the Stator is driven by Thyristor pairs 1,4 and 5.

This implementation allows all 4 quadrants of Speed and Torque to be controlled.

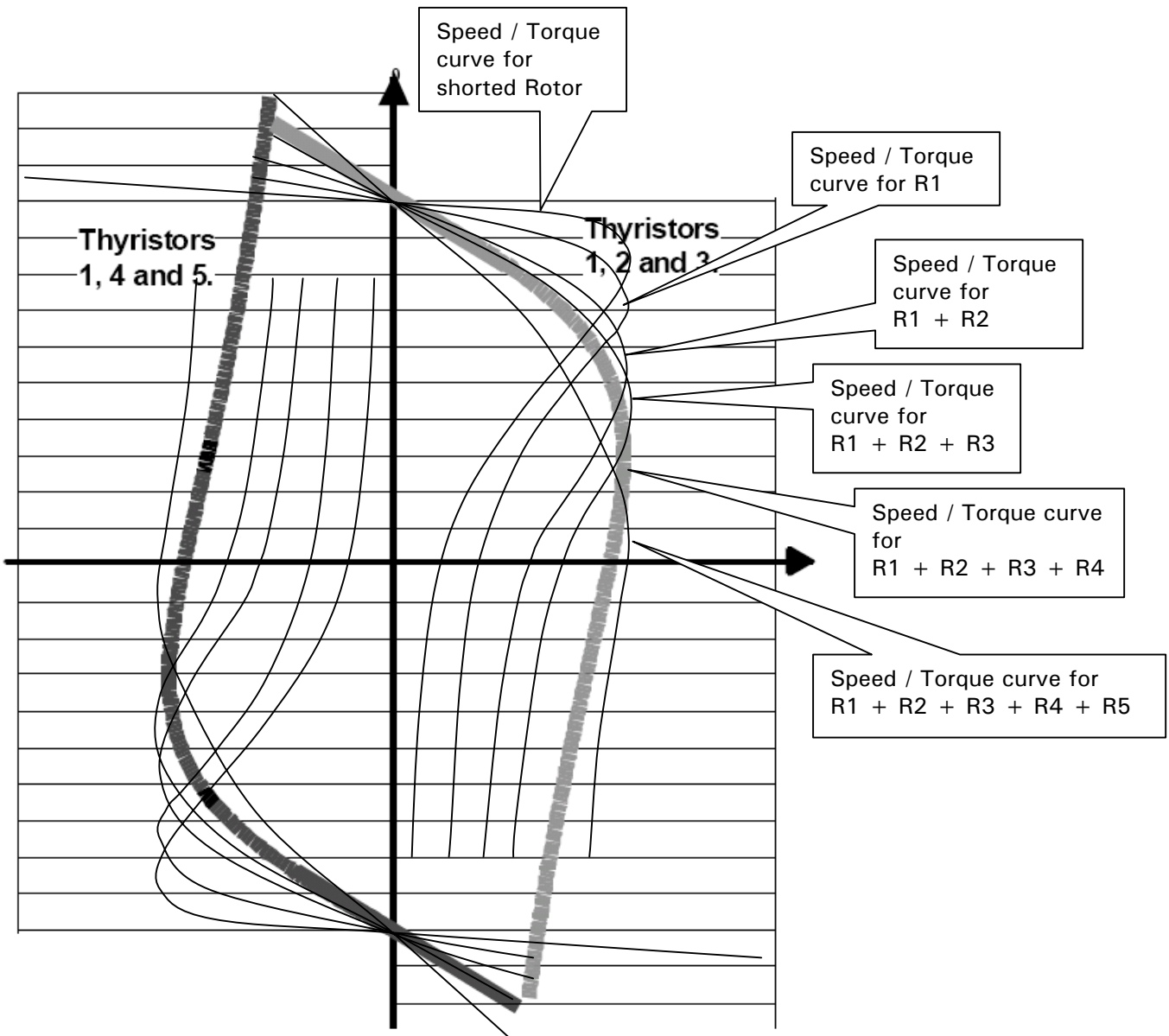
2.1.3 Rotor Control to optimise torque across speed range

The diagram shows all 4 quadrants of Speed against Torque, with curves for a shorted rotor and for 4 other values of rotor resistance. This diagram is of course a simplistic representation to facilitate the explanation of the control strategy.

For a high Rotor resistance ($R1 + R2 + R3 + R4 + R5$) the starting torque is high but the torque at higher speeds reduces.

For a shorted Rotor the starting torque is low but the torque at higher speeds increases.

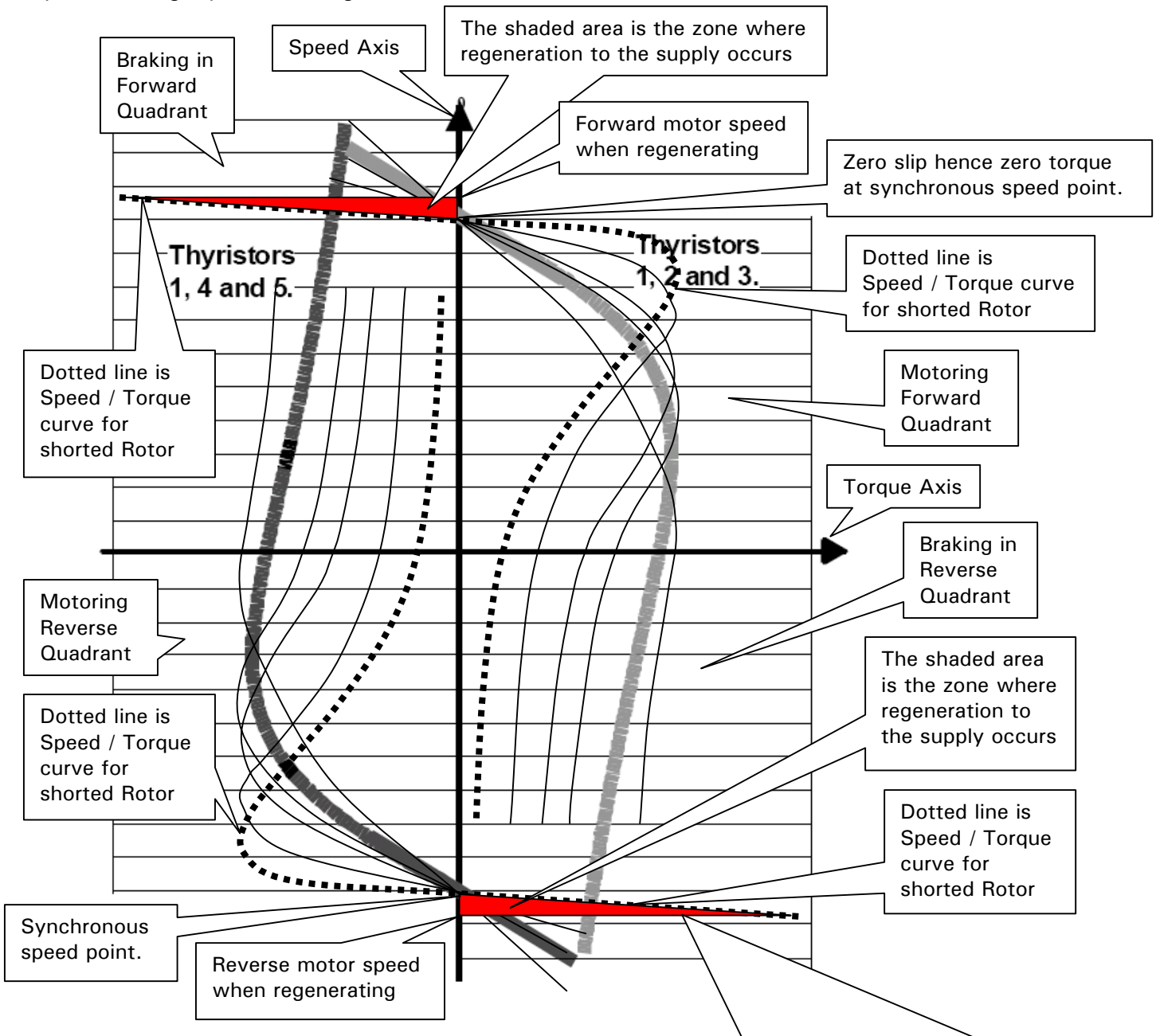
There is a family of curves inbetween. The JL/X automatically selects the appropriate Rotor resistance using the contactor outputs to keep the torque curve at maximum throughout the speed range.



2.1.4 Hyper-synchronous regeneration

The shaded areas in the braking quadrants are where regeneration can occur. Outside the shaded areas any braking that occurs is achieved through a process known as plugging in which the absorbed energy is dissipated in the rotor and the rotor resistors.

Hence for regeneration to occur the load must be forcing the speed to exceed synchronous speed. The JLX must arrange for the correct loop conditions and thyristor combination to be selected to regenerate the current back into the supply. As the motor approaches the synchronous speed in either of the motoring quadrants, the opposing stator phase rotation is selected to activate the braking quadrant. Simultaneously the speed demand is set above synchronous speed to ensure that the motor speed exceeds the synchronous speed allowing slip to create regenerative current.



Motor speed is higher than synchronous speed hence regenerative current is created by slip and returned to the supply by the JLX. The braking torque is optimised for the lowest slip by using a shorted rotor. The maximum torque depends primarily on the overload limit of the JLX and also the motor / installation rating. The speed will rise above synchronous speed until the torque reaches a level that satisfies the load. This action is mirrored in the Braking Forward quadrant under similar conditions.

2.2 Control terminal default functions

When the JL/X is shipped the control terminals are allocated with the following functions. **All the programmable terminals are available to be re-allocated to an alternative function by the user if desired.**

IMPORTANT WARNING: The JL/X default configuration is locked in recipe page 3. To restore it a 3 Key reset is required. Do not perform a 4 key reset as this is for the PL/X. See section 13.13.2 in the main manual

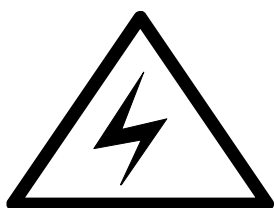
OV terminal		OV	T1
Spare Input	Analogue Input	UIP2	T2
Spare Input	Analogue Input	UIP3	T3
Ramped Speed Reference	Analogue Input	UIP4	T4
0 to +/-10V linear input for 0 to +/-100% speed. Input impedance 100K. This input is routed through a programmable up/down ramp, see section 6.2 of the PL/X manual.			
Joystick Input 1	Digital Input	UIP5	T5
Used as a digital input for RAISE SPEED 1			
Joystick Input 2	Digital Input	UIP6	T6
Used as a digital input for RAISE SPEED 2/LOWER SPEED 2			
Joystick input 3	Digital Input	UIP7	T7
Used as a digital input for LOWER SPEED 1			
Spare input	Digital Input	UIP8	T8
Joystick demand select	Digital Input	UIP9	T9
Used as a digital input to select either progressive joystick or analogue (on UIP4) speed demand.			
Speed Feedback	Analogue Output	AOP1	T10
0 to +/-10V linear output for 0 to +/-100% speed feedback. Output current capability 5mA max. Short circuit protection to 0V. Programmable Uni-polar or Bi-polar output mode. (AOP1 or 2 or 3 must not be simultaneously shorted to 0V).			
Torque estimation	Analogue Output	AOP2	T11
0 to 10V linear output approximation for 0 to +/-100% torque. Output current capability 5mA max. Short circuit protection to 0V. (AOP1 or 2 or 3 must not be simultaneously shorted to 0V).			
Power approximation	Analogue Output	AOP3	T12
0 to 10V linear output approximation for 0 to 100% power. Output current capability +/-5mA max. Short circuit protection to 0V. (AOP1 or 2 or 3 must not be simultaneously shorted to 0V).			
OV on T13 must be used for protective clean earth connection		OV	T13
Spare input	Logic low below 2V, high above 4V	Digital Input	DIP1 T14
Marker input	Logic low below 2V, high above 4V	Digital Input	DIP2 T15
Encoder (B train or sign)	Logic low below 2V, high above 4V	Digital Input	DIP3 T16
Encoder (A train)	Logic low below 2V, high above 4V	Digital Input	DIP4 T17
Rotor Resistor control R5		Digital Output	DIO1 T18
Output high to control highest rotor resistor shorting contactor. Nominal 24VDC output with internal flywheel. Short circuit protected and drive ALARM - DOP SCCT TRIP protected.			

Rotor Resistor Control R4	Digital Output	DIO2 T19
Output high to control second highest rotor resistor shorting contactor. Nominal 24VDC output with internal flywheel. Short circuit protected and drive ALARM - DOP SCCT TRIP protected.		
Rotor Resistor Control R3	Digital Output	DIO3 T20
Output high to control third highest rotor resistor shorting contactor. Nominal 24VDC output with internal flywheel. Short circuit protected and drive ALARM - DOP SCCT TRIP protected.		
Rotor Resistor Control R2	Digital Output	DIO4 T21
Output high to control lowest rotor resistor shorting contactor. Nominal 24VDC output with internal flywheel. Short circuit protected and drive ALARM - DOP SCCT TRIP protected.		
Regeneration Relay R1	Digital Output	DOP1 T22
Output high to control rotor resistors shorting contactor. Nominal 24VDC output with internal flywheel. Short circuit protected and drive ALARM - DOP SCCT TRIP protected.		
Brake Disable	Digital Output	DOP2 T23
Output high to disable brake. Nominal 24VDC output with internal flywheel. Short circuit protected and drive ALARM - DOP SCCT TRIP protected. WARNING - MUST BE SEPERATELY INTERLOCKED WITH MAIN SUPPLY CONTACTOR		
Drive healthy	Digital Output	DOP3 T24
Output high when the controller is healthy. Nominal 24VDC output with internal flywheel. Short circuit protected and drive ALARM - DOP SCCT TRIP protected.		
OV terminal		OV T25
DC Tachogenerator Input		TACH T26
Full speed setting range +/-10V to +/-200V. Input impedance 150K Ohms. Signal range 0V to +/-200V.		
User +10V Reference		+10V T27
User -10V Reference		-10V T28
+/-10.00V, 0.5%, 10mA max. Short circuit protection to 0V		
RMS Current Output		IARM T29
0 to +/-5V linear output for 0 to +/-100% model current. Output current capability +/-10mA max. Short circuit protection to 0V. Programmable Uni-polar or Bi-polar output mode.		
Motor thermistor input		THM T30
It is good practice to protect motors against sustained thermal overloads by fitting temperature sensitive resistors or switches in the field and interpole windings of the machine. These devices have a low resistance (typically 200 Ohm) up to a reference temperature 125 C. Above this temperature, their resistance rises rapidly to greater than 2000 Ohms. Motor over-temperature sensors should be connected in series between terminals T30 and T36. A motor over-temperature alarm will be displayed if the external resistance between T30 and T36 exceeds 1800 Ohms ± 200 Ohms.		

2.2.1 Run, Jog, Start, Cstop

Run

Digital input RUN T31



The RUN Input provides a means of electronically inhibiting controller operation. If the RUN input is low, all control loops will be inhibited and the motor stops. If the contactor is being held in by a) The zero speed detector while the motor is decelerating or b) The contactor drop out delay, then this will be terminated by RUN going low and will result in immediate contactor drop out. (The RUN input terminal may also be used as a programmable digital input if it is not required as a RUN function)

WARNING. Do not rely on any drive function to prevent the motor from operating when personnel are undertaking maintenance, or when machine guards are open. Electronic control is not accepted by safety codes to be the sole means of inhibition of the controller. Always isolate the power source before working on the drive or the motor or load. If the RUN input goes low at any point during the stopping process, either heading for zero speed or during the delay period, then the contactor will drop out straight away.

Jog **Digital input JOG T32**

When the Jog Input is held high the drive jogs (rotates slowly while requested to), provided input Start T33 is low. When the Jog Input is removed the drive will ramp down to zero obeying the Jog/Slack Ramp time. T19 JOG MODE SELECT is not available on the JL/X, if selectable JOG reference is required a spare input must be configured for the purpose

Start **Digital input START T33**

When a high input is applied to this terminal the controller will operate provided there are no alarms, the coast stop input (T34) is already high, the controller run input (T31) is high and the Jog input is low. When the input is removed the controller will perform a ramped stop to zero speed. The rate of deceleration will be set according to the programmed stop ramp time. The JLX models will plug to maintain the ramp rate. So will the JL models that have the electronic stopping facility. The JL models that do not have this facility will not be able to decelerate faster than the natural coast down rate. For all models, when the motor has reached zero speed, then the main contactor will de-energise.

The Start and Jog inputs provide the following operating features

- a) Normal running
- b) Jogging with programmable contactor drop out delay
- c) Slack take up with 2 selectable take up speeds

With start high and jog low, then jog going high acts as a slack take up. With start low the jog input is a jog control.

There is no Crawl facility on the JL/X.

Coast stop main contactor control **Digital input CSTOP T34**

With a high input, the controller operates normally. When the Coast Stop is at zero volts or open circuit, the main contactor is open and the drive no longer operates. If this input drops low during running then the main contactor will de-energise within 100mS and the motor will coast to rest under the influence of external factors e.g. friction and inertia. **Note. The CSTOP must be high for at least 50mS prior to START going high.**

Note. If the digital outputs are shorted the 24V output will continue to operate with a current capability of 50mA. This is so that the CSTOP line does not go low and shut down the drive. If it is important that the drive continues running with a shorted digital output then a digital output set permanently high may be used as an auxiliary 24V power output for other tasks, allowing the main 24V output to be devoted entirely to the CSTOP function.

+ 24V Supply (22V to 32V) **Output + 24V T35**

+ 24V output for external logic. Short circuit protected with fault annunciation.

OV terminal **OV T36**

Control terminals on lower power board numbers 41 to 53. Not programmable.

Unconnected terminal. Leave this terminal free of connections. **NC T41**

Unconnected terminal. Leave this terminal free of connections. **NC T42**

Unconnected terminal. Leave this terminal free of connections. **NC T43**

Unconnected terminal. Leave this terminal free of connections. **NC T44**

Volt free contact for main contactor coil. **Rating up to 240V 500VA. CON1 T45**

Volt free contact for main contactor coil. **Rating up to 240V 500VA. CON2 T46**

Volt free contact for latching contactor push button. **Rating up to 240V 500VA. LAT1 T47**

Volt free contact for latching contactor push button. **Rating up to 240V 500VA. LAT2 T48**

EARTH on 51 is a dirty earth connection to the control supply **EARTH T51**

L and N is for control power 100-240V 50/60Hz +/-10% 50VA **N T52**

L T53

If the voltage falls below 80V AC the unit will commence an orderly shutdown sequence, the display will annunciate INTERNAL ERROR CODE – SUPPLY PHASE LOSS.

2.2.2 Summary of default terminal functions

OV terminal		OV	T1
No function by default	Analogue input	UIP2	T2
No function by default	Analogue input	UIP3	T3
Ramped speed reference	Analogue input	UIP4	T4
Progressive joystick input	Digital input	UIP5	T5
Progressive joystick input	Digital input	UIP6	T6
Progressive joystick input	Digital Input	UIP7	T7
No function by default	Digital Input	UIP8	T8
Progressive joystick select	Digital input	UIP9	T9
Speed feedback	Analogue output	AOP1	T10
Torque estimation	Analogue output	AOP2	T11
Power estimation	Analogue output	AOP3	T12
OV terminal. Protective clean earth connected here.		OV	T13
Spare input	Digital input	DIP1	T14
Encoder marker input	Digital input	DIP2	T15
Encoder (B train or sign)	Digital input	DIP3	T16
Encoder (A train)	Digital input	DIP4	T17
Rotor resistor contactor control R5	Digital output	DIO1	T18
Rotor resistor contactor control R4	Digital output	DIO2	T19
Rotor resistor contactor control R3	Digital output	DIO3	T20
Rotor resistor contactor control R2	Digital output	DIO4	T21
Regeneration resistor contactor control R1	Digital output	DOP1	T22
Brake disable	Digital output	DOP2	T23
Drive healthy	Digital output	DOP3	T24
OV terminal.		OV	T25
DC Tachogenerator input		TACH	T26
User +10V reference		+10V	T27
User -10V reference		-10V	T28
RMS current output		IARM	T29
Motor thermistor input		THM	T30
Run	Digital input	RUN	T31
Jog	Digital input	JOG	T32
Start/stop contactor control	Digital input	START	T33
Coast stop contactor control	Digital input	CSTOP	T34
+24V Supply	Output	+24V	T35
OV terminal		OV	T36

3 Rating Table for JL/X standard versions

JL/X standard versions Rating Table

These models have a 150% overload capability for 25 seconds

Nominal maximum continuous shaft ratings

Model		kW at 415 Volt AC	HP at 415 Volt AC	HP at 480 Volt AC	HP 690V AC HV model	100% Output Current	Line reactor type	Cooling air flow and dissipation		Dimensions mm W x H x D
	Model							cfm	watts	
Frame 2										
JL and JLX	130	75	100	115		130	LR270	365	380	216 x 378 x 218
JL and JLX	170	100	130	150		170	LR270	365	500	216 x 378 x 218
JL and JLX	220	130	170	200		220	LR270	365	650	216 x 378 x 218
JL and JLX	270	160	210	240		270	LR330	365	875	216 x 378 x 218
Frame 4										
JL and JLX	370	215	290	335	480	370	LR430	400	1200	253 x 700 x 350
JL and JLX	450	260	350	405	580	450	LR530	400	1450	253 x 700 x 350
JL and JLX	530	310	415	480	690	530	LR650	400	1700	253 x 700 x 350
JL and JLX	615	360	480	555	800	615	LR750	400	2000	253 x 700 x 350
JL and JLX	700	405	550	630	915	700	LR850	400	2300	253 x 700 x 350
JL and JLX	780	450	610	705	1015	780	LR950	400	2500	253 x 700 x 350
Frame 5										
JL and JLX	860	500	670	775	1115	860	LR1050	800	2700	506 x 700 x 350
JL and JLX	1025	595	800	925	1330	1025	LR1250	800	3200	506 x 700 x 350
JL and JLX	1190	690	930	1075	1550	1190	LR1450	800	3700	506 x 700 x 350
JL and JLX	1350	785	1055	1220	1755	1350	LR1650	800	4200	506 x 700 x 350
JL and JLX	1520	880	1190	1375	1980	1520	LR1850	800	4700	506 x 700 x 350
JL and JLX	1680	975	1310	1515	2180	1680	LR2050	800	5200	506 x 700 x 350

3.1 Rating Table for JL/XHD High Duty versions

JLXHD High Duty versions Rating Table

These models have a 250% overload capability for 25 seconds

Nominal maximum continuous shaft ratings

Model		kW at 415 Volt AC	HP at 415 Volt AC	HP at 480 Volt AC	HP 690V AC HV Model	100% Output Current	Line reactor type	Cooling air flow and dissipation		Dimensions mm W x H x D
	Model							cfm	watts	
Frame 2										
JLHD & JLXHD	75	45	60	70		75	LR270	365	380	216 x 378 x 218
JLHD & JLXHD	100	60	80	90		100	LR270	365	500	216 x 378 x 218
JLHD & JLXHD	130	75	100	115		130	LR270	365	650	216 x 378 x 218
JLHD & JLXHD	160	95	125	145		160	LR330	365	875	216 x 378 x 218
Frame 4										
JLHD & JLXHD	220	130	170	200	280	220	LR430	400	1200	253 x 700 x 350
JLHD & JLXHD	270	160	210	240	350	270	LR530	400	1450	253 x 700 x 350
JLHD & JLXHD	320	190	250	290	415	320	LR650	400	1700	253 x 700 x 350
JLHD & JLXHD	370	215	290	335	480	370	LR750	400	2000	253 x 700 x 350
JLHD & JLXHD	420	245	330	380	550	420	LR850	400	2300	253 x 700 x 350
JLHD & JLXHD	470	270	370	430	615	470	LR950	400	2500	253 x 700 x 350
Frame 5										
JLHD & JLXHD	520	300	405	470	670	520	LR1050	800	2700	506 x 700 x 350
JLHD & JLXHD	615	360	480	555	800	615	LR1250	800	3200	506 x 700 x 350
JLHD & JLXHD	715	415	560	650	930	715	LR1450	800	3700	506 x 700 x 350
JLHD & JLXHD	815	475	640	740	1065	815	LR1650	800	4200	506 x 700 x 350
JLHD & JLXHD	910	530	710	820	1180	910	LR1850	800	4700	506 x 700 x 350
JLHD & JLXHD	1010	585	790	915	1310	1010	LR2050	800	5200	506 x 700 x 350

Standard Models

Main 3 phase supply	50 - 60hz	Any supply from 12 to 480V AC +/- 10%
Auxiliary 3 phase supply	50 - 60hz	Any supply from 100 to 480V AC +/- 10%
Control 1 phase (50VA)	50 - 60Hz	Any supply from 110 to 240V AC +/- 10%

High Voltage (HV) Models

Main 3 phase supply	50 - 60hz	Any supply from 12 to 690V AC +/- 10%
Auxiliary 3 phase supply	50 - 60hz	Any supply from 100 to 690V AC +/- 10%
Control 1 phase (50VA)	50 - 60Hz	Any supply from 110 to 240V AC +/- 10%

Internal Fan supply

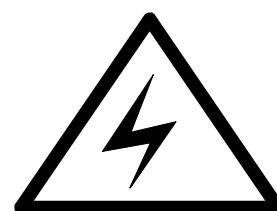
JL/X 370/450/530/615/700/780/860 models also need a separate 100VA 240V 50/60Hz ac fan supply.
 JL/X 860/1025/1190/1350/1520/1680 models need a 200VA 240V 50/60Hz ac fan supply.

OUTPUT VOLTAGE RANGE

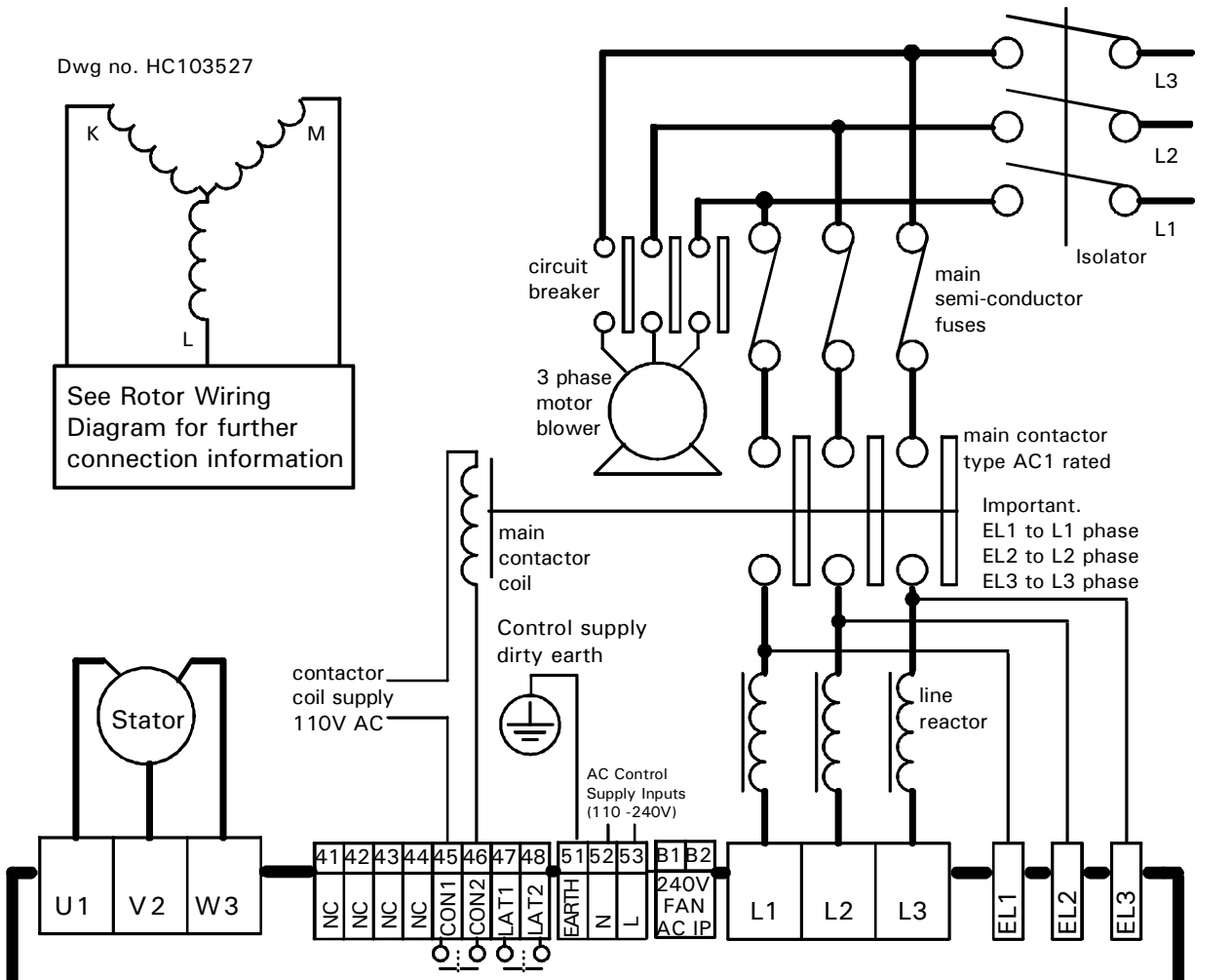
U, V, W 0 to 1.0 times AC supply.

OUTPUT CURRENT RANGE

0 to 100% continuous.	150% for 25 seconds	+/- for JL/X
0 to 100% continuous.	250% for 25 seconds	+/- for JL/XHD



4 Basic speed control wiring diagram



Symbolic connection block.

TERMINALS 1 - 12 FUNCTION											
0V Terminal	Spare input	Spare input	Ramped Speed Setpoint	Joystick input 1	Joystick input 2	Joystick input 3	Spare input	Joystick Select	Speed Feedback	Torque Estimation	Power Estimation
1	2	3	4	5	6	7	8	9	10	11	12

TERMINALS 13 - 24 FUNCTION											
0V Terminal	Spare input	Encoder Marker	Feedback encoder	Feedback encoder	Rotor Resistor Relay R5	Rotor Resistor Relay R4	Rotor Resistor Relay R3	Rotor Resistor Relay R2	Regeneration Relay R1	Brake off Relay	Drive Healthy
13	14	15	16	17	18	19	20	21	22	23	24

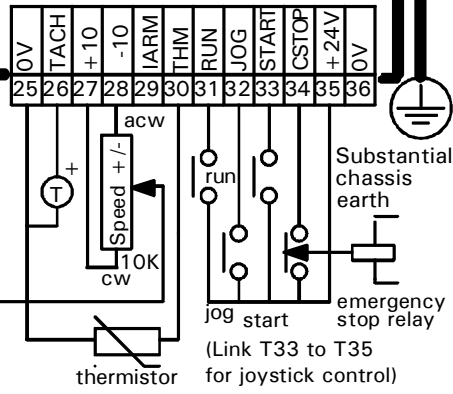
Terminals 1 - 36 are located on the bottom edge of the upper control board arranged as 3 blocks of 12.

Terminals 2 - 12, 14 - 24, and 31 are programmable. Their default function is shown here.

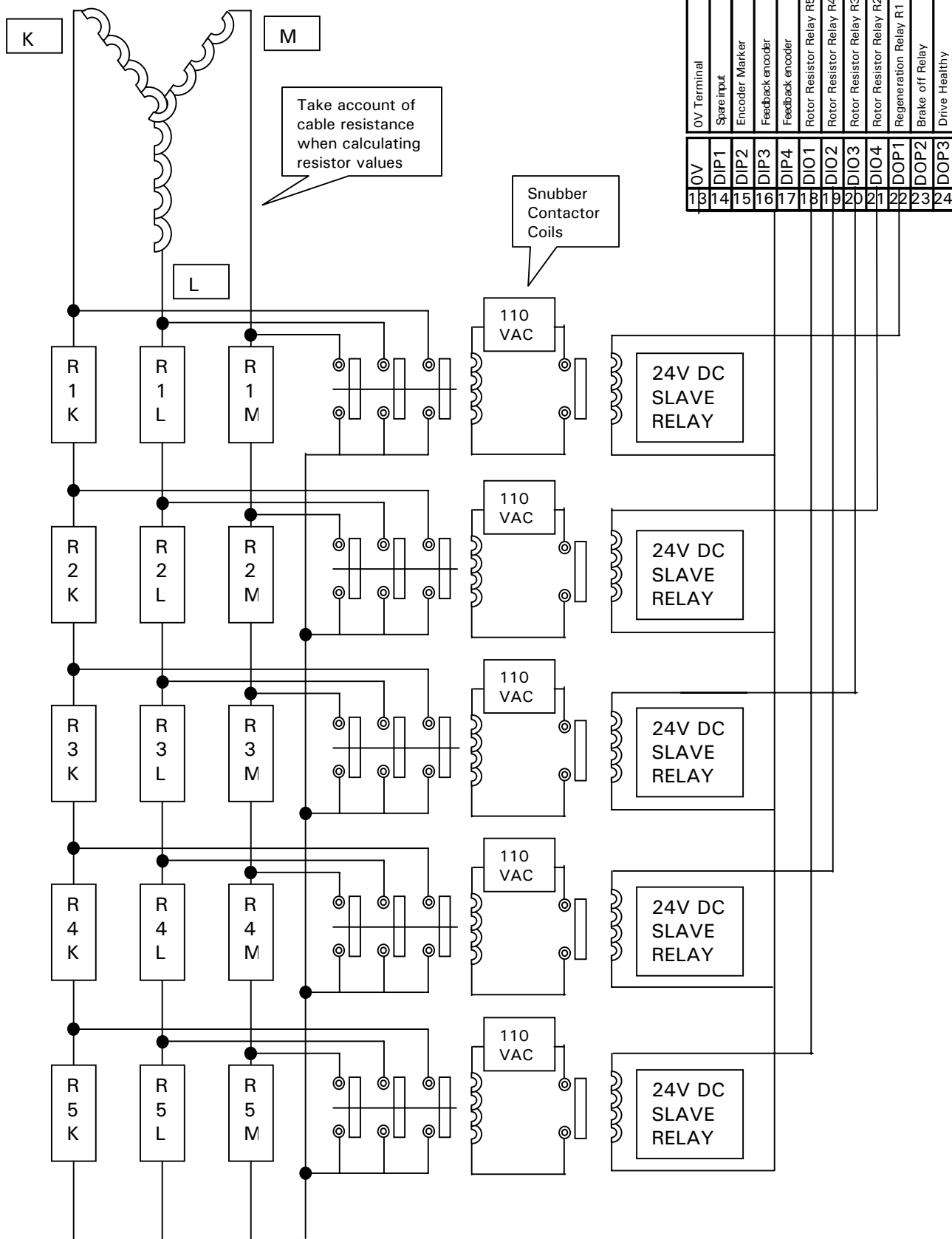
See Joystick Wiring Diagram for details

See Rotor Wiring Diagram for further connection information

Protective clean earth.

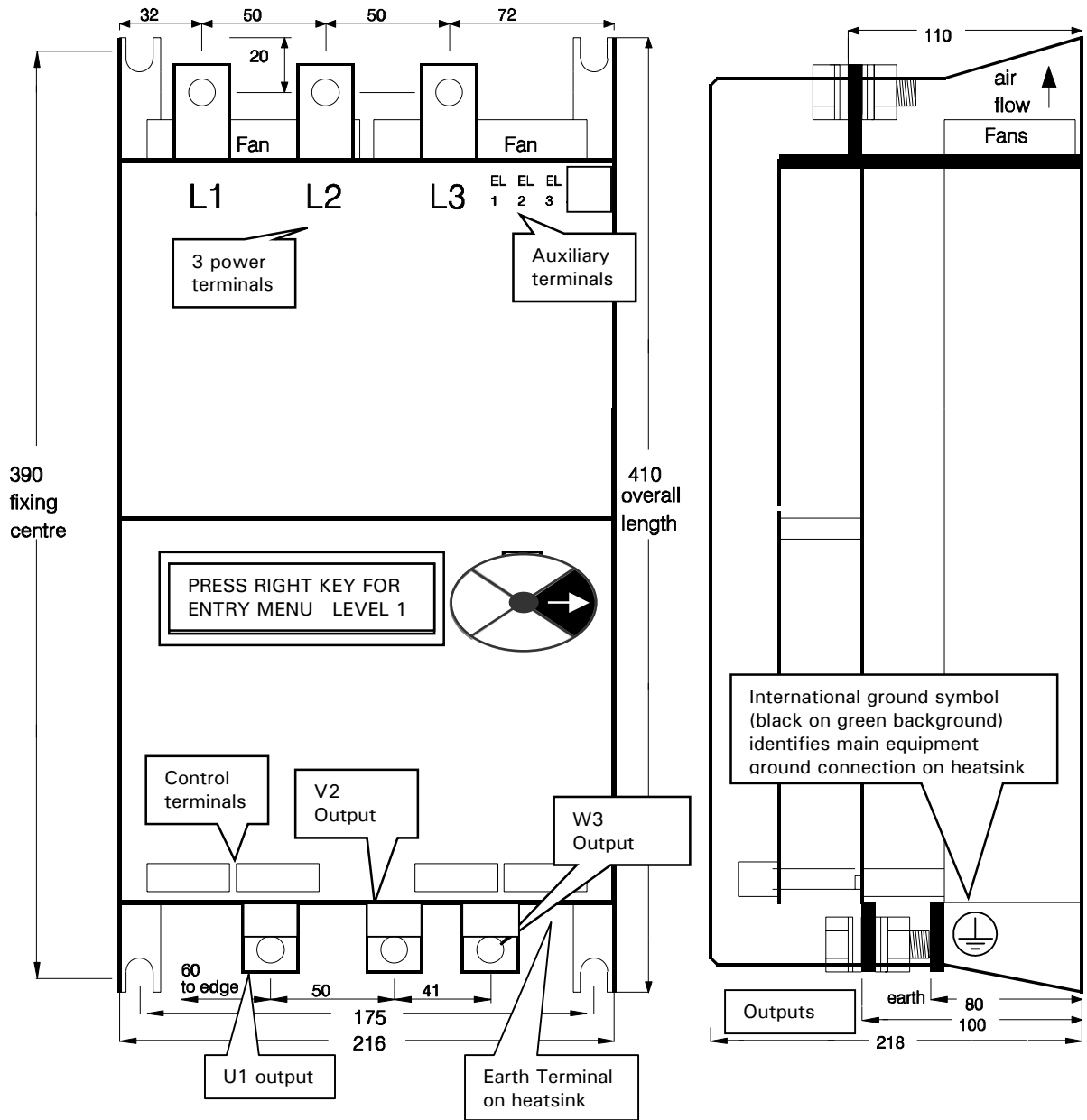


4.1 Rotor Wiring Diagram



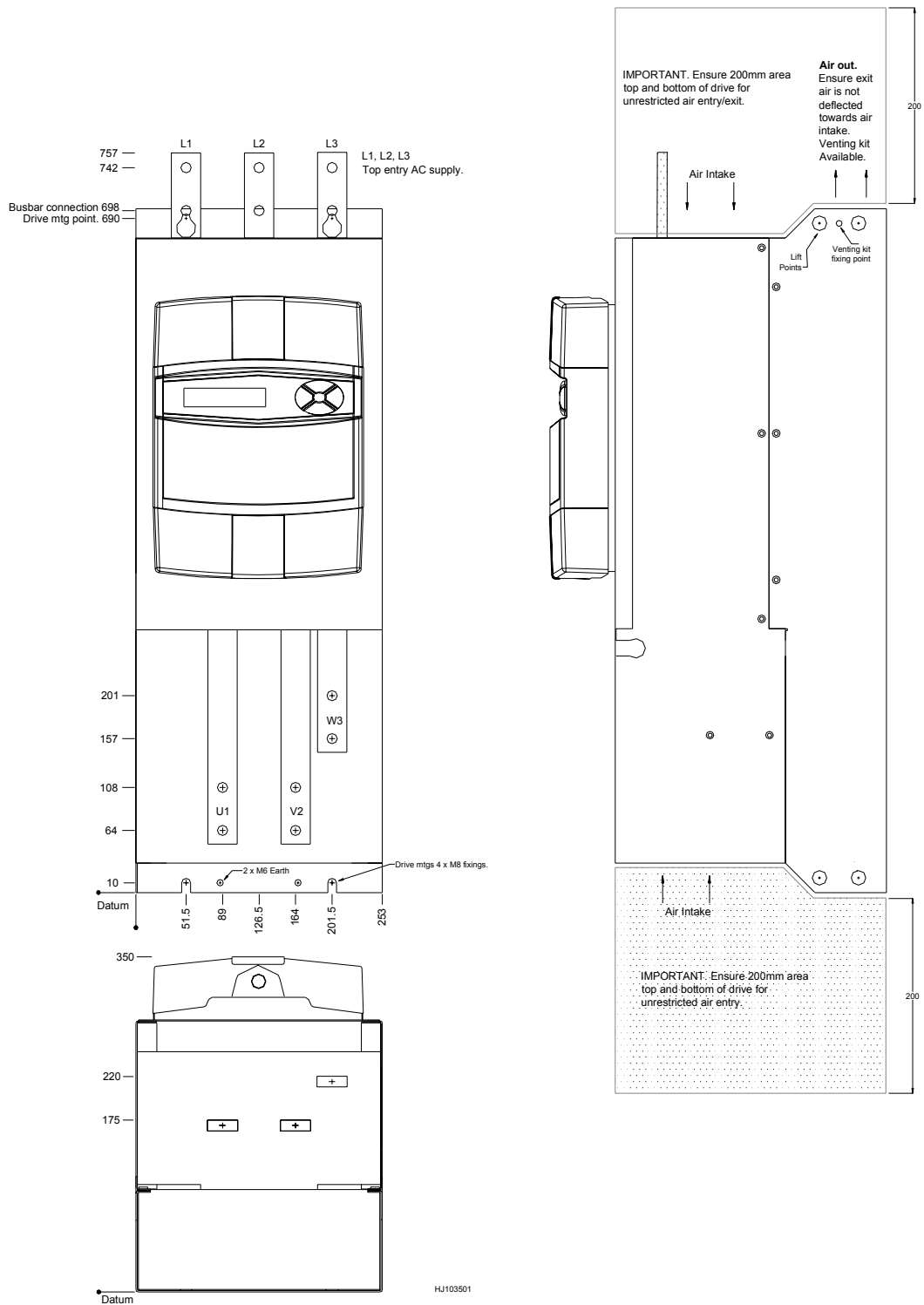
5 Mechanical Dimensions

5.1 Frame 2 JL/X 130 - 270



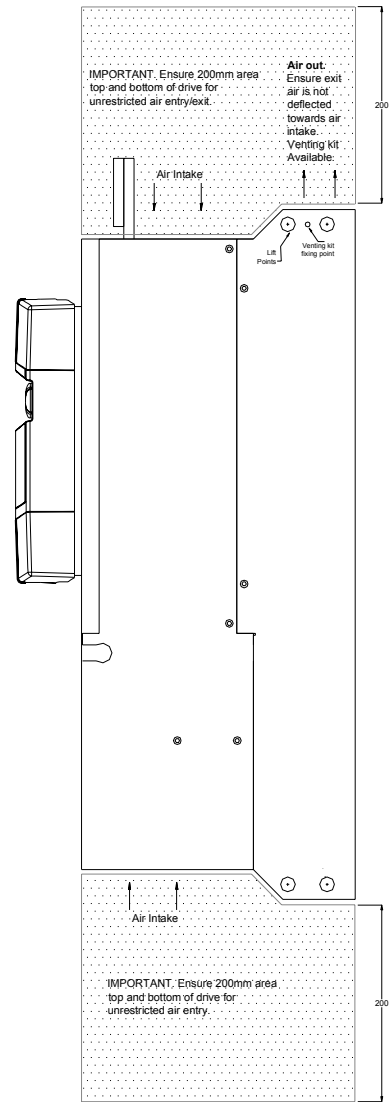
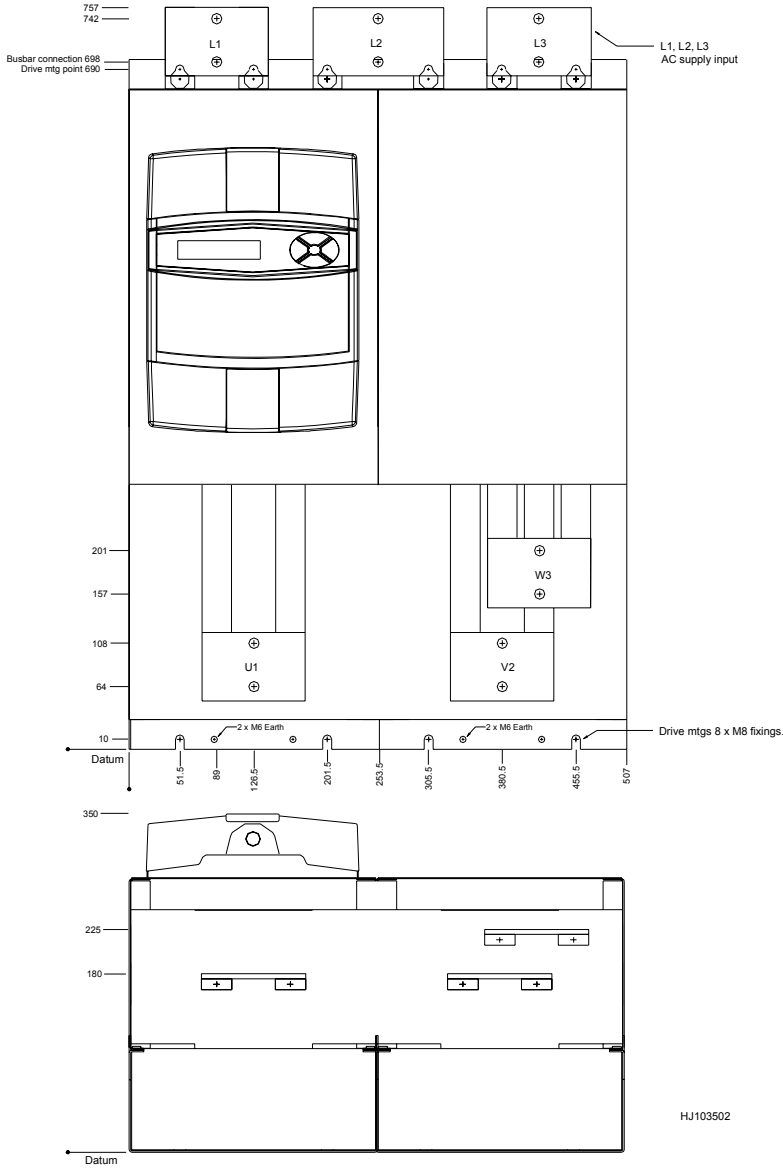
Weight 15Kg

5.2 Frame 4 JL/X 370-780



Weight 45Kg

5.3 Frame 5 JL/X 860-1680



HJ103502

Weight 90KG.

6 Venting

6.1 General venting information for frame 4 and 5

In order to keep these units within the required operating temperatures under all operating limits they are equipped with a very efficient cooling system. It consists of a powerful centrifugal fan system integral to the unit mounted at the bottom, which blows air over a high dissipation heatsink. Cool air is drawn in both at the top and bottom of the unit and after travelling over the internal heatsink fins, is exhausted at the top of the unit. See 6.4 Air supply to enclosure. From here the warm air must be vented from the enclosure used to house the drive. The unit will run cooler and hence be less stressed if the warm exhaust air is prevented from mixing with the intake air. This can be achieved by the use of the optional venting kit. See below.

6.1.1 When venting kit impractical. Frame 4 and 5 Models JL/X 370 - 1680

For these models it is necessary to keep the exhaust air that is emitted from the top end of the fin section separated from the rest of the enclosure by constructing a duct that can evacuate the exhaust air from the enclosure. If this requires an indirect route then you may need to use external fans to maintain the required airflow. See 7 Product rating table for airflow ratings. Ensure against pollutants entering the port and you may need to use a suitable grill if there is a danger of birds or vermin making it their home.

6.2 Venting kit for frame 4 JL/X 370 - 780

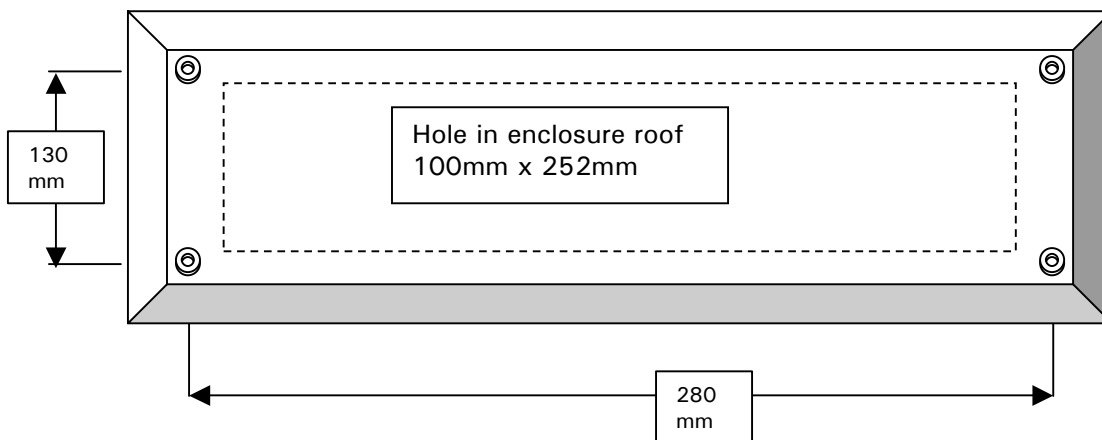
The venting kit comprises two steel ducts which are designed to telescope together. Hence the duct length from the top of the drive is adjustable between 270mm to 538mm. It consists of three main components.

- 1) A lower duct which fits within the side cheeks directly above the heatsink exhaust area.

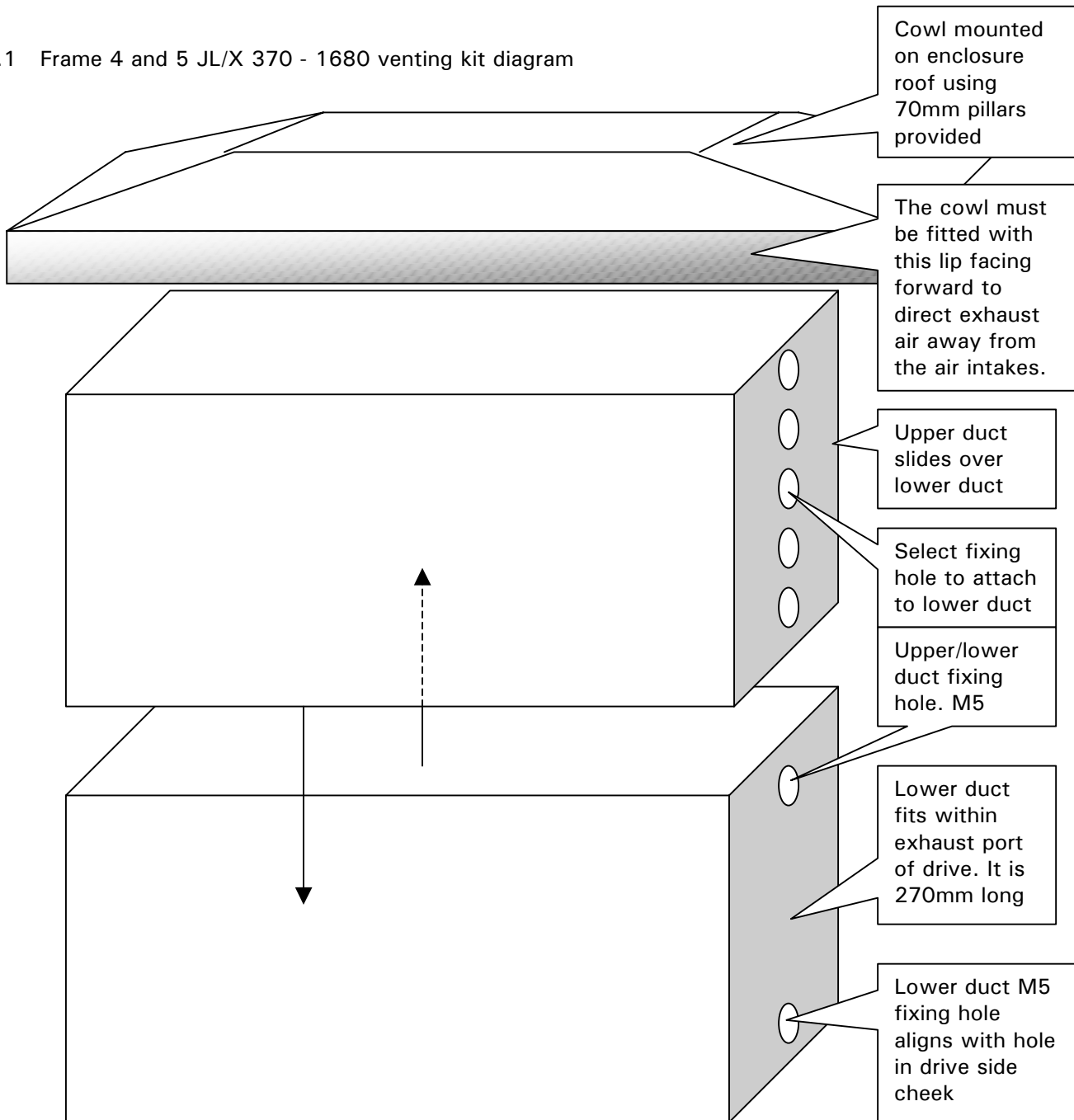
This is secured with 2 M5 screws. See 5 Mechanical Dimensions for fixing point drawing. The lower duct is 270mm long from the top edge of the JL/X.

- 2) The upper duct, which fits over the lower duct section, to extend the total length of the assembly. It has a series of M5 side holes to allow adjustment. Once the desired height is established the upper duct can be screwed to the lower duct through the selected hole, one screw per side. The useful length of the extended duct may be adjusted in steps of approx. 20mm from 270mm to 535mm. The duct must be inserted through a tight fitting rectangular hole in the roof of the enclosure (hole size 100mm x 252mm) and protrude above it by 10-20mm. Then the gap between the duct and the enclosure roof must be sealed (e.g. using tape or flexible filler) to ensure that the exhaust air and pollutants cannot enter into the enclosure.

- 3) A cowl which is fixed on top of the enclosure to prevent pollutants from dropping into the outlet. The cowl is supplied with 4 off 50mm mounting pillars, and 4 M6 holes must be drilled in the roof of the enclosure, to allow the mounting pillars to be fixed such that the cowl is positioned centrally over the duct. The cowl will overhang the duct by 70mm all the way round. If there is a danger of birds or vermin entering the exhaust port then it is recommend that a suitable grille is added round the edge of the cowl.



6.2.1 Frame 4 and 5 JL/X 370 - 1680 venting kit diagram

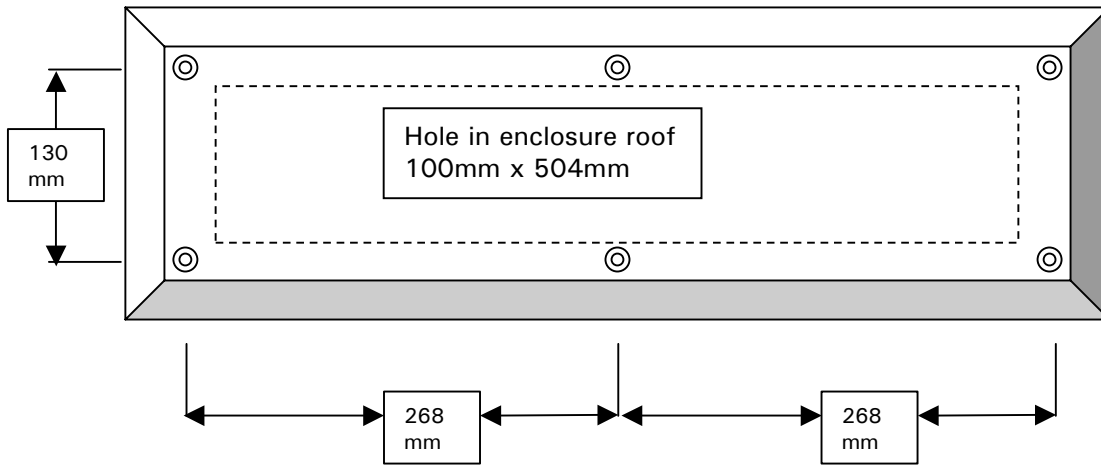


6.3 Venting kit for frame 5 JL/X 860 - 1680

The venting kit comprises a cowl and 2 pairs of steel ducts, each pair being designed to telescope together. Hence the duct length from the top of the drive is adjustable between 270mm to 535mm. There is also an enclosure roof cowl. Each pair is the same unit as described in 6.2 Venting kit for frame 4 JL/X 370 - . There are 2 exhaust ports at the top of the JL/X and each pair of ducts is used with one of the ports. Please read section 5.2 for details about each pair.

The ducts must be inserted through a tight fitting rectangular hole in the roof of the enclosure (hole size 100mm x 504mm) and protrude above it by 10-20mm. Then the gap between the duct and the roof must be sealed (e.g. using tape or flexible filler) to ensure that the exhaust air and pollutants cannot enter into the enclosure. Also the interface between each pair of ducts must be sealed at the top where it protrudes from the roof.

The cowl is fixed on top of the enclosure to prevent pollutants from dropping into the exhaust outlet of the drive. The cowl is supplied with 6 off 50mm mounting pillars, and 6 M6 holes must be drilled in the roof of the enclosure, to allow the mounting pillars to be fixed such that the cowl is positioned centrally over the duct. The cowl will overhang the duct by 70mm all the way round. If there is a danger of birds or vermin entering the exhaust port then it is recommend that a suitable grille is added round the edge of the cowl



6.4 Air supply to enclosure

It is essential that the enclosure which houses the JL/X is supplied with sufficient cool clean air to satisfy the throughput requirements of the JL/X and any other devices within the enclosure. Do not forget that the current carrying components associated with the drive will be dissipating a considerable amount of heat especially when the system is running at full capacity.

The enclosure must be fitted with air filters suitable for the airbourne pollutants encountered within its environment. Together they must have a rated throughput of sufficient capacity for all of the exhaust fans used in the enclosure. If the JL/X is fitted with a venting kit and there is another exhaust fan also operating for cooling other components it is essential that the auxiliary fan does not starve the JL/X of its air supply. This should be avoided if the input filters have sufficient capacity. It is recommended that the JL/X is provided with its own filters, and an enclosure partition used to isolate it from the influence of the rest of the enclosure cooling arrangements.

There should be 2 filters for the JL/X. One to provide air to the lower input port, and one for the upper port. The inlet filters should be fitted to the enclosure adjacent to the input ports at the lower and upper ends of the unit to ensure that the air drawn in is close to where it is needed. The reason for using filters at the top and bottom of the unit is because if only one filter is provided, then when the enclosure door is shut, the airpath from top to bottom may become throttled if the door is close to the face of the unit.

6.5 Exhaust air

After leaving the enclosure containing the JL/X the heated exhaust air will need to be prevented from elevating the ambient temperature of the room that is housing the enclosure by using sufficient ventilation. Alternatively the supply of cooling air may be obtained from outside and ducted to the enclosure.

6.6 Venting summary

Ensure a clean un-interruptible supply of cool filtered air is available for the JL/X and that the exhaust air is adequately and safely disposed of. Use the venting kit to keep the hot exhaust air separate from the cooling input air within the enclosure. Ensure the cooling air is available at the top and bottom of the unit. The JL/X will survive running at high ambient temperatures but possibly at the expense of its potential lifespan. Observe good engineering practice and keep all the components within the enclosure as cool as possible, consistent with avoiding condensation. For installations subjected to high ambient temperatures consider the use of air conditioning to achieve these requirements.

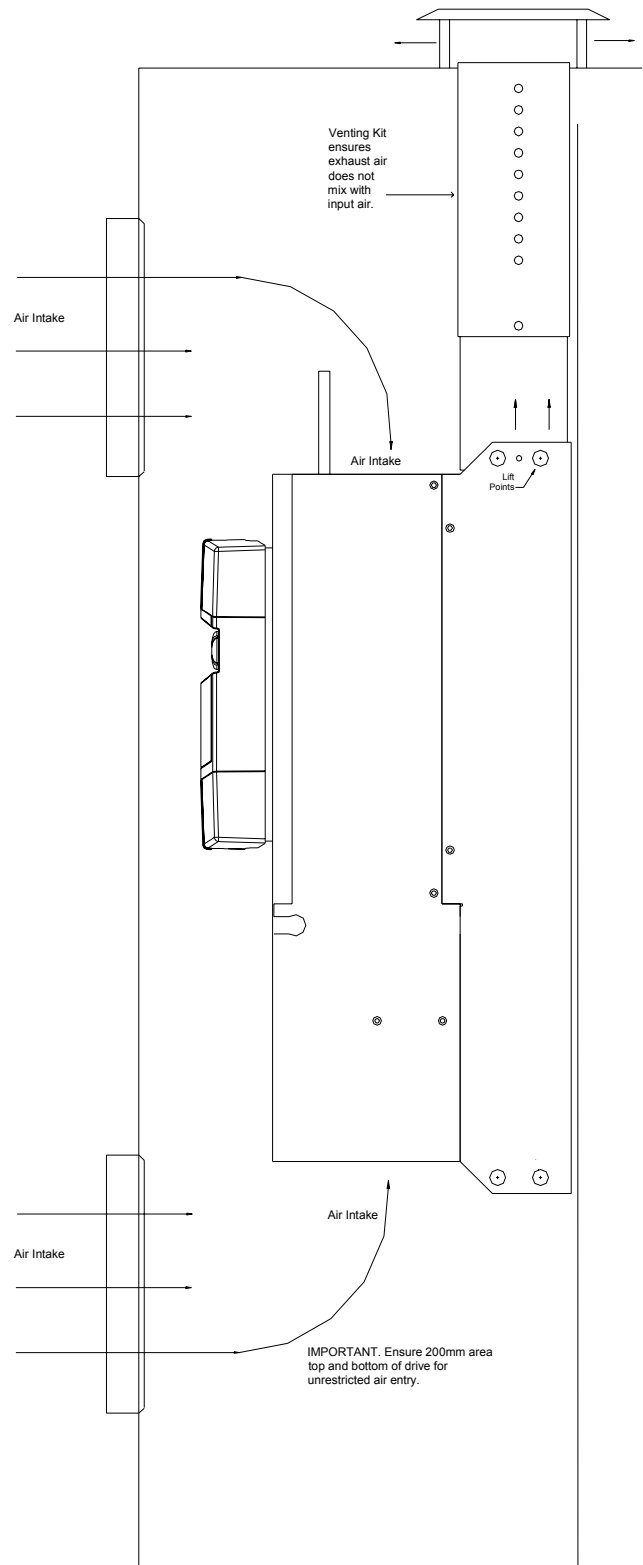
6.6.1 Diagram of airflow for frame 4 and 5

This diagram shows a side view of a unit in an enclosure. This is the recommended method for arranging the flow of cooling air. The fan in the JL/X will draw air into the top and bottom air intakes of the unit.

There are 2 air inlet filters mounted on the door. One adjacent to the lower air intake of the unit and the other adjacent to the upper air intake of the unit.

The exhaust air is exiting the enclosure via the venting kit assembly which is shown with the cowl fitted on the roof of the enclosure.

If this hot exhaust air is likely to raise the temperature of the air being drawn in, then further measures must be taken to direct it away from the system.



7 Product rating table

Nominal maximum continuous shaft ratings

Model		kW at 415 Volt AC	HP at 415 Volt AC	HP at 480 Volt AC	HP 690V AC HV model	100% Output Current	Line reactor type	Cooling air flow and dissipation		Dimensions mm W x H x D
								cfm	watts	
Frame 2	Model									
JL and JLX	130	75	100	115		130	LR270	365	380	216 x 378 x 218
JL and JLX	170	100	130	150		170	LR270	365	500	216 x 378 x 218
JL and JLX	220	130	170	200		220	LR270	365	650	216 x 378 x 218
JL and JLX	270	160	210	240		270	LR330	365	875	216 x 378 x 218
Frame 4										
JL and JLX	370	215	290	335	480	370	LR430	400	1200	253 x 700 x 350
JL and JLX	450	260	350	405	580	450	LR530	400	1450	253 x 700 x 350
JL and JLX	530	310	415	480	690	530	LR650	400	1700	253 x 700 x 350
JL and JLX	615	360	480	555	800	615	LR750	400	2000	253 x 700 x 350
JL and JLX	700	405	550	630	915	700	LR850	400	2300	253 x 700 x 350
JL and JLX	780	450	610	705	1015	780	LR950	400	2500	253 x 700 x 350
Frame 5										
JL and JLX	860	500	670	775	1115	860	LR1050	800	2700	506 x 700 x 350
JL and JLX	1025	595	800	925	1330	1025	LR1250	800	3200	506 x 700 x 350
JL and JLX	1190	690	930	1075	1550	1190	LR1450	800	3700	506 x 700 x 350
JL and JLX	1350	785	1055	1220	1755	1350	LR1650	800	4200	506 x 700 x 350
JL and JLX	1520	880	1190	1375	1980	1520	LR1850	800	4700	506 x 700 x 350
JL and JLX	1680	975	1310	1515	2180	1680	LR2050	800	5200	506 x 700 x 350

Important Notes

- 1) Only use UL fuses for installations complying with UL codes.
- 2) Model JL/X 1680 have max ambient temperature rating of 35C. Derate by 100 Amps for 40C.
- 3) The EL1/2/3 connections should be wired from the drive side of the main fuses.
- 4) Please consider the total component dissipation within the enclosure when calculating the required air throughput. This includes the fuses, line reactors and other sources of dissipation.
- 5) 400 Cubic feet per minute is approximately equivalent to 12 cubic metres per minute.
800 Cubic feet per minute is approximately equivalent to 24 cubic metres per minute.
- 6) The output power rating shown is at the 100% rating of the drive and is the power available at the shaft for a typical motor. The actual power available will depend on the efficiency of the motor.
- 8) The 690V AC supply is an extra cost option and needs to be specified at the time of order. Suffix HV

7.1 Product rating labels

The product rating labels are located on the unit under the upper end cap. The product serial number is unique and can be used by the manufacturer to identify all ratings of the unit. The power ratings and model type are also found here, along with any product standard labels applicable to the unit.

7.2 Semiconductor fuses

WARNING. All units must be protected by correctly rated semi-conductor fuses. Failure to do so will invalidate warranty. For semi-conductor fuses please refer to supplier.

Model PL 2Q PLX 4Q	Main fuses Max I ² t	Main fuses Max I ² t	Main fuses Max I ² t	Main fuses Max I ² t
	480V AC 50Hz AC	480V AC 60Hz AC	690V AC 50Hz AC	690V AC 60Hz AC
	Standard	Standard	High Voltage	High Voltage
Frame 2				
JL/X130	60000	60000		
JL/X170	60000	60000		
JL/X220	128000	128000		
JL/X270	128000	128000		
Frame 4				
JL/X370	1,170,000	1,170,000	810,000	770,000
JL/X450	1,170,000	1,170,000	810,000	770,000
JL/X530	1,170,000	1,170,000	810,000	770,000
JL/X615	1,170,000	1,170,000	810,000	770,000
JL/X700	1,170,000	1,170,000	810,000	770,000
JL/X780	1,304,000	1,290,000	1,260,000	1,200,000
JL/X860	1,304,000	1,290,000	1,260,000	1,200,000
Frame 5				
JL/X860	3,240,900	3,240,900	2,243,700	2,132,900
JL/X1025	3,240,900	3,240,900	2,243,700	2,132,900
JL/X1190	3,240,900	3,240,900	2,243,700	2,132,900
JL/X1350	4,212,000	4,212,000	2,916,000	2,772,000
JL/X1520	4,694,400	4,694,400	2,916,000	2,772,000
JL/X1680	4,694,400	4,694,400	2,916,000	2,772,000

7.2.1 JL/X Models AC fuses for Standard supply voltage (Up to 480V AC)

JL AC Fuses	SPRINT PART No.	SIZE	CURRENT RATING (A)	MOUNTING	DEPTH mm	FERRAZ PART NUMBER AND REFERENCE	
JL/X130	CH008160	Size 00	160				
JL/X170	CH009250	Size 1	250				
JL/X220	CH009250	Size 1	250				
JL/X270	CH010550	Size 3	550				
JL/X370	CH103301	33	800	TTF	50.6	6,9 URD 33 TTF 0800	Z300080
JL/X450	CH103301	33	800	TTF	50.6	6,9 URD 33 TTF 0800	Z300080
JL/X530		31	800	TTF	50.6	6,9 URD 31 TTF 0800	Y300401
JL/X530		32	800	TTF	50.6	6,9 URD 32 TTF 0800	P300071
JL/X530	CH103301	33	800	TTF	50.6	6,9 URD 33 TTF 0800	Z300080
JL/X615		32	900	TTF	50.6	6,9 URD 32 TTF 0900	Q300072
JL/X615	CH103302	33	900	TTF	50.6	6,9 URD 33 TTF 0900	A300081
JL/X700		32	1000	TTF	50.6	6,9 URD 32 TTF 1000	S300074
JL/X700	CH103303	33	1000	TTF	50.6	6,9 URD 33 TTF 1000	B300082
JL/X780		32	1100	TTF	50.6	6 URD 32 TTF 1100	M300759
JL/X780	CH103304	33	1100	TTF	50.6	6,9 URD 33 TTF 1100	C300083
JL/X860	CH103305	33	1250	TTF	50.6	6,9 URD 33 TTF 1250	D300084
JL/X860		2x33	1250	TTF	67.6	6,9 URD 233 TTF 1250	D300268
JL/X1025	CH103306	33	1500	TTF	50.6	6 URD 33 TTF 1500	Y300585
JL/X1025		33	1600	TTF	50.6	6 URD 33 TTF 1600	Z300586
JL/X1190	CH103307	33	1800	TTF	50.6	6 URD 33 TTF 1800	A300587
JL/X1190		2x33	1800	PLAF	55.5	6,9 URD 233 PLAF 1800	B300427
JL/X1350	CH103308	33	2000	TTF	50.6	5,5 URD 33 TTF 2000	B300588
JL/X1350)		2x33	2000	PLAF	91.5	6 URD 233 PLAF 2000	R302235
JL/X1520		2x33	2200	PLAF	91.5	6 URD 233 PLAF 2200	Q302234
JL/X1520)	CH103309	44	2200	TQF	65	7,5 URD 44 TTQF 2200	K235184
JL/X1680		44	2500	TQF	65	7 URD 44 TTQF 2500 BS	C221538
JL/X1680	CH103310	44	2400	TQF	65	7,5 URD 44 TTQF 2400	W233906

7.3 Terminal information

7.3.1 Control Terminals

See main product manual for control terminal information section 3.3.3, 3.4 and 3.5.

7.3.2 Powerboard Terminals

Remove busbar cover plate to reveal powerboard terminals.

For terminals T41 to T53 refer to main manual section 3.3.3, for power terminals refer to section 3.3.2.

7.3.2.1 Fan supply input

Remove busbar cover plate to reveal powerboard terminals. The fan supply input terminals are located on the lower left hand edge of the powerboard marked AC FAN SUPPLY B1 N, B2 L.

Internal Fan supply

JL/X 370/450/530/615/700/780/860 models need a separate 100VA 240V 50/60Hz ac supply for the fan.

JL/X 860/1025/1190/1350/1520/1680 models need a 200VA 240V 50/60Hz ac supply for the fan.

Note. For these units frame 4 and frame 5, if the fan supply fails, or is not present on power up then a warning message HEATSINK OVERTEMP is displayed on the front of the unit, and operation of the motor will be prevented. See also the main manual section 8.1.11.13 for further details of this message related to actual overtemp events.

7.3.2.2 Field supply input and output

Remove busbar cover plate to reveal powerboard terminals

The terminals EL1 EL2 EL3 F+ F- are M6 stud types found on the bottom right hand corner of the powerboard. Further information on utilising these terminals is in Section 4 Basic Application and Section 14.9 Wiring instructions, in the main manual. Also section 3.3.2 for specification. See section 7 Product rating table, in this manual.

7.3.3 Terminal tightening torques

Terminals	Model	Tightening torque
Terminals 1 to 100	JL/X 130-1680	4 lb-in or 0.5 N-m
EL1 EL2 EL3	JL/X 130-270	9 lb-in or 1.0 N-m
EL1 EL2 EL3	JL/X 370-1680	35 lb-in or 3.9 N-m
L1 L2 L3 U V W-	JL/X 130-1680	242 lb-in or 27 N-m
Fan supply terminals	JL/X 370-1680	9 lb-in or 1.0 N-m

7.3.4 Forces applied to the power terminals

Avoid applying mechanical stress to the heavy current terminals L1/2/3 U1, V2, W3. Please ensure that any cables or busbars that are bolted to these terminals are supported within the enclosure. Do not rely on the drive terminals to support the weight of the external connections.

Do not use the connecting bolt to hold the terminal and the connecting cable or busbar in alignment, otherwise, if they have been levered into alignment prior to inserting the bolt, there will be a permanent stress on the terminal. Always support the connection to the terminal such that the only purpose of the terminal bolt is to tighten them together and not to maintain their relative position to each other. The respective holes in the terminal and the connecting busbar should remain in alignment without the aid of the terminal bolt. Then you can be sure that there is minimum stress on the drive terminal busbar.

When tightening the connecting bolts of the terminals L1/2/3 A+ A- please ensure that the busbar is not subjected to a turning moment as the nut is torqued down. To do this always use two spanners, one on the bolt head to provide a counter torque and one on the nut to provide tightening torque.

7.3.5 Avoid dropping small objects into unit

If the unit is in the horizontal plane then there is a danger that objects may be accidentally dropped into the air intake grille when connecting the busbars to the terminals. Or when the unit is vertical, dropping washers into the fin section at the top, or objects dropping through the upper air intake grill. As a precaution it is advised that a temporary cover be utilised over these areas when working on the unit, e.g. a piece of cardboard. Do not forget to remove the temporary cover prior to starting the unit. If anything is dropped into the unit then it may interfere with the fan rotation.

7.4 Line reactors

Only use UL certified line reactors for installations complying with UL codes. These line reactors are not certified. Refer to supplier for certified alternatives.

Model JL 2Q JLX 4Q	Max continuous Current (AMPS)		Line reactor Type 480V AC Supply	Line reactor Type 690V AC Supply
	Input AC	Output AC		
JL/X130	130	130	LR270	
JL/X170	170	170	LR270	
JL/X220	220	220	LR270	
JL/X270	270	270	LR330	
JL/X370	530	530	LR430	LR650HV
JL/X450	615	615	LR530	LR650HV
JL/X530	530	530	LR650	LR650HV
JL/X615	615	615	LR750	LR750HV
JL/X700	700	700	LR850	LR850HV
JL/X780	780	780	LR950	LR950HV
JL/X860	860	860	LR1050	LR1050HV
JL/X1025	1025	1025	LR1250	LR1250HV
JL/X1190	1190	1190	LR1450	LR1450HV
JL/X1350	1350	1350	LR1650	LR1650HV
JL/X1520	1520	1520	LR1850	LR1850HV
JL/X1680	1680	1680	LR2050	LR2050HV

To obtain line reactor dimensions please refer to supplier

7.5 Lifting the unit frame 4 and 5

Use the lifting points provided. There are lifting holes at each end of the unit. Attach a loop of suitable rope (approx. 1.2m for JL/X370-780 and 1.5m for JL/X860-1680) between the lifting holes at each side at the top end, and a similar loop at the bottom end, to assist in lifting the unit out of its container. When lifting the unit keep it in either the horizontal or vertical plane to avoid deforming the side cheeks at the lifting points. Use the top end lifting loop to assist in presenting the unit onto the back panel. The fixing holes at the top of the unit are designed with a keyhole shape to allow the unit to be initially hung on the securing bolts. These should be fixed on the back panel prior to presenting the unit into the enclosure.

Alternatively a small fork lift may be employed if the wheel has access under the door of the enclosure. (It is usually possible to have access for one fork from the side of a typical enclosure with the side panel removed). If access can be gained this way then you will need to bolt some temporary wooden extensions to the lifting holes at the bottom of the unit in order to stand the unit on the fork which will enter the enclosure).

7.5.1 Unit weight

The JL/X 370-780 weighs 45Kg. The JL/X 860-1680 weighs 90Kg.

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