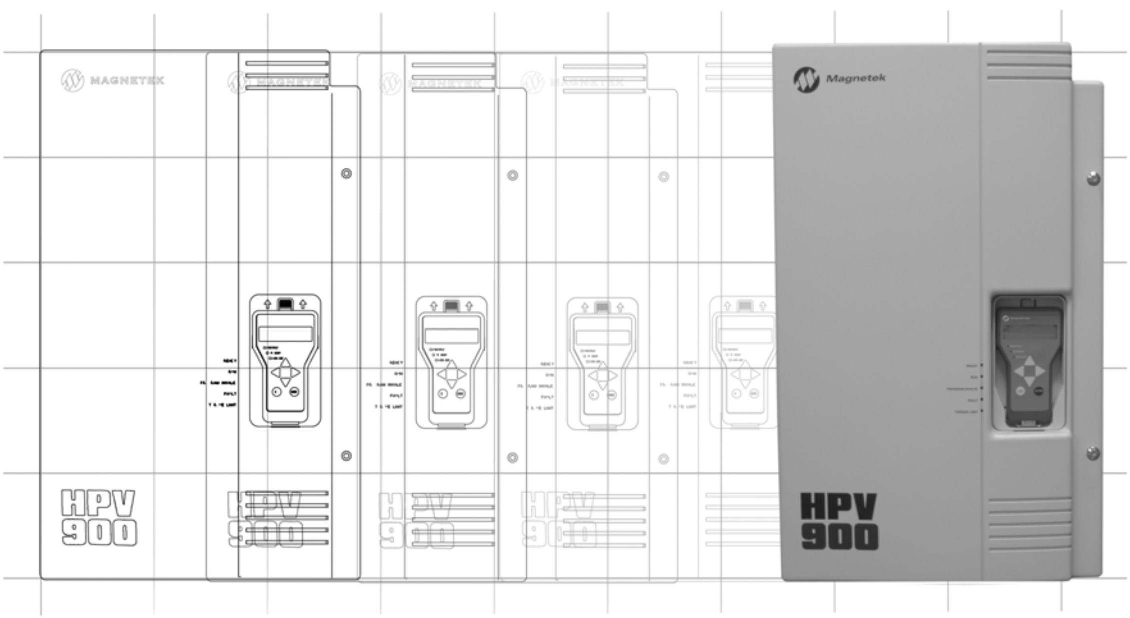
HPV 900 AC Elevator Drive

Technical Manual



TM4090 rev 3

WARRANTY Standard products manufactured by the Company are warranted to be free from defects in workmanship and material for a period of one year from the date of shipment, and any products which are defective in workmanship or material will be repaired or replaced, at the Company's option, at no charge to the Buyer. Final determination as to whether a product is actually defective rests with the Company. The obligation of the Company hereunder shall be limited solely to repair or replace, at the Company's discretion, products that fall within the foregoing limitations, and shall be conditioned upon receipt by the Company of written notice of any alleged defects or deficiency promptly after discovery and within the warranty period, and in the case of components or units purchased by the Company, the obligation of the Company shall not exceed the settlement that the Company is able to obtain from the supplier thereof. No products shall be returned to the Company without its prior consent. Products which the company consents to have returned shall be shipped prepaid f.o.b. the Company factory. The Company cannot assume responsibility or accept invoices for unauthorized repairs to its components, even though defective. The life of the products the Company depends, to a large extent, upon type of usage thereof and THE COMPANY MAKES NO WARRANTY AS TO FITNESS OF ITS PRODUCTS FOR THE SPECIFIC APPLICATIONS BY THE BUYER NOR AS TO PERIOD OF SERVICE UNLESS THE COMPANY SPECIFICALLY AGREES OTHERWISE IN WRITING AFTER PROPOSED USAGE HAS BEEN MADE KNOWN TO IT.
This warranty does not apply to experimental products for which no warranty is made or given and Buyer waives any claim thereto.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT LIMITED TO, ANY WARRANTY OF MECHANTIBILITY OR OF FITNESS FOR A PARTICULAR PURPOSE AND BUYER HEREBY WAIVES ANY AND ALL CLAIMS THEREFORE.

LIMITATIONS OF LIABILITY IN NO EVENT SHALL MAGNETEK BE LIABLE FOR LOSS OF PROFIT, INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES WHETHER ARISING OUT OF WARRANTY, BREACH OF CONTRACT OR TORT.

HPV 900 is a trademark of Magnetek, Inc.

Table of Contents

HPV 900 Drive Ratings

Rated Input Voltage	Rated HP	Rated kW	Continuous Output Current General Purpose Rating	Continuous Output Current Elevator Duty Cycle* Rating	Maximum Output Current for 5 Sec	Cube Size**	Model Number***
230V	7.5	5.5	25	29	62.5	A	HPV900-2025-0E1-xx
	10	7.5	27	31	67.5	B	HPV900-2027-0E1-xx
	15	11	41	47	102	B	HPV900-2041-0E1-xx
	20	15	52	60	130	B	HPV900-2052-0E1-xx
	25	18	75	84	170	B+	HPV900-2075-0E1-xx
	30	22	88	99	200	B+	HPV900-2088-0E1-xx
	40	30	104	120	260	C	HPV900-2104-0E1-xx
460V	5	3.7	8	9	20	A	HPV900-4008-0E1-xx
	10	7.5	16	18	40	A	HPV900-4016-0E1-xx
	15	11	21	24	52.5	A	HPV900-4021-0E1-xx
	20	15	27	31	67.5	B	HPV900-4027-0E1-xx
	25	18	34	39	85	B	HPV900-4034-0E1-xx
	30	22	41	47	102	B	HPV900-4041-0E1-xx
	40	30	52	60	130	B	HPV900-4052-0E1-xx
	50	37	65	75	162	C	HPV900-4065-0E1-xx
	60	45	77	89	192	C	HPV900-4077-0E1-xx
	75	55	96	111	240	C	HPV900-4096-0E1-xx

Table 1: HPV 900 Drive Ratings

NOTE: all ratings at 60/50Hz and 10 kHz carrier frequency
all ratings for based on a geared elevator application,
for gearless ratings, see Gearless Application on page 126

For more information on altitude, temperature, and carrier frequency derating, see Drive Derating on page 12.
Replaced model numbers: –2068 replaced by –2075 and –2080 replaced by –2088, see page 134
* *For more information on the Elevator Duty Cycle Rating, see page 107*
** *Cube size dimensions, mounting holes, and weights are shown in Dimensions, Mounting Holes and Weights on page 112*
*** *From more information on model numbers, see page 12.*

Submenu	Parameter	Units	Range	Default	Site Setting
A1	***Drive A1 Submenu – For details, see Drive A1 Submenu on page 30.***				
A1	CONTRACT CAR SPD	fpm	0.0 – 1500.0	400.0	
		m/s	0.000 – 8.000	2.000	
A1	CONTRACT MTR SPD	RPM	50.0 – 3000.0	1130.0	
A1	RESPONSE	rad/sec	1.0 – 20.0	10.0	
A1	INERTIA	sec	0.25 – 50.00	2.00	
A1	INNER LOOP XOVER	rad/sec	0.1 – 20.0	2.0	
A1	GAIN REDUCE MULT	%	10 – 100	100	
A1	GAIN CHNG LEVEL	% of rated spd	0.0 – 100.0	100.0	
A1	TACH RATE GAIN	%	0.0 – 30.0	0.0	
A1	SPD PHASE MARGIN	degrees	45 – 90	80	
A1	RAMPED STOP TIME	sec	0.00 – 2.50	0.20	
A1	CONTACT FLT TIME	sec	0.10 – 5.00	0.50	
A1	BRAKE PICK TIME	sec	0.00 – 5.00	1.00	
A1	BRAKE HOLD TIME	sec	0.00 – 5.00	0.20	
A1	OVERSPEED LEVEL	% of contract spd	100.0 – 150.0	115.0	
A1	OVERSPEED TIME	sec	0.00 – 9.99	1.00	
A1	OVERSPEED MULT	%	100.0 – 150.0	125.0	
A1	ENCODER PULSES	pls/rev	600 – 10000	1024	
A1	SPD DEV LO LEVEL	% of contract spd	0.1 – 20.0	10.0	
A1	SPD DEV TIME	sec	0.00 – 9.99	0.50	
A1	SPD DEV HI LEVEL	% of contract spd	0.0 – 99.9	10.0	
A1	SPD COMMAND BIAS	volts	0.00 – 6.00	0.00	
A1	SPD COMMAND MULT	none	0.90 – 5.00	1.00	
A1	PRE TORQUE BIAS	volts	0.00 – 6.00	0.00	
A1	PRE TORQUE MULT	none	-10.00 – +10.00	1.00	
A1	ZERO SPEED LEVEL	% of contract spd	0.00 – 99.99	1.00	
A1	ZERO SPEED TIME	sec	0.00 – 9.99	0.10	
A1	UP/DWN THRESHOLD	% of contract spd	0.00 – 9.99	1.00	
A1	MTR TORQUE LIMIT	% of rated torque	0.0 – 275.0	200.0	
A1	REGEN TORQ LIMIT	% of rated torque	0.0 – 275.0	200.0	
A1	FLUX WKN FACTOR	% of rated torque	60 – 100	100	
A1	ANA 1 OUT OFFSET	%	-99.9 – +99.9	0.0	
A1	ANA 2 OUT OFFSET	%	-99.9 – +99.9	0.0	
A1	ANA 1 OUT GAIN	none	0.0 – 10.0	1.0	
A1	ANA 2 OUT GAIN	none	0.0 – 10.0	1.0	
A1	FLT RESET DELAY	sec	0 – 120	5	
A1	FLT RESETS/HOUR	#	0 – 10	3	
A1	UP TO SPD. LEVEL	% of contract spd	0.00 – 110.00	80.00	
A1	MAINS DIP SPEED	%	5.00 – 99.99	25.00	
A1	RUN DELAY TIMER	sec	0.00 – 0.99	0.00	
A1	AB ZERO SPD LEV	%	0.00 – 2.00	0.00	
A1	AB OFF DELAY	sec	0.00 – 9.99	0.00	
A1	CONTACTOR DO DLY	sec	0.00 – 5.00	0.00	
A1	TRQ LIM MSG DLY	sec	0.0 – 10.00	0.50	
A1	SER2 INSP SPD	fpm	0.0 – 100.0	30.0	
		m/s	0.000 – 0.500	0.150	
A1	SER2 CRP SPD	fpm	0.0 – 300.0	10.0	
		m/s	0.000 – 1.540	0.050	
A1	SER2 CRP TIME	sec	0.0 – 200.0	180.0	
A1	SER2 FLT TOL	sec	0.00 – 2.00	0.04	
A1	ROLLBACK GAIN	none	1 – 20	1	
A1	NOTCH FILTER FRQ	Hz	5 – 60	20	
A1	NOTCH FILT DEPTH	%	0 – 100	0	
A1	MSPD DELAY 1-4	sec	0.000 – 10.000	0.000	

Submenu	Parameter	Units	Range	Default	Site Setting
A2	***S-Curves A2 Submenu – For details, see S-Curves A2 Submenu on page 41.***				
A2	ACCEL RATE 0	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.090	
A2	DECEL RATE 0	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.090	
A2	ACCEL JERK IN 0	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	ACCEL JERK OUT 0	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	DECEL JERK IN 0	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	DECEL JERK OUT 0	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	ACCEL RATE 1	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.090	
A2	DECEL RATE 1	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.090	
A2	ACCEL JERK IN 1	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	ACCEL JERK OUT 1	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	DECEL JERK IN 1	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	DECEL JERK OUT 1	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	ACCEL RATE 2	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.090	
A2	DECEL RATE 2	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.090	
A2	ACCEL JERK IN 2	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	ACCEL JERK OUT 2	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	DECEL JERK IN 2	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	DECEL JERK OUT 2	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	ACCEL RATE 3	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.090	
A2	DECEL RATE 3	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.090	
A2	ACCEL JERK IN 3	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	ACCEL JERK OUT 3	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	DECEL JERK IN 3	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	DECEL JERK OUT 3	ft/s^3	0.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	

Submenu	Parameter	Units	Range	Default	Site Setting
A3	***Multistep Ref A3 Submenu – For details see Multistep Ref A3 Submenu on page 43.***				
A3	SPEED COMMAND 1	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 2	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 3	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 4	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 5	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 6	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 7	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 8	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 9	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 10	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 11	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 12	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 13	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 14	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A3	SPEED COMMAND 15	ft/min	-3000.0 – +3000.0	0.0	
		m/sec	-16.000 – +16.000	0.000	
A4	***Power Convert A4 Submenu – For details, see Power Convert A4 Submenu on page 45.***				
A4	Id REG DIFF GAIN	none	0.80 – 1.20	1.00	
A4	Id REG PROP GAIN	none	0.20 – 0.40	0.30	
A4	Iq REG DIFF GAIN	none	0.80 – 1.20	1.00	
A4	Iq REG PROP GAIN	none	0.20 – 0.40	0.30	
A4	PWM FREQUENCY	kHz	2.5 – 16.0	10.0	
A4	UV ALARM LEVEL	%	80 – 99	90	
A4	UV FAULT LEVEL	%	50 – 99	80	
A4	EXTERN REACTANCE	%	0.0 – 10.0	0.0	
A4	INPUT L-L VOLTS	volts	110 – 480	460 or 230	

Submenu	Parameter	Units	Range	Default	Site Setting
A5	***Motor A5 Submenu – For details see Motor A5 Submenu on page 47.***				
A5	MOTOR ID	-	-	-	
A5	RATED MTR POWER	HP	1.0 – 500.0	0.0	
		kW	0.75 – 400.00	0.00	
A5	RATED MTR VOLTS	volts	190.0 – 575.0	0.0	
A5	RATED EXCIT FREQ	Hz	5.0 – 400.0	0.0	
A5	RATED MOTOR CURR	amps	1.00 – 800.00	0.00	
A5	MOTOR POLES	none	2 – 32	0	
A5	RATED MTR SPEED	RPM	50.0 – 3000.0	0.0	
A5	% NO LOAD CURR	%	10.0 – 80.0	Per ID	
A5	STATOR LEAKAGE X	%	0.00 – 20.00	Per ID	
A5	ROTOR LEAKAGE X	%	0.00 – 20.00	Per ID	
A5	STATOR RESIST	%	0.0 – 20.0	1.5	
A5	MOTOR IRON LOSS	%	0.0 – 15.0	0.5	
A5	MOTOR MECH LOSS	%	0.0 – 15.0	1.0	
A5	OVLD START LEVEL	%	100 – 150	110	
A5	OVLD TIME OUT	sec	5.0 – 120.0	60.0	
A5	FLUX SAT BREAK	% Flux	0 – 100	75	
A5	FLUX SAT SLOPE 1	PU Slope	0 – 200	0	
A5	FLUX SAT SLOPE 2	PU Slope	0 – 200	50	
C1	***User Switches C1 Submenu – For details, see User Switches C1 on page 52.***				
C1	SPD COMMAND SRC	none	– analog input – multi-step – ser mult step – serial	MULTI-STEP	
C1	RUN COMMAND SRC	none	– external tb – serial – serial+extrn	EXTERNAL TB	
C1	HI/LO GAIN SRC	none	– external tb – serial – internal	INTERNAL	
C1	SPEED REG TYPE	none	– elev spd reg – pi speed reg – external reg	ELEV SPD REG	
C1	MOTOR ROTATION	none	– forward – reverse	FORWARD	
C1	SPD REF RELEASE	none	– reg release – brake picked	REG RELEASE	
C1	CONT CONFIRM SRC	none	– none – external tb	NONE	
C1	Pre Torque SOURCE	none	– none – analog input – serial	NONE	
C1	Pre Torque LATCH	none	– not latched – latched	NOT LATCHED	
C1	PTorq LATCH CLCK	none	– serial – external tb	EXTERNAL TB	
C1	FAULT RESET SRC	none	– external tb – serial – automatic	EXTERNAL TB	
C1	OVERSPD TEST SRC	none	– external tb – serial	EXTERNAL TB	
C1	BRAKE PICK SRC	none	– internal – serial	INTERNAL	
C1	BRAKE PICK CNFM	none	– none – internal time – external tb	NONE	

Submenu	Parameter	Units	Range	Default	Site Setting
C1	***User Switches C1 Submenu continued …***				
C1	BRAKE HOLD SRC	none	– internal – serial	INTERNAL	
C1	RAMPED STOP SEL	none	– none – ramp on stop	NONE	
C1	RAMP DOWN EN SRC	none	– external tb – run logic – serial	EXTERNAL TB	
C1	BRK PICK FLT ENA	none	– disable – enable	DISABLE	
C1	BRK HOLD FLT ENA	none	– disable – enable	DISABLE	
C1	EXT TORQ CMD SRC	none	– none – analog input – serial	NONE	
C1	DIR CONFIRM	none	– disable – enable	DISABLE	
C1	S-CURVE ABORT	none	– disable – enable	DISABLE	
C1	FAST FLUX	none	– disable – enable	DISABLE	
C1	MAINS DIP ENA	none	– disable – enable	DISABLE	
C1	DB PROTECTION	none	– fault – alarm	FAULT	
C1	ENCODER FAULT	none	– disable – enable	ENABLE	
C1	STOPPING MODE	none	– immediate – ramp to stop	IMMEDIATE	
C1	MOTOR OVRLD SEL	none	– alarm – flt immediate – fault at stop	ALARM	
C1	AUTO STOP	none	– disable – enable	DISABLE	
C1	SERIAL MODE	none	– none – mode 1 – mode 2 – mode 2 test	NONE	
C1	SER2 FLT MODE	none	– immediate – run remove – rescue	IMMEDIATE	
C1	DRV FAST DISABLE	none	– disable – enable	DISABLE	
C1	MLT-SPD TO DLY 1-4	none	– none – mspd 1-15	NONE	
C2	***Logic Inputs C2 Submenu – For details, see Logic Inputs C2 on page 66.***				
C2	LOGIC INPUT 1	– contact confirm – drive enable – extrn fault 1 – extrn fault 2 – extrn fault 3 – extrn / flt 4 – fault reset – low gain sel – mech brk hold – mech brk pick – no function – ospd test src – pre trq latch	– run – run down – run up – s-curve sel 0 – s-curve sel 1 – ser2 insp ena – step ref b0 – step ref b1 – step ref b2 – step ref b3 – trq ramp down – up/dwn	DRIVE ENABLE	
C2	LOGIC INPUT 2			RUN	
C2	LOGIC INPUT 3			FAULT RESET	
C2	LOGIC INPUT 4			UP/DWN	
C2	LOGIC INPUT 5			S-CURVE SEL 0	
C2	LOGIC INPUT 6			STEP REF B0	
C2	LOGIC INPUT 7			STEP REF B1	
C2	LOGIC INPUT 8			STEP REF B2	
C2	LOGIC INPUT 9			EXTRN FAULT 1	

<table>
<tr><th>Submenu</th><th>Parameter</th><th>Units</th><th>Range</th><th>Default</th><th>Site Setting</th></tr>
<tr><td>C3</td><td colspan="5">Logic Outputs C3 Submenu – For details, see Logic Outputs C3 on page 68.</td></tr>
<tr><td>C3</td><td>LOGIC OUTPUT 1</td><td colspan="2" rowspan="6">– alarm
– alarm+flt
– auto brake
– brake alarm
– brake hold
– brake pick
– brk hold flt
– brk igbt flt
– brk pick flt
– car going dwn
– car going up
– charge fault
– close contact
– contactor flt
– curr reg flt
– drv overload
– encoder flt
– fan alarm
– fault
– flux confirm
– fuse fault
– ground fault
– in low gain
– motor trq lim
– mtr overload
– no function
– not alarm
– over curr flt
– overspeed flt
– overtemp flt
– overvolt flt
– ovrtemp alarm
– phase fault
– ramp down ena
– ready to run
– regen trq lim
– run commanded
– run confirm
– speed dev
– speed dev low
– speed ref rls
– speed reg rls
– undervolt flt
– up to speed
– uv alarm
– zero speed</td><td>READY TO RUN</td><td></td></tr>
<tr><td>C3</td><td>LOGIC OUTPUT 2</td><td>RUN COMMANDED</td><td></td></tr>
<tr><td>C3</td><td>LOGIC OUTPUT 3</td><td>MTR OVERLOAD</td><td></td></tr>
<tr><td>C3</td><td>LOGIC OUTPUT 4</td><td>ENCODER FLT</td><td></td></tr>
<tr><td>C3</td><td>RELAY COIL 1</td><td>FAULT</td><td></td></tr>
<tr><td>C3</td><td>RELAY COIL 2</td><td>SPEED REG RLS</td><td></td></tr>
<tr><td>C4</td><td colspan="5">Analog Outputs C4 Submenu – For details, see Analog Outputs C4 on page 70.</td></tr>
<tr><td>C4</td><td>ANALOG OUTPUT 1</td><td colspan="2" rowspan="2">– aux torq cmd
– bus voltage
– current out
– drv overload
– flux current
– flux ref
– flux output
– flux voltage
– frequency out
– mtr overload
– power output
– pretorque ref
– slip freq
– speed command
– speed error
– speed feedbk
– speed ref
– spd rg tq cmd
– tach rate cmd
– torq current
– torque ref
– torq voltage
– torque output
– voltage out</td><td>SPEED REF</td><td></td></tr>
<tr><td>C4</td><td>ANALOG OUTPUT 2</td><td>SPEED FEEDBK</td><td></td></tr>
</table>

Quick Parameter Reference

Sub menu	Parameter	Units
D1	***Elevator Data D1 Submenu***	
D1	Speed Command	ft/min or m/s
D1	Speed Reference	ft/min or m/s
D1	Speed Feedback	ft/min or m/s
D1	Speed Error	ft/min or m/s
D1	Pre-Torque Ref	% of rated torque
D1	Spd Reg Torq Cmd	% of rated torque
D1	Tach Rate Cmd	% of rated torque
D1	Aux Torque Cmd	% of rated torque
D1	Est Inertia	seconds
D1	Rx Com Status	1 = true; 0 = false
D1	Logic Outputs	1 = true; 0 = false
D1	Logic Inputs	1 = true; 0 = false
D2	***Power Data D2 Submenu***	
D2	Torque Reference	% of rated torque
D2	Motor Current	Amps
D2	% Motor Current	% rated current
D2	Motor Voltage	Volts
D2	Motor Frequency	Hz
D2	Motor Torque	% rated torque
D2	Power Output	kW
D2	DC Bus Voltage	Volts
D2	Flux Reference	%
D2	Flux Output	%
D2	Slip Frequency	Hz
D2	Motor Overload	%
D2	Drive Overload	%
D2	Flux Current	%
D2	Torque Current	% rated current
D2	Flux Voltage	% rated volts
D2	Torque Voltage	% rated volts
D2	Base Impedance	Ohms
D2	Est No Load Curr %	%
D2	Est Rated RPM	Rpm

Sub menu	Parameter	Site Setting
U1	***Password U1 Submenu***	
U1	Enter password	
U1	New password	
U1	Password lockout	
U2	***Hidden Items U2 Submenu***	
U2	Hidden Items Enable	
U3	***Units U3 Submenu***	
U3	Units Selection	
U4	***Ovrspeed Test U4 Submenu***	
U4	Overspeed Test	
U5	***Restore Dflts U5 Submenu***	
U5	Restore Motor Dflts	
U5	Restore Drive Dflts	
U6	***Drive Info U6 Submenu***	
U6	Drive Version	
U6	Boot Version	
U6	Cube ID	
U6	Drive Type	
U7	***Hex Monitor U7 Submenu***	
U7	Address	
U8	***Language Sel***	
U8	Language Select	
F1	***Active Faults F1 Submenu***	
F1	Display Active Faults	-
F1	Reset Active Faults	-
F2	***Faults History F2 Submenu***	
F2	Display Fault History	-
F2	Clear Fault History	-

Introduction

Drive Specifications

Ratings

- Horse Power ratings
  - 230 Volt AC input: 7.5, 10, 15, 20, 25, 30, and 40 HP
  - 460 Volt AC input: 5, 10, 15, 20, 25, 30, 40, 50, 60, and 75 HP
- 150% of continuous current rating (general purpose rating) for 60 seconds
- 250% of continuous current rating (general purpose rating) for 5 seconds*
  * Note: increased rated currents for B+ cubes do not allow for 250% maximum current.

Performance Features

- Control Method: Digital flux vector, Space Vector PWM (1/3 less switching loss then Sine coded)
- Speed Command Sources: Serial channel; Analog channel; and Multi-step command
- Speed Control:
  Range: 0 to rated speed
  Accuracy: ±0.02%
- Speed Reference Resolution
  Multi-step reference: 0.1ft/min / 0.001m/s
  Analog reference: 0.05%
- Speed Reference Signal: -10V to +10V
- Four distinctive programmable S-curves with: adjustable accel / decel rates and adjustable jerk rates (accel/decel & leveling)
- Torque Limit: Setting range: 0 to 250% motoring/regeneration set independently
- Selectable Functions: Multi-step speed operation (16 steps max.) and S-curves accel / decel (4 selectable max.)
- Adaptive Tune: Adjusts motor parameters automatically by: calculating the percentage no load current and estimating the rated rpm
- Estimates Inertia: Calculates the inertia of the entire elevator for easy tuning of the speed regulator
- Functions Available: Configuration and tuning of the speed regulator; Specifying the input line and motor parameters; Monitoring various internal signals; Fault annunciation & Fault log viewing.

Input Power

- Voltage: 200 - 240 VAC, 3-phase, ± 10%
  380 - 480 VAC, 3-phase, ± 10%
- Frequency: 48 - 63 Hz
- Line Impedance: 3% without choke
  1% with choke
- Nominal Voltage Levels:
  230 & 460 VAC, 3-phase, 60/50 Hz

Output Power

- Voltage: 0 - Input Voltage
- Frequency: 0 - 120 Hz
- Carrier Frequency: 2.5 kHz - 16 kHz

Digital Inputs

Nine (9) programmable opto-isolated logic inputs.

- Voltage: 24VDC pull-up (internal or external)
- Sinking Current: inputs 1&2 = 18 mA
  inputs 3-10 = 9 mA
- Scan Rate: 2 msec.
- Update Rate: 4 msec.

Digital Outputs

Two (2) programmable Form-C relays.
For more on the relay specifications, see Relay Specifications on page 132.

- Relay 1: 2A at 30VDC / 250VAC (inductive load)
- Relay 2: 7.5A at 110VAC
  5A at 24VDC
  (inductive load)
- Update Rate: 2 msec.

Four (4) programmable opto-isolated open collectors.

- Voltage: 50 Volts DC (max.)
- Capacity: ≤ 150 mA
- Update Rate: 2 msec.

Analog Inputs

Two (2) differential inputs.

- Voltage: ± 10 Volts DC
- Channel 1: Speed Command
- Channel 2: Pre Torque Command
- Resolution: 12 Bit
- Software gain and offset available
- Update Rate: 2 msec.

Analog Outputs

Two (2) programmable differential outputs.

- Voltage: ± 10 Volts DC
- Capacity: 10 mA
- Resolution: 12 Bit
- Update Rate: 2 msec

Encoder Feedback

- Supply Voltage: 12VDC or 5VDC
- Capacity: 200mA or 150mA
- PPR: 600 - 10,000
- Maximum Frequency: 300 kHz
- Input: 2 channel quadrature
5 or 12 volts dc differential
(A, /A, B, /B)

Design Features

- DC Bus Choke: Connections for optional external DC Bus Choke
- Internal Dynamic Brake IGBT: Connections for external Dynamic Brake Resistor
- Serial Channel: Optically isolated RS422 port

Protective Features

- Internal motor overload protection per UL/CSA
- Overspeed Fault
- Drive Overload Fault
- DC Bus Overvoltage and Undervoltage Faults
- Overcurrent Fault
- Phase Overcurrent Fault
- Open Phase Fault
- Overtemperature Fault
- Encoder Malfunction Fault

Environmental

- Operating ambient air temperature range -10°C (14°F) to 55°C (130°F)
- Altitude 1000m (3300 ft) without derating
- Relative humidity 95% (non-condensing)
- Environment: protected from corrosive gases; conductive dust
- Vibration: displacement of 0.032mm < 57Hz; peak acceleration 0.5g > 57Hz

Standards and Reliability

- CSA listed
- CE
- Surface mount devices

Drive Derating

Motor Frequency Derating

For rated motor frequencies16 Hz and above, there would be no derating. For rated motor frequencies below 16 Hz, derate 1% for each 1 Hz.

Altitude Derating

Control ratings apply to 1000 meters (3300 feet) altitude without derating. For installations at higher altitudes, derate both the continuous and peak current levels 5% for each 300 m (1000 ft) above 1000 m (3300 ft).

Derating for Carrier Frequency

Control ratings apply for carrier frequencies up to and including 10 kHz. Above that linearly derate both the continuous and peak current levels by 5% for each 1kHz.

Derating for Single Phase Input Power

For single-phase input power, derate both the continuous and peak current levels by 50%.

Drive Model Number

The HPV 900 nameplate contains a fifteen-digit model number, which provides complete identification of the drive. Figure 1 details the model number.

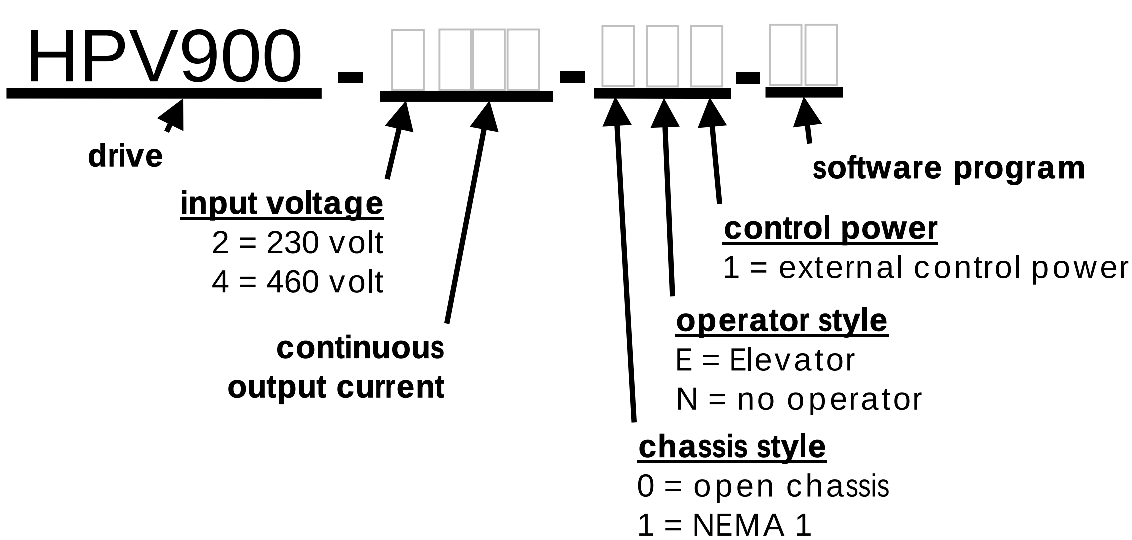


Figure 1: Model Number

General Start-Up Procedure

The following is a recommended start-up procedure:

1. The HPV 900 is thoroughly tested at the factory. Verify the drive has been installed without shipping and installation damage.
2. Review the HPV 900 technical manual, shipped with the drive.
3. Verify the proper drive model numbers and voltage ratings as specified on the purchase order.
4. Verify the drive has been installed in accordance with the guidelines detailed below:

Location of the HPV 900 is important for proper operation of the drive and normal life expectancy. The installation should comply with the following:

- DO NOT mount in direct sunlight, rain or extreme (condensing) humidity.
- DO NOT mount where corrosive gases or liquids are present.
- AVOID exposure to vibration, airborne dust or metallic particles.
- DO NOT allow the ambient temperature around the control to exceed the ambient temperature listed in the specification.
- Mount control vertically using mounting holes provided by Magnetek.
- Allow at least 7cm (2.5 in) clearance above and at least 7 to 13 cm (2.5 to 5 in) clearance below the unit.
- Allow at least 3 cm (1 in) clearance to either side of the drive.
- Separate grounded metal conduit is required for input, output and control wiring.

The unit should be installed in an open ventilated area where free air can be circulated around the control. The installation should comply with the following:

- When necessary, the cooling should be provided by using filtered air.
- If the cooling air coming inside the control cabinet contains airborne dust, filter the incoming air as required and clean the cooling surface of the HPV 900 regularly using compressed air and a brush. An unclean heatsink operates at an efficiency less than that of cooling design specifications. Therefore, drive may fault on thermal protection if heatsink is not cleaned periodically.

5. Inspect the security of the supply line power, ground connections, and all control circuit connections. Ensure that the main circuit input/output precautions are observed. Also, ensure that the control circuit precautions are observed.

   Observe the following precautions:

- Use 600V vinyl sheathed wire or equivalent. Wire size should be determined considering voltage drop of leads.
- Never connect main AC power to the output terminals: U, V, and W.
- Never allow wire leads to contact metal surfaces. Short circuit may result.
- SIZE OF WIRE MUST BE SUITABLE FOR CLASS I CIRCUITS.
- Motor lead length should not exceed 45m (150 ft) and motor wiring should be run in a separate conduit from the power wiring. If lead length must exceed this distance, contact Magnetek for proper installation procedures.
- Use UL/CSA certified connectors sized for the selected wire gauge. Install connectors using the specified crimping tools specified by the connector manufacturer.
- Use twisted shielded or twisted-pair shielded wire for control and signal circuit leads. The shield sheath MUST be connected at the HPV 900 ONLY. The other end should be dressed neatly and left unconnected (floating).
- Control wire size should be determined considering the voltage drops of the leads.
- Control wire lead length should not exceed 45m (150 ft). Signal leads and feedback leads should be run in separate conduits from power and motor wiring.

6. Verify that the input voltage matches the drive's rating.
7. Verify that the motor is wired for the application voltage and amperage.
8. Tighten all of the three-phase power and ground connections. Check that all control and signal terminations are also tight. As they sometimes come loose during the shipment process.

Pre-Power Check

CAUTION: TO PREVENT DAMAGE TO THE DRIVE. THE FOLLOWING CHECKS MUST BE PERFORMED BEFORE APPLYING THE INPUT POWER.

- Inspect all equipment for signs of damage, loose connections, or other defects.
- Ensure the three-phase line voltage is within ±10% of the nominal input voltage. Also verify the frequency (50 or 60 Hz) is correct for the elevator control system.
- Remove all shipping devices.
- Ensure all electrical connections are secure.
- Ensure that all transformers are connected for proper voltage.

IMPORTANT: Double-check all the power wires and motor wires (R, S, T, U, V, & W) to make sure that they are securely tightened down to their respective lugs (loose wire connections may cause problems at any time).

IMPORTANT: Insure the incoming line supply IS CONNECTED to the drive INPUT TERMINALS R, S, & T and NOT to the output motor terminals U, V, & W.

9. Insure the DC Choke link is in place, if a DC choke is NOT used.
10. Insure a Dynamic Braking Resistor is connected to the drive, see page 116
11. Measure and verify transformer primary and secondary volts
12. Check for balanced Vac from phase to ground.
13. Verify the accuracy of the drive's input line-to-line voltage in parameter INPUT L-L VOLTS (A4)

NOTE: The INPUT L-L VOLTS (A4) parameter helps to determine the DC bus undervoltage alarm/fault level.

This completes the recommended general start-up procedure.

CSA Warnings

The following are written warnings located on the drive chassis. They appear in both English and French. In this section, these warnings appear in English only.

Caution—Risk of Electric Shock:

Capacitive voltages above 50V may remain for 5 minutes after power is disconnected

Caution—Risk of Electric Shock: More than one live circuit: See diagram

The following written warning is also located on the drive chassis.

This device provides motor overload protection in accordance with NEC and CEC requirements. This device is factory configured to stop the motor from a motor overload trip. See instruction manual for options.

WARNING: Separate Motor Overcurrent Protection is required to be provided in accordance with the Canadian Electrical Code, Part 1, and NEC.

Terminals

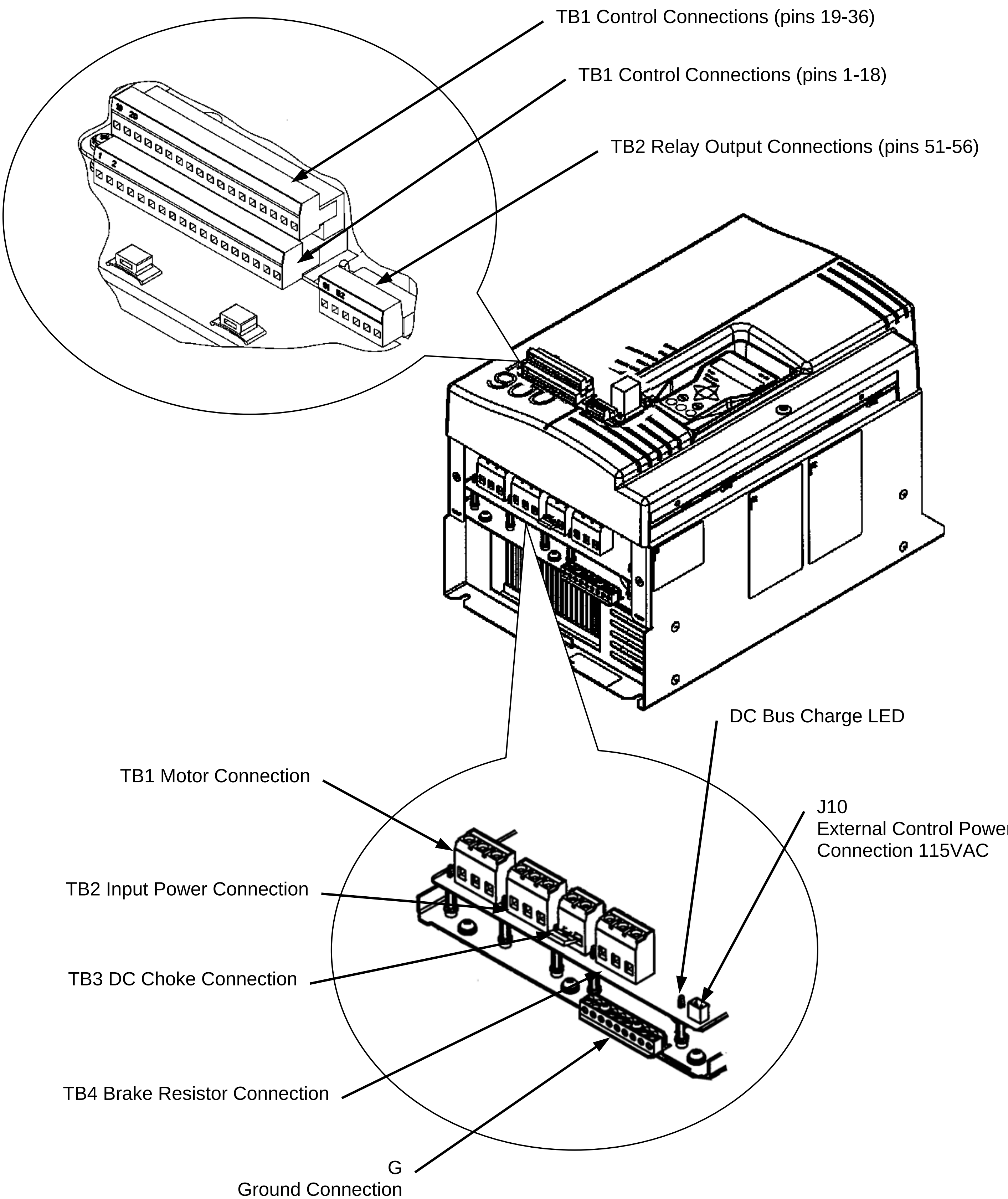


Figure 2: Terminal Connections (A cube)

Terminals

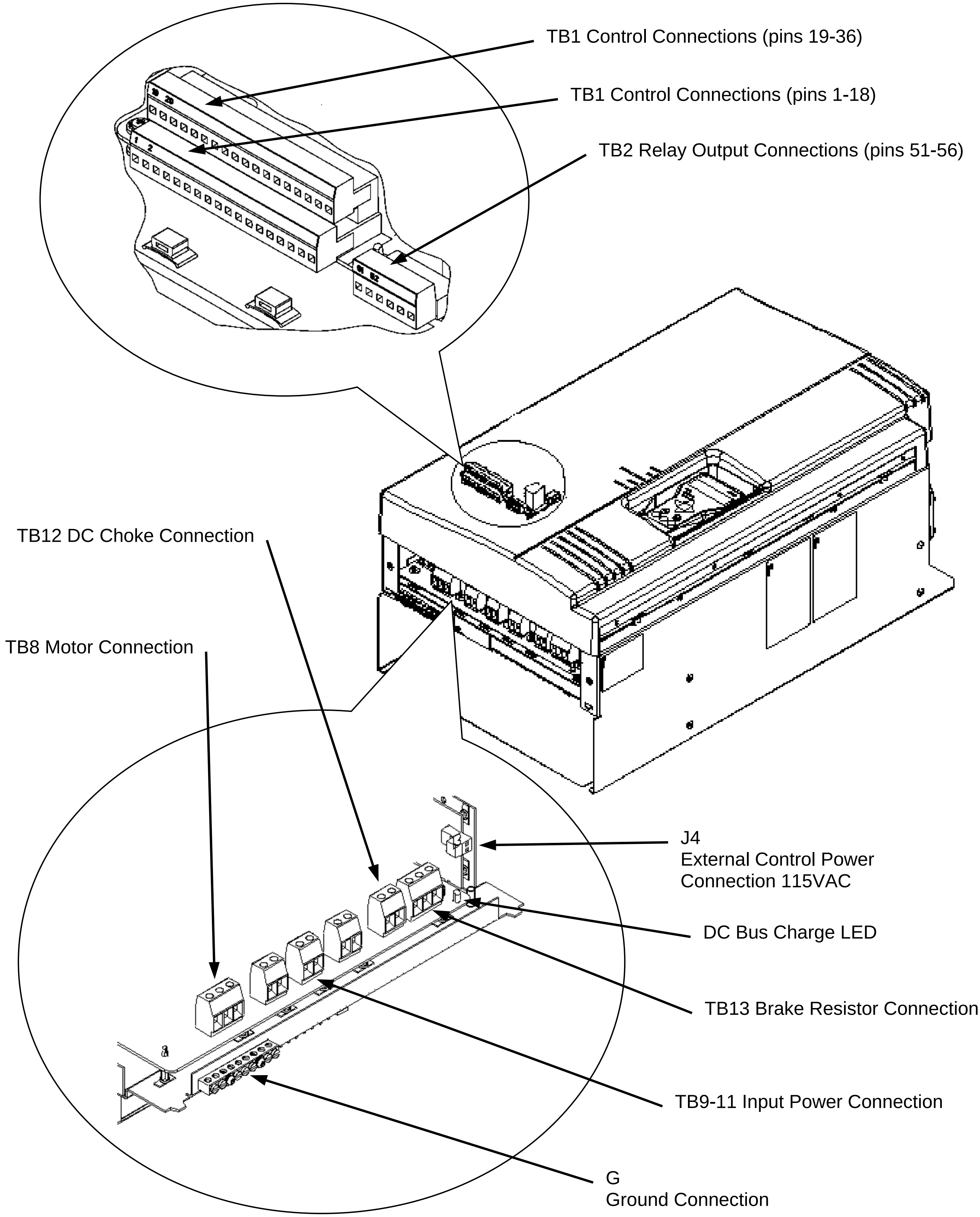


Figure 3: Terminal Connections (B cube)

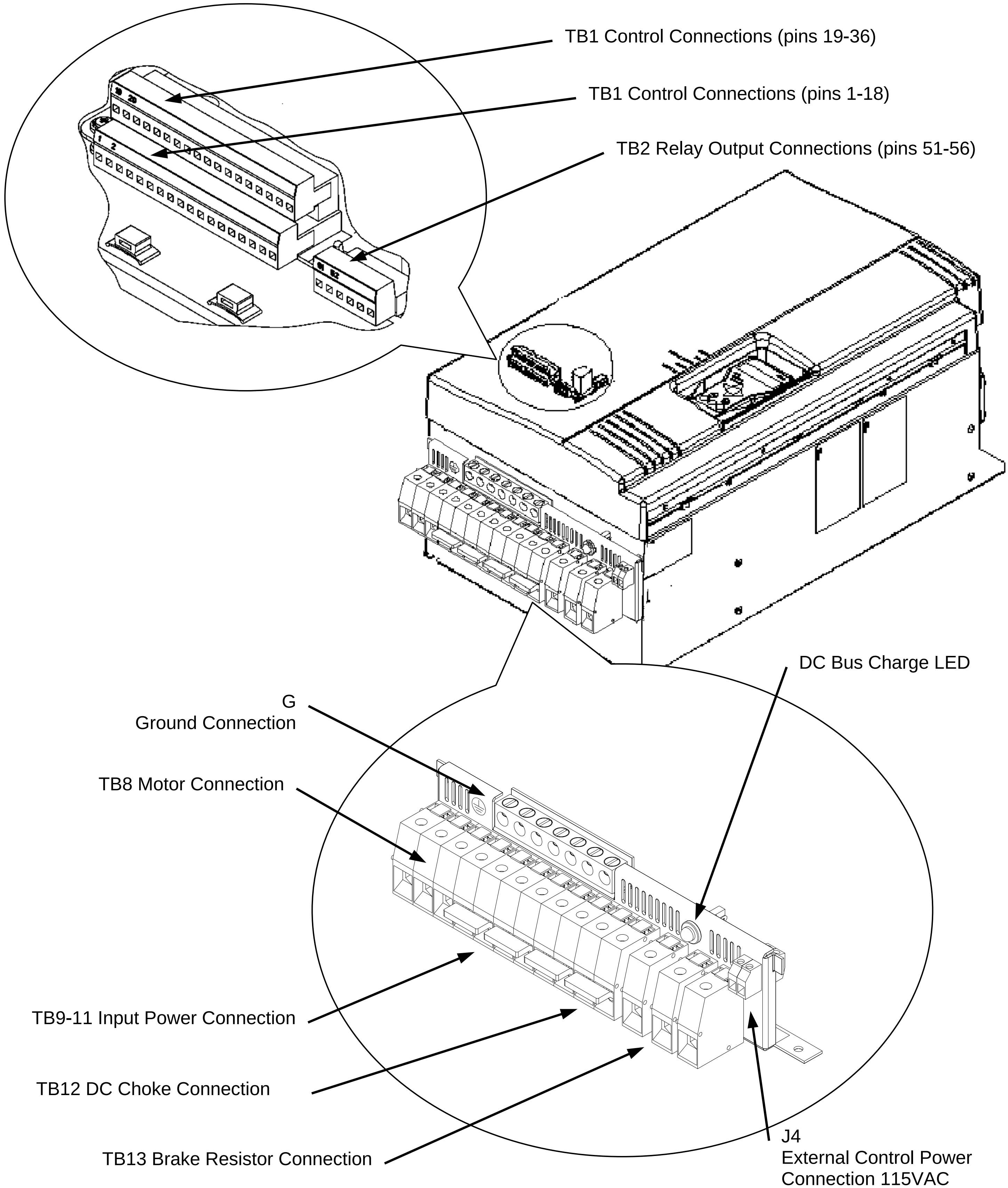


Figure 4: Terminal Connections (B+ Cube)

Terminals

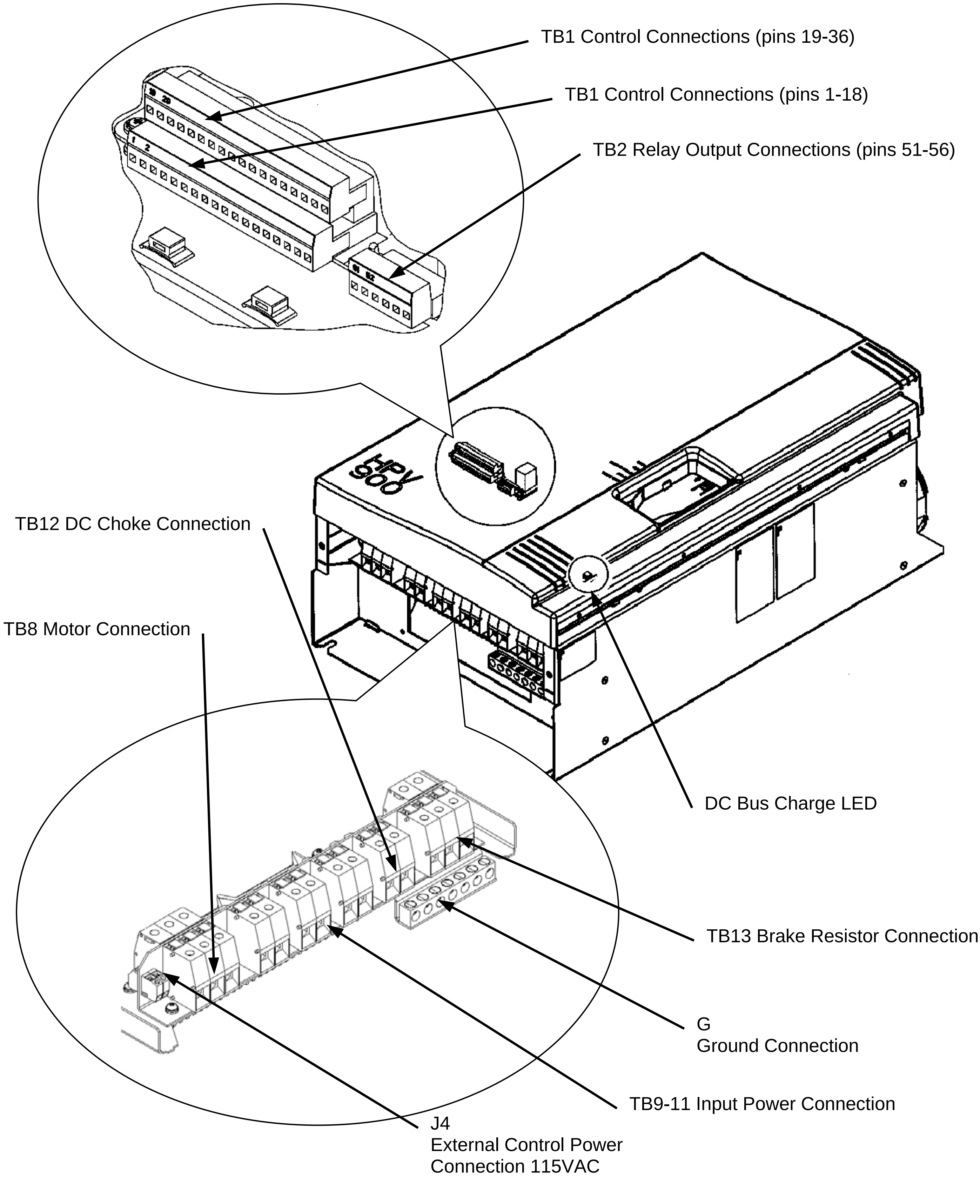


Figure 5: Terminal Connections (C cube)

Interconnections

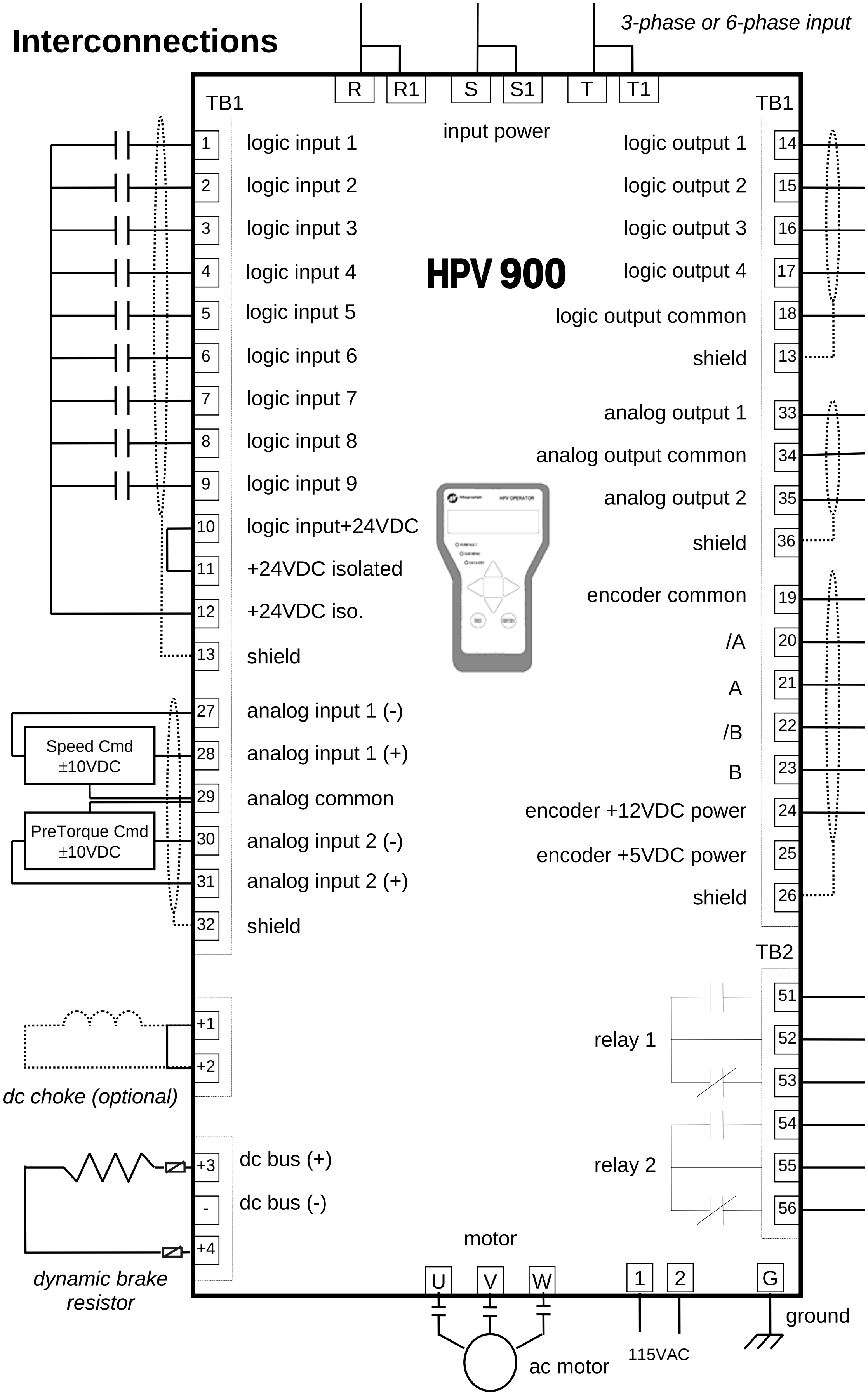


Figure 6: Interconnection Diagram

Logic Inputs

The HPV 900's nine programmable logic inputs are opto-isolated. The inputs become "true" by closing contacts or switches between the logic input terminal and voltage source common. The voltage supply for the logic inputs is 24VDC.

The choices for the voltage source common depend on if the user is using an external voltage supply or using the internal voltage supply.

Figure 7 shows the connection for using the internal voltage supply. And in this case, the voltage source common is TB1-12 (+24VDC isolated common).

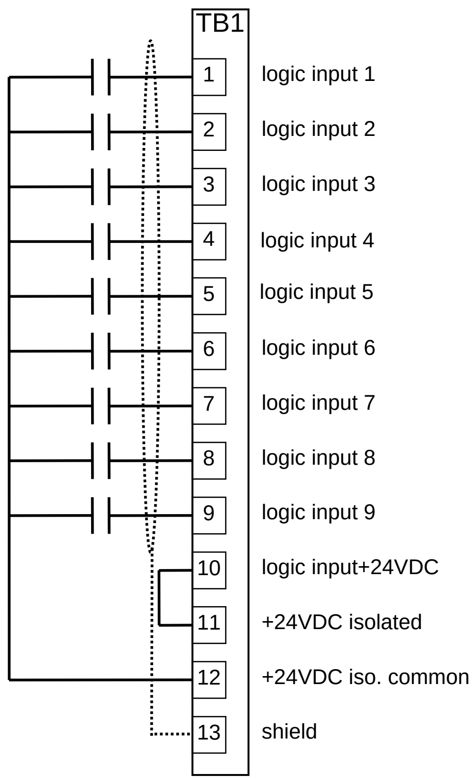


Figure 7: Logic Inputs (Internal Supply)

Figure 8 shows the connection for using the external voltage supply. And in this case the voltage source common is negative side of the external voltage supply.

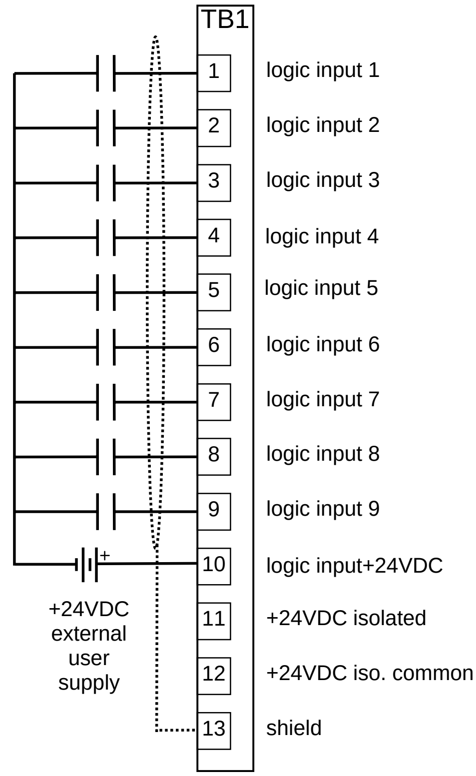


Figure 8: Logic Inputs (External Supply)

The logic inputs have two different sinking current ratings.

- logic inputs 1 and 2 - sink 18mA.
- logic inputs 3, 4, 5, 6, 7, 8, and 9 - sink 9mA.

The switches or contacts used to operate the logic inputs may be replaced by logic outputs from a PLC or car controller. If the outputs are open collector, the ground is needs to be connected to the proper voltage source common.

For more information on the programming the logic inputs, see Logic Inputs C2 on page 66.

Logic Outputs

The HPV 900's four programmable logic outputs are opto-isolated, open collector. The outputs are normally open and can withstand an applied maximum voltage of 50VDC. When the output becomes "true", the output closes and is capable of sinking up to 150mA between the logic output terminal and the logic output common (TB1-18). Figure 9 shows the logic output terminals.

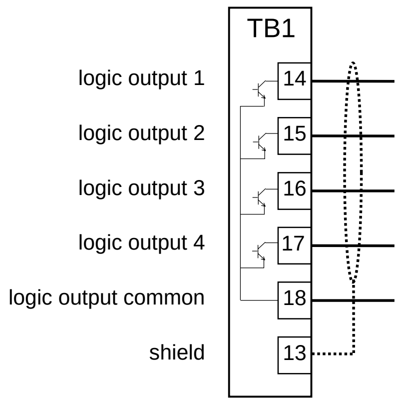


Figure 9: Logic Outputs

For more information on the programming the logic outputs, see section Logic Outputs C3 on page 68.

Relay Outputs

The HPV 900's two programmable relay logic outputs are Form-C relays. The have both normally open and normally closed contacts. Relay 2 is designed for more operations and is recommended for use with in controlling the motor contactor. Relay 1 is recommended for use with the fault circuitry.

The specifications for each relay are as follows:

Relay 1

- 2A at 30VDC / 250VAC (inductive load)

Relay 2

- 7.5A at 110VAC / 5A at 24VDC (inductive load)

For more on the relay specifications, see page 132

Figure 10 shows the logic output terminals.

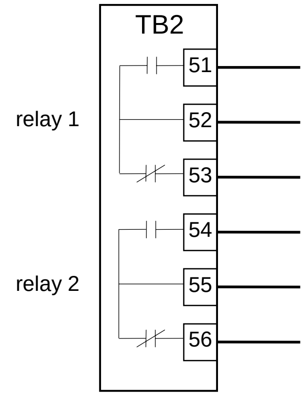


Figure 10: Relay Outputs

For more information on the programming the relay outputs, see Logic Outputs C3 on page 68

Encoder

The HPV 900 has connections for an incremental two-channel quadrature encoder. The drive's encoder circuitry incorporates resolution multiplication and complimentary outputs.

Encoder Wiring

Use twisted pair cable with shield tied to chassis ground at drive end, in order to minimize magnetic and electrostatic pick-up current and to minimize radiated and conducted noise.

Reasonable care must be taken when connecting and routing power and signal wiring. Radiated noise from nearby relays (relay coils should have R/C suppressors), transformers, other electronic drives, etc. may be induced into the signal lines causing undesired signal pulses.

Power leads and signal lines must be routed separately. Signal lines should be shielded, twisted and routed in separate conduits or harnesses spaced at least 12 inches apart from power wiring. This protects the cable from physical damage while providing a degree of electrical isolation. Also, do not run cable in close proximity to other conductors, which carry current to heavy loads such as motors, motor starters, contactors, or solenoids. Doing so could result in electrical transients in the encoder cable, which can cause undesired signal pulses. Power leads are defined as the transformer primary and secondary leads, motor leads and any 120 VAC or above control wiring for relays, fans, thermal protectors, etc.

Continuity of wires and shields should be maintained from the encoder through to the controller avoiding the use of terminals in a junction box. The shield and shield drain wires must be insulated from other objects. This helps to minimize radiated & induced noise problems and magnetically induced ground loops.

Always use an encoder with complementary output signals. Connect with twisted-pair shielded wire so that wire-induced currents will self-cancel.

NOTE: DO NOT ground the encoder through both the machine and the cable wiring. Connect the shield at the receiver device only. If the shield is connected at both ends, noise currents will flow through the shield and degraded performance will result.

HPV 900 Encoder Specifications

The HPV 900 requires the use of an encoder coupled to the motor shaft. The encoder power can be either a 5VDC or 12VDC supply. The capacity of each power supply is the following:

- supply voltage: 12VDC
  200mA capacity
- supply voltage: 5VDC
  150mA capacity

The HPV 900 can accept encoder pulses of:

- 600 to 10,000 pulses per revolution (ppr)
- a maximum frequency of 300kHz

IMPORTANT

Motor phasing should match the encoder feedback phasing. If the phasing is not correct, the motor will not accelerate up to speed. It will typically oscillate back and forth at zero speed, and the current will be at the torque limit. Swapping A and /A or switching two motor phases should correct this situation.

The encoder pulses per revolution must by entered in the ENCODER PULSES parameter, *see Drive A1 Submenu on page 30*.

The encoder connection terminals are shown in Figure 11.

For more information on Encoder Selection and Mounting see page

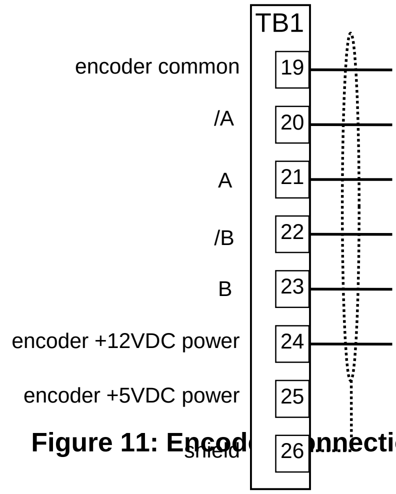


Figure 11: Encoder Connections

Analog Inputs

The HPV 900 has two non-programmable differential analog input channels.

- Analog input channel 1 is reserved for the speed command (if used).
- Analog input channel 2 is reserved for the pre-torque command (if used).

The analog input channels are bipolar and have a voltage range of ±10VDC.

Available with the analog channels is multiplier gain parameters (SPD COMMAND MULT and PRE TORQUE MULT) and bias parameters (SPD COMMAND BIAS and PRE TORQUE BIAS). These parameters are used to scale the user's analog command to the proper range for the drive software. The formula below shows the scaling effects of these two parameters.

$$\left(\begin{matrix} \text{analog} \\ \text{channel} \\ \text{input} \\ \text{voltage} \end{matrix} - BIAS \right) \times MULT = \begin{matrix} \text{signal} \\ \text{drive} \\ \text{software} \\ \text{uses} \end{matrix}$$

For more on the multiplier gain or bias parameters, see Drive A1 Submenu on page 30*.*

The scaling of the analog input signals follows:

- Speed Command
  +10VDC = positive contract speed
  -10VDC = negative contract speed
- Pre Torque Command
  +10VDC = positive rated torque of motor
  -10VDC = negative rated torque of motor

NOTE: The drive cannot recognize voltages outside of the ±10VDC on its analog input channels.

The HPV 900 provides common mode noise rejection with the differential analog inputs.

The connection of these two inputs is shown in Figure 12

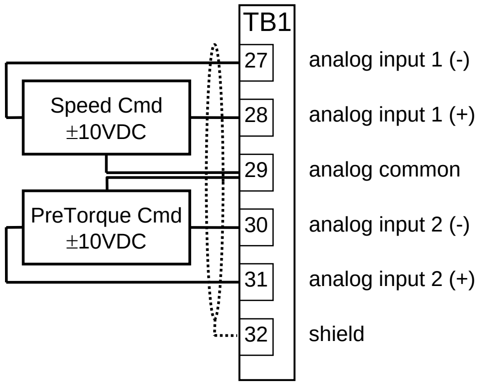


Figure 12: Analog Inputs (Differential)

Figure 13 shows the connection for the analog inputs, if they are configured to be single ended. In this configuration, the HPV 900 noise immunity circuitry is not in effect.

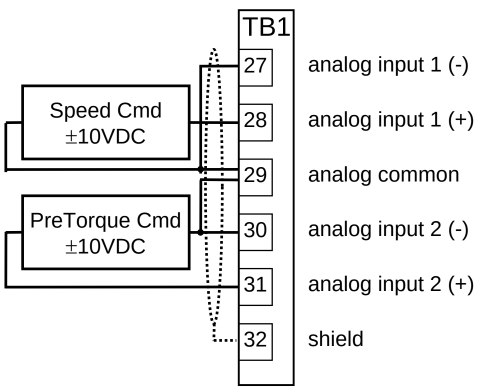


Figure 13: Analog Inputs (Single Ended)

Analog Outputs

The HPV 900 has two programmable differential analog output channels. The two analog output channels were designed for diagnostic help. *For more information on programming the analog output channels, see Analog Outputs C4 Submenu on page 70.*

The analog output channels are bipolar and have a voltage range of ±10VDC.

Available with the analog channels is multiplier gain parameters (ANA 1 OUT GAIN and ANA 2 OUT GAIN) and a bias or offset parameters (ANA 1 OUT OFFSET and ANA 2 OUT OFFSET). These parameters are used to scale the user's analog outputs to the proper range for the drive software. The formula below shows the scaling effects of these two parameters.

$$\left(\begin{matrix} \textit{signal} \\ \textit{drive} \\ \textit{software} \\ \textit{creates} \end{matrix} - \textit{OFFSET}\right) \times \textit{BIAS} = \begin{matrix} \textit{analog} \\ \textit{channel} \\ \textit{output} \\ \textit{voltage} \end{matrix}$$

The scaling of the analog output signals is shown below.

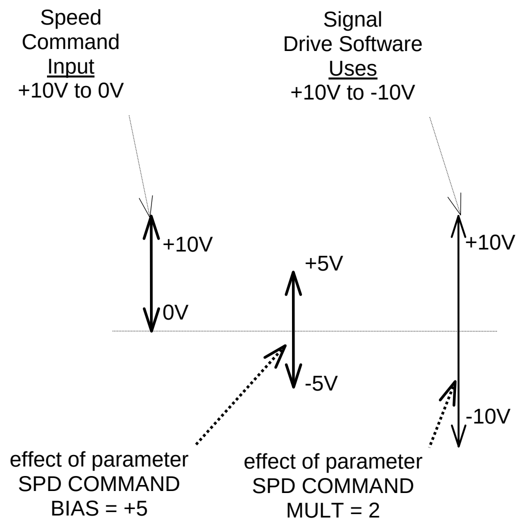


Figure 14: Analog Input Scaling

The connection of these two inputs is shown in Figure 15.

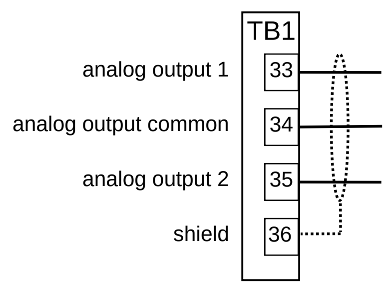


Figure 15: Analog Outputs

Electrical Installation

Input Power Connections

Terminals: R & R1, S & S1, and T & T1 provide connections for AC input power. Two position removable links are provided for the following pairs of terminals: R:R1, S:S1, T:T1. With the links in place power can be supplied as a three-phase source.

IMPORTANT

Class J Input Fusing is required for the A-cube models: -4008, -4016, -4021, and –2025. For more information, see page 120

Motor Lead Connections

U, V, & W terminals provide connection points for the motor leads.

DC Choke Connections

Terminals +1 and +2 provide connection points for a user supplied DC choke. A two position removable link is provided to the pair of terminals. With this link, the drive can be operated without the use of a DC choke.

Brake Resistor Connections

Terminals +3, -, and +4 provide connection points for an external user supplied braking resistor. Connect the external brake resistor between terminals +3 and +4. Terminals: +3 and - are the positive and negative rails of the DC bus (see Figure 16, Figure 17, and Figure 18).

Equipment Grounding

A terminal block is provided for the required user supplied equipment grounding.

Control Circuit

Observe the following precautions:

Refer to Figure 6 on page 19 for completing encoder connections; analog inputs; logic inputs; and logic outputs at the HPV 900's Control Board.

IMPORTANT

Parameter adjustments will have to be made for the specific analog input, logic inputs, and logic outputs to be used for the installation.

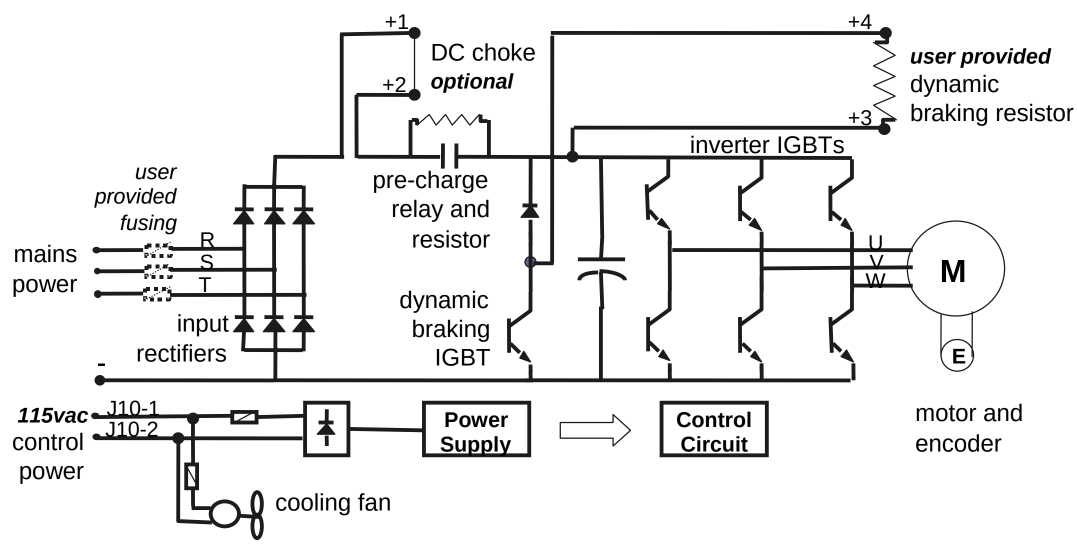


Figure 16: Main Circuit Block Diagram (A-cube)

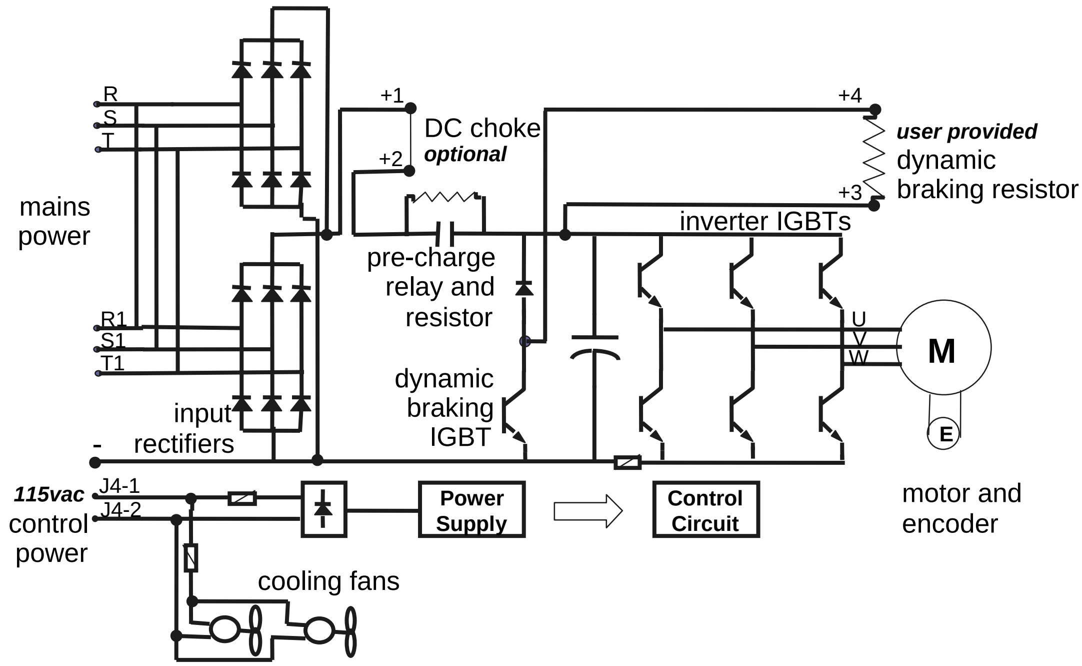


Figure 17: Main Circuit Block Diagram (B-cube and B+ cube)

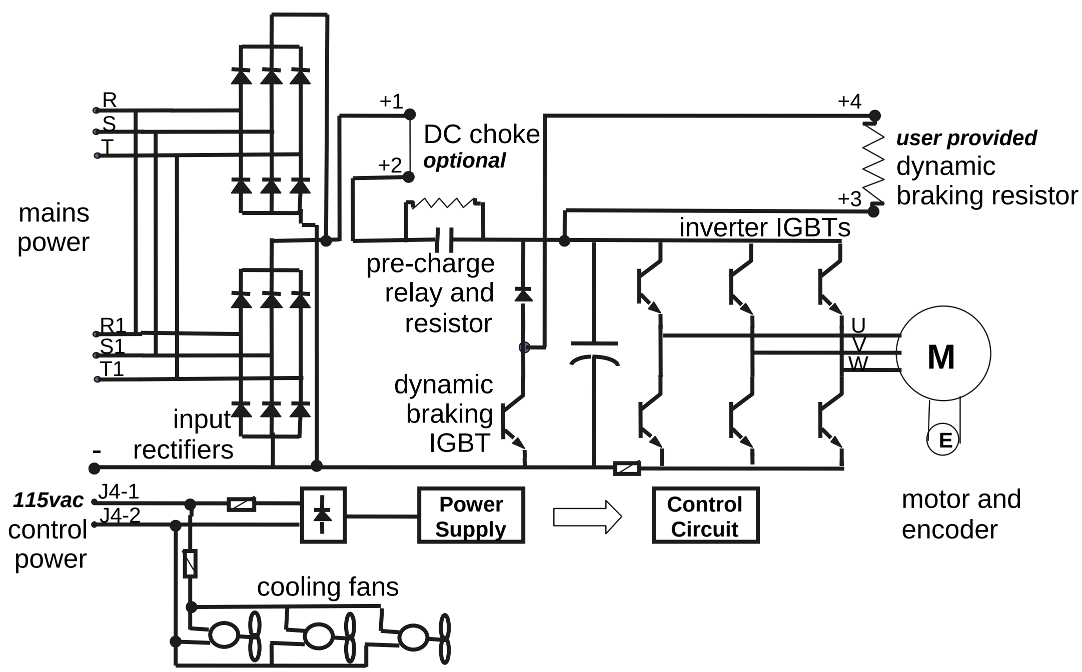


Figure 18: Main Circuit Block Diagram (C-cube)

Parameters

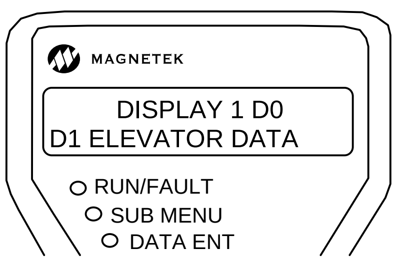
Parameter Introduction

This section describes the parameter menu structure; how to navigate this menu structure via the HPV 900 digital operator; and a detailed description of each parameter.

Parameters are grouped under six major menus:

- ADJUST A0
- CONFIGURE C0
- UTILITY U0
- FAULTS F0
- DISPLAY 1 D0
- DISPLAY 2 D0

When the SUB-MENU LED is *not* lit, the currently selected menu is shown on the top line of the Digital Operator display and the currently selected sub-menu is shown on the bottom line of the Digital Operator display.



The menu/sub-menu tree is shown below.

The digital operator keys operate on three levels, the menu level, the sub-menu level and the entry level. At the menu level, they function to navigate between menus or sub-menus. At the sub-menu level, they navigate between sub-menus or menu items. At the entry level, they are used to adjust values or select options. Six (6) keys are used for this navigation, they are:

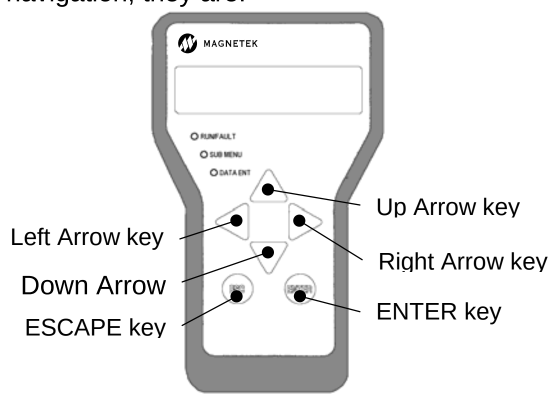


Figure 19: Digital Operator Keys

- Display 1 D0
  - Elevator Data D1
  - Power Data D2
- Adjust A0
  - Drive A1
  - S-Curves A2
  - Multistep Ref A3
  - Power Convert A4
  - Motor A5
- Configure C0
  - User Switches C1
  - Logic Inputs C2
  - Logic Outputs C3
  - Analog Outputs C4
- Utility U0
  - Password U1
  - Hidden Items U2
  - Units U3
  - Ovrspeed Test U4
  - Restore Dflts U5
  - Drive Info U6
  - Hex Monitor U7
- Faults F0
  - Active Faults F1
  - Fault History F2
- Display 2 D0
  - Elevator Data D1
  - Power Data D2

Figure 20: Menu/Sub-Menu Tree

MENUS

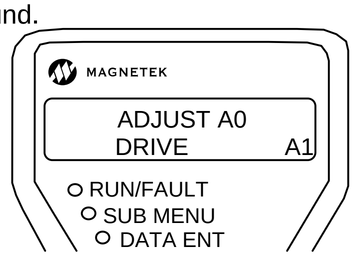
Each menu has a number of sub-menus, see Figure 20.

Menu Navigation

How these keys in Figure 19 operate is dependent on the "level" (i.e. menu, sub-menu or entry level.) In general, the "ENTER" and "ESCAPE" keys control the level. That is the ENTER key used to move to a lower level and the ESCAPE key is used to move to a higher level. The arrow keys control movement. With the up and down arrow keys controlling vertical position. And the left and right arrow keys controlling horizontal position.

Navigation at the Menu Level

At the menu level, the up and down arrow keys cause the display to show the sub-menus. The side arrow keys cause the display to select which menu is active. When the end is reached (either up, down, left or right), pressing the same key will cause a wrap around.

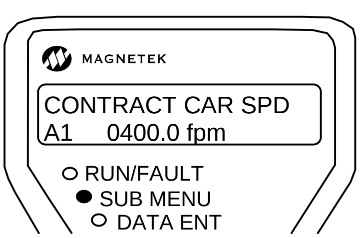


Each menu will remember the last accessed sub-menu. The left and right arrow keys will navigate between these last active sub-menus. This remembrance of last active sub-menu is volatile and will be lost at power down.

When any sub-menu is displayed, pressing the "ENTER" key will place the operator in the sub-menu level.

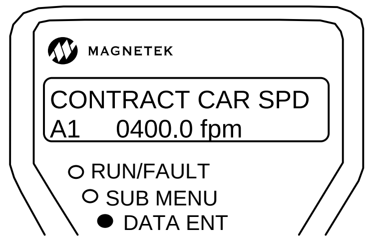
Navigation at the Sub-menu Level

When in the sub-menu level, the SUB-MENU LED on the digital operator is lit. At the sub-menu level, the positioning keys work slightly different than they did at the menu level. The up and down arrow keys now select separate items in the sub-menu.



Navigation at the Entry Level

When in the entry level, the DATA ENT LED on the digital operator is lit. At the entry level, the functions of keys are redefined. The "ESCAPE" key remains as the key used to move back to the higher level. The left and right arrow keys are used as cursor positioning keys and the up and down arrow keys are used as increment and decrement keys.



Upon exiting a sub-menu via the "ESCAPE" key, the last item number is "remembered". The next time this sub-menu is entered, it is entered at the "remembered" item number. This feature can be used to obtain quick access to two monitor values. Two menus one labeled Display 1 D0 and one labeled Display 2 D0 have the same display items. One item can be selected one under the Display 1 menu and another under the Display 2 menu. The left and right arrow keys can then be used to move back and forth between these two display items. Remember, that the "remembering" of sub-menus and sub-menu items is volatile and is lost at power-down.

Hidden Parameters

There are two types of parameters: standard and hidden. Standard parameters are available at all times. Hidden parameters are for more advanced functions and are available only if activated. Activation of the hidden parameters is accomplished by setting of a utility parameter, HIDDEN ITEMS U2. *See details in Hidden Items on page 75.*

Display D0

Elevator Data D1
- Speed Command
- Speed Reference
- Speed Feedback
- Speed Error
- Pre-Torque Ref
- Spd Reg Torq Cmd
- Tach Rate Cmd
- Aux Torque Cmd
- Est Inertia
- Rx Com Status
- Logic Inputs
- Logic Outputs

Power Data D2
- Torque Reference
- Motor Current
- % Motor Current
- Motor Voltage
- Motor Frequency
- Motor Torque
- Power Output
- DC Bus Voltage
- Flux Reference
- Flux Output
- Slip Frequency
- Motor Overload
- Drive Overload
- Flux Current
- Torque Current
- Flux Voltage
- Torque Voltage
- Base Impedance
- Est No Load Curr
- Est Rated RPM

Adjust A0

Drive A1
- Contract Car Spd
- Contract Mtr Spd
- Response
- Inertia
- Inner Loop Xover
- Gain Reduce Mult
- Gain Chng Level
- Tach Rate Gain
- Spd Phase Margin
- Ramped Stop Time
- Contact Flt Time
- Brake Pick Time
- Brake Hold Time
- Overspeed Level
- Overspeed Time
- Overspeed Mult
- Encoder Pulses
- Spd Dev Lo Level
- Spd Dev Time
- Spd Dev Hi Level
- Spd Command Bias
- Spd Command Mult
- Pre Torque Bias
- Pre Torque Mult
- Zero Speed Level
- Zero Speed Time
- Up/Dwn Threshold
- Mtr Torque Limit
- Regen Torq Limit
- Flux Wkn Factor
- Ana Out 1 Offset
- Ana Out 2 Offset
- Ana Out 1 Gain
- Ana Out 2 Gain
- Flt Reset Delay
- Flt Resets/Hour
- Up To Spd. Level
- Mains Dip Speed
- Run Delay Timer
- Ab Zero Spd Lev
- Ab Off Delay
- Contactor Do Dly
- Trq Lim Msg Dly
- Ser2 Insp Spd
- Ser2 Rs Crp Spd
- Ser2 Rs Cpr Time
- Ser2 Flt Tol
- Rollback Gain
- Notch Filter Frq
- Notch Filt Depth
- Mspd Delay 1
- Mspd Delay 2
- Mspd Delay 3
- Mspd Delay 4

S-Curves A2
- Accel Rate 0
- Decel Rate 0
- Accel Jerk In 0
- Accel Jerk Out 0
- Decel Jerk In 0
- Decel Jerk Out 0
- Accel Rate 1
- Decel Rate 1
- Accel Jerk In 1
- Accel Jerk Out 1
- Decel Jerk In 1
- Decel Jerk Out 1
- Accel Rate 2
- Decel Rate 2
- Accel Jerk In 2
- Accel Jerk Out 2
- Decel Jerk In 2
- Decel Jerk Out 2
- Accel Rate 3
- Decel Rate 3
- Accel Jerk In 3
- Accel Jerk Out 3
- Decel Jerk In 3
- Decel Jerk Out 3

Multistep Ref A3
- Speed Command 1
- Speed Command 2
- Speed Command 3
- Speed Command 4
- Speed Command 5
- Speed Command 6
- Speed Command 7
- Speed Command 8
- Speed Command 9
- Speed Command 10
- Speed Command 11
- Speed Command 12
- Speed Command 13
- Speed Command 14
- Speed Command 15

Power Convert A4
- Id Reg Diff Gain
- Id Reg Prop Gain
- Iq Reg Diff Gain
- Iq Reg Prop Gain
- PWM Frequency
- UV Alarm Level
- UV Fault Level
- Extern Reactance
- Input L-L Volts

Motor A5
- Motor Id
- Rated Mtr Pwr
- Rated Mtr Volts
- Rated Excit Freq
- Rated Motor Curr
- Motor Poles
- Rated Mtr Speed
- % No Load Curr
- Stator Leakage X
- Rotor Leakage X
- Stator Resist
- Motor Iron Loss
- Motor Mech Loss
- Ovld Start Level
- Ovld Time Out
- Flux Sat Break
- Flux Sat Slope 1
- Flux Sat Slope 2

Configure C0

User Switches C1
- Spd Command Src
- Run Command Src
- Hi/Lo Gain Src
- Speed Reg Type
- Motor Rotation
- Spd Ref Release
- Cont Confirm Src
- PreTorque Source
- PreTorque Latch
- PTorq Latch Clck
- Fault Reset Src
- Overspd Test Src
- Brake Pick Src
- Brake Pick Cnfm
- Brake Hold Src
- Ramped Stop Sel
- Ramp Down En Src
- Brk Pick Flt Ena
- Brk Hold Flt Ena
- Ext Torq Cmd Src
- Dir Confirm
- S-curve Abort
- Fast Flux
- Mains Dip Ena
- Db Protection
- Encoder Fault
- Stopping Mode
- Motor Ovrld Sel
- Auto Stop
- Serial Mode
- Ser2 Flt Mode
- Drv Fast Disable
- Mlt-Spd To Dly1
- Mlt-Spd To Dly2
- Mlt-Spd To Dly3
- Mlt-Spd To Dly4

Logic Inputs C2
- Logic Input 1
- Logic Input 2
- Logic Input 3
- Logic Input 4
- Logic Input 5
- Logic Input 6
- Logic Input 7
- Logic Input 8
- Logic Input 9

Logic Outputs C3
- Logic Output 1
- Logic Output 2
- Logic Output 3
- Logic Output 4
- Relay Coil 1
- Relay Coil 2

Analog Outputs C4
- Analog Output 1
- Analog Output 2

Utility U0

Password U1
- New Password
- Enter Password
- Password Lockout

Hidden Items U2
- Hidden Items Enable

Units U3
- Units Selection

Ovrspeed Test U4
- Overspeed Test?

Restore Dflts U5
- Restore Motor Defaults
- Restore Drive Defaults

Drive Info U6
- Drive Version
- Boot Version
- Cube ID
- Drive Type

Hex Monitor U7
- Address

Language Sel U8
- English
- Deutsch (German)

Faults F0

Active Faults F1
- Display Active Faults
- Reset Active Faults

Fault History F2
- Display Fault History
- Clear Fault History

Adjust A0 Menu

Drive A1 Submenu

NOTE: When the word ***Hidden*** appears with the parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details on page 75.*

NOTE: When the word ***Lockout*** appears with the parameter description, the parameter cannot be changed when the drive is in the RUN mode.

Name	Description	Units	Range	Default	Hidden Item	Lock out
CONTRACT CAR SPD	(Contract Car Speed) This parameter programs the elevator contract speed in feet per minute (fpm) or meters per second (m/s)	**fpm**	**0.0 – 1500.0**	**400.0**	N	Y
		m/s	**0.000 – 8.000**	**2.000**		
CONTRACT MTR SPD	(Contract Motor Speed) This parameter programs the motor speed at elevator contract speed in revolutions per minute (rpm).	**rpm**	**50.0 – 3000.0**	**1130.0**	N	Y
RESPONSE	(Response) This parameter sets the sensitivity of the drive's speed regulator in terms of the speed regulator bandwidth in radians. The responsiveness of the drive as it follows the speed reference will increase as this number increases. If the number is too large, the motor current and speed will become jittery. If this number is too small, the motor will become sluggish.	**rad/ sec**	**1.0 – 20.0**	**10.0**	N	N
INERTIA	(System Inertia) This parameter sets the equivalent of the system inertia in terms of the time it takes the elevator to accelerate to motor base speed at rated torque.	**sec**	**0.25 – 50.00**	**2.00**	N	N
INNER LOOP XOVER	(Inner Loop Cross Over) This parameter sets the inner speed loop cross over frequency. This parameter is only used by the Elevator Speed Regulator (Ereg).	**rad/ sec**	**0.1 – 20.0**	**2.0**	N	N
GAIN REDUCE MULT	(Gain Reduce Multiplier) This parameter is the percent of 'response' the speed regulator should use in the 'low gain' mode. This value reduces the RESPONSE value when the drive is in 'low gain' mode. (i.e. setting this parameter to 100% equals no reduction in gain in the 'low gain' mode). See GAIN CHNG LEVEL on page 36.	**%**	**10 – 100**	**100**	Y	N
GAIN CHNG LEVEL	(Gain Change Level) This parameter sets the speed level to change to low gain mode (only with internal gain switch). See GAIN CHNG LEVEL on page 36. Units in percent of rated speed.	**%**	**0.0 – 100.0**	**100.0**	Y	N
TACH RATE GAIN	(Tach Rate Gain) This parameter can be used to help to reduce the effects of rope resonance. It should be adjusted only after the INERTIA (A1), and RESPONSE (A1) has been set correctly. The tach rate function is available for high performance systems that exhibit problems with rope resonance characteristics. This function subtracts a portion of the speed feedback derivative from the output of the speed regulator. The Tach Rate Gain parameter (TACH RATE GAIN (A1)) selects a unit less gain factor that determines how much of the derivative is subtracted.	**none**	**0.0 – 30.0**	**0.0**	Y	N

Name	Description	Units	Range	Default	Hidden Item	Lock out
SPD PHASE MARGIN	(Speed Phase Margin) This parameter sets the phase margin of the speed regulator assuming a pure inertial load. This parameter is only used by the PI speed regulator.	**degs**	**45 – 90**	**80**	Y	N
RAMPED STOP TIME	(Ramped Stop Time) Time to ramp torque from rated torque to zero. Note: this parameter is used only with torque ramp down stop function. For more information see RAMPED STOP TIME on page 37.	**sec**	**0.00 – 2.50**	**0.20**	Y	N
CONTACT FLT TIME	(Contact Fault Time) When external logic outputs are used to control the closing of the motor contactor, this parameter sets the amount of time delay at start until the drive output is enabled and current flows. And when external logic inputs are used to confirm the closing of the motor contactor, this parameter sets the time allowed for the contactor's auxiliary contacts to reach the user commanded state before a CONTACTOR FLT occurs.	**sec**	**0.10 – 5.00**	**0.50**	Y	N
BRAKE PICK TIME	(Brake Pick Time) If the brake pick fault is enabled, this parameter sets the time allowed for the brake pick feedback not to match the brake pick command before a BRK PICK FLT occurs. Also, when the user switch SPD REF RELEASE (C1) is set to brake picked, this parameter determines the amount of time the drive will command zero speed after the RUN comman dis removed (time allowed for the brake to close).	**sec**	**0.00 – 5.00**	**1.00**	Y	N
BRAKE HOLD TIME	(Brake Hold Time) If the brake hold fault is enabled, this parameter sets the time allowed for the brake hold feedback not match the brake hold command before a BRK HOLD FLT occurs.	**sec**	**0.00 – 5.00**	**0.20**	Y	N
OVERSPEED LEVEL	(Overspeed Level) This parameter sets the percentage of rated speed the drive uses (in conjunction with OVERSPEED TIME, below) to determine when an OVERSPEED FLT occurs. Units in percent of contract speed.	**%**	**100.0 – 150.0**	**115.0**	Y	N
OVERSPEED TIME	(Overspeed Time) This parameter sets the time that the drive can be at or above the OVERSPEED LEVEL (A1), before the drive declares an OVERSPEED FLT.	**sec**	**0.00 – 9.99**	**1.00**	Y	N
OVERSPEED MULT	(Over Speed Multiplier) This parameter sets the percentage of contract speed for the OVERSPEED TEST (U4).	**%**	**100.0 – 150.0**	**125.0**	Y	N
ENCODER PULSES	(Encoder Pulses) This parameter sets the pulses per revolution the drive receives from the encoder. This value is directly from the encoder nameplate.	**PPR**	**600 – 10000**	**1024**	N	Y
SPD DEV LO LEVEL	(Speed Deviation Lo Level) Range around the speed reference for speed deviation low logic output. For more information, see SPD DEVIATION on page 37. Units in percent of contract speed.	**%**	**0.1 – 20.0**	**10.0**	Y	N

Drive A1 Submenu

Name	Description	Units	Range	Default	Hidden Item	Lock out
SPD DEV TIME	(Speed Deviation Time) This parameter defines the time the speed feedback needs to be in the range around the speed reference defined by SPD DEV LO LEVEL (A1) before the Speed Deviation Low logic output is true. For more information, see SPD DEVIATION on page 37.	**sec**	**0.00 – 9.99**	**0.50**	Y	N
SPD DEV HI LEVEL	(Speed Deviation High Level) This parameter sets the level at which a speed deviation alarm will be declared. For more information, see SPD DEVIATION on page 37.	**%**	**0.0 – 99.9**	**10.0**	Y	N
SPD COMMAND BIAS	(Speed Command Bias) This parameter subtracts an effective voltage to the actual analog speed command voltage signal. $\left(\textit{analog channel\#1 input voltage} - \textit{SPD COMMAND BIAS}\right) \times \textit{SPD COMMAND MULT} = \textit{signal drive software uses}$	**volts**	**0.00 – 6.00**	**0.00**	Y	Y
SPD COMMAND MULT	(Speed Command Multiplier) This parameter scales the analog speed command. $\left(\textit{analog channel\#1 input voltage} - \textit{SPD COMMAND BIAS}\right) \times \textit{SPD COMMAND MULT} = \textit{signal drive software uses}$	**none**	**0.90 – 5.00**	**1.00**	Y	Y
PRE TORQUE BIAS	(Pre-Torque Bias) This parameter subtracts an effective voltage to the actual analog pre torque command (channel 2) voltage signal. $\left(\textit{analog channel\#2 input voltage} - \textit{PRE TORQUE BIAS}\right) \times \textit{PRE TORQUE MULT} = \textit{signal drive software uses}$	**volts**	**0.00 – 6.00**	**0.00**	Y	Y
PRE TORQUE MULT	(Pre-Torque Multiplier) This parameter scales the analog pretorque command (channel 2). $\left(\textit{analog channel\#2 input voltage} - \textit{PRE TORQUE BIAS}\right) \times \textit{PRE TORQUE MULT} = \textit{signal drive software uses}$	**none**	**-10.00 – +10.00**	**1.00**	Y	Y
ZERO SPEED LEVEL	(Zero Speed Level) This parameter sets the threshold for zero speed detection. This is only used to generate the zero speed logic output. Note: if DIR CONFIRM (C1) is enabled, this parameter also sets the threshold for the termination of the test to confirm the polarity of the analog speed command. Units in percent of contract speed.	**%**	**0.00 – 99.99**	**1.00**	Y	Y
ZERO SPEED TIME	(Zero Speed Time) This parameter sets the time at which the drive is at the ZERO SPEED LEVEL (A1) before zero speed logic output is true	**sec**	**0.00 – 9.99**	**0.10**	Y	Y
UP/DWN THRESHOLD	(Directional Threshold) This parameter sets the threshold for the direction sense logic outputs. If speed feedback does not reach this level, the drive will not detect a directional change. This is only used to generate the direction sense logic outputs (car going up and car going down). Units in percent of contract speed.	**%**	**0.00 – 9.99**	**1.00**	Y	Y

Name	Description	Units	Range	Default	Hidden Item	Lock out
MTR TORQUE LIMIT	(Motoring Current Limit) This parameter sets the maximum torque allowed at when in the motoring mode. This parameter may need adjustment to reduce the effects of field weakening. Units in percent of rated torque. Note: The Torque Limit LED will be lit once the limit defined by this parameter is reached.	**%**	**0.0 – 275.0**	**200.0**	N	N
REGEN TORQ LIMIT	(Regenerating Current Limit) This parameter sets the maximum amount of regenerative torque the drive will see during regeneration. This parameter may need adjustment to reduce the effects of field weakening. Units in percent of rated torque. Note: The Torque Limit LED will be lit once the limit defined by this parameter is reached.	**%**	**0.0 – 275.0**	**200.0**	N	N
FLUX WKN FACTOR	(Flux Weakening Factor) This parameter limits the maximum amount of torque available at higher speeds. When the drive is commanding higher speeds, this parameter defines a percentage of the defined torque limits (MTR TORQUE LIMIT and REGEN TORQ LIMIT). This parameter is used to reduce the effects of field weakening and reduce the amount of motor current produced at higher speeds. Units in percent of torque. *For further information, see page 38.*	%	**60 – 100**	**100**	Y	N
ANA 1 OUT OFFSET	(Digital to Analog #1 Output Offset) Offset for scaling Analog Output Channel #1. $\left(\text{signal drive software creates} - \text{ANA OUT OFFSET}\right) \times \text{ANA OUT GAIN} = \text{analog channel output voltage}$	**%**	**-99.9 – +99.9**	**0.0**	Y	Y
ANA 2 OUT OFFSET	(Digital to Analog #2 Output Offset) Offset for scaling Analog Output Channel #2. $\left(\text{signal drive software creates} - \text{ANA OUT OFFSET}\right) \times \text{ANA OUT GAIN} = \text{analog channel output voltage}$	**%**	**-99.9 – +99.9**	**0.0**	Y	Y
ANA 1 OUT GAIN	(Digital to Analog #1 Output Gain) Adjusts the scaling for the Analog Output Channel #1. NOTE: value of 1.0 = 0 to 10VDC signal. $\left(\text{signal drive software creates} - \text{ANA OUT OFFSET}\right) \times \text{ANA OUT GAIN} = \text{analog channel output voltage}$	**none**	**0.0 – 10.0**	**1.0**	Y	Y
ANA 2 OUT GAIN	(Digital to Analog #2 Output Gain) Adjusts the scaling for the Analog Output Channel #2. NOTE: value of 1.0 = 0 to 10VDC signal. $\left(\text{signal drive software creates} - \text{ANA OUT OFFSET}\right) \times \text{ANA OUT GAIN} = \text{analog channel output voltage}$	**none**	**0.0 – 10.0**	**1.0**	Y	Y
FLT RESET DELAY	(Fault Reset Delay) When the drive is set for automatic fault reset, this is the time before a fault is automatically reset.	**sec**	**0 – 120**	**5**	Y	N
FLT RESETS / HOUR	(Fault Resets per Hour) When the drive is set for automatic fault reset, this is the number of faults that is allowed to be automatically reset per hour.	**#**	**0 – 10**	**3**	Y	N

Name	Description	Units	Range	Default	Hidden Item	Lock out
UP TO SPD. LEVEL	(Up to Speed Level) This parameter sets the threshold for the up to speed logic output. This is only used to generate the up to speed logic output. Units in percent of contract speed.	**%**	**0.00 – 110.00**	**80.00**	Y	N
MAINS DIP SPEED	(Mains Dip Speed Multiplier) This parameter sets the percentage of contract speed for the speed to be reduced when the drive goes into 'low voltage' mode. The Mains Dip function is enabled by the Mains Dip Enable (MAINS DIP ENA(C1)) parameter. When the drive goes into 'low voltage' mode, it reduces the speed by the percentage defined by this parameter. 'Low voltage' mode is defined as when the drive declares a UV alarm, which is defined by the Input line-to-line voltage (INPUT L-L VOLTS(A4)) parameter and the Undervoltage Alarm Level (UV ALARM LEVEL(A4)).	**%**	**5.00 – 99.99**	**25.00**	Y	Y
RUN DELAY TIMER	(Run Delay Timer) Allows the user to delay the drive's recognition of the RUN signal. For more information, see RUN DELAY TIMER on page 39.	**sec**	**0.00 – 0.99**	**0.00**	Y	Y
AB ZERO SPD LEV	(Auto Brake Zero Speed Level) This parameter sets the speed point that will be considered as zero speed for the auto brake function. The units are % of contract speed and the parameter has a maximum value of 2.00% and a default value of 0.00%. In order to the use the Auto Brake function, a logic output needs to be configured for AUTO BRAKE (C3), the parameter SPD COMMAND SRC(C1)=MULTI-STEP, the parameter SPD REF RELEASE(C1)=BRAKE PICKED, and the parameter BRAKE PICK CFRM(C1)=INTERNAL TIME or EXTERNAL TB1.	**%**	**0.00 – 2.00**	**0.00**	Y	Y
AB OFF DELAY	(Auto Brake Off Delay) This parameter determines the time after zero speed is reached (level determined by the AB ZERO SPD LEV (A1) parameter) that the Auto Brake logic output goes false. The units are seconds and the parameter has a maximum value of 9.99 seconds and a default value of 0.00 seconds.	**sec**	**0.00 – 9.99**	**0.00**	Y	Y
CONTACTOR DO DLY	(Contactor Drop-out Delay) When the drive controls the motor contactor via CLOSE CONTACT logic output, this parameter, CONTACTOR DO DLY (A1), allows the user to delay the drive's dropout of the motor contactor. The CONTACTOR DO DLY Timer Delay starts when the speed regulator release signal goes false.	**sec**	**0.00 – 5.00**	**0.00**	Y	Y
TRQ LIM MSG DLY	(Torque Limit Message Delay) This parameter determines the amount of time the drive is in torque limit before the "HIT TORQUE LIMIT" alarm message is displayed.	**sec**	**0.00 – 10.00**	**0.50**	Y	Y

Name	Description	Units	Range	Default	Hidden Item	Lock out
SER2 INSP SPD	(Serial Mode 2 Inspection Speed) *Used only with custom serial protocol (mode 2)* When in Serial Mode 2, this parameter defines the inspection speed to be used. To run in inspection speed via serial mode 2 requires that the run command for inspection speed come from two sources, a command sent in a serial message and via hardware as a logic input defined as "SER2 INSP ENA".	**ft/ min**	**0.0 – 100.0**	**30.0**	Y	Y
		m/ sec	**0.000 – 0.500**	**0.150**		
SER2 RS CRP SPD	(Serial Mode 2 Rescue Creep Speed) *Used only with custom serial protocol (mode 2)* When in Serial Mode 2 and SER2 FLT MODE (C1)=rescue, this parameter defines the creep speed that will be used in the "rescue mode".	**ft/ min**	**0.0 – 300.0**	**10.0**	Y	Y
		m/ sec	**0.000 – 1.540**	**0.050**		
SER2 RS CRP TIME	(Serial Mode 2 Rescue Creep Time) *Used only with custom serial protocol (mode 2)* When in Serial Mode 2 and SER2 FLT MODE (C1)=rescue, this parameter defines the maximum time the drive will continue to run at rescue creep speed (defined by SER2 RS CRP SPD (A1) parameter) when reacting to a serial fault. The time is defined as the time running at creep speed. It does not include the time it takes to decelerate to creep speed.	**sec**	**0.0 – 200.0**	**180.0**	Y	Y
SER2 FLT TOL	(Serial Mode 2 Fault Tolerance) *Used only with custom serial protocol (mode 2)* When in Serial Mode 2, this parameter defines the maximum time that may elapse between valid run time messages while in serial run mode before a serial fault is declared.	**sec**	**0.00 – 2.00**	**0.04**	Y	Y
ROLLBACK GAIN	(Rollback Gain) Gain of anti-rollback. See ROLLBACK GAIN on page 39.	**none**	**1 – 20**	**1**	Y	Y
NOTCH FILTER FRQ	(Notch Filter Frequency) Notch filter center frequency. For more information, see NOTCH FILTER FRQ on page 40.	**Hz**	**5 – 60**	**20**	Y	Y
NOTCH FILT DEPTH	(Notch Filter Depth) This parameter determines notch filter maximum attenuation. Note: A filter depth setting of zero (NOTCH FILT DEPTH (A1) =0) removes the filter. For more information, see NOTCH FILTER FRQ on page 40.	**%**	**0 – 100**	**0**	Y	Y
MSPD DELAY 1-4	(Multi-Step Speed Delay 1-4) Determines the recognition time delay for a defined multi-step speed command. For more information, see MSPD DELAY 1-4 on page 40.	**sec**	**0.000 – 10.000**	**0.000**	Y	Y

Table 2: Drive A1 Submenu

Detailed descriptions

GAIN CHNG LEVEL
(Gain Change Level)
When the gain control is set to internal, the drive will control the high/low gain switch. This parameter sets the speed reference level, when the drive is in 'low gain' mode.

The speed regulator high / low gain function was developed in response to high performance elevator requirements where the resonant nature of the elevator system interferes with the speed response of the drive.

When the speed response (gain) is set to high levels, the resonant characteristics created by the spring action of the elevator ropes can cause car vibration. To solve this problem, the speed regulator is set to a low enough response (gain) so that the resonant characteristics of the ropes are not excited.

This is accomplished by controlling the sensitivity or response of the speed regulator via the high / low gain switch and gain reduce multiplier.

By using the gain reduce multiplier; the user can specify a lower response (gain) for the speed regulator when the drive is at higher speeds. The gain reduce multiplier (GAIN REDUCE MULT(A1)) tells the software how much lower, as a percentage, the speed regulator response (gain) should be.

The high / low gain switch determines when the HPV 900 is in 'low gain' mode. In the 'low gain' mode, the gain reduce multiplier has an effect on the speed regulator's response (gain).

The drive allows for the high / low gain switch to be controlled either externally or internally. The high / low gain source parameter (HI/LO GAIN SRC) allows for this external or internal selection.

The high / low gain switch can be controlled externally by either:

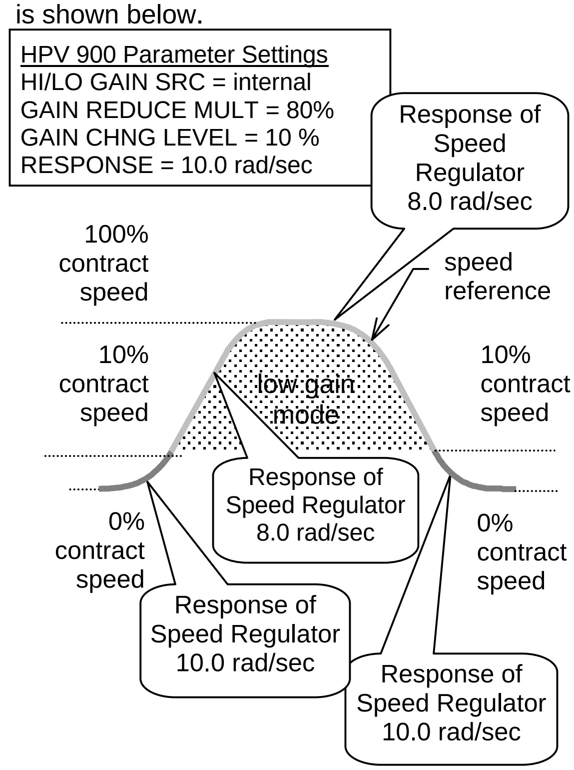
- a logic input
- the serial channel

The high / low gain switch can also be controlled internal by:

- the gain change level parameter (GAIN CHNG LEVEL), which defines a percentage of contract speed

With the drive set to internal control, the speed regulator will go into 'low gain' mode when the drive senses the motor is above a defined speed level. The defined speed level is determined by the gain change level parameter.

An example of internal high / low gain control is shown below.



High / Low Gain Example

RAMPED STOP TIME
(Ramped Stop Time)
This parameter is only used by the torque ramp down stop function and sets the time to ramp torque from rated torque to zero.
After the elevator lands and the brake is applied, the torque ramp down function allows the torque to ramp down at an even level. This helps eliminate the 'bump' felt upon landing caused by the torque being immediately dropped to zero.

A function unique to elevators involves the interaction between the motor torque and the mechanical brake that holds the elevator. Under full load conditions at the end of a run, if the brake is set and the motor torque is removed quickly, some brake slippage may occur. Therefore, the option of gradually reducing the motor torque is provided by the Torque Ramp Down Stop function.

Upon being enabled by the Ramped Stop Select Parameter (RAMPED STOP SEL(C1)), the torque command is linearly ramped to zero from the value that was present when the 'Ramp Down Enable' was selected.

The Ramp Down Enable has the following three possible sources:

- An input logic bit (EXTERNAL TB1)
- The run logic – initiated by the removal of the run command
- The serial channel

The Ramp Down Enable Source parameter (RAMP DOWN EN SRC(C1)) is used to select one of the above options.

A method of providing the Ramp Down Enable would be with a logic signal (EXTERNAL TB1) that is dedicated to that function. The Ramp Down Enable would be asserted while the Run command is still present and remain there until the ramp is completed, after which the Run command would be removed.

The RUN LOGIC option to trigger the Ramp Down Enable from the Run command is provided. In this case, removal of the Run command enables the Ramp Down Stop Function.
The time it takes for the HPV 900 to perform its ramped stop is determined by the Ramped Stop Time Parameter. The Ramped Stop Time parameter (RAMPED STOP TIME(A1)) selects the amount of time it would take for the drive to ramp from the rated torque to zero torque.

SPEED DEVIATION
(Speed Deviation)
The following two functions are available to indicate how the speed feedback is tracking the speed reference.

- Speed Deviation Low – indicates that the speed feedback is tracking the speed reference within a defined range.
- Speed Deviation High – indicates that the speed feedback is failing to properly track the speed reference.

The Speed Deviation Low function has the ability to set a configurable logic output *(C3 Submenu).* The logic output will be true, when the speed feedback is tracking the speed reference within a defined range around the speed reference for a defined period of time, see Figure 21. The defined range is determined by the Speed Deviation Low Level parameter (SPD DEV LO LEVEL(A1)) and the defined time is determined by the Speed Deviation Time parameter (SPD DEV TIME(A1)).

The Speed Deviation High function annunciates a Speed Deviation Alarm and has the ability to set a configurable logic output*, see Logic Outputs C3 on page 68.* The alarm will be annunciated and the logic output will be true, when the speed feedback is not properly tracking the speed reference and is outside a defined range around the speed reference. The defined range is determined by the Speed Deviation High Level parameter (SPD DEV HI LEVEL(A1)).

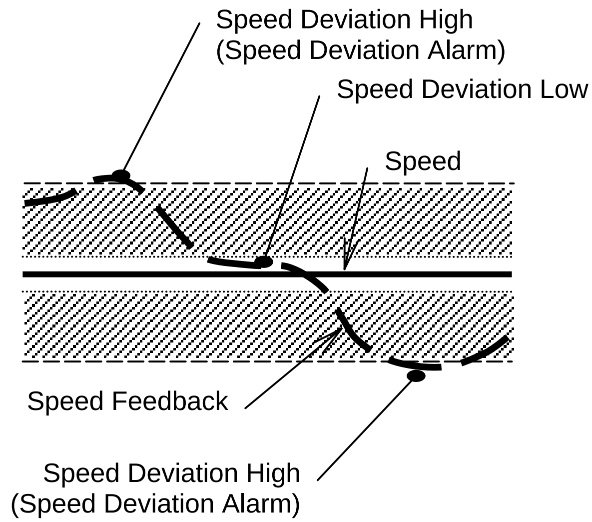


Figure 21: Speed Deviation Example

FLUX WEAKENING

The HPV 900 will calculate the rated flux level by using the following motor parameters:

- rated motor voltage
- rated motor current
- rated excitation frequency
- stator resistance
- stator and rotor leakage reactances

As motor speed increases, the drive will calculate the maximum available flux and decrease the flux automatically. This 'field weakening' will cause less torque to be available during this time.

In the HPV 900, flux weakening begins before the motor reaches rated speed.

The drive can supply more than 100% current, since the CEMF is lower. Therefore, the drive can produce more than 100% of the motor's rated torque at the rated speed.

However, this increased torque capability requires more than 100% motor current to produce 100% torque at rated speed.

Flux Weakening Parameters

The following three HPV 900 parameters affect both the available torque curve and flux level curve:

- Motor Torque Limit
- Regenerative Mode Torque Limit
- Flux Weakening Factor

The highest of the two torque limits is used as the torque limit that defines the two curves.

An example of the effects of the torque limit on the amount of flux weakening needed and the amount of torque available through the entire speed range is shown in Figure 22.

By lowering the torque limit you can effectively reduce the amount of field weakening needed and reduce the amount of current needed by the motor at motor's rated speed. The trade-off is you have lower over-all torque available.

In order to have more torque available at the lower speeds, the HPV 900 has the Flux Weakening Factor parameter, which effectively reduces the amount of torque available only at the higher speeds. This will allow the HPV 900 to have a higher flux level at the motor's rated speed and require less current to produce rated torque.

An example of the effects of the flux weakening factor on the amount of flux weakening needed and the amount of torque available through the entire speed range is also shown in Figure 22.

The maximum amount of torque available can be defined as the following:

- At low speeds…
  the torque limit parameters
- At high speeds…
  function of the torque limit parameters and the flux weakening factor

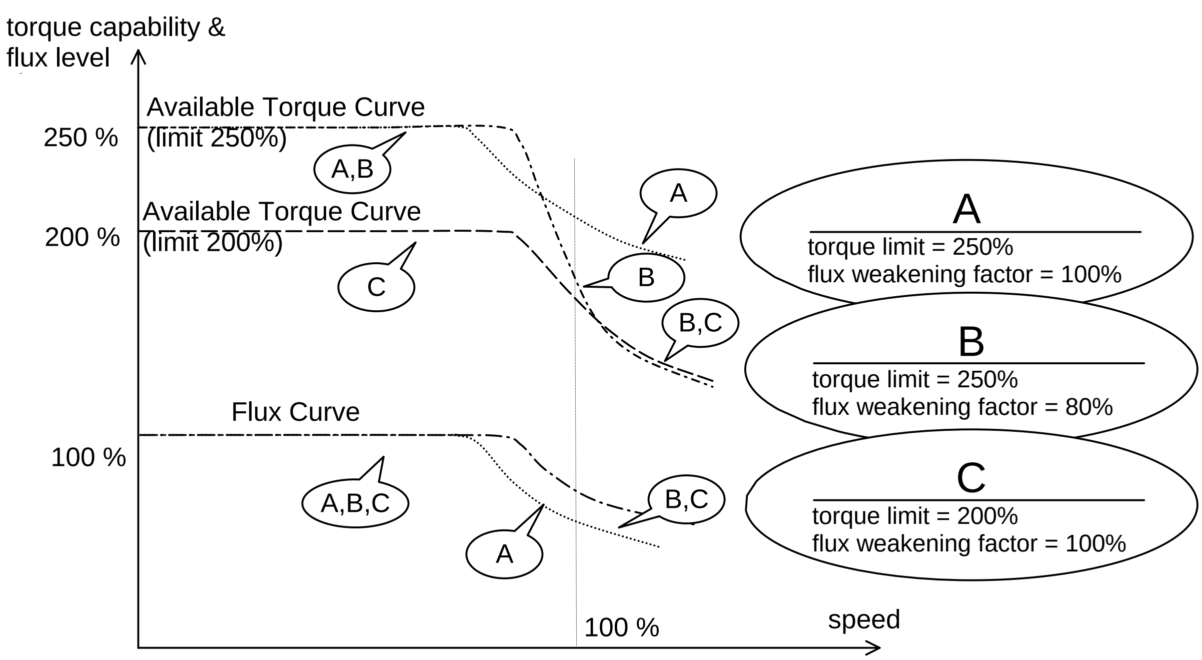
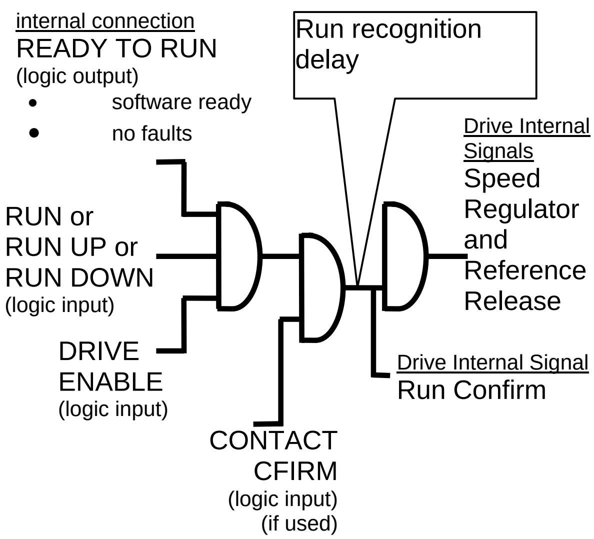


Figure 22: Speed-Torque Curves (Examples)

RUN DELAY TIMER
(Run Recognition Delay Timer)
This parameter allows the user to delay the drive's recognition of the RUN signal (i.e. the Run Confirm signal). The Run Delay Timer can be set from 0.00 to 0.99 seconds. The default for the RUN DELAY TIMER (A1) parameter is 0.00 seconds.



ROLLBACK GAIN
(Anti-rollback Gain)
This parameter increases the sensitivity (or gain) of the speed regulator during the start in the interval between "Speed Regulator Release" and "Reference Release". The parameter acts as a multiplier to the existing speed regulator gain.

Note: this function will only for use with multi-step speed commands (SPD COMMAND SRC (C1) = MULTI-STEP)

During the start, this function can help the drive re-establish the torque to help to control rollback (or roll forward),

Set-up
In order to the use the Anti-Rollback function, the following parameters must be set: SPD REF RELEASE(C1)=BRAKE PICKED and BRAKE PICK CFRM(C1)=INTERNAL TIME. With the these settings for SPD REF RELEASE(C1) and BRAKE PICK CFRM(C1), the BRAKE PICK TIME (A1) parameter determines the amount of time the drive will command zero speed after the Run command is given and the amount of time the drive will command zero speed after the Run command is removed.

At the start, the ROLLBACK GAIN parameter will increase the speed regulator gain during the time determined by BRAKE PICK TIME parameter when the drive is commanding zero speed (i.e. the time between the speed regulator is released and the speed reference is released). During this BRAKE PICK TIME, the mechanical brake should be picked (either by the car controller or drive).

Adjustment
Start at ROLLBACK GAIN=1 and increase in increments of 1 to help control rollback.

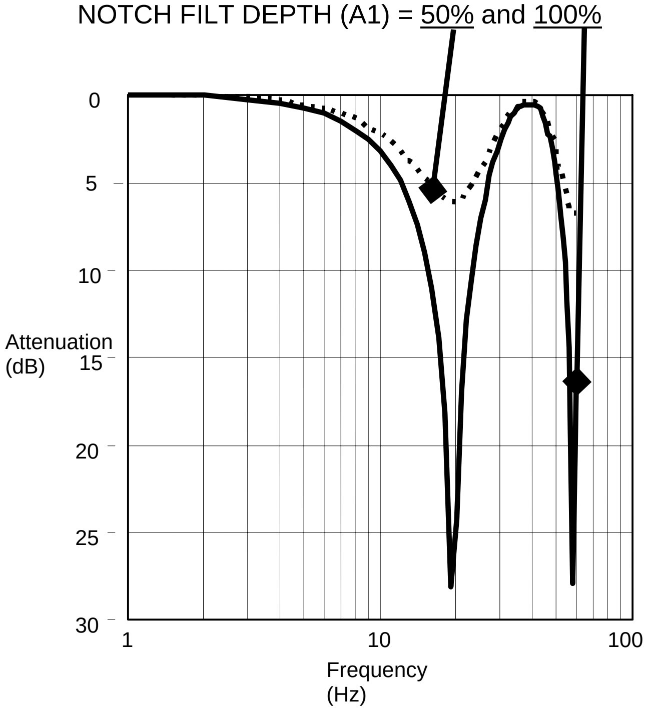
***IMPORTANT**: too high a setting for this parameter can lead to drive instability.*

NOTCH FILTER FRQ
(Notch Filter Center Frequency)
This parameter determines the notch filter center frequency.

Notch Filter
Although originally created for gearless applications where elevator rope resonance is sometimes an issue, this filter affects the torque command output of the speed regulator and will filter out specific frequencies. By filtering a specific frequency, the speed regulator will avoid exciting a mechanical resonance if one exists at that frequency.

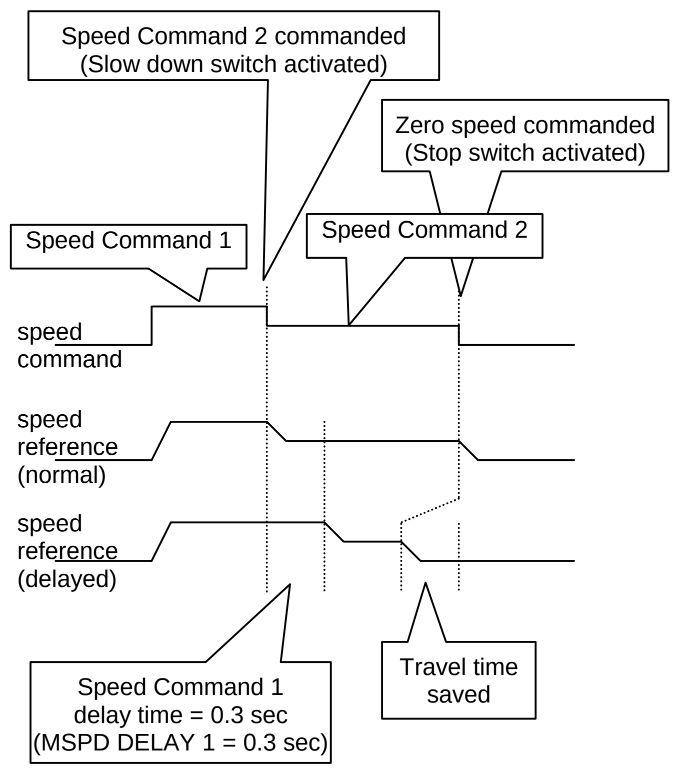
There is attenuation across a range of frequencies, not just at the set frequency, but also to a lesser degree. The filter starts attenuation at frequencies lower than the notch frequency set point. When the notch frequency is set to low values (less than 10 Hz), the filter can interfere with the desired response of the drive. This can be exhibited by minor increase in the rollback of the drive at start and some deterioration in the ability of the drive to track an s-curve reference. Generally, this would not be an issue if the notch frequency were set at or above 10 Hz.

Notch Filter Example
settings:
NOTCH FILTER FRQ (A1) = 20Hz
NOTCH FILT DEPTH (A1) = 50% and 100%



MSPD DELAY 1-4
(Multi-step Speed Delay)
These four parameters determine the recognition time delay for a multi-step speed commands defined by MLT-SPD TO DLY1-4 (C1) parameters.

When setting up an elevator, slow-down and stop switches are set at fixed locations in the shaft. Once the drive is tuned, it might require the user to move the switches in the shaft in order to minimize the time spent at leveling speed. Under "normal" operation, the drive speed reference follows the speed command. By configuring for "delayed" operation and setting speed command 1 for a delay (MLT-SPD TO DLY 1 = MSPD 1), the recognition of the speed command change from speed command 1 to any other speed command (in this case speed command 2) will be delayed by the setting of MSPD DELAY 1 (A1) parameter.



S-Curves A2 submenu

Detailed descriptions

The HPV 900 speed command is passed through an internal S-curve in order to produce the speed reference. In general, the S curve function takes an arbitrary speed command and generates a speed reference subject to the conditions that the maximum accel, decel and jerk rates not be exceeded. The speed command is typically the target speed that the reference is headed to.

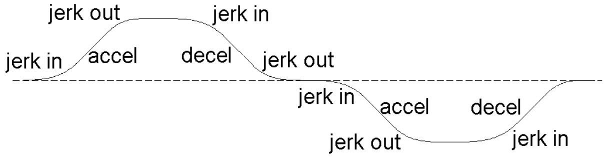
Note: If the car controller is feeding the drive a speed profile including s-curves, the s-curve settings on the drive need to be placed out of the way. In those cases, set ACCEL RATE 0 and DECEL RATE 0 to the maximum (7.99 ft/s^2 or 3.999 m/s^2) and set ACCEL JERK IN 0, ACCEL JERK OUT 0, DECEL JERK IN 0, and DECEL JERK OUT 0 to the minimum (0.0 ft/s^2 or 0.00 m/s^2).

Below shows the six parameters associated with an S-Curve data set:

- Accel- Maximum allowed acceleration rate (ft/s^2 or m/s^2)
- Decel - Maximum allowed deceleration rate (ft/s^2 or m/s^2)
- Accel Jerk In - Maximum allowed change in acceleration towards Accel (ft/s^3 or m/s^3)
- Accel Jerk Out - Maximum allowed change in acceleration from Accel (ft/s^3 or m/s^3)
- Decel Jerk In - Maximum allowed change in deceleration towards Decel (ft/s^3 or m/s^3)
- Decel Jerk Out - Maximum allowed change in deceleration from Decel (ft/s^3 or m/s^3)

The S-curves are specified by four parameters: acceleration rate (ft/s^2 or m/s^2), deceleration rate (ft/s^2 or m/s^2), leveling jerk rate (ft/s^3 or m/s^3), and jerk rate (ft/s^3 or m/s^3).

Since an adjustable jerk rate is helpful for smooth landings, the jerk rates are split for ease in elevator fine-tuning. The jerk rate parameters specify: acceleration from the floor (ACCEL JERK IN), jerk out of acceleration (ACCEL JERK OUT), jerk into deceleration (DECEL JERK IN), and the leveling into the floor (DECEL JERK OUT).



S-Curve

There are four S-curve patterns available in the drive and each S-curve is customized by six parameters:

Parameters for S-curve-0 (SC0):

- ACCEL RATE 0, DECEL RATE 0, ACCEL JERK IN 0, ACCEL JERK OUT 0, DECEL JERK IN 0, and DECEL JERK OUT 0

Parameters for S-curve-1 (SC1):

- ACCEL RATE 1, DECEL RATE 1, ACCEL JERK IN 1, ACCEL JERK OUT 1, DECEL JERK IN 1, and DECEL JERK OUT 1

Parameters for S-curve-2 (SC2):

- ACCEL RATE 2, DECEL RATE 2, ACCEL JERK IN 2, ACCEL JERK OUT 2, DECEL JERK IN 2, DECEL JERK OUT 2

Parameters for S-curve-3 (SC3):

- ACCEL RATE 3, DECEL RATE 3, ACCEL JERK IN 3, ACCEL JERK OUT 3, DECEL JERK IN 3, DECEL JERK OUT 3

S-Curve Pattern Selection

The default S-curve pattern is S-curve-0 (SC0). To make the other patterns available, the user must assign S-CURVE SEL 0 and/or S-CURVE SEL 1 as logic input(s). The logic input(s) can then be used to select one of the S-curve patterns, as follows:

Logic Inputs Assigned	S-curves Available
None	SC0 only
SEL 0 only	SC0 or SC1
SEL 1 only	SC0 or SC2
SEL 0 & SEL 1	SC0, SC1, SC2 or SC3

S-curve Availability

logic input S-CURVE SEL 1	SEL 0	S-curve selected
0	0	SCO
0	1	SC1
1	0	SC2
1	1	SC3

Selecting S-curves

The jerk rates can be turned off by setting the jerk rates to zero.

The accel / decel rates can also be turned off by setting them to zero. But, setting the accel / decel rates to zero is not recommended.

S-Curves A2 Submenu

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
ACCEL RATE 0	Acceleration rate limit	**ft/s^2**	**0.00 – 7.99**	**3.00**	N	Y
		m/s^2	**0.000 – 3.999**	**0.090**		
DECEL RATE 0	Deceleration rate limit	**ft/s^2**	**0.00 – 7.99**	**3.00**	N	Y
		m/s^2	**0.000 – 3.999**	**0.090**		
ACCEL JERK IN 0	Rate of increase of acceleration, up to ACCEL RATE, when increasing elevator speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
ACCEL JERK OUT 0	Rate of decrease of acceleration to zero when approaching contract elevator speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
DECEL JERK IN 0	Rate of increase of deceleration, up to DECEL RATE, when decreasing elevator speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
DECEL JERK OUT 0	Rate of decrease of deceleration to zero when slowing the elevator to leveling speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
ACCEL RATE 1	Acceleration rate limit	**ft/s^2**	**0.00 – 7.99**	**3.00**	N	Y
		m/s^2	**0.000 – 3.999**	**0.090**		
DECEL RATE 1	Deceleration rate limit	**ft/s^2**	**0.00 – 7.99**	**3.00**	N	Y
		m/s^2	**0.000 – 3.999**	**0.090**		
ACCEL JERK IN 1	Rate of increase of acceleration, up to ACCEL RATE, when increasing elevator speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
ACCEL JERK OUT 1	Rate of decrease of acceleration to zero when approaching contract elevator speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
DECEL JERK IN 1	Rate of increase of deceleration, up to DECEL RATE, when decreasing elevator speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
DECEL JERK OUT 1	Rate of decrease of deceleration to zero when slowing the elevator to leveling speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
ACCEL RATE 2	Acceleration rate limit	**ft/s^2**	**0.00 – 7.99**	**3.00**	N	Y
		m/s^2	**0.000 – 3.999**	**0.090**		
DECEL RATE 2	Deceleration rate limit	**ft/s^2**	**0.00 – 7.99**	**3.00**	N	Y
		m/s^2	**0.000 – 3.999**	**0.090**		
ACCEL JERK IN 2	Rate of increase of acceleration, up to ACCEL RATE, when increasing elevator speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
ACCEL JERK OUT 2	Rate of decrease of acceleration to zero when approaching contract elevator speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
DECEL JERK IN 2	Rate of increase of deceleration, up to DECEL RATE, when decreasing elevator speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
DECEL JERK OUT 2	Rate of decrease of deceleration to zero when slowing the elevator to leveling speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
ACCEL RATE 3	Acceleration rate limit	**ft/s^2**	**0.00 – 7.99**	**3.00**	N	Y
		m/s^2	**0.000 – 3.999**	**0.090**		
DECEL RATE 3	Deceleration rate limit	**ft/s^2**	**0.00 – 7.99**	**3.00**	N	Y
		m/s^2	**0.000 – 3.999**	**0.090**		
ACCEL JERK IN 3	Rate of increase of acceleration, up to ACCEL RATE, when increasing elevator speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
ACCEL JERK OUT 3	Rate of decrease of acceleration to zero when approaching contract elevator speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
DECEL JERK IN 3	Rate of increase of deceleration, up to DECEL RATE, when decreasing elevator speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		
DECEL JERK OUT 3	Rate of decrease of deceleration to zero when slowing the elevator to leveling speed	**ft/s^3**	**0.0 – 29.9**	**8.0**	N	Y
		m/s^3	**0.00 – 9.99**	**2.40**		

Table 3: S-Curve A2 Submenu

Multistep Ref A3 submenu

Detailed descriptions

The multi-step speed reference function is one possible way for the drive to accept speed command. To use this function, the user can enter up to fifteen speed commands (CMD1 – CMD15) and assign four logic inputs as speed command selections.

Note: CMD0 is reserved for zero speed, therefore is not accessible to the user for programming.

During operation, the user will encode a binary signal on the four logic inputs that determines which speed command the software should use. The user need not use all four speed command selection bits; if no logic input is specified for one of the selection bits, that bit is always zero. For instance, if no logic input is specified for the most significant bit (B3), that bit will be zero and the user can select from CMD0 - CMD7.

IMPORTANT

Since these speed commands are selected with external contacts, a new command selection must be present for 50ms before it is recognized.

	logic input STEP REF			multi-step speed
B3	B2	B1	B0	command
0	0	0	0	CMD0
0	0	0	1	CMD1
0	0	1	0	CMD2
0	0	1	1	CMD3
0	1	0	0	CMD4
0	1	0	1	CMD5
0	1	1	0	CMD6
0	1	1	1	CMD7
1	0	0	0	CMD8
1	0	0	1	CMD9
1	0	1	0	CMD10
1	0	1	1	CMD11
1	1	0	0	CMD12
1	1	0	1	CMD13
1	1	1	0	CMD14
1	1	1	1	CMD15

Multi-step Selection

An example of the use of the multi-step command is as follows:

- All speed commands are positive.
- CMD0 specifies zero speed.
- CMD1 specifies leveling speed.
- CMD2 specifies inspection speed.
- CMD3 specifies an overspeed limit.
- CMD4 – CMD15 specify different top speeds depending on number of floors in the run.

For typical use, the user will have all speed commands to be positive, in which case a logic input s (UP/DWN or RUNUP & RUNDOWN) must also be specified to determine up or down direction. It is possible for the user to specify both positive and negative values for CMD1 - CMD15, in which case logic input bit(s) are not needed.

Multistep Ref A3 Submenu

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
SPEED COMMAND 1	Multi-step speed command #1	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 2	Multi-step speed command #2	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 3	Multi-step speed command #3	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 4	Multi-step speed command #4	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 5	Multi-step speed command #5	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 6	Multi-step speed command #6	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 7	Multi-step speed command #7	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 8	Multi-step speed command #8	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 9	Multi-step speed command #9	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 10	Multi-step speed command #10	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 11	Multi-step speed command #11	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 12	Multi-step speed command #12	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 13	Multi-step speed command #13	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 14	Multi-step speed command #14	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
SPEED COMMAND 15	Multi-step speed command #15	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		

Table 4: Multistep Ref A3 Submenu

Power Convert A4 Submenu

NOTE: When the word ***Hidden*** appears above a parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details on page 75.*

NOTE: When the word ***Lockout*** appears above a parameter description, the parameter cannot be changed when the drive is in the RUN mode.

Parameter	Description	Units	Range	Default	Hidden item	Lock out
Id REG DIFF GAIN	(Current Regulator Differential Gain for Flux Generation) The differential gain for the current regulator flux generation. This parameter is meant for advanced operation; therefore, the parameter will rarely need to be changed from the default value.	**none**	**0.80 – 1.20**	**1.00**	Y	N
Id REG PROP GAIN	(Current Regulator Proportional Gain for Flux Generation) The proportional gain for the current regulator flux generation**.** This parameter is meant for advanced operation; therefore, the parameter will rarely need to be changed from the default value.	**none**	**0.20 – 0.40**	**0.30**	Y	N
Iq REG DIFF GAIN	(Current Regulator Differential Gain for Torque Generation) The differential gain for the current regulation of motor torque. This parameter is meant for advanced operation; therefore, the parameter will rarely need to be changed from the default value.	**none**	**0.80 – 1.20**	**1.00**	Y	N
Iq REG PROP GAIN	(Current Regulator Proportional Gain for Torque Generation) The proportional gain for the current regulator torque generation. This parameter is meant for advanced operation; therefore, the parameter will rarely need to be changed from the default value.	**Non**	**0.20 – 0.40**	**0.30**	Y	N
PWM Frequency	(Carrier Frequency) This parameter sets the PWM or ‘carrier’ frequency of the drive. The carrier is defaulted at 10.0 kHz, which is well out of audible range. The drive does not derate when the PWM frequency is set to 10kHz or below. *For more information on derating see page 12.*	**kHz**	**2.5 – 16.0**	**10.0**	N	N
UV Alarm Level	(Undervoltage Alarm Level) This parameter sets the level (as a percentage of the INPUT L-L VOLTS) at which an under voltage alarm will be declared. Units in percent of nominal bus.	**%**	**80 – 99**	**90**	Y	N

Parameter	Description	Units	Range	Default	Hidden item	Lock out
UV Fault Level	(Undervoltage Fault Level) This parameter sets the level (as a percentage of the INPUT L-L VOLTS) at which an under voltage fault will occur. Units in percent of nominal bus.	**%**	**50 – 99**	**80**	Y	N
Extern Reactance	(External Reactance) This parameter sets the externally connected reactance (as a percentage of base impedance) between the drive and the motor. Units in percent of reactance.	**%**	**0.0 – 10.0**	**0.0**	Y	Y
Input L-L Volts	(Input Line to Line Voltage) This parameter sets the input voltage or AC line input voltage to the drive.	**Vrms**	**110 – 480**	**460 or 230**	N	N

Table 5: Power Convert A4 Submenu

Motor A5 Sub-menu
This sub-menu contains parameters, which are programmed with information about the motor being controlled by the drive.

IMPORTANT
The parameters in this sub-menu defined the motor model, which is very important for proper operation. Ensure that the data is accurate.

NOTE: When the word ***Hidden*** appears above a parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details on page 75.*
NOTE: When the word ***Lockout*** appears above a parameter description, the parameter cannot be changed when the drive is in the RUN mode.

<table>
<tr><th>Parameter</th><th>Description</th><th>Units</th><th>Range</th><th>Default</th><th>Hidden item</th><th>Run lock out</th></tr>
<tr><td>MOTOR ID</td><td>(Motor Identification) This parameter allows for the selection of motor parameters. A listing of each Motor ID with its corresponding set of motor parameters is sown below.
<table>
<tr><th rowspan="2">motor parameter</th><th colspan="2">Motor ID</th></tr>
<tr><th>4 pole dflt</th><th>6 pole dflt</th></tr>
<tr><td>Rated Mtr Power</td><td>0.0 HP</td><td>0.0 HP</td></tr>
<tr><td>Rated Mtr Volts</td><td>0.0 V</td><td>0.0 V</td></tr>
<tr><td>Rated Excit Freq</td><td>0.0 Hz</td><td>0.0 Hz</td></tr>
<tr><td>Rated Motor Curr</td><td>0.0 A</td><td>0.0 A</td></tr>
<tr><td>Motor Poles</td><td>0</td><td>0</td></tr>
<tr><td>Rated Mtr Speed</td><td>0.0 rpm</td><td>0.0 rpm</td></tr>
<tr><td>% No Load Curr</td><td>35.00%</td><td>45.00%</td></tr>
<tr><td>Stator Leakage X</td><td>9.00%</td><td>7.50%</td></tr>
<tr><td>Rotor Leakage X</td><td>9.00%</td><td>7.50%</td></tr>
<tr><td>Stator Resist</td><td>1.50%</td><td>1.50%</td></tr>
<tr><td>Motor Iron Loss</td><td>0.50%</td><td>0.50%</td></tr>
<tr><td>Motor Mech Loss</td><td>1.00%</td><td>1.00%</td></tr>
<tr><td>Flux Sat Break</td><td>75%</td><td>75%</td></tr>
<tr><td>Flux Sat Slope 1</td><td>0%</td><td>0%</td></tr>
<tr><td>Flux Sat Slope 2</td><td>50%</td><td>50%</td></tr>
</table>
Table 6: Motor ID Defaults
NOTE: The default motor selections need to have the motor nameplate information entered in the appropriate motor parameters. The other motor parameters are already set to nominal values.
IMPORTANT
Whichever Motor ID is used, the Adaptive Tune Procedure should be followed to obtain maximum motor performance. See Using the Adaptive Tune to Obtain Maximum Motor Performance on page 97.</td><td>none</td><td>– 4 pole dflt
– 6 pole dflt</td><td>4 POLE DFLT</td><td>N</td><td>Y</td></tr>
<tr><td rowspan="2">RATED MTR POWER</td><td rowspan="2">(Rated Motor Power)
This parameter sets the rated power in horsepower (HP) or kilowatts (kW) of the motor. Note: value should be obtained from the motor nameplate</td><td>HP</td><td>1.0 – 500.0</td><td>0.0</td><td rowspan="2">N</td><td rowspan="2">Y</td></tr>
<tr><td>kW</td><td>0.75 – 400.00</td><td>0.00</td></tr>
</table>

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
RATED MTR VOLTS	(Rated Motor Voltage) This parameter sets the rated motor voltage. Note: value should be obtained from the motor nameplate	**Volts**	**190.0 – 575.0**	**0.0**	N	Y
RATED EXCIT FREQ	(Rated Motor Excitation Frequency) This parameter sets the excitation frequency of the motor. Note: value should be obtained from the motor nameplate	**Hz**	**5.0 – 400.0**	**0.0**	N	Y
RATED MOTOR CURR	(Rated Motor Amps) This parameter sets the rated motor current. Note: value should be obtained from the motor nameplate.	**Amps**	**1.00 – 800.00**	**0.00**	N	Y
MOTOR POLES	(Motor Poles) This parameter sets the number of poles in the motor. NOTE: This must be an even number or a Setup Fault #3 will occur. Note: value should be obtained from the motor nameplate.	**none**	**2 – 32**	**0**	N	Y
RATED MTR SPEED	(Rated Motor Speed) This parameter sets the rated rpm of the motor (nameplate speed). NOTE: This is a function of the motor only and does not need to be the same as the CONTRACT MTR SPD (A1) parameter setting. Note: value should be obtained from the motor nameplate. Rated Mtr Speed is defined as the synchronous speed minus the slip. At times, the motor manufacturer will place the synchronous speed on the data nameplate. The Adaptive Tune procedure on page 97 calculates the amount of slip of the motor. $\left(\begin{matrix}\text{synchronous}\\ \text{speed of}\\ \text{motor}\end{matrix}\right) = \frac{120 * \left(\begin{matrix}\text{rated}\\ \text{excitation}\\ \text{frequency}\end{matrix}\right)}{\#\text{ of Poles}}$	**RPM**	**50.0 – 3000.0**	**0.0**	N	Y
% NO LOAD CURR	(Percent No Load Current) This parameter sets the percent no load current of the motor. This parameter sets the window (±25%) around which the adaptive tune can adjust the motor's percent no load current. Units in percent of current. *For more information on the adaptive tune, see Adaptive Tune on page 97.*	**%**	**10.0 – 80.0**	**per MOTOR ID**	N	N
STATOR LEAKAGE X	(Stator Leakage Reactance) This parameter sets the stator reactance leakage, as a percent of the BASE IMPEDANCE, which appears in the Power Data display. Note: The base impedance is based on the RATED MTR PWR and RATED MTR VOLTS parameters.	**%**	**0.00 – 20.00**	**per MOTOR ID**	Y	N
ROTOR LEAKAGE X	(Rotor Leakage Reactance) This parameter sets the rotor reactance leakage, as a percent of the BASE IMPEDANCE, which appears in the Power Data D2 Submenu.	**%**	**0.00 – 20.00**	**per MOTOR ID**	Y	N

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
STATOR RESIST	(Stator Resistance) This parameter sets the amount of resistance in the motor stator, as a percent of the BASE IMPEDANCE, which appears in the Power Data D2 Submenu.	**%**	**0.0 – 20.0**	**1.5**	Y	N
MOTOR IRON LOSS	(Motor Iron Losses) This parameter sets the motor iron loss at rated frequency. Units in percent of rated power.	**%**	**0.0 – 15.0**	**0.5**	Y	N
MOTOR MECH LOSS	(Motor Mechanical Losses) This parameter sets the motor mechanical losses at rated frequency. Units in percent of rated power.	**%**	**0.0 – 15.0**	**1.0**	Y	N
OVLD START LEVEL	(Motor Overload Start Level) This parameter defines maximum current at which motor can run continuously. This parameter is also one of the two parameters that define the motor overload curve. Units in percent of rated current. For more information, see OVLD START LEVEL on page 50.	**%**	**100 – 150**	**110**	Y	Y
OVLD TIME OUT	(Motor Overload Time Out) This parameter defines the amount of time before a motor overload alarm occurs when the motor is running at the current level defined below: $\left(\textit{OVLD START LEVEL :}\right) + \left(\textit{40\% rated motor current}\right)$ This is the other parameter used to define the overload curve. For more information, see OVLD START LEVEL on page 50.	**sec**	**5.0 – 120.0**	**60.0**	Y	Y
FLUX SAT BREAK	(Flux Saturation Break Point) This parameter sets the flux saturation curve slope change point. Units in percent of flux.	**%**	**0 – 100**	**75**	Y	N
FLUX SAT SLOPE 1	(Flux Saturation Slope #1) This parameter sets the flux saturation curve slope for low fluxes. Units are PU slope 100%. NOTE: Performance may be unstable if FLUX SAT SLOPE 1 is set to 0 and FLUX SAT SLOPE 2 is set to 0.	**%**	**0 – 200**	**0**	Y	N
FLUX SAT SLOPE 2	(Flux Saturation Slope #2) This parameter sets the flux saturation curve slope for high fluxes. Units are PU slope 100%. NOTE: Performance may be unstable if FLUX SAT SLOPE 1 is set to 0 and FLUX SAT SLOPE 2 is set to 0.	**%**	**0 – 200**	**50**	Y	N

Table 7: Motor A5 Submenu

OVLD START LEVEL
(Motor Overload Start Level)
This parameter defines maximum current at which motor can run continuously. This parameter is also one of the two parameters that define the motor overload curve.

The motor overload parameters can be adjusted by the user. The following two parameters are used to define the motor overload curve.

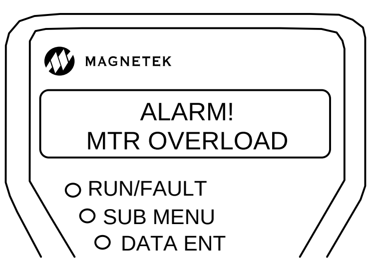
- motor current overload start level (OVLD START LEVEL(A5)) parameter
- motor current time out (OVLD TIME OUT(A5)) parameter

Three overload curves are shown. Curve #1 is the default motor overload curve. The parameter settings that define the three overload curves are shown.

	OVLD START LEVEL	OVLD TIME OUT
curve #1	110%	60 sec
curve #2	110%	40 sec
curve #3	120%	70 sec

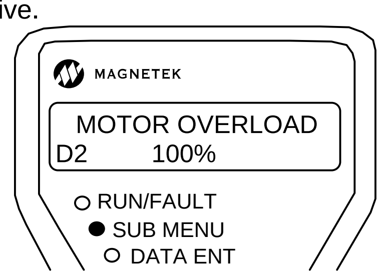
Motor Overload Parameters

When the motor had exceeded the user defined motor overload curve, the drive will declare a motor overload alarm.



The motor overload alarm can also be assigned to a logic output.

Under the POWER DATA display sub-menu, the MOTOR OVERLOAD (D2) value displays the percentage of motor overload trip level reached. Once this value reaches 100% the motor has exceeded its user defined overload curve and a motor overload alarm is declared by the drive.

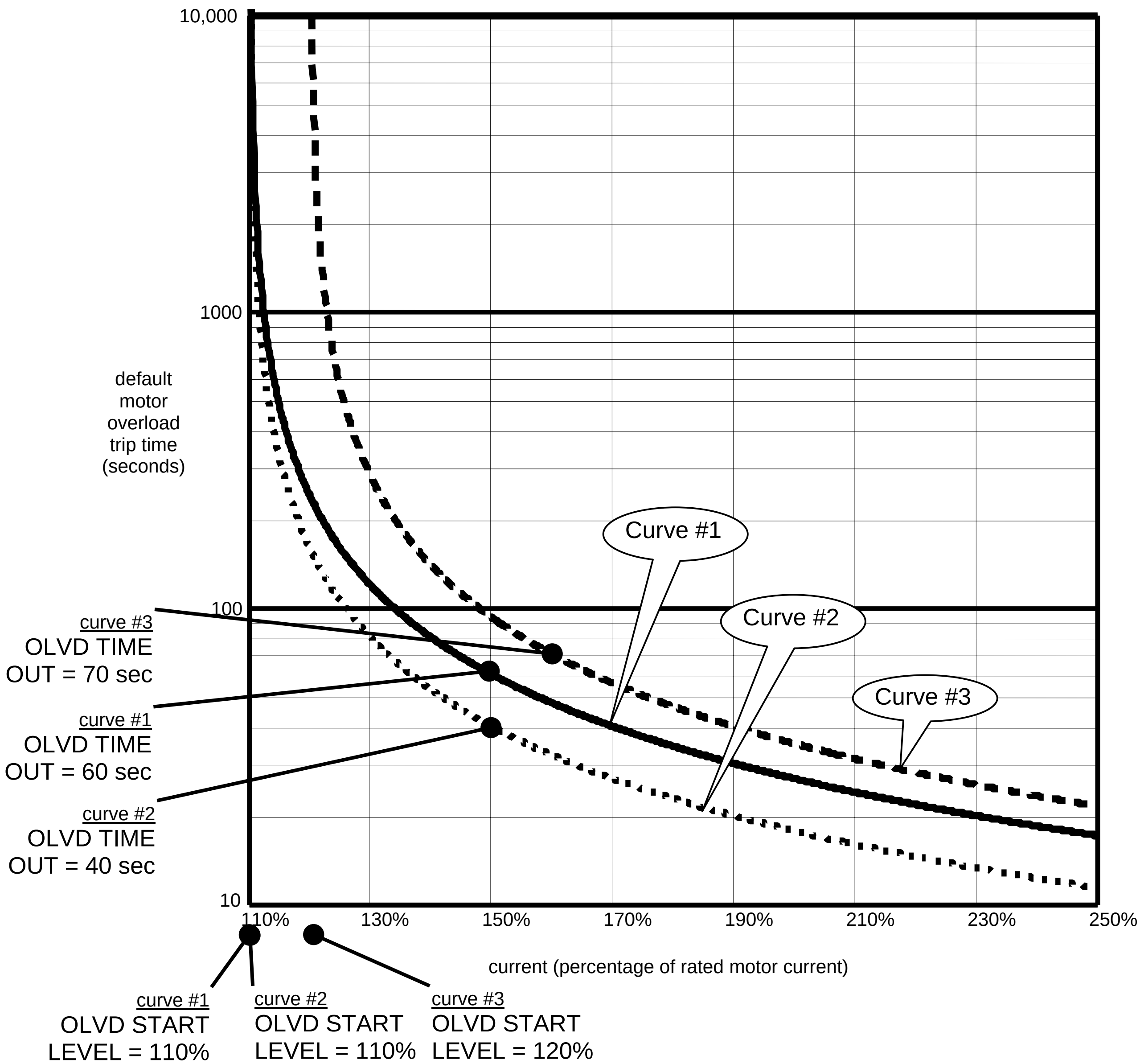


The drive will only declare a motor overload and the user is responsible for action.

But, if the user wants the drive to declare a fault on a motor overload the following need to be completed:

- logic output configured to MTR OVERLOAD
- logic input configured to EXT FAULT
- wire the EXT FAULT logic input terminal to the to MTR OVERLOAD logic output terminal
- wire the logic input common terminal to the logic output common

With the above set-up, the drive will then declare an External Fault on a motor overload.



Motor Overload Curve

Configure C0 Menu

User Switches C1 Submenu

Parameter	Description	Choices	Default	Hidden item	Run lock out
SPD COMMAND SRC	(Speed Command Source) This parameter designates the source of the drive's speed command. The three possible sources for the speed command are following: • Serial Channel - a RS-422 serial port located on the drive control board (either speed profile or multi-step speed commands) – serial – speed profile (only used in serial mode 1) – ser mult step – serial multi-step speed commands (only used in serial mode 2) • Analog Channel – a bipolar (±10V) signal. Available with the analog channel is a Speed Command Multiplier (SPD COMMAND MULT(A1)) and Speed Command Bias (SPD COMMAND BIAS(A1)). These parameters are used to scale the user's analog speed command to the proper range for use by the drive software. • Multi-Step Command - user defined fifteen discrete speed commands (CMD1 - CMD15). Four logic inputs are used as speed command selections (CMD0 is reserved for zero speed. But, the user can specify CMD1 - CMD15 to be any speed command either positive or negative)	– **analog input** – **multi-step** – **serial** – **ser mult step**	**MULTI-STEP**	Y	Y
RUN COMMAND SRC	(Run Command Source) This parameter allows the user to choose the source of the run command from one of the following sources: an external run signal from a logic input (external tb), a run signal transferred across a serial channel (serial), or a signal from both the serial channel and a logic input (serial+extrn). If a signal is required from a logic input (either external tb or serial+extrn), the Run signal on TB1 must be selected.	– **external tb** – **serial** – **serial+extrn**	**EXTERNAL TB**	Y	Y
HI/LO GAIN SRC	(High / Low Gain Source) High / low gain change switch source. For more information, see HI/LO GAIN SRC on page 61.	– **external tb** – **serial** – **internal**	**INTERNAL**	Y	Y

Parameter	Description	Choices	Default	Hidden item	Run lock out
SPEED REG TYPE	(Speed Regulator Type) Chooses speed regulator: Ereg or PI regulator. Magnetek recommends the use of the Elevator Speed Regulator (Ereg) for better elevator performance. If set to external regulator, the drive will be configured as a torque controller. **IMPORTANT** This assumes the car controller is doing its own closed-loop speed regulation. (i.e. a completely closed outer speed loop with the car controller having its own encoder feedback). The source of the external torque command is determined by the EXT TORQ CMD SRC (C1) parameter. For more information, see SPEED REG TYPE on page 62.	– **elev spd reg** – **pi speed reg** – **external reg**	**ELEV SPD REG**	Y	Y
MOTOR ROTATION	(Motor Rotation) This parameter allows the user to change the direction of the motor rotation. As an example, if the car controller is commanding the up direction and the car is actually going in a down direction, this parameter can be changed to allow the motor rotation to match the car controller command.	– **forward** – **reverse**	**FORWARD**	Y	Y
SPD REF RELEASE	(Speed Reference Release) The user can select when the Speed Reference Release signal is asserted: • If the user does not want the drive to wait for the mechanical brake to be picked then SPD REF RELEASE can be made equal to REG RELEASE • If the user does want the drive to wait for the brake to be picked then SPD REF RELEASE is not asserted until BRAKE PICKED becomes true.	– **reg release** – **brake picked**	**REG RELEASE**	Y	Y
CONT CONFIRM SRC	(Contactor Confirm Source) This switch selects if hardware confirmation of motor contactor closure is necessary before drive attempts to pass current through motor. If hardware confirmation is available set to EXTERNAL TB and select the Contact Cnfirm signal on a logic input terminal.	– **none** – **external tb**	**NONE**	Y	Y

Parameter	Description	Choices	Default	Hidden item	Run lock out
PreTorque SOURCE	(Pre-Torque Source) This switch determines if a pre torque command is used and with what source. Pre-torque is the value of torque that the drive should produce as soon as the speed regulator is released to prevent rollback due to unbalanced elevator loads. This 'priming' of the speed regulator is done with the pre-torque command, which is used when the speed regulator release is asserted. The two possible sources for the pre-torque command are following: • serial channel • analog channel The serial channel is a RS-422 or 485 serial port depending on control board. The analog pre-torque signal is bipolar (±10V). Available with the analog channel is a Pre-Torque Command Multiplier (PRE TORQUE MULT (A1)) and Pre-Torque Bias (PRE TORQUE BIAS(A1)). These parameters are used to scale the user's analog pre-torque command to the proper range for use by the drive software.	− **none** − **analog input** − **serial**	**NONE**	Y	Y
PreTorque LATCH	(Pre-Torque Latch) This parameter determines if the pre-torque signal is latched. NOTE: If PreTorque Source has been set to NONE, the setting does not have any effect on the operation of the drive. Some car controllers send both pre-torque and speed commands. To facilitate this, the HPV 900 has the option of latching the pre-torque command. If pre-torque latching is selected using the Pre-Torque Latch parameter, a FALSE to TRUE transition on the pre-torque latch clock latches the value on the pre-torque channel into the drive. This channel is allowed to change any time except during this transition without affecting the value of the latched pre-torque command. The Pre-Torque Latch Clock controls when the pre-torque command is latched. The Pre-Torque Latch clock parameter (PTorq LATCH CLCK) determines the source of this latch control. The two choices for latch control are the serial channel or a logic input (EXTERNAL TB). The speed regulator uses the latched pre-torque command when the internal Speed Regulator Release signal is asserted. Once the pre-torque command is used the latch and the pre-torque command is cleared.	− **latched** − **not latched**	**NOT LATCHED**	Y	Y

Parameter	Description	Choices	Default	Hidden item	Run lock out
PTorq LATCH CLCK	(Pre-Torque Latch Clock) If the PRE-TORQUE LATCH has been set to LATCHED, then this parameter chooses the source for latch control. If set to EXTERNAL TB, the Pre-Trq Latch signal on TB1 must be selected.	– **serial** – **external tb**	**EXTERNAL TB**	Y	Y
FAULT RESET SRC	(Fault Reset Source) This parameter determines the source of the drive's external fault reset from one of the following sources: an external fault reset signal from a logic input (external tb), a fault reset signal transferred across a serial channel (serial), or the drive automatically resets the faults (automatic). The user also has the option to reset faults directly through the operator. Automatic Fault Reset If the fault reset source is set to automatic, the faults will be reset according to the setting of the FLT RESET DELAY (A1) and FLT RESETS/HOUR (A1) parameters. When a logic input is defined as "fault reset" and this logic input signal is transitioned from false to true: an active fault will be reset and automatic fault reset counter (defined by FLT RESETS/HOUR(A1)) will be reset to zero. **CAUTION** If the run signal is asserted at the time of a fault reset, the drive will immediately go into a run state. Unless using the auto-fault reset function (FAULT RESET SRC (C1)=automatic), then the run command needs to be cycled to be reset automatically, but will reset if initiated by a logic input without cycling the run command.	– **external tb** – **serial** – **automatic**	**EXTERNAL TB**	Y	Y
OVERSPD TEST SRC	(Overspeed Test Source) This switch determines the source of the overspeed test. Operation of the overspeed test function is specified by the OVRSPEED MULT (A1) parameter. Regardless of the setting of this parameter, the user can call for the overspeed test via the Digital Operator.	– **external tb** – **serial**	**EXTERNAL TB**	Y	Y
BRAKE PICK SRC	(Brake Pick Source) If the BRAKE PICK SRC (C1) is set to INTERNAL, the HPV 900 will attempt to pick (lift) the brake when magnetizing current has been developed in the motor.	– **internal** – **serial**	**INTERNAL**	Y	Y
BRAKE PICK CNFM	(Brake Pick Confirm) If this switch is set to EXTERNAL TB, the HPV 900 will wait for brake pick confirmation before releasing the speed reference. When set to EXTERNAL TB, the MECH BRK PICK signal on TB1 must also be selected.	– **none** – **external tb** – **internal time**	**NONE**	Y	Y
BRAKE HOLD SRC	(Brake Hold Source) If set to internal, the drive will command the mechanical brake to hold mode until confirmation of brake picked exists.	– **internal** – **serial**	**INTERNAL**	Y	Y

Parameter	Description	Choices	Default	Hidden item	Run lock out
RAMPED STOP SEL	(Ramp Stop Select) Chooses between normal stop and torque ramp down stop. For more information, see RAMPED STOP SEL on page 63.	– **none** – **ramp on stop**	**NONE**	Y	Y
RAMP DOWN EN SRC	(Ramp Down Enable Source) If RUN LOGIC is selected, the user can remove the run command and the drive will delay in dropping the run command until torque ramp down stop function is complete. If EXTERNAL TB or SERIAL is selected, the user must keep the run command while allowing the Torque Ramp Down Stop function to be completed.	– **external tb** – **run logic** – **serial**	**EXTERNAL TB**	Y	Y
BRK PICK FLT ENA	(Brake Pick Fault Enable) When this parameter is set to ENABLE, the brake pick command and confirmation must match within the specified time in BRK PICK TIME (A1) parameter or a brake pick fault is declared.	– **disable** – **enable**	**DISABLE**	Y	Y
BRK HOLD FLT ENA	(Brake Hold Fault Enable) When this parameter is set to ENABLE, the brake hold command and confirmation must match within the specified time in BRK HOLD TIME (A1) parameter or a brake hold fault is declared.	– **disable** – **enable**	**DISABLE**	Y	Y
EXT TORQ CMD SRC	(Torque Command Source) Sets the source of the external torque command when the SPEED REG TYPE (C1) is set to external reg. NOTE: • if SPEED REG TYPE is set to external reg and EXT TORQ CMD SRC is set to serial, the drive is a torque controller • if SPEED REG TYPE is set for a speed regulator (either pi speed reg or elev spd reg) and EXT TORQ CMD SRC is set to either serial, the torque command is an auxiliary torque command (torque feedforward command)	– **none** – **serial** – **analog input**	**NONE**	Y	Y
DIR CONFIRM	(Direction Confirm) When enabled, the function allows confirmation of the polarity of the initial analog speed command via the Run Up or Run Down logic input commands. • If the Run Up logic input is selected and true with the polarity of the analog signal positive, then the analog speed command is accepted unchanged+d. • If the logic input Run Down logic input is selected and true with the polarity of the analog speed command negative, the analog speed command is accepted unchanged. • If however, the logic input Run Up is true and the polarity is negative or the logic input Run Down is true and the polarity is positive, then the speed command is held at zero.	– **disabled** – **enabled**	**DISABLED**	Y	Y

Parameter	Description	Choices	Default	Hidden item	Run lock out
S-CURVE ABORT	(S-Curve Abort) This parameter, S-CURVE ABORT (C1), addresses how the S-Curve Speed Reference Generator handles a reduction in the speed command before the S-Curve Generator has reached its target speed. For more information, see S-Curve Abort on page 64.	– **disabled** – **enabled**	**DISABLED**	Y	Y
FAST FLUX	(Fast Flux Enable) This parameter addresses the method the HPV 900 uses to build up flux in the motor. Enabling the Fast Flux function can decrease the motor fluxing time significantly. By decreasing the motor's flux time, the starting takeoff time will also be decreased. For more information, see Fast Flux on page 63.	– **disable** – **enable**	**DISABLED**	Y	Y
MAINS DIP ENA	(Mains Dip Enable) When enabled, the function will reduce the speed (by the percentage defined by the MAINS DIP SPEED parameter) when the drive goes into 'low voltage' mode. 'Low voltage' mode is defined as when the drive declares a UV alarm, which is defined by the Input line-to-line voltage (INPUT L-L VOLTS) parameter and the Undervoltage Alarm Level (UV ALARM LEVEL)	– **disable** – **enable**	**DISABLE**	Y	Y
DB PROTECTION	(Dynamic Braking Resistor Protection Selection) The dynamic braking IGBT is limited as to when it can be turned "on" (i.e. send power to the dynamic braking resistors). The dynamic braking IGBT is allowed to be "on" while the drive is running (i.e. while the speed regulator is released) and for a period of ten (10) seconds after the drive is stopped. If the dynamic braking IGBT is still "on" ten seconds after the drive stops running, the drive will turn "off" the dynamic braking IGBT (thus stop sending power to the dynamic braking resistors) and declare a "DB VOLTAGE" fault or alarm (whether fault or alarm, depends on setting of this parameter).	– **fault** – **alarm**	**FAULT**	Y	Y

Parameter	Description	Choices	Default	Hidden item	Run lock out
ENCODER FAULT	(Encoder Fault Enable) This parameter allows the user to temporarily disable the Encoder Fault. Adding this feature allows the user to temporarily disable the Encoder Fault during the initial start-up process, when the motor model (defined by the A5 Motor Parameters) is not clearly defined. When the Encoder Fault is disabled (ENCODER FAULT (C1) = disabled), the drive will display the warning message “EncoderFault OFF”, every time the RUN command is removed. IMPORTANT: After the motor parameters in A5 have been established, the Encoder Fault should be enabled (ENCODER FAULT (C1) = enabled).	– **disable** – **enable**	**ENABLE**	Y	Y
STOPPING MODE	(Multi-step Stopping Mode Selection) When the speed command source is set to multi-step (SPD COMMAND SRC (C1)=multi-step), the parameter, STOPPING MODE (C1), determines the stopping mode of the HPV 900. The two selectable methods for the Stopping Mode parameter are “Immediate” and “Ramp to stop”. Note: If the SPD COMMAND SRC (C1) parameter is set to any other definition other than “multi-step”, the drive will behave to the “immediate” stopping mode (independent of the setting of the STOPPING MODE (C1) parameter). The “Immediate” stopping mode requires the drive to be at zero speed prior to removing the “Run” command. The “Immediate“ selection is how the HPV 900 has traditionally behaved prior to the addition of this parameter. The “Ramp to stop” stopping mode is intended for use when removing the “Run” command prior to the drive reaching zero speed (as defined by the AB ZERO SPD LEV (A1) parameter). When the “Run” command is removed and the speed reference is above zero speed, the speed reference will ramp to zero speed following the selected s-curve.	– **immediate** – **ramp to stop**	**IMMEDIATE**	Y	Y

Parameter	**Description**	**Choices**	**Default**	**Hidden item**	**Run lock out**
MOTOR OVRLD SEL	(Motor Overload Select) This parameter selects the action to be taken by drive when declaring a user selectable Motor Overload. When the motor overload level is reached, the options are: • Alarm – the drive only declares a motor overload and the user is responsible for action • Flt immediate – the drive will immediately declare a fault and turn-off the drive's output • Fault at stop – the drive will delay declaring a fault until the run command is removed	– **alarm** – **flt immediate** – **fault at stop**	**ALARM**	Y	Y
AUTO STOP	(Auto Stop Function Enable) The Auto Stop function determines how the drive logic will respond to a zero or non-zero speed command. The function will only work when the speed command source is either multi-step or serial (SPD COMMAND SRC (C1)=multi-step or serial). For more information, see Auto Stop on page 65.	– **disable** – **enable**	**DISABLE**	Y	Y
SERIAL MODE	(Serial Mode Selection) This parameter selects between two serial protocols. The choices are: • Mode 1 – selects the Magnetek standard protocol. • Mode 2 – selects a custom protocol. • Mode 2 Test – test mode used only when testing custom protocol serial mode 2.	– **none** – **mode 1** – **mode 2** – **mode 2 test**	**NONE**	Y	Y

User Switches C1 Submenu

<table>
<tr><th>Parameter</th><th>Description</th><th>Choices</th><th>Default</th><th>Hidden item</th><th>Run lock out</th></tr>
<tr><td>SER2 FLT MODE</td><td>(Serial Mode 2 Fault Mode)
Used only with custom serial protocol (mode 2)
This parameter defines the reaction to a serial communications fault while in Serial Mode 2. There are three possible settings:
• Immediate – upon sensing a serial communications fault while in the run mode will result in an immediate stop. The equivalent to removal of the “Drive Enable” logic input.
• Run Remove – upon sensing a serial communications fault while in the run mode, the drive will react in the same manner that removal of the run command would react. In this case, the type of stop will be defined by the STOPPING MODE (C1) parameter.
• Rescue – upon sensing a serial communications fault while in the run mode, an attempt will be made to continue to run at a low speed to the next floor. Upon sensing the fault, the drive will decelerate to a creep speed and continue to run at that speed until the first of the two following termination conditions are reached.
– The hardware “Drive Enable” logic input is removed.
– A timer set by parameter SER2 RS CRP TIME (A1) has elapsed.</td><td>– immediate
– run remove
– rescue</td><td>IMMEDIATE</td><td>Y</td><td>Y</td></tr>
<tr><td>DRV FAST DISABLE</td><td>(Drive Fast Disable)
Addresses how fast the drive responds to the removal of the DRIVE ENABLE logic input.</td><td>– disable
– enable</td><td>DISABLE</td><td>Y</td><td>Y</td></tr>
<tr><td>MLT-SPD TO DLY1</td><td rowspan="4">(Multi-step Speed Command Delay x)
This parameter assigns multi-step speed command to recognition delay timer x as defined by the MSPD DELAY x (A1) parameter. For more information, see MULTI-STEP COMMAND DELAYS on page 65.</td><td rowspan="4">– none
– mspd 1
– mspd 2
– mspd 3
– mspd 4
– mspd 5
– mspd 6
– mspd 7
– mspd 8
– mspd 9
– mspd 10
– mspd 11
– mspd 12
– mspd 13
– mspd 14
– mspd 15</td><td>NONE</td><td>Y</td><td>Y</td></tr>
<tr><td>MLT-SPD TO DLY2</td><td>NONE</td><td>Y</td><td>Y</td></tr>
<tr><td>MLT-SPD TO DLY3</td><td>NONE</td><td>Y</td><td>Y</td></tr>
<tr><td>MLT-SPD TO DLY4</td><td>NONE</td><td>Y</td><td>Y</td></tr>
</table>

Detailed descriptions

HI/LO GAIN SRC
(High / Low Gain Source)
This parameter determines the source of the high / low gain switch.

The speed regulator high / low gain function was developed in response to high performance elevator requirements where the resonant nature of the elevator system interferes with the speed response of the drive.

When the speed response (gain) is set to high levels, the resonant characteristics created by the spring action of the elevator ropes can cause car vibration. To solve this problem, the speed regulator is set to a low enough response (gain) so that the resonant characteristics of the ropes are not excited.

This is accomplished by controlling the sensitivity or response of the speed regulator via the high / low gain switch and gain reduce multiplier.

By using the gain reduce multiplier; the user can specify a lower response (gain) for the speed regulator when the drive is at higher speeds. The gain reduce multiplier (GAIN REDUCE MULT(A1)) tells the software how much lower, as a percentage, the speed regulator response (gain) should be.

The high / low gain switch determines when the HPV 900 is in ‘low gain’ mode. In the ‘low gain’ mode, the gain reduce multiplier has an effect on the speed regulator’s response (gain).

The drive allows for the high / low gain switch to be controlled either externally or internally. The high / low gain source parameter (HI/LO GAIN SRC) allows for this external or internal selection.

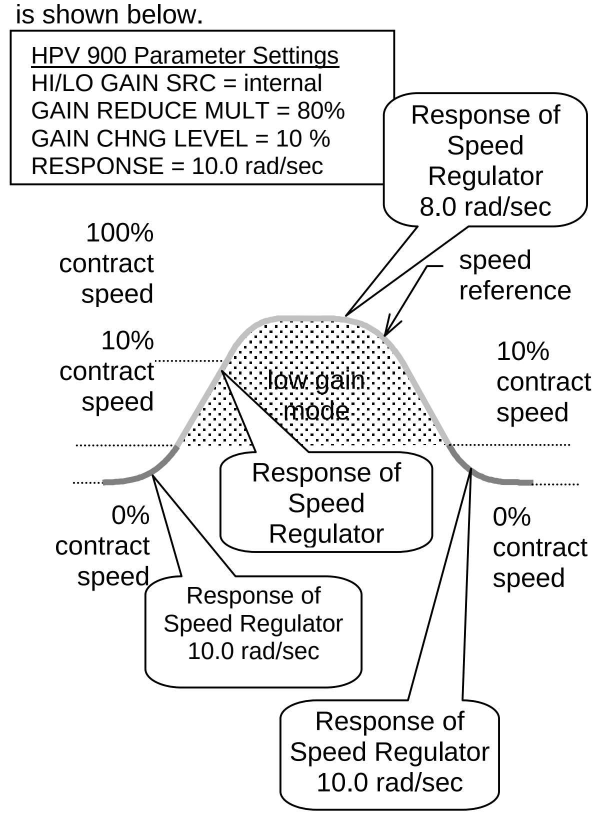
The high / low gain switch can be controlled externally by either:

- a logic input
- the serial channel

The high / low gain switch can also be controlled internal by:

- the gain change level parameter (GAIN CHNG LEVEL), which defines a percentage of contract speed

With the drive set to internal control, the speed regulator will go into ‘low gain’ mode when the drive senses the motor is above a defined speed level. The defined speed level is determined by the gain change level parameter.
An example of internal high / low gain control is shown below.



High / Low Gain Example

SPEED REG TYPE
(Speed Regulator Type)
This switch toggles between the Elevator Speed Regulator (Ereg) and the PI Speed Regulator. Magnetek recommends the use of the Elevator Speed Regulator for better elevator performance. If this parameter is set to external regulator, the drive will be configured as a torque controller.

The source of the external torque command is determined by the EXT TORQ CMD SRC (C1) parameter. The HPV 900 has the following three closed loop speed regulation options and an option for turning off the internal speed regulator:

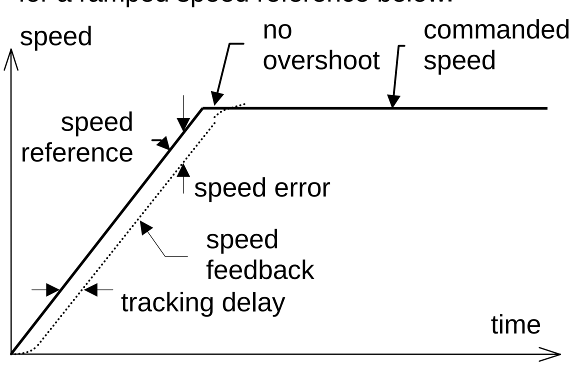
- Elevator Speed Regulator (Ereg)
- PI Speed Regulator
- External Speed Regulator

The Elevator Speed Regulator is recommended for use with elevator applications but is not required. The regulator type can be changed by using the SPEED REG TYPE (C1) parameter.

Elevator Speed Regulator (Ereg)
The use of the Elevator Speed Regulator allows the overall closed loop response between speed reference and speed to be ideal for elevator applications. The desirable features of the Elevator Speed Regulator are:

- no overshoot at the end of accel period
- no overshoot at the end of decel period

One characteristic of the Elevator Speed Regulator is that during the accel / decel period the speed feedback does not match the speed reference creating a speed error or tracking delay. As an example, the Elevator Speed Regulator's speed response is shown for a ramped speed reference below.



Ereg Example

The Elevator Speed Regulator is tuned by:

- System Inertia parameter (INERTIA(A1)), which is easy to obtain by using the drive software to estimate the system inertia.
- Response parameter (RESPONSE(A1)), which is the overall regulator bandwidth in radians per sec. This parameter defines the responsiveness of the speed regulator.

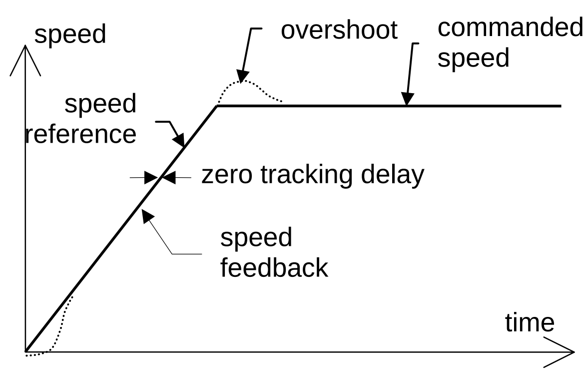
The tracking delay shown is defined as (1/RESPONSE) seconds. The tracking delay is not effected by the gain reduce multiplier.

The inner loop crossover parameter (INNER LOOP XOVER(A1)) should not need to be changed. But if the number is changed, it must satisfy the following formula:

$$\text{inner loop crossover} < \text{response} \times \text{gain reduce multiplier}$$

PI Speed Regulator
When the Proportional plus Integral (PI) speed regulator is used, the response to a speed reference is different. As an example, the PI Speed Regulator's speed response is shown below for a ramped speed reference. With the PI speed regulator, the end of each accel and decel period, there will be an overshoot. The amount of overshoot will be a function of the defined phase margin and response parameters.

Because of this overshoot, the PI regulator is not recommended for elevator control



PI Speed Regulator Example

The PI Speed Regulator is tuned by:

- System Inertia parameter (INERTIA(A1)), which is easy to obtain by using the drive software to estimate the system inertia.
  - Response parameter (RESPONSE(A1)), which is the overall regulator bandwidth in radians per sec. This parameter defines the responsiveness of the speed regulator.
  - Speed Phase Margin parameter (SPD PHASE MARGIN(A1)) is used only by the PI Speed Regulator to define the phase margin of the speed regulator.

RAMPED STOP SEL

(Ramp Stop Select) This parameter allows the selection of the Torque Ramp Down Stop function. This function is used to gradually remove the torque command after the elevator has stopped and the mechanical brake has been set. This prevents a shock and possible ‘bump’ felt in the elevator from the torque signal going to zero too quickly.

A function unique to elevators involves the interaction between the motor torque and the mechanical brake that holds the elevator. Under full load conditions at the end of a run, if the brake is set and the motor torque is removed quickly, some brake slippage may occur. Therefore, the option of gradually reducing the motor torque is provided by the Torque Ramp Down Stop function.

Upon being enabled by the Ramped Stop Select Parameter (RAMPED STOP SEL(C1)), the torque command is linearly ramped to zero from the value that was present when the ‘Ramp Down Enable’ was selected.

The Ramp Down Enable has the following three possible sources:

- An input logic bit (EXTERNAL TB1)
- The run logic – initiated by the removal of the run command
- The serial channel

The Ramp Down Enable Source parameter (RAMP DOWN EN SRC(C1)) is used to select one of the above options.

A method of providing the Ramp Down Enable would be with a logic signal (EXTERNAL TB1) that is dedicated to that function. The Ramp Down Enable would be asserted while the Run command is still present and remain there until the ramp is completed, after which the Run command would be removed.

The RUN LOGIC option to trigger the Ramp Down Enable from the Run command is provided. In this case, removal of the Run command enables the Ramp Down Stop Function.

The time it takes for the HPV 900 to perform its ramped stop is determined by the Ramped Stop Time Parameter. The Ramped Stop Time parameter (RAMPED STOP TIME(A1)) selects the amount of time it would take for the drive to ramp from the rated torque to zero torque.

FAST FLUX

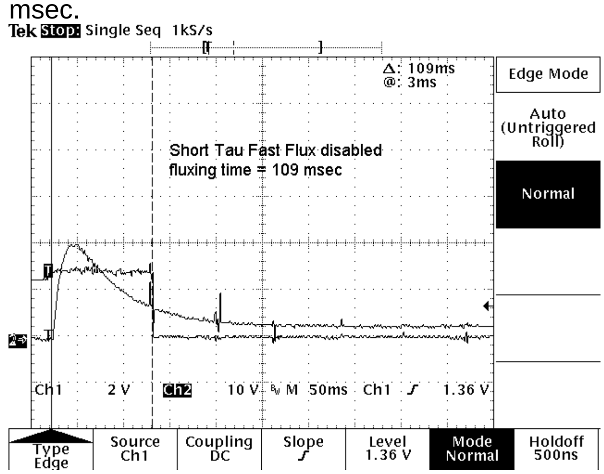
(Fast Flux Enable)

This parameter addresses the method the HPV 900 uses to build up flux in the motor. Enabling the Fast Flux function can decrease the motor fluxing time significantly. By decreasing the motor’s flux time, the starting takeoff time will also be decreased.

Certain motors will have a noticeably long fluxing time, which is indicated by the time between the run command being issued and the speed regulator release output going true. Enabling the Fast Flux function will reduce this delay.

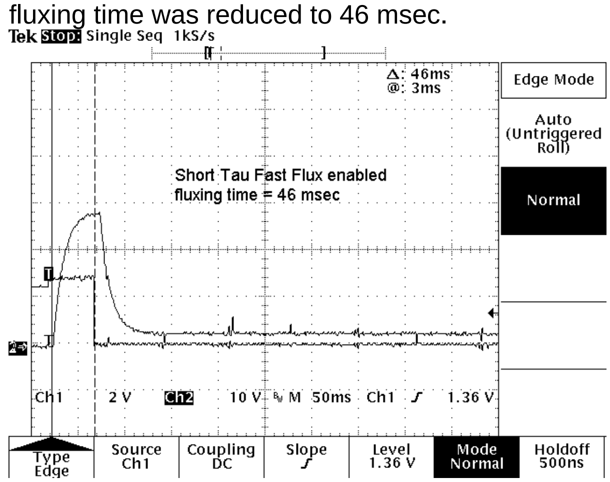
<u>Fast Flux Function with FAST FLUX = disabled</u>

In this example, the motor fluxing time was 109 msec.



<u>Fast Flux Function with FAST FLUX = enabled</u>

With the same motor example, the motor fluxing time was reduced to 46 msec.



S-CURVE ABORT

This parameter, S-CURVE ABORT (C1), addresses how the HPV 900's S-Curve Speed Reference Generator handles a *reduction* in the speed command before the S-Curve Generator has reached its target speed.

Note: the default for the S-CURVE ABORT (C1) parameter is disabled.

S-curve Function with S-CURVE ABORT = disabled

With a normal S-curve function, a change in the speed command is never allowed to violate the defined acceleration or jerk rates. If a reduction in the speed command is issued before the S-Curve generator has reached its target speed, then the jerk rate dictates what speed is reached before the speed may be reduced.

Figure 23 below shows this type of operation. Note the jerk rates are very low to exaggerate proportion of S in the curve to clearly show the overshoot in speed so that the maximum jerk rate is not violated. In this figure, a reduction in the speed command occurs from a high-speed command (which was not yet achieved on the output of the S-Curve) to a low speed command. Note that the speed reference (S-Curve output) continued to increase after the speed command was reduced. This increase is speed was necessary to avoid violation of the jerk rate setting.

S-curve Function with S-CURVE ABORT = enabled

In Figure 24 below, the optional S-Curve abort has been selected. In this case when the speed command is reduced, the speed reference immediately starts to reduce violating the jerk limit (thus no jerk out phase), which could be felt in the elevator.

For optional S-Curve abort to be active requires that:

- The speed command source must be selected as Multi-step (SPD COMMAND SRC=multi-step).
- The S-curve Abort function must be ENABLED (S-CURVE ABORT = enabled).

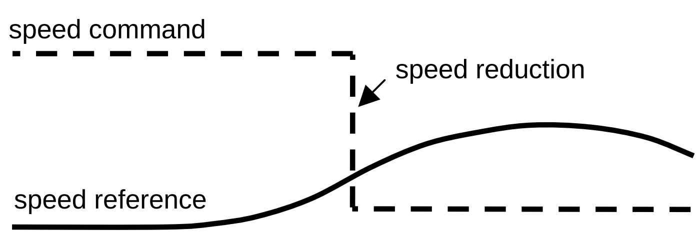


Figure 23: Normal S-curve Abort

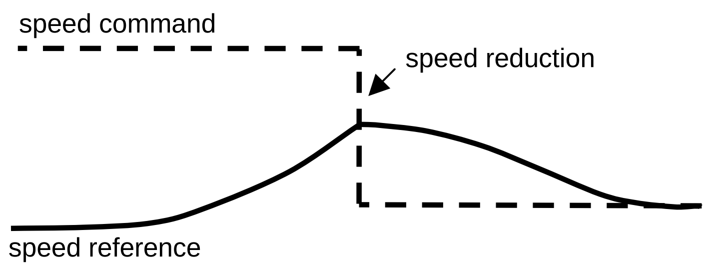


Figure 24: Optional S-curve Abort

AUTO STOP
(Auto Stop Function Enable)
When the speed command source is set to multi-step or serial (SPD COMMAND SRC (C1)=multi-step or serial), the parameter determines the stopping mode of the drive. The two selectable methods for the STOPPING MODE (C1)* parameter are "Immediate" and "Ramp to stop".
The Auto Stop function determines how the drive logic will respond to a zero or non-zero speed command. The function will only work when the speed command source is either multi-step or serial (SPD COMMAND SRC (C1)=multi-step or serial).

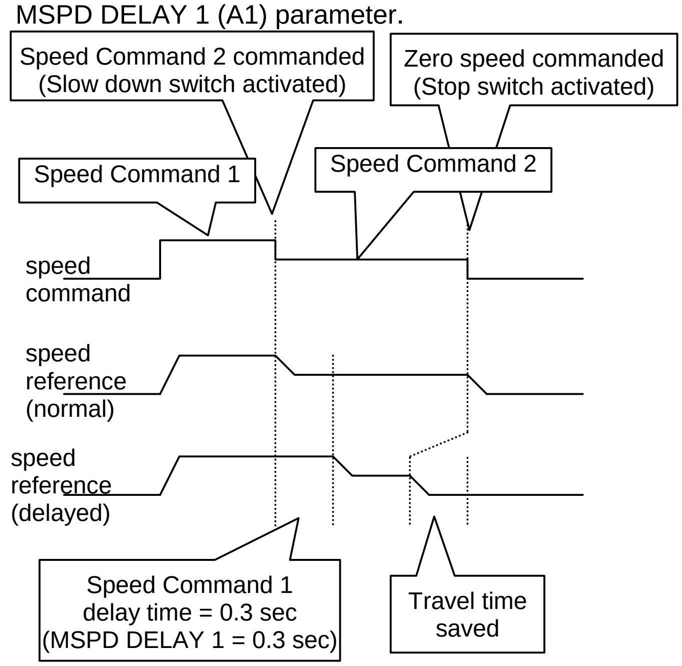
<u>Disabled</u>
When the Auto Stop function is disabled, the magnitude of the speed command plays no part in the logical starting or stopping of the drive.

<u>Enabled</u>
When the Auto Stop function is enabled and the speed command source is either multi-step or serial, the following changes occurs to the start and stop sequence:

- Both a Run command and a non-zero speed command are required to start the drive
- Either the removal of the Run command or the setting the speed command to zero will initiate a stop.

Remember, when the auto stop function is enabled (AUTO STOP (C1)=enabled) both a non-zero multi-step/serial speed command AND the run command are required to start the drive. It makes no difference which signal is enabled first; the drive does not start until both are present. When initiating a stop, which signal is removed first does make a difference.

MULTI-STEP COMMAND DELAYS
When setting up an elevator, slow-down and stop switches are set at fixed locations in the shaft. Once the drive is tuned, it might require the user to move the switches in the shaft in order to minimize the time spent at leveling speed.
Under "normal" operation, the drive speed reference follows the speed command. By configuring for "delayed" operation and setting speed command 1 for a delay (MLT-SPD TO DLY 1 = MSPD 1), the recognition of the speed command change from speed command 1 to any other speed command (in this case speed command 2) will be delayed by the setting of MSPD DELAY 1 (A1) parameter.



Logic Inputs C2 Sub-menu

NOTE: The user can assign particular functions to each input terminal. Only one function per terminal is allowed and multiple terminals cannot have the same function. When a function is assigned to an input terminal, it is removed from the list of possible selections for subsequent terminals.

NOTE: When the word ***Hidden*** appears with the parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. See details on page 75.

NOTE: When the word ***Lockout*** appears with the parameter description, the parameter cannot be changed when the drive is in the RUN mode.

NOTE: The *current* setting of each parameter is displayed in all caps; all other choices in the list are displayed in lower case.

Parameter	**Description**	**Default**	**Hidden Item**	**Run lock out**
LOGIC INPUT 1 TB1-1	Logic Input 1	**DRIVE ENABLE**	Y	Y
LOGIC INPUT 2 TB1-2	Logic Input 2	**RUN**	Y	Y
LOGIC INPUT 3 TB1-3	Logic Input 3	**FAULT RESET**	Y	Y
LOGIC INPUT 4 TB1-4	Logic Input 4	**UP/DWN**	Y	Y
LOGIC INPUT 5 TB1-5	Logic Input 5	**S-CURVE SEL 0**	Y	Y
LOGIC INPUT 6 TB1-6	Logic Input 6	**STEP REF B0**	Y	Y
LOGIC INPUT 7 TB1-7	Logic Input 7	**STEP REF B1**	Y	Y
LOGIC INPUT 8 TB1-8	Logic Input 8	**STEP REF B2**	Y	Y
LOGIC INPUT 9 TB1-9	Logic Input 9	**EXTRN FAULT 1**	Y	Y

<table>
<tr><th>choices…</th><th colspan="2">choice descriptions…</th></tr>
<tr><td>contact cfirm</td><td colspan="2">(Contactor Confirm) Closure of the auxiliary contacts confirming closure of the motor contactor.</td></tr>
<tr><td>drive enable</td><td colspan="2">(Drive Enable) Must be asserted to permit drive to run. This does not initiate run, just permits initiation.</td></tr>
<tr><td>extrn fault 1</td><td>(External Fault 1) User input fault #1</td><td rowspan="3">Closure of this contact will cause the drive to declare a fault and perform a fault shutdown.</td></tr>
<tr><td>extrn fault 2</td><td>(External Fault 2) User input fault #2</td></tr>
<tr><td>extrn fault 3</td><td>(External Fault 3) User input fault #3</td></tr>
<tr><td>extrn /flt 4</td><td colspan="2">(External / Fault 4) User input fault #4. Opening of this contact will cause the drive to declare a fault and perform a fault shutdown.</td></tr>
<tr><td>fault reset</td><td colspan="2">(Fault Reset) If the FAULT RESET SRC (C1) is set to EXTERNAL TB1, the drive’s fault circuit will be reset when this signal is true. If the FAULT RESET SRC switch is set to AUTOMATIC, the drive’s fault circuit will be reset when this signal is true and the automatic fault reset counter, defined by FLT RESETS/HOUR, will be reset to zero.
NOTE: this input is edge sensitive and the fault is reset on the transition from false to true.</td></tr>
<tr><td>low gain sel</td><td colspan="2">(Low Gain Selection) If the HI/LO GAIN SRC switch is set to EXTERNAL TB1, the low gain mode is chosen for the speed regulator when this signal is true.</td></tr>
<tr><td>mech brake hold</td><td colspan="2">(Mechanical Brake Hold) Auxiliary contact closures confirming when the mechanical brake is in the hold mode (engaged).</td></tr>
<tr><td>mech brake pick</td><td colspan="2">(Mechanical Brake Pick) Auxiliary contacts from mechanical brake. Asserted when brake is picked (lifted).</td></tr>
<tr><td>no function</td><td colspan="2">(No Function) Input not assigned. When this setting is selected for one of the TB1 input terminals, any logic input connected to that terminal will have no effect on drive operation.</td></tr>
<tr><td>ospd test src</td><td colspan="2">(Overspeed Test Source) This function works only if the OVRSPEED TEST SRC switch is set to EXTERNAL TB1. A true signal on this input applies the OVERSPEED MULT to the speed command for the next run. After the run command has dropped, the drive returns to ‘normal’ mode and must be re-configured to perform the overspeed function again. The OVERSPEED FLT level is also increased by the OVERSPEED MULT, allowing the elevator to overspeed without tripping out on an overspeed fault.
NOTE: This input must be taken false then true each time that an overspeed test is run. If the input is left in the true, it is ignored after the first overspeed test.</td></tr>
<tr><td>pre-trq latch</td><td colspan="2">(Pre-Torque Latch) Transition from false to true latches pre torque command.</td></tr>
</table>

choices…	***choice descriptions…***	
run	(Run) If drive is enabled through the DRIVE ENABLE logic input, this function will start drive operation.	
run down	(Run Down) If drive is enabled through the DRIVE ENABLE logic input, this function will start drive operation with negative speed commands. Note: if both RUN UP and RUN DOWN are true then the run is not recognized. Note: if DIR CONFIRM (C1) is enabled, this input will not change the polarity of the speed command and will be used to confirm the polarity of the analog speed command as well as starting the operation of the drive.	
run up	(Run Up) If drive is enabled through the DRIVE ENABLE logic input, this function will start drive operation with positive speed commands. Note: if both RUN UP and RUN DOWN are true then the run is not recognized. Note: if DIR CONFIRM (C1) is enabled, this input is also used to confirm the polarity of the analog speed command as well as starting the operation of the drive.	
s-curve sel 0	(S-Curve Select 0) Bit 0 of S-curve selection	These two bits are used to select one of four s-curve selections. *For more information, see S-Curve A2 Submenu on page 41*
s-curve sel 1	(S-Curve Select 1) Bit 1 of S-curve selection	
ser2 insp ena	(Serial Mode 2 Inspection Enable) defines one of the two sources of inspection run command *(only serial mode 2)*	
step ref b0	(Step Reference Bit 0) Bit 0 of multi-step speed command selection	Four inputs, which must be used together as a 4-bit command for multi-step speed selection. *For more information, see Multi-step Ref A3 Submenu on page 43.*
step ref b1	(Step Reference Bit 1) Bit 1 of multi-step speed command selection	
step ref b2	(Step Reference Bit 2) Bit 2 of multi-step speed command selection	
step ref b3	(Step Reference Bit 3) Bit 3 of multi-step speed command selection	
trq ramp down	(Torque Ramp Down) Asserting this ramps torque output to zero at “Ramped Stop Time parameter” rate.	
up/dwn	(Up/Dwn) This logic can be used to change the sign of the speed command. false = no inversion, true = inverted.	

Table 8: Logic Inputs C2 Submenu

Logic Outputs C3 submenu

LOGIC OUTPUT x
(Logic Outputs 1-4)
This parameter defines the function of the logic outputs.
NOTE: The *current* setting of each parameter is displayed in all caps; all other choices in the list are displayed in lower case.

RELAY COIL x
(Relay Logic Outputs 1-2)
This parameter defines the function of the relay logic outputs.
NOTE: The *current* setting of each parameter is displayed in all caps; all other choices in the list are displayed in lower case.

Parameter	Description	Default	Hidden item	Run lock out
LOGIC OUTPUT 1 TB1-14	logic output #1	**READY TO RUN**	Y	Y
LOGIC OUTPUT 2 TB1-15	logic output #2	**RUN COMMANDED**	Y	Y
LOGIC OUTPUT 3 TB1-16	logic output #3	**MTR OVERLOAD**	Y	Y
LOGIC OUTPUT 4 TB1-17	logic output #4	**ENCODER FLT**	Y	Y
RELAY COIL 1	relay output #1	**FAULT**	Y	Y
RELAY COIL 2	relay output #2	**SPEED REG RLS**	Y	Y

choices…	***choice descriptions…***
alarm	(Alarm) The output is true when an alarm is declared by the drive.
alarm+flt	(Alarm and/or Fault) The output is true when a fault and/or an alarm is declared by the drive.
auto brake	(Auto Brake) The output is controlled by the Auto Brake function and is used to open the mechanical brake.
brake alarm	(Brake Alarm) The output is true when the dynamic brake resistor is in an overcurrent condition and the drive is in a run condition.
brake hold	(Brake Hold) The output is true when the brake pick confirmation is received. It is used to show the mechanical brake is remaining open. This function is used with brakes that need to have less than 100% voltage to hold the brake open.
brake pick	(Brake Pick) The output is true when the speed regulator is released and is used to open the mechanical brake.
brk hold flt	(Brake Hold Fault) The output is true when the brake hold command and the brake feedback do not match for the user specified time.
brk igbt flt	(Brake IGBT Fault) The output is true when the dynamic brake resistor is in an overcurrent condition and the drive is not in a run condition.
brk pick flt	(Brake Pick Fault) The output is true when the brake pick command and the brake feedback do not match for the user specified time.
car going dwn	(Car Going Down) The output is true when the motor moves in negative direction faster than the user specified speed.
car going up	(Car Going Up) The output is true when motor moves in positive direction faster than user specified speed.
charge fault	(Charging Fault) The output is true when the DC bus voltage has not stabilized above the voltage fault level or the charge contactor has not closed after charging.
close contact	(Close Motor Contactor) The output is true when the run command is given, the drive is enabled, the software has initialized, and no faults are present.
contactor flt	(Contactor Fault) The output is true when the command to close the contactor and the contactor feedback do not match before the user specified time.
curr reg flt	(Current Regulator Fault) The output is true when the actual current measurement does not match commanded current.
drv overload	(Drive Overload) The output is true when the drive has exceeded the drive overload curve.
encoder flt	(Encoder Fault) The output is true when the drive is declaring an encoder fault
fan alarm	(Fan Alarm) The output is true when the fan on the drive is not functioning.
fault	(Fault) The output is true when a fault is declared by the drive.
flux confirm	(Motor Flux Confirmation) The output is true when the drive has confirmed there is enough flux to issue a speed regulator release (the drive's estimate of flux must reach 75% of reference).
fuse fault	(Fuse Fault) The output is true when the DC bus fuse has blown.
ground fault	(Ground Fault) The output is true when the sum of all phase current exceeds 50% of rated current of the drive.
in low gain	(In Low Gain) The output is true when the speed regulator is in "low gain" mode.
motor trq lim	(Motor Torque Limit) The output is true when the torque limit has been reached while the drive is in the motoring mode. The motoring mode is defined as the drive delivering energy to the motor.

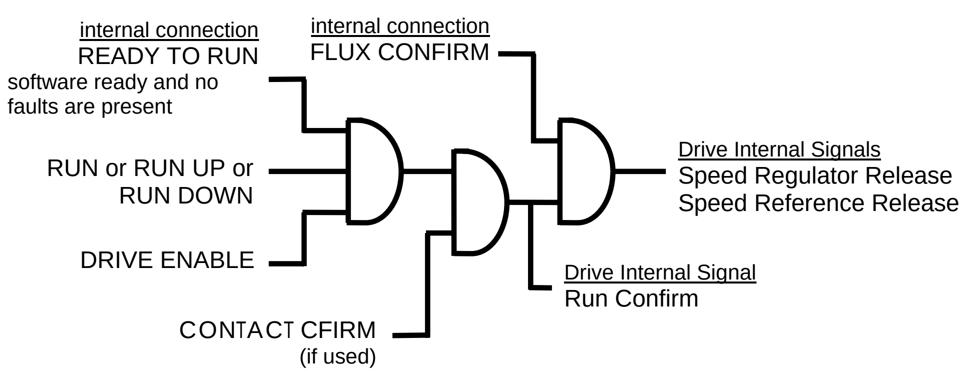
choices…	***choice descriptions…***
mtr overload	(Motor Overload) The output is true when the motor has exceeded the user defined motor overload curve.
no function	(No Function) This setting indicates that the terminal or relay will not change state for any operating condition; i.e. the output signal will be constantly false.
not alarm	(Not Alarm) The output is true when an alarm is NOT present.
over curr flt	(Motor overload current fault) The output is true when the phase current has exceeded 300% of rated current.
overspeed flt	(Overspeed Fault) The output is true when the motor has gone beyond the user defined percentage contract speed for a specified amount of time.
overtemp flt	(Heatsink Over Temperature Fault) The output is true when the drive's heatsink has exceeded 90°C (194°F).
overvolt flt	(Over Voltage Fault) The output is true when the DC bus voltage exceeds 850VDC for a 460V class drive or 425VDC for a 230V class drive.
ovrtemp alarm	(Drive Over Temperature Alarm) The output is true when the drive's heatsink temperature has exceeded 80°C (176°F).
phase fault	(Phase Loss) The output is true when the drive senses an open motor phase.
ramp down ena	(Ramp Down Enable) The output is true after a torque ramp down stop has been initiated by either a logic input, the serial channel, or internally by the drive. When this output is true the torque is being ramped to zero.
ready to run	(Ready to Run) The output is true when the drive's software has been initialized and no faults are present.
regen trq lim	(Regeneration Torque Limit) The output is true when the torque limit has been reached while the drive is in the regenerative mode. The regenerative mode is defined as when the motor is returning energy to the drive. When the drive is in regenerative mode, the energy is dissipated via the dynamic brake circuitry (internal brake IGBT and external brake resistor).
run commanded	(Run Commanded) The output is true when the drive is being commanded to run.
run confirm	(Run Command Confirm) The output is true after the software has initialized, no faults are present, the drive has been commanded to run, the contactor has closed and the IGBTs are firing.
speed dev	(Speed Deviation) The output is true when the speed feedback is failing to properly track the speed reference. The speed deviation needs to be above a user defined level. (Speed Dev. = reference - feedback)
speed dev low	(Speed Deviation Low Level) The output is true when the speed feedback is properly tracking the speed reference. The speed deviation needs to be within a user defined range for a user defined period of time. (Speed Dev. = reference - feedback)
speed ref rls	(Speed Reference Release) The output is true when the flux is confirmed and drive is NOT in DC injection.
speed reg rls	(Speed Regulator Release) The output is true when the flux is confirmed at 75% and brake is commanded to be picked (if used) 
undervolt flt	(Low Voltage Fault) The output is true when the DC bus voltage drops below the user specified percent of the input line-to-line voltage.
up to speed	(Up to Speed) The output is true when the motor speed is above the user specified speed
uv alarm	(Low Voltage Alarm) The output is true when the DC bus voltage drops below the user specified percent of the input line-to-line voltage.
zero speed	(Zero Speed) The output is true when the motor speed is below the user specified speed for the user specified time.

Table 9: Logic Outputs C3 Submenu

Analog Outputs C4 submenu

ANALOG OUTPUT 1
(Analog Outputs 1)
Default: TORQUE REF
This parameter defines the function of the analog output #1.
NOTE: The *current* setting of each parameter is displayed in all caps; all other choices in the list are displayed in lower case.

ANALOG OUTPUT 2
(Analog Outputs 2)
Default: SPEED FEEDBACK
This parameter defines the function of the analog output #2.
NOTE: The *current* setting of each parameter is displayed in all caps; all other choices in the list are displayed in lower case.

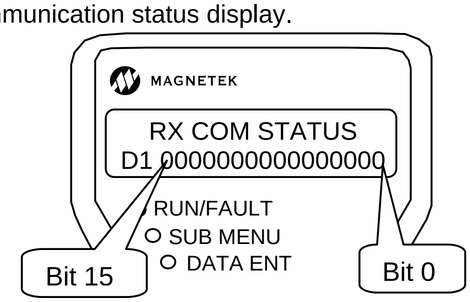
Parameter	**Description**	**Default**	**Hidden item**	**Run lock out**
ANALOG OUTPUT 1 TB1-33	analog output #1	**SPEED REF**	Y	N
ANALOG OUTPUT 2 TB1-35	analog output #2	**SPEED FEEDBACK**	Y	N

choices…	***choice descriptions…***	***D/A units…***
aux torq cmd	(Auxiliary Torque Command) Additional torque command from auxiliary source, when used.	% rated torque
bus voltage	(DC Bus Voltage Output) Measured DC bus voltage.	% of peak in
current out	(Current Output) Percent motor current.	% rated current
drv overload	(Drive Overload) Percent of drive overload trip level reached.	% of trip point
flux current	(Flux Producing Current) Measured flux producing current.	% rated current
flux output	(Flux Output) Measured flux output.	% rated flux
flux ref	(Flux Reference) Flux reference used by vector control	% rated flux
flux voltage	(Flux Producing Voltage) Flux producing voltage reference.	% rated volts
frequency out	(Frequency Output) Electrical frequency.	% rated freq
mtr overload	(Motor Overload) Percent of motor overload trip level reached.	% of trip point
power output	(Power Output) Calculated power output.	% rated power
pretorque ref	(PreTorque Reference) Pre-torque reference.	% base torque
slip frequency	(Motor Slip Frequency) Commanded slip frequency.	% rated frequency
spd rg tq cmd	(Speed Regulator Torque Command) Torque command from speed regulator.	% base torque
speed command	(Speed Command) Speed command before S-Curve	% rated speed
speed error	(Speed Error) Speed reference minus speed feedback.	% rated speed
speed feedbk	(Speed Feedback) Speed feedback used by speed regulator.	% rated speed
speed ref	(Speed Reference) Speed reference after S-Curve	% rated speed
tach rate cmd	(Tachometer Rate Command) Torque command from tach rate gain function.	% base torque
torq current	(Torque Producing Current) Measured torque producing current.	% rated current
torq voltage	(Torque Producing Voltage) Torque producing voltage reference.	% rated volts
torque output	(Torque Output) Calculated torque output.	% rated torque
torque ref	(Torque Reference) Torque reference used by vector control.	% base torque
voltage out	(Voltage Output) RMS motor terminal voltage.	% rated volts

Table 10: Analog Outputs C4 Submenu

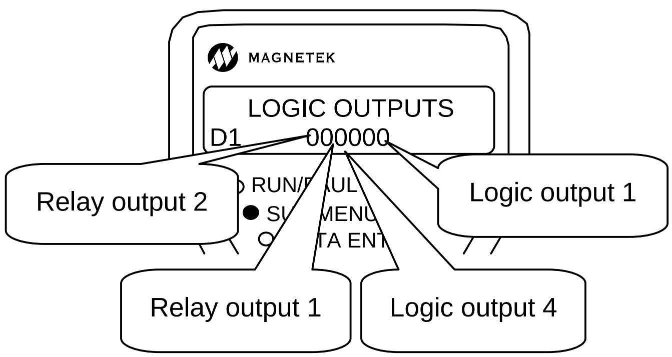
Display D0 menu

Elevator Data D1 submenu

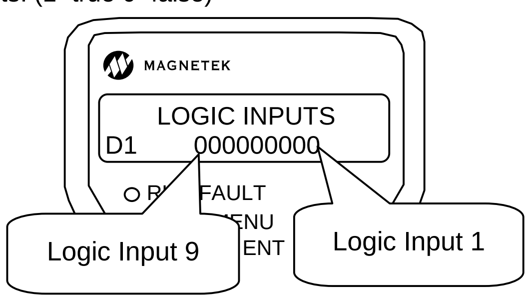
<table>
<tr><th>Parameter</th><th>Description</th><th>Units</th><th>Hidden item</th></tr>
<tr><td>SPEED COMMAND</td><td>(Speed Command) Monitors the speed command before the speed reference generator (input to the S-Curve). This command comes from multi-step references, speed command from analog channel, or the serial channel.</td><td>ft/min or m/s</td><td>N</td></tr>
<tr><td>SPEED REFERENCE</td><td>(Speed Reference) Monitors the speed reference being used by the drive. This is the speed command after passing through the speed reference generator (which uses a S-Curve).</td><td>ft/min or m/s</td><td>N</td></tr>
<tr><td>SPEED FEEDBACK</td><td>(Speed Feedback) Monitors the speed feedback coming from the encoder. It is based on contract speed, motor rpm and encoder pulses per revolution. The drive converts from motor RPM to linear speed using the relationship between the CONTRACT CAR SPD (A1) and CONTRACT MTR SPD (A1) parameters.</td><td>ft/min or m/s</td><td>N</td></tr>
<tr><td>SPEED ERROR</td><td>(Speed Error) Monitors the speed error between the speed reference and the speed feedback. It is equal to the following equation:
$\left|\begin{pmatrix} speed \\ reference \end{pmatrix} - \begin{pmatrix} speed \\ feedback \end{pmatrix}\right| = \begin{matrix} speed \\ error \end{matrix}$</td><td>ft/min or m/s</td><td>N</td></tr>
<tr><td>PRE-TORQUE REF</td><td>(Pre-Torque Reference) Monitors the pre torque reference, coming from either analog channel #2 or the serial channel.</td><td>% rated torque</td><td>N</td></tr>
<tr><td>SPD REG TORQ CMD</td><td>(Regulator Torque Command) Monitors the speed regulator’s torque command. This is the torque command before it passes through the tach rate gain function or the auxiliary torque command. It is the torque required for the motor to follow the speed reference.</td><td>% rated torque</td><td>N</td></tr>
<tr><td>TACH RATE CMD</td><td>(Tachometer Rate Command) Monitors the torque command from the tach rate gain function, (if used).</td><td>% rated torque</td><td>N</td></tr>
<tr><td>AUX TORQUE CMD</td><td>(Auxiliary Torque Command) Monitors the feedforward torque command from auxiliary source, when used.</td><td>% rated torque</td><td>N</td></tr>
<tr><td>EST INERTIA</td><td>(Estimated Inertia) Estimated elevator system inertia.</td><td>secs</td><td>N</td></tr>
<tr><td>RX COM STATUS</td><td>(Serial Communications Status)
Serial communication status display.


<table>
<tr><th>Bit</th><th>Severity</th><th>Name Description/Reason</th></tr>
<tr><td>0</td><td>Info</td><td>RX_INVALID_SETUP_ID; Invalid setup id on setup message</td></tr>
<tr><td>1</td><td>Info</td><td>RX_SETUP_IN_RUN; A setup message to write was received while the serial run bit was set.</td></tr>
<tr><td>2</td><td>Fatal</td><td>RX_TIMEOUT; A COMM FAULT was declared because of a communication time-out.</td></tr>
<tr><td>3</td><td>Info / Fatal</td><td>RX_INVALID_CHECKSUM; If COMM FAULT was declared because of bad message checksums.</td></tr>
<tr><td>4</td><td>Info</td><td>RX_INVALID_MESSAGE; Invalid header character in message.</td></tr>
</table></td><td>1=true, 0=false</td><td>N</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Description</th><th>Units</th><th>Hidden item</th></tr>
<tr><td>RX COM STATUS</td><td>
<table>
<tr><td>Bit</td><td>Severity</td><td>Name Description/Reason</td></tr>
<tr><td>5</td><td>Info</td><td>RX_FIFO_OVERRUN; Overflow has occurred.</td></tr>
<tr><td>6</td><td>Info</td><td>RX_INVALID_RUN_ID; Set if the Cmd_Id sent in the RUN MESSAGE is not in range.</td></tr>
<tr><td>7</td><td>Info</td><td>RX_INVALID_MONITOR_ID (Not available in Mode 2) Set if the Monitor_Id received in the run message is not in range.</td></tr>
<tr><td>8</td><td>Info</td><td>RX_INVALID_FAULT_ID; Set if the Fault_Id sent in the setup message is not in range.</td></tr>
<tr><td>9</td><td>Info</td><td>RX_FAULT_DETECTED; COMM FAULT has been detected</td></tr>
<tr><td>10</td><td>Info</td><td>Fault_Mode_1 (Not available in Mode 1) Immediate Shutdown Mode</td></tr>
<tr><td>11</td><td>Info</td><td>Fault_Mode_2 (Not available in Mode 1) Run Removal Shutdown Mode</td></tr>
<tr><td>12</td><td>Info</td><td>Fault_Mode_3 (Not available in Mode 1) Rescue Shutdown Mode</td></tr>
<tr><td>13</td><td></td><td>N/a</td></tr>
<tr><td>14</td><td></td><td>N/a</td></tr>
<tr><td>15</td><td>Fatal</td><td>RX_COMM_FAULT; COMM FAULT has been declared by the drive</td></tr>
</table>
</td><td>1=true, 0=false</td><td>N</td></tr>
<tr><td>LOGIC OUTPUTS</td><td>(Logic Outputs Status) This display shows the condition of the logic outputs. (1=true 0=false)



</td><td>1=true 0=false</td><td>N</td></tr>
<tr><td>LOGIC INPUTS</td><td>(Logic Inputs Status) This display shows the condition of the logic inputs. (1=true 0=false)



</td><td>1=true 0=false</td><td>N</td></tr>
</table>

Table 11: Elevator Data D1 Submenu

Power Data D2 submenu

Parameter	Description	Units	Hidden item
TORQUE REFERENCE	(Torque Reference) Monitors the torque reference used by the drive control.	**% rated torque**	N
MOTOR CURRENT	(RMS Motor Current Output) Monitors the RMS motor output current.	**Amps**	N
% MOTOR CURRENT	(Percent Motor Current) Monitors the motor current as a percent of rated motor current.	**% rated current**	N
MOTOR VOLTAGE	(Motor Voltage Output) Monitors the RMS motor terminal line-line voltage.	**Volts**	N
MOTOR FREQUENCY	(Motor Frequency Output) Monitors the electrical frequency of the motor output.	**Hz**	N
MOTOR TORQUE	(Motor Torque Output) Calculated motor output torque in terms of percent rated torque.	**% rated torque**	N
POWER OUTPUT	(Power Output) Calculated drive power output.	**KW**	N
DC BUS VOLTAGE	(DC Bus Voltage) Measured voltage of the DC bus.	**Volts**	N
FLUX REFERENCE	(Flux Reference) Flux reference used by the vector control of the drive	**% rated flux**	N
FLUX OUTPUT	(Flux Output) Measured value of the flux output.	**% rated flux**	N
SLIP FREQUENCY	(Slip Frequency) Displays the commanded slip frequency of the motor	**Hz**	N
MOTOR OVERLOAD	(Motor Overload) Displays the percentage of motor overload trip level reached. Once this value reaches 100% the motor has exceeded its user defined overload curve and a motor overload alarm is declared by the drive.	**%**	N
DRIVE OVERLOAD	(Drive Overload) Displays the percentage of drive overload trip level reached. Once this value reaches 100% the drive has exceeded its overload curve and a drive overload fault is declared.	**%**	N
FLUX CURRENT	(Flux Current) Displays the flux producing current of the motor.	**% rated current**	Y
TORQUE CURRENT	(Torque Current) Displays the torque producing current of the motor.	**% rated current**	Y
FLUX VOLTAGE	(Flux Voltage) Displays the flux voltage reference.	**% rated volts**	Y
TORQUE VOLTAGE	(Torque Voltage) Displays the torque voltage reference.	**% rated volts**	Y
BASE IMPEDANCE	(Base Impedance) Displays the drive calculated base impedance, which is based on the RATED MTR PWR and the RATED MTR VOLTS parameters. This value is used to calculate the Per Unit values of the system impedances (i.e. EXTERN REACTANCE and STATOR RESIST).	**Ohms**	N
EST NO LOAD CURR	(Estimated No Load Current) Estimated no load current of the motor calculated by the HPV 900’s adaptive tune.	**%**	N
EST RATED RPM	(Estimated Rated RPM) Estimated rated rpm of the motor calculated by the HPV 900’s adaptive tune.	**RPM**	N

Table 12: Power Data D2 Submenu

Utility U0 menu

U0	Parameter	Description	Default	Choices	Hidden item	Run lock out
U1	**PASSWORD**	*For more information, see PASSWORD on page 75.*				
	ENTER PASSWORD	Allows the user to enter in a password	012345		N	N
	NEW PASSWORD	Used to change the established password			N	N
	PASSWORD LOCKOUT	Used to enable and disable password lockout	DISABLED	disabled enabled	N	N
U2	**HIDDEN ITEMS**	*For more information, see HIDDEN ITEMS on page 75.*				
	HIDDEN ITEMS	Selects if the “hidden” parameters will be displayed on the Digital Operator.	DISABLED	enabled disabled	N	N
U3	**UNITS**	*For more information, see UNITS on page 75.*				
	UNITS SELECTION	Choose either Metric units or standard English measurements units	ENGLISH	english metric	N	Y
U4	**OVRSPEED TEST**	*For more information, see OVERSPEED TEST on page 76.*				
	OVERSPEED TEST?	Allows for Overspeed Test to be enabled via the digital operator	NO	no yes	N	Y
U5	**RESTORE DFLTS**	*For more information, see RESTORE DFLTS on page 77.*				
	RESTORE DRIVE DEFAULTS?	Resets all parameters to default values except parameters in MOTOR A5			N	Y
	RESTORE MOTOR DEFAULTS?	Resets the parameters in the MOTOR A5 to the defaults defined by the MOTOR ID			N	Y
U6	**DRIVE INFO**	*For more information, see DRIVE INFO on page 78.*				
	DRIVE VERSION	Shows the software version of the drive software			N	N
	BOOT VERSION	Shows the lower level software version of the drive			N	N
	CUBE ID	Displays the cube identification number of the drive			N	N
U7	**HEX MONITOR**	*For Magnetek personnel, see HEX MONITOR on page 78.*			N	N
U8	**LANGUAGE SEL**	*For more information, see LANGUAGE SEL on page 78.*				
	LANGUAGE SELECT	Selects language for operator text	ENGLISH	english deutsch *(german)*	N	N

Table 13: Utilities Menu

Detailed Description

PASSWORD
(Password Function)
The following three different screens are used by the password function:

- ENTER PASSWORD
- NEW PASSWORD
- PASSWORD LOCKOUT

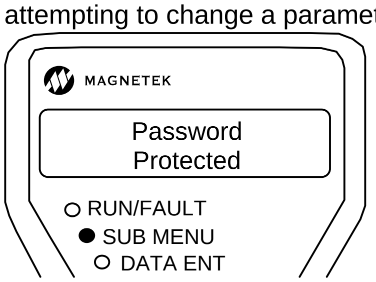
Password Function

The password function allows the user to select a six-digit number for a password. The password function allows the user to lockout changes to the parameters until a valid password is entered.

And with the password lockout enabled, all parameters and display values will be able to be viewed but no changes to the parameters will be allowed until a correct password is entered.

Parameter Protection

If the password lockout is enabled, the following message will appear on the display when attempting to change a parameter.

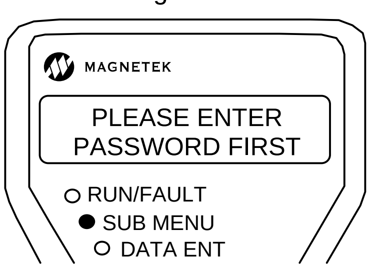


In order to change a parameter after password lockout has been enabled, the following two steps must be followed in the PASSWORD sub-menu:
1) A valid password must be entered in the ENTER PASSWORD screen.
2) The password lockout must be DISABLED in the PASSWORD LOCKOUT screen.

PASSWORD Sub-menu Protection

The following message will appear when in the PASSWORD sub-menu, if you are trying to:

- Enable or disable the password lockout without a valid password being entered.
- Enter a new password without a valid password being entered.



ENTER PASSWORD Screen

This screen allows the user to enter in a password. A valid password must be entered before enabling or disabling the password lockout or changing to a new password.

NEW PASSWORD Screen

This screen is used to change the established password.

NOTE: Remember that a valid password must be entered at the ENTER PASSWORD screen before the established password can be changed.

PASSWORD LOCKOUT Screen

This screen is used to enable and disable password lockout. The factory default for password lockout is DISABLED.

NOTE: Remember that a valid password must be entered at the ENTER PASSWORD screen before the password lockout condition can be changed.

HIDDEN ITEMS
(Hidden Items Function)
The HIDDEN ITEMS sub-menu allows the user to select whether or not “hidden” parameters will be displayed on the Digital Operator. There are two types of parameters, standard and hidden. Standard parameters are available at all times. Hidden parameters are available only if activated. The default for this function is ENABLED (meaning the hidden parameters are visible).

UNITS
(Units Selection Function)
When the UNITS SELECTION sub-menu is displayed, the user can choose either Metric units or Standard English measurements units for use by the drive’s parameters.
IMPORTANT
The unit selection must be made before entering any setting values into the parameters. The user cannot toggle between units after drive has been programmed.

OVERSPEED TEST
(Overspeed Test Function)
The speed command is normally limited by Overspeed Level parameter (OVERSPEED LEVEL(A1)), which is set as a percentage of the contract speed (100% to 150%). But in order to allow overspeed tests during elevator inspections, a means is provided to multiply the speed command by the Overspeed Multiplier parameter (OVERSPEED MULT(A1)).

An overspeed test can be initiated by:
- an external logic input
- the serial channel
- directly from the digital operator

Overspeed Test via Logic Input

The external logic input can be used by:
- Setting the Overspeed Test Source parameter to external tb1.
- Defining a logic input terminal to ospd test src.

NOTE: This logic input requires a transition from false to true to be recognized - this prevents the overspeed function from being permanently enabled if left in the true state.

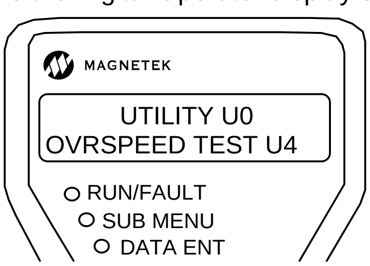
Overspeed Test via Serial Channel

The serial channel can be used by setting Overspeed Test Source parameter to serial.

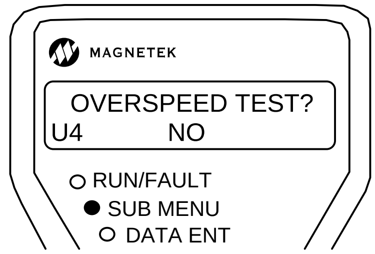
Overspeed Test via Operator

The Digital Operator can also initiate the overspeed test by performing the following:

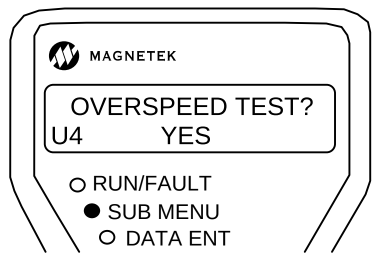
- While the Digital Operator display shows



Press the ENTER key. The sub-menu LED will turn on, and the Digital Operator will display:



- Press the ENTER key again. The sun menu LED will go out and data ent LED will turn on.
- Press the up arrow or down arrow key and the display will change to:



- Press the ENTER key to begin the overspeed test.

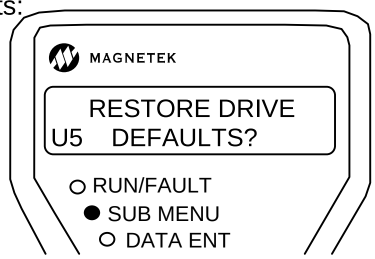
The value in the Overspeed Mult parameter is applied to the speed reference and the overspeed level, so that the elevator can be operated at greater than contract speed and not trip on an Overspeed Fault.
When the Run command is remove after the overspeed test, overspeed test reverts back to its default of NO. In order to run another overspeed test via the Digital Operator, the above steps must be repeated again.

RESTORE DFLTS
(Restore Parameter Defaults)
Two different functions are included in this sub-menu.

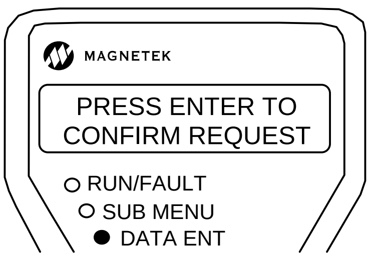
RESTORE DRIVE DEFAULTS

This function resets all parameters to there default values except the parameters in the MOTOR A5 sub-menu.

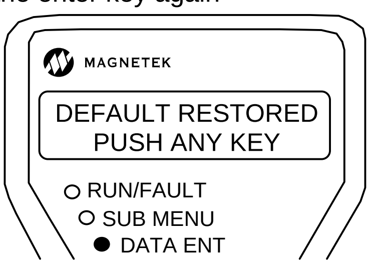
The following shows how to restore the drive defaults:



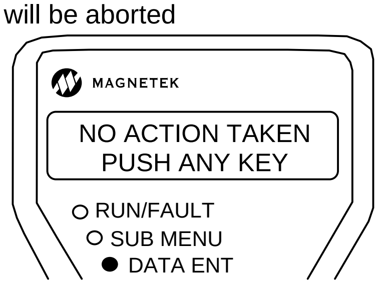
Press the enter key



Press the enter key again

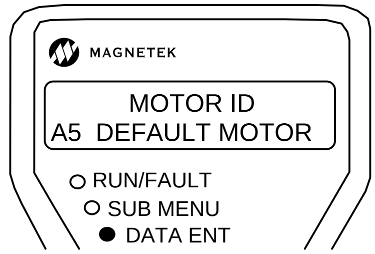


If the esc key is pressed, instead the reset action will be aborted

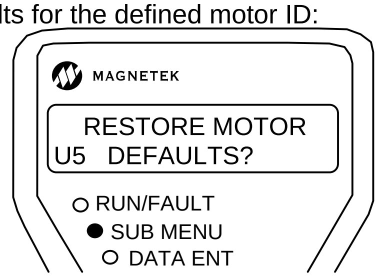


RESTORE MOTOR DEFAULTS

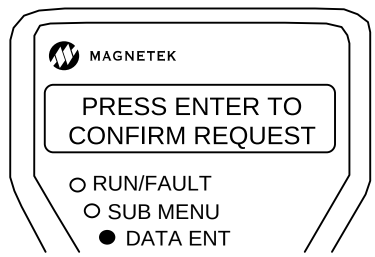
This function resets the parameters in the MOTOR A5 sub-menu to the defaults defined by the MOTOR ID parameter in that sub-menu.



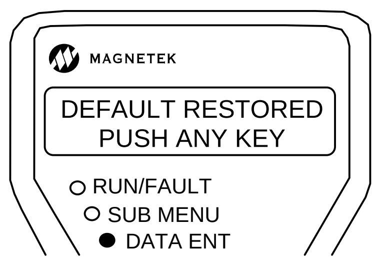
The following shows how to restore the motor defaults for the defined motor ID:



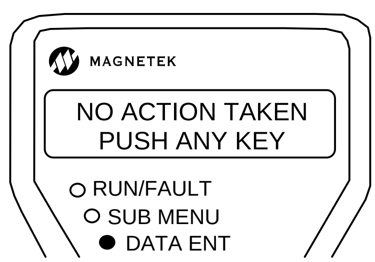
Press the enter key



Press the enter key again



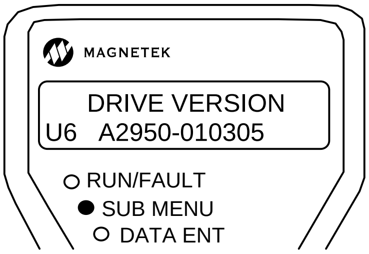
If the esc key is pressed, instead the reset action will be aborted



DRIVE INFO
(Drive Information)
Four different screens are included in this sub-menu, each display an identification number.

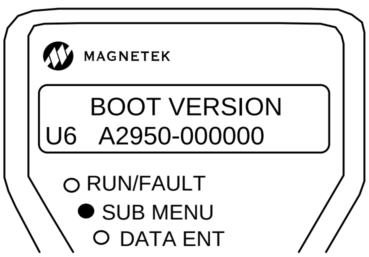
DRIVE VERSION Screen

Shows the software version of the drive software.



BOOT VERSION Screen

Shows the lower level software version of the drive.

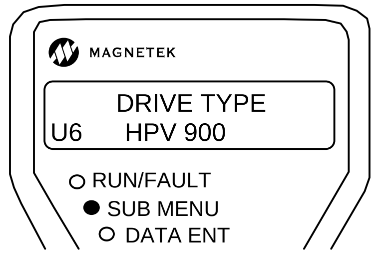


CUBE ID Screen
Displays the cube identification number of the drive.

volts	hp	kw	model	cube size	ID#
460V	5	3.7	-4008	A	5
	10	7.5	-4016	A	7
	15	11	-4021	A	8
	20	15	-4027	B	9
	25	18	-4034	B	10
	30	22	-4041	B	11
	40	30	-4052	B	12
	50	37	-4065	C	13
	60	45	-4077	C	14
	75	55	-4096	C	15
230V	7.5	5.5	-2025	A	31
	10	7.5	-2027	B	32
	15	11	-2041	B	34
	20	15	-2052	B	35
	25	18	-2075	B+	39
	30	22	-2088	B+	40
	25	18	-2104	C	36
	30	22	-2080	C	37
	40	30	-2104	C	38

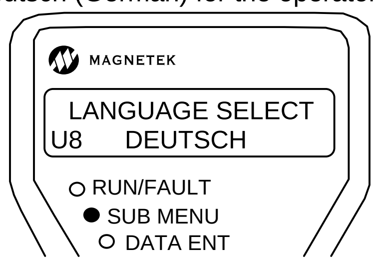
Cube ID Numbers

DRIVE TYPE Screen
Shows the drive software type HPV 900



HEX MONITOR
(Hex Monitor)
The hex monitor was designed for fault and parameter diagnostics. It is intended for use by Magnetek personnel.

LANGUAGE SEL
(Language Selection Function)
When the Language Selection sub-menu is displayed, the user can choose either English or Deutsch (German) for the operator's text.



Fault F0 menu

F0	parameter	description	hidden item	run lock out
F1	ACTIVE FAULTS			
	DISPLAY ACTIVE FAULTS?	Contains a list of the active faults	N	N
	RESET ACTIVE FAULTS?	Allows for reset of active faults	N	N
F2	FAULT HISTORY			
	DISPLAY FAULT HISTORY?	Contains a list of up to the last sixteen faults	N	N
	CLEAR FAULT HISTORY?	Allows for the clearing of the fault history	N	N

Detailed Descriptions

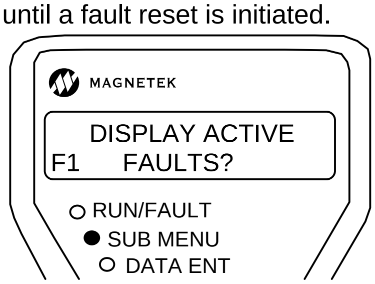
The FAULTS F0 menu does not access settable parameters; instead, it provides a means of examining the drive's active faults and the fault history.
This menu also allows for clearing of active faults in order to get the drive ready to return to operation after a fault shutdown.

ACTIVE FAULTS
(Active Faults)

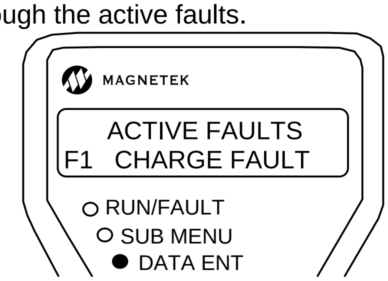
This sub-menu contains a list of the active faults. This sub-menu also allows the user to reset the active faults.

Active Faults List

The active fault list displays and records the active faults. The faults will remain on the fault list until a fault reset is initiated.



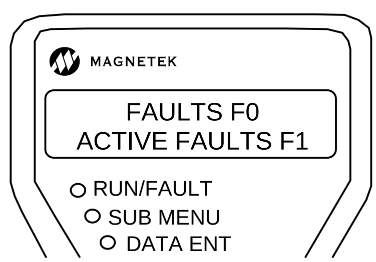
Press the enter key to enter the active fault list. Use the up and down arrow keys to scroll through the active faults.



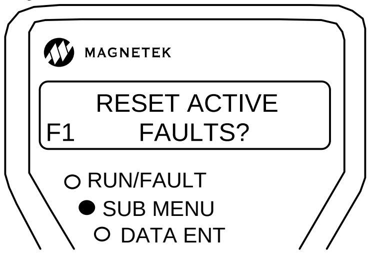
Resetting Active Faults

The Reset Active Faults function allows the user to initiate a fault reset via the digital operator, regardless of the setting of the Fault Reset Source parameter.

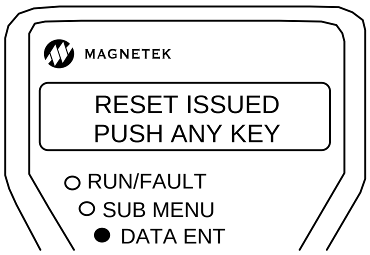
- While the Digital Operator display shows:



Press the ENTER key. The sub-menu LED will turn ON, and the Digital Operator will display:



Press the ENTER key again to begin the fault reset procedure. The sub-menu LED will go out and the data ent LED will turn on.



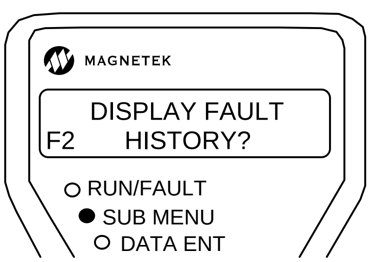
FAULT HISTORY
(Fault History)

This sub-menu contains a list of up to the last sixteen faults.

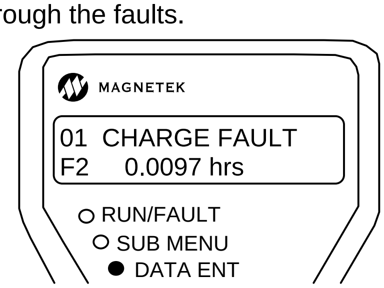
NOTE: The fault history is not affected by the fault reset or a power loss. The fault history can only be cleared by a function in this sub-menu.

Fault History

All faults are on the fault history. The fault history displays the last 16 faults that have occurred and a time stamp indicating when each happened.



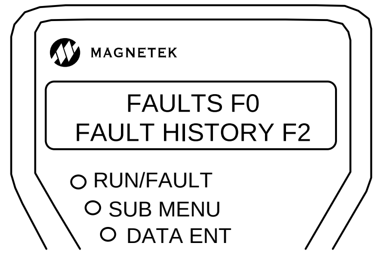
Press the enter key to enter the fault history. Use the up and down arrow keys to scroll through the faults.



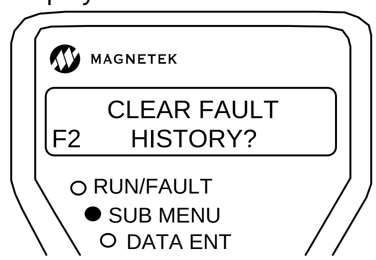
Clearing Fault History

The fault history is not affected by the fault reset or a power loss. The fault history can only be cleared via the user function described below.

- While the Digital Operator display shows:

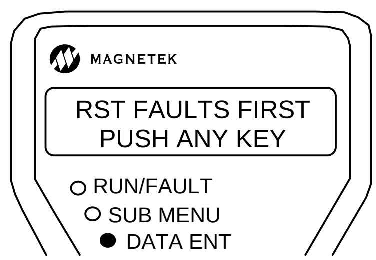


Press the ENTER key. The sub-menu LED will turn ON, and the Digital Operator will display:

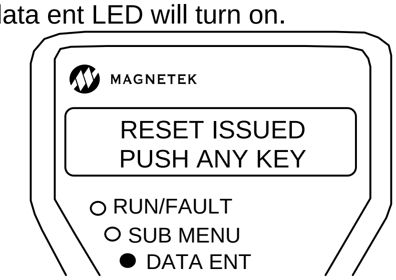


- Press the ENTER key again to begin the fault reset procedure.

The active faults must be cleared in order to clear the fault history. If not the following message will appear when trying to clear the fault history.



The sub-menu LED will go out and the data ent LED will turn on.



Maintenance

Maintenance Overview

Preventive maintenance is primarily a matter of routine inspection and cleaning. The most important maintenance factors are the following:

Is their sufficient airflow to cool the drive?

Has vibration loosened any connections?

The HPV 900 needs to have sufficient air flow for long, reliable operation. Accumulated dust and dirt accumulation can reduce airflow and cause the heat sinks to overheat. The heat sinks can be kept clean by brushing, while using a vacuum cleaner.

Periodically, check air filters on enclosure doors, clean if dirty and replace as necessary.

Periodically, clean the cooling fans to prevent dirt buildup. At the same time, check that the impellers are free and not binding in the housing.

Periodically, check all mounting and electrical connections. Any loose hardware should be tightened.

WARNING
Hazardous voltages may exist in the drive circuits even with drive circuit breaker in off position. NEVER attempt preventive maintenance unless incoming power and control power is disconnected and locked out. Also, ensure the DC Bus charge light is out.

Drive Servicing

Remember when servicing the HPV 900: Hazardous voltages may exist in the drive circuits even with drive circuit breaker in off position.

IMPORTANT
Use extreme caution: Do not touch any circuit board, the drive, or motor electrical connections without making sure that the unit is properly grounded and that no high voltage is present.
NEVER attempt maintenance unless:

- the incoming three phase power and control power is disconnected and locked out.
- also, ensure the DC Bus charge light is out.
- even with the light out, we recommend that you use a voltmeter between (+3) and (-) to verify that no voltage is present.

If after 5 minutes the DC bus charge light remains ON or voltage remains between terminals (+3) and (-):

- First, check that the incoming three phase power is disconnected
- Once the incoming three-phase power is disconnected, it will be necessary to discharge the DC bus with a “bleeder” resistor.

IMPORTANT
Use extreme caution when connecting the bleeding resistor.

Using a 250ohm/100 watt “bleeder” resistor, connect the resistor leads to the (+3) and (-) terminals located on the brake resistor terminal.

The resistor leads should be connected for 20 seconds or until the DC bus charge light extinguishes.

Once the DC bus charge light is out, verify with a voltmeter that no voltage exists between the (+3) and (-) terminals.

It will be necessary to have the drive repaired or replaced.

Reforming Bus Capacitors

The following is a procedure for reforming the electrolytic bus capacitors.

If the drive has been stored for more than 9-months, it is recommended that the bus capacitors be reformed. After 18 months of storage it is ***mandatory*** that the bus capacitors are reformed.

The bus capacitors in the HPV 900 can be reformed *without removing them from the drive.* To reform the capacitors, voltage must be gradually increased as follows: Increase the AC input voltage from zero at a very slow rate, approximately 7 VAC per minute, reaching full rated voltage after about an hour.

This will reform the capacitors.

Lifetime Maintenance

The HPV 900 is an AC digital drive. It is intended to last for twenty years in the field assuming the drive is installed and run according to Magnetek specifications and recommendations. The following recommendations for part replacement to ensure twenty-year life is as follows:

- **Fans - 3 to 8 years**
  depending on ambient temperature and dust
- **Bus Capacitors - 8 to 15 years**
  depending on ambient temperature and elevator system load profile

Troubleshooting

Faults and Alarms

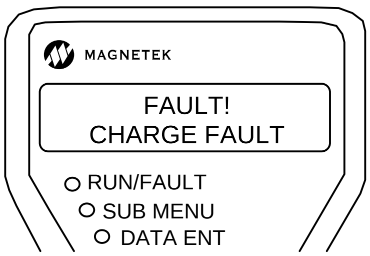
The HPV 900 reports two classes of warnings; these are identified as Faults and Alarms.

Faults and Fault Annunciation

A fault a severe failure that will stop a drive if it has been running and prevent the drive from starting as long as it is present. All faults require some type of action by the user to clear.

There are four means of fault annunciation.

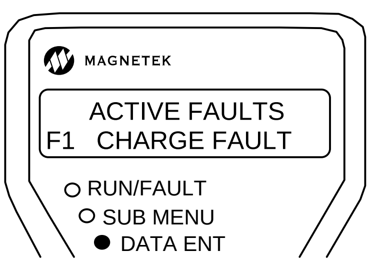
A priority message will be seen on the Digital Operator:



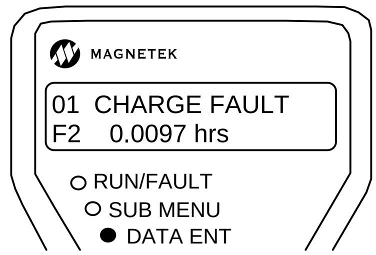
A priority message will overwrite what ever is currently displayed. The user can clear this message by pressing any key on the Digital Operator keypad. If another fault is present, the next fault will appear as a priority message.

NOTE: Clearing the fault priority message from the display DOES NOT clear the fault from the active fault list. The faults must be cleared by a fault reset before the drive will run.

The fault will be placed on the active fault list. The active fault list will display and record currently active faults. The faults will remain on the fault list until an active fault reset is initiated.



The fault will be placed on the fault history. The fault history displays the last 16 faults and a time stamp indicating when each happened. The fault history IS NOT affected by an active fault reset or a power loss. The fault history can be cleared via a user-initiated function.



The user can assign a fault to an external logic output.

Fault Clearing

Most faults can be cleared by performing a fault reset. The fault reset can be initiated by:

- an external logic input
- the serial channel
- automatically by the drive

CAUTION
If the run signal is asserted at the time of a fault reset, the drive will immediately go into a run state.

CAUTION
If the run signal is asserted at the time of a fault reset, the drive will immediately go into a run state. Unless using the auto-fault reset function (FAULT RESET SRC(C1)=automatic) then the run command needs to be cycled.

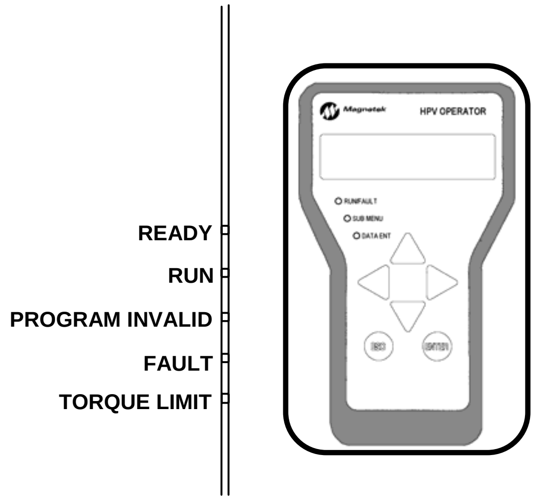
A fault reset can also be done via the Digital Operator.

Troubleshooting Guide

Below lists the HPV 900's faults, alarms, and operator messages along with possible causes and corrective actions.

Note:

- **fault** - a severe failure that will stop a drive if it has been running and prevent the drive from starting as long as it is present. All faults require some type of action by the user to clear.
- **alarm** - only meant for annunciation. It will NOT stop the operation of the drive or prevent the drive from operating.
- **operator message** - operator communications message. It will NOT stop the operation of the drive or prevent the drive from operating.



Status LED	Description	Possible Causes & Corrective Action
READY (green)	The drive is ready to run meaning: • The software is up and ready. • No faults are present.	N/A
RUN (green)	The drive is in operation. • RUN & DRIVE ENABLE logic inputs true • Current being sent to the motor	N/A
PROGRAM INVALID (red)	The HPV 900 is not sensing any valid software in the drive's control board.	**Drive is Not Sensing Software** ⇩ Power cycle the drive. ⇩ If re-occurs, replace Drive Control board ⇩ If re-occurs, check the power supplies, *see Testpoints on page 103.* If there is a problem with power supplies, the drive needs to be replaced.
FAULT (red)	The drive has declared a fault.	**Fault Present in the Drive** ⇩ Use digital operator to check the fault
TORQUE LIMIT (amber)	The drive has reached its torque limit.	**Incorrect Wiring** ⇩ Motor phasing should match the encoder feedback phasing. If the phasing is not correct, the motor will not accelerate up to speed. It will typically oscillate back and forth at zero speed, and the current will be at the torque limit. ⇩ Switch either two motor phases or swap two encoder wires (A and /A). **Drive and/or Motor is Undersized** ⇩ Verify drive and/or motor sizing. May need a larger capacity HPV 900 and or motor. **Check Parameter Settings** ⇩ Check the torque limit parameters MTR TORQUE LIMIT and REGEN TORQ LIMIT (A1) – maximum 250% ⇩ Check speed regulator parameters RESPONSE and INERTIA (A1)

Table 14: Status LED Troubleshooting Guide

The following table lists the HPV 900's faults and alarms along with possible causes and corrective actions.

Note:

- **fault** - a severe failure that will stop a drive if it has been running and prevent the drive from starting as long as it is present. All faults require some type of action by the user to clear.
- **alarm** - only meant for annunciation. It will NOT stop the operation of the drive or prevent the drive from operating.
- **operator message** - operator communications message. It will NOT stop the operation of the drive or prevent the drive from operating.

Name	Description	Possible Causes & Corrective Action
AtoD Fault	The Analog to Digital conversion on the drive's control board is not working properly.	**Drive Control PCB Failure** ⇩ Replace Drive Control board
Brake Alarm *(alarm)*	Dynamic brake resistor overcurrent. Note: After the run command has been dropped, this alarm becomes a Brake IGBT fault.	**Brake Resistor problem** ⇩ Braking Resistor is shorted.
Bridge Fault	The integrated power module is sensing an overcurrent or overtemperature condition *(only A-cubes)*	**Overcurrent Problem** ⇩ Check for a possible short between the motor windings. ⇩ Verify dynamic brake resistor size (could be too small) **Overtemperature Problem** ⇩ Reduce Ambient Temperature ⇩ Clean heat sink ⇩ Check for cooling fan failure The drive may need to be replaced, if no other problem found.
Brk Hold Flt	The brake hold command and the brake feedback did not match for the time specified with Brake Hold Time parameter.	**Check Parameter Settings** ⇩ Check BRAKE HOLD SRC (C1) parameter for the correct source of brake hold feedback ⇩ Check BRAKE HOLD TIME (A1) parameter for the correct brake hold time. If nuisance fault, the fault can be disabled by BRK HOLD FLT ENA (C1) parameter.
Brk IGBT Flt	Dynamic brake resistor overcurrent.	**Brake Resistor problem** ⇩ Braking Resistor is shorted. ⇩ When this fault occurs while the elevator is in motion, it will be declared as a brake fault alarm until the run condition is removed. If the drive is in regeneration an Overvolt Fault may occur instead.

Name	Description	Possible Causes & Corrective Action
Brk Pick Flt	The brake pick command and the brake feedback did not match for the time specified with Brake Pick Time parameter.	**Check Parameter Settings and Mechanical Brake Pick Signal Wiring** ⇩ Check the correct logic input is configured for the correct TB1 terminal and set to MECH BRK PICK (C2) ⇩ Check wiring between the mechanical brake and the terminal on TB1. ⇩ Check BRAKE PICK SRC (C1) parameter for the correct source of brake pick feedback ⇩ Check BRAKE PICK TIME (A1) parameter for the correct brake hold time. If nuisance fault, the fault can be disabled by BRK PICK FLT ENA (C1) parameter.
Charge Fault	The DC bus voltage has not stabilized above the voltage fault level within 2 seconds or the charge contactor has not closed after charging. OR The DC bus voltage is below the UV Fault level as defined by the INPUT L-L VOLTS (A4) and UV FAULT LEVEL (A4) parameters	**DC Choke Connection** ⇩ Check that the DC choke link is present or if using DC choke, check DC choke connections **Low Input Voltage** ⇩ Check INPUT L-L VOLTS (A4) and UV FAULT LEVEL (A4) parameters ⇩ Disconnect Dynamic Braking resistor and re-try. ⇩ Verify proper input voltage and increase, if necessary, the input AC voltage within the proper range ⇩ Check for a missing input phase ⇩ Check power line disturbances due to starting of other equipment **Drive Accurately Reading the Dc Bus** ⇩ Measure the dc bus with a meter ⇩ Compare that with the value on the digital operator, DC BUS VOLTAGE (D2) Drive may need to be replaced
Comm Fault	The drive is being operated by serial communications and one of the following has occurred: • Communication time-out – if the serial run bit is set and the drive does not receive a run-time message for 40 msec • Bad message checksum – drive has detected three consecutive bad message checksums	**Bad Serial Connection** ⇩ Remove and re-seat the RS-422 serial cable ⇩ Check car controller serial driver board ⇩ Check the serial cable connected to the drive's RS-422 port ⇩ Also, the drive's control board may need to be replaced. **Check Parameter Setting** ⇩ If not using serial communications, check SERIAL MODE (C1) = none
Comm Fault Invalid Checksum *(operator)*	The operator received four consecutive invalid messages.	**Noise or Bad Connector Connection** ⇩ Remove and re-seat the operator in its cradle. ⇩ If re-seating of the operator does not work, the operator or the drive's control board may need to be replaced.

Name	Description	Possible Causes & Corrective Action
Comm Fault No Drv Handshake *(operator)*	The operator lost communications with the drive's control board.	**Bad Connector Connection** ⇩ Remove and re-seat the operator in its cradle. ⇩ If re-seating of the operator does not work, the operator or the drive's control board may need to be replaced.
Contactor Flt	The command to close the contactor and the contactor feedback do not match before the time specified by the Contact Flt Time parameter.	**Check Parameter Settings and Contactor** ⇩ Check CONTACT FLT TIME (A1) parameter for the correct contactor fault time. ⇩ Check wiring to logic input configured as CONTACT CFIRM ⇩ Contactor hardware problem **Run Command / Contact Confirm Timing** ⇩ Check Contact Cfirm logic input vs. Run command ⇩ Increase CONTACT FLT TIME (A1) enough for both CONTACT CFIRM and RUN to be active If nuisance fault, the fault can be disabled by CONT CONFIRM SRC (C1) parameter (set to none).
Cube data Flt	The cube (drive) parameters checksum is invalid.	**Parameters Corrupted** ⇩ Re-enter parameters and power-cycle ⇩ If re-occurs, replace Drive Control board
Cube ID Fault	The identification number for the drive is invalid.	**Hardware Problem** ⇩ Power cycle the drive. ⇩ If re-occurs, replace Drive Control board ⇩ If re-occurs, the drive needs to be replaced
Curr Reg Flt	Actual current does not match the command current. The drive is commanding more motor voltage then is available on the input.	**Current Regulation problem** ⇩ Check for a low input line ⇩ Check if drive accurately reading the dc bus • Measure the dc bus with a meter across terminals +3 and – • Compare that with the value on the digital operator, DC BUS VOLTAGE (D2) ⇩ Complete Adaptive Tune and Inertia procedure, *see pages 97-100.* ⇩ Check for a possible motor open phase ⇩ Check if contactor is closing. ⇩ Check for accurate motor parameters (A5) • Verify motor nameplate values are entered correctly • Complete Adaptive Tune and Inertia procedure, *see pages 97-100.* • As a last step, calculate motor parameters from motor's equivalent circuit, *see page 101.* ⇩ Otherwise, replace the drive

Name	Description	Possible Causes & Corrective Action
DB VOLTAGE or **DB VOLTAGE** *(alarm)*	Dynamic braking IGBT is still on ten seconds after the drive stops running	**Too High of Braking Resistor Value** ⇩ Check for no braking resistor ⇩ Possible Brake IGBT Failure ⇩ Possible brake resistor is open **Dynamic Braking Wiring Problem** ⇩ Check dynamic brake hardware wiring **High Input Voltage** ⇩ Decrease input AC voltage with the proper range (see specifications in technical manual) ⇩ Use reactor to minimize voltage spikes **Drive Accurately Reading the DC Bus** ⇩ Measure the dc bus with a meter ⇩ Compare that with the value on the digital operator, DC BUS VOLTAGE (D2) **Hardware Problem** ⇩ Replace Drive Control board ⇩ Replace Drive
DCU data Flt	The DCU parameters checksum is invalid.	**Parameters Corrupted** ⇩ Check & re-enter parameters and power cycle the drive ⇩ If re-occurs, replace Drive Control board
Dir Conflict *(alarm)*	Declared when the speed command is held at zero due conflict with the analog speed command polarity and the run up / run down logic DIR CONFIRM (C1) must be enabled. *For more information on this function, see User Switches C1 Submenu on page 52.*	**Check Parameter Settings** ⇩ Sensitivity determined by the ZERO SPEED LEVEL (A1) **Confirm Speed Command Polarity** ⇩ Check polarity of the analog speed command on analog channel #1 ⇩ Compare that with the RUN UP (positive) and RUN DOWN (negative) logic input status If nuisance, the function can be disabled by DIR CONFIRM (C1) parameter.

Name	Description	Possible Causes & Corrective Action
Drv Ovrload	The drive has exceeded the drive overload curve.	**Excessive Field Weakening** ⇩ Decrease FLUX WKN FACTOR (A1) parameter ⇩ Decrease both MTR TORQUE LIMIT (A1) and REGEN TORQ LIMIT (A1) parameters ⇩ Watch for the Torque Limit LED (see Table 14 on page 83), if lit the torque limits or the flux weakening factor parameters were decreased too much. **Accurate Motor Parameters** ⇩ Verify motor nameplate values are entered correctly ⇩ Complete Adaptive Tune and Inertia procedure, *see pages 97-100.* ⇩ As a last step, calculate motor parameters from motor's equivalent circuit, *see Motor Parameter Calculations on page 101.* **Excessive Current Draw** ⇩ Decrease accel/decel rate ⇩ Is elevator car being held in position? (i.e. mechanical brake not releasing) ⇩ Mechanical brake may not have properly released **Encoder Problem** ⇩ Check encoder coupling: align or replace ⇩ Encoder failure (replace encoder) ⇩ Check encoder count parameter ENCODER PULSES (A1) **Motor Problem** ⇩ Check for motor failure **Drive Sizing** ⇩ Verify drive sizing. May need a larger capacity HPV 900

Name	Description	Possible Causes & Corrective Action
Encoder Flt	The drive is in a run condition and the encoder is: not functioning or not connected. or phasing is not proper with the motor.	**Encoder Should Match Motor Phasing** ⇩ Usually drive's "HIT TORQUE LIMIT" alarm message is displayed (depending on setting of TRQ LIM MSG DLY (A1) parameter) ⇩ Switch either two motor phases or swap two encoder wires (A and /A) **Encoder Power Supply Loss** ⇩ Check 12 or 5 volt supply on terminal strip **Accurate Motor Parameters** ⇩ Verify motor nameplate values are entered correctly ⇩ Complete Adaptive Tune and Inertia procedure ⇩ As a last step, calculate motor parameters from motor's equivalent circuit. **Response of Speed Regulator** ⇩ Enter accurate INERTIA (A1) parameter ⇩ Increase RESPONSE (A1) parameter **Encoder Coupling Sloppy or Broken** ⇩ Check encoder to motor coupling ⇩ Excessive Noise on Encoder Lines ⇩ Check encoder connections. Separate encoder leads from power wiring (cross power lead at 90°) **Other Conditions Causing Fault** ⇩ Check encoder count parameter ENCODER PULSES (A1) ⇩ Possible motor phase loss **Hardware Problem** ⇩ Replace Drive Control board.
EncoderFault OFF *(alarm)*	When the Encoder Fault is disabled (ENCODER FAULT (C1) = disabled), the drive will display the warning message "EncoderFault OFF", every time the RUN command is removed.	**Check Parameter Settings** ⇩ Check the setting of parameter ENCODER FAULT (C1)
Extrn Fault 1	User defined external logic fault input	**Check Parameter Settings and External Fault Signal Wiring** ⇩ Check the correct logic input is configured for the correct TB1 terminal and set to EXTRN FAULT 1 (C2) ⇩ Check external fault is on the correct terminal on TB1.
Extrn Fault 2	User defined external logic fault input	**Check Parameter Settings and External Fault Signal Wiring** ⇩ Check the correct logic input is configured for the correct TB1 terminal and set to EXTRN FAULT 2 (C2) ⇩ Check external fault is on the correct terminal on TB1.

Name	Description	Possible Causes & Corrective Action
Extrn Fault 3	User defined external logic fault input	**Check Parameter Settings and External Fault Signal Wiring** ⇩ Check the correct logic input is configured for the correct TB1 terminal and set to EXTRN FAULT 3 (C2) ⇩ Check external fault is on the correct terminal on TB1.
Extrn /Flt 4	User defined external logic fault input *...Opening of this contact will cause the drive to declare the fault*	**Check Parameter Settings and External Fault Signal Wiring** ⇩ Check the correct logic input is configured for the correct TB1 terminal and set to EXTRN /FLT 4 (C2) ⇩ Check external fault is on the correct terminal on TB1.
Fan Alarm *(alarm)*	The heatsink cooling fan on the drive is not functioning.	**Excessive Heat** ⇩ Reduce Ambient Temperature ⇩ Clean heat sink ⇩ Check for cooling fan failure
Fuse Fault	The DC bus fuse on the drive is open.	**Hardware Problem** ⇩ Check if motor is faulty ⇩ Check if any output phases shorted to ground. ⇩ The drive may need to be replaced.
Ground Fault	The sum of all phase currents has exceeded 50% of the rated amps of the drive.	**Improper Wiring** ⇩ Reset drive faults. Retry. If cleared, reconnect motor and control. If problem continues possible short between the motor windings and chassis ⇩ If problem continues, check system grounding ⇩ Also, the drive may need to be replaced.
HIT TORQUE LIMIT *(alarm)*	The drive has reached its torque limit.	**Incorrect Wiring** ⇩ Motor phasing should match the encoder feedback phasing. If the phasing is not correct, the motor will not accelerate up to speed. It will typically oscillate back and forth at zero speed, and the current will be at the torque limit. ⇩ Switch either two motor phases or swap two encoder wires (A and /A). **Drive and/or Motor is Undersized** ⇩ Verify drive and/or motor sizing. May need a larger capacity HPV 900 and or motor. **Check Parameter Settings** ⇩ Check the torque limit parameters MTR TORQUE LIMIT and REGEN TORQ LIMIT (A1) ⇩ Check speed regulator parameters RESPONSE and INERTIA (A1) ⇩ Alarm sensitivity - TRQ LIM MSG DELAY (A1) parameter determines the amount of time the drive is in torque limit before the alarm message is displayed.

Name	Description	Possible Causes & Corrective Action
HW/SW Mismatch	Software not compatible with hardware	**Incorrect Software** ⇩ HPV 600 software installed in a HPV 900 ⇩ Replace software with correct version
Motor id Flt	Motor parameters checksum is invalid.	**Parameters Corrupted**
Mspd Tmr Flt	This fault is declared if at least two MLT-SPD TO DLY x (C1) parameters are defined to the same multi-step speed command.	**Check Parameters Settings:** ⇩ Check MLT-SPD TO DLY 1 (C1) parameter for setting ⇩ Check MLT-SPD TO DLY 2 (C1) parameter for setting ⇩ Check MLT-SPD TO DLY 3 (C1) parameter for setting ⇩ Check MLT-SPD TO DLY 4 (C1) parameter for setting
Mtr data Flt	Motor Parameters checksum is invalid.	⇩ Check parameters and reset ⇩ If re-occurs, replace Drive Control board
Mtr Overload *(fault or alarm)*	The motor had exceeded the user defined motor overload curve. Note: fault or alarm setting dependant on setting of MOTOR OVRLD SEL (C1) parameter.	**Verify Overload Curve Parameters** ⇩ Check both OVLD START LEVEL (A5) and OVLD TIME OUT (A5) parameters. **Excessive Field Weakening** ⇩ Decrease FLUX WKN FACTOR (A1) parameter ⇩ Decrease both MTR TORQUE LIMIT (A1) and REGEN TORQ LIMIT (A1) parameters ⇩ Watch for the "**Hit Torque Limit" alarm message**, if message appears the torque limits or the flux weakening factor parameters were decreased too much. **Accurate Motor Parameters** ⇩ Verify motor nameplate values are entered correctly ⇩ Complete Adaptive Tune and Inertia procedure (*see pages 97-100).* ⇩ As a last step, calculate motor parameters from motor's equivalent circuit. **Excessive Current Draw** ⇩ Decrease accel/decel rate ⇩ Is elevator car being held in position? (i.e. mechanical brake not releasing) ⇩ Mechanical brake may not have properly released **Encoder Problem** ⇩ Check encoder coupling: align or replace ⇩ Encoder failure (replace encoder) ⇩ Check encoder count parameter ENCODER PULSES (A1) **Motor Problem** ⇩ Check for motor failure

Name	Description	Possible Causes & Corrective Action
Overcurr Flt	The phase current exceeded 300% of rated current.	**Encoder Problem** ⇩ Check encoder coupling: align or replace ⇩ Encoder failure (replace encoder) **Motor Problem** ⇩ Possible motor lead short ⇩ Check for motor failure **Excessive Load** ⇩ Verify motor and drive sizing. May need a larger capacity HPV 900 **Accurate Motor Parameters** ⇩ Verify motor nameplate values are entered correctly ⇩ Complete Adaptive Tune and Inertia procedure, *see pages 97-100.* ⇩ As a last step, calculate motor parameters from motor's equivalent circuit, *see Motor Parameter Calculations on page 101.* **Inaccurate Parameters** ⇩ Check setting of FAST FLUX (C1) ⇩ Disable if enabled **Timing Issue** ⇩ Check Contactor Timing ⇩ Check for a steady RUN command (usually only able to be viewed on a scope) **Hardware Problem** ⇩ The drive may need to be replaced.
Overspeed Flt	Generated when the motor has gone beyond the user defined percentage contract speed for a specified amount of time.	**Check Parameter Settings** ⇩ Check OVERSPEED LEVEL (A1) parameter for the correct level. ⇩ Check OVERSPEED TIME (A1) parameter for the correct time. ⇩ Note: This fault is defined by Overspeed Level parameter and Overspeed Time parameter.
Ovrtemp Alarm *(alarm)*	The heatsink on the drive has exceeded 90°C (194°F).	**Excessive Heat** ⇩ Reduce Ambient Temperature ⇩ Clean heat sink ⇩ Check for cooling fan failure
Overtemp Flt	The heatsink on the drive has exceeded 105°C (221°F).	**Excessive Heat** ⇩ Reduce Ambient Temperature ⇩ Clean heat sink ⇩ Check for cooling fan failure

Name	Description	Possible Causes & Corrective Action
Overvolt Flt	The DC bus voltage of the drive exceeded: 850 Volts for a 460V class drive 425 Volts for a 230V class drive.	**Too High of Braking Resistor Value** ⇩ Check for no braking resistor ⇩ Possible Brake IGBT Failure ⇩ Possible brake resistor is open **Dynamic Braking Wiring Problem** ⇩ Check dynamic brake hardware wiring **High Input Voltage** ⇩ Decrease input AC voltage with the proper range ⇩ Use reactor to minimize voltage spikes **Drive Accurately Reading the Dc Bus** ⇩ Measure the dc bus with a meter across terminals +3 and – ⇩ Compare that with the value on the digital operator, DC BUS VOLTAGE (D2) **Hardware Problem** ⇩ Replace Drive Control board
PCU data Flt	PCU parameters checksum is invalid.	**Parameters Corrupted** ⇩ Check parameters and power cycle ⇩ If re-occurs, replace Drive Control board
Phase Flt	The drive senses an open motor phase. The drive senses more than one motor phase crossing zero at the same time.	**Motor Problem** ⇩ Check motor wiring ⇩ Check for motor failure ⇩ Check for bad contactor or contactor timing issue.
Ser2 Spd Flt	This fault is declared if the SER2 INSP SPD (A1) or SER2 RS CRP SPD (A1) parameters have exceeded contract speed (CONTRACT CAR SPD (A1) parameter).	**Check Parameters Settings:** ⇩ Check SER2 INSP SPD (A1) parameter, if greater than CONTRACT CAR SPD (A1) parameter. ⇩ Check SER2 RS CRP SPD (A1) parameter, if greater than CONTRACT CAR SPD (A1) parameter.
Setup Fault 1	This fault is declared if the rated motor speed and excitation frequency do not satisfy: $9.6 < \left[120\left(\begin{matrix}rated\\excitation\\frequency\end{matrix}\right)\right] - \left[\left(\begin{matrix}\#\\poles\end{matrix}\right)\left(\begin{matrix}rated\\motor\\speed\end{matrix}\right)\right] < 1222.3$ *…checks for too low or too high value of slip*	**Check Parameters Settings:** ⇩ Check RATED EXCIT FREQ (A5) parameter for correct setting ⇩ Check RATED MTR SPEED (A5) parameter for correct setting ⇩ Check MOTOR POLES (A5) parameter for correct setting
Setup Fault 2	This fault is declared if the number of poles and encoder pulses per revolution do not satisfy: $\frac{\left(\begin{matrix}encoder\\pulses\end{matrix}\right)}{\left(\begin{matrix}\#\\poles\end{matrix}\right)} > 64$	**Check Parameters Settings:** ⇩ Check ENCODER PULSES (A1) parameter for correct setting ⇩ Check MOTOR POLES (A5) parameter for correct setting
Setup Fault 3	This fault is declared if the number of poles is not an even number.	**Check Parameters Settings:** ⇩ Check MOTOR POLES (A5) parameter for correct setting

Name	Description	Possible Causes & Corrective Action
Setup Fault 4	This fault is declared if the contract motor speed (in rpm) and encoder pulses/revolution do not satisfy: $300{,}000 < \begin{pmatrix} contract \\ motor \\ speed \end{pmatrix} \begin{pmatrix} encoder \\ pulses \end{pmatrix} < 18{,}000{,}000$	**Check Parameters Settings:** ⇩ Check ENCODER PULSES (A1) parameter for correct setting ⇩ Check CONTRACT MTR SPD (A1) parameter for correct setting
Setup Fault 5	This fault is declared if the rated motor power (in watts) and rated motor voltage do not satisfy: $(0.07184)\left[\frac{\begin{pmatrix} rated \\ motor \\ power \end{pmatrix}}{\begin{pmatrix} rated \\ motor \\ voltage \end{pmatrix}}\right] < \begin{matrix} general \\ purpose \\ current \\ rating \\ of \\ drive \end{matrix}$	**Check Parameters Settings:** ⇩ Check RATED MOTOR PWR (A5) parameter for correct setting ⇩ Check RATED MTR VOLTS (A5) parameter for correct setting
Setup Fault 6	This fault is declared if the multi-step speed references have exceeded a defined limit, which is defined in terms of a percentage of contract speed (CONTRACT CAR SPD parameter).	**Check Parameters Settings:** ⇩ Check SPEED COMMAND1-16 (A3) parameters, if greater than 110% of CONTRACT CAR SPD (A1) parameter
Setup Fault 7	This fault is declared if the run logic inputs are defined incorrectly. You can either choose group #1 (RUN and UP/DWN) or group #2 (RUN UP and RUN DOWN). But you cannot mix and match or this fault will be declared.	**Check Parameters Settings:** ⇩ Check configurations of logic inputs (C2) – either RUN & UP/DWN or RUN UP & RUN DOWN
Setup Fault 8	This fault is declared if the DIR CONFIRM (C1) parameter is enabled and any of the following conditions are not met: A logic input (C2) must be assigned to RUN UP. A logic input (C2) must be assigned to RUN DOWN. The SPD COMMAND SRC (C1) parameter must be set to ANALOG INPUT *... Confirms proper set-up of Analog Speed Command direction confirm function*	**Check Parameters Settings:** ⇩ Check configurations of logic inputs (C2) for two logic input defined as RUN UP & RUN DOWN ⇩ Verify SPD COMMAND SRC (C1) is set to ANALOG INPUT ⇩ If nuisance fault and not using Up-Down Confirm function disabled by setting the DIR CONFIRM (C1) parameter to DISABLED
Speed Dev *(alarm)*	The speed feedback is failing to properly track the speed reference. Sensitivity determined by SPD DEV HI LEVEL (A1) parameter.	**Fault LED lit?** ⇩ If fault LED lit, check which fault occurred ⇩ Speed Deviation is only an alarm and will not light the Fault LED **Check Parameters Settings:** ⇩ Verify SPD DEV HI LEVEL (A1) is set to the proper level. **Torque Limit LED lit?** ⇩ If Torque Limit LED is lit during running, verify the Fault LED is NOT lit. ⇩ Then, increase the torque limit parameters MTR TORQUE LIMIT and REGEN TORQ LIMIT (A1) – maximum 250%

Name	Description	Possible Causes & Corrective Action
Tq Lim **2Hi 4cube**	The torque limits (based on the defined motor) exceed the cube's capacity *(only B+ cubes)*	**Check Parameters Settings** ⇩ Verify motor nameplate values are entered correctly in the A5 sub-menu ⇩ Decrease both MTR TORQUE LIMIT (A1) and REGEN TORQ LIMIT (A1) parameters **Drive Sizing** ⇩ Verify drive sizing. May need a larger capacity HPV 900
Undervolt Flt	Generated during a run condition when the DC bus voltage drops below the user specified percent of the input line-to-line voltage. The input line-to-line voltage is specified by the Input L-L Volts parameter and the fault level is specified by the Undervoltage Fault Level parameter.	**Low Input Voltage** ⇩ Check INPUT L-L VOLTS (A4) and UV FAULT LEVEL (A4) parameters ⇩ Disconnect Dynamic Braking resistor and re-try. ⇩ Verify proper input voltage and increase, if necessary, the input AC voltage within the proper range ⇩ Check for a missing input phase ⇩ Check power line disturbances due to starting of other equipment **Drive Accurately Reading the Dc Bus** ⇩ Measure the dc bus with a meter across terminals +3 and – ⇩ Compare that with the value on the digital operator, DC BUS VOLTAGE (D2) **Hardware Problem** ⇩ The drive may need to be replaced.
Uv Alarm *(alarm)*	Generated during a run condition when the DC bus voltage drops below the user specified percent of the input line-to-line voltage. The input line-to-line voltage is specified by the Input L-L Volts parameter and the fault level is specified by the Undervoltage Alarm Level parameter.	**Low Input Voltage** ⇩ Check INPUT L-L VOLTS (A4) and UV ALARM LEVEL (A4) parameters ⇩ Disconnect Dynamic Braking resistor and re-try. ⇩ Verify proper input voltage and increase, if necessary, the input AC voltage within the proper range ⇩ Check for a missing input phase ⇩ Check power line disturbances due to starting of other equipment **Drive Accurately Reading the Dc Bus** ⇩ Measure the dc bus with a meter across terminals +3 and – ⇩ Compare that with the value on the digital operator, DC BUS VOLTAGE (D2) **Hardware Problem** ⇩ The drive may need to be replaced.

Operator Communication Messages	Description	Possible Causes & Corrective Action
Ready, Waiting For Drive	The operator is waiting to establish communications with the drive's control board.	**Normal, if displayed momentarily** ⇩ No action is required, if the message disappears shortly after power-up of the operator. **Bad Connector Connection** ⇩ Remove and re-seat the operator in its cradle. ⇩ If re-seating of the operator does not work, the operator or the drive's control board may need to be replaced.
Comm Fault Invalid Checksum	The operator received four consecutive invalid messages.	**Noise or Bad Connector Connection** ⇩ Remove and re-seat the operator in its cradle. ⇩ If re-seating of the operator does not work, the operator or the drive's control board may need to be replaced.
Comm Fault No Drv Handshake	The operator lost communications with the drive's control board.	**Bad Connector Connection** ⇩ Remove and re-seat the operator in its cradle. ⇩ If re-seating of the operator does not work, the operator or the drive's control board may need to be replaced.

Figure 25: Operator Troubleshooting Guide

Appendix

Adaptive Tune

The adaptive tune automatically calculates, under certain operating conditions, the percentage no load current and the rated rpm (slip frequency). The HPV 900 software uses these two adaptive tune calculated values to obtain the maximum performance from the motor.

Adaptive Tune Operating Conditions

The HPV 900 software estimates the motor's percent no load current and the motor's rated rpm. These estimated values are only estimated around a window of ±25% of the parameter settings for:

- percent no-load current (% NO LOAD CURR)
- rated motor speed (RATED MTR SPEED)

The adaptive tune will estimate:

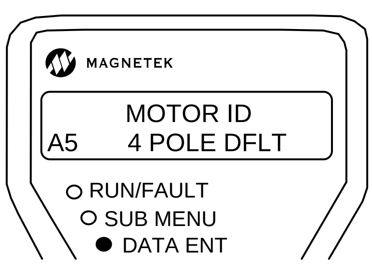
- the motor's percent no load current when the motor torque is below 20%.
- the motor's rated rpm when the motor torque is above 30%.

Using the Adaptive Tune to Obtain Maximum Motor Performance

The following is a step-by-step procedure to optimize the window around which the adaptive tune will estimate its two values. NOTE: Although the listed speeds are recommended, the adaptive tune procedure can be ran initially at lower speeds, as long as the speed is greater than 10% of contract speed.

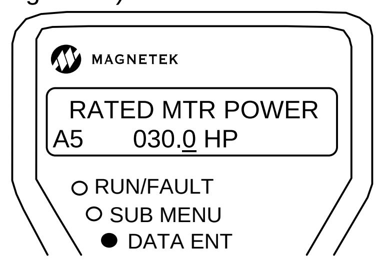
Initial Set-up

- Select a valid Motor ID or one of the two default motors (either 4 or 6 pole) for the MOTOR ID parameter



The default motor selections for the motor id will place a zero values in the motor nameplate parameters (see Figure 26). This selection will also load nominal values for the other motor parameters listed in Table 15

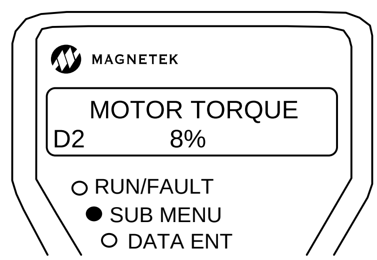
- Now, enter the motor nameplate data into the needed motor nameplate parameters (see Figure 26)



Tuning Motor No-Load Current

With a balanced car, run the car at 70% contract speed from top floor to the bottom floor then back to the top floor.

- During these runs verify under DISPLAY MENU - POWER DATA D2 that the MOTOR TORQUE is between ±15%. If the value is larger then ±15% the car is not balanced correctly.



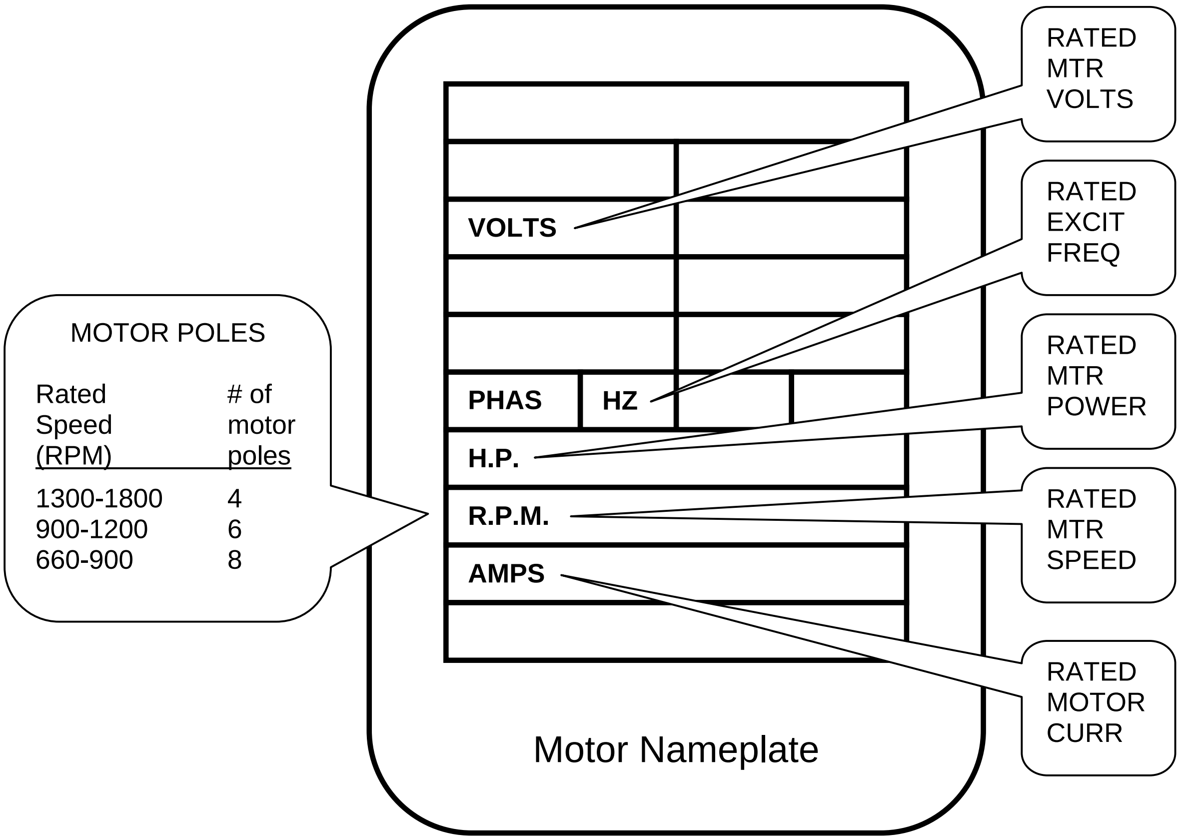


Figure 26: Motor Parameters Entered from Motor Nameplate

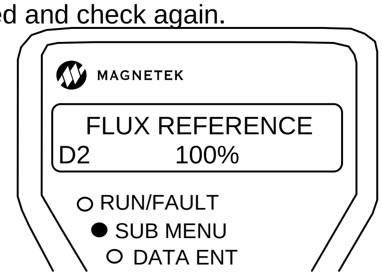
description	*parameter*	*4 pole dflt*	*6 pole dflt*
percentage no load current	% NO LOAD CURR	35.0 %	45.0 %
stator leakage reactance	STATOR LEAKAGE X	9.0 %	7.5 %
rotor leakage reactance	ROTOR LEAKAGE X	9.0 %	7.5 %
stator resistance	STATOR RESIST	1.5 %	1.5 %
motor loss - motor iron loss	MOTOR IRON LOSS	0.5 %	0.5 %
motor loss - motor mechanical loss	MOTOR MECH LOSS	1.0 %	1.0 %
flux curve - flux saturation break point	FLUX SAT BREAK	75 %	75 %
flux curve - flux saturation slope #1	FLUX SAT SLOPE 1	0 %	0 %
flux curve - flux saturation slope #2	FLUX SAT SLOPE 2	50 %	50 %

Table 15: Nominal Values for Motor Parameters

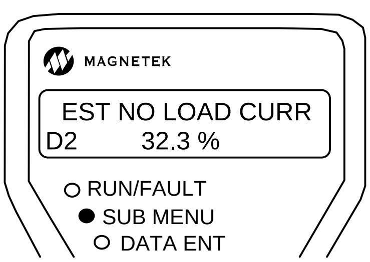
NOTE: If you are having problems getting the motor torque under 15% the cause may be:

- <u>No compensation chains</u>
  If the elevator system has no compensation chains, achieving balanced condition may be difficult. In that case, the MOTOR TORQUE should be between ±15% for as much of the run as possible.
- <u>High elevator system friction</u>
  If the elevator system has high friction, achieving motor torque of under 15% may be difficult. In that case, have less than the balance car weight in the car, thus letting the counterweight help to overcome the frictional losses. In this case, the you should look only at the estimated values in the up direction and run the car in the up direction a number of times before changing any parameter settings.

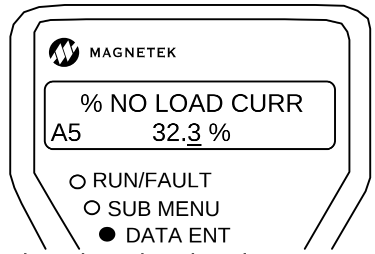
- Also, verify that the FLUX REFERENCE is 100%. If the value is not equal to 100% reduce the speed to less then 70% contract speed and check again.



- While still performing these top / bottom runs observe under DISPLAY MENU - POWER DATA D2 the EST NO LOAD CURR value.



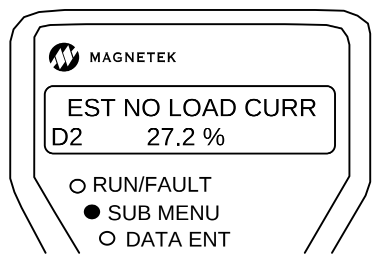
Enter this estimated value into the motor parameter.



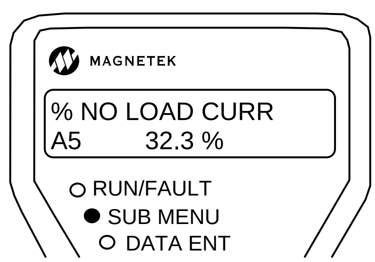
- Continue iterating the above two steps until the two values are within 2%. If the values do not converge after two iterations, verify the information entered in the initial set-up is correct.
- After the values converge, again verify the MOTOR TORQUE < 15% and the FLUX REFERENCE = 100%.

Tuning Motor's Flux Saturation Curve
With a <u>balanced car, run the car at 100% contract speed</u> from top floor to the bottom floor then back to the top floor.

- During these top / bottom runs observe under DISPLAY MENU - POWER DATA D2 the EST NO LOAD CURR value.

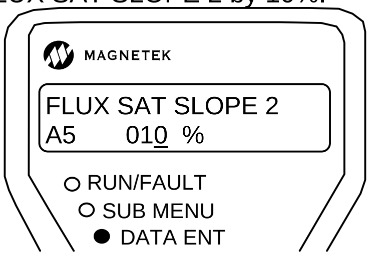


- Compare the displayed value EST NO LOAD CURR with the value entered for % NO LOAD CURR under the ADJUST MENU - MOTOR A5



If the EST NO LOAD CURR is 2% larger than the % NO LOAD CURR then, decrease the FLUX SAT SLOPE 2 by 10%.

- If the EST NO LOAD CURR is 2% smaller than the % NO LOAD CURR then, increase the FLUX SAT SLOPE 2 by 10%.



NOTE: If the EST NO LOAD CURR and % NO LOAD CURR are within 2% of each other, then continue on to Tuning the Rated Motor RPM.

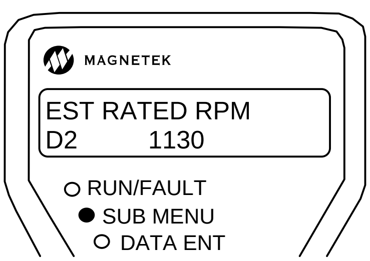
- Continue iterating FLUX SAT SLOPE 2 in 10% increments until the EST NO LOAD CURR and % NO LOAD CURR are within 2% of each other.

NOTE: Remember <u>change only the FLUX SAT SLOP 2</u> parameter DO NOT change any other parameter (these were fixed in the previous steps).

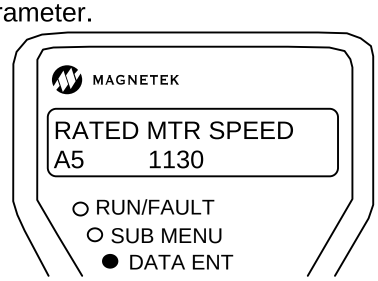
Tuning Rated Motor RPM

With a <u>full-load car, run the car at 100% contract speed</u> from top floor to the bottom floor then back to the top floor.

- During these top / bottom runs observe under DISPLAY MENU - POWER DATA D2 the EST RATED RPM value.



- Enter this estimated value into the motor parameter.



- Continue iterating the above to steps until the two values are within 3 RPM.

NOTE: Remember <u>change only the RATED MTR SPEED</u> parameter DO NOT change any other parameter (these were fixed in the previous steps).

Estimating System Inertia

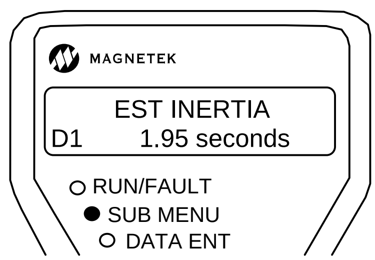
The HPV 900 software can be used to calculate the inertia of the entire elevator, which is used for accurate tuning of the speed regulator.

The following is a step-by-step procedure for using the HPV 900 to estimate the elevator system inertia.

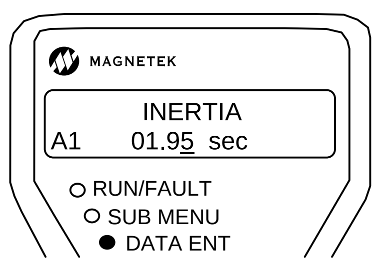
Using the Software to Estimate the System's Inertia

With a <u>balanced car, run the car at 100% contract speed</u> from top floor to the bottom floor then back to the top floor.

- Observe the EST INERTIA under DISPLAY MENU - ELEVATOR DATA D1 for both the down and up direction.



- Average the two values and enter the DRIVE A1 parameter.



Appendix

Motor Parameter Calculations

The default motor selections (4 POLE DFLT or 6 POLE DFLT will load nominal values (see Table 6 on page 47) for the following motor parameters: % NO LOAD CURR, STATOR LEAKAGE X, ROTOR LEAKAGE X, STATOR RESIST, MOTOR IRON LOSS, and MOTOR MECH LOSS.

Most of the time the nominal values will work just fine. But in some cases, these motor parameter values must be precisely calculated.

Motor Manufacturer Data

The following is list of data that would be needed from a motor manufacturer in order to precisely calculate the motor parameters.

1. Rated voltage
2. Rated frequency
3. Rated kW or HP
4. Rated (full-load) Current (under conditions 1,2 and rated torque)
5. Power factor (under 1,2 and rated torque)
6. Rated RPM (under 1,2 and rated torque)
7. No load Current under 1 and 2
8. Iron Loss under 1 and 2
9. Mechanical loss under 1 and 2
10. Per phase Stator resistance
11. Stator leakage Inductance
12. Rotor leakage Inductance

Calculation from the Motor's Equivalent Circuit

This section details how to calculate the following HPV 900 motor parameters, which are entered as a percentage of the base impedance:

- Stator Leakage Reactance (STATOR LEAKAGE X)
- Rotor Leakage Reactance (ROTOR LEAKAGE X)
- Stator Resistance (STATOR RESIST)

Also,

- Motor Iron Loss (MOTOR IRON LOSS)
- Motor Mechanical Loss (MOTOR MECH LOSS)
- Initial value for Percentage No Load Current (% NO LOAD CURR)

The following data is required:

- Rated motor power in KW (or HP)
- Rated motor frequency (f)
- Rated motor current (I_{rated})
- Rated motor line-to-line voltage (V_{l-l})
- Equivalent single-phase circuit of the motor

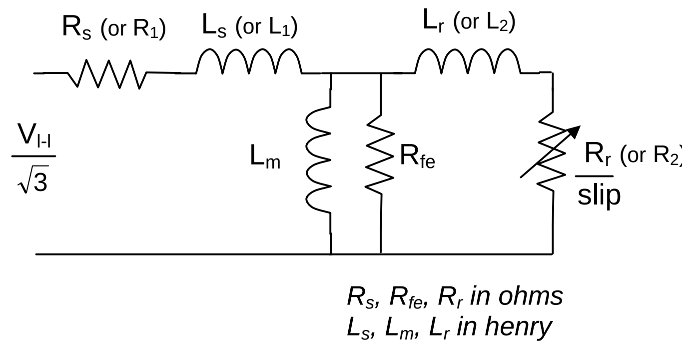


Figure 27: Equivalent single-phase circuit of the motor (Y connected)

Calculate Base Impedance

Calculate Z_{base} (base impedance)

$$Z_{base} = \frac{V_{l-l}^2}{power\ (in\ kW) \times 1000}$$

Note: KW = HP × 0.746

Calculate Stator Resistance

Calculate R_s (STATOR RESIST) as a percentage of the base impedance

$$R_s(\%) = \frac{R_s\ \ (in\ ohms)}{Z_{base}} \times 100$$

Note: R_s is per phase (Y connected)

Calculate Stator Reactance

Calculate L_s (STATOR LEAKAGE X) as a percentage of the base impedance

$$L_s(\%) = \frac{2\pi f \times L_s \quad (in\ henry)}{Z_{base}} \times 100$$

Note: if XL_s are available then do not use ($2\pi f$) and L_s is per phase (Y connected)

Calculate Rotor Reactance

Calculate L_r (ROTOR LEAKGE X) as a percentage of the base impedance

$$L_r(\%) = \frac{2\pi f \times L_r \quad (in\ henry)}{Z_{base}} \times 100$$

Note: if XL_r are available then do not use ($2\pi f$) and L_r is per phase (Y connected)

Calculate Motor Iron Loss

Calculate Motor Iron Loss (MOTOR IRON LOSS) as a percentage of the motor's rated power

$$\%\ Iron\ Loss = \frac{V_{l-l}^2 \times \frac{1}{R_{fe} \quad (in\ ohms)}}{power\ (in\ KW) \times 1000} \times 100$$

$$\%\ Iron\ Loss = \frac{total\ iron\ loss\ (in\ kW)}{power\ (in\ KW) \times 1000} \times 100$$

Note: KW = HP × 0.74 and R_{fe} is per phase (Y connected)

Calculate Motor Mechanical Loss

Calculate Motor Mechanical Loss (MOTOR MECH LOSS) as a percentage of the motor's rated power

$$\%\ Mechanical\ Loss = \frac{total\ loss\ (in\ kW)}{power\ (in\ KW) \times 1000} \times 100$$

Note: KW = HP × 0.746

Calculate Percentage No Load Current

Calculate Percentage No Load Current (%NO LOAD CURR) as a percentage of the motor's rated current

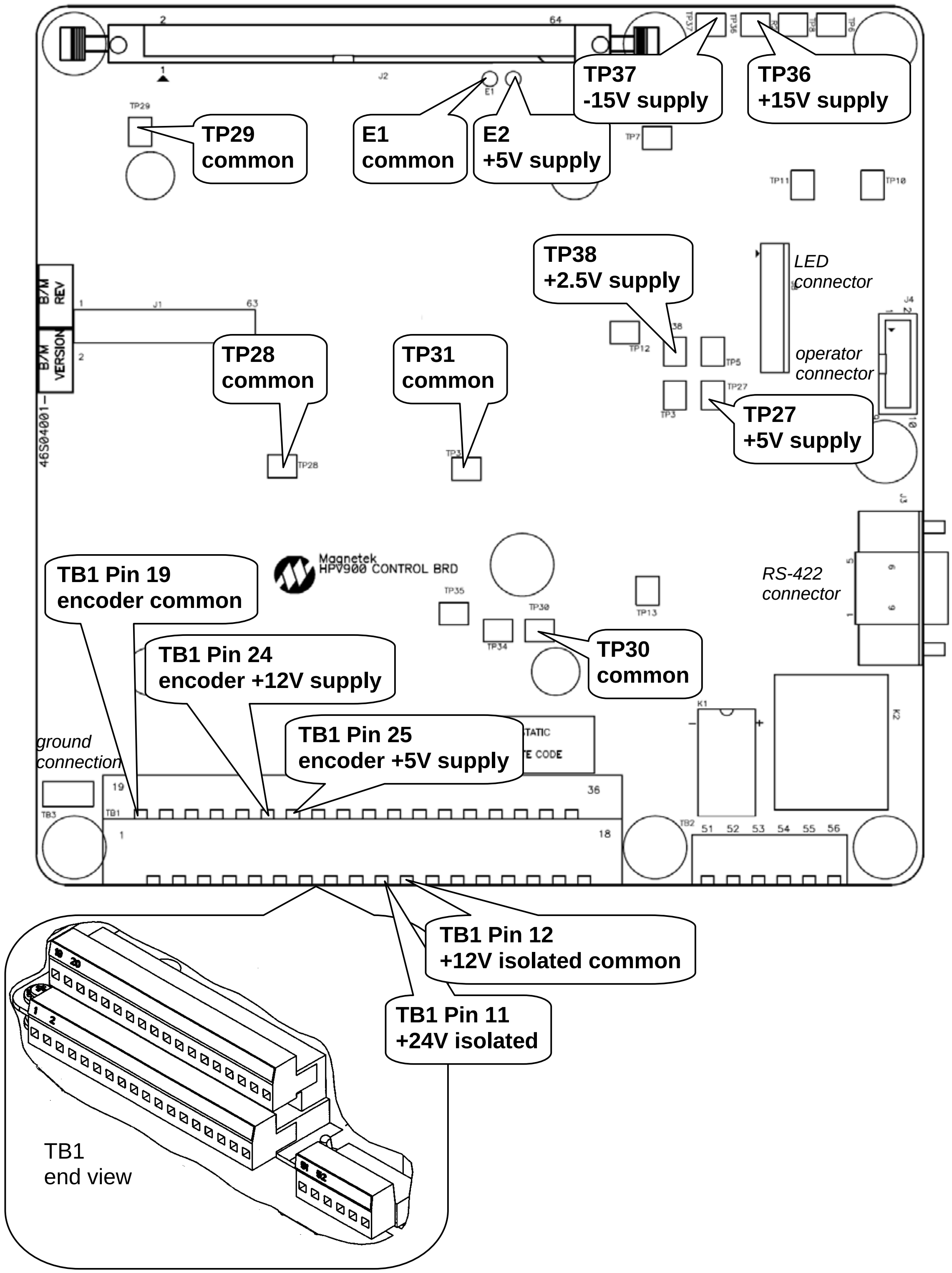
$$\%\ no\ load\ current = \frac{\left(\frac{V_{l-l}}{\sqrt{3}}\right)}{2\pi f \times L_m \times I_{rated}}$$

Note: if XL_m are available then do not use ($2\pi f$) and L_m is per phase (Y connected)

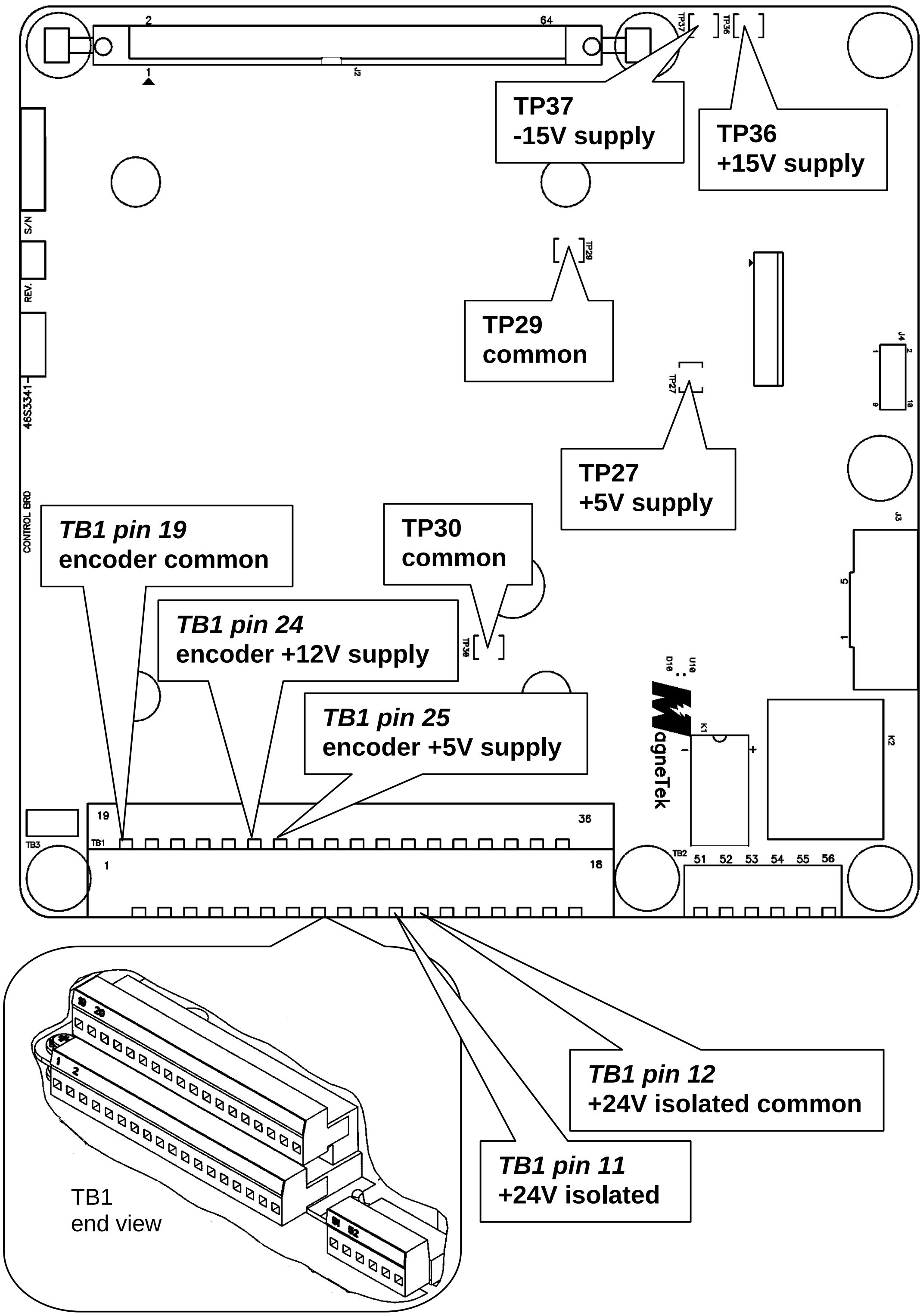
After this initial value is entered, use the adaptive tune procedure (see Adaptive tune on page 97) to properly tune.

Appendix

Testpoints (Power Supply)
Part Number 46S04000-0010

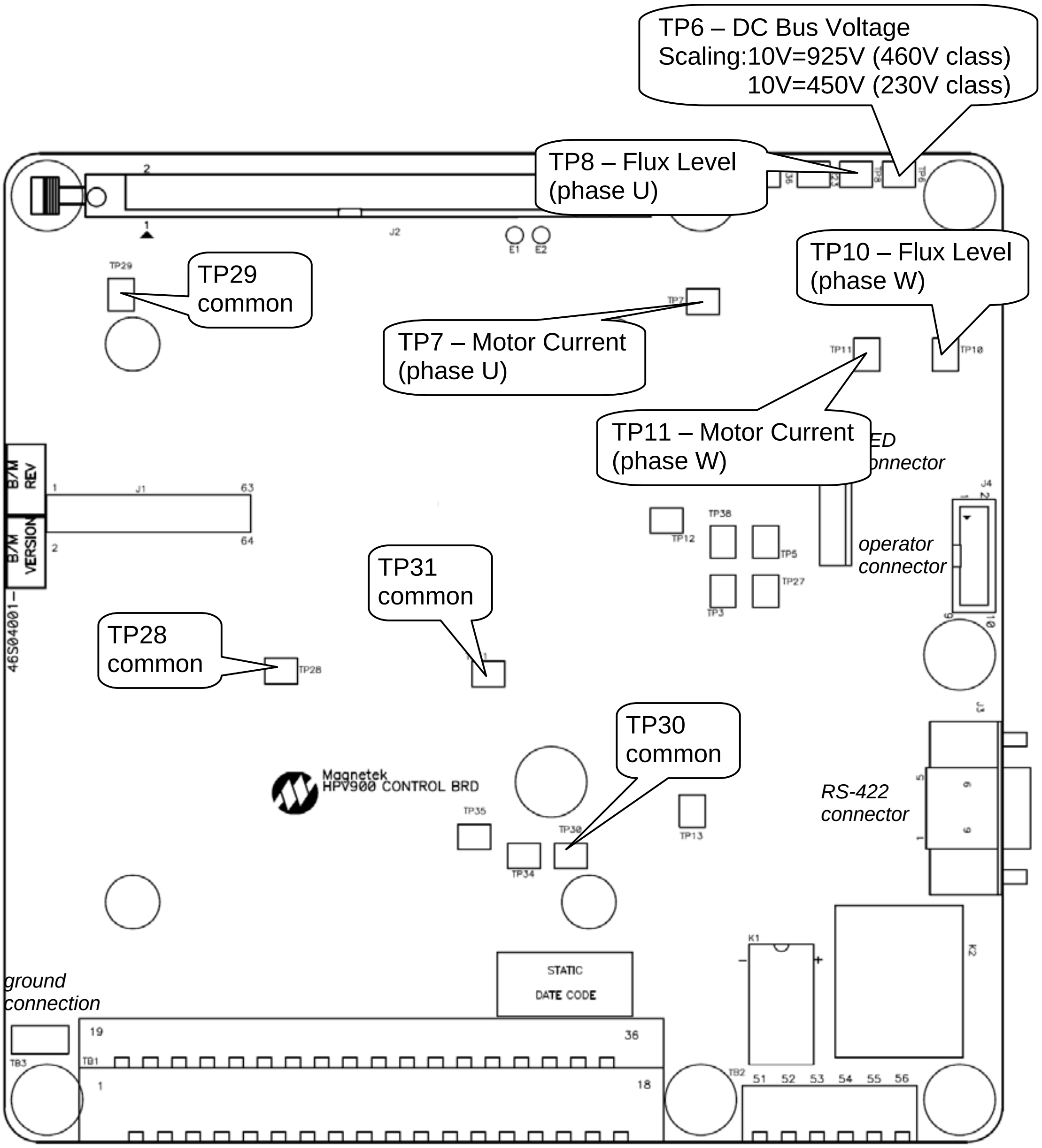


Part Number 46S03341-0010

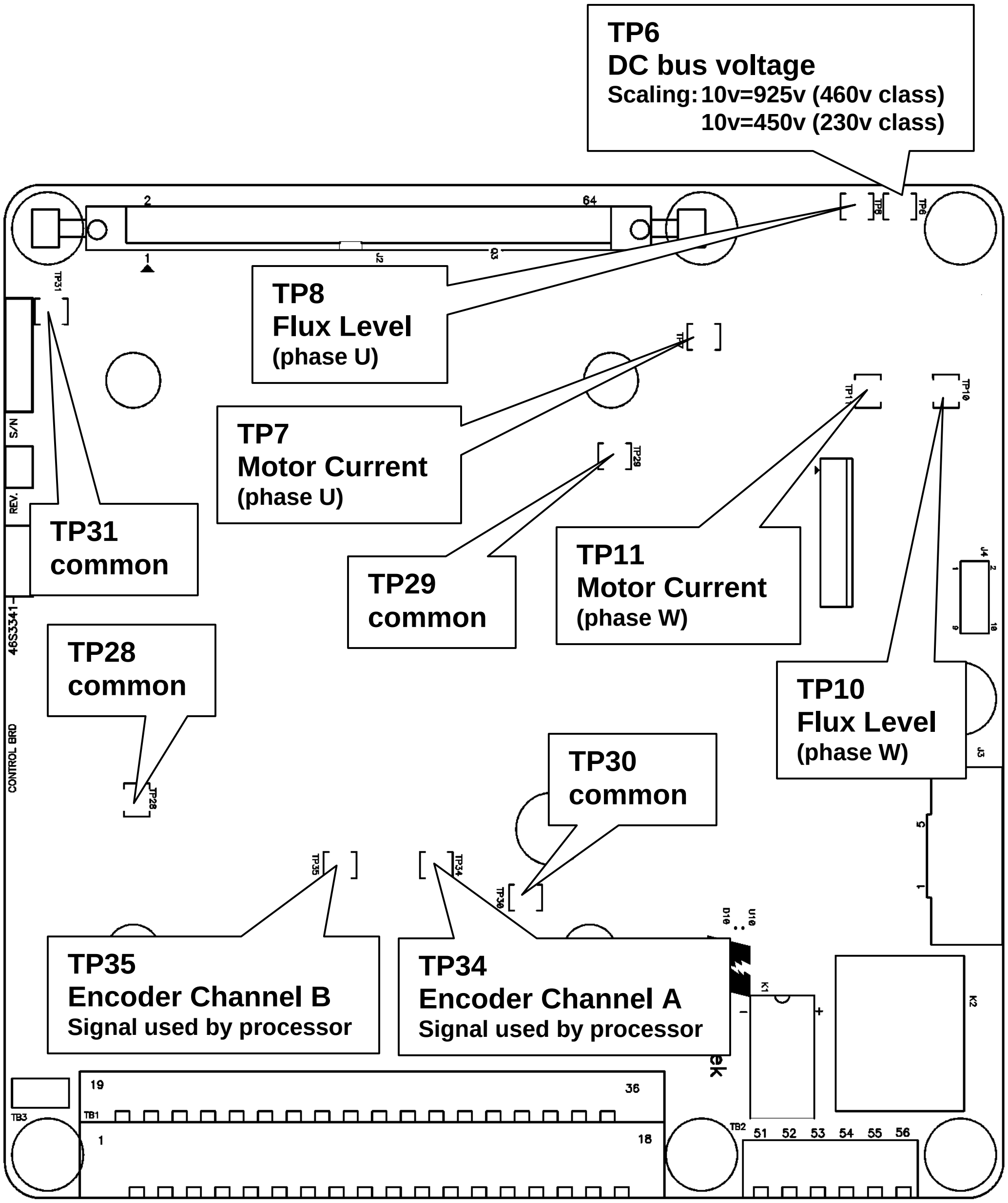


Appendix

Testpoint (Other)
Part Number 46S04000-0010



Part Number 46S03341-0010



<u>Other testpoints</u>
TP3, TP5, TP12, and TP13
No function (at this time)

Appendix

Elevator Duty Cycle

The HPV 900 Ratings Table has the following two continuous current ratings:

- Continuous Output Current General Purpose Rating
- Continuous Output Current Elevator Duty Cycle Rating

The General Purpose rating defines the maximum amount of current the drive can produce if the drive was to run non-stop.

The Elevator Duty Cycle Rating defines the maximum amount of current the drive can produce following the worst case Elevator System Load Profile.

Rated Full-Load Current

Rated Current From the Elevator System Load Profile

Rated Input Voltage	Rated HP	Rated kW	Continuous Output Current General Purpose Rating	Continuous Output Current Elevator Duty Cycle* Rating	Maximum Output Current for 5 Sec	Cube Size**	Model Number***
	7.5	5.5	25	29	62.5	A	HPV900-2025-0E1-xx
2	10	7.5	27	31	67.5	B	HPV900-2027-0E1-xx
3	15	11	41	47	102	B	HPV900-2041-0E1-xx
0	20	15	52	60	130	B	HPV900-2052-0E1-xx
V	25	18	75	84	170	B+	HPV900-2075-0E1-xx
	30	22	88	99	200	B+	HPV900-2088-0E1-xx
	40	30	104	120	260	C	HPV900-2104-0E1-xx
	5	3.7	8	9	20	A	HPV900-4008-0E1-xx
	10	7.5	16	18	40	A	HPV900-4016-0E1-xx
	15	11	21	24	52.5	A	HPV900-4021-0E1-xx
4	20	15	27	31	67.5	B	HPV900-4027-0E1-xx
6	25	18	34	39	85	B	HPV900-4034-0E1-xx
0	30	22	41	47	102	B	HPV900-4041-0E1-xx
V	40	30	52	60	130	B	HPV900-4052-0E1-xx
	50	37	65	75	162	C	HPV900-4065-0E1-xx
	60	45	77	89	192	C	HPV900-4077-0E1-xx
	75	55	96	111	240	C	HPV900-4096-0E1-xx

Range for continuous current operation

NOTE: all ratings at 60/50Hz and 10 kHz carrier frequency
all ratings for based on a geared elevator application,
for gearless ratings, see Gearless Application on page 126.

For more information on altitude, temperature, and carrier frequency derating, see Drive Derating on page 12.
Replaced model numbers: –2068 replaced by –2075 and –2080 replaced by –2088, see Replaced Models on page 134.
* *For more information on the Elevator Duty Cycle Rating, see Elevator Duty Cycle on page 107.*
** *Cube size dimensions, mounting holes, and weights are shown starting on page 112.*
*** *From more information on model numbers, see Drive Model Number on page 12.*

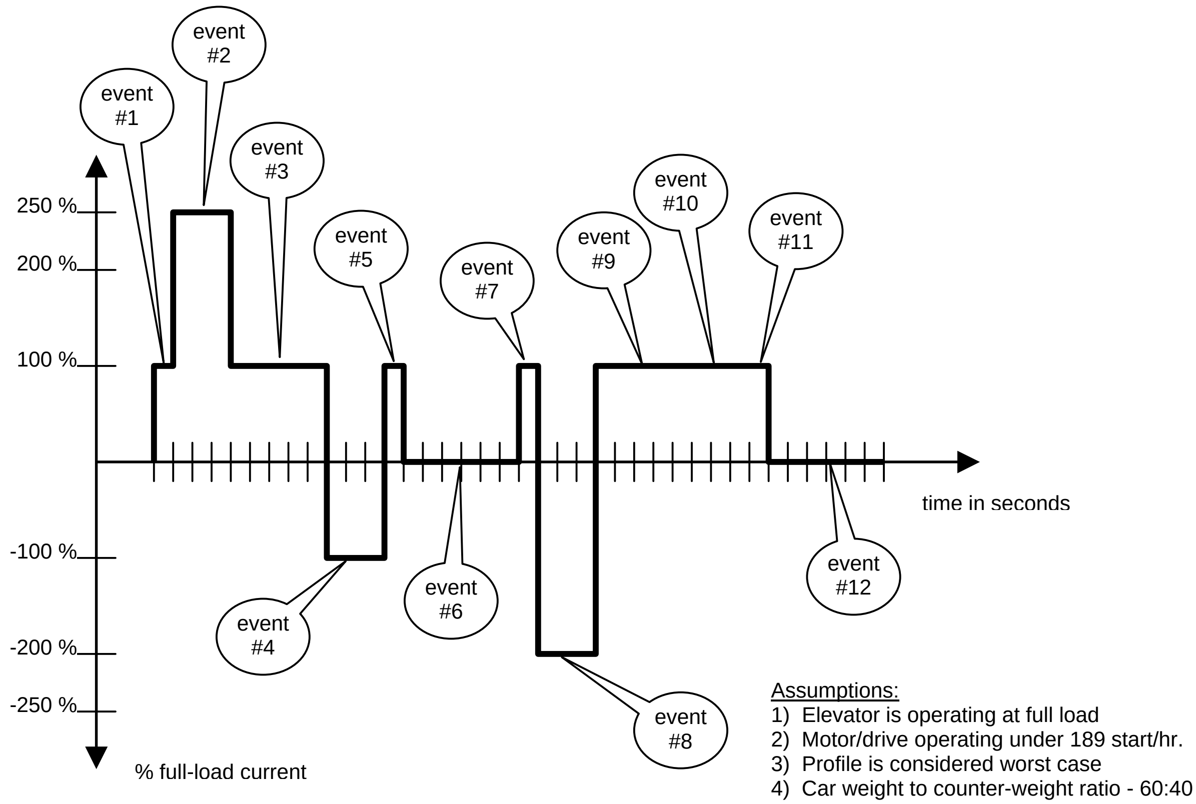


Figure 28: Elevator System Load Profile (except B+ cubes)

Event	Description	Time (s)	Current (per unit)	Current (% full load)	(I^2t)
1	Pre torque	1	1	100%	1.0
2	Accel up	3	2.5	250%	18.75
3	Cruise	5	1	100%	5.0
4	Decel up	3	1	100%	3.0
5	Post torque	1	1	100%	1.0
6	Rest	6	0	0%	0.0
7	Pre torque	1	1	100%	1.0
8	Accel down	3	2	200%	12
9	Cruise	5	1	100%	5.0
10	Decel down	3	1	100%	3.0
11	Post torque	1	1	100%	1.0
12	Rest	6	0	0%	0.0
	Total	38			50.75
				RMS Per Unit Current for Load Profile	1.16
				Percentage of Full-Load Current for Load Profile	116%
				Cycles per hour	95
				Starts per hour	189

Table 16: Elevator System Load Profile (except B+ cubes)

Event	Description	Time (s)	Current (per unit)	Current (% full load)	(I^2t)
1	Pre torque	1	1	100%	1.0
2	Accel up	3	2.25	225%	15.2
3	Cruise	5	1	100%	5.0
4	Decel up	3	1	100%	3.0
5	Post torque	1	1	100%	1.0
6	Rest	7	0	0%	0.0
7	Pre torque	1	1	100%	1.0
8	Accel down	3	2.25	225%	15.2
9	Cruise	5	1	100%	5.0
10	Decel down	3	1	100%	3.0
11	Post torque	1	1	100%	1.0
12	Rest	7	0	0%	0.0
	Total	40			50.4
RMS Per Unit Current for Load Profile					1.12
Percentage of Full-Load Current for Load Profile					112%
Cycles per hour					90
Starts per hour					180

Assumptions:
1) Elevator is operating at full load
2) Motor/drive operating under 180 start/hr.
3) Profile is considered worst case
4) Car weight to counter-weight ratio - 60:40

Table 17: Elevator System Load Profile (only B+ cubes)

Appendix

CE Guidelines

Below are guidelines for CE compliance.

Standards

EN 12015	Electromagnetic compatibility Emission
EN 12015	Electromagnetic compatibility Immunity

Recommended Line Filter

A line filter must be connected between the main power supply and input three phase input terminals to comply with the standards listed above. Line Filter Selection on page 121 lists the recommended line filters to be used with HPV 900 drives.

Installation Guidelines for EMI/RFI Issues

The HPV 900 drive should be installed in a control panel or metal enclosure. Enclosure manufacturers' designs vary and it is not the intent of this document to cover all designs. Some designs require different countermeasures than other designs. This paper covers only the general points of enclosure design when the HPV 900 drive is used.

Countermeasures For the Enclosure

Radio frequency interference of various wavelengths emitted by electrical components are scattered randomly inside a control panel. This RFI induces noise on the cables within the control panel. When these cables are led out of the control panel, the cables containing the RFI noise act as antenna and radiate noise externally.

If drives or other control equipment are connected to a power supply without using a line filter, high frequency noise generated in the equipment can flow into the power supply.

Problems related to these emissions include:

- Radiated noise from the electric components inside the control panel or from the connecting cables.
- Radiated noise from the cables leading out of the control panel.
- Conducted noise and radiated noise (due to conducted noise) flowing from the control panel into the main input cables.

The basic countermeasures against the above conditions include modification of the control panel structure. Using EMI gaskets, ferrite cores, shielded cable, and enhanced grounding is also beneficial. The separation of signal and power wires is essential.

To help comply it is necessary to prevent the leakage or penetration of radio waves through cable entrances and installation holes in the enclosure.

Modifications to the enclosure include the following:

1. The enclosure should be made of ferrous metal and the joints at the top, bottom, and side panels should be continuously welded to make them electrically conductive.
2. The paint on the joint sections should be removed back to the bare metal to provide good electrical conductance.
3. Be careful to avoid gaps, which could be created when panels become warped due to over tightening of retaining screws.
4. The section where the cabinet and door fit should have a ridged structure to avoid any gaps where RFI may leak.
5. There should be no conducting sections, which are left floating electrically.
6. Both the cabinet and drive unit should be connected to a common ground.

Enclosure Door Construction

To help comply it is necessary to reduce RFI by eliminating gaps around doors used for opening/closing the control panel.

1. The door should be made of ferrous metal.
2. Conductive packing should be used between the doors and the main unit. Assure conductivity by removing the paint on the sections, which contact the door.
3. Be careful to avoid gaps which could be opened when panels are warped due to the tightening retaining screws, etc.

Wiring External to the Enclosure

To help comply, the treatment of cables is the most important countermeasure. The grounding and the treatment of gaps in the external connection sections between the control panel and the machine are also important. It is recommended that the OEM / installer examine the present structure of all cable entrances.

Screened/shielded cable must be used for the motor cable (20 meters, 65 feet. max). The screen of the motor cable must be grounded at both ends by a short connection using as large an area as practical. The output lead section of the control panel should be treated to minimize leakage of RFI by eliminating clearances. The grounding surfaces should be metal conductors (steel solid or flexible conduit) and conductance should be assured by the following:

- Ground the connectors at both ends.
- The motor should be grounded.
- Flexible conduit (metallic) connected to a junction box should be grounded.

Group the wiring external to the enclosure into six separate steel conduits:

1. AC main input power,
2. AC control input power,
3. output to the motor,
4. motor encoder/thermistor wiring,
5. low voltage control including analog and digital inputs and outputs,
6. dynamic braking resistor.

Wiring Internal to the Enclosure

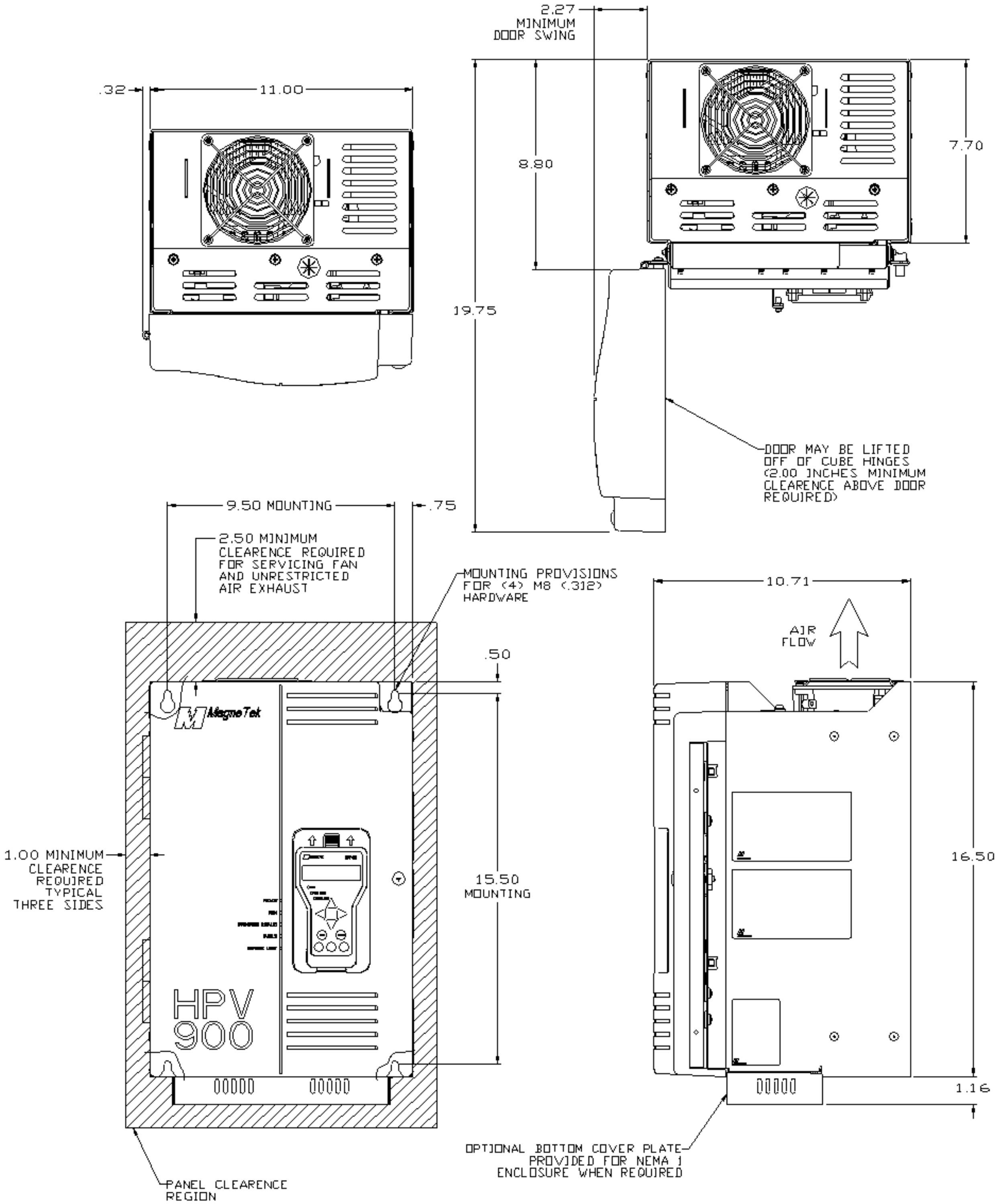
The most effective treatment for cables is shielding. Screened / shielded cable is recommended within the control panel. Use cables with a woven screen. The screen of the cable should be securely grounded using the largest area and shortest distance practical. Shield terminations must be as short as possible. It is recommended to ground the screen of the cable by clamping the cable to the grounding plate.

Panel Layout

The line filter and the drive must be mounted on the same metal panel. The metal panel should be securely grounded. The filter should be mounted as close as possible to the drive. Power cables should be kept as short as possible.

Appendix

Dimensions, Mounting Holes, & Weights



NOTES:

1. WEIGHT: 48 ± 2 lbs.

Figure 29: A-cube Dimensions and Mounting Holes

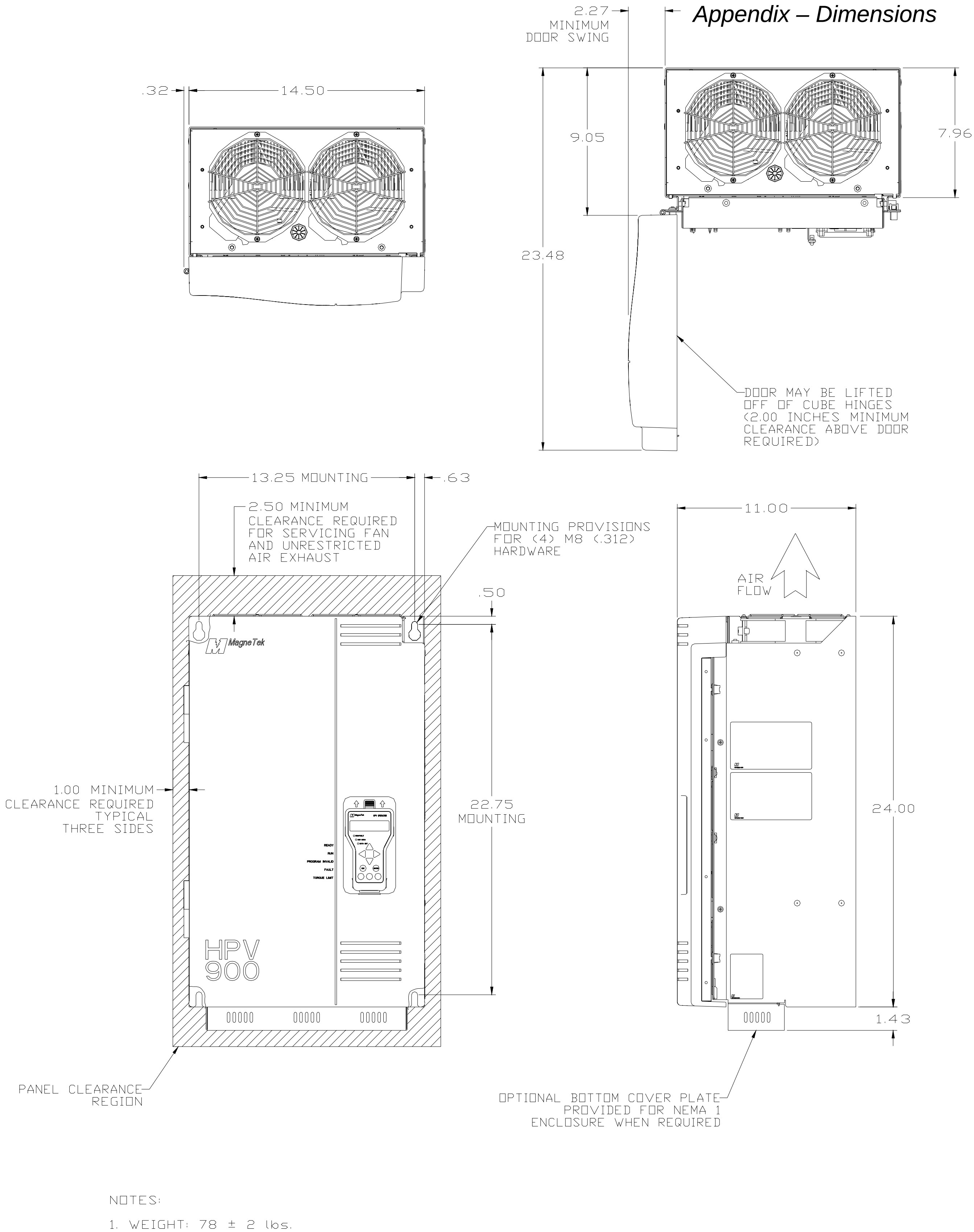


Figure 30: B-cube Dimensions and Mounting Holes

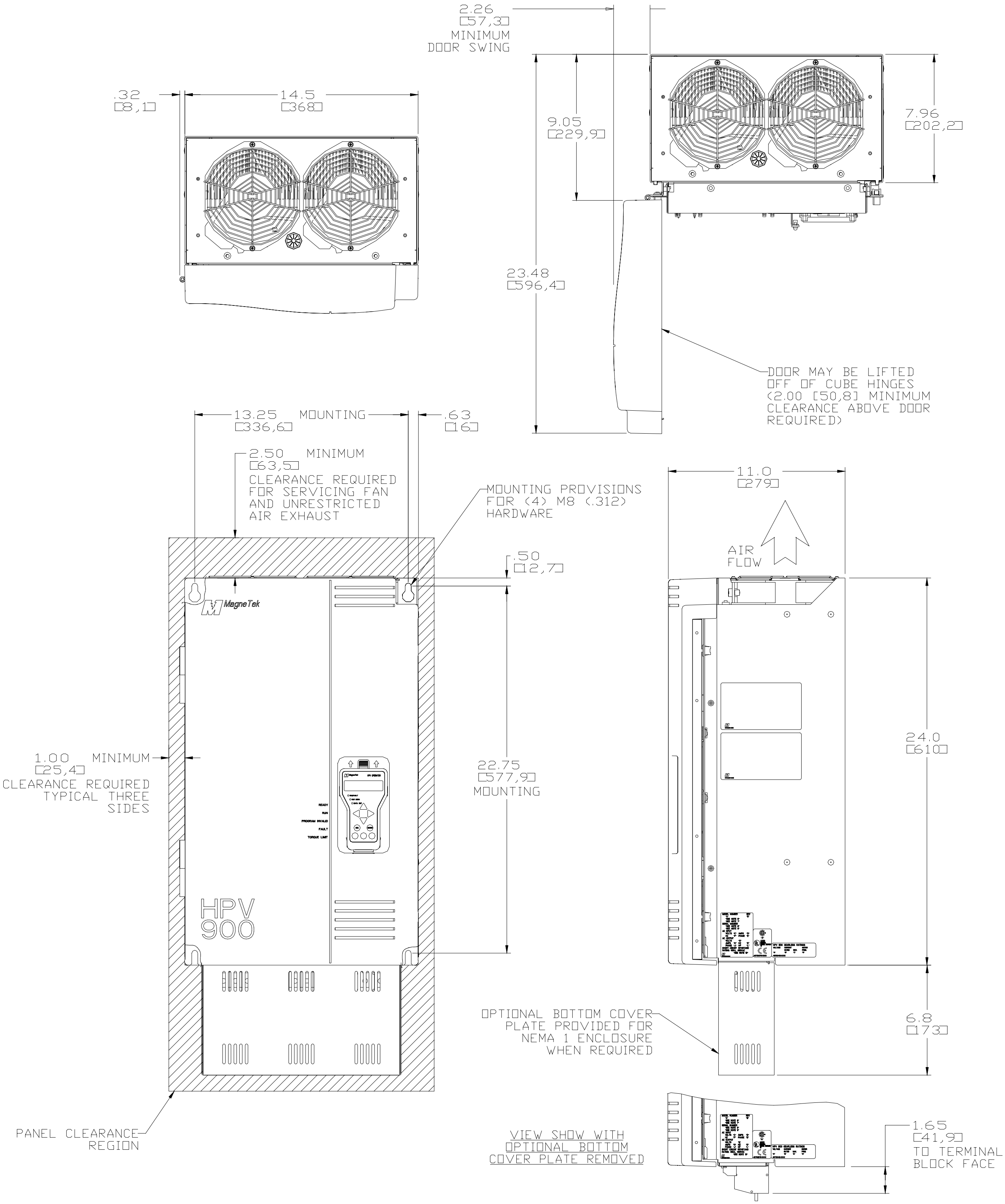
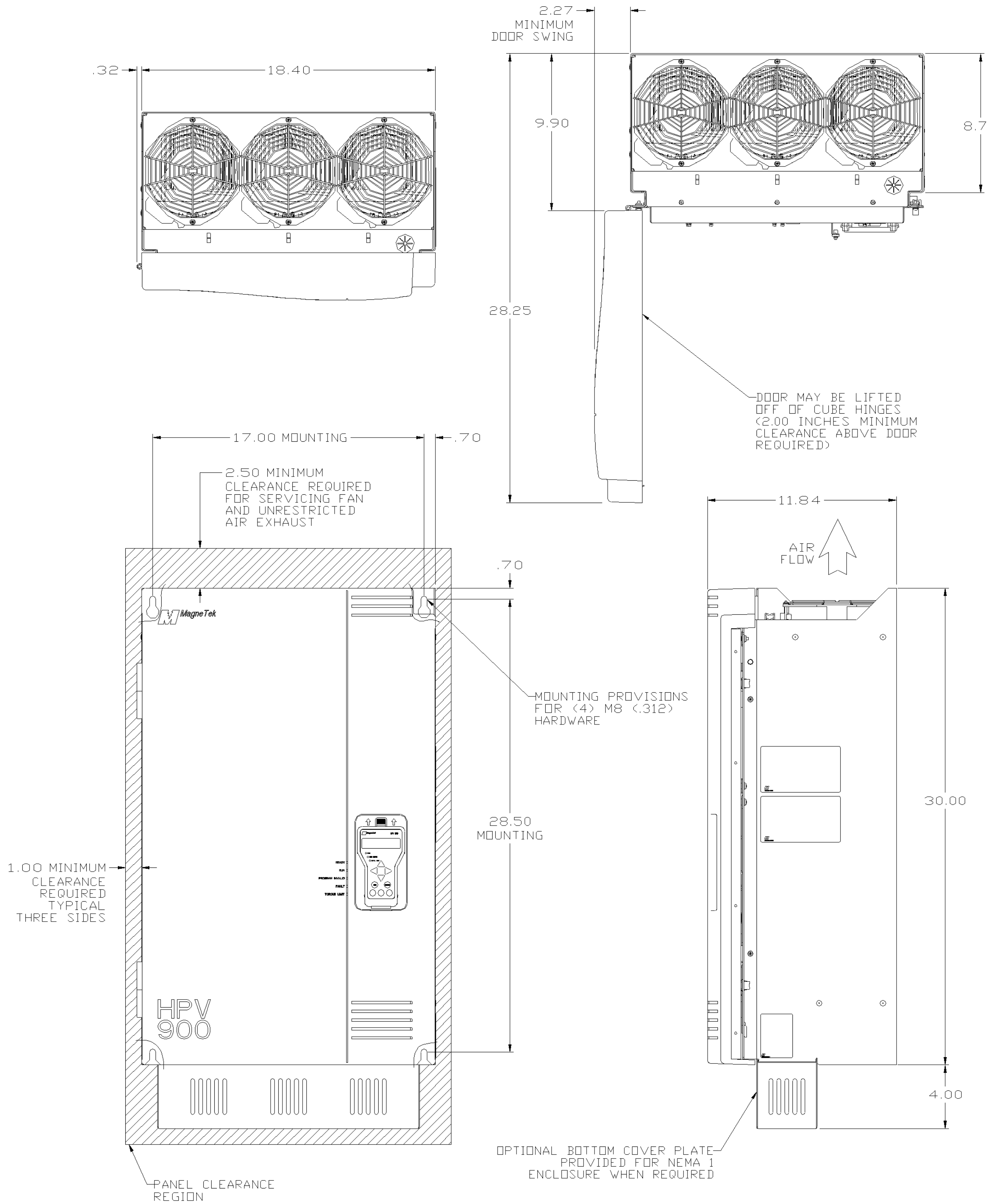


Figure 31: B+ cube Dimensions and Mounting Holes



NOTES:

1. WEIGHT: 139 ± 2 lbs.

Figure 32: C-cube Dimensions and Mounting Holes

Appendix

Dynamic Braking Resistor Selection

Cube HP	Cube kW	Model	Power Dissipation kW (Worm Gear)	Resistor Value Range (Worm Gear)	Power Dissipation kW (Planetary Gear)	Resistor Value Range (Planetary Gear)
5	3.7	-4008	0.8	150 Ω - 40 Ω	1.7	75 Ω - 40 Ω
10	7.5	-4016	1.6	75 Ω - 20 Ω	3.4	40 Ω - 20 Ω
15	11	-4021	2.4	50 Ω - 20 Ω	5.0	25 Ω - 20 Ω
20	15	-4027	3.2	40 Ω - 16 Ω	6.8	20 Ω - 16 Ω
25	18	-4034	4.0	30 Ω - 11 Ω	8.5	15 Ω - 11 Ω
30	22	-4041	4.8	27 Ω - 11 Ω	10	13 Ω - 11 Ω
40	30	-4052	6.4	20 Ω - 8 Ω	14	10 Ω - 8 Ω
50	37	-4065	8.0	16 Ω - 4 Ω	17	7.5 Ω - 4 Ω
60	45	-4077	9.6	13 Ω - 4 Ω	20	6.3 Ω - 4 Ω
75	55	-4096	12	10 Ω - 4 Ω	25	5 Ω - 4 Ω

Note: 460 V, Regeneration dc bus voltage = 800V

Table A2. 1 - 460V Brake Resistor Recommendations

Cube HP	Cube kW	Model	Power Dissipation kW (Worm Gear)	Resistor Value Range (Worm Gear)	Power Dissipation kW (Planetary Gear)	Resistor Value Range (Planetary Gear)
7.5	5.5	-2025	1.2	27 Ω - 10 Ω	2.5	13 Ω - 10 Ω
10	7.5	-2027	1.6	20 Ω - 8 Ω	3.4	9.5 Ω - 8 Ω
15	11	-2041	2.4	13 Ω - 5.5 Ω	5.0	6.3 Ω - 5.5 Ω
20	15	-2052	3.2	10 Ω - 4 Ω	6.8	4.7 Ω - 4 Ω
25	18	-2075	4.0	8 Ω - 2 Ω	8.5	3.8 Ω - 2 Ω
30	22	-2088	4.8	6.6 Ω - 2 Ω	10	3.2 Ω - 2 Ω
40	30	-2104	6.4	5 Ω - 2 Ω	14	2.3 Ω - 2 Ω

Note: 230 V, Regeneration dc bus voltage = 400V

Table A2. 2 - 230V Brake Resistor Recommendations

Assumptions for Brake Resistor Recommendations

1) Peak regenerative requirement is: (Cube KW) * 2.5 * (Gear Efficiency) * (Motor Efficiency). This occurs at start of deceleration under maximum overhauling load (for counterweight < 50%, this is full load car, start of decel going down). From peak regen power the maximum resistor is calculated as: $R = V_{dc}^2 / P_{peak}$
2) Motor efficiency is 95%, jerk out is assumed to be infinite
3) 250% regenerative torque limit
4) Worm gear efficiency = 45%; planetary gears = 95%
5) For power dissipations, a 50% duty cycle is assumed (i.e. elevator runs continuously up and down but regenerates 50% of the time). Also, 100% regenerative power required. Average power = (Cube KW) * 1.0 * (Gear Efficiency) * (Motor Efficiency) * 0.5
6) Minimum resistor values based on 100% of device rated current except for 5/10/15HP at 460V cubes (uses 80%).

Appendix

Dynamic Braking Resistor Fusing Selection

All fuses should be rated for 800VDC

Input Voltage	Cube HP	Cube KW	Model	Fuse Type (Bussmann pn)	Fuse Size (in Amps)
460 V	5	3.7	-4008	FWS-10A20F	10 A
	10	7.5	-4016	FWJ-20A14F	20 A
	15	11	-4021	FWJ-25A14F	25 A
	20	15	-4027	FWJ-30A14F	30 A
	25	18	-4034	FWJ-40A	40 A
	30	22	-4041	FWJ-50A	50 A
	40	30	-4052	FWJ-70A	70 A
	50	37	-4065	FWJ-100A	100 A
	60	45	-4077	FWJ-125A	125 A
	75	55	-4096	FWJ-125A	125 A

Table 18: 460V DB Fusing Recommendations

All fuses should be rated for at least 400VDC

Input Voltage	Cube HP	Cube KW	Model	Fuse Type (Bussmann pn)	Fuse Size (in Amps)
230 V	7.5	5.5	-2025	FWH-25A14F	25 A
	10	7.5	-2027	FWH-35B	35 A
	15	11	-2041	FWH-50B	50 A
	20	15	-2052	FWH-70B	70 A
	25	18	-2075	FWH-100B	100 A
	30	22	-2088	FWH-125B	125 A
	40	30	-2104	FWH-150B	150 A

Table 19: 230V DB Fusing Recommendations

IMPORTANT

Dynamic Braking Resistor Fusing:
1. Fusing is intended to limit drive damage in the event of an external resistor failure or short circuit.
2. Fusing will NOT protect DB resistors or wiring in the event of an overload.
3. Fuse both resistor legs mounting fuses as close to the drive as possible.
4. Always use fast acting semiconductor type fuses of sufficient voltage rating.

Appendix

Three-Phase AC Input Reactor Selection

Input Voltage	Cube HP	Cube KW	Model	Inductance (mH)	Amps
460 V	5	3.7	-4008	1.4 mH	16 A
	10	7.5	-4016	0.88 mH	25 A
	15	11	-4021	0.63 mH	35 A
	20	15	-4027	0.63 mH	35 A
	25	18	-4034	0.49 mH	45 A
	30	22	-4041	0.28 mH	80 A
	40	30	-4052	0.28 mH	80 A
	50	37	-4065	0.28 mH	80 A
	60	45	-4077	0.20 mH	110 A
	75	55	-4096	0.138 mH	180 A

Table 20: 460V Input Reactor Recommendations

Input Voltage	Cube HP	Cube KW	Model	Inductance (mH)	Amps
230 V	7.5	5.5	-2025	0.63 mH	35 A
	10	7.5	-2027	0.49 mH	45 A
	15	11	-2041	0.28 mH	80 A
	20	15	-2052	0.28 mH	80 A
	25	18	-2075	0.28 mH	80 A
	30	22	-2088	0.20 mH	110 A
	40	30	-2104	0.138 mH	180 A

Table 21: 230V Input Reactor Recommendations

Manufacturer Considerations:
When selecting an input reactor, the elevator load profile needs to be taking into account. Consider the following when selecting a manufacturer.

- Repeated 250% overloads current values
- Heating of inductors due to overloads and harmonics
- Saturation of inductor
- Life of reactor
- Ambient temperature vs. inductor current curve. The drive can operate at 55°C (130°F).

Appendix

DC Choke Selection

Input Voltage	Cube HP	Cube KW	Model	Inductance (mH)	DC Current Rating (A)
460 V	5	3.7	-4008	1.5 mH	18 A
	10	7.5	-4016	0.38 mH	36 A
	15	11	-4021	0.38 mH	36 A
	20	15	-4027	0.38 mH	36 A
	25	18	-4034	0.12 mH	72 A
	30	22	-4041	0.12 mH	72 A
	40	30	-4052	0.12 mH	72 A
	50	37	-4065	0.10 mH	120 A
	60	45	-4077	0.10 mH	120 A
	75	55	-4096	0.10 mH	120 A

Table 22: 460V DC Choke Recommendations

Input Voltage	Cube HP	Cube KW	Model	Inductance (mH)	DC Current Rating (A)
230 V	7.5	5.5	-2025	0.38 mH	36 A
	10	7.5	-2027	0.38 mH	36 A
	15	11	-2041	0.12 mH	72 A
	20	15	-2052	0.12 mH	72 A
	25	18	-2075	0.10 mH	120 A
	30	22	-2088	0.10 mH	120 A
	40	30	-2104	0.10 mH	120 A

Table 23: 230V DC Choke Recommendations

NOTE:
Magnetek prefers the use of AC Input Reactor over the use of the DC Choke because:
The DC choke has the disadvantage of isolating the diode bridge from the capacitor bank, making the diode bridge more susceptible to damage from transient surges. On the other hand, DC Chokes can be used where the line conditions preclude large surges.

Manufacturer Considerations:
When selecting an input reactor, the elevator load profile needs to be taking into account.
Consider the following when selecting a manufacturer.

- Repeated 250% overloads current values
- Heating of inductors due to overloads and harmonics
- Saturation of inductor
- Life of reactor
- Ambient temperature vs. inductor current curve. The drive can operate at 55°C (130°F).

Appendix

AC Input Fusing Selection

All fuses should be Class J, Low Peak Dual Element, Time delay 600VAC fuses.

Input Voltage	Cube HP	Cube KW	Model	Fusing Required?	Fuse Size (in Amps)
460 V	5	3.7	-4008	Yes	16 to 45 A
	10	7.5	-4016	Yes	25 to 45 A
	15	11	-4021	Yes	35 to 45 A
	20	15	-4027	No*	45 to 100 A
	25	18	-4034	No*	50 to 100 A
	30	22	-4041	No*	60 to 100 A
	40	30	-4052	No*	80 to 100 A
	50	37	-4065	No*	100 to 200 A
	60	45	-4077	No*	125 to 200 A
	75	55	-4096	No*	150 to 200 A

Table 24: 460V Fusing Recommendations

All fuses should be Class J, Low Peak Dual Element, Time delay 600VAC fuses.

Input Voltage	Cube HP	Cube KW	Model	Fusing Required?	Fuse Size (in Amps)
230 V	7.5	5.5	-2025	Yes	35 to 45 A
	10	7.5	-2027	No*	45 to 100 A
	15	11	-2041	No*	60 to 100 A
	20	15	-2052	No*	80 to 100 A
	25	18	-2075	No*	100 to 200 A
	30	22	-2088	No*	125 to 200 A
	40	30	-2104	No*	150 to 200 A

Table 25: 230V Fusing Recommendations

IMPORTANT

Class J Input Fusing is required for the A-cube models:

-4008, -4016, -4021, and –2025

* With all other models circuit breakers can be substituted for fuses in accordance with local codes

Appendix

Line Filter Selection

The suggested Line Filters to help meet the requirements for the following CE standards:

- EN 12015:1998
- EN 12016:1998

Note: also see CE Guidelines on page 110 for additional installation guidelines

Input Voltage	Cube HP	Cube KW	Model	Filter Type (BLOCK pn)		Current Rating (A)	Voltage Rating (V)
460 V	5	3.7	-4008	HLD 110-500/16	B 0105030	16	500
	10	7.5	-4016	HLD 110-500/30	B 0105031	30	500
	15	11	-4021	HLD 110-500/30	B 0105031	30	500
	20	15	-4027	HLD 110-500/42	B 0105032	42	500
	25	18	-4034	HLD 110-500/42	B 0105032	42	500
	30	22	-4041	HLD 110-500/55	B 0105033	55	500
	40	30	-4052	HLD 110-500/75	B 0105034	75	500
	50	37	-4065	HLD 110-500/75	B 0105034	75	500
	60	45	-4077	HLD 110-500/100	B 0105035	100	500
	75	55	-4096	HLD 110-500/130	B 0105036	130	500

Table 26: 460V Line Filter Recommendations

Input Voltage	Cube HP	Cube KW	Model	Filter Type (BLOCK pn)		Current Rating (A)	Voltage Rating (V)
230 V	7.5	5.5	-2025	HLD 110-500/30	B 0105031	30	500
	10	7.5	-2027	HLD 110-500/30	B 0105031	30	500
	15	11	-2041	HLD 110-500/42	B 0105032	42	500
	20	15	-2052	HLD 110-500/75	B 0105034	75	500
	25	18	-2075	HLD 110-500/75	B 0105034	75	500
	30	22	-2088	HLD 110-500/100	B 0105035	100	500
	40	30	-2104	HLD 110-500/130	B 0105036	130	500

Table 27: 230V Line Filter Recommendations

Appendix

Selecting and Mounting of Encoder

Encoder Specification

The HPV 900 has connections for an incremental two-channel quadrature encoder.

For better noise immunity, the HPV 900 provides…

- an isolated power supply, which separates the processor power from the encoder
- optically isolated encoder signals from the HPV 900's processor

Encoder Feedback

- Supply Voltage: 12VDC or 5VDC
- Capacity: 200mA or 150mA
- PPR: 600 - 10,000
- Maximum Frequency: 300 kHz
- Input: 2 channel quadrature
5 or 12 volts dc differential
(A, /A, B, /B)

Encoder Considerations

Electrical interference and mechanical speed modulations are common problems that can result in improper speed feedback getting to the drive. To help avoid these common problems, the following electrical and mechanical considerations are suggested.

IMPORTANT

Proper encoder speed feedback is essential for a drive to provide proper motor control.

Electrical Considerations

- If possible, insulate both the encoder case and shaft from the motor. For more information, see Insulating Encoder from Motor on page 122.
- Use twisted pair cable with shield tied to chassis ground at drive end. For more information, see Encoder Wiring on page 21.
- Use limited slew rate differential line drivers. For more information, see Differential Line Drivers on page 124.
- Do not allow capacitors from internal encoder electronics to case. For more information, see Capacitors from Electronics to Case on page 124.
- Do not exceed the operating specification of the encoder/drive. For more information, see Exceeding Operating Specification on page 125.
- Use the proper encoder supply voltage and use the highest possible voltage available (i.e. HPV 900 - 12VDC preferred). For more information, see Encoder Supply Voltage on page 125.

Mechanical Considerations

- Use direct motor mounting without couplings. For more information, see Direct Motor Mounting on page 123.
- Use hub or hollow shaft encoder with concentric motor stub shaft. For more information, see motor stub shaft on page 123.
- If possible, use a mechanical protective cover for exposed encoders. For more information, see Encoder Protective Covers on page 124.

Encoder Mounting

Insulating Encoder from Motor

It is preferred that both the encoder case and shaft are insulated from the motor, in order to minimize encoder bearing currents and ground noise.

There will be PWM electrical noise on the motor shaft that will take the easiest path to ground. If the encoder is not electrically isolated from the motor, this path could be through the encoder bearings and/or electronics. Encoder bearing current will reduce the life of the bearings and create additional ground noise. The solution would be to electrically isolate both the encoder shaft and case from the motor.

Insulating the encoder case from the motor also reduces ground current coupling from the motor frame to the internal electronics of the encoder. Ground noise from the motor frame can disturb the operation of the encoder and propagate down the connected cable to disturb the transmission of the encoder signals. (i.e. there can be coupling from the case to the internal electronics even though a discrete capacitor is not present)

Figure 36 shows how to insulate a hollow-shaft encoder from the motor (similar mounting hardware and insulating insert can be used for hub-shaft encoders).

Direct Motor Mounting
Use direct motor mounting without couplings, in order to avoid eccentricities and to provide for zero backlash.

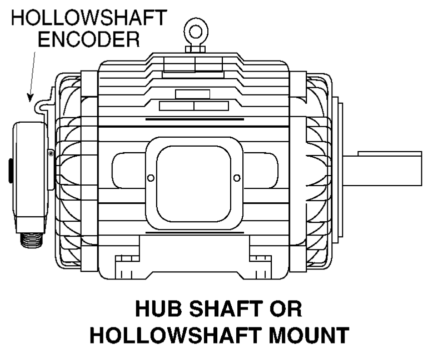


Figure 33: Direct Motor Mount

Direct mounted encoders do not have shafts and are mounted directly onto the motor shaft. Examples include hub-shaft or hollow-shaft models with integral flexible mounts. These have no separate shaft to shaft coupling. In addition, there may be no need for mounting brackets or adapters.

Direct mounted encoders do not have shafts and are mounted directly onto the motor shaft. Examples include hub-shaft or hollow-shaft models with integral flexible mounts. These have no separate shaft to shaft coupling. In addition, there may be no need for mounting brackets or adapters.

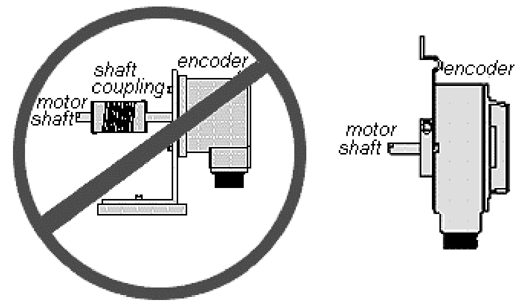


Figure 34: Avoiding Couplings

Motor Stub Shaft

Use hub or hollow shaft encoder with concentric motor stub shaft and use a flexible encoder mount rather than a flexible shaft coupling.

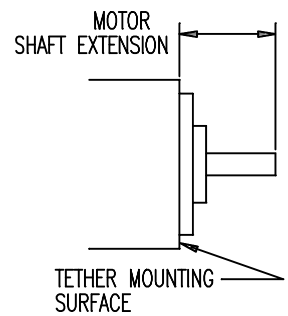


Figure 35: Motor Stub Shaft

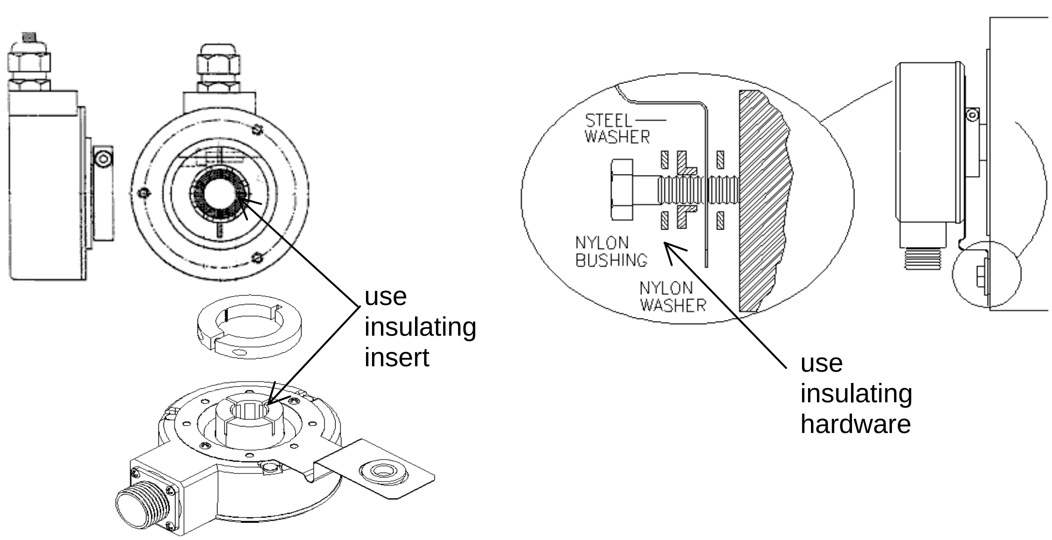


Figure 36: Insulating Encoder from Motor

It is preferred that a solid shaft extension is specified from the motor manufacturer for a length recommended by the encoder manufacturer.

Although it is not the preferred method, installations that employ a screwed on sub shaft adapter should:
- use the original hole used to machine the motor shaft
- use locktight to hold the thread in position
- align the stub shaft to 0.002 inches TIR or less with a dial indicator

A hub-shaft or hollow-shaft encoder should be mounted so that its shaft receptacle is in as close as possible alignment with the axis of the motor shaft. Clamp or set screws should then be tightened to secure the encoder.

REMEMBER: If you are following the preferred method of insulating the encoder from the motor, install the proper insulating hardware.

NOTE: Do not defeat or restrict the flexure. This causes failure of the encoder or driving shaft bearings.

Encoder Protective Covers

In order to protect the encoders from mechanical damage, it is preferred that for exposed encoders a mechanical protective cover is used.

Encoders are vulnerable to mechanical damage from impact. Encoders can be damaged by impact during installation or during exposed operation. Motors are even sometimes lifted by the encoders on one end. Therefore, it is preferred that the encoder be protected by a cover as shown below.

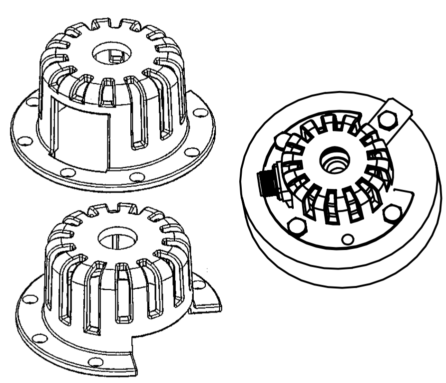


Figure 37: Protective Encoder Covers

Differential Line Drivers

Use limited slew rate differential line drivers, in order to minimize transmission line reflections use type 7272 drivers.

Encoder's line drivers transition from logic states in a fraction of a microsecond. The fast rise and fall times of the driver's circuitry can interact with the cable impedance and create significant ringing on the receiver end of the cable. This can interfere with the encoder signals and the operation of the drive. To reduce the ringing, it is recommended that the encoder use type 7272 line drivers, which have slower rise and fall times.

Also to improve performance, line driver outputs should use differential pairs of complementary outputs, each paired with its inverse. This allows the signal to be used with a differential line receiver, which improves the noise margin, cancels common-mode noise and helps to reject ringing from the cable.

Capacitors from Electronics to Case

Do not allow capacitors from internal encoder electronics to case, in order to minimize ground current noise injection and minimize the coupling of high frequency noise.

Encoders are sometimes supplied with an internal capacitor from circuit common to case ground to drain electrical noise from common to building ground. However, PWM drives have extremely high frequency noise that is coupled to the frame and shaft of the motor. A capacitor placed between the encoder case and the encoder electronics will couple this noise into the encoder, where it can interfere with normal operation.

The result is intermittent rough operation, motor reversal or no operation at all. The presumption is that there is a drive or encoder problem. An improvement is to remove any internal encoder capacitors between electrical common and the case.

The above analysis assumes that the electrical wiring is correct and that the shield on the encoder cable is properly grounded, *see Encoder Wiring on page 21.*

The scope traces in Figure 38 and Figure 39 show a noise comparison of output signals from similar encoders with and without internal capacitors, both connected to a motor with typical PWM switching noise on the frame.

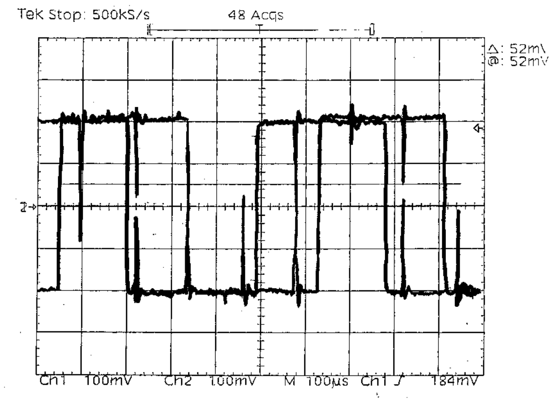


Figure 38: Encoder with a capacitor (common to ground)

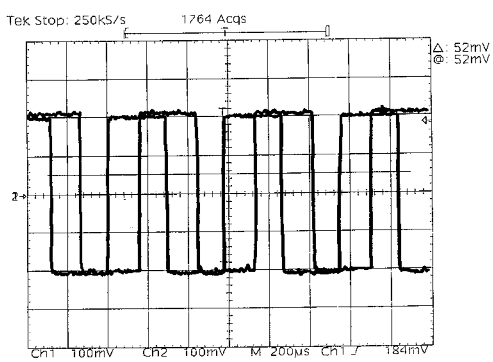


Figure 39: Encoder with no capacitor (common to ground)

Exceeding Operating Specification

Do not exceed the operating specification of the encoder/drive, in order to prevent the encoder from providing incorrect data.

All encoders have inherent mechanical and electronic limitations regarding speed. The combination of several design factors including bearings, frequency response of the electronics, and PPR of the encoder, etc. combine to determine "maximum operating speed". Exceeding the maximum speed may result in incorrect data or premature failure. Both the electrical and mechanical encoder specifications can be provided by the encoder manufacturer.

To determine the encoder's maximum operating speed:

Step 1: Determine maximum electronic operating speed in RPM.

$$RPM = \frac{Encoder\ freq.\ response\ (kHz)\ x\ 60}{Encoder\ PPR}$$

Step 2:

A. If the RPM calculated in Step 1 is less than or equal to the encoder's maximum mechanical RPM specification, then the RPM calculated in Step 1 is the maximum operating speed specification for this particular encoder application.

B. If the RPM calculated in Step 1 is greater than the encoder's maximum mechanical RPM specification, then the maximum mechanical RPM specification is the maximum operating speed for this encoder application.

Step 3:
Compare the maximum operating speed as determined in Step 2 above with the application requirements.

To determine if the application exceeds the operating specification of the HPV 900:

- Calculate the maximum pulses per revolution (PPR) for this application (using the HPV 900 frequency limit of 300 kHz and 120% of the application's top speed)

$$PPR_{\max} = \frac{300{,}000\ \ Hz\ \ x\ 60}{max\ \ applicatio\ n\ RPM\ \ \times 1.2}$$

- Verify that the selected encoder's PPR is below the calculated maximum PPR (PPRmax) for this application

Encoder Supply Voltage

Ensure proper encoder supply voltage and use highest possible voltage available, in order to ensure proper operation and increase noise immunity

Ensure that the voltage drop of the encoder wiring is such that the minimum power supply voltage for operating the encoder is not violated. (i.e. 5VDC ±5% power supply and 5VDC ±10% encoder specification is violated when the encoder draws 0.3 A and it is wired with 500 ft at 22 AWG)

- Use an encoder with an internal supply regulator
- Use a wide supply range encoder (i.e. 5 – 15 VDC)

It is also preferred that the encoder be powered by the HPV 900's 12VDC power supply in order to help with noise immunity by having the signals at a higher voltage level.

Appendix

Gearless Application

Rated Input Voltage	Rated HP	Rated kW	Continuous Output Current Rating	Maximum Output Current	Motor Frequency	Maximum Carrier Frequency	Model Number
460V	30	22	38	75	7.5-15Hz	8kHZ	HPV900-4052-0E1-G1
	50	37	64	128	7.5-15Hz	8kHZ	HPV900-4096-0E1-G1

NOTE: all ratings at 60/50Hz and maximum 8 kHz carrier frequency

Table 28: Gearless Drive Ratings

Model Number	Rated HP	Rated kW	Power Dissipation kW (gearless)	Resistor Value Range (gearless)	Cube Size*
HPV900-4052-0E1-G1	30	22	10	15Ω - 8Ω	B
HPV900-4096-0E1-G1	50	37	17	9Ω - 4Ω	C

** Cube size dimensions, mounting holes, and weights are found in DIMENSIONS, MOUNTING HOLES, and WEIGHTS on page 112.*

Table 29: Gearless Dynamic Braking Resistor / Dimensions

Appendix

Suggested Wire Sizes

It is recommended that the same wire size be used for the input, output and DB resistor wiring and copper wire should only be used.

Conductor size, AWG	Amps Conductors with 105°C (221°F) insulation: In conduit or non ventilated raceway	Open or in ventilated raceway	Suggested HPV 900 Wire Sizes for various cubes ratings: 460V	230V
14	10	15	5HP(-4008)	
12	15	22		
10	22	35	10HP(-4016)	
8	35	55	15HP(-4021) 20HP(-4027)	7.5HP(-2025) 10HP(-2027)
6	52	80	25HP(-4034) 30HP(-4041) 40HP(-4052)	15HP(-2041) 20HP(-2052)
4	71	108		
3	80	121	50HP(-4065)	25HP(-2075)
2	90	140	60HP(-4077)	30HP(-2088)
1	107	164		
0	133	190	75HP(-4096)	40HP(-2104)

Note: wire ratings from: Table 2 – Allowable Ampacities of Insulated Copper Conductors Inside Industrial Control Equipment Enclosures (Based on a Room Ambient Temperature of 40°C (104°F)) source: CAN/CSA-B44.1-M91

Table 30: Suggested Wire Sizes

Appendix

Wire Terminal Specifications

V	hp	Model	Power Terminals *input, output & DB*		Ground Terminals		Control Power Terminals *115VAC*		Control Wiring Terminals *TB1 & TB2*	
			Wire size range (AWG)	Torque Spec. (in-lb)	Wire size range (AWG)	Torque Spec. (in-lb)	Wire size range (AWG)	Torque Spec. (in-lb)	Wire size range (AWG)	Torque Spec. (in-lb)
230V	7.5	-2025	20 to 6	18 in-lb	14 to 6	20 in-lb	14 to 22	4.5 in-lb	14 to 22	4.5 in-lb
	10	-2027	20 to 6	15 in-lb	14 to 6	20 in-lb	14 to 22	4.5 in-lb	14 to 22	4.5 in-lb
	15	-2041	20 to 6	15 in-lb	14 to 6	20 in-lb	14 to 22	4.5 in-lb	14 to 22	4.5 in-lb
	20	-2052	20 to 6	15 in-lb	14 to 6	20 in-lb	14 to 22	4.5 in-lb	14 to 22	4.5 in-lb
	25	-2075	6 to 1/0	75 in-lb	14 to 1/0	35 in-lb	22 to 10	5.3 in-lb	14 to 22	4.5 in-lb
	30	-2088	6 to 1/0	75 in-lb	14 to 1/0	35 in-lb	22 to 10	5.3 in-lb	14 to 22	4.5 in-lb
	40	-2104	6 to 1/0	75 in-lb	14 to 1/0	35 in-lb	22 to 10	5.3 in-lb	14 to 22	4.5 in-lb
460V	5	-4008	20 to 6	18 in-lb	14 to 6	20 in-lb	14 to 22	4.5 in-lb	14 to 22	4.5 in-lb
	10	-4016	20 to 6	18 in-lb	14 to 6	20 in-lb	14 to 22	4.5 in-lb	14 to 22	4.5 in-lb
	15	-4021	20 to 6	18 in-lb	14 to 6	20 in-lb	14 to 22	4.5 in-lb	14 to 22	4.5 in-lb
	20	-4027	20 to 6	15 in-lb	14 to 6	20 in-lb	14 to 22	4.5 in-lb	14 to 22	4.5 in-lb
	25	-4034	20 to 6	15 in-lb	14 to 6	20 in-lb	14 to 22	4.5 in-lb	14 to 22	4.5 in-lb
	30	-4041	20 to 6	15 in-lb	14 to 6	20 in-lb	14 to 22	4.5 in-lb	14 to 22	4.5 in-lb
	40	-4052	20 to 6	15 in-lb	14 to 6	20 in-lb	14 to 22	4.5 in-lb	14 to 22	4.5 in-lb
	50	-4065	6 to 1/0	75 in-lb	14 to 1/0	35 in-lb	22 to 10	5.3 in-lb	14 to 22	4.5 in-lb
	60	-4077	6 to 1/0	75 in-lb	14 to 1/0	35 in-lb	22 to 10	5.3 in-lb	14 to 22	4.5 in-lb
	75	-4096	6 to 1/0	75 in-lb	14 to 1/0	35 in-lb	22 to 10	5.3 in-lb	14 to 22	4.5 in-lb

Note: use only copper wire

Table 31: Wire Terminal Specifications

Appendix

Drive Ratings (with 12-pulse option)

Rated Input Voltage	Rated HP	Rated kW	Model Number	Continuous Output Current Rating (range)	Maximum Output Current for 5 Sec	12-pulse option
230V	7.5	5.5	HPV900-2025-0E1-xx	25-29	62.5	No
	10	7.5	HPV900-2027-0E1-xx	27-31	67.5	Yes
	15	11	HPV900-2041-0E1-xx	41-47	102	Yes
	20	15	HPV900-2052-0E1-xx	52-60	130	Yes
	25	18	HPV900-2075-0E1-xx	75-84	170	Yes
	30	22	HPV900-2088-0E1-xx	88-99	200	Yes
	40	30	HPV900-2104-0E1-xx	104-120	260	Yes
460V	5	3.7	HPV900-4008-0E1-xx	8-9	20	No
	10	7.5	HPV900-4016-0E1-xx	16-18	40	No
	15	11	HPV900-4021-0E1-xx	21-24	52.5	No
	20	15	HPV900-4027-0E1-xx	27-31	67.5	Yes
	25	18	HPV900-4034-0E1-xx	34-39	85	Yes
	30	22	HPV900-4041-0E1-xx	41-47	102	Yes
	40	30	HPV900-4052-0E1-xx	52-60	130	Yes
	50	37	HPV900-4065-0E1-xx	65-75	162	Yes
	60	45	HPV900-4077-0E1-xx	77-89	192	Yes
	75	55	HPV900-4096-0E1-xx	96-111	240	Yes

NOTE: all ratings at 60/50Hz and 10 kHz carrier frequency
all ratings for based on a geared elevator application,

Table 32: Drive Ratings (with 12-pulse option)

Appendix

Input / Output Rating

Rated Input Voltage	Rated HP	Rated kW	Model	Input			Output	
				Voltage V	Current A	Short Circuit Withstand Rating	Voltage V	Current A
230V	7.5	5.5	-2025	200-240	30	42 KA	0-input voltage	25
	10	7.5	-2027	200-240	33	42 KA	0-input voltage	27
	15	11	-2041	200-240	45	42 KA	0-input voltage	41
	20	15	-2052	200-240	57	42 KA	0-input voltage	52
	25	18	-2075	200-240	92	10 KA	0-input voltage	75
	30	22	-2088	200-240	107	10 KA	0-input voltage	88
	40	30	-2104	200-240	115	42 KA	0-input voltage	104
460V	5	3.7	-4008	380-480	10	42 KA	0-input voltage	8
	10	7.5	-4016	380-480	17	42 KA	0-input voltage	16
	15	11	-4021	380-480	26	42 KA	0-input voltage	21
	20	15	-4027	380-480	33	42 KA	0-input voltage	27
	25	18	-4034	380-480	40	42 KA	0-input voltage	34
	30	22	-4041	380-480	45	42 KA	0-input voltage	41
	40	30	-4052	380-480	57	42 KA	0-input voltage	52
	50	37	-4065	380-480	71	42 KA	0-input voltage	65
	60	45	-4077	380-480	85	42 KA	0-input voltage	77
	75	55	-4096	380-480	106	42 KA	0-input voltage	96

Table 33: Input / Output Ratings

Appendix

Watts Loss

460V	Power loss
5HP (-4008)	130 watts
10HP (-4016)	210 watts
15HP (-4021)	325 watts
20HP (-4027)	390 watts
25HP (-4034)	500 watts
30HP (-4041)	600 watts
40HP (-4052)	800 watts
50HP (-4065)	935 watts
60HP (-4077)	1150 watts
75HP (-4096)	1500 watts

230V	Power loss
7.5HP (-2025)	320 watts
10HP (-2027)	350 watts
15HP (-2041)	500 watts
20HP (-2052)	700 watts
25HP (-2075)	800 watts
30HP (-2088)	1000 watts
40HP (-2104)	1400 watts

Note: values calculated from the worse case condition of 116% of general purpose continuous current rating, 10kHz carrier frequency.

Table 34: Watts Loss per Drive Rating

Control Power Dissipation

460V	Control Power (115VAC) Dissipation
5HP (-4008)	80 watts
10HP (-4016)	80 watts
15HP (-4021)	80 watts
20HP (-4027)	145 watts
25HP (-4034)	145 watts
30HP (-4041)	145 watts
40HP (-4052)	145 watts
50HP (-4065)	185 watts
60HP (-4077)	185 watts
75HP (-4096)	185 watts

230V	Control Power (115VAC) Dissipation
7.5HP (-2025)	80 watts
10HP (-2027)	145 watts
15HP (-2041)	145 watts
20HP (-2052)	145 watts
25HP (-2075)	145 watts
30HP (-2088)	145 watts
40HP (-2104)	185 watts

Table 35: Control Power Dissipation per Drive Rating

Appendix

Relay Specifications

RELAY 1

Contact Data

	Standard	
Load	Resistive load (p.f. = 1)	Inductive load (p.f. = 0.4) (L/R = 7ms)
Rated Load	5 A at 250 VAC 5 A at 30 VDC	2 A at 250 VAC 2 A at 30 VDC
Carry current	5 A	
Max. operating voltage	380 VAC, 125 VDC	
Max. operating current	5 A	
Max. switching capacity	1,250 VA, 150 W	500 VA, 60 W
Min, permissible load	10mA, 5 VDC	

Table 36: Relay 1 Contact Data

Maximum Switching Capacity

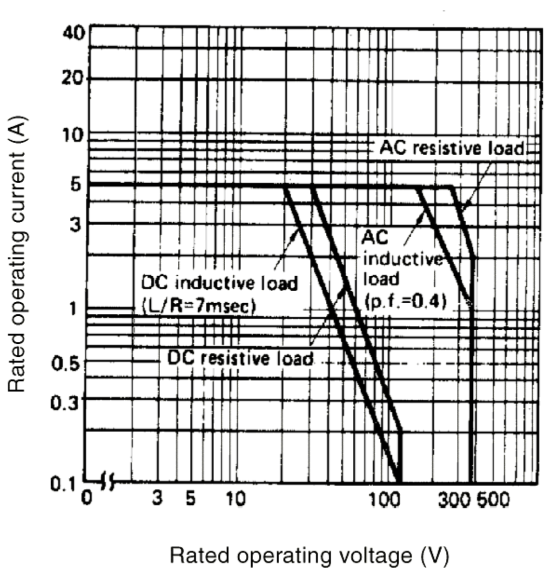


Figure 40: Relay 1 Maximum Switching Capacity

Electrical Service Life

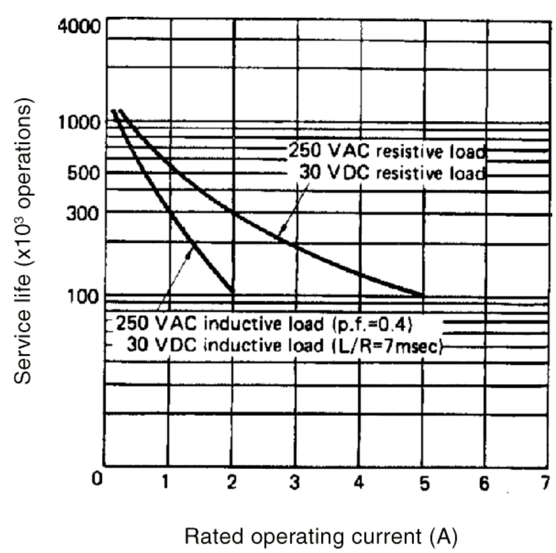


Figure 41: Relay 1 Electrical Service Life

RELAY 2

Contact Data

Load	Standard	
	Resistive load (p.f. = 1)	Inductive load (p.f. = 0.4) (L/R = 7ms)
Rated Load	10 A at 110 VAC 10 A at 24 VDC	7.5 A at 110 VAC 5 A at 24 VDC
Carry current	10 A	
Max. operating voltage	250 VAC, 125 VDC	
Max. operating current	10 A	
Max. switching capacity	1,100 VA, 240 W	830 VA, 120 W

Table 37: Relay 2 Contact Data

Maximum Switching Capacity

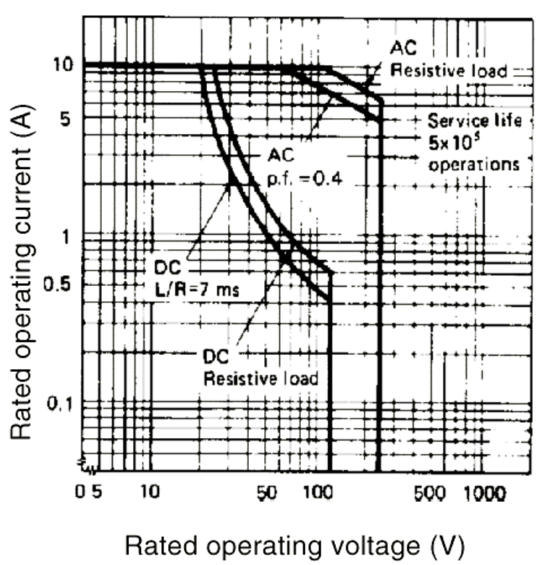


Figure 42: Relay 2 Maximum Switching Capacity

Electrical Service Life

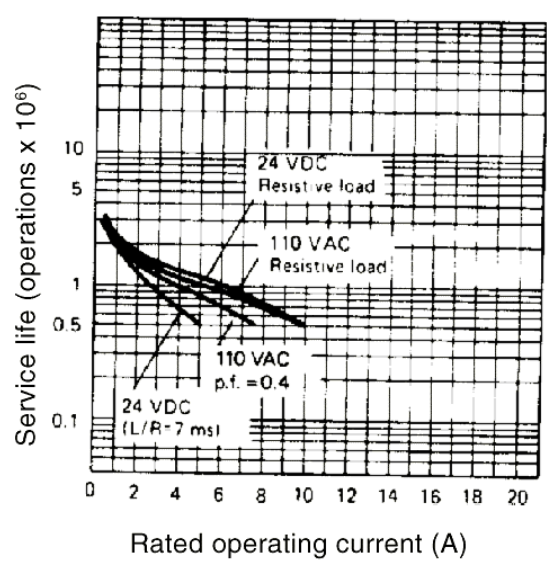


Figure 43: Relay 2 Electrical Service Life

Appendix

Replaced Models

The following details information for the replaced model numbers listed below:

- HPV 900-2068-0E1-xx replaced by HPV900-2075-0E1-xx
- HPV 900-2080-0E1-xx replaced by HPV900-2088-0E1-xx

Rated Input Voltage	Rated HP	Rated kW	Continuous Output Current General Purpose Rating	Continuous Output Current Elevator Duty Cycle* Rating	Maximum Output Current for 5 Sec	Cube Size**	Model Number***
230V	25	18	68	78	170	C	HPV900-2068-0E1-xx
	30	22	80	92	200	C	HPV900-2080-0E1-xx

Table 38: HPV 900 Drive Ratings

NOTE: all ratings at 60/50Hz and 10 kHz carrier frequency
all ratings for based on a geared elevator application.

For more information on altitude, temperature, and carrier frequency derating, see Drive Derating on page 12.

* *For more information on the Elevator Duty Cycle Rating, see ELEVATOR DUTY CYCLE on page 107.*

** *Cube size dimensions, mounting holes, and weights are shown on pages 112- 115*

*** *From more information on model number, see DRIVE MODEL NUMBER on page 12*

Cube HP	Cube kW	Model	Power Dissipation kW (Worm Gear)	Resistor Value Range (Worm Gear)	Power Dissipation kW (Planetary Gear)	Resistor Value Range (Planetary Gear)
25	18	-2068	4.0	8 Ω - 2 Ω	8.5	3.8 Ω - 2 Ω
30	22	-2080	4.8	6.6 Ω - 2 Ω	10	3.2 Ω - 2 Ω

Note: 230 V, Regeneration dc bus voltage = 400V

Table 39: Brake Resistor Recommendations

For Assumptions for Brake Resistor Recommendations, see page 116

Input Voltage	Cube HP	Cube KW	Model	Inductance (mH)	Amps
230 V	25	18	-2068	0.28 mH	80 A
	30	22	-2080	0.20 mH	110 A

Table 40: Input Reactor Recommendations

For Manufacturer Considerations, see page 118.

Input Voltage	Cube HP	Cube KW	Model	Inductance (mH)	DC Current Rating (A)
230 V	25	18	-2068	0.10 mH	120 A
	30	22	-2080	0.10 mH	120 A

Table 41: DC Choke Recommendations

See note on page 119

All fuses should be Class J, Low Peak Dual Element, Time delay 600VAC fuses.

Input Voltage	Cube HP	Cube KW	Model	Fusing Required?	Fuse Size (in Amps)
230 V	25	18	-2068	No*	100 to 200 A
	30	22	-2080	No*	125 to 200 A

Table 42: Fusing Recommendations

* With all other models circuit breakers can be substituted for fuses in accordance with local codes

Conductor size, AWG	Amps Conductors with 105°C (221°F) insulation: In conduit or non ventilated raceway	Open or in ventilated raceway	Suggested HPV 900 Wire Sizes for various cubes ratings: 230V
3	80	121	25HP(-2075)
2	90	140	30HP(-2088)

Table 43: Suggested Wire Sizes

Note: wire ratings from: Table 2 – Allowable Ampacities of Insulated Copper Conductors Inside Industrial Control Equipment Enclosures (Based on a Room Ambient Temperature of 40°C (104°F)) source: CAN/CSA-B44.1-M91

			Power Terminals *input, output & DB*		Ground Terminals		Control Power Terminals *115VAC*		Control Wiring Terminals *TB1 & TB2*	
V	hp	Model	Wire size range (AWG)	Torque Spec. (in-lb)	Wire size range (AWG)	Torque Spec. (in-lb)	Wire size range (AWG)	Torque Spec. (in-lb)	Wire size range (AWG)	Torque Spec. (in-lb)
230	25	-2068	6 to 1/0	75 in-lb	14 to 1/0	35 in-lb	22 to 10	5.3 in-lb	14 to 22	4.5 in-lb
	30	-2080	6 to 1/0	75 in-lb	14 to 1/0	35 in-lb	22 to 10	5.3 in-lb	14 to 22	4.5 in-lb

Note: use only copper wire

Table 44: Wire Terminal Specifications

Rated Input Voltage	Rated HP	Rated kW	Model Number	Continuous Output Current Rating (range)	Maximum Output Current for 5 Sec	12-pulse option
230V	25	18	HPV900-2068-0E1-xx	68-78	170	Yes
	30	22	HPV900-2080-0E1-xx	80-92	200	Yes

Table 45: Drive Ratings (with 12-pulse option)

NOTE: all ratings at 60/50Hz and 10 kHz carrier frequency
all ratings for based on a geared elevator application

Rated Input Voltage	Rated HP	Rated kW	Model	Input		Output	
				Voltage V	Current A	Voltage V	Current A
230V	25	18	-2068	200-240	75	0-input voltage	68
	30	22	-2080	200-240	88	0-input voltage	80

Table 46: Input / Output Ratings

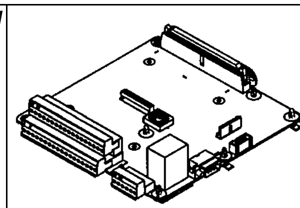
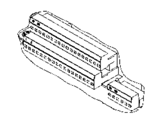
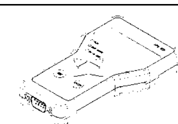
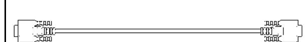
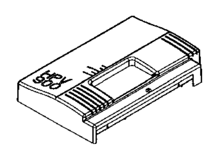
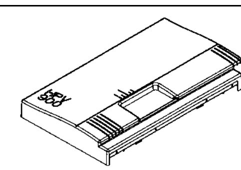
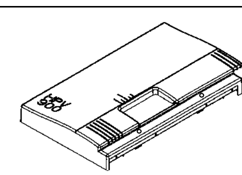
230V	Power loss*	Control Power (115VAC) Dissipation
25HP (-2068)	800 watts	185 watts
30HP (-2080)	1000 watts	185 watts

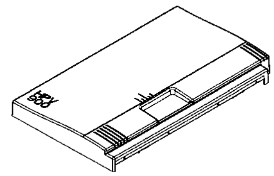
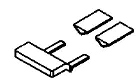
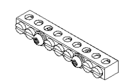
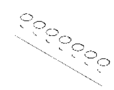
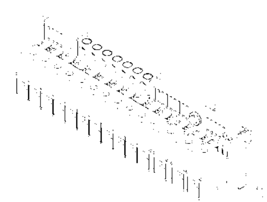
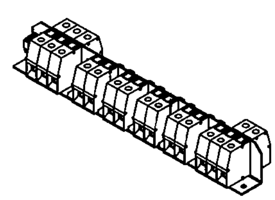
Table 47: Watts Loss / Control Power Dissipation per Drive Rating

Note: values calculated from the worse case condition of 116% of general purpose continuous current rating, 10kHz carrier frequency.

Appendix

Replacement Parts

part number	description	detailed description	
HPV9-CTL0010-01	FRU,HPV900,Ctl PCB, Std Sfw	*Includes the control PCB, software flash, terminal blocks, grounding screw and hardware, and 7 spacers*	
HPV9-CTLTB	FRU,HPV900,Control TBs	*Control terminal blocks.*	
HPV9-PSTB-AB	FRU,HPV900,Control Power TB	*Terminal block for 115VAC control power*	
HPV-ELOP	FRU, HPV900 Oper, Elevator	*Digital operator*	
HPV-CABLE	FRU, HPV900 Oper, Cable	*Digital operator extension cable 2m (6.6 ft)*	
HPV9-COVRA00	FRU,HPV900,Cover,A	*Includes the front plastic cover, cover frame sheet metal, and hardware for A cube.*	
HPV9-COVRB00	FRU,HPV900,Cover,B (side opening)	*Includes the front plastic cover, cover frame sheet metal, and hardware for B and B+ cubes.*	
HPV9-COVRB01	FRU,HPV900,Cover,B (front opening)	*Includes the front plastic cover, cover frame sheet metal, and hardware for B and B+ cubes.*	

part number	***description***	***detailed description***	
HPV9-COVRC00	FRU,HPV900,Cover,C	*Includes the front plastic cover, cover frame sheet metal, and hardware for C cube.*	
HPV9-JMPAB	FRU,HPV900,TB Jumper,Cube A+B	*Terminal block jumpers (quantity=4) for A and B cubes*	
HPV9-JMPC	FRU,HPV900,TB Jumper,Cube C	*Terminal block jumpers (quantity=4) for B+ and C cubes*	
HPV9-GNDTB-AB	FRU,HPV900, Ground TB, Cube A+B	*Terminal block for the ground connections for A and B cubes*	
HPV9-GNDTB-C	FRU,HPV900, Ground TB, Cube C	*Terminal block for the ground connections for B+ and C cubes*	
HPV9-PWRTB-BP	FRU,HPV900, Power TB assembly, Cube B+	*Terminal block assembly for the power terminals for input power, DB resistor, ground, control 115VAC and DC bus LED for B+ cubes*	
HPV9-PWRTB-C	FRU,HPV900, Power TB assembly, Cube C	*Terminal block assembly for the power terminals for input power, DB resistor and control 115VAC for C cubes*	

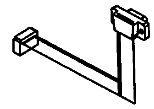
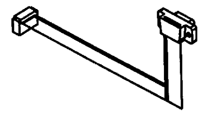
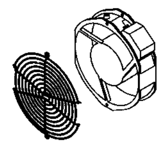
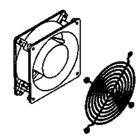
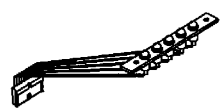
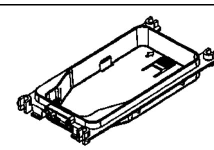
part number	description	detailed description	
HPV9-OPCABLE-AB	FRU,HPV900,Cable Cntl-Op Port, cube-AB	*Ribbon cable connecting Control PCB to the Operator Port (DB-9) for A, B, and B+ cubes*	
HPV9-OPCABLE-C	FRU,HPV900,Cable Cntl-Op Port, cube-C	*Ribbon cable connecting Control PCB to the Operator Port (DB-9) for C cubes*	
HPV9-FAN1BC	FRU,Fan,250CFM,115V	*Includes the 250CFM/115V fan and fan guard for B, B+, & C cubes*	
HPV9-FAN1A	FRU,Fan,105CFM,115V	*Includes the 105CFM/115V fan and fan guard for A cubes*	
HPV9-LED	FRU,HPV900,LED Assembly	*LED display assembly*	
HPV9-OPCRADLE	FRU,HPV900,Operator Cradle	*Operator Cradle*	

Table 48: Replacement Parts

Index

E

F

G

H

I

L

M

N

O

P

R

S

T

U

V

W

Z

HPV 900

Magnetek Elevator Products
N50 W13775 Overview Dr
Menomonee Falls, Wisconsin 53051
(800) 236-1705, (262) 252-6999, FAX (262) 790-4142
http://www.elevatordrives.com

Magnetek Elevator Products - Europe
20 Drake Mews, Crownhill
Milton Keynes, Bucks MK8 0ER UK
+44(0) 1908 261427, FAX +44(0) 1908 261674

MAGNETEK
ELEVATOR