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MAGNETEK
ELEVATOR

Quattro® AC/PM

Quattro AC/PM Elevator Drive

Technical Manual

To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure that the end user receives this manual.

TM7341 Rev 11
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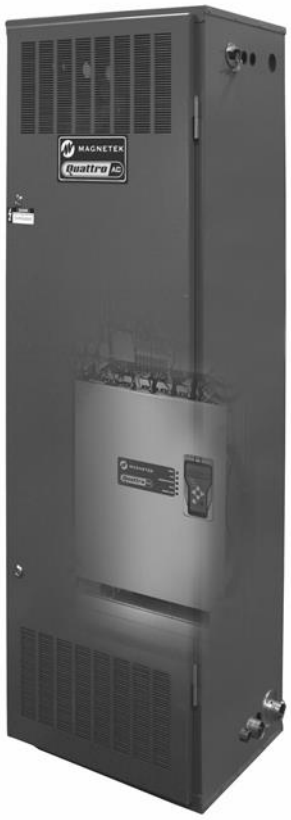
Change History:

R11 Changed the EnDat encoder color code table

The Quattro AC/PM is available in two frame sizes: the cube version and the enclosed version.

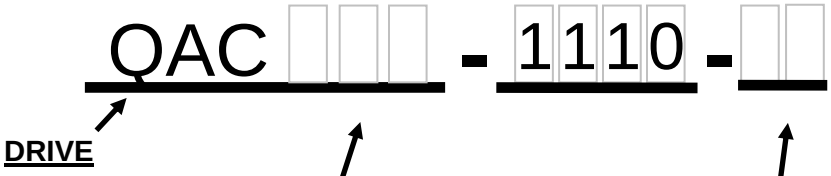
Cube Version



Enclosed Version

Drive Model Numbers (Cube)

The Quattro AC drive cube is currently available with six different output currents and a variety of options.



DRIVE

output current rating
028 = 28A output current
034 = 34A output current
042 = 42A output current
054 = 54A output current
068 = 68A output current
085 = 85A output current

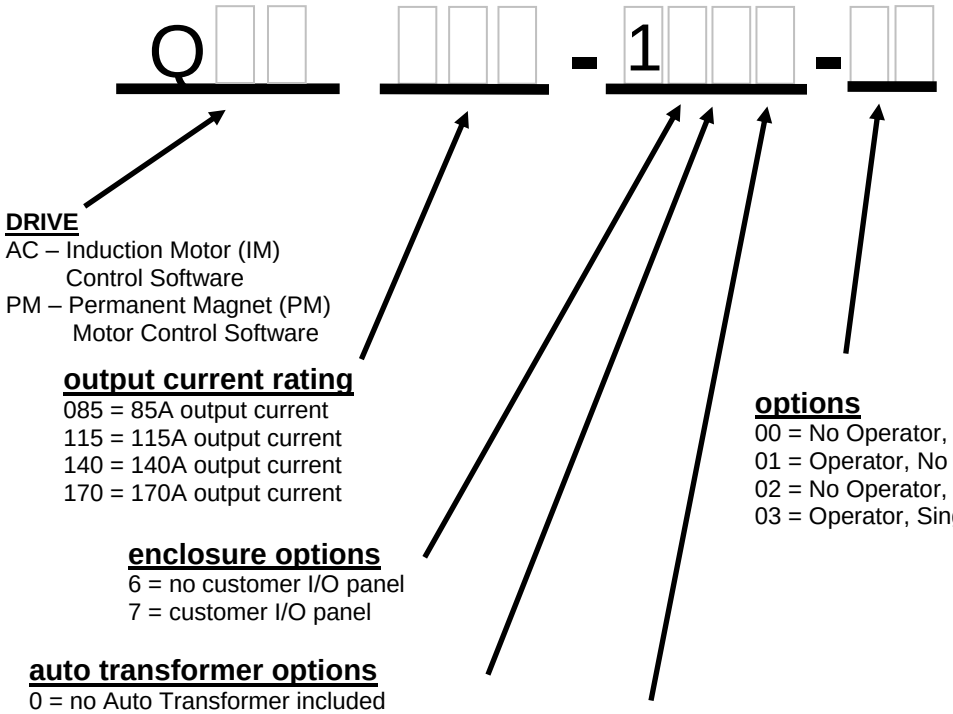
options
00 = No Operator, No Contactor, IM software
01 = Operator, No Contactor, IM software
02 = Operator, Contactor, IM software
03 = No Operator, No Contactor, PM software, PM option card
04 = Operator, No Contactor, PM software, PM option card
05 = Operator, Contactor, PM software, PM option card
06 = No Operator, Contactor, IM software
07 = No Operator, Contactor, PM software, PM option card
08 = No Operator, No Contactor, IM software,DC Bus terminals
09 = Operator, No Contactor, IM software,DC Bus terminals
0A = Operator, Contactor, IM software,DC Bus terminals
0B = No Operator, No Contactor, PM software, PM option card,DC Bus terminals
0C = Operator, No Contactor, PM software, PM option card,DC Bus terminals
0D = Operator, Contactor, PM software, PM option card,DC Bus teminals
0E = No Operator, Contactor, IM software,DC Bus terminals
0F = No Operator, Contactor, PM software, PM option card,DC Bus terminals

Note options 08 – 0F are required for the backup power mode.

Drive Model Numbers (Enclosed)

The Quattro AC/PM drive enclosed is currently available with four different output currents and a variety of options.

The enclosure option consists of a customer I/O panel. The customer I/O panel option is a larger width cabinet that allows for customer interfacing within the supplied cabinet. See Dimensions / Weights on page 165.



Sub menu	Parameter	Units	Range	Default	Site Setting
A1	***A1 DRIVE Submenu – see A1 DRIVE Submenu on page 39.***				
A1	Contract Car Spd	ft/min	0.0 – 2000.0	400.0	
		m/s	0.000 – 10.000	2.000	
A1	Contract Mtr Spd	RPM	30.0 – 3000.0[i]	130.0	
			18.0 – 3000.0[ii]		
A1	Response	Rad/sec	1.0 – 20.0[i]	10.0	
			1.0 – 60.0[ii]		
A1	Inertia	Sec	0.25 – 10.00[i]	2.00	
			0.10 – 10.00[ii]		
A1	Encoder Pulses	PPR	600 – 32700[i]	1024[i]	
			500 – 25000[ii]	2048[ii]	
A1	Serial Cnts/Rev[ii]	Cnts/Rev	600 – 25000[ii]	8192[ii]	
A1	Torque Limit	% of rated torque	0.0 – 275.0	200.0	
A1	Flux Wkn Factor[i]	%	60 – 100[i]	100[i]	
A1	Trq Lim Msg Dly	Sec	0.00 – 10.00	0.50	
A1	Gain Reduce Mult	%	10 – 100	100	
A1	Gain Chng Level	% of rated spd	0.0 – 100.0	100.0	
A1	Spd Dev Hi Level[i]	%	00.0 – 99.9[i]	10.0[i]	
A1	Ramped Stop Time	Seconds	0.00 – 2.50	0.20	
A1	Contact Flt Time	Seconds	0.10 – 5.00	0.50	
A1	Contactor DO Dly	Sec	0.00 – 5.00	0.00	
A1	Flt Reset Delay	Seconds	000 – 120	5	
A1	Flt Resets/Hour	Faults	00 – 10	3	
A1	Brake Pick Time	Seconds	0.00 – 5.00	1.00	
A1	AB Zero Spd Lev	%	0.00 – 2.00	0.00	
A1	AB Off Delay	Sec	0.00 – 9.99	0.00	
A1	Brake Hold Time	Seconds	0.00 – 5.00	0.20	
A1	Overspeed Level	% of contract spd	90.0 – 150.0	115.0	
A1	Overspeed Time	Seconds	0.00 – 9.99	1.00	
A1	Overspeed Mult	%	100.0 – 150.0	125.0	
A1	Spd Dev Lo Level	% of contract spd	0.1 – 20.0	10.0	
A1	Spd Dev Time	Seconds	0.00 – 9.99	0.50	
A1	Spd Dev Alm Lvl[ii]	%	0.0 – 99.9[ii]	10.0[ii]	
A1	Spd Dev Flt Lvl[ii]	%	0.0 – 99.9[ii]	25.0[ii]	
A1	Up To Spd. Level	%	0.00 – 110.00	80.00	
A1	Zero Speed Level	% of contract spd	0.00 – 99.99	1.00	
A1	Zero Speed Time	Seconds	0.00 – 9.99	0.10	
A1	Up/Dwn Threshold	% of contract spd	0.00 – 9.99	1.00	
A1	Notch Filter Frq	Hz	5 – 60	20	
A1	Notch Filt Depth	%	000 – 100	0	
A1	Run Delay Timer	Sec	0.00 – 0.99	0.00	
A1	Tach Rate Gain	none	00.0 – 30.0	0.0	

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Sub menu	Parameter	Units	Range	Default	Site Setting
A1	Inner Loop Xover	rad/sec	00.1 – 20.0[i]	2.0	
			0.1 – 60.0[ii]		
A1	Spd Phase Margin	Degrees	45 – 90	80	
A1	Spd Command Bias	Volts	-6.000 – 6.000	0.000	
A1	Spd Command Mult	none	0.90 – 5.00	1.00	
A1	Spd Zero Band	Volts	0.000 – 1.000	0.000	
A1	Pre Torque Bias	Volts	-6.00 – 6.00	0.00	
A1	Pre Torque Mult	none	-10.00 – 10.00	1.00	
A1	Pre Torque Time	Seconds	0.00 – 10.00	0.00	
A1	Ana Out 1 Offset	%	-99.9 – 99.9	0.0	
A1	Ana Out 2 Offset	%	-99.9 – 99.9	0.0	
A1	Ana Out 1 Gain	none	00.0 – 10.0	1.0	
A1	Ana Out 2 Gain	none	00.0 – 10.0	1.0	
A1	Ser2 Insp Spd	ft/min	000.0 – 100.0	30.0	
		m/s	0.000 – 0.500	0.150	
A1	Ser2 RS Crp Spd	ft/min	000.0 – 300.0	10.0	
		m/s	0.000 – 1.540	0.050	
A1	Ser2 RS Crp Time	Sec	0.0 – 200.0	180.0	
A1	Ser2 Flt Tol	Sec	0.00 – 2.00	0.50	
A1	Mspd Delay 1	Sec	00.000 – 10.000	0.000	
A1	Mspd Delay 2	Sec	00.000 – 10.000	0.000	
A1	Mspd Delay 3	Sec	00.000 – 10.000	0.000	
A1	Mspd Delay 4	Sec	00.000 – 10.000	0.000	
A1	Mid Speed Level	%	000.00 – 110.00	80.00	
A1	Encdr Flt Sense[ii]	%	10 – 100[ii]	30[ii]	
A1	ARB Advance[ii]	Sec	0.0 – 2.00[ii]	0.30[ii]	
A1	ARB Decay[ii]	Sec	0.0 – 2.00[ii]	0.20[ii]	
A1	ARB Timeout[ii]	Sec	0.0 – 2.00[ii]	0.80[ii]	
A1	ARB Deadband[ii]	none	0 – 5[ii]	1.00[ii]	
A1	ARB KP[ii]	none	0.0 – 320.00[ii]	1.00[ii]	
A1	ARB KI[ii]	none	0.0 – 320.00[ii]	1.00[ii]	
A1	ARB FFWD[ii]	none	0 – 32767[ii]	0[ii]	
A1	Abs Ref Offset[ii]	Degs	-180.00 – 180.00[ii]	0.00[ii]	
A1	NTSD Target Spd	ft/min	00.0 – 50.0	0.0	
		m/sec	0.000 – 0.254		
A1	NTSD Threshold 1	ft/min	0.0 – 1500.0	0.0	
		m/sec	0.000 – 8.000		
A1	NTSD Threshold 2	ft/min	0.0 – 1500.0	0.0	
		m/sec	0.000 – 8.000		
A1	NTSD Threshold 3	ft/min	0.0 – 1500.0	0.0	
		m/sec	0.000 – 8.000		
A1	Brk Flt Level[ii]	%	0.0 – 20.0[ii]	2.0[ii]	

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Sub menu	Parameter	Units	Range	Default	Site Setting
A1	DSPR Time	Minutes	000 – 546	10	
A2	***A2 S-CURVES Submenu – see A2 S-CURVES Submenu on page 53.***				
A2	Accel Rate 0	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.900	
A2	Decel Rate 0	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.900	
A2	Accel Jerk In 0	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Accel Jerk Out 0	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Decel Jerk In 0	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Decel Jerk Out 0	ft/s^3	00.0 – 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	0.900	
A2	Decel Rate 1	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.900	
A2	Accel Jerk In 1	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Accel Jerk Out 1	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Decel Jerk In 1	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Decel Jerk Out 1	ft/s^3	00.0 – 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	0.900	
A2	Decel Rate 2	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.900	
A2	Accel Jerk In 2	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Accel Jerk Out 2	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Decel Jerk In 2	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Decel Jerk Out 2	ft/s^3	00.0 – 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	0.900	
A2	Decel Rate 3	ft/s^2	0.00 – 7.99	3.00	
		m/s^2	0.000 – 3.999	0.900	
A2	Accel Jerk In 3	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Accel Jerk Out 3	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Decel Jerk In 3	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Decel Jerk Out 3	ft/s^3	00.0 – 29.9	8.0	
		m/s^3	0.00 – 9.99	2.40	
A2	Accel Rate 4	ft/s^2	0.00 – 7.99	5.00	
		m/s^2	0.000 – 3.999	1.500	
A2	Decel Rate 4	ft/s^2	0.00 – 7.99	5.00	
		m/s^2	0.000 – 3.999	1.500	
A2	Accel Jerk In 4	ft/s^3	00.0 – 29.9	0.0	
		m/s^3	0.00 – 9.99	0.00	

Sub menu	Parameter	Units	Range	Default	Site Setting
A2	Accel Jerk Out 4	ft/s^3	00.0 – 29.9	0.0	
		m/s^3	0.00 – 9.99	0.00	
A2	Decel Jerk In 4	ft/s^3	00.0 – 29.9	0.0	
		m/s^3	0.00 – 9.99	0.00	
A2	Decel Jerk Out 4	ft/s^3	00.0 – 29.9	0.0	
		m/s^3	0.00 – 9.99	0.00	
A3	***A3 MULTISTEP REF Submenu – see A3 MULTISTEP REF Submenu on page 56.***				
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	***A4 MS PWR CONVRT Submenu – see A4 MS PWR CONVRT Submenu on page 57***				
A4	UV Alarm Level	%	80 – 99	90	
A4	UV Fault Level	%	50 – 99	80	
A4	PWM Frequency	kHz	2.5 – 16.0	10.0	
A4	Extern Reactance	%	0.0 – 10.0	0.0	
A4	ID Reg Diff Gain	none	0.00 – 1.20[i]	0.60	
			0.0 – 0.60[ii]		
A4	ID Reg Prop Gain	none	0.10 – 0.40[i]	0.10	
			0.100 – 3.000[ii]		
A4	ID Reg Intg Gain[ii]	none	0.00 – 2.00[ii]	1.00[ii]	

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Sub menu	Parameter	Units	Range	Default	Site Setting
A4	IQ Reg Diff Gain	none	0.00 – 1.20[i] 0.00 – 0.60[ii]	0.60	
A4	IQ Reg Prop Gain	none	0.10 – 0.40[i] 0.100 – 3.000[ii]	0.10	
A4	IQ Reg Intg Gain[ii]	none	0.00 – 2.00[ii]	1.00[ii]	
A4	Fine Tune Ofst[ii]	deg	-75.00 – 75.00[ii]	0.00[ii]	
A4	ID Ref Threshold[ii]	none	0.00 – 0.20[ii]	0.00[ii]	
A4	Flux Weaken Rate[ii]	none	0.000 – 1.000[ii]	0.000[ii]	
A4	Flux Weaken Lev[ii]	none	0.70 – 1.00[ii]	0.95[ii]	
A4	Align Vlt Factor[ii]	none	0.05 – 1.99[ii]	1.00[ii]	
A4	Autoalign Volts[ii]	%	1 – 50[ii]	10[ii]	
A5	***A5 LS PWR CONVRT Submenu – see A5 LS PWR CONVRT Submenu on page 62.***				
A5	Input L-L Volts	Vrms	150 – 480	480	
A5	Initial L Freq	Hz	50 – 60	55	
A5	DC Bus V Boost	Volts	15 – 75	30	
A5	SW Bus OV Level	Vdc	100 – 850	850	
A5	Bus Vref Source	none	- track line v - trk vin param	TRACK LINE V	
A5	LS PWM Frequency	kHz	8.0 – 12.0	10.0	
A5	Pre Chge Thresh	none	1 – 60	28	
A5	PLL Filter Fc	Hz	20.0 – 150.0	40.0	
A5	Pole Filter	kHz	0.1 – 3.0	2.2	
A5	LS ID Reg P Gain	none	0.00 – 9.99	0.60[iii] 0.30[iv]	
A5	LS ID Reg I Gain	none	0 – 999	20[iii] 10[iv]	
A5	LS IQ Reg P Gain	none	0.00 – 9.99	0.60[iii] 0.30[iv]	
A5	LS IQ Reg I Gain	none	0 – 999	20[iii] 40[iv]	
A5	DC Bus Reg P GN	none	0.00 – 9.99	3.00	
A5	DC Bus Reg I GN	none	0 – 999	40	
A6	***A6 MOTOR Submenu – see A6 MOTOR Submenu on page 64.***				
A6	Motor ID	none	- 4 pole dflt[i] - 6 pole dflt[i] small pm dflt[ii]	4 POLE DFLT[i] SMALL PM DFLT[ii]	
A6	Rated Mtr Power	HP kW	1.0 – 500.0 0.75 – 400.00	0.00	
A6	Rated Mtr Volts	V	85.0 – 575.0	0.0	
A6	Rated Excit Freq[i]	Hz	5.0 – 400.0[i]	0.0[i]	
A6	Rated Motor Curr	A	1.00 – 800.00	0.00	

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software
[iii] Parameter settings for the Cube drive
[iv] Parameter settings for the Enclosed drive

Sub menu	Parameter	Units	Range	Default	Site Setting
A6	Motor Poles	none	2 – 32[i] 2 – 128[ii]	per motor ID	
A6	Rated Mtr Speed	RPM	50.0 – 3000.0[i] 18.0 – 3000.0[ii]	0.0	
A6	% No Load Curr[i]	%	1.0 – 80.0[i]	per motor ID	
A6	Stator Leakage X[i]	%	0.1 – 20.0[i]	per motor ID	
A6	Rotor Leakage X[i]	%	0.0 – 20.0[i]	per motor ID	
A6	Flux Sat Break[i]	%	0 – 100[i]	75[i]	
A6	Flux Sat Slope 1[i]	%	0 – 200[i]	0[i]	
A6	Flux Sat Slope 2[i]	%	0 – 200[i]	50[i]	
A6	Ovld Start Level	%	100 – 150	110	
A6	Ovld Time Out	sec	5.0 – 120.0	60.0	
A6	Stator Resist	%	0.1 – 20.0[i] 0.0 – 20.0[ii]	per motor ID	
A6	Motor Iron Loss	%	0.1 – 15.0[i] 0.0 – 15.0[ii]	per motor ID	
A6	Motor Mech Loss	%	0.1 – 15.0[i] 0.0 – 15.0[ii]	per motor ID	
A6	D Axis Induct[ii]	mH	0.50 – 150.00[ii]	10.00[ii]	
A6	Q Axis Induct[ii]	mH	0.50 – 150.00[ii]	10.00[ii]	
A6	OL Align Scale[ii]	none	0.50 – 2.00[ii]	0.78[ii]	
A6	Encoder Ang Ofst[ii]	none	0 – 30000[ii]	30000[ii]	
C1	***C1 USER SWITCHES Submenu – see C1 USER SWITCHES Submenu on page 70.***				
C1	Spd Command Src	none	– multi-step – ser mult step – analog input – serial	MULTI-STEP	
C1	Run Command Src	none	– external tb – serial – serial+extrn	EXTERNAL TB	
C1	Motor Rotation	none	– forward – reverse	FORWARD	
C1	Encoder Select[ii]	none	– endat abslute[ii]	ENDAT ABSLUTE[ii]	
C1	Encoder Fault	none	– enable – disable	ENABLE	
C1	Cont Confirm Src	none	– external tb	EXTERNAL TB	
C1	Fast Flux[i]	none	– disabled[i] – enabled[i]	DISABLED[i]	
C1	HI/LO Gain Src	none	– internal – external tb – serial	INTERNAL	
C1	I-Reg Inner Loop[ii]	none	– enabled med[ii] – enabled high[ii] – disabled[ii] – enabled low[ii]	ENABLED MED[ii]	
C1	Ramped Stop Sel	none	– none – ramp on stop	NONE	
C1	Ramp Down En Src	none	– external tb – run logic – serial	EXTERNAL TB	

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Sub menu	Parameter	Units	Range	Default	Site Setting
C1	S-Curve Abort	none	– disabled – enabled	DISABLED	
C1	Spd Ref Release	none	– reg release – brake picked	REG RELEASE	
C1	Brake Pick Src	none	– internal – serial	INTERNAL	
C1	Brake Pick Cnfm	none	– none – external tb – internal time – serial – on speed cmd	NONE	
C1	Motor Ovrld Sel	none	– alarm – flt immediate – fault at stop	ALARM	
C1	Stopping Mode	none	– immediate – ramp to stop	IMMEDIATE	
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	Speed Reg Type	none	– elev spd reg – pi speed reg – external reg	ELEV SPD REG	
C1	Brake Hold Src	none	– internal – serial	INTERNAL	
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 – serial – analog input	NONE	
C1	Fault Reset Src	none	– external tb – serial – automatic	EXTERNAL TB	
C1	Overspd Test Src	none	– external tb – serial	EXTERNAL TB	
C1	Pretorque Source	none	– none – analog input – serial	NONE	
C1	Pretorque Latch	none	– not latched – latched	NOT LATCHED	
C1	Ptorq Latch Clck	none	– external tb – serial	EXTERNAL TB	
C1	Dir Confirm	none	– disabled – enabled	DISABLED	
C1	Mlt-Spd TO Dly1	none	– none – mspd 1 - 15	NONE	
C1	Mlt-Spd TO Dly2	none		NONE	
C1	Mlt-Spd TO Dly3	none		NONE	
C1	Mlt-Spd TO Dly4	none		NONE	
C1	Priority Msg	none	– enable – disable	ENABLE	

Sub menu	Parameter	Units	Range	Default	Site Setting
C1	Arb Select	none	– disable – arb3	DISABLE	
C1	Endat Interp[ii]	none	– times 8[ii] – times 16[ii] – times 32[ii] – times 64[ii] – times 128[ii] – times 256[ii] – times 512[ii] – times 1024[ii]	TIMES 128[ii]	
C1	Endat Out Mult[ii]	none	– times 8[ii] – times 1[ii] – times 2[ii] – times 4[ii]	TIMES 8[ii]	
C1	Drive Enable Src	none	– external tb – serial – serial+extern	EXTERNAL TB	
C1	NTSD Mode	none	– external – 1 threshold – 2 thresholds – 3 thresholds	EXTERNAL	
C1	PWM Mode[ii]	none	– 3PH-2PH[ii] – 2PH[ii] – 3PH[ii]	3PH-2PH[ii]	
C1	Boost Enable Src	none	– enable on de – external tb – serial – enable on run	ENABLE ON DE	
C1	Bu Pwr Mode	none	– none – external tb – serial+extern – serial	NONE	
C1	Engr Parm Lock[ii]	none	– locked[ii] – unlocked[ii]	LOCKED[ii]	

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Sub menu	Parameter	Units	Range	Default	Site Setting
C2	***C2 LOGIC INPUTS Submenu – see C2 LOGIC INPUTS Submenu on page 87.***				
C2	Log In 1 TB1-1	– boost enable – bu pwr enable – contact cfirm – ctr pwr sense – 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 – ntsd input 1 – ntsd input 2	– ospd test src – pre-trq latch – run 2 – 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	CONTACT CFIRM	
C2	Log In 2 TB1-2			CTR PWR SENSE	
C2	Log In 3 TB1-3			DRIVE ENABLE	
C2	Log In 4 TB1-4			RUN	
C2	Log In 5 TB1-5			FAULT RESET	
C2	Log In 6 TB1-6			UP/DWN	
C2	Log In 7 TB1-7			STEP REF B0	
C2	Log In 8 TB1-8			STEP REF B1	
C2	Log In 9 TB1-9			STEP REF B2	
C2	N.C. INPUTS	Hex Number		001 HEX	
C3	***C3 Logic Outputs Submenu – see C3 Logic Outputs Submenu on page 89.***				
C3	Log Out 1 TB1-25	– alarm – alarm+flt – at mid speed – auto brake – bu pwr active – brake hold – brake pick – brk hold flt – brk pick flt – car going dwn – car going up – charge fault – close contact – contactor flt – curr reg flt – drv overload – encoder flt – fault – flux confirm – ground fault – in low gain – motor trq lim – mtr overload – no function	– not alarm – not fault – ntsd active – over curr flt – overspeed flt – overtemp flt – overvolt flt – ovrtemp alarm – phase fault – ramp down ena – ready 2 start – ready to run – regen trq lim – run commanded – run confirm – safe off – speed dev – speed dev low – speed ref rls – speed reg rls – undervolt flt – up to speed – uv alarm – zero speed	CLOSE CONTACT	
C3	Log Out 2 TB1-26			RUN COMMANDED	
C3	Log Out 3 TB1-27			MTR OVERLOAD	
C3	Log Out 4 TB1-28			ENCODER FLT	
C3	Log Out 5 TB1-29			FAULT	
C3	Log Out 6 TB1-30			SPEED REG RLS	
C3	Log Out 7 TB1-31			SPEED REG RLS	
C3	Solid State Rly1			NO FUNCTION	
C3	Solid State Rly2			NO FUNCTION	
C3	Relay Coil 1			NO FUNCTION	
C3	Relay Coil 2			NO FUNCTION	

Sub menu	Parameter	Units	Range	Default	Site Setting
C4	***C4 ANALOG OUTPUT Submenu – see C4 ANALOG OUTPUT Submenu on page 91.***				
C4	Ana Out 1 TB1-12	– abs pos angle[ii] – absolut angl[ii] – arb state – aux torq cmd – bus voltage – current out – d-current ref[ii] – dist torq est – drv overload – flux current – flux output[i] – flux ref[i] – flux voltage – frequency out – increm angle[ii] – mtr overload – pos fdbk angl[ii]	– power output – pretorque ref – slip freq[i] – spd rg tq cmd – speed command – speed error – speed feedbk – speed ref – tach rate cmd – torq current – torq voltage – torque output – torque ref – u8-addr1 – u8-addr2 – u8-addr3 – voltage out	SPEED REF	
C4	Ana Out 2 TB1-13			SPEED FEEDBK	

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Menu	***Parameter***	***Unit***
D1	***D1 ELEVATOR DATA Submenu***	
D1	Speed Command	ft/min or m/sec
D1	Speed Reference	ft/min or m/sec
D1	Speed Feedback	ft/min or m/sec
D1	Encoder Speed	RPM
D1	Speed Error	ft/min or m/sec
D1	Est Inertia	Seconds
D1	Logic Outputs	1 = true; 0 = false
D1	Logic Inputs	1 = true; 0 = false
D1	Rx Logic In	1 = true; 0 = false
D1	Rx Com Status	1 = true; 0 = false
D1	Pre-Torque Ref	% of rated torque
D1	Spd Reg Torq Cmd	% of rated torque
D1	Tach Rate Cmd	% of rated torque
D1	FF Torque Cmd	% of rated torque
D1	NTSD 1 Spd Fdbk	ft/min or m/sec
D1	NTSD 2 Spd Fdbk	ft/min or m/sec
D1	NTSD 3 Spd Fdbk	ft/min or m/sec
D2	***D2 MS POWER DATA Submenu***	
D2	DC Bus Voltage	V
D2	Motor Current	A
D2	Motor Voltage	V
D2	Motor Frequency	Hz
D2	Motor Torque	% rated torque
D2	Est No Load Curr[i]	%
D2	Est Rated RPM[i]	RPM
D2	Torque Reference	% of rated torque
D2	Flux Reference[i]	%
D2	Flux Output[i]	%
D2	% Motor Current	% rated current
D2	Power Output	kW
D2	Slip Frequency[i]	Hz
D2	D-Curr Reference[ii]	%
D2	Motor Overload	%
D2	Drive Overload	%
D2	Flux Current	%
D2	Torque Current	%
D2	Flux Voltage	%
D2	Torque Voltage	%
D2	Base Impedance	Ohms
D2	Rated Excit Freq[i]	Hz
D2	Rotor Position[ii]	Deg
D2	DS Module Temp	C
D2	Highest Temp.	C

Menu	***Parameter***	***Unit***
D3	***D3 LS POWER DATA Submenu***	
D3	DC Bus Volts	V
D3	DC Bus Volts Ref	V
D3	Input Vab	V
D3	Input Vca	V
D3	Input Hz	Hz
D3	LS Input Current	A
D3	LS Power Input	kW
D3	LS Overload	%
D3	LS D Axis I	%
D3	LS Q Axis I	%
D3	LS D Axis V	%
D3	LS Q Axis V	%
D3	LS Module Temp	C

[i] Parameters accessible through Induction Closed-Loop software

[ii] Parameters accessible through PM software

Menu	***Parameter***	
U1	***U1 PASSWORD Submenu***	
U1	Enter Password	-
U1	New Password	-
U1	Password Lockout	-
U2	***U2 HIDDEN ITEMS Submenu***	
U2	Hidden Items En	-
U3	***U3 UNITS Submenu***	
U3	Units Selection	-
U4	***U4 OVRSPEED TEST Submenu***	
U4	Overspeed Test?	-
U5	***U5 RESTORE DFLTS Submenu***	
U5	Restore Motor Defaults?	-
U5	Restore Drive Defaults?	-
U5	Restore Utility Defaults?	-
U6	***U6 MS INFO Submenu***	
U6	MS Type	AC or PM Drive
U6	MS Code Version	A4420-_U_ _ _ _
U6	MS S/W Date	Jan 01 2000
U6	MS S/W Time	24:00:00
U6	MS FPGA Revision	
U6	Option Type	
U6	Option FPGA Rev	
U6	MS Cube ID	
U7	***U7 LS INFO Submenu***	
U7	LS Type	
U7	LS Code Version	A4410-L_ _ _ _
U7	LS S/W Date	Jan 01 2000
U7	LS S/W Time	24:00:00
U7	LS FPGA Rev	
U7	LS Cube ID	

Menu	***Parameter***	
U8	***U8 HEX MONITOR Submenu***	
U8	Addr1	-
U8	Addr2	-
U8	Addr3	-
U10[ii]	***U10 ROTOR ALIGN Submenu***	
U10	Alignment Method[ii]	-
U10	Alignment[ii]	-
U10	Begin Alignment[ii]	-
U12[ii]	***U12 AUTOTUNE Submenu***	
U12	AUTOTUNE SELECT[ii]	-
F1	***F1 ACTIVE FAULTS Submenu***	
F1	Display Active Faults?	-
F1	Reset Active Faults?	-
F2	***F2 FAULTS HISTORY Submenu***	
F2	Display Fault History?	-
F2	Clear Fault History?	-
F2	Display Fault Counters?	-

[i] Parameters accessible through Induction Closed-Loop software

[ii] Parameters accessible through PM software

Introduction

Drive Ratings and Specifications

The Quattro drive is designed for connection to a 4 wire grounded 3-phase input along with a single-phase 230V_{AC} control power input.

Basic Drive Specifications

- 28, 34, 42, 54, 68, and 85 amps output for cube style (Elevator Run Current)
- 85, 115, 140, and 170 amps output for enclosed style (Elevator Run Current)
- 150% overload for 60 seconds
- 250% overload for 5 seconds
- Low utility input current harmonics at full power
- Unity Power Factor (1.0 Service Factor)
- 0–45ºC (32–115ºF) ambient temp range
- Fully regenerative operation
- Includes motor contactor / output contactor
- 4+ Million Start-Stop operating cycles
- (9) 24VDC Programmable Logic Inputs
- (11) Programmable Logic Outputs:
  - (7) 24VDC
  - (2) Solid-State Relays
  - (2) Relays

Service Conditions

- Required: 200-480V_{AC}, 3-phase, 50/60 Hz input power, Line Impedance Z < 6%
- Required: 220-240V_{AC}, single-phase control power, 50/60 Hz

Software Operating Features

The General Purpose Quattro-AC/PM elevator drive is a four-quadrant torque and speed regulated motor drive with low power line harmonic currents and unity power factor. It can be configured to operate geared and gearless elevators and lifts. Basic features include:

- Separate Motor Control softwares
  - Induction Motor (IM) closed loop control
  - Permanent Magnet (PM) motor closed loop control
- User choice of operating speed reference *(see page 35)*
  - External analog reference follower
  - Serial link reference follower
  - Internal reference generator with controlled S-Curve smoothing to one of 15 preset speeds
- User choice of ft/min or m/sec speed programming and display units *(see page 102)*
- User choice of input control logic for Run-Up / Run-Down or Run / Direction relay control with internal preset speeds *(see page 35)*
- User choice of P-I type or Magnetek exclusive E-Reg elevator velocity regulators *(see page 82)*
- Torque Feed-Forward when available from the car controller *(see page 35)*
- Pre-Torque at drive start to reduce roll-back *(see page 35)*
- Controlled torque Ramp-Down to prevent elevator brake thumping at stops *(see page 35)*
- Internal frequency notch filter to reject rope resonance interference *(see page 49)*
- Drive Stand-by Power Reduction *(see page 36)*
- User selectable choices for relay logic outputs, including *(see Logic Outputs C3 submenu on page 90):*
  - Drive OK / No Faults relay
  - Alarms Relay
  - Drive operating, OK to release brake
  - Car above/below speed X threshold
  - Car above/below Zero speed threshold
  - Car Moving Up
  - Car Moving Down
  - Speed Error above/below X threshold for Y secs
  - Drive Standby Power Reduction (DSPR)
  - Elevator Brake actuation
- User selectable analog trace outputs for system diagnostics *(see Analog Outputs C4 submenu on page 92)*
- Diagnostic indicator for verifying logic input and output conditions
- Programmable Alarm Relay to indicate important but non-critical conditions
  - Motor thermostat over-temperature
  - Motor over-load
  - Drive over-heating
  - Low utility line input
- Safety related fault trapping with diagnostics, including:
  - Motor over-current
  - Motor malfunction
  - Contactor failure
  - Severe utility line disturbances
  - Encoder loss
  - Over-speed trip
- User selectable automatic or external commanded Fault Reset *(see User Switches C1 submenu on pages 70-83)*

Quattro Startup Guide

Initial Inspection

Unpacking

1. When unpacking, check the drive for any shipping damage.
2. If the Quattro needs to be lifted, see the spare parts list on page 194 for the lifting kit part number.
3. Review the technical manual.
4. Verify the proper drive model numbers and voltage ratings as specified on the purchase order.
5. Location of the Quattro is important for proper operation of the drive and normal life expectancy.

Installation

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.

Observe the following precautions:

1. Wiring guide lines:
   - For Logic Input and Output I/O connections, use quality, multi-conductor cable or discrete stranded wire only.
   - For Encoder and Analog I/O connections, use quality, multi-conductor braided shield cable*.
   - For Communication I/O connections, use quality, multi-conductor braided shield* cable or twisted pair wire.

*Cable shields to be terminated with a 180/360 degree metal cable clamp attached to Control Tray panel. Refer to Figure 30 on page 154 or Figure 32 on page 155.

2. Never connect main AC power to the output terminals.
3. Never allow wire leads to contact metal surfaces. Short circuit may result.
4. The size of the wire must be suitable for Class I circuits.
5. Motor lead length should not exceed 20m (60 ft). If lead length must exceed this distance, contact Magnetek for proper installation procedures.
6. The following are required to be contained in individual conduit runs: 3-phase incoming power, control power, and 3-phase motor.
7. Use UL/CSA certified connectors sized for the selected wire gauge. Install connectors using the crimping tools specified by the connector manufacturer.
8. Control wire lead length should not exceed 20m (60 ft). Signal leads and feedback leads should be run in separate conduits from power and motor wiring.
9. Verify that the input voltage matches the drive's rating.
10. Verify that the motor is wired for the application voltage and amperage.
11. Tighten all of the three-phase power and ground connections. See page 163 for torque specifications.
12. Check that all control and signal terminations are also tight.

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

- During shipping, connections may loosen; 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 all transformers are connected for proper voltage.
- Open F1 and F2 and ensure control power brought into fuse F1 and F2 is $230V_{AC}$.

IMPORTANT

Double-check all the power wires and motor wires to make sure that they are securely tightened down to their respective lugs (loose wire connections may cause problems at any time).

Grounding considerations

1. Encoder
   a. Encoder cable
      i. The encoder shield is not to be connected at the encoder end. On the drive side of the cable a portion of PVC material 1 inch [25mm] should be removed approximately 12 inches [300mm] from the connection to the customer interface PCB (A6) to expose the shield material. This point is required to be secured under a clamp located under the control tray. Do not connect the shield to any other point.
2. Motor frame
   a. The motor frame is required to be grounded. The bond wire should be returned to the common ground point located in the Quattro enclosure (PE).
3. Three phase power
   a. The three-phase wires must be run with a ground wire. This ground wire, which is connected back to the utility ground, is required to be connected to the Quattro ground (PE).
4. Control power, $230V_{AC}$
   a. The neutral side of the control power is required to be grounded at the Quattro ground (PE).

Initial adjustments after power up

Encoder Set-up
Verify the encoder has been selected and installed in accordance with the manufacturer recommended setup and Magnetek recommended setup. For PM, verify the absolute encoder option card has been installed correctly.

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 (PM):

- Use a Heidenhain EnDat Encoder, specifically: ECN113, ECN1313, ECN413, or ROC413.
- Follow encoder manufacturer's mounting and wiring recommendations.
- Use Heidenhain extension Cable p/n 309778-xx (with xx less than or equal to 15) to connect Encoder to Drive.
- Connect Encoder Cable using a Heidenhain extension cable.
- If encoder cable length exceeds 15m (50ft) refer to Testpoints (EnDat Optional Board – Other) on page 191.
- Maximum encoder cable length is 100m (328ft).

Electrical Requirements:

- Insulate both the encoder case and shaft from the motor for incremental encoders.
- Incremental or EnDat Absolute type encoders
- Use twisted pair cable with shield tied to chassis ground at drive end.
- Use limited slew rate differential line drivers.
- Do not allow capacitors from internal encoder electronics to case.
- Do not exceed the operating specification of the encoder/drive (300kHz @ rated motor speed maximum).
- Use the proper encoder supply voltage and use the highest possible voltage available. The Quattro provides both 5VDC and 12VDC for incremental encoders. Magnetek recommends using the 12VDC for the incremental encoder supply.

Mechanical Considerations:

- Use direct motor mounting without couplings.
- Use hub or hollow shaft encoder with concentric motor stub shaft.
- If possible, use a mechanical protective cover for exposed encoders.
- It is not advisable to use friction wheels.

Enter/verify the encoder pulses entered in the ENCODER PULSES (A1) parameter matches the encoder's nameplate.

Motor Parameter Set-up
Enter/verify the following from the motor's nameplate:

1. Motor Current (RATED MTR CURRENT (A6))
2. Motor Voltage (RATED MTR VOLTS (A6))
3. Motor Poles (MOTOR POLES (A6))
4. Motor Speed (RATED MTR RPM (A6))

Hoist way Parameter Set-up
Enter/verify the hoist way parameters:
1. CONTRACT CAR SPD (A1) parameter programs the elevator contract speed in ft/min or m/s.
2. CONTRACT MTR SPD (A1) parameter programs the motor speed at elevator contract speed in RPM.

Line voltage setup
Enter/verify the line voltage parameter:
1. INPUT L-L VOLTS (A5) parameter programs the line voltage level.

Alignment Procedure (PM only)
Refer to page 144 on how run the alignment procedures. Alignment is critical to the success of a PM motor/drive installation.

(C1, C2, C3, C4) configuration setup
It will be required to adjust the configuration menus to operate the Quattro as the elevator manufacturer has specified to interact with the car controller. Magnetek does not supply this data.

Low speed inspection mode
Run the drive in low speed inspection mode and:
1. Verify encoder polarity; the motor rotation should match the encoder phasing. For PM, this is checked during the Open Loop Alignment procedure. For PM, do NOT change the wires on either the encoder or the motor after the drive has passed the Open Loop Alignment.
2. Verify proper hoist way direction. This should be reversed with the MOTOR ROTATION (C1) parameter.
3. Verify that the Safety Chain/Emergency Stop works.

Interconnections

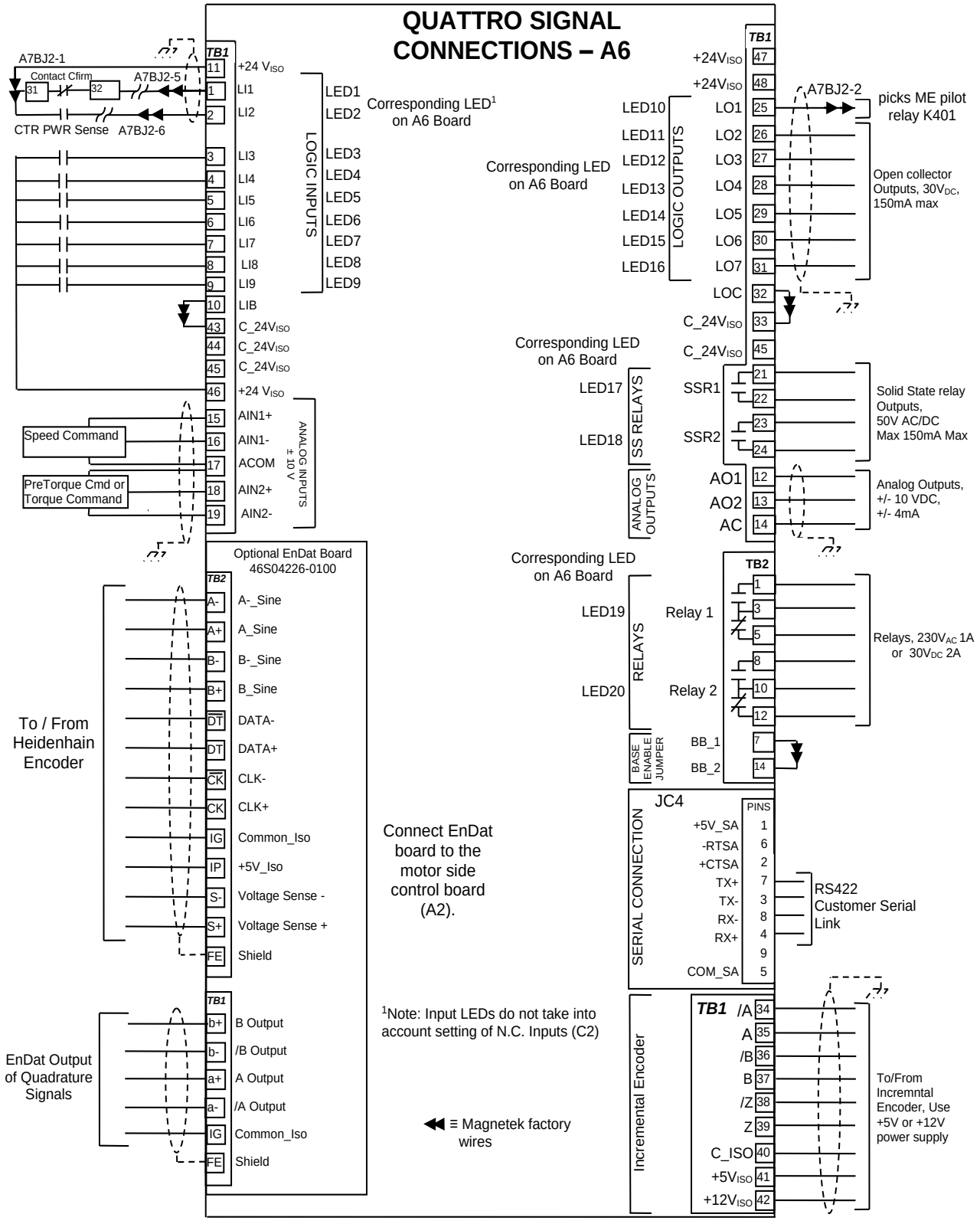


Figure 1: Interconnection Diagram for Cube

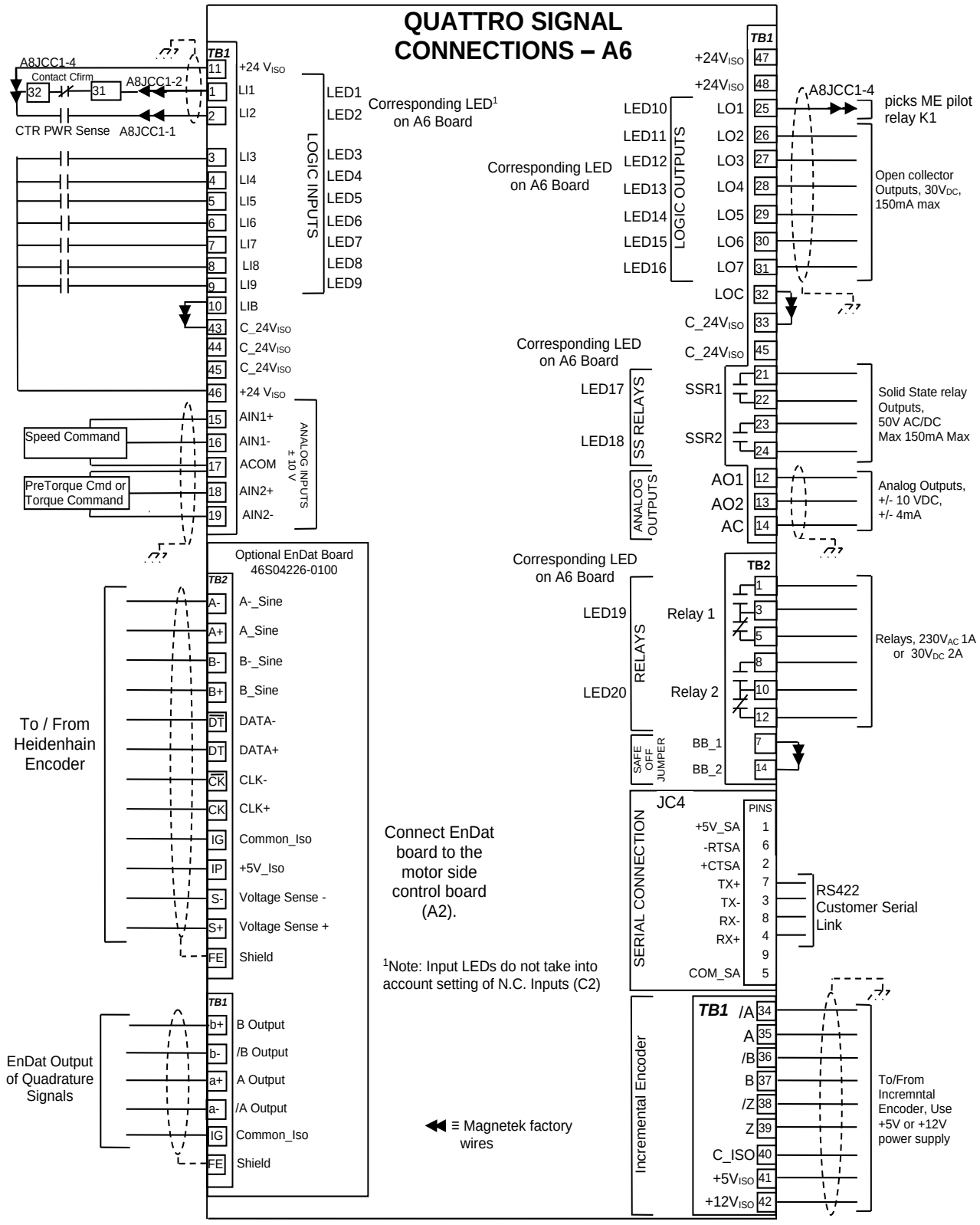


Figure 2: Interconnection Diagram for Enclosed

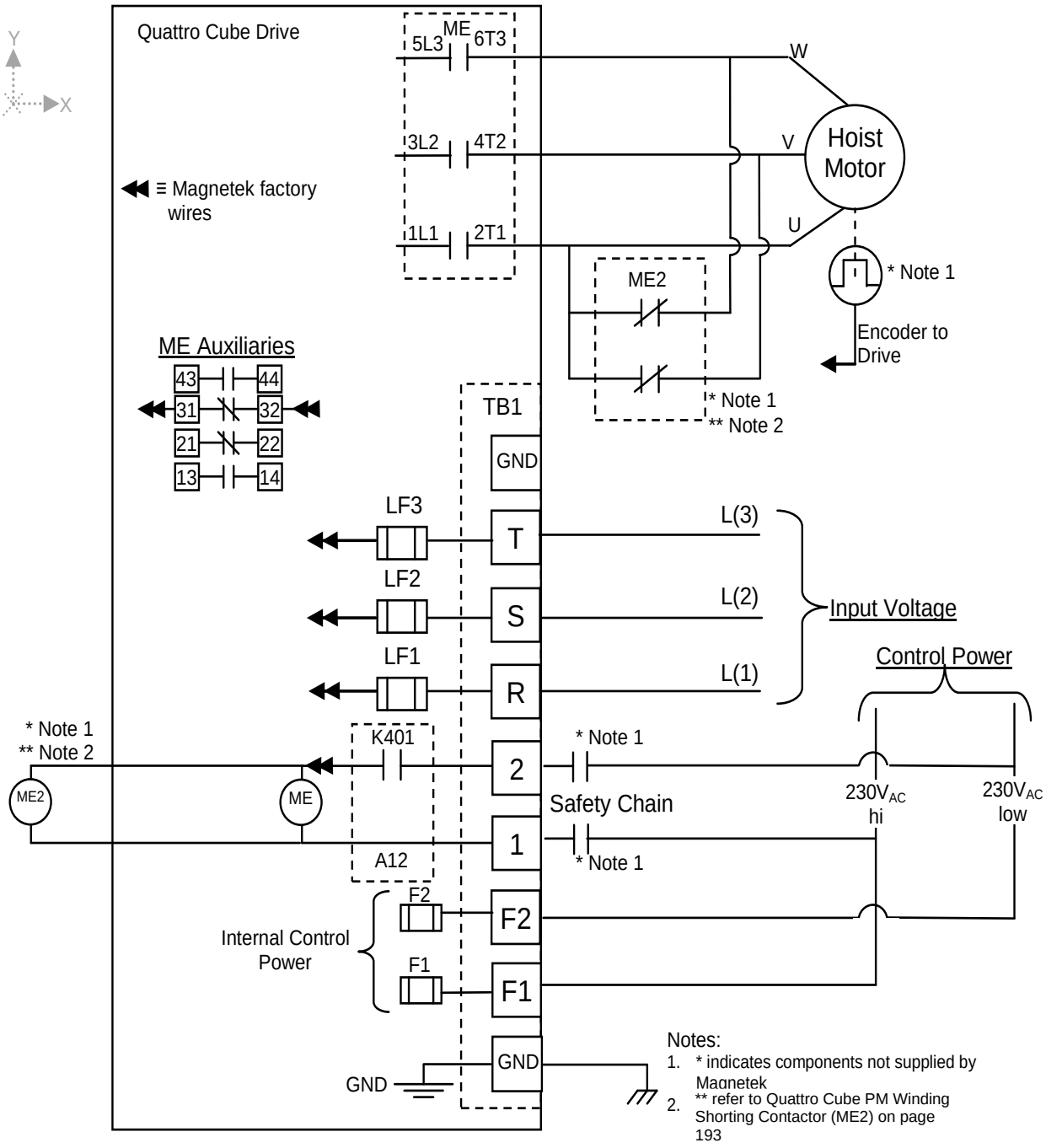


Figure 3: Quattro Cube Power Connections

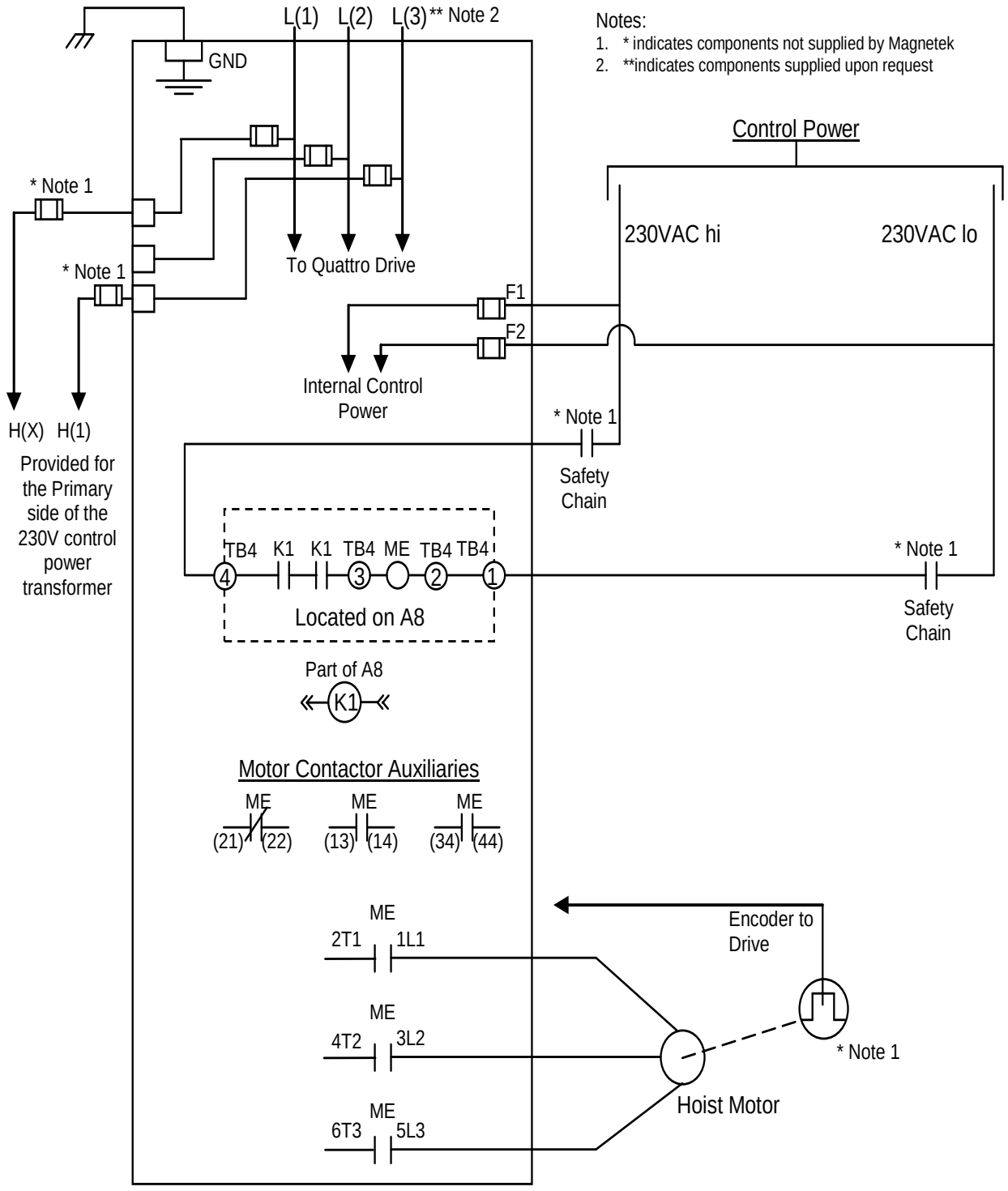


Figure 4: Quattro AC/PM Enclosed Power Connections

Logic Inputs

The Quattro AC/PM's nine programmable logic inputs are opto-isolated. *For more information on programming logic inputs, see Logic Inputs C2 submenu on page 87.* The inputs become "true" by closing contacts or switches between the logic input terminal and voltage source common (or voltage source). The inputs are sourcing inputs – nominally sitting at common and when the contacts or switches are closed, turning "true" at 24VDC. The voltage supply for the logic inputs is 24VDC.

IMPORTANT

The internal 24VDC power supply has a capacity of 400 mA.

NOTE: Logic input 1 and 2 are reserved and pre-wired for CONTACT CFIRM and CTR PWR SENSE respectively.

The choices for the voltage source common (or voltage source) depend on if the user is using an external voltage supply or using the internal voltage supply. See Figure 5 for the internal supply example and Figure 6 for the external supply example.

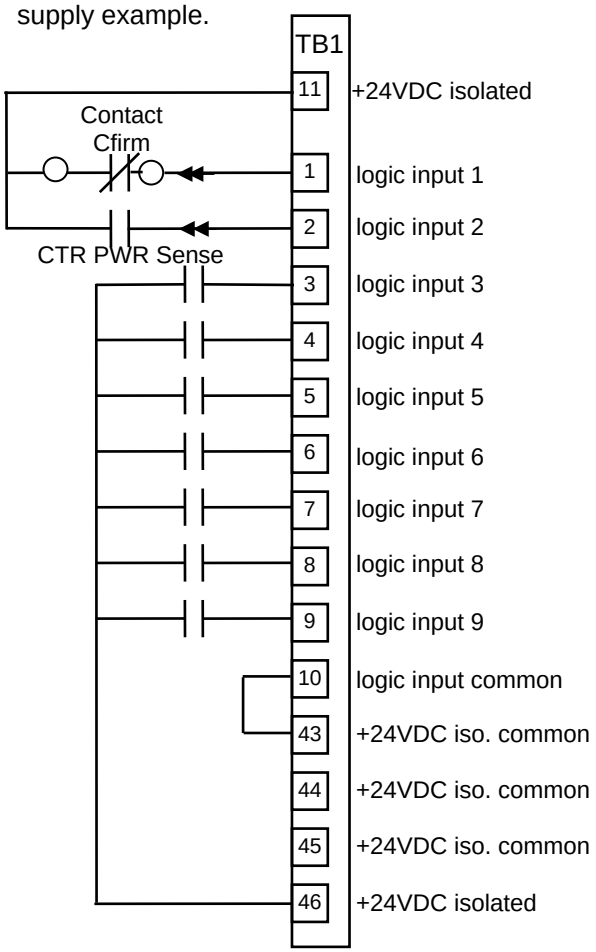


Figure 5: Logic Input Diagram (Internal Supply)

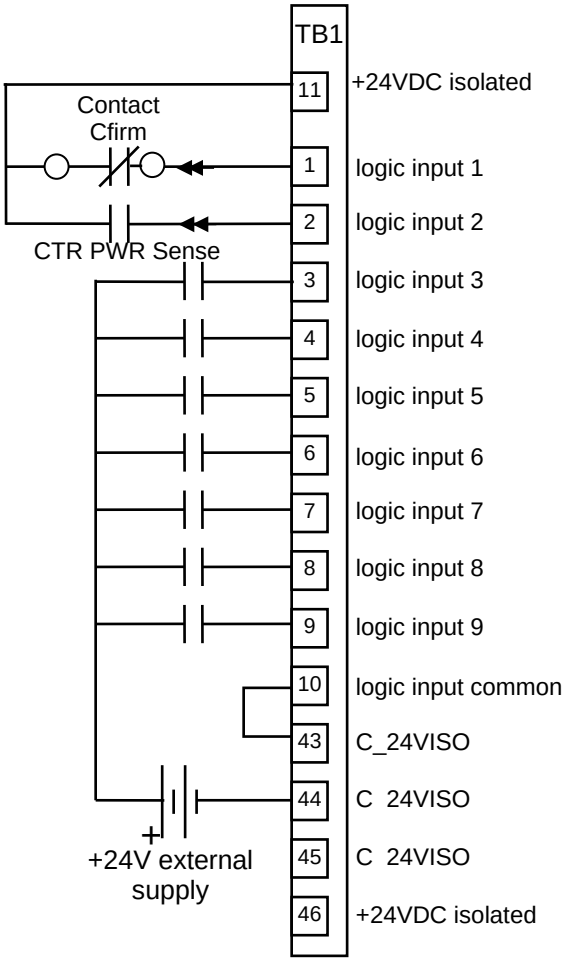


Figure 6: Logic Inputs (External Supply)

Analog Inputs

The Quattro AC/PM 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) or torque command source (if used).

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

Available with the analog channels are the multiplier gain parameters (SPD COMMAND MULT and EXT TORQUE MULT) and bias parameters (SPD COMMAND BIAS and EXT 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.

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

For more on the multiplier gain or bias parameters, see Drive A1 submenu on page 39.

The scaling of the analog input signals, with BIAS set to 0.00 and MULT set to 1.0 follows:

- Speed Command
  +10VDC = positive contract speed
  -10VDC = negative contract speed
- Pre Torque Command
  +10VDC = positive rated pre-torque of motor
  -10VDC = negative rated pre-torque of motor
- 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 Quattro AC/PM provides common mode noise rejection with the differential analog inputs. The connection of these two differential inputs is shown in Figure 7.

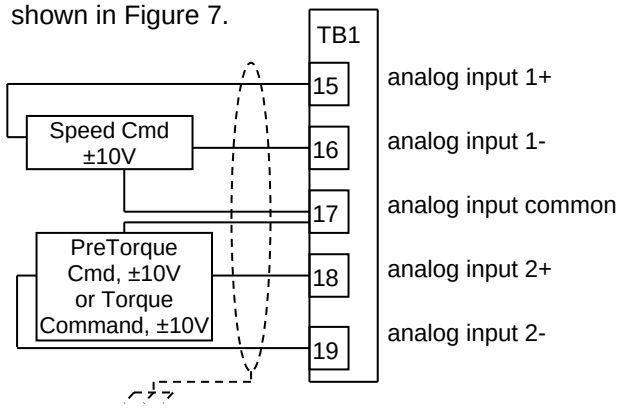


Figure 7: Analog Inputs (Differential)

Figure 8 shows the connection for the analog inputs if they are configured for single-ended connection. In this configuration, the Quattro AC/PM noise immunity circuitry is not in effect. *NOTE: For prevention of ground noise interference, a twisted shielded pair must be run to the source and not connected at the board.*

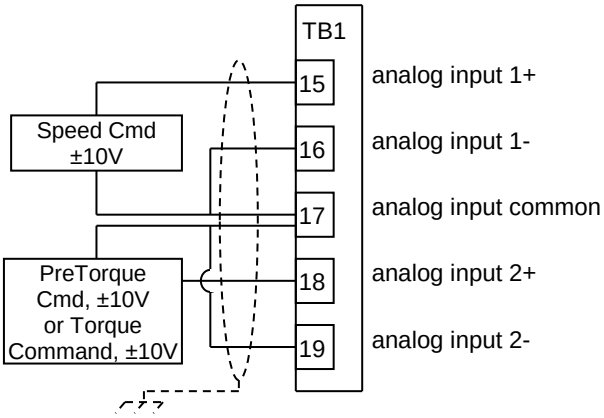


Figure 8: Analog Inputs (Single Ended)

Logic Outputs

The Quattro AC/PM's seven programmable logic outputs are opto-isolated, open collector. The outputs are normally open and can withstand an applied maximum voltage of 30VDC. When the outputs become "true", the output closes and is capable of sinking up to 150mA between the logic output terminal and the logic output common (TB1-32). Figure 9: Logic Outputs shows the logic output terminals. *NOTE: Logic Output 1 is prewired for CLOSE CONTACT.*

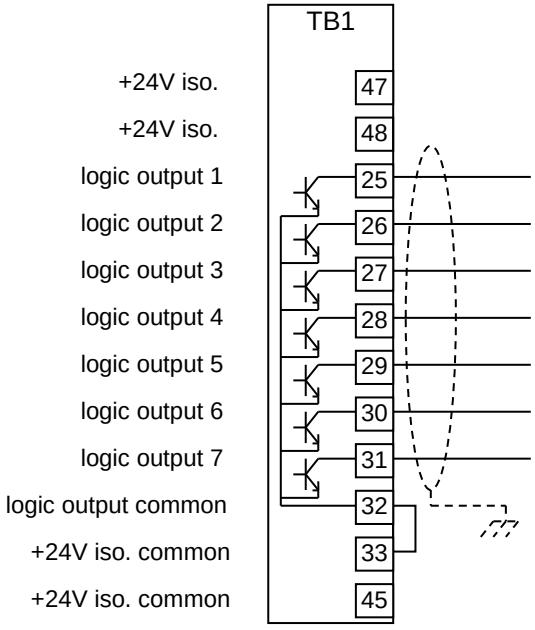


Figure 9: Logic Outputs

For more information on programming the logic outputs, see Logic Outputs C3 submenu on page 90.

Relay Outputs

The Quattro AC/PM's two programmable relay logic outputs are Form-C relays. The have both normally open and normally closed contacts.

The specifications for each relay are as follows:

Relay 1

- 2A at 30VDC or 1A at 230V_{AC}

Relay 2

- 2A at 30VDC or 1A at 230V_{AC}

Figure 10: Relay Outputs shows the logic output terminals.

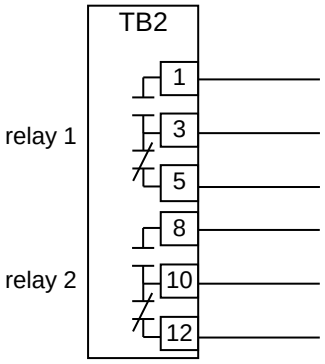


Figure 10: Relay Outputs

For more information on programming the relay outputs, see Logic Outputs C3 submenu on page 90.

Solid State Relay Outputs

The Quattro AC/PM has two programmable solid-state relays. They have a 30VDC max with 150mA load capability.

Figure 11: Solid State Relay Outputs shows the relay output connections.

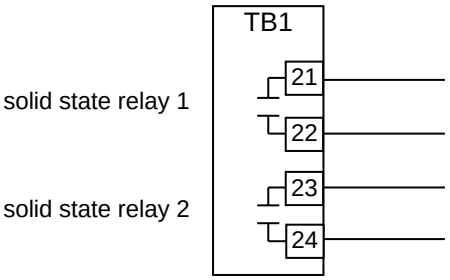


Figure 11: Solid State Relay Outputs

For more information on programming the solid-state relays, see Logic Outputs C3 submenu on page 90.

Analog Outputs

The Quattro AC/PM 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 92.*

The analog output channels are bipolar and have a voltage range of ±10VDC and current draw of +/- 4mA.

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.

$$\left(\begin{array}{c}\text{signal}\\ \text{drive}\\ \text{software}\\ \text{creates}\end{array} - \text{OFFSET}\right) \times \text{GAIN} = \begin{array}{c}\text{analog}\\ \text{channel}\\ \text{output}\\ \text{voltage}\end{array}$$

For more on the gain or offset parameters, see section Drive A1 submenu on page 39.

The connection of these two outputs is shown in Figure 12: Analog Outputs.

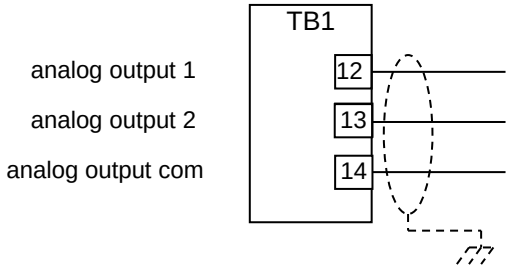


Figure 12: Analog Outputs

For more information on programming the Analog Outputs, see Analog Outputs C4 submenu on page 92

Encoder Connections

The Quattro drive with induction motor control will only run with an incremental encoder feedback.

The Quattro drive with PM control has an absolute encoder option card that reads absolute rotor position data and converts analog incremental (sine/cosine) signals into standard quadrature feedback signals. The drive's encoder circuitry incorporates resolution multiplication (set per parameter EnDat Out Mult in User Switches C1 submenu). The output quadrature signals are available for use by the car controller.

Encoder Wiring

Use twisted pair shielded cable with shield tied to chassis ground at drive end (using the ground clamp provided) in order to minimize magnetic and electrostatic pick-up current and to minimize radiated and conducted noise. See Figure 13 or Figure 14 for location of ground clamp.

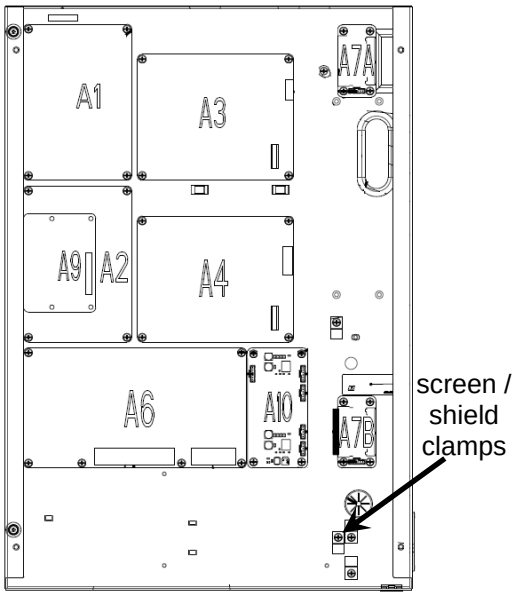


Figure 13: Ground clamp for encoder shield (Cube)

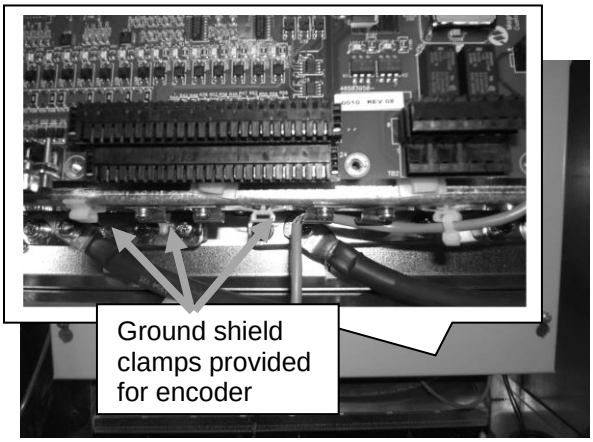


Figure 14: Ground Shield for Encoder Wires (Enclosed)

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 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 120V_{AC} or above control wiring for relays, fans, thermal protectors, etc.

For PM drives, Magnetek recommends using a 17-pin circular (M23) flange socket paired with a Heidenhain 309778-xx cable. The following is also acceptable: an encoder pigtail cable up to 1m in length fitted with M23 (17-pin male) coupling (291698-25, 291698-26, or 291698-27) and paired with a Heidenhain 309778-xx cable. Maximum length of the encoder cable (including a pigtail cable, if applicable) is 100 meters (328').

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.

Quattro PM Encoder Specifications

The Quattro PM drive requires the use of an absolute encoder coupled to the motor shaft. The absolute encoder option board supports sine/cosine encoders (also called servo encoders) with the 13-bit single turn EnDat 2.1 or 2.2 data interface with incremental signals (EnDat01). The following Heidenhain encoders can be used: ECN113, ECN1313, ECN413, and ROC 413. For high pole count gearless motors use encoders with high incremental line count (2048).

IMPORTANT
Motor phasing should match the encoder feedback phasing for both absolute and incremental feedback. The proper phasing for PM can be easily established through the open loop rotor alignment procedure. Refer to the open loop alignment section for more details. Never swap incremental leads to establish proper phasing with absolute encoders.

The encoder pulses per revolution must be entered in the ENCODER PULSES (A1) parameter from the encoder nameplate. Encoder signal connections with Heidenhain 309778-xx cable are shown on the page 142.

Quattro PM allows for connections of the voltage sense wires from the Heidenhain encoder to the PM option card. These are purely for use in seeing the voltage drop of the encoder cable at the drive end. Refer to Testpoints (EnDat Optional Board – Other) on page 191 for setup.

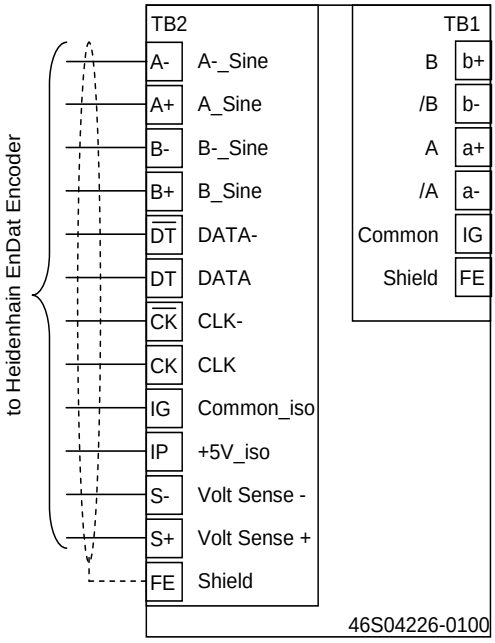


Figure 15: EnDat Encoder Option Card

The connections shown in Figure 16 are only for use if the user desires viewing the encoder signals. *NOTE: The default number of pulses is 8 times the encoder nameplate (i.e. 16384 for a 2048 encoder).* The Quattro PM drive automatically accounts for the multiplication of 8 as set by EnDat Out Mult (C1) and the encoder nameplate data as required in A1.

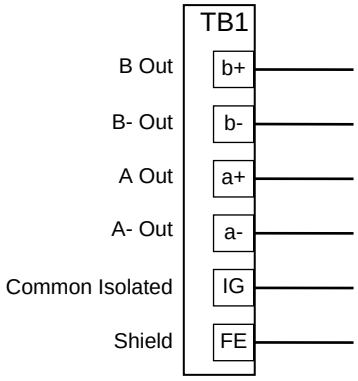


Figure 16: EnDat Encoder Buffered Output

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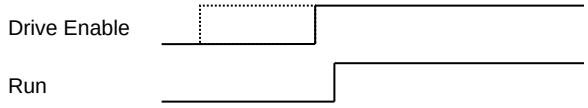
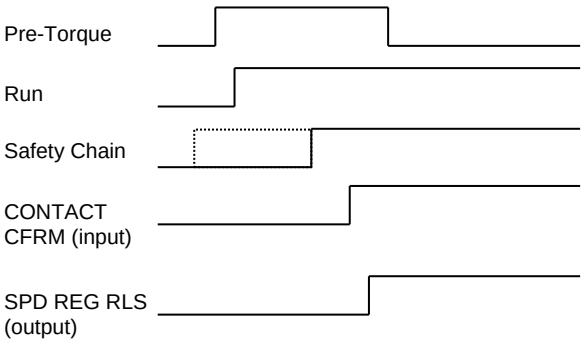
Drive Sequencing

NORMAL operating sequence

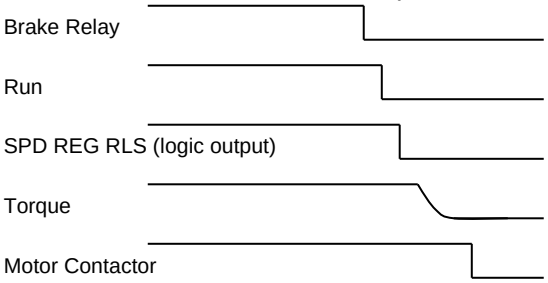
1. The No Faults relay is active. Run command signal is OFF. Motor contactor Safety circuits may be open or closed. The DC bus will remain charged with regulated voltage as long as DSPR (Drive Stand-by Power Reduction) is not active.
2. If the DC bus is not pre-charged, a pre-charge cycle will be completed when the run command is issued to the drive. See Quattro AC/PM Pre-Charge on page 34 for timing information of the Pre-Charge circuit.



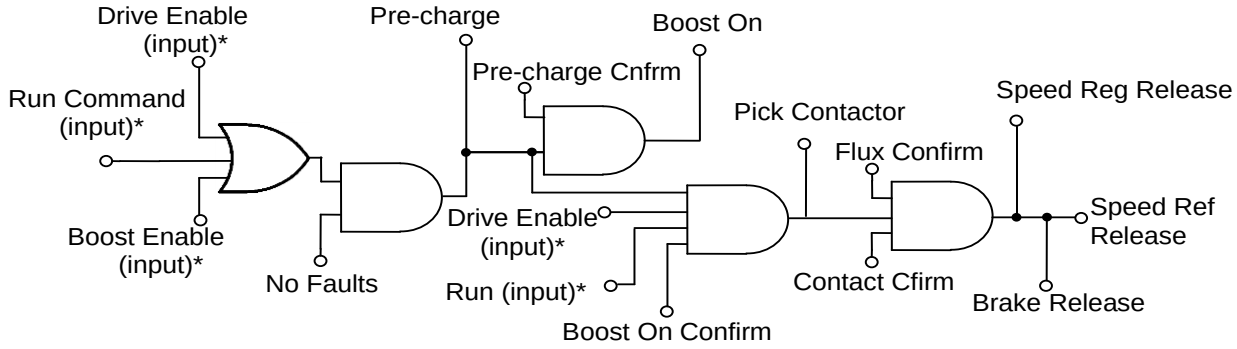
3. Pre-Torque command value is sent to the drive. It must be available before a run command is given. If the Pre-Torque Latch is used, see Pre-Torque Latch (C1) - it can be placed inactive depending on the settings of Pre-Torque Latch Clk (C1). If latching is not used, it must remain active until the SPD REG RLS output is active.



4. Once the regulators are released, motor current starts at pre-torque amperes. The velocity regulator starts at zero speed.
5. Drive activates elevator Brake relays, if programmed to do so (or the car controller does it externally).
6. Drive follows the external or internal velocity profile via the programmed accel/decel rate as programmed during the remainder of the elevator run cycle.
7. When at the next landing, the Drive (or car controller) de-activates elevator Brake.
8. After the Brake has set, the Run command is removed, which causes:
9. Reference speed to be clamped to zero.
10. Motor torque ramps down to zero, and then the Motor contactor is opened.



11. A DSPR time-out may occur while drive is on stand-by. In that case, the AC main power contactor to the drive is opened. A pre-charge cycle and power on recovery will occur on the next command.



*When Drive Enable and Run are required is dependent upon the setting of BOOST ENABLE SRC (C1). If Boost Enable is used separately from Drive Enable / Run, then Drive Enable / Run will be required after the boost is confirmed in order to output current to the motor.

ABNORMAL Operation Sequence

1. If a Drive or Drive Sequence Fault occurs the Drive will immediately open the motor contactor, de-energize the Brake Pick, Brake Hold, and Drive OK Relays if so programmed. May be caused by:
   a. "Fatal Error" drive Faults, including loss of serial communications;
   b. Opening of the contactor power Safety circuit while the contactor is pulled in; or
   c. Loss of correct motor contactor or Brake Relay feedback.
2. If an Alarm occurs, the drive will signal an Alarm but continue to run. May be caused by:
   a. Drive Alarms including motor overload, drive over temp warning;
   b. Loss of correct feedback from Brake Hold relay or Brake Switches;
   c. Open motor thermostat circuit;
   d. Speed command is held at zero due to conflict with the analog speed; command polarity and the run up/ run down logic;
   e. Encoder Fault (C1) set to disabled;
   f. The drive is or was being limited by the motor torque limit setting (Hit Torque Limit);
   g. Speed feedback is failing to properly track the speed reference (Speed Dev); or
   h. DC bus voltage drops below user-specified percent of the input line to line voltage.

Quattro AC/PM Pre-Charge

When power is first applied to the Quattro AC/PM drive, or after it has shut itself down via a DSPR (Drive Stand-by Power Reduction) time-out, the internal DC bus must be pre-charged before operation can resume. The following sequence will occur:

1. Power is applied to the Quattro AC/PM drive.
   a. Control power may be applied before or after 3-phase main power.
   b. Some drive versions may have a built-in control transformer.
   c. Drive controls should become active, but no contactors should operate.
2. Quattro AC/PM drive receives command to 'energize'.
   a. This command may be from serial link software or hardware logic command, depending on setting of BOOST ENA SRC (C1).
   b. AC input voltage from mains is measured and verified to be adequate according to the setting of the V_{AC}-input adjustment parameter.
   c. Pre-charge contactor PCM is then pulled in. This provides resistor limited inrush current to DC bus capacitors from AC mains and separate rectifier.
3. DC bus is pre-charged.
   a. With pre-charge contactor PCM closed, separate resistor and rectifier circuits limit capacitor charging inrush current.
   b. Bus voltage is monitored during pre-charge to verify proper voltage build-up. (See 6.a. below)
   c. Target bus voltage is nominal input V_{AC} ((INPUT L-L VOLTS (A5)) X $\sqrt{2}$ + DC BUS V BOOST (A4)).
4. Mains contactor is closed.
   a. As measured DC bus voltage nears target value, main utility power contactor UTM closes.
   b. Aux contact feedback from UTM indicates to controls that main utility contactor is closed.
   c. Then pre-charge contactor PCM is opened. (See 6.b. below)
5. Boost converter is turned ON.
   a. DC bus voltage is boosted to a higher level as programmed by the Boost Level parameter setting in order to achieve near unity power factor and low harmonic content of the Quattro AC/PM drive.
   b. The boost converter will remain ON as long as the drive is sending current to the motor. (See 6.c. below) Time-out of the DSPR feature or other command may turn the Boost converter OFF when drive is idle. In that case, a new pre-charge cycle must occur before drive will re-start.
6. Problem prevention
   a. If DC bus voltage does not rise at the expected rate to the expected voltage level during pre-charge, a "LS Charge" is declared.
   b. UTM and PCM are interlocked with aux contacts such that UTM cannot be picked unless PCM is already closed. Once picked, an aux contact of UTM seals the same circuit, allowing PCM to be dropped with UTM remaining ON.
   c. In the event of a major drive Fault, UTM will be opened to disconnect utility lines from main power devices of Quattro AC/PM.

Drive Operation and Feature Overview

The Quattro AC/PM drive is a velocity and torque regulated motor drive designed specifically for operating elevators. Many of the features described below can be selectively programmed to customize an individual application.

Analog Velocity Follower

The elevator car controller provides an analog velocity reference to the drive at A6TB1-15 and A6TB1-16. The signal may be bi-polar ±10VDC to indicate speed and travel direction, or a positive only unipolar signal with the direction of travel selected by logic commands. In most cases the signal profile will be adjusted by the car controller for precise landing positioning. The velocity reference passes directly to the closed loop velocity controller, except for an internal rate limiter to buffer any unexpected electrical noise. Start and Stop commands are via 24VDC logic inputs. Calibration of the analog velocity reference signal may be adjusted with separate gain and offset parameters. To set the Analog Velocity Follower, the user must set SPD COMMAND SRC (C1) to Analog Input.

Preset Speed & Profile Generator

An alternate method of speed control is that the elevator car controller provides 24VDC logic input commands to select one of 15 pre-determined running speeds. The drive generates a smooth S-Curve acceleration profile to transition between speed selections. Either of three separately adjustable ramp times may be selected. The direction of travel may be determined by either a Run command with an Up/Down command signal, or by separate Run-Up/Run-Down logic commands. To set the Analog Velocity Follower, the user must set SPD COMMAND SRC (C1) to Multi-Step, then adjusting Multi-Step Speed Commands in the Multi-Step Submenu A3.

Serial Link Follower

The elevator car controller provides the equivalent of an analog reference command over a digital serial link. The drive returns operating status conditions and messages. Primary run commands are 24VDC logic for redundant safety if desired. The speed sensitivity of the serial velocity reference is adjustable. Enabling the serial link follower requires SPD COMMAND SRC (C1) to be set to SERIAL.

Pre-Torque

When enabled, the speed error integrator will be pre-conditioned by the supplied pre-torque signal before starting the regulator. This will cause motor current to begin at a magnitude proportional to the pre-torque command to prevent elevator motion or rollback when the elevator brake is released. The pre-torque signal will be from either an analog (wired at A6TB1-18 and A6TB1-19) or serial link digital source as selected by programming PRETORQUE SOURCE (C1). If pre-torque is not used, leave PRETORQUE SOURCE (C1) at the defaulted value of none. An EXT TORQUE BIAS (A1) and an EXT TORQUE MULT (A1) are available to scale the pre-torque signal. Ten volts = rated motor current with a multiplier of 1 and a bias of zero.

Torque Feed Forward

Some car controllers may calculate an accurate demand for motor torque as required, accelerating the connected load as well as holding it against gravity. The torque demand signal can be programmed to directly drive the torque control part of Quattro AC/PM from either an analog or serial link input. EXT TORQ CMD SRC (C1) must be set to either analog input or serial and SPEED REG TYPE (C1) must be set to pi speed reg, elev spd reg, or external reg. The connections for an analog external torque command source are A6TB1-18 and A6TB1-19. With an accurate torque compensating signal, the gain of the PI regulator can be reduced to better ignore and not amplify mechanical vibrations of the hoist way. Separate adjustments are provided for torque signal gain and offset. An EXT TORQUE BIAS (A1) and an EXT TORQUE MULT (A1) are available to scale the torque signal. Ten volts = rated motor current with a multiplier of 1 and a bias of zero.

Torque/Current Ramp-Down

When the drive is told to cease operation by removal of the Run logic command (and after Brake Drop time, if that function is engaged), the motor current reference ramps down to zero at a constant rate. This allows the mechanical Brake to gently assume elevator holding torque, reducing the tendency to 'thump' the brake. When motor current ramp-down is complete, the contactor will be opened. In the event that the contactor opens unexpectedly, as reported by the feedback contact, or in the event of a severe drive fault, there will be no timed delay for current ramp-down. This time may be adjusted by the function RAMPED STOP TIME (A1).

DSPR

While the drive is idle, a second timer for Drive Stand-by Power Reduction (DSPR) will be running. When/if the DSPR timer times out, the main 3-phase power to the drive will be removed. This helps save electrical energy during long periods of non-use. Recovery of this condition will be automatic upon the receipt of the next command. At that time, recovery from a DSPR power OFF condition may take several seconds. DSPR TIME can be set in the Drive A1 Submenu.

Over-Speed Test

A reference speed multiplier is provided to help testing of the elevator governor over-speed trip. This feature will automatically return to normal at the completion of each elevator run. However, to ensure that the drive Over-Speed Trip does not interfere with the governor test, one must temporarily raise the value set for the Drive Over-Speed Trip point to a value higher than that of the governor.

Fault & Alarm Reset

An external Fault Reset command signal from the car controller may be applied to a logic input or from a serial command link. Alternatively, an automatic Fault Reset will occur 5 seconds after a drive fault occurs, if enabled to do so. Either method may be used to enable the car controller to quickly recover from a resettable fault. One Fault will be subtracted from a fault count accumulation every 20 minutes. The maximum number of Auto-Resets that can be accumulated is 5. The Auto-Reset function will then require a power Off/On cycle in order to recover. Faults & Alarms may also be cleared by use of the Magnetek Operator.

Electronic Motor Over-Load

An electronic motor over-load function is provided to take the place of heater type power components. Motor current is continuously monitored and the heating effect is calculated over time. A motor overload trip will not automatically stop the drive, but is an important alarm signal to the elevator car controller to help prevent equipment damage.

Status Indicator Lights

Five status indicator lamps are provided on the front panel of the drive.

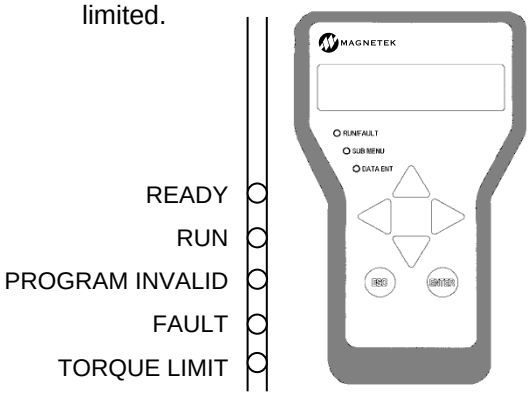
READY – (GRN) Power is applied to the drive, there are no drive Faults and drive is ready to Run when requested. The Run light will blink slowly when it is in DSPR (Drive Standby Power Reduction) Mode or not boosting, but three-phase power is applied.

RUN – (GRN) Indicates that the motor contactor is closed and the drive is following applied references operating to control torque and speed.

PROGRAM INVALID – (RED) There is no valid program loaded.

FAULT – (Red) A drive Fault exists that is preventing the drive from operating.

TORQUE LIMIT – (YEL) Motor current is being limited.



MONITOR / Adjust / Set-up Parameters:

The values of all adjustments and set-up parameters are stored locally in non-volatile drive memory. Monitoring of live data status and modification of parameter values can be accomplished by sequences over the serial link or the Magnetek Operator. They can both be attached at the same time to modify parameters or monitor drive operation. Detailed descriptions of all adjustments are located in later sections of this manual.

Parameters

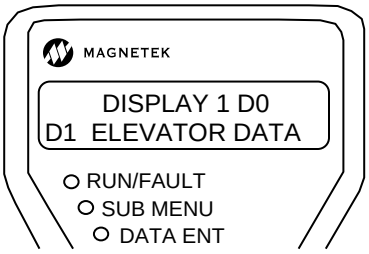
Parameter Introduction

This section describes the parameter menu structure; how to navigate this menu structure via the Quattro AC/PM digital operator; and a detailed description of each parameter.

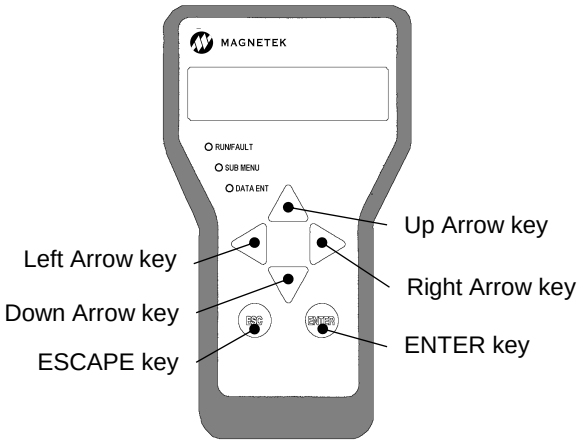
Parameters are grouped under six major menus:

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

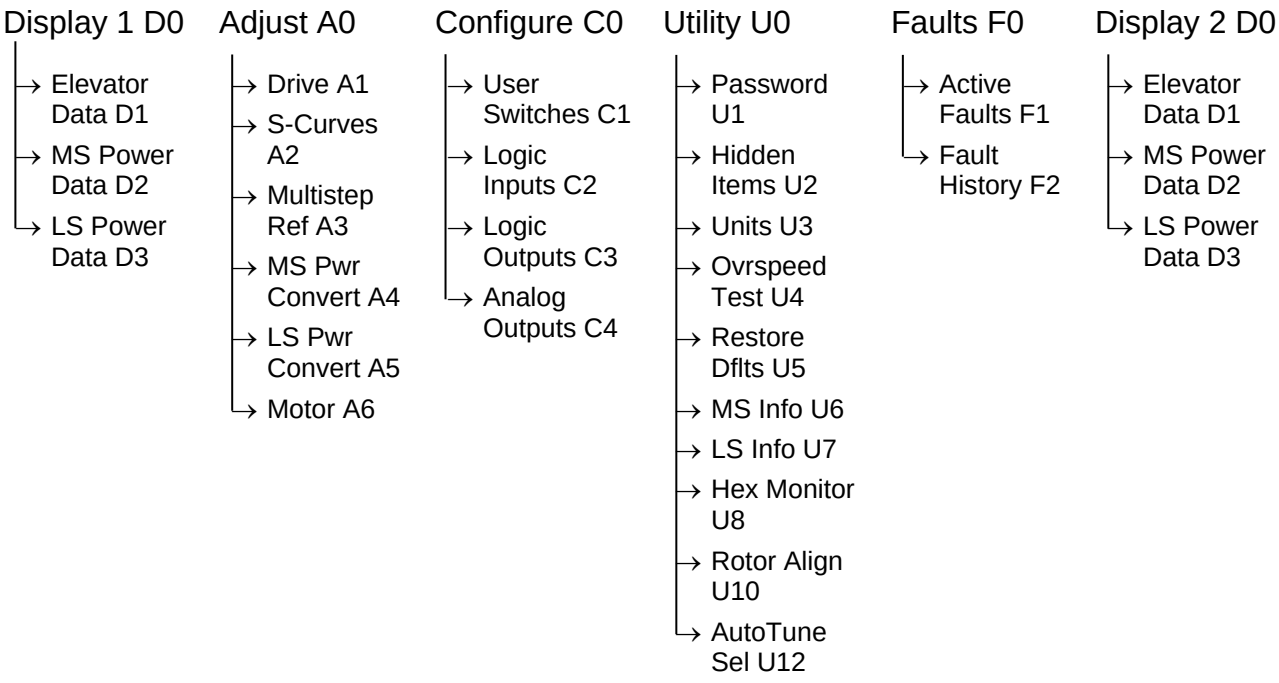
When the SUB-MENU LED is *not* lit, the currently selected menu is shown on the top line of the Digital Operator display and the currently selected sub-menu is shown on the bottom line of the Digital Operator display.



The 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:



Digital Operator Keys



Menu / Submenu Tree

Menu Navigation

How these keys operate is dependent on the "level" (i.e. menu, sub-menu, or entry level). In general, the "ENTER" and "ESCAPE" keys control the level; 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

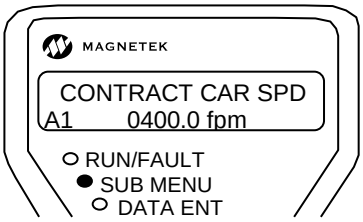
At the menu level, the up and down arrow keys cause the display to show the sub-menus. The side arrow keys cause the display to select which menu is active. When the end of the menu is reached (either up, down, left or right) pressing the same key will cause a wrap around.

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 the 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.

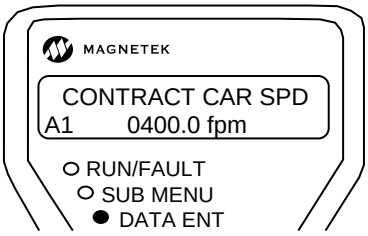


At any time pressing the "ESCAPE" key will return to the menu level. Upon exiting a sub-menu via the "ESCAPE" key, the last item number is "remembered". The next time this sub-menu is entered, it is entered at the "remembered" item number.

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 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. *NOTE: The "remembering" of sub-menus and sub-menu items is volatile and is lost at power-down.*

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 the keys are redefined. The "ESCAPE" key remains as the key used to move back to the higher level (in this case to the sub-menu 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.



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 utility parameter, HIDDEN ITEMS U2, to enabled.

Adjust A0 menu

Drive A1 submenu

Parameter	Description	Units	Range	Default	Hidden item	Run 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)	**ft/min**	**0.0 – 2000.0**	**400.0**	N	Y
		m/sec	**0.0 – 10.000**	**2.000**		
Contract Mtr Spd	(Contract Motor Speed) This parameter programs the motor speed at elevator contract speed in revolutions per minute (rpm).	**RPM**	**30.0 – 3000.0**[i]	**130.0**	N	Y
			18.0 – 3000.0[ii]			
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**[i]	**10.0**	N	N
			1.0 – 60.0[ii]			
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 – 10.00**[i]	**2.00**	N	N
			0.10 – 10.00[ii]			
Encoder Pulses	(Encoder Pulses) This parameter sets the pulses per revolution the drive receives from the encoder. This value comes directly from the encoder nameplate.	**PPR**	**600 – 32700**[i]	**1024**[i]	N	Y
			500 – 25000[ii]	**2048**[ii]		
Serial Cnts/Rev[ii]	(Serial Counts/Revolution) This parameter sets the number of discrete absolute positions per rotor revolution that the drive receives from the absolute encoder (if applicable). The value for a 13-bit encoder is 8192. All recommended Heidenhain encoders will be 8192.	**Cnts/Rev**	**600 – 25000**[ii]	**8192**[ii]	N	Y
Torque Limit	(Torque Limit) This parameter sets the maximum torque allowed. This parameter may need adjustment to reduce the effects of field weakening. Units in percent of rated torque. Note: the amber current limit LED will turn on when the limit defined by this parameter is reached.	**%**	**0.0 – 275.0**	**200.0**	N	N
Flux Wkn Factor[i]	(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.	**%**	**60 – 100**[i]	**100**[i]	Y	N

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
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. The units are seconds and the parameter has a maximum value of 10.00 seconds and a default value of 0.50 seconds.	**Sec**	**0.00 – 10.00**	**0.50**	N	Y
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).	**%**	**10 – 100**	**100**	N	N
Gain Chng Level	(Gain Change Level) Speed level to change to low gain mode (only with internal gain switch). See GAIN CHNG LEVEL on page 47. Units in percent of rated speed.	**%**	**0.0 – 100.0**	**100.0**	N	N
Spd Dev Hi Level[i]	(Speed Deviation High Level) This parameter sets the level at which a speed deviation alarm will be declared.	**%**	**0.0 – 99.9**[i]	**10.0**[i]	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 47.	**Seconds**	**0.00 – 2.50**	**0.20**	N	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. 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.	**Seconds**	**0.10 – 5.00**	**0.50**	N	N
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 and can be set from 0.00 to 5.00 seconds.	**Sec**	**0.00 – 5.00**	**0.00**	N	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.	**Seconds**	**0 – 120**	**5**	N	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.	**Faults**	**0 – 10**	**3**	N	N

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
Brake Pick Time	(Brake Pick Time) If the brake pick fault is enabled, this parameter sets the time allowed for the brake pick feedback to not match the brake pick command before a BRK PICK FLT occurs.	**Seconds**	**0.00 – 5.00**	**1.00**	N	N
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**	N	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)) 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**	N	Y
Brake Hold Time	(Brake Hold Time) If the brake hold fault is enabled, this parameter sets the time allowed for the brake hold feedback to not match the brake hold command before a BRK HOLD FLT occurs.	**Seconds**	**0.00 – 5.00**	**0.20**	N	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 fault occurs. Units are in percent of contract speed.	**%**	**90.0 – 150.0**	**115.0**	N	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.	**Seconds**	**0.00 – 9.99**	**1.00**	N	N
Overspeed Mult	(Overspeed Multiplier) This parameter sets the percentage of contract speed for the OVERSPEED TEST (U4).	**%**	**100.0 – 150.0**	**125.0**	N	N
Spd Dev Lo Level	(Speed Deviation Low Level) Range around the speed reference for speed deviation low logic output. For more information, see SPD DEVIATION on page 48. Units are in percent of contract speed.	**%**	**0.1 – 20.0**	**10.0**	N	N
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 48.	**Seconds**	**0.00 – 9.99**	**0.50**	N	N

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
Spd Dev Alm Lvl[ii]	(Speed Deviation Alarm Level) This parameter sets the level at which a speed deviation alarm will be declared. For more information, see SPD DEVIATION on page 48.	**%**	**0.0 – 99.9**[ii]	**10.0**[ii]	N	N
Spd Dev Flt Lvl[ii]	(Speed Deviation Fault Level) This parameter sets the level at which a speed deviation fault will be declared. For more information, see SPD DEVIATION on page 48.	**%**	**0.0 – 99.9**[ii]	**25.0**[ii]	N	N
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**	N	N
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**	N	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.	**Seconds**	**0.00 – 9.99**	**0.10**	N	Y
Up/Dwn Threshold	(Up or Down 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**	N	Y
Notch Filter Frq	(Notch Filter Frequency) This parameter determines notch filter center frequency. For more information, see NOTCH FILTER FRQ on page 49.	**Hz**	**5 – 60**	**20**	N	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 49.*	**%**	**000 – 100**	**0**	N	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 48.	**Sec**	**0.00 – 0.99**	**0.00**	N	Y

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
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 unitless gain factor that determines how much of the derivative is subtracted.	**none**	**0.0 – 30.0**	**0.0**	N	N
Inner Loop Xover	(Inner Loop Cross Over) This parameter sets the inner speed loop crossover frequency. This parameter is only used by the Elevator Speed Regulator (Ereg).	**rad/sec**	**0.1 – 20.0**[i] **0.1 – 60.0**[ii]	**2.0**	N	N
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.	**Degrees**	**45 – 90**	**80**	N	N
Spd Command Bias	(Speed Command Bias) This parameter subtracts an effective voltage to the actual analog speed command voltage signal. $(\text{analog channel\#1 input voltage} - \text{SPD COMMAND BIAS}) \times \text{SPD COMMAND MULT} = \text{signal drive software uses}$	**Volts**	**-6.000 – 6.000**	**0.00**	N	Y
Spd Command Mult	(Speed Command Multiplier) This parameter scales the analog speed command. $(\text{analog channel\#1 input voltage} - \text{SPD COMMAND BIAS}) \times \text{SPD COMMAND MULT} = \text{signal drive software uses}$	**none**	**0.90 – 5.00**	**1.00**	N	Y
Spd Zero Band	(Speed Zero Band) Voltage range that is considered to be a 0 speed command when analog speed commands are used. Typical value less than 50 mV.	**Volts**	**0.000 – 1.000**	**0.000**	N	Y
Pre Torque Bias	(Pre-Torque Bias) This parameter subtracts an effective voltage to the actual analog pre-torque command (channel 2) voltage signal. $(\text{analog channel\#2 input voltage} - \text{PRE TORQUE BIAS}) \times \text{PRE TORQUE MULT} = \text{signal drive software uses}$	**Volts**	**-6.00 – 6.00**	**0.00**	N	Y
Pre Torque Mult	(Pre-Torque Multiplier) This parameter scales the analog pre-torque command (channel 2). $(\text{analog channel\#2 input voltage} - \text{PRE TORQUE BIAS}) \times \text{PRE TORQUE MULT} = \text{signal drive software uses}$	**none**	**-10.00 – 10.00**	**1.00**	N	Y

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
Pre Torque Time	(Pre-Torque Time) Time to ramp torque from zero to pre-torque value. When set to zero, Pre-Torque will be applied immediately. This helps eliminate the 'bump' felt upon starting caused by the torque being immediately set to rated pre-torque. For more information, see Pre Torque Time on page 49.	**Seconds**	**0.00 – 10.00**	**0.00**	N	Y
Ana Out 1 Offset	(Analog Output #1 Offset) Offset for scaling Analog Output Channel #1. (signal drive software creates − ANA OUT OFFSET) × ANA OUT GAIN = analog channel output voltage	**%**	**-99.9 – 99.9**	**0.0**	N	Y
Ana Out 2 Offset	(Analog Output #2 Offset) Offset for scaling Analog Output Channel #2. (signal drive software creates − ANA OUT OFFSET) × ANA OUT GAIN = analog channel output voltage	**%**	**-99.9 – 99.9**	**0.0**	N	Y
Ana Out 1 Gain	(Analog Output #1 Gain) Adjusts the scaling for the Analog Output Channel #1. *NOTE: value of 1.0 = 0 to 10VDC signal.* (signal drive software creates − ANA OUT OFFSET) × ANA OUT GAIN = analog channel output voltage	**none**	**0.0 – 10.0**	**1.0**	N	Y
Ana Out 2 Gain	(Analog Output #2 Gain) Adjusts the scaling for the Analog Output Channel #2. *NOTE: value of 1.0 = 0 to 10VDC signal.* (signal drive software creates − ANA OUT OFFSET) × ANA OUT GAIN = analog channel output voltage	**none**	**0.0 – 10.0**	**1.0**	N	Y
Ser2 Insp Spd	(Serial Mode 2 Inspection Speed) *NOTE: 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**	N	Y
		m/sec	**0.000 – 0.500**	**0.150**		

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
Ser2 RS Crp Spd	(Serial Mode 2 Rescue Creep Speed) *NOTE: 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**	N	Y
		m/sec	**0.000 – 1.540**	**0.050**		
Ser2 RS Crp Time	(Serial Mode 2 Rescue Creep Time) *NOTE: 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**	N	Y
Ser2 Flt Tol	(Serial Mode 2 Fault Tolerance) *NOTE: 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**	**0.50**	N	Y
Mspd Delay 1	(Multi-Step Speed Delay 1) Determines the recognition time delay for a defined multi-step speed command. For more information, see MSPD DEALY 1-4 on page 52.	**Sec**	**0.0 – 10.000**	**0.000**	N	Y
Mspd Delay 2	(Multi-Step Speed Delay 2) Determines the recognition time delay for a defined multi-step speed command. For more information, see MSPD DEALY 1-4 on page 52.	**Sec**	**0.0 – 10.000**	**0.000**	N	Y
Mspd Delay 3	(Multi-Step Speed Delay 3) Determines the recognition time delay for a defined multi-step speed command. For more information, see MSPD DEALY 1-4 on page 52.	**Sec**	**0.0 – 10.000**	**0.000**	N	Y
Mspd Delay 4	(Multi-Step Speed Delay 4) Determines the recognition time delay for a defined multi-step speed command. For more information, see MSPD DEALY 1-4 on page 52.	**Sec**	**0.0 – 10.000**	**0.000**	N	Y
Mid Speed Level	(Mid Speed Level) This parameter sets the level/threshold for mid speed detection. This is only used to generate the mid speed logic output. Units in percent of contract speed.	**%**	**0.00 – 110.00**	**80.00**	N	N
Encdr Flt Sense[ii]	(Encoder Fault Sensitivity) Determines the percentage of voltage rise to occur before an Encoder Fault occurs due to voltage rise at the beginning of run. Units in percent of Rated Mtr Volts (A6)	**%**	**10 – 100**[ii]	**30**[ii]	N	Y
ARB Advance[ii]	(Anti-Rollback Advance) The amount of time the drive is in high gain mode to develop torque for ARB. This should reflect the duration from drive running to brakes fully lifting.	**Sec**	**0.0 - 2.00**[ii]	**0.30**[ii]	N	Y
ARB Decay[ii]	(Anti-Rollback Decay) The amount of time the drive takes to stabilize the gains back from high ARB gain to normal running gains.	**Sec**	**0.0 - 2.00**[ii]	**0.20**[ii]	N	Y

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
ARB Timeout[ii]	(Anti-Rollback Timeout) The maximum amount of time the drive will wait for encoder feedback until it gets out of ARB 3. *NOTE: ARB Timeout > ARB Advance + ARB Decay + 0.20s*	**Sec**	**0.0 – 2.00**[ii]	**0.80**[ii]	N	Y
ARB Deadband[ii]	(Anti-Rollback Deadband) The amount of encoder feedback pulses the drive ignores before initiating ARB 3. *NOTE: while setting this value, the setting of Endat Interp (C1) should also be considered as inversely related*	**none**	**0 – 5**[ii]	**1**[ii]	N	Y
ARB KP[ii]	(Anti-Rollback KP) This parameter is the KP inner velocity loop proportional gain for ARB 3.	**none**	**0.0 – 320.00**[ii]	**1.0**[ii]	N	Y
ARB KI[ii]	(Anti-Rollback Inegral) This parameter is the KI inner velocity loop integral gain for ARB 3.	**none**	**0.0 – 320.00**[ii]	**1.0**[ii]	N	Y
ARB FFWD[ii]	(Anti-Rollback Feed Forward) This parameter adds a feed forward to the ARB 3 loop.	**none**	**0 – 32767**[ii]	**0**[ii]	N	Y
Abs Ref Offset[ii]	*(Absolute Reference Offset) For Magnetek personnel* – This parameter sets angular offset for absolute position reference signal that can be exported through analog outputs and used for position feedback/alignment testing.	**Degs**	**-180.0 – 180.0**[ii]	**0.00**[ii]	Y	N
NTSD Target Spd	(Normal Terminal Stopping Device Target Speed) Maximum speed/speed clamp at which drive will run motor at when the drive is in NTSD mode.	**ft/min** **m/sec**	**0.0 – 50.0** **0.0 – 0.254**	**0.0**	N	Y
NTSD Threshold 1	(Normal Terminal Stopping Device Threshold 1) Speed threshold which decides whether or not the drive goes into reduced speed for NTSD mode at the NTSD checkpoint closest to the terminal landing.	**ft/min** **m/sec**	**0.0 – 1500.0** **0.000 – 8.000**	**0.0**	N	Y
NTSD Threshold 2	(Normal Terminal Stopping Device Threshold 2) Speed threshold which decides whether or not the drive goes into reduced speed for NTSD mode at the 2nd NTSD checkpoint in the hoistway.	**ft/min** **m/sec**	**0.0 – 1500.0** **0.000 – 8.000**	**0.0**	N	Y
NTSD Threshold 3	(Normal Terminal Stopping Device Threshold 3) Speed threshold which decides whether or not the drive goes into reduced speed for NTSD mode at the NTSD checkpoint furthest away from the terminal landing.	**ft/min** **m/sec**	**0.0 – 1500.0** **0.000 – 8.000**	**0.0**	N	Y
Brk Flt Level[ii]	(Brake Fault Level) This parameter sets the level of speed error the drive will fault with a BRK IS OPEN fault during an Auto Align or Auto Tune.	**%**	**0.0 – 20.0**[ii]	**2.0**[ii]	N	N
DSPR Time	(Drive Standby Power Reduction Time) Determines how long the drive will remain energized in boost before progressing to complete drive shutdown. Setting of 0 will shut down the boost immediately.	**Minutes**	**0 – 546**	**10**	Y	Y

Table 1: Drive A1 Submenu

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

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 Quattro AC/PM 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:

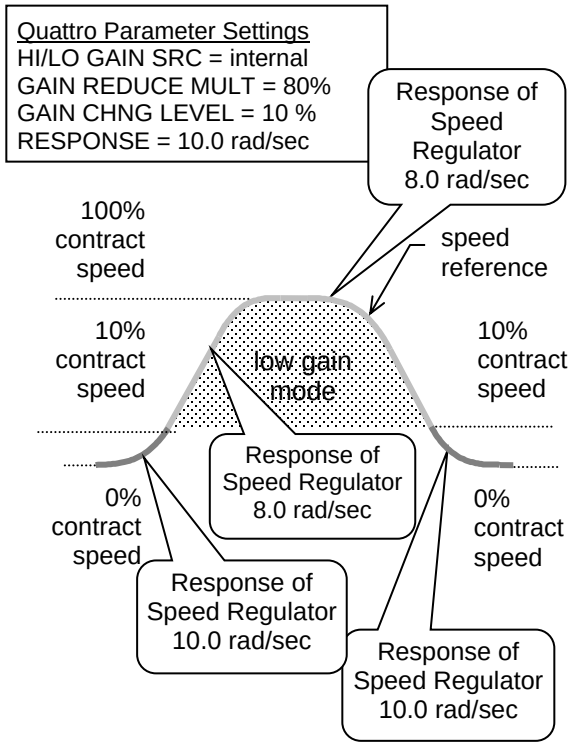
- a logic input
- the serial channel.

The high/low gain switch can also be controlled internally 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 in the next column.



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.

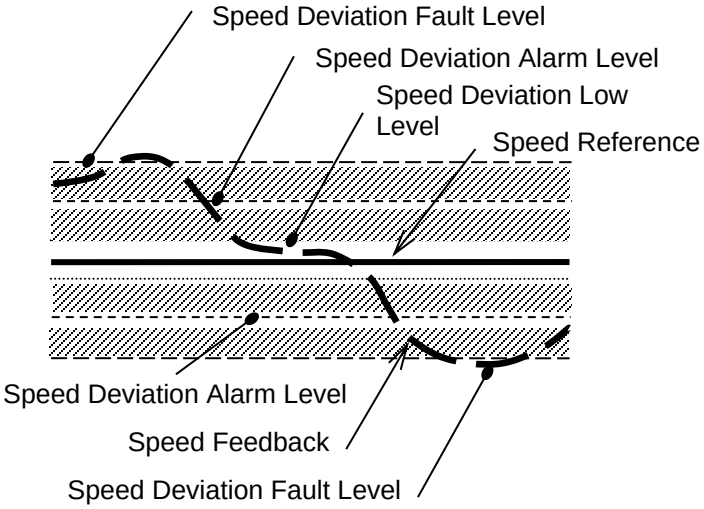
A method of providing the Ramp Down Enable would be with a logic signal (EXTERNAL TB1) that is dedicated to that function. The Ramp Down Enable would be asserted while the Run command is still present and remain there until the ramp is completed, after which the Run command would be removed.

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 Quattro AC/PM 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.

SPD DEVIATION
(SPD DEV LO LEVEL, SPD DEV TIME, SPD DEV ALM LVL, and SPD DEV FLT LVL)
SPD DEV LO LEVEL defines a range around the speed reference. When the speed feedback is within this range (in conjunction with SPD DEV TIME (A1)) the drive will set the SPEED DEV LO logic output. The Speed Deviation Low function indicates that the speed feedback is tracking the speed reference within a defined range for a defined period of time. The Speed Deviation Low function has the ability to set a configurable logic output. 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. 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).

SPD DEV ALM LVL is the point at which a Speed Deviation Alarm will be declared by the software. It is defaulted at 10%. Similarly, SPD DEV FLT LVL is the point at which a Speed Deviation Fault will be declared. It is defaulted at 25%.



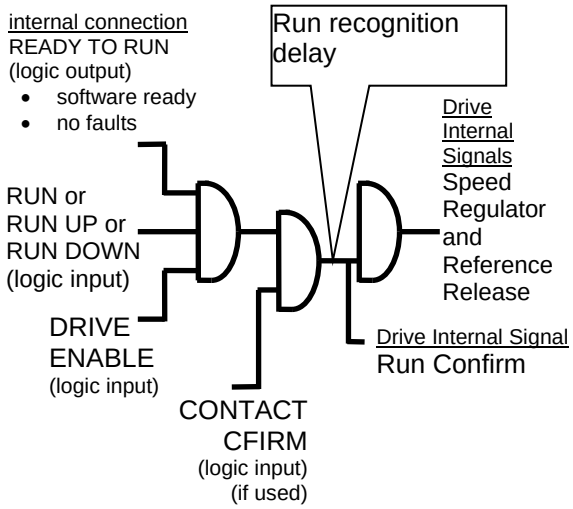
PRE TORQUE TIME
(Torque Ramp Up)
This parameter is used to adjust the pre-torque response. The pre-torque can be applied instantaneously or ramped up at a desired rate. That rate is set by the PRE TORQUE TIME (A1) parameter.

Before the brake is lifted, the Pre Torque Ramp Up Function allows the torque to ramp at a defined rate to the desired level. This helps eliminate the 'thump' heard when torque is immediately applied to the motor.

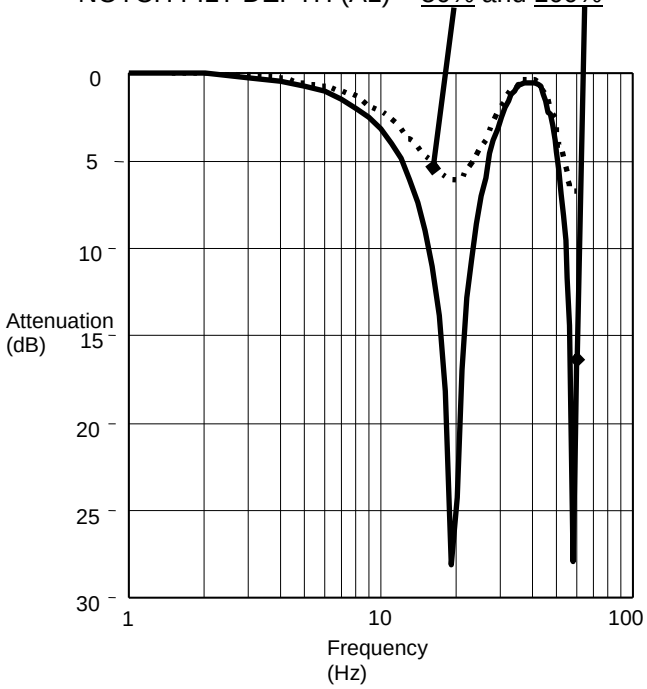
Setting this parameter to zero will disable the Pre Torque Ramp Up Function, i.e. the torque will be immediately stepped up to full pre-torque value given through Analog Input Channel 2 or the serial channel. With a non-zero setting for Pre Torque Time, the torque reference will be linearly ramped from zero to the value given. Therefore, half of the requested torque will be available at time (1/2 x PRE TORQUE TIME (A1)).

The PRE TORQUE TIME Parameter and the commanded pre-torque determine the time it takes for the Quattro AC/PM to build the requested pre-torque.

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.



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 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%



ANTI-ROLLBACK

Anti-Rollback is an independent function meant to calculate the amount of torque necessary to hold the car when load weighing is not available. Included in this application note are diagrams and procedures for ARB setup. See Figure 17 for help in adjusting and setting up ARB for a Quattro AC/PM drive. Please note: ARB should be a final adjustment. All adjustments in tuning the drive for smooth car ride should occur before tuning ARB

CAUTION

ARB cannot be used in conjunction with pre-torque. PRETORQUE SRC (C1) = NONE when ARB SELECT (C1) is set to ARB3.

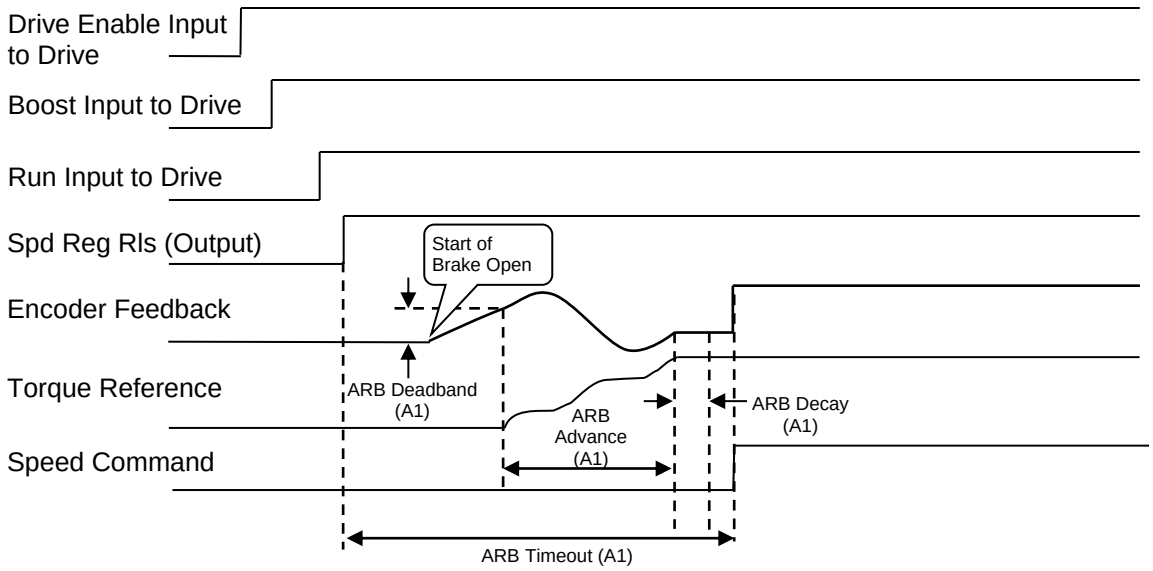


Figure 17: ARB Timing Diagram

1. Set the car in middle of the hoistway so rollback will not cause the elevator to go into the final limits while adjusting ARB.
2. Verify the following parameters are set as in the table below

Parameter Name	Default Value	Initial Start Value
ARB SELECT (C1)	DISABLE	ARB3
ARB Advance (A1)	0.30s	0.30s
ARB Decay(A1)	0.20s	0.20s
ARB Timeout (A1)	0.80s	0.80s
ARB Deadband (A1)	1.0	1.0
ARB KP (A1)	1.0	1.0
ARB KI (A1)	1.0	1.0
ARB FFWD (A1)	0	0

3. Start by giving the car a zero speed command on elevator inspection.
4. Once Anti-Rollback has been enabled, three parameters should ideally only need to be adjusted:
   a. **ARB Advance (A1)** is the time the drive gains are set high so the drive is more sensitive to motor movement. ARB will not become activated until the drive sees X amount of encoder pulses as set by ARB Deadband (A1). Setting ARB Advance (A1) value too long will cause issues with the drive reacting to noise on the speed feedback channels. Setting this value too short may cause major rollback to occur.
      i. Below are some expected results based on timing of this parameter.

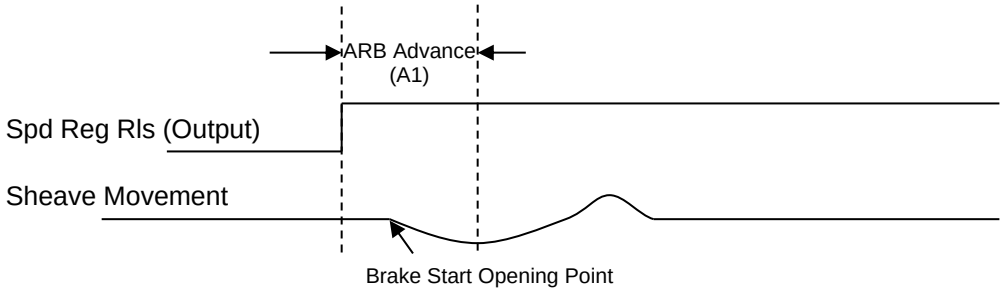


Figure 18: ARB Advance set too short

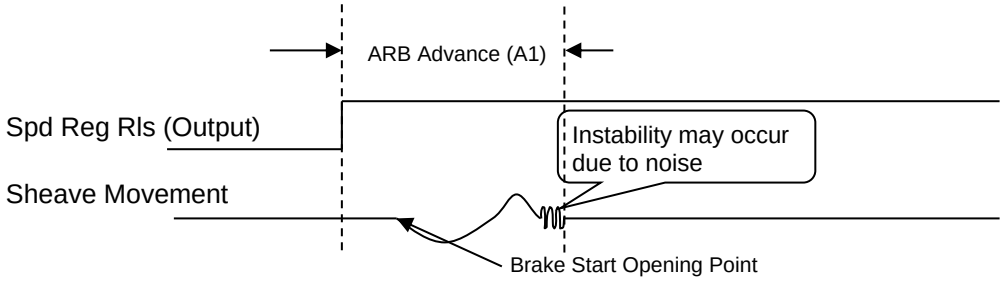


Figure 19: ARB Advance set too long

ARB Decay (A1) is the amount of time the drive spends lowering the higher ARB gains. Setting this value too high may cause instability in the motor. If the motor growls or vibrates, lower this setting. Setting this parameter too low may cause excessive rollback.

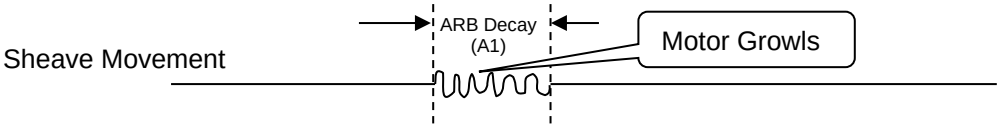


Figure 20: ARB Decay (A1) too long

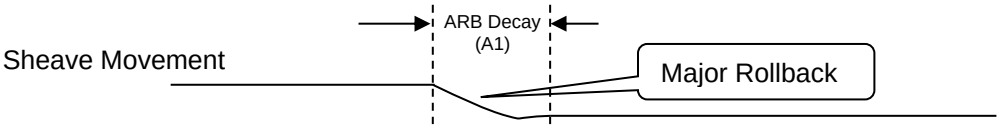
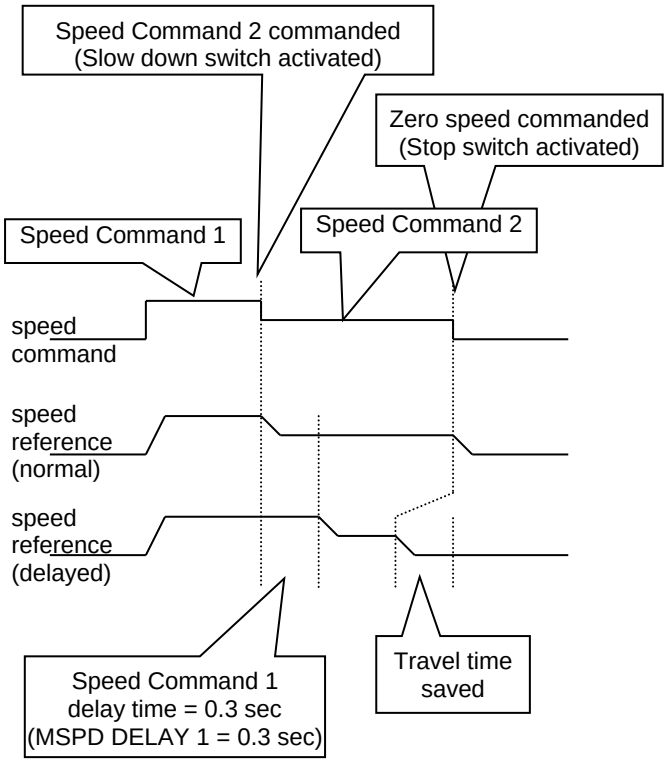


Figure 21**: ARB Decay (A1) too short**

   b. **ARB Timeout (A1)** should be set to a time that is greater than [ARB Advance (A1) + ARB Decay (A1) + 0.30 sec]

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

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
Accel Rate 0	Acceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.900**		
Decel Rate 0	Deceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.900**		
Accel Jerk In 0	Rate of increase of acceleration, up to ACCEL RATE 0, when increasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**2.40**		
Accel Jerk Out 0	Rate of decrease of acceleration to zero when approaching contract elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**2.40**		
Decel Jerk In 0	Rate of increase of deceleration, up to DECEL RATE 0, when decreasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**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/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**2.40**		
Accel Rate 1	Acceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.900**		
Decel Rate 1	Deceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.900**		
Accel Jerk In 1	Rate of increase of acceleration, up to ACCEL RATE 1, when increasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**2.40**		
Accel Jerk Out 1	Rate of decrease of acceleration to zero when approaching contract elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**2.40**		
Decel Jerk In 1	Rate of increase of deceleration, up to DECEL RATE 1, when decreasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**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/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**2.40**		
Accel Rate 2	Acceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.900**		
Decel Rate 2	Deceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.900**		
Accel Jerk In 2	Rate of increase of acceleration, up to ACCEL RATE 2, when increasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**2.40**		
Accel Jerk Out 2	Rate of decrease of acceleration to zero when approaching contract elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**2.40**		
Decel Jerk In 2	Rate of increase of deceleration, up to DECEL RATE 2, when decreasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**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/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**2.40**		
Accel Rate 3	Acceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.900**		
Decel Rate 3	Deceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.900**		
Accel Jerk In 3	Rate of increase of acceleration, up to ACCEL RATE 3, when increasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**2.40**		
Accel Jerk Out 3	Rate of decrease of acceleration to zero when approaching contract elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**2.40**		
Decel Jerk In 3	Rate of increase of deceleration, up to DECEL RATE 3, when decreasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**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/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**2.40**		

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
Accel Rate 4	NTSD Acceleration rate	**ft/s²**	**0.00 – 7.99**	**5.00**	N	Y
		m/s²	**0.000 – 3.999**	**1.500**		
Decel Rate 4	NTSD Deceleration rate	**ft/s²**	**0.00 – 7.99**	**5.00**	N	Y
		m/s²	**0.000 – 3.999**	**1.500**		
Accel Jerk In 4	NTSD Rate of increase of acceleration, up to ACCEL RATE 4, when increasing elevator speed	**ft/s³**	**0.0 – 29.9**	**0.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.00**		
Accel Jerk Out 4	NTSD Rate of decrease of acceleration to zero when approaching contract elevator speed	**ft/s³**	**0.0 – 29.9**	**0.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.00**		
Decel Jerk In 4	NTSD Rate of increase of deceleration, up to DECEL RATE 4, when decreasing elevator speed	**ft/s³**	**0.0 – 29.9**	**0.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.00**		
Decel Jerk Out 4	NTSD Rate of decrease of deceleration to zero when slowing the elevator to leveling speed	**ft/s³**	**0.0 – 29.9**	**0.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.00**		

Table 2: S-Curve A2 Submenu

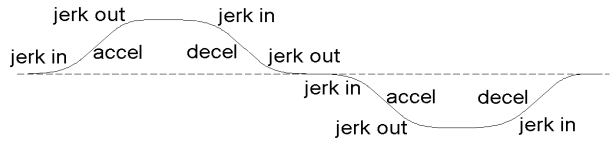
Detailed Descriptions
The Quattro AC/PM speed command is passed through an internal S-curve in order to produce the speed reference. In general, the S curve function takes an arbitrary speed command and generates a speed reference subject to the conditions that the maximum accel, decel and jerk rates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

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 specifies: 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	SC0
0	1	SC1
1	0	SC2
1	1	SC3

Selecting S-curves

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 3: 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 it 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.

Motor Side Power Converter A4 submenu

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
UV Alarm Level	(Undervoltage Alarm Level) This parameter sets the level (as a percentage of the INPUT L-L VOLTS (A4)) at which an undervoltage alarm will be declared. Units in percent of nominal DC Bus voltage.	**%**	**80 – 99**	**90**	N	N
UV Fault Level	(Undervoltage Fault Level) This parameter sets the level (as a percentage of the INPUT L-L VOLTS (A4)) at which an undervoltage fault will occur. Units in percent of nominal DC Bus voltage.	**%**	**50 – 99**	**80**	N	N
PWM Frequency	(PWM 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 below 10kHz.	**kHz**	**2.5 – 16.0**	**10.0**	N	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 base impedance.	**%**	**0.0 – 10.0**	**0.0**	N	Y
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**	**0.0 – 1.20**[i] **0.00 – 0.60**[ii]	**0.60**	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**	**0.10 – 0.40**[i] **0.100 – 3.000**[ii]	**0.100**	N	N

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
ID Reg Intg Gain[ii]	(Current Regulator Integral Gain for Flux Generation) The integral 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**	**0.00 – 2.00**[ii]	**1.00**[ii]	N	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**	**0.0 – 1.20**[i] **0.00 – 0.60**[ii]	**0.60**	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.	**none**	**0.10 – 0.40**[i] **0.100 – 3.000**[ii]	**0.100**	N	N
IQ Reg Intg Gain[ii]	(Current Regulator Integral Gain for Torque Generation) The integral 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.	**none**	**0.00 – 2.00**[ii]	**1.00**[ii]	N	N
Fine Tune Ofst[ii]	(Fine Tune Offset) This parameter is used to manually offset the absolute position feedback for testing purposes. **WARNING:** Changing this parameter can lead to motor runaway. It should always be set to zero for normal operation. Locked by ENGR PARM LOCK (C1).	**deg**	**-75.00 – 75.00**[ii]	**0.00**[ii]	Y	N
ID Ref Threshold[ii]	*For Magnetek personnel* – This parameter is used to manually set non-zero current reference for flux production. This needs to be zero for normal operation as flux in PM motors is produced by permanent magnets. Locked by ENGR PARM LOCK (C1).	**none**	**0.00 – 0.20**[ii]	**0.00**[ii]	Y	N

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
Flux Weaken Rate[ii]	(Flux Weakening Slew Rate) This parameter determines the slew rate of the flux weakening controls. The higher this parameter is, the faster flux weakening will respond to the voltage limit. Setting this parameter to zero will disable it. For more information, see Flux Weakening at Voltage Limits on page 61. Locked by ENGR PARM LOCK (C1).	**none**	**0.000 – 1.000**[ii]	**0.000**[ii]	Y	N
Flux Weaken Lev[ii]	(Flux Weakening Level) This parameter determines how close to the voltage limit the drive will get before it will flux weaken. For more information, see Flux Weakening at Voltage Limits on page 61. Locked by ENGR PARM LOCK (C1).	**none**	**0.70 – 1.00**[ii]	**0.95**[ii]	Y	N
Align Vlt Factor[ii]	(Open Loop Alignment Voltage Reference Scaling Factor) This parameter is used to scale open loop voltage reference at the initial phase of the open loop alignment.	**none**	**0.05 – 1.99**[ii]	**1.00**[ii]	N	N
Autoalign Volts[ii]	(Auto Alignment Voltage[ii]) This parameter is used during Auto Alignment. This parameter should only be adjusted if a SPD DEV FAULT following an auto alignment. Default value is 10.	**%**	**1 – 50**[ii]	**10**[ii]	**N**	**N**

Table 4: MS Pwr Convert A4 Submenu

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Detailed Descriptions

FLUX WEAKENING AT VOLTAGE LIMITS

The following Quattro PM parameters affect flux weakening:

- Flux Weakening Slew Rate (FLUX WEAKEN RATE (A4))
- Flux Weakening Level (FLUX WEAKEN LEV (A4))

Permanent magnets are used to generate a constant flux linkage in PM synchronous motors. Under normal operating conditions, the PM drive only controls torque production as the machine is permanently excited. Rarely, is there a need to reduce the flux level in a PM motor.

However, with an elevator application, the need may arise to reduce the flux level if the input voltage to the drive is relatively low in comparison to the maximum motor voltage. The drive is capable of supplying more current with the same terminal voltage as the counter electromotive force (CEMF) is lower at a given speed.

In order to weaken the flux in a PM motor, an additional current component is injected and the current required to produce certain torque will increase. This increased current demand will reduce the efficiency of the system and increase thermal stress on the drive and the motor. For these reasons, flux weakening should be used if only absolutely necessary. This feature is disabled by default (FLUX WEAKEN RATE (A4) = 0). The parameter Flux Weakening Slew Rate (FLUX WEAKEN RATE (A4)) is used to set how fast flux weakening occurs when the output voltage reaches the limit. Set this to a minimum value that ensures successful acceleration of the fully loaded car for more gradual flux weakening.

With flux weakening enabled, the Quattro PM will automatically adjust the current to keep the output voltage from reaching the voltage limits. The Quattro PM can begin flux weakening before the motor reaches the voltage limit or at the very limit. The limit depends upon the setting of FLUX WEAKEN LEV (A4). The sooner the flux weakening begins, the more voltage margin is available to compensate for transient disturbances. However, the set point must be set higher than rated motor voltage such that the full flux (NO flux weakening) is available for cruising speed.

The flux weakening can also lead to an abrupt reduction of torque producing capability of the motor. Different motors have different flux weakening capabilities. In some cases the maximum torque increase cannot be achieved. Even then, it may be worth using flux weakening as it allows the drive to accelerate to full speed on a compromised curve without declaring current regulator fault (CURR REG FLT).

When the drive is flux weakening, the monitor function D-CURR REFERENCE (D2) will be negative. It is advisable to verify D-CURR REFERENCE (D2) is zero when the car is running fully loaded at constant speed.

Line Side Power Converter A5 submenu

NOTE: The only parameter that should ever need to be adjusted is INPUT L-L VOLTS.

Other parameters are for Magnetek Engineering use only.

Parameter	Description	Units	Range	Default	Hidden Item	Run lock out
Input L-L Volts	(Input Line to Line Voltage - Input Voltage) This parameter sets the nominal input voltage to the drive. Must be set correctly to calibrate DC bus voltage regulation and precharge.	**Vrms**	**150 – 480**	**480**	N	Y
Initial L Freq	(Initial Line Frequency) This parameter sets the initial frequency of the input line voltage. The defaulted value of 55Hz will work for most applications; however, when line power is switched from utility power to emergency power, this value should be set for the actual line power input frequency.	**Hz**	**50 – 60**	**55**	N	Y
DC Bus V Boost	(DC bus voltage reference) Adjusts the DC bus voltage boost above the peak of line voltage. *NOTE: The bus must be higher than the Motor Voltage and higher than the line voltage for proper line side regulation of harmonics and power factor.*	**Volts**	**15 – 75**	**30**	N	N
SW Bus OV Level	(Software Bus Overvoltage Level) DC bus software Overvoltage trip point.	**Vdc**	**100 – 850**	**850**	N	N
Bus Vref Source	(Bus Voltage Reference Source) Selects the bus voltage boost reference. • Track Line V uses the actual line voltage for the bus reference. Recommended for systems with a stiff line. Trk Vin Param uses INPUT L-L VOLTS (A5) for the bus reference. Recommended to systems with a soft line.	**none**	– **track line v** – **trk vin param**	**TRACK LINE V**	N	N
LS PWM Frequency	(Line Side PWM Frequency) This parameter sets the PWM or 'carrier' frequency of the converter portion of the drive.	**kHz**	**8.0 – 12.0**	**10.0**	N	N

Parameter	Description	Units	Range	Default	Hidden Item	Run lock out
Pre Chge Thresh	(Pre-Charge Threshold) This parameter determines the allowable variance between actual and calculated Bus Voltage during power up. Failure to meet this threshold will result in a LS CHARGE Fault and can be an indication of a loaded down Bus. Most applications should use the default value. Lowering this value tightens the tolerance and leads to nuisance faults. Raising this value can cause loose tolerance and risk damage to Pre-Charge Resistors.	**none**	**1 – 60**	**28**	N	N
PLL Filter Fc	(Phase Locked Loop Filter Frequency) Utility line Phase Locked Loop filter corner Frequency	**Hz**	**20.0 – 150.0**	**40.0**	N	N
Pole Filter	(Pole Filter Setting) This parameter adds a low pass filter to the line side to help alleviate nuisance noise issues. This can be very useful in situations where multiple drives are located on the same line. For one Quattro AC/PM on the line, 2.2kHz setting is recommended. Setting this parameter between 0.1 and 0.9 kHz, an 800 Hz 2nd order low pass filter, plus a 2nd order notch filter is added to the line side. Setting this parameter to 1.0 kHz, an 800 Hz 2nd order low pass filter is added. Setting this parameter between 1.1 and 3.0, a cascaded 2nd order notch filter is added with the center frequency the setting of POLE FILTER.	**kHz**	**0.1 – 3.0**	**2.2**	Y	N
LS ID Reg P Gain	Proportional gain for out-of-phase current regulator	**none**	**0.00 – 9.99**	**0.60**[iii] **0.30**[iv]	N	N
LS ID Reg I Gain	Integral gain for out-of-phase current regulator	**none**	**0 – 999**	**20**[iii] **10**[iv]	N	N
LS IQ Reg P Gain	Proportional gain for in-phase current regulator	**none**	**0.00 – 9.99**	**0.60**[iii] **0.30**[iv]	N	N
LS IQ Reg I Gain	Integral gain for in-phase current regulator	**none**	**0 – 999**	**20**[iii] **40**[iv]	N	N
DC Bus Reg P GN	Proportional gain for bus voltage regulator	**none**	**0 – 9.99**	**3.00**	N	N
DC Bus Reg I GN	Integral gain for bus voltage regulator	**none**	**0 – 999**	**40**	N	N

Table 5: Line Side Power Convert A5

[iii] Parameter settings for the Cube drive
[iv] Parameter settings for the Enclosed drive

Motor A6 submenu

<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.
<table>
<tr><td>Motor Parameter</td><td colspan="3">Motor ID</td></tr>
<tr><td></td><td>4 pole dflt</td><td>6 pole dflt</td><td>small pm default</td></tr>
<tr><td>rated mtr power</td><td>0.0 HP</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><td>0.0 V</td></tr>
<tr><td>rated motor curr</td><td>0.0 A</td><td>0.0 A</td><td>0.0 A</td></tr>
<tr><td>motor poles</td><td>4</td><td>6</td><td>0</td></tr>
<tr><td>rated mtr speed</td><td>0.0 RPM</td><td>0.0 RPM</td><td>0.0 RPM</td></tr>
<tr><td>% no load curr</td><td>35.0 %</td><td>45.0 %</td><td>-</td></tr>
<tr><td>stator leakage X</td><td>9.0 %</td><td>7.5 %</td><td>-</td></tr>
<tr><td>rotor leakage X</td><td>9.0 %</td><td>7.5 %</td><td>-</td></tr>
<tr><td>stator resist</td><td>1.5 %</td><td>1.5 %</td><td>7.0 %</td></tr>
<tr><td>motor iron loss</td><td>0.5 %</td><td>0.5 %</td><td>0.0 %</td></tr>
<tr><td>motor mech loss</td><td>1.0 %</td><td>1.0 %</td><td>1.0 %</td></tr>
<tr><td>D axis induct</td><td>-</td><td>-</td><td>10 mH*</td></tr>
<tr><td>Q axis induct</td><td>-</td><td>-</td><td>10 mH*</td></tr>
<tr><td>OL Align Scale</td><td>-</td><td>-</td><td>0.78</td></tr>
<tr><td>encoder ang ofst</td><td>-</td><td>-</td><td>30000</td></tr>
</table>
Table 6: Motor ID Defaults
*NOTE: These values are rough estimates, and more accurate values obtained from the motor nameplate will create better performance.</td><td>none</td><td>– 4 pole dflt[i]
– 6 pole dflt[i]
– small pm dflt[ii]</td><td>4 POLE DFLT[i]

SMALL PM DFLT[ii]</td><td>N</td><td>Y</td></tr>
<tr><td>Rated Mtr Power</td><td>(Rated Motor Power)
This parameter sets the rated power in horsepower (HP) or kilowatts (kW) of the motor. NOTE: The value should be obtained from the motor nameplate.</td><td>HP
kW</td><td>1.0 – 500.0
0.75 – 400.00</td><td>0.00</td><td>N</td><td>Y</td></tr>
<tr><td>Rated Mtr Volts</td><td>(Rated Motor Voltage)
This parameter sets the rated motor voltage. NOTE: The value should be obtained from the motor nameplate.</td><td>V</td><td>85.0 – 575.0</td><td>0.0</td><td>N</td><td>Y</td></tr>
<tr><td>Rated Excit Freq[i]</td><td>(Rated Motor Excitation Frequency)
This parameter sets the excitation frequency of the motor. NOTE: The value should be obtained from the motor nameplate.</td><td>Hz</td><td>5.0 – 400.0[i]</td><td>0.0[i]</td><td>N</td><td>Y</td></tr>
<tr><td>Rated Motor Curr</td><td>(Rated Motor Amps) This parameter sets the rated motor current. NOTE: The value should be obtained from the motor nameplate.</td><td>A</td><td>1.00 – 800.00</td><td>0.00</td><td>N</td><td>Y</td></tr>
</table>

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
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: The value should be obtained from the motor nameplate or calculated from motor excitation frequency and rated motor speed. See motor parameter calculations on page 137.*	**none**	**2 – 32**[i] **2 – 128**[ii]	**per MOTOR ID**	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: The value should be obtained from the motor nameplate or calculated from motor excitation frequency and number of poles. See motor parameter calculations on page 137.*	**RPM**	**50.0 – 3000.0**[i] **18.0 – 3000.0**[ii]	**0.0**	N	Y
% No Load Curr[i]	*(Percent No Load Current) This parameter sets the percent no load current of the motor. Units in percent of current.*	**%**	**1.0 – 80.0**[i]	**per MOTOR ID**	N	N
Stator Leakage X[i]	*(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.*	**%**	**0.1 – 20.0**[i]	**per MOTOR ID**	Y	N
Rotor Leakage X[i]	*(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.*	**%**	**0.0 – 20.0**[i]	**per MOTOR ID**	Y	N
Flux Sat Break[i]	*(Flux Saturation Break Point) This parameter sets the flux saturation curve slope change point. Units in percent of flux.*	**%**	**0 – 100**[i]	**75**[i]	Y	Y
Flux Sat Slope 1[i]	*(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**[i]	**0**[i]	Y	Y
Flux Sat Slope 2[i]	(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**[i]	**50**[i]	Y	Y

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
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 68.	**%**	**100 – 150**	**110**	N	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: $\left(\begin{matrix}OVLD\\START\\LEVEL:\end{matrix}\right)+\left(\begin{matrix}40\%\\rated\\motor\\current\end{matrix}\right)$ This is the other parameter used to define the overload curve.	**sec**	**5.0 – 120.0**	**60.0**	N	Y
Stator Resist	(Stator Resistance) This parameter sets the amount of resistance in the motor stator, as a percent of the BASE IMPEDANCE (D2), which appears in the Power Data display. Units in percent of base impedance (base Z). *NOTE: The base impedance is based on the RATED MTR PWR (A6) and RATED MTR VOLTS (A6) parameters.*	**%**	**0.1 – 20.0**[i] **0.0 – 20.0**[ii]	**per MOTOR ID**	N	N
Motor Iron Loss	(Motor Iron Losses) This parameter sets the motor iron loss at rated frequency. Units in percent of rated power.	**%**	**0.1 – 15.0**[i] **0.0 – 15.0**[ii]	**per MOTOR ID**	N	N
Motor Mech Loss	(Motor Mechanical Losses) This parameter sets the motor mechanical losses at rated frequency. Units in percent of rated power.	**%**	**0.1 – 15.0**[i] **0.0 - 15.0**[ii]	**per MOTOR ID**	N	N

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Units	Range	Default	Hidden item	Run lock out
D Axis Induct[ii]	(Magnet/Flux Axis Equivalent Circuit Inductance) This parameter sets amount of inductance in flux producing equivalent circuit of the vector controlled PM motor. Higher inductances are used for higher horsepower motors, but it is best if obtained from motor specifications.	**mH**	**0.50 – 150.00**[ii]	**10.00**[ii]	N	N
Q Axis Induct[ii]	(Torque Axis Equivalent Circuit Inductance) This parameter sets amount of inductance in torque producing equivalent circuit of the vector controlled PM motor. Higher inductances are used for higher horsepower motors, but it is best if obtained from motor specifications.	**mH**	**0.50 – 150.00**[ii]	**10.00**[ii]	N	N
OL Align Scale[ii]	(Open-Loop Alignment Scale) The drive automatically calculates the torque constant. This value can scale the calculated torque constant to provide better performance.	**none**	**0.50 – 2.00**[ii]	**0.78**[ii]	N	N
Encoder Ang Ofst[ii]	(Encoder Angle Offset) This parameter contains the value of the alignment determined during the alignment procedure. For more information on the alignment procedure, see Rotor Alignment Procedure on page 144.	**none**	**0 – 30000**[ii]	**30000**[ii]	N	Y

Table 7: Motor A6 Submenu

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Detailed Descriptions

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:

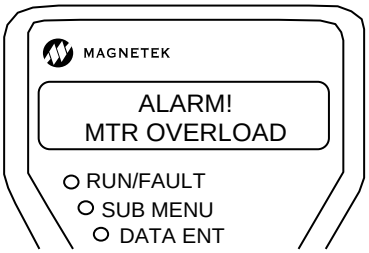
- motor current overload start level (OVLD START LEVEL(A6)) parameter
- motor current time out (OVLD TIME OUT(A6)) parameter

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

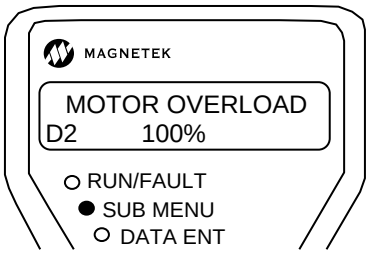
Motor Overload Parameters

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.

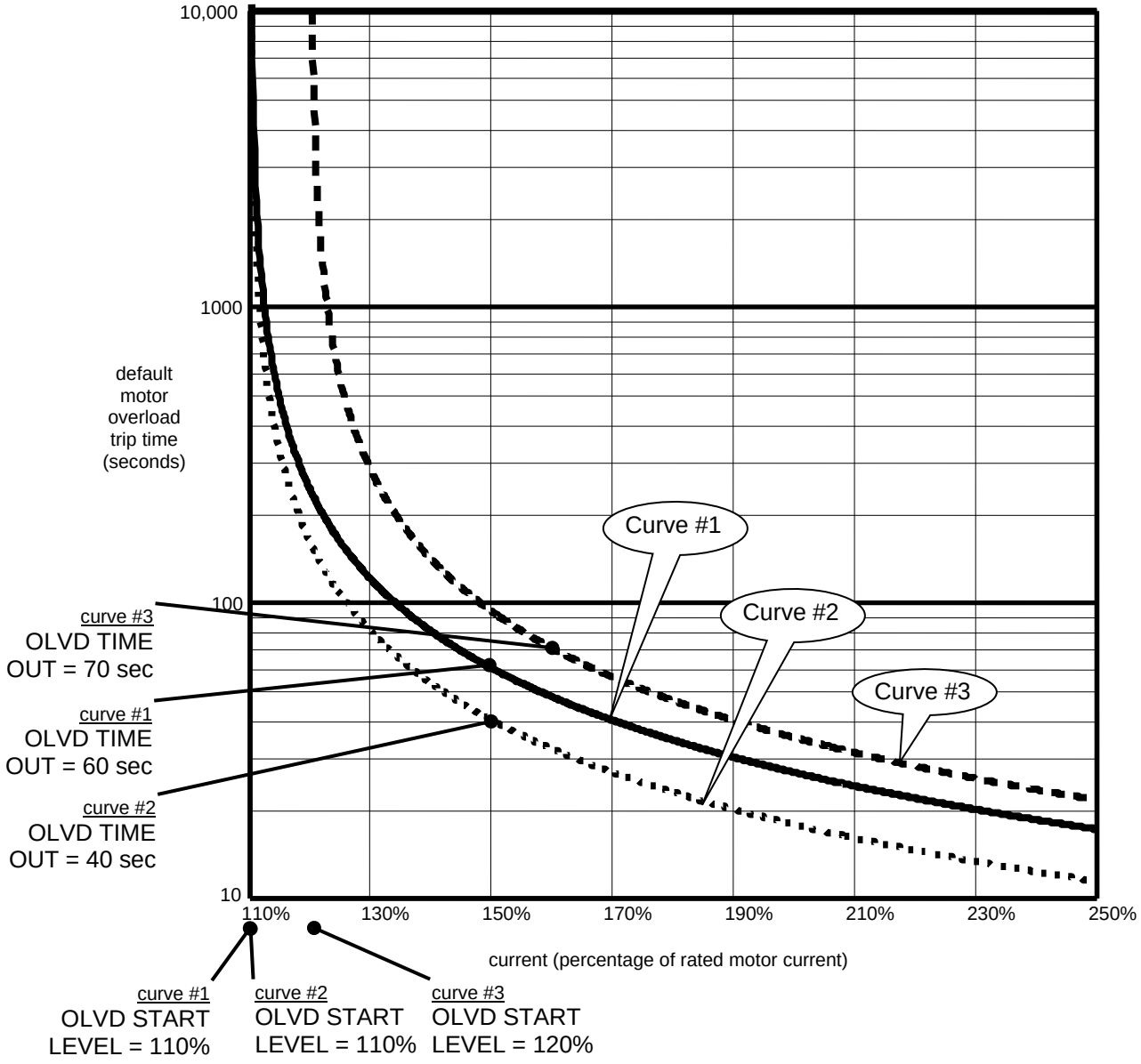


The drive will only declare a motor overload and the user is responsible for action.

However, 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 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 four choices are as follow: • Multi-Step: user-defined fifteen discrete speed commands (CMD1 - CMD15). Maximum of 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) • Serial Multi-Step: multi-step speed commands sent through a RS-422 serial port located on the drive Customer Interface Board (only used in serial Mode 2) • Analog: 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. • Serial: a speed profile sent through a RS-422 serial port located on the drive Customer Interface Board (only used in serial Mode 1)	– **multi-step** – **ser mult step** – **analog input** – **serial**	**MULTI-STEP**	N	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 tb1), 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 tb1 or serial+extrn), the Run signal on TB1 must be selected.	– **external tb** – **serial** – **serial+extrn**	**EXTERNAL TB**	N	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**	N	Y

Parameter	Description	Choices	Default	Hidden item	Run lock out
Encoder Select[ii]	(Encoder Select) *Magnetek personnel only* – Presently, only EnDat absolute encoder option is available. The switch selects between absolute and incremental encoder feedback. Locked by ENGR PARM LOCK.	– **endat abslute**[ii]	**ENDAT ABSLUTE**[ii]	Y	N
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 A6 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 A6 have been established, the Encoder Fault should be enabled (ENCODER FAULT (C1) = enabled).	– **enable** – **disable**	**ENABLE**	N	Y
Cont Confirm Src	(Contactor Confirm Source) A hardware confirmation of motor contactor (ME) closure is necessary before drive attempts to pass current through motor	– **external tb**	**EXTERNAL TB**	N	Y
Fast Flux[i]	(Fast Flux Enable) This parameter addresses the method the Quattro AC uses to build up flux in the motor. Enabling the Fast Flux function can decrease the motor fluxing time and reduce starting takeoff time significantly.	– **disabled**[i] – **enabled**[i]	**DISABLED**[i]	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 81.	– **internal** – **external tb** – **serial**	**INTERNAL**	N	Y
I-Reg Inner Loop[ii]	(Current Regulator Inner Loop) This switch is used to disable/enable the current regulator inner loop function. It is used to enhance the current loop performance.	– **enabled med**[ii] – **enabled high**[ii] – **disabled**[ii] – **enabled low**[ii]	**ENABLED MED**[ii]	N	N
Ramped Stop Sel	(Ramp Stop Select) Chooses between normal stop and torque ramp down stop. For more information, see RAMPED STOP SEL on page 83.	– **none** – **ramp on stop**	**NONE**	N	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 TB1 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**	N	Y

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Choices	Default	Hidden item	Run lock out
S-Curve Abort	(S-Curve Abort) This parameter 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. 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. Enabled 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. • 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).	– **disabled** – **enabled**	**DISABLED**	N	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**	N	Y
Brake Pick Src	(Brake Pick Source) If the BRAKE PICK SRC (C1) is set to INTERNAL, the Quattro AC/PM will attempt to pick (lift) the brake when magnetizing current has been developed in the motor.	– **internal** – **serial**	**INTERNAL**	N	Y
Brake Pick Cnfm	(Brake Pick Confirm) If this switch is set to EXTERNAL TB, the Quattro AC/PM 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. If switch is set to internal time, the Quattro AC/PM will wait for BRAKE PICK TIME (A1) before releasing the speed reference. If switch is set to serial, the Quattro AC/PM will wait for bit B6 of byte 4 on runtime message before releasing the speed reference.	– **none** – **external tb** – **internal time** – **serial** – **on speed cmd**	**NONE**	N	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**	N	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 Quattro AC/PM. 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 Quattro AC/PM 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**	N	Y

Parameter	Description	Choices	Default	Hidden item	Run lock out
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). Disabled: When the Auto Stop function is disabled, the speed command plays no part in the logical start or stop of the drive. Enabled: 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 • Either the removal of the Run command or a zero speed command will initiate a stop Remember, when the auto stop function is 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, as the drive does not start until both are present. When initiating a stop, if STOPPING MODE (C1) = RAMP TO STOP, the drive will behave the same if either the run or the speed command is removed. If STOPPING MODE (C1) = IMMEDIATE, the drive will immediate drop SPD REF RLS and turn off SPD REG RLS after BRAKE PICK TIME (A1). With this same setup, if the speed command is removed before the run command, the drive will behave the same as if STOPPING MODE (C1) = Ramp to Stop.	– **disable** – **enable**	**DISABLE**	Y	N
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**	N	Y

Parameter	Description	Choices	Default	Hidden item	Run lock out
Ser2 Flt Mode	(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 – 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.	– **immediate** – **run remove** – **rescue**	**IMMEDIATE**	N	Y
Speed Reg Type	(Speed Regulator Type) *Chooses speed regulator: Ereg or PI regulator. For more information, see SPEED REG TYPE on page 82.*	– **elev spd reg** – **pi speed reg** – **external reg**	**ELEV SPD REG**	N	Y
bu pwr enable	(Backup Power Enable Source) determines how the logic signal will come into the drive to turn on this mode.	– **none** – **external tb** – **ser + ext** – **serial**	**NONE**	N	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**	N	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**	N	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**	N	Y

Parameter	Description	Choices	Default	Hidden item	Run lock out
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 EX 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 EX TORQ CMD SRC is set to either serial or analog. The torque command is an auxiliary torque command (torque feedforward command)*	– **none** – **serial** – **analog input**	**NONE**	N	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 tb1), 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. <u>Automatic Fault Reset</u> 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**	N	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**	N	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 if used the 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 on option card. 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**	N	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 analog pre-torque and speed commands. To facilitate this, the Quattro AC/PM 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 TB1). The latched pre-torque command is used by the speed regulator when the internal Speed Regulator Release signal is asserted. Once the pre-torque command is used, the latch and the pre-torque command are cleared.	– **not latched** – **latched**	**NOT LATCHED**	N	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 TB1, the Pre-Trq Latch signal on TB1 must be selected.	– **external tb** – **serial**	**EXTERNAL TB**	N	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. • 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. However, if 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**	N	Y
Mlt-Spd TO Dly1	(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 83.	– **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**	**NONE**	N	Y
Mlt-Spd TO Dly2			**NONE**	N	Y
Mlt-Spd TO Dly3			**NONE**	N	Y
Mlt-Spd TO Dly4			**NONE**	N	Y
Priority Msg	(Priority Message Enabling) With Priority Message disabled the user will not see priority messages, meaning faults and alarms will not be displayed on the operator, but the faults will be placed into the fault history and active fault lists with the Fault LED on. Leave Priority Message enabled when drive is not being worked on.	– **enable** – **disable**	**ENABLE**	N	Y
ARB Select	(Anti-Rollback Select) With ARB SELECT set to ARB3, the drive will calculate pre-torque values when movement is seen on the shaft. For information on how to setup ARB, see ANTI-ROLLBACK on page 50.	– **disable** – **arb3**	**DISABLE**	N	Y

Parameter	Description	Choices	Default	Hidden item	Run lock out
Endat Interp[ii]	(EnDat Interpolation) This parameter sets the feedback interpolation rate multipler for the EnDat board for increased encoder feedback resolution	– **times 8**[ii] – **times 16**[ii] – **times 32**[ii] – **times 64**[ii] – **times 128**[ii] – **times 256**[ii] – **times 512**[ii] – **times 1024**[ii]	**TIMES 128**[ii]	N	Y
Endat Out Mult[ii]	(EnDat Output Multiplier) This parameter sets the EnDat encoder PPR multiplier factor for the EnDat board differential quadrature buffered output	– **times 8**[ii] – **times 1**[ii] – **times 2**[ii] – **times 4**[ii]	**TIMES 8**[ii]	N	Y
Drv Eable Src	(Drive Enable Source) This parameter allows the user to choose the source of the drive enable command from one of the following sources: an external run signal from a logic input (external tb1), a drive enable 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 tb1 or serial+extrn), the drive enable signal on TB1 must be selected.	– **external tb** – **serial** – **serial+extern**	**EXTERNAL TB**	N	Y
NTSD Mode	(Normal Terminal Stopping Device Mode) This parameter allows user to program the drive to run at a preprogramed reduced speed based on the state of the logic input when the elevator is travelling too fast as it is coming into the terminal landings.	– **external** – **1 threshold** – **2 thresholds** – **3 thresholds**	**EXTERNAL**	N	Y
PWM Mode[ii]	(Pulse-Width Modulation Mode) • 2-PH - 2 Phase Modulation - This mode provides energy savings as one of the three output phase's gates are held high or low for each PWM modulation cycle and there are no switching losses on that phase during the PWM cycle. The other two phases mathematically adjust to still produce sinusoidal voltages on the motor. • 3-PH - 3 phase Modulation- All 3 phases are proportionally producing PWM output at all times. This results in a slightly better output resolution (in particular at low speed/current) but draws more switching (heat) losses. • 2-PH/3-Ph - Two Phase Three Phase Modulation - In this mode, at low voltages the drive produces 3 Phase modulation (where resolution is more important) and at high voltages the drive produces 2 phase modulation (where switching losses are more important). This provides the best of all worlds	– **3PH-2PH**[ii] – **2PH**[ii] – **3PH**[ii]	**3PH-2PH**[ii]	N	Y

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Choices	Default	Hidden item	Run lock out
Boost Enable Src	(Boost Enable Source) This parameter determines the method in which the drive will start the precharge. A precharge is required after the drive is first powered up, or after DSPR has time out. For more information on sequencing, see Quattro AC/PM Pre-Charge on page 34.	– **enable on de** – **external tb** – **serial** – **enable on run**	**ENABLE ON DE**	N	Y
Engr Parm Lock[ii]	*Magnetek personnel only* – This function is used to lock out parameters that should only be changed by Magnetek engineers. Some of the parameters that are protected by this switch may cause drive malfunction if they are set to an incorrect value.	– **locked**[ii] – **unlocked**[ii]	**LOCKED**[ii]	Y	N

Table 8: User Switches C1 Submen

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 Quattro AC/PM 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:

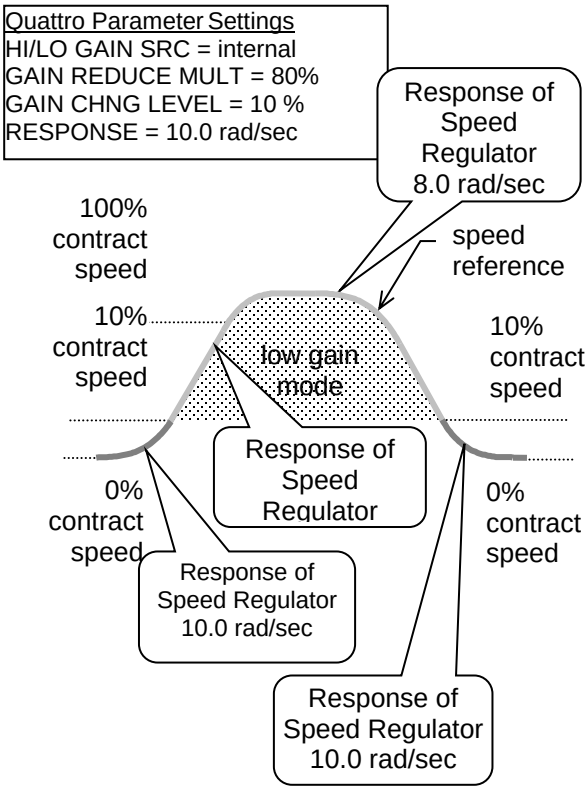
- a logic input
- the serial channel

The high/low gain switch can also be controlled internally 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)
The Speed Regulator Type 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 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.

The source of the external torque command is determined by the EXT TORQ CMD SRC (C1) parameter.

The Quattro AC/PM has the following two closed loop speed regulation options and an option for turning off the internal speed regulator:

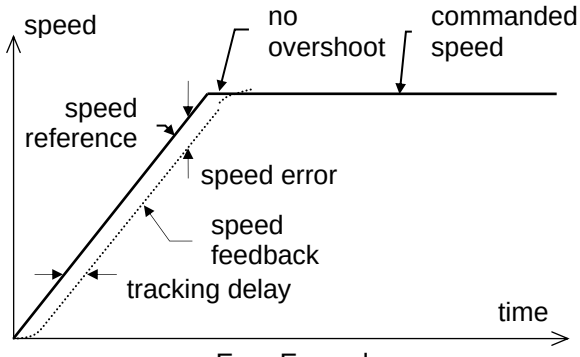
- Elevator Speed Regulator (Ereg)
- PI Speed Regulator
- External Speed Regulator

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.

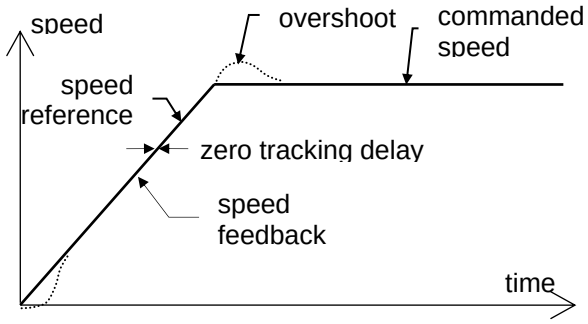
The tracking delay shown is defined as (1/RESPONSE) seconds. The tracking delay is not affected by the gain reduce multiplier.

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:

$$\begin{matrix} \textit{inner} \\ \textit{loop} \\ \textit{crossover} \end{matrix} \quad \langle \quad \textit{response} \times \begin{matrix} \textit{gain} \\ \textit{reduce} \\ \textit{multiplier} \end{matrix}$$

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, there will be an overshoot at the end of each accel and decel period. 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.

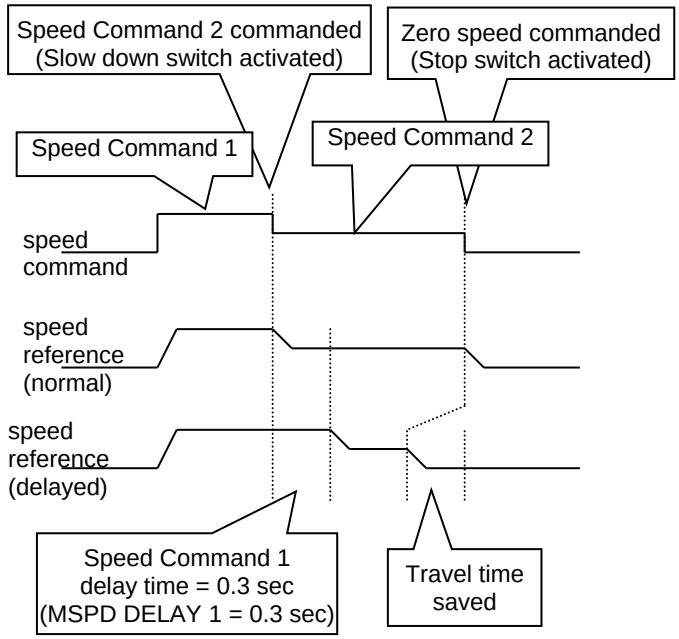
A method of providing the Ramp Down Enable would be with a logic signal (EXTERNAL TB1) that is dedicated to that function. The Ramp Down Enable would be asserted while the Run command is still present and remain there until the ramp is completed, after which the Run command would be removed.

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 Quattro AC/PM 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.

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.

When configured for "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.



NTSD MODE
(Normal Terminal Stopping Device Mode) This parameter allows the drive to perform pre-programmed NTS slowdown. The drive will ignore most speed command (drive will follow any speed command slower than the NTSD Target Speed to ensure proper floor leveling) it is being told to run at, slow down using the S-Curve 4 parameters, and clamp the drive speed command at NTSD Target Spd (A1) if it measures an elevator speed faster than what is set in NTSD Threshold 1 (A1), NTSD Threshold 2 (A1), and/or NTSD Threshold 3 (A1) to when the logic input NTSD Input 1 (C2)

and/or NTSD Input 2 (C2) isn't being triggered. There are 4 methods that can be selected:

External:
This should be selected if the drive NTSD function will not be used or if it is desired for the drive to go into NTSD mode as soon as NTSD Input 1 (C2) is triggered logic low. The drive will immediately slow down using S-Curve 4 to the NTSD Target Spd (A1) and clamp the speed there. The drive will get out of NTSD mode and back into normal operation when: the NTSD input is re-asserted as logic high again.

NTSD Input 1	NTSD Input 2	Result
Not Used	Not Used	Internal NTSD function of drive is not used
1		Normal Operation
0		Use S-Curve 4 to decel and run at NTSD Target Speed, OR run at a slower supplied drive speed command

Table 9: External NTSD Mode function table

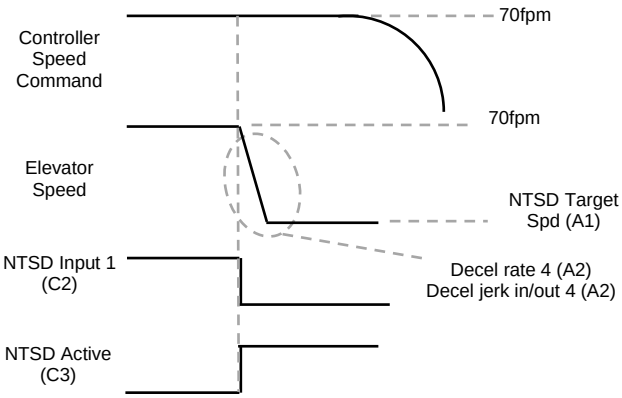


Figure 22: External NTSD Mode

1 Threshold:
The drive uses only 1 speed check point to determine whether or not it should go into NTSD mode. When Logic Input 1 (C2) is logic low, the drive will compare the speed feedback to NTSD Threshold 1. If the absolute value of speed feedback is greater than NTSD Threshold 1 (A1), the drive will slow down using S-Curve 4. Then it will clamp the drive speed command so that the absolute value of speed command is less than or equal to NTSD Target Speed (A1). The drive will get out of NTSD mode and back into normal operation when: the NTSD input is re-asserted as logic high again and the absolute value of speed feedback is less than or equal to the NTSD Target Spd (A1).

NTSD Input 1	NTSD Input 2	Result
1	Not Used	Normal Operation
0		if | speed feedback | > NTSD Threshold 1 decel using S-Curve 4, and clamp the drive speed command to | speed command | ≤ NTSD Target Speed

Table 10: 1 Threshold NTSD Mode funtion table

Example:
NTSD 1 Spd Fdbk (D1) = 80 fpm
NTSD Threshold 1 (A1) = 70 fpm
NTSD Target Spd (A1) = 10 fpm

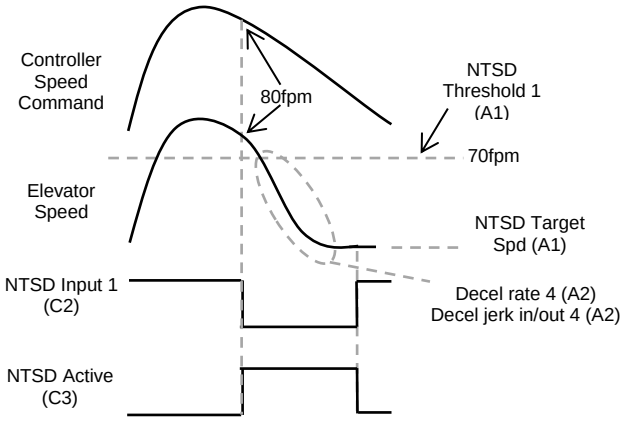


Figure 23: 1 Threshold NTSD Mode

2 Thresholds:
The drive uses 2 speed check points to determine whether or not it should go into NTSD mode. When either NTSD Input 1 (C2) or NTSD Input 2 (C2) is logic low, the drive will compare the speed feedback to NTSD Threshold 1 (A1) or NTSD Threshold 2 (A1). If the absolute value of speed feedback is greater than the selected threshold, the drive will slow down using S-Curve 4. Then it will clamp the drive speed command so that the absolute value of speed command is less than or equal to NTSD Target Speed (A1). The drive will get out of NTSD mode and back into normal operation when: both NTSD inputs are re-asserted as logic high again and the absolute value of speed feedback is less than or equal to the NTSD Target Spd (A1).

NTSD Input 1	NTSD Input 2	Result
1	1	Normal Operation
1	0	if | speed feedback | > NTSD Threshold 2 decel using S-Curve 4, and clamp the drive speed command to | speed command | ≤ NTSD Target Speed
0	1	if | speed feedback | > NTSD Threshold 1 decel using S-Curve 4, and clamp the drive speed command to | speed command | ≤ NTSD Target Speed
0	0	if | speed feedback | > NTSD Threshold 1 decel using S-Curve 4, and clamp the drive speed command to | speed command | ≤ NTSD Target Speed

Table 11: 2 Thresholds NTSD Mode function table

Example:
NTSD 2 Spd Fdbk (D1) = 80 fpm
NTSD 1 Spd Fdbk (D1) = 23 fpm
NTSD Threshold 2 (A1) = 70 fpm
NTSD Threshold 1 (A1) = 60 fpm
NTSD Target Spd (A1) = 10 fpm

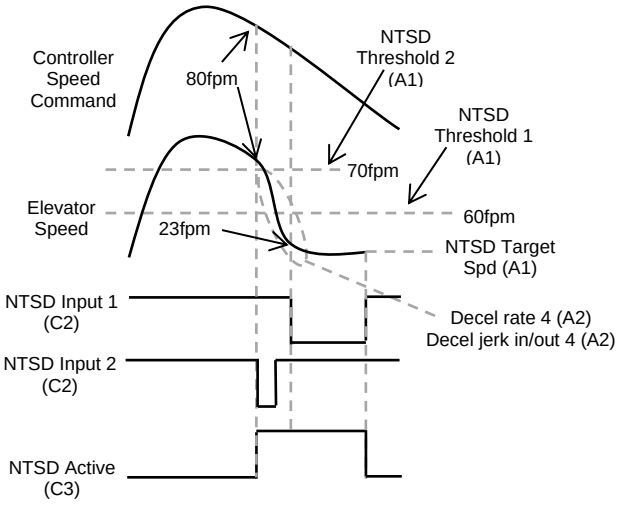


Figure 24: 2 Thresholds NTSD Mode

3 Thresholds:
The drive uses 3 speed check points to determine whether or not it should go into NTSD mode. When any combination of NTSD Input 1 (C2) or NTSD Input 2 (C2) is logic low, the drive will compare the speed feedback to NTSD Threshold 1 (A1), NTSD Threshold 2 (A1), or NTSD Threshold 3 (A1). If the absolute value of speed feedback is greater than the selected threshold, the drive will slow down using S-Curve 4. Then it will clamp the drive speed command so that the absolute value of speed command is less than or equal to NTSD Target Speed (A1). The drive will get out of NTSD mode and back into normal operation when: both NTSD inputs are re-asserted as logic high again and the absolute value of speed feedback is less than or equal to the NTSD Target Spd (A1).

NTSD Input 1	NTSD Input 2	Result
1	1	Normal Operation
0	1	if | speed feedback | > NTSD Threshold 3 decel using S-Curve 4, and clamp the drive speed command to | speed command | ≤ NTSD Target Speed
1	0	if | speed feedback | > NTSD Threshold 2 decel using S-Curve 4, and clamp the drive speed command to | speed command | ≤ NTSD Target Speed
0	0	if | speed feedback | > NTSD Threshold 1 decel using S-Curve 4, and clamp the drive speed command to | speed command | ≤ NTSD Target Speed

Table 12: 3 Thresholds NTSD Mode function table

Example:
NTSD 3 Spd Fdbk (D1) = 80 fpm
NTSD 2 Spd Fdbk (D1) = 60 fpm
NTSD 1 Spd Fdbk (D1) = 23 fpm
NTSD Threshold 3 (A1) = 80 fpm
NTSD Threshold 2 (A1) = 60 fpm
NTSD Threshold 1 (A1) = 20 fpm
NTSD Target Spd (A1) = 10 fpm

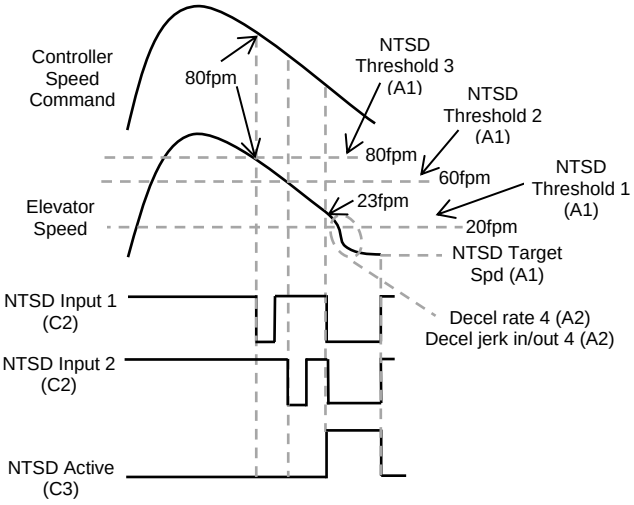


Figure 25: 3 Thresholds NTSD Mode

ENDAT INTERPOLATION[ii]
(EnDat Interp)
This parameter determines how precisely the drive is able to sense the angular position of the motor shaft. Higher interpolation values correspond to a more precise sensing of the shaft position. The default setting provides an optimal ride quality for most applications. It may be necessary to lower this parameter for faster motors or to raise it for slower motors. For any installation, the EnDat Interp (C1) setting should not exceed the value shown in Table 13 for a given Contract Mtr Spd (A1). The recommended maximum Contract Mtr Spd (A1) settings will allow over-speed test operation up to 150%.

Maximum Contract Mtr Spd (A1) in RPM	Setting of EnDat Interp (C1)
1200 RPM	32 or lower
580 RPM	64
290 RPM	128
140 RPM	256
70 RPM	512
30 RPM	1024

Table 13: Maximum acceptable setting of EnDat Interp (C1) for a given Contract Mtr Spd (A1)

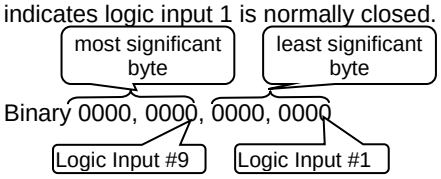
[ii] Parameters accessible through PM software

Logic Inputs C2 submenu

LOGIC INPUT x
(Logic Inputs 1-9)
This parameter defines the function of the logic inputs.

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

<table>
<tr><th>Parameter</th><th>Description</th><th>Default</th><th>Hidden item</th><th>Run lock out</th></tr>
<tr><td>Log In 1 TB1-1</td><td>logic input #1 on Terminal Block 1 pin 1</td><td>CONTACT CFIRM</td><td>N</td><td>Y</td></tr>
<tr><td>Log In 2 TB1-2</td><td>logic input #2 on Terminal Block 1 pin 2</td><td>CTR PWR SENSE</td><td>N</td><td>Y</td></tr>
<tr><td>Log In 3 TB1-3</td><td>logic input #3 on Terminal Block 1 pin 3</td><td>DRIVE ENABLE</td><td>N</td><td>Y</td></tr>
<tr><td>Log In 4 TB1-4</td><td>logic input #4 on Terminal Block 1 pin 4</td><td>RUN</td><td>N</td><td>Y</td></tr>
<tr><td>Log In 5 TB1-5</td><td>logic input #5 on Terminal Block 1 pin 5</td><td>FAULT RESET</td><td>N</td><td>Y</td></tr>
<tr><td>Log In 6 TB1-6</td><td>logic input #6 on Terminal Block 1 pin 6</td><td>UP/DWN</td><td>N</td><td>Y</td></tr>
<tr><td>Log In 7 TB1-7</td><td>logic input #7 on Terminal Block 1 pin 7</td><td>STEP REF B0</td><td>N</td><td>Y</td></tr>
<tr><td>Log In 8 TB1-8</td><td>logic input #8 on Terminal Block 1 pin 8</td><td>STEP REF B1</td><td>N</td><td>Y</td></tr>
<tr><td>Log In 9 TB1-9</td><td>logic input #9 on Terminal Block 1 pin 9</td><td>STEP REF B2</td><td>N</td><td>Y</td></tr>
<tr><td>N.C. INPUTS</td><td>(Normally Closed Inputs) All Logic Inputs may be configured for use with Normally Open or Normally Closed external contacts. The numeric entry is a hexadecimal representation of a binary control bit for each channel. A binary 0 means Normally Open. A binary 1 indicates a Normally Closed external switch. Logic Input #1 is the least significant bit. The defaulted value of 0001 indicates logic input 1 is normally closed.
 

See table below for converting binary to hex:
<table>
<tr><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th><th>Hex</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>2</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>3</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>5</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td><td>6</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>7</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>8</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>9</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>A</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>B</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>C</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>D</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>E</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>F</td></tr>
</table></td><td>001 HEX</td><td>N</td><td>Y</td></tr>
</table>

Option	***Option Description***
bu pwr enable	(Backup Power Enable) Enabling this input will disable the boost function (regeneration) of the drive.
boost enable	(Boost Enable) Closure of this contact will start the prechage in the drive is BOOST ENABLE SRC (C1) is set to external tb.
contact cfirm	(Contact Confirm Signal) Closure of the auxiliary contacts confirming closure of the motor contactor.
ctr pwr sense	(Contactor Power Sensing) Energized when AC power is available to energize the motor contactor. Power to this circuit is controlled by elevator relay logic. This circuit must be energized before the drive will be allowed to start. If power is not available when told to start, or while running, a Fault will occur for diagnostic purposes.
drive enable	(Drive Enable) Enables drive to run. This signal must be asserted to permit drive to run. This does not initiate run, just permits initiation.
extrn fault 1	User input fault #1 — Closure of this contact will cause the drive to declare a fault and perform a fault shutdown.
extrn fault 2	User input fault #2
extrn fault 3	User input fault #3
extrn /flt 4	(External /Fault 4) Opening of this contact will cause the drive to declare a fault and perform a fault shutdown.
fault reset	(Fault Reset) If the FAULT RESET SRC (C1) switch is set to EXTERNAL TB1, the drive's fault circuit will be reset when this signal is true. If the FAULT RESET SRC (C1) 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(A1)) will be reset to zero. *NOTE: This input is edge sensitive and the fault is reset on the transition from false to true.*
low gain sel	(Low Gain Select Signal) If the HI/LO GAIN SRC (C1) switch is set to EXTERNAL TB1, the low gain mode is chosen for the speed regulator when this signal is true.
mech brk hold	(Mechanical Brake Hold Signal) Auxiliary contact closures confirming when the mechanical brake is in the hold mode (engaged).
mech brk pick	(Mechanical Brake Pick Signal) Closure of auxiliary contacts confirming the mechanical brake has been picked (lifted).
no function	(No Function) 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.
ntsd input 1	(Normal Terminal Stopping Device input # 1) Removing the signal will force the drive to compare preprogram speeds to speed feedback to decide whether or not it has to clamp its running speed.
ntsd input 2	(Normal Terminal Stopping Device input # 2) Removing the signal will force the drive to compare preprogram speeds to speed feedback to decide whether or not it has to clamp its running speed.
ospd test src	(Overspeed Test Source) This function works only if the OVRSPEED TEST SRC (C1) 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.*
pre-trq latch	(Pre-Torque Latch) Closing a contact between this input and ground latches the pre-torque command present on the analog channel.
run	(Run) If drive is enabled through the DRIVE ENABLE logic input, this function will start drive operation.
run 2	(Run 2) This functions as a 2nd RUN input that will start drive operation when DRIVE ENABLE, RUN 2, and serial run bit are activated. This input will not change the polarity of the speed command. NOTE: This ONLY works when Run Command Src (C1) is set to (serial + Extern). This input is NOT required to operate (serial + Extern). If both RUN and RUN 2 are activated at the same time, the drive will start drive operation.

Option	***Option Description***	
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.* *NOTE: Run Command Src (C1) must be set to (External TB)*	
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.* *NOTE: Run Command Src (C1) must be set to (External TB)*	
s-curve sel 0	Bit 0 of S-curve selection	For more information, see S-Curves A2 Submenu on page 53.
s-curve sel 1	Bit 1 of S-curve selection	
ser2 insp ena	(Serial Mode 2 Inspection Enable) Used only with custom serial protocol (mode 2) Defines the logic input to be used as one of the two sources of inspection run command when using serial mode 2. This input must be true as well as a comparable inspection run command sent serially for the drive to run in inspection mode.	
step ref b0	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.
step ref b1	Bit 1 of multi-step speed command selection	
step ref b2	Bit 2 of multi-step speed command selection	
step ref b3	Bit 3 of multi-step speed command selection	
trq ramp down	(Torque Ramp Down Signal) This function works only if the RAMP STOP SEL (C1) switch is set to RAMP TO STOP and RAMP DOWN EN SRC (C1) is set to EXTERNAL TB1.	
up/dwn	(Up/Down Signal) This signal is used to change the sign of the speed command. Default is FALSE; therefore, positive commands are for the up direction and negative speed command are for the down direction. Making this input true reverses the car's direction.	

Table 14: 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	Defaults	Hidden Item	Run lock out
Log Out 1 TB1-25	logic output #1 on Terminal block 1 pin 25 *NOTE: drive comes pre-wired for logic output #1 to be CLOSE CONTACT.*	CLOSE CONTACT	Y	N
Log Out 2 TB1-26	logic output #2 on Terminal block 1 pin 26	RUN COMMANDED	Y	N
Log Out 3 TB1-27	logic output #3 on Terminal block 1 pin 27	MTR OVERLOAD	Y	N
Log Out 4 TB1-28	logic output #4 on Terminal block 1 pin 28	ENCODER FLT	Y	N
Log Out 5 TB1-29	logic output #5 on Terminal block 1 pin 29	FAULT	Y	N
Log Out 6 TB1-30	logic output #6 on Terminal block 1 pin 30	SPEED REG RLS	Y	N
Log Out 7 TB1-31	logic output #7 on Terminal block 1 pin 31	SPEED REG RLS	Y	N
Solid State Rly1	solid state relay #1	NO FUNCTION	Y	N
Solid State Rly2	solid state relay #2	NO FUNCTION	Y	N
Relay Coil 1	relay coil #1	NO FUNCTION	Y	N
Relay Coil 2	relay coil #2	NO FUNCTION	Y	N

Options	
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.
at mid speed	(At Mid Speed) true only when the motor speed is above the user-specified speed defined by the MID SPEED LEVEL (A1) parameter.
auto brake	(Auto Brake) The output is controlled by the Auto Brake function and is used to open the mechanical brake (only multi-step speed commands).
bu pwr active	(Backup Power Active) This logic output is true when the bu power mode is engaged. Can be used to enable an external braking module.
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 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 encoder is disconnected or not functioning while attempting to run
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 motor flux to issue a speed regulator release.

Options continued…	
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” or response 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.
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.
not fault	(Not Fault) No fault is currently present in a drive.
ntsd active	(Normal Terminal Stopping Device Active) The output is true when the drive is in NTSD mode.
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 825VDC.
ovrtemp alarm	(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 2 start	(Ready to Start) The output is true when the drive’s software has been initialized, no faults are present, and the drive is ready to begin or already is boosting the DC bus voltage.
ready to run	(Ready to Run) The output is true when the drive’s software has been initialized, no faults are present, and the drive is boosting.
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 dumped back into the 3-phase input as reuseable power.
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.
safe off	(Safe Off) Provides feedback to the controller of the staus of the safe off input. This output is ‘High’ when the gates are disabled and ‘Low’ when enabled by the safe off circuitry.
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	(Under 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 15: Logic Outputs C3 Submenu

Analog Outputs C4 submenu

ANALOG OUTPUT 1
(Analog Outputs 1)
Default: SPEED 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
Ana Out 1 TB1-12	analog output #1 on Terminal block 1 pin 12	SPEED REF	N	N
Ana Out 2 TB1-13	analog output #2 on Terminal block 1 pin 13	SPEED FEEDBACK	N	N

Options	***Option Description***	***D/A units…***
abs pos angle[ii]	(Absolute Position Binary) Raw absolute position reading from the absolute encoder.	counts
absolut angl[ii]	(Theta Absolute Reference) Absolute position reference signal adjusted using ABS REF OFFSET used for absolute position feedback testing.	% electric cycle
arb state	(Anti-Rollback State) Shows the state of Anti-Rollback when drive is in a running condition. For more information, see Anti-Rollback on page 50.	none
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
d-current ref[ii]	(D-Axis Current Reference) D-Axis current component that does not contribute to torque production and is generally kept at zero. It will be non-zero at no-load and flux-weakening.	%
dist torq est	(Disturbance Torque Estimate) Estimated value of disturbance torque. *NOTE: Presently unavailable.*	Internal drive unit
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[i]	(Flux Output) Measured flux output	% rated flux
flux ref[i]	(Flux Reference) Flux re0ference 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
increm angle[ii]	(Accumulated Incremental Angle) Raw accumulated incremental position from incremental position feedback.	% electric cycle
mtr overload	(Motor Overload) Percent of motor overload trip level reached.	% of trip point
pos fdbk angl	(Position Feedback Angle) Actual rotor position feedback used for motor control.	% electric cycle
power output	(Power Output) Calculated power output.	% rated power
pretorque ref	(PreTorque Reference) Pre-torque reference.	% base torque
slip freq[i]	(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.	% base torque

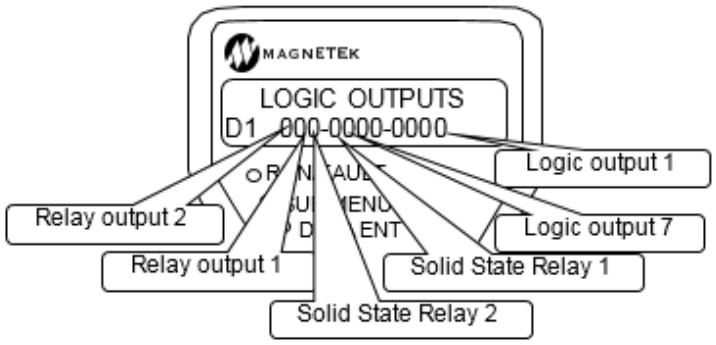
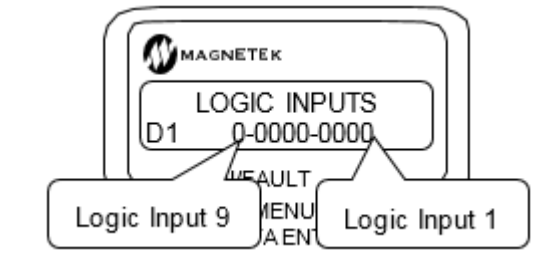
[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

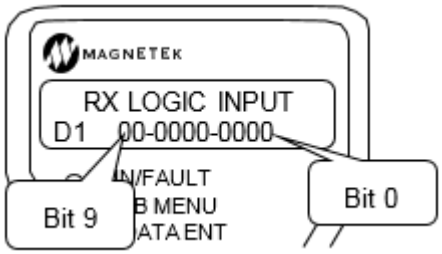
Options	***Option Description***	***D/A units…***
torq current	(Torque Producing Current) Measured torque producing current.	% rated current
torq voltage	(Torque Producing Voltage) Torque producing voltage reference.	% rated volts
torque output	(Torque Output) Calculated torque output.	% rated torque
torque ref	(Torque Reference) Torque reference used by vector control.	% base torque
u8-addr1	(Analog Address 1) Ability to view hex monitor functions via the analog outputs. Choosing this function will display the hex monitor value of ADDR1& (U8).	none
u8-addr2	(Analog Address 2) Ability to view hex monitor functions via the analog outputs. Choosing this function will display the hex monitor value of ADDR2& (U8).	none
u8-addr3	(Analog Address 3) Ability to view hex monitor functions via the analog outputs. Choosing this function will display the hex monitor value of ADDR3& (U8).	none
voltage out	(Voltage Output) RMS motor terminal voltage.	% rated volts

Table 16: Analog Outputs C4 Submenu

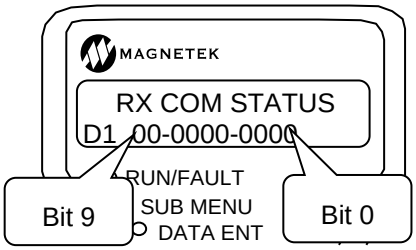
Display D0 menu

Elevator Data D1 submenu

Parameter	Description	Units	Hidden item
Speed Command	(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.	**ft/min or m/s**	N
Speed Reference	(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 an S-Curve).	**ft/min or m/s**	N
Speed Feedback	(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.	**ft/min or m/s**	N
Encoder Speed	(Encoder Speed) Monitors the measured speed feedback coming from the encoder. CONTRACT MTR SPD (A1) calibrates this parameter.	**RPM**	N
Speed Error	(Speed Error) Monitors the speed error between the speed reference and the speed feedback. It is equal to the following equation: $\left\lvert \begin{pmatrix} speed \\ reference \end{pmatrix} - \begin{pmatrix} speed \\ feedback \end{pmatrix} \right\rvert = \begin{matrix} speed \\ error \end{matrix}$	**ft/min or m/s**	N
Est Inertia	(Estimated Inertia) Estimated elevator system inertia.	**Seconds**	N
Logic Outputs	(Logic Outputs Status) This display shows the condition of the logic outputs. (1=true 0=false) 	1=true 0=false	N
Logic Inputs	(Logic Inputs Status) This display shows the condition of the logic inputs. (1=true 0=false) 	1=true 0=false	N

<table>
<tr><th>Parameter</th><th>Description</th><th>Units</th><th>Hidden item</th></tr>
<tr><td>Rx Logic In</td><td>(Serial Communications Logic Inputs)
 

<table>
<tr><th>Bit</th><th>Name Description/Reason</th></tr>
<tr><td>0</td><td>AUX_RUN_BIT Serial Run Command bit from car controller</td></tr>
<tr><td>1</td><td>AUX_FLT_RST_REQ_BIT Serial Fault Reset Request from car controller</td></tr>
<tr><td>2</td><td>AUX_PT_CLK_BIT Serial Pre-Torque Latch Clock Bit from car controller</td></tr>
<tr><td>3</td><td>AUX_LOW_GAIN_BIT Serial Low PI Gain Control Bit from car controller</td></tr>
<tr><td>4</td><td>AUX_RAMP_DWN_EN_BIT Serial Ramp Down Enable Bit from car controller</td></tr>
<tr><td>5</td><td>AUX_BRAKE_PICK_BIT Serial Brake Pick Command Bit from car controller</td></tr>
<tr><td>6</td><td>AUX_BRAKE_HOLD_BIT Serial Brake Hold Command Bit from car controller</td></tr>
<tr><td>7</td><td>AUX_OSPD_TST_BIT Serial Overspeed Test Bit from car controller</td></tr>
<tr><td>8</td><td>AUX_BOOST_ENABLE_BIT Serial Boost Enable Bit from car controller</td></tr>
<tr><td>9</td><td>N/A</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>(Serial Communications Status)
 

<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>
<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 as defined by Ser2 Flt Tol (A1) (Only available in Mode 2)</td></tr>
</table></td><td>1=true
0=false</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>FF Torque Cmd</td><td>(Feedforward Torque Command) Monitors the feedforward torque command from auxiliary source (when used).</td><td>% rated torque</td><td>N</td></tr>
<tr><td>NTSD 1 Spd Fdbk</td><td>(Normal Terminal Stopping Device 1 Speed Feedback) This function is to aid in the setup of NTSD. It captures the speed that the drive measured from speed feedback when the NTSD Threshold 1 was triggered.</td><td>ft/min</td><td>N</td></tr>
<tr><td>NTSD 2 Spd Fdbk</td><td>(Normal Terminal Stopping Device 2 Speed Feedback) This function is to aid in the setup of NTSD. It captures the speed that the drive measured from speed feedback when the NTSD Threshold 2 was triggered.</td><td>ft/min</td><td>N</td></tr>
<tr><td>NTSD 3 Spd Fdbk</td><td>(Normal Terminal Stopping Device 3 Speed Feedback) This function is to aid in the setup of NTSD. It captures the speed that the drive measured from speed feedback when the NTSD Threshold 3 was triggered.</td><td>ft/min</td><td>N</td></tr>
</table>

Table 17: Elevator Data D1 Submenu

MS Power Data D2 submenu

Parameter	Description	Units	Hidden item
DC Bus Voltage	(DC Bus Voltage) Measured voltage of the DC bus. This parameter is read by the motor side board.	**V**	N
Motor Current	(RMS Motor Current Output) Monitors the RMS motor output current.	**A**	N
Motor Voltage	(Motor Voltage Output) Monitors the RMS motor terminal line-line voltage.	**V**	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
Est No Load Curr[i]	(Estimated No Load Current) Estimates the no load current or excitation current of the induction motor.	**%**	N
Est Rated RPM[i]	(Estimated Motor Rated RPM) Estimates what the slip frequency of an induction motor.	**RPM**	N
Torque Reference	(Torque Reference) Monitors the torque reference used by the drive control.	**% rated torque**	N
Flux Reference[i]	(Flux Reference) Displays the flux reference used for vector control.	**%**	N
Flux Output[i]	(Flux Output) Displays the measured flux output to the induction motor.	**%**	N
% Motor Current	(Percent Motor Current) Monitors the motor current as a percent of rated motor current.	**% rated current**	N
Power Output	(Power Output) Calculated drive power output.	**kW**	N
Slip Frequency[i]	(Slip Frequency) Displays the drive commanded slip frequency.	**Hz**	N
D-Curr Reference[ii]	(D-Axis Current Reference) This current is the measured D-Axis Component of Current. It will be non-zero at no-load and flux-weakening states.	**%**	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

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Parameter	Description	Units	Hidden item
Rated Excit Freq[ii]	Motor rated frequency calculated from rated speed and pole number. This value should be close to motor nameplate value if such value is given. The only difference between two values could be result of number rounding. Large discrepancy suggests that inaccurate parameters are entered in A6 menu.	**Hz**	N
Rotor Position[ii]	(Absolute Rotor Position) Displays the raw rotor mechanical position reading from the absolute encoder. May be helpful during installations to verify encoder is being read properly.	**Deg**	N
DS Module Temp	(Drive Side Module Temperature) Indicates the hottest of the drive side IGBT module.	**C**	N
Highest Temp.	(Highest Measured Temperature) Indicates the hottest of the drive side IGBT module and the line side IGBT module.	**C**	N

Table 18: Power Data D2 Submenu

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

LS Power Data D3 submenu

Parameter	Description	Units	Hidden Item
DC Bus Volts	(DC Bus Voltage) Measured DC Bus voltage as seen by the line side controller.	**V**	N
DC Bus Volts Ref	(DC Bus Voltage Reference) Calculated applied DC Bus Voltage reference as the peak of the AC line voltage plus the amount to boost. For more information, see Line Side Power Convert A5 Submenu on page 62.	**V**	N
Input Vab	(Input Voltage A-B Phase) Measured input line-to-line voltage phase A-B.	**V**	N
Input Vca	(Input Voltage C-A Phase) Measured input line-to-line voltage phase C-A.	**V**	N
Input Hz	(Input Frequency) Measured input line frequency. *NOTE: This value will read 55Hz until the drive is able to measure true input frequency.*	**Hz**	N
LS Input Current	(Line Side Input Current) Measured input line current as the average of the three phases.	**Amps**	N
LS Power Input	(Line Side Power Input) Estimated power transfer to and from the AC Line. Value is positive when drive is pulling power from the line, and negative when drive is delivering power back to the line.	**kW**	N
LS Overload	(Line Side Overload) Reports active condition of Line Side overload accumulator during operation. If this parameter reaches 100%, the Line Side Overload faults will occur. This overload is provided for Quattro AC/PM equipment protection.	**%**	N
LS D Axis I	(Line Side D Axis Current) Percent of rated current in the D axis. *NOTE: This is reactive power-producing current.*	**%**	N
LS Q Axis I	(Line Side Q Axis Current) Percent of rated current in the Q axis. *NOTE: This is power-producing current.*	**%**	N
LS D Axis V	(Line Side D Axis Voltage) Percent of rated voltage in the Q axis. *NOTE: This is reactive power-producing voltage.*	**%**	N
LS Q Axis V	(Line Side Q Axis Voltage) Percent of rated voltage in the Q axis. *NOTE: This is power-producing voltage.*	**%**	N
LS Module Temp	(Line Side Module Temp) Indicates the hottest of the line side converters IGBT modules.	**C**	N

Table 19: LS Power Data D3 Submenu

Utility U0 menu

U0	Parameter	Description	Default	Choices	Hidden Item	Run lock out
U1	**PASSWORD**	*For more information, see PASSWORD on page 102.*				
	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 102.*				
	Hidden Items En	Selects if the "hidden" parameters will be displayed on the Digital Operator.	SHOW ITEMS	show items hide items	N	N
U3	**UNITS**	*For more information, see UNITS on page 102.*				
	Units Selection	Choose either Metric units or standard English units.	ENGLISH	english metric	N	Y
U4	**OVRSPEED TEST**	*For more information, see OVERSPEED TEST on page 102.*				
	Overspeed Test?	Allows for Overspeed Test to be enabled via the operator.	NO	no yes	N	Y
U5	**RESTORE DFLTS**	*For more information, see RESTORE DFLTS on page 103.*				
	Restore Motor Default?	Resets some parameters in the A6 Submenu.			N	Y
	Restore Drive Defaults?	Resets all parameters in the A1, A2, A3, A4, C1, C2, C3, and C4 Submenus. Also resets the following parameters in the A6 submenu: FLUX CONFIRM LEV, TACH VOLT SENSE, TACH SPEED SENSE, OVLD START LEVEL, and OVLD TIME OUT.			N	Y
	Restore Utility Defaults?	Resets the parameters in A5 submenu to default values. Also reset GAIN SELECTION (A4).			N	Y
U6	**MS INFO**	*For more information, see MS INFO on page 105.*				
	MS Type			Read Only Data	N	N
	MS Code Version			Read Only Data	N	N
	MS S/W Date			Read Only Data	N	N
	MS S/W Time			Read Only Data	N	N
	MS FPGA Revision			Read Only Data	N	N
	Option Type			Read Only Data	N	N
	Option FPGA Rev			Read Only Data	N	N
	MS Cube ID			Read Only Data	N	N
U7	**LS INFO**	*For more information, see LS INFO on page 105.*				
	LS Type			Read Only Data	N	N
	LS Code Version			Read Only Data	N	N
	LS S/W Date			Read Only Data	N	N
	LS S/W Time			Read Only Data	N	N
	LS FPGA Rev			Read Only Data	N	N
	LS Cube ID			Read Only Data	N	N
U8	**HEX MONITOR**	*For more information see HEX MONITOR on page 106.*				
	Addr1				N	N
	Addr2				N	N
	Addr3				N	N

U0	Parameter	Description	Default	Choices	Hidden Item	Run lock out
U10	**ROTOR ALIGN**[ii]	*For more information, see ROTOR ALIGN on page 106.*				
	Alignment Method[ii]	Determines alignment method.	OPEN LOOP[ii]	open loop[ii] auto align[ii]	N	Y
	Alignment[ii]	Allows the alignment procedure or value ENCODER ANG OFST (A6) to be changed.	DISABLE[ii]	disable[ii] enable[ii]	N	Y
	Begin Alignment[ii]	Selecting option other than NO begins alignment procedure.	NO[ii]	no[ii] on run[ii] yes[ii]	N	Y
U12	**AUTOTUNE SEL**[ii]	*For more information, see AUTOTUNE on page 106.*				
	AUTOTUNE SELECT[ii]	Setting this parameter to “yes” or “on run” allows the AutoTune feature to run.	DISABLE[ii]	disable[ii] on run[ii] yes[ii]	N	Y

[i] Parameters accessible through Induction Closed-Loop software
[ii] Parameters accessible through PM software

Detailed Description

PASSWORD
(Password Function)

The following three different screens are used by the password function:

- ENTER PASSWORD
- NEW PASSWORD
- PASSWORD LOCKOUT

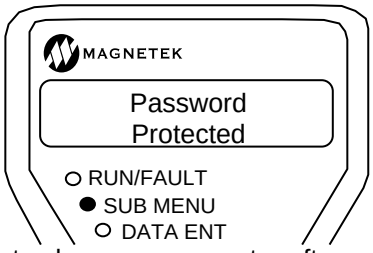
Password Function

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

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.



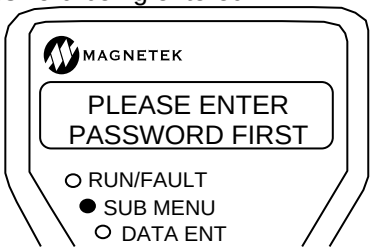
In order to change a parameter after password lockout has been enabled, the following two steps must be followed in the PASSWORD sub-menu:

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’s 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%). 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; or
- 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, or

– 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.

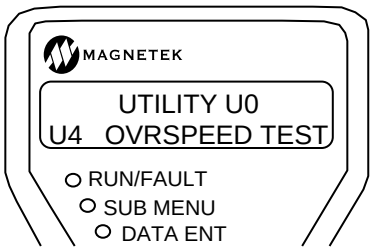
Overspeed Test via Serial Channel

The serial channel can be used by setting Overspeed Test Source (C1) parameter to serial.

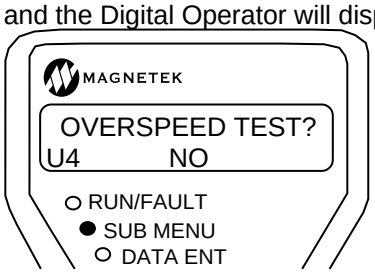
Overspeed Test via Operator

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

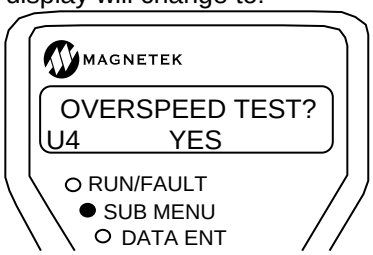
- While the Digital Operator display shows:



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



- Press the ENTER key again. The sub 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 (A1) 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 removed 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.

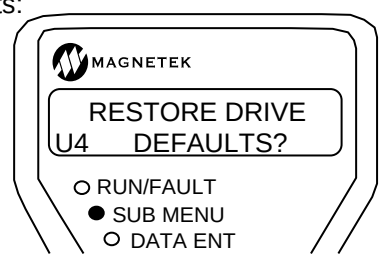
RESTORE DFLTS
(Restore Parameter Defaults)

Three different functions are included in this sub-menu.

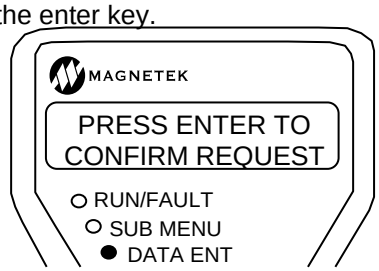
Restore Drive Defaults

This function resets parameters in DRIVE A1 submenu, S-CURVES A2 submenu, MULTISTEP REF A3 submenu, MS PWR CONVERT A4 submenu and CONFIGURE C0 menu to their default values. It also resets the following parameters in the A6 submenu: FLUX CONFIRM LEV, TACH VOLT SENSE, TACH SPEED SENSE, OVLD START LEVEL, and OVLD TIME OUT.

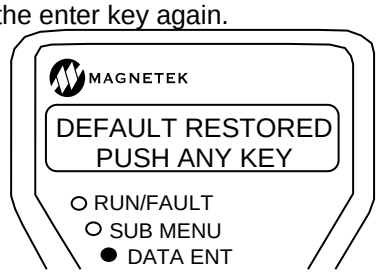
The following shows how to restore the drive defaults:



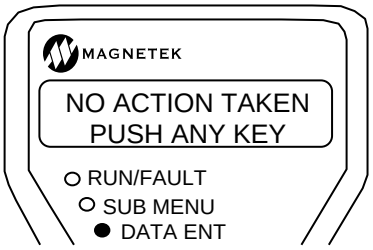
Press the enter key.



Press the enter key again.

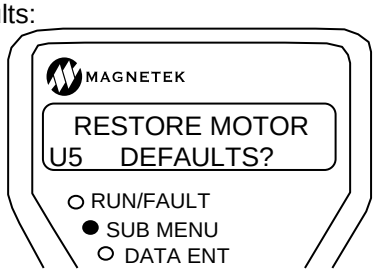


If the esc key is pressed, the reset action will be aborted.

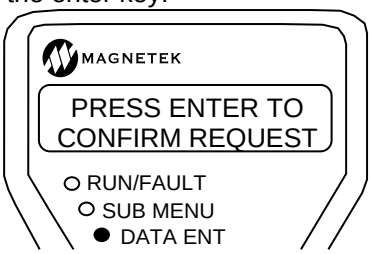


Restore Motor Defaults

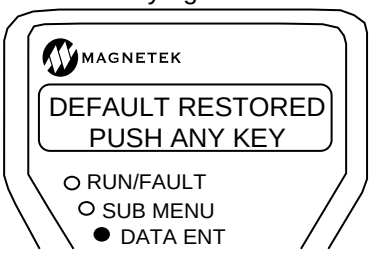
The following shows how to restore the motor defaults:



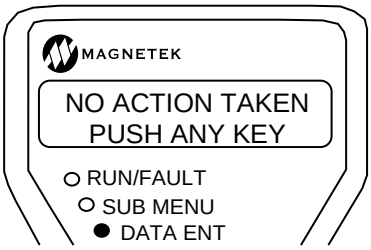
Press the enter key.



Press the enter key again.

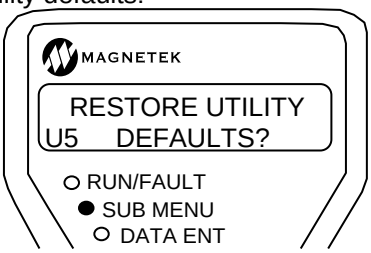


If the esc key is pressed, the reset action will be aborted.

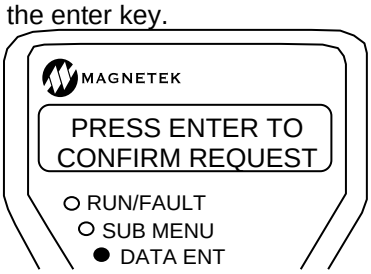


Restore Utility Defaults

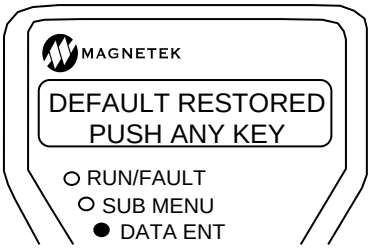
This function resets the parameters in the LS PWR CONVERT (A5) submenu to the defaults. The following shows how to restore the utility defaults:



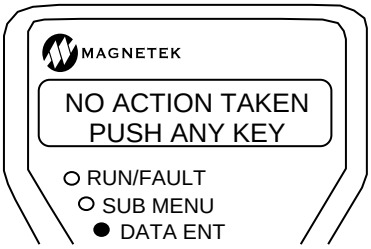
Press the enter key.



Press the enter key again.

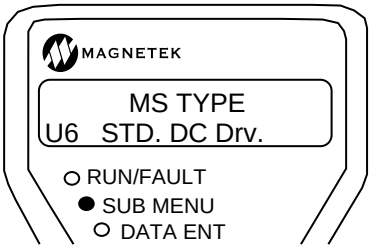


If the esc key is pressed, the reset action will be aborted.

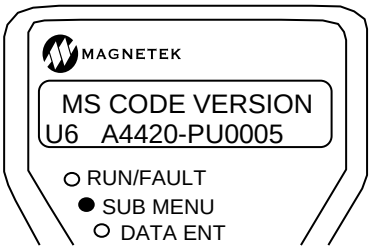


MS INFO
(Motor Side Information)
Six different screens are included in this sub-menu; each display has an identification number.

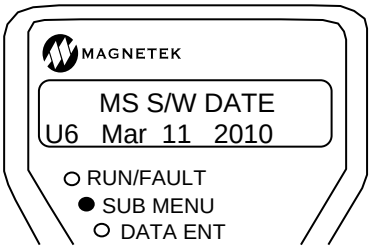
MS TYPE Screen
Shows the type of drive the software is installed in:



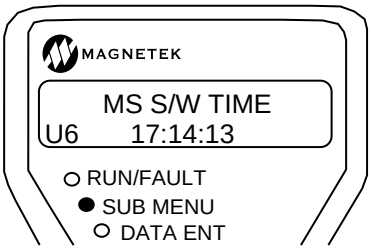
MS CODE VERSION
Shows the version of code located in the Motor Side portion of the drive.



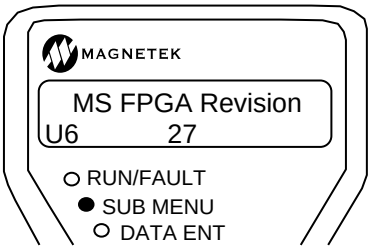
MS S/W DATE Screen
Gives the date of the released motor side code version.



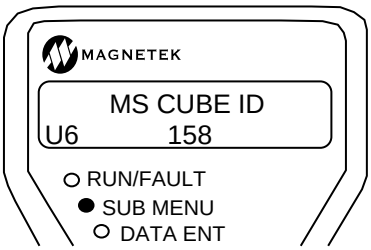
MS S/W TIME Screen
Displays the time of the released motor side code version.



MS FPGA REVISION Screen
Gives the revision number for the motor side FPGA.



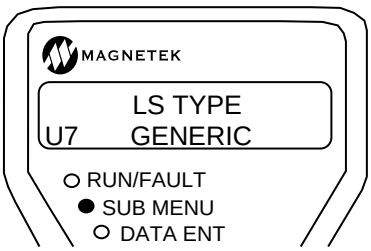
MS CUBE ID Screen
Displays the cube identification number of the drive. This number identifies specific drive ratings related to detected equipment hardware.



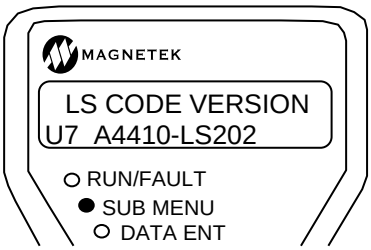
	Ampere Rating of drive	Model Number	Cube ID #
Cube	28A	QAC028-	2590
	34A	QAC034-	2600
	42A	QAC042-	2610
	54A	QAC054-	2620
	68A	QAC068-	2630
	85A	QAC085-	2640
Enclosed	85A	Q_ _085-	156
	115A	Q_ _115-	158
	140A	Q_ _140-	168
	170A	Q_ _170-	170

LS INFO
(Line Side Information)
Six different screens are included in this sub-menu; each display has an identification number.

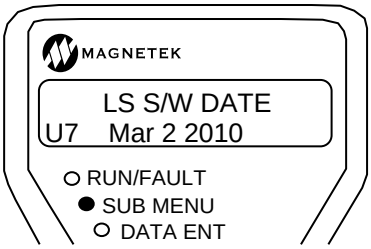
LS TYPE Screen
Shows the type of drive the software is installed in:



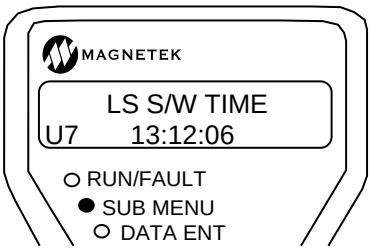
LS CODE VERSION
Shows the version of code located in the Line Side portion of the drive.



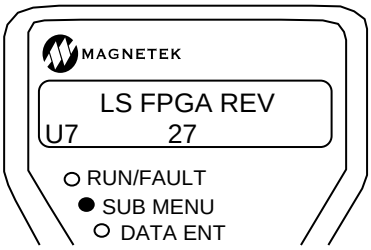
LS S/W DATE Screen
Gives the date of the released Line side code version.



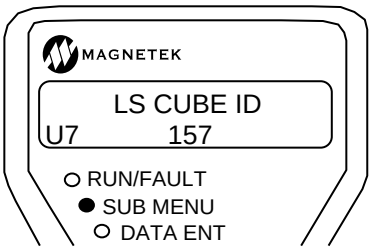
LS S/W TIME Screen
Displays the time of the released Line side code version.



LS FPGA REV Screen
Gives the revision number for the Line side FPGA.



LS CUBE ID Screen
Displays the cube identification number of the drive. This number identifies specific drive ratings related to detected equipment hardware.



	Ampere Rating of drive	Model Number	Cube ID #
Cube	28A	QAC028-	2591
	34A	QAC034-	2601
	42A	QAC042-	2611
	54A	QAC054-	2621
	68A	QAC068-	2631
	85A	QAC085-	2641
Enclosed	85A	Q_ _085-	155
	115A	Q_ _115-	157
	140A	Q_ _140-	167
	170A	Q_ _170-	169

HEX MONITOR
(Hex Monitor)
The hex monitor was designed for fault and parameter diagnostics. It is intended for use by Magnetek personnel only. The Hex Monitor contains 3 addresses for viewing. Address 1 may only be displayed in U8, whereas Address 2 and Address 3 may be viewed in either U8, D1, or may be programmed to an analog output.

ROTOR ALIGN
(Rotor Alignment Function)
The Rotor Align submenu purpose is to align the rotor with the magnets in the motor for PM motors. For a detailed procedure see Rotor Alignment Procedure on page 144.

AUTOTUNE SEL
(AutoTune Function)
The AutoTune Select submenu allows the user to use the AutoTune function to have the drive automatically determine motor parameters, including: D Axis Induct (A6), Q Axis Induct (A6), and Stator Resist (A6). For a detailed procedure, see Setting up PM Auto-Tune on page 149.

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
	DISPLAY FAULT COUNTERS?	Contains list of faults and the number of times they occurred	N	N

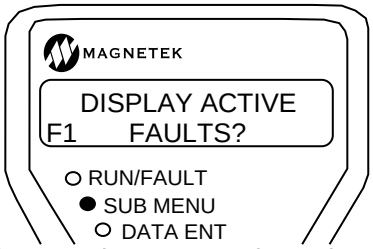
Detailed Descriptions

ACTIVE FAULTS
(Active Faults)

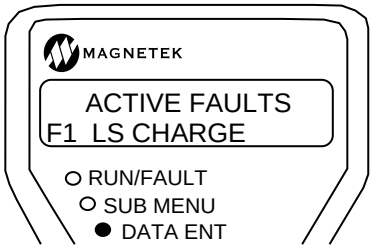
This sub-menu contains a list of the active faults. This sub-menu also allows the user to reset the active faults.

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.



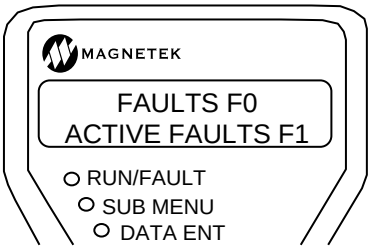
Press the enter key to enter the active fault list. Use the up and down arrow keys to scroll through the active faults.



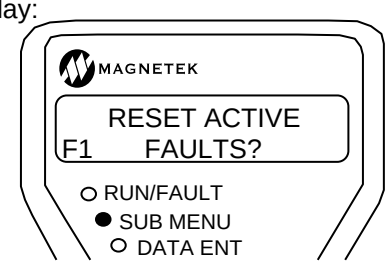
Resetting Active Faults

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 (*see User Switches C1 submenu on page 70*).

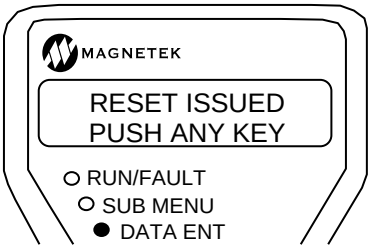
While the Digital Operator display shows:



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.



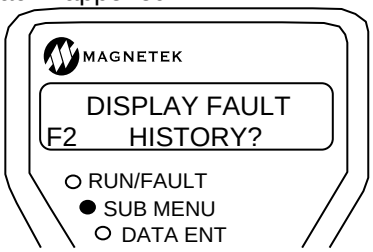
FAULT HISTORY
(Fault History)

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

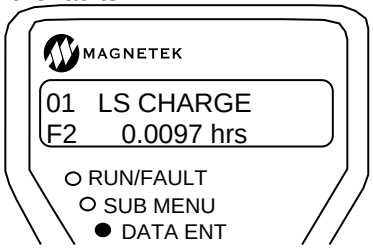
NOTE: The fault history is not affected by the fault reset or a power loss. The fault history can only be cleared by a function in this sub-menu.

Fault History

All faults are placed in 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.



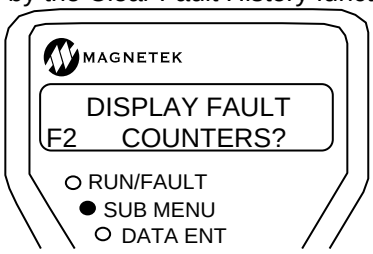
FAULT COUNTERS
(Fault Counters)

This sub-menu contains a list of all the faults and the numbers of times they occurred.

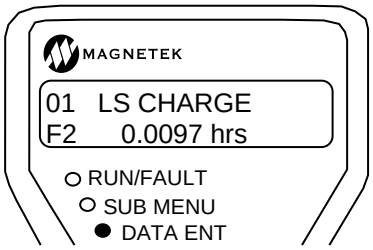
NOTE: The fault counters list is not affected by the fault reset or a power loss. The fault counters can only be cleared by a clear fault history.

Fault Counter

All possible faults are located in the Fault Counter. The fault counter shows each fault and the number of times it occurred until cleared by the Clear Fault History function.



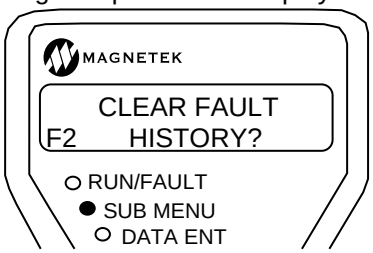
Press the enter key to enter the fault history. Use the up and down arrow keys to scroll through the faults.



Clearing Fault History

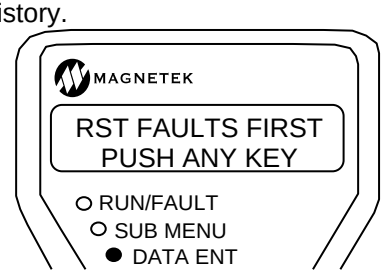
The fault history is not affected by the fault reset or a power loss. The fault history can only be cleared via the user function described below. Clearing the Fault History will also clear the Fault Counters.

Enter the submenu in F2 by pressing the ENTER key. The sub-menu LED will turn ON and the Digital Operator will display:

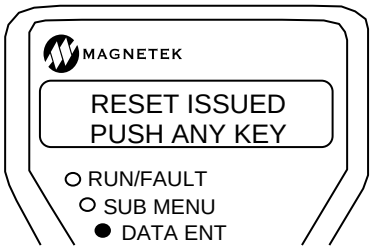


- Press the ENTER key again to begin the fault reset procedure.

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 there sufficient airflow to cool the drive?

Has vibration loosened any connections?

The drive 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 them 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 the 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. There are two separate areas for the DC Bus Charge light: one charge light is located on the control panel in the lower right hand corner, and two additional charge lights are located on the DC Bus Board. The turn-off voltage for the DC Bus Board Charge lights (DS1 and DS2) is 2V.

Drive Servicing

Remember when servicing the drive: Hazardous voltages may exist in the drive circuits even with drive circuit breaker in the 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, and verify (with a voltmeter) that no voltage exists between the (+) and (-) terminals.

Troubleshooting

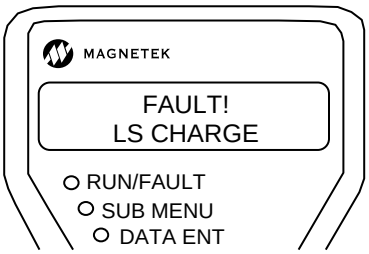
Two classes of warnings are reported by the Quattro AC/PM; these are identified as Faults and Alarms.

Faults and Fault Annunciation

A fault is 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.

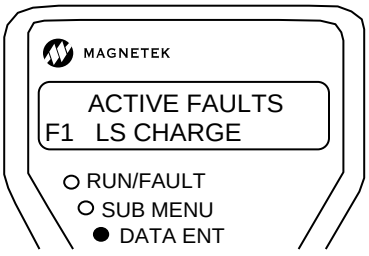
A priority message will be seen on the Digital Operator:



A priority message will overwrite whatever 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.

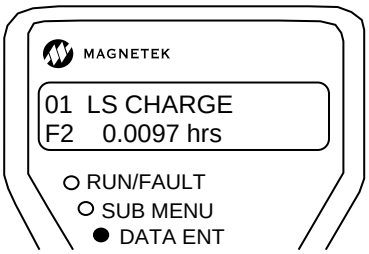
NOTE: Clearing the fault priority message from the display DOES NOT clear the fault from the active fault list. The faults must be cleared by a fault reset before the drive will run.

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.



Faults and Alarms

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.

Below are the Quattro AC/PM'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.*

Name	Description	Possible Causes & Corrective Action
ARB Start Error *(Alarm)*	The drive has detected movement on the sheave before ARB START TIME (A1) was active.	**Check Parameter Settings** ⇩ Lower the value of ARB START TIME (A1). ⇩ Repeat lowering the value of ARB START TIME (A1) until ARB START ERROR is no longer seen.
AT Cntactr Flt	The drive has detected an open phase during Auto-Tune or Auto-Align.	**Check Contactor Setting** ⇩ Verify the contactor is closed during Auto-Tune or Auto Align. ⇩ Check the motor to see if there is an open phase.
Algn Vlts Adjust *(Alarm)*	The drive has detected that during Auto-Align, 1 or more of the 5 encoder angle offset it measure was out of tolerance	**Check Parameter Settings** ⇩ Increase Autoalign Volts (A4) by 2% gradually until the drive has an accurate Encoder Ang Ofst (A5)
Base Ena Opnd	The contact between TB2-7 and TB2-14 on the customer interface board has opened.	**Check Connections** ⇩ Verify external contact between TB2-7 and TB2-14 is closed. ⇩ Verify +24VDC is present on pin TB2-7. ⇩ Reconnect cable from A6JC3 to A4JP9.
Bad Srl Chksm *(Alarm)*	More than two messages with bad checksums have been received over the serial channel.	**Electronic noise interference** ⇩ Verify there is no electronic noise interference. **Baud rate mismatch** ⇩ Baud rate mismatch is between drive and car controller. Verify baud rate settings.
Brake is Open	The drive has detected movement on the sheave during a static Auto-Tune or Auto Align.	**Check Brake Setting** ⇩ Verify brake is not lifting. ⇩ Verify no movement on the sheave occurs during Auto-Tune or Auto Align. ⇩ Verify no electrical noise is being fed through the encoder feedback ○ Verify that the encoder cable is shielded properly ○ Reroute the encoder wires away from power wires
Bridge Ground	A ground fault has been detected by the hardware on the motor side. The current reading on the motor does not match the commanded current.	**Check Motor Wiring** ⇩ Check motor wiring and motor for insulation breakdown or unintentional contact to other objects. ⇩ Ensure proper connection of shield drain wires to chassis. **Check Connections** ⇩ Possibly missing connector on one of the current sensors of the motor side bridge. **Bad Current Sensor**

Name	Description	Possible Causes & Corrective Action
Brk Hold Flt	The brake hold command and the brake feedback did not match for the time specified with Brake Hold Time (A1) parameter.	**Check Parameter Settings** ⇩ Check the correct logic input is configured for the correct TB1 terminal and set to MECH BRK HOLD (C2). ⇩ Check BRAKE HOLD SRC (C1) parameter for the correct source of brake pick feedback. ⇩ Check BRAKE HOLD TIME (A1) parameter for the correct brake hold time. ⇩ Wrong assignment of Normally Closed contact mask (C2). ⇩ Check BRK HOLD FLT ENA (C1). **Verify Brake Settings** ⇩ If drive is controlling brake, verify a logic output is set to BRAKE HOLD (C3). ⇩ Check for an open circuit between the brake pick pilot relay and the logic output assigned to brake pick control. **Mechanical Brake Hold Signal Wiring** ⇩ Defective Brake Hold Coil. ⇩ Defective Brake Hold Auxiliary contactor used for sensing the brake state. **If nuisance fault, the fault can be disabled by BRK HOLD FLT ENA (C1) parameter.**
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** ⇩ Check the correct logic input is configured for the correct TB1 terminal and set to MECH BRK PICK (C2). ⇩ 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. ⇩ Wrong assignment of Normally Closed contact mask (C2). ⇩ Increase BRAKE PICK TIME (A1). **Verify Brake Settings** ⇩ If drive is controlling brake, verify a logic output is set to BRAKE PICK (C3). ⇩ Check for an open circuit between the brake pick pilot relay and the logic output assigned to brake pick control. **Mechanical Brake Pick Signal Wiring** ⇩ Defective Brake Pick Coil. ⇩ Defective Brake Pick Auxiliary contactor used for sensing the brake state. **If nuisance fault, the fault can be disabled by BRK PICK FLT ENA (C1) parameter.**
Check Setup	This fault is logged when a new program is loaded to the motor side processor, and the default data is loaded for the parameter values.	**Invalid Parameter Setup** ⇩ This is an advisory fault indicating that the user should verify the drive's parameters or upload a valid parameter set using Magnetek Explorer.

Name	Description	Possible Causes & Corrective Action
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 the operator did not work, the operator or the drive's control board may need to be replaced.
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 the operator did not work, the operator or the drive's control board may need to be replaced.
Connector Off	The power interface board has detected a missing or loose connector on the motor side.	**Missing Connector** ⇩ Verify connectors to Motor Side Gate Driver Board.
Contactor Flt	The command to close the contactor and the contactor feedback do not match for 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. ⇩ Verify wiring to logic input 1 (CONTACT CFIRM (C2)) is correct and Logic Input 1 (C2) is set to CONTACT CFIRM. ⇩ Verify Logic Output 1 is set to CLOSE CONTACT (C3). ⇩ Verify N.C. Inputs are correct. **Contactor hardware problem** ⇩ Problem with poles or auxiliary.
Cube ID Fault	The cube identification number for the motor side is invalid.	**Hardware Problem** ⇩ Power cycle the drive. ⇩ Verify the Cube ID board is properly connected and fully seated. ⇩ Check MS INFO in submenu U6 to verify processor is reading the correct cube ID. ⇩ Check LS INFO in submenu U7 to verify processor is reading the correnct cube ID. ⇩ Verify that the correct Cube ID part number is in the drive. ⇩ Verify the line side and motor side Cube ID are in the correct locations. ⇩ If re-occurs, replace Drive Control board or cube ID. *NOTE: This fault cannot be reset; the unit must be powered down before fault will clear.*

Name	Description	Possible Causes & Corrective Action
Curr Reg Flt	Declared if the current regulator loses the ability to generate the current required by the speed regulator.	**Problem with Motor Contactor** ⇩ Verify that motor contactor is closing. ⇩ Verify motor contactor is not opening unexpectedly. **Faulty current feedback signals** ⇩ Verify that reported drive current is zero when drive is not operating. ⇩ Verify connections to current transducers CT1 – CT6. **Loss of gate power supply** ⇩ Verify base block jumper is between TB2-7 and TB2-14. ⇩ Reseat the the JP9 connector on the MS Product Interface Board. **Incorrect DC Bus Voltage reading** ⇩ Measure the DC bus with a meter. ⇩ Compare that with the value on the digital operator, MS BUS VOLT (D2) or DC BUS VOLTS (D3). **Inaccurate Motor Parameters** ⇩ Verify motor nameplate values (A6) are entered correctly. **Motor Problems** ⇩ Verify motor does not have an open wire.
DCU Data Flt	The DCU parameters checksum is invalid on the motor side.	**Parameters Corrupted** ⇩ Power cycle the drive. ⇩ Write down all parameters and set the drive parameters to factor default. Re-enter all parameters back into the drive. ⇩ If re-occurs, replace Drive Control board.
Dir Conflict *(alarm)*	Declared when the speed command is held at zero due to conflict with the analog speed command polarity and the run up / run down logic. DIR CONFIRM (C1) must be enabled.	**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
Drive Ovrload	The drive has exceeded the drive overload curve.	**Accurate Motor Parameters** ⇩ Verify motor nameplate values are entered correctly. **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. **Low Frequency Output** ⇩ If motor frequency is 1Hz or below, DRV OVERLOAD will occur at a rate 1.4 times faster than when the drive's frequency output is greater than 1Hz. ⇩ Increase speed of elevator to move the frequency out of the low frequency operation. ⇩ Verify mechanical brake is releasing properly. ⇩ Decrease time the drive is running at zero speed at the end of run. ⇩ See Drive Overload Curve on page 152 for overload curve graphic. **Encoder Problem** ⇩ Check encoder coupling: fix or replace loose coupling and then repeat alignment procedure. ⇩ Encoder failure (if a PM motor, replace encoder and re-ALIGN the rotor). ⇩ Inadequate encoder type – the absolute encoder option only supports sin/cos absolute encoders. **PM Option Board Problem** ⇩ Replace the EnDat option board. **PM Alignment Problem** ⇩ Inaccurate rotor alignment – erroneous absolute rotor position feedback may cause excessive current draw. Redo the alignment after making sure that the encoder coupling is correct. **Motor Problem** ⇩ Check for motor failure. **Drive Sizing** ⇩ Verify drive sizing. May need a larger capacity Quattro AC/PM.

Name	Description	Possible Causes & Corrective Action
Drive Temp. *(alarm)*	One or more of the IGBT modules on the motor side power bridge has exceeded 85°C (185°F).	**Overtemperature Problems** ⇩ Verify blowers/fans are operating ⇩ *ENCLOSED:* Inspect and clean air intake filters. ⇩ Verify ambient temperature is less than 45°C. ⇩ Inspect IGBT modules for proper mounting. ⇩ Verify drive is sized correctly. ⇩ Possible defective temperature sensor. **Excessive Current Draw** ⇩ Decrease accel/decel rates. ⇩ Mechanical brake not releasing properly. **Hardware Problem** ⇩ View DS Module Temp (D2), LS Module Temp (D3); determine which module is causing fault. ⇩ Possible defective temperature sensor.
Drive Temp. *(fault)*	One or more of the IGBT modules on the motor side power bridge has exceeded 95°C (203°F).	**Overtemperature Problems** ⇩ Verify blower/fans are operating ⇩ Encolsed: Inspect and clean air intake filters. ⇩ Verify ambient temperature is less than 45°C. ⇩ Inspect IGBT modules for proper mounting. ⇩ Verify drive is sized correctly. ⇩ Possible defective temperature sensor. **Excessive Current Draw** ⇩ Decrease accel/decel rates. ⇩ Mechanical brake not releasing properly. **Hardware Problem** ⇩ View DS Module Temp (D2), LS Module Temp (D3); determine which module is causing fault. ⇩ Possible defective temperature sensor.
Encdr Crc Err	Alarm and Fault: Absolute encoder checksum error is detected. The alarm is posted if the CRC error does not affect drive operation. If the error persists, the alarm is converted into the fault.	**Noise Immunity Issue** ⇩ Make sure that the encoder cable is properly grounded. **Encoder Problem** ⇩ Encoder wiring problem – check for broken encoder leads. ⇩ Encoder Power Supply folding back, check between IP and IG for +5V on EnDat TB2. If supply is low, verify encoder voltage sense and ground sense wires are not connected together. ⇩ Encoder failure – replace encoder and re-ALIGN rotor. ⇩ Inadequate encoder type – the absolute encoder option board will only support sin/cos absolute encoders. **Option Board Problem** ⇩ Replace the Endat option board.

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 • not phasing properly with the motor	**Endat Encoder Should Match Motor Phasing** ⇩ Encoder wiring – check for correct wiring ⇩ Swap 2 motor phase wires and re-ALIGN rotor. ⇩ Perform an OPEN-LOOP alignment to verify motor and encoder phasing. **Incremental Encoder Phasing** ⇩ Swap /A and A on TB1-34 and TB1-35. **Encoder Power Supply Loss** ⇩ Check power supply on encoder. ○ Incremental: 12V or 5V on TB1 ○ EnDat: 5V on IP and IG on EnDat Board **Accurate Drive Parameters** ⇩ Verfy proper setting of Encoder Pulses (A1) ⇩ Verify motor nameplate values are entered correctly in A6 menu. **Response of Speed Regulator** ⇩ Enter accurate INERTIA (A1) parameter. ⇩ Increase RESPONSE (A1) parameter. **Encoder Coupling Sloppy or Broken** ⇩ Check encoder to motor coupling. If PM, re-ALIGN after fixing the encoder coupling. **Excessive Noise on Encoder Lines** ⇩ Check encoder connections. Separate encoder leads from power wiring (cross power lead at 90°). ⇩ Make sure that the encoder cable is properly grounded. **Encoder Problem** ⇩ Replace motor encoder **Mechanical Brake Problem** ⇩ Check that the mechanical brakes are lifting as the drive is trying to rotate the motor **Hardware Problem** ⇩ Replace Customer Interface Board, A6, or absolute encoder option board, A9. **Motor / Motor Connection Problem** ⇩ Verify that a there isn't any loose motor wire connection ⇩ Verify that the ME contactor is not dropping out on the drive while it is in a RUN mode ○ ENCODER FAULT (C1) can be used to troubleshoot problems related to motor / motor connection. ○ Check for Phase Fault conditions because Encoder Fault can be declared instead of Phase Fault (trigger mechanism for encoder fault is faster)

Name	Description	Possible Causes & Corrective Action
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).
Endat Fault	*The set endat interpolation value is too high based on the the contract motor speed in the A1 menu*	**Check Parameter Settings** ⇩ Verify Endat Interp (C1) and Contract Mtr Spd (A1) are set to values that meets the criteria in Table 13 on page 86
Extrn Fault 1	User-defined external logic fault input. *...Closure 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 FAULT 1 (C2). ⇩ Verify the source of the external fault signal.
Extrn Fault 2	User-defined external logic fault input. *...Closure 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 FAULT 2 (C2). ⇩ Verify the source of the external fault signal.
Extrn Fault 3	User-defined external logic fault input. *...Closure 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 FAULT 3 (C2). ⇩ Verify the source of the external fault signal.
Extrn Fault 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). ⇩ Verify the source of the external fault signal.

Name	Description	Possible Causes & Corrective Action
Hit Torque Limit *(alarm)*	The drive is, or was, being limited by the motor current limit setting. This can limit acceleration rates and cause subsequent velocity tracking errors.	**Incorrect Wiring** ⇩ Verify motor circuit wiring. **Drive and/or Motor is Undersized** ⇩ Verify drive and/or motor sizing. May need a larger capacity Drive and/or motor. **Check Parameter Settings** ⇩ Check the torque limit parameter TORQUE 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. ⇩ Check parameter Encoder Pulses (A1) for correct setting ⇩ Check all the motor parameters in the A6 submenu **Incremental Encoder** ⇩ Verify that the encoder is connected properly ⇩ Check for possible encoder and motor phasing problems ○ Swap /A and A on TB1-34 and TB1-35 **Mechanical Problems** ⇩ Verify that the mechanical brakes are lifting and that not dragging
HW/SW Mismatch	Line side software is installed in the motor side control board and cube ID is for motor side.	**Mismatching cube IDs vs. software** ⇩ Replace A2 board with correct software for board location or program correct software into Motor Side Board.
Invalid Checksum *(operator serial link error)*	The operator received four consecutive invalid messages.	**Noise or Bad Connector Connection** ⇩ Remove and re-seat the operator in its cradle. ⇩ If re-occurs, the operator or the drive's control board may need to be replaced.
IP Comm	A fault has occurred in the communications channel between the Line Side and Motor Side processors. This was detected on the motor side.	**Communication problem** ⇩ Reset drive. ⇩ Verify Line Side software and Motor Side software is compatible. ⇩ If re-occurs, replace Main Processor PCBs.
Line HI Volts	Line voltage is greater than max drive rating. Monitored via the DC Bus.	**Line Voltage is too High** ⇩ Verify DC Bus is reading voltage correctly. ⇩ Verify Line voltage is set correctly.

Name	Description	Possible Causes & Corrective Action
LS AC Cntcr	The main AC power contactor is not following the commanded state within 1 second.	**AC Power Contactor Problem** ⇩ Check for faulty UTM contactor coil or interlocking aux contact blocks on PCM or UTM. ⇩ *ENCLOSED:* Verify that pilot relay K2 on PCB A8 is working properly. ⇩ *CUBE:* Verify that pilot relay K402 on the LS Gate Board A11 is working properly **CAUTION:** Do not manually engage the UTM contactor with power applied.
LS Brdg Gnd	The hardware has detected a ground fault on the line side power bridge.	**IGBT Breakdown** ⇩ Inspect and measure for physical voltage breakdown damage on IGBTs and DC bus.
LS Charge	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 (A5) and UV FAULT LEVEL (A4) parameters. Please note: if LS Charge occurs 3 consecutive times, the drive will require a power cycle to reset the fault	**Low Input Voltage** ⇩ Check INPUT L-L VOLTS (A5) and UV FAULT LEVEL (A4) parameters. ⇩ 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. **Incorrect Operation** ⇩ Verify the PCM pulls in. ⇩ Observe DC BUS VOLTS (D3) and verify it increases until the fault occurs. ⇩ Observe DC BUS VOLTS (D3) decreased after the fault as occurred. ⇩ If this is the case, increase the setting in PRE CHRGE THRESH (A5). **DC Bus Problems** ⇩ If this is the case, increase the setting in PRE CHRGE THRESH (A5). ⇩ Observe DC BUS VOLTS (D3) . ⇩ *ENCLOSED:* Verify connectors (A3JP8 on Product Interface Board and A11JG3 on Power Module Gate Drive Board) are seated correctly. ⇩ *CUBE:* Verify connectors (A3JP8 on Product Interface Board and A11J400 on Power Module Gate Drive Board) are seated correctly. **Hardware Failure** ⇩ Possible Damaged Product Interface Board. ⇩ Possible Damaged Pre-Charge Resistor and / or Pre-Charge Contactor. ⇩ Possible Damaged Main Charge Contactor. ⇩ Drive may need to be replaced.
LS CHK Setup	This fault is logged when a new program is loaded to the line side processor, and the default data is loaded for the parameter values.	**Inconsistent Parameter Settings** ⇩ Verify Parameters settings in menu A5 are correct.

Name	Description	Possible Causes & Corrective Action
LS Conn Off	The power interface board has detected a missing or loose connector on the line side.	**Missing Connector** ⇩ Verify Connection to Line Side Gate Driver Board, A11.
LS Cube Data	The cube data for the line side processor is invalid.	**Invalid Cube ID** ⇩ Verify LS Cube ID is seated correctly and not damaged.
LS Cube ID	The generation of this fault is indicative of a bad processor board.	**Invalid Cube ID** ⇩ Verify LS Cube ID is seated correctly and not damaged. ⇩ Verify LS Cube ID in U7 is correct. ⇩ Indicates a bad processor board.
LS Curr Reg	Inability to regulate AC side to match incoming line 3-phase voltage.	**Faulty current feedback signals** ⇩ Verify connections to current transducers. **Loss of gate power supply** ⇩ Check LS gate power supply by using testpoints on page 181. **Incorrect DC Bus Voltage reading** ⇩ Measure the DC bus with a meter. ⇩ Compare that with the value on the digital operator, DC BUS VOLTS (D3) or DC BUS VOLTAGE (D2). **Parameter Settings** ⇩ Increase DC BUS V BOOST (A5). ⇩ Set BUS VREF SOURCE (A5) to TRK VIN PARAM. ⇩ Decrease values in LS ID REG I GAIN (A5) and LS IQ REG I GAIN (A5). ⇩ Decrease values in LS ID REG P GAIN (A5) and LS IQ REG P GAIN (A5). **External Relay Timing** ⇩ Check for improper external relay timing ⇩ Verify UTM is closed. **Check Wiring** ⇩ Missing jumper wire at Customer Interface Board PCB, TB2. ⇩ Missing jumper at JP9 on LS Product Interface Board, A3.
LS DCU Data	The DCU parameters checksum is invalid on the line side.	**Parameters Corrupted** ⇩ Check & re-enter Line Side parameters and power cycle the drive.
LS Hit Trq Lim *(alarm)*	The line side is or was being limited by the motoring current limit or regenerative current limit setting. This can limit current into the DC bus leading to an under-voltage condition, or limit current into the line leading to a bus over-voltage condition.	**Improper Line Side Menu Parameters (A5)** ⇩ Verify and correct all Line Side (A5) parameter data. **Low Line Voltage** ⇩ Input line voltage is too low causing current to be too high for the operating power level. ⇩ Verify INPUT L-L VOLTS (A5).
LS Hw/Sw	Motor side software is installed in the line side control board and cube ID is for line side.	**Mismatching cube IDs vs. software** ⇩ Replace A1 board with correct software for board location or program correct software into Line Side Board.

Name	Description	Possible Causes & Corrective Action
LS I Conn Off	The line side power interface board has detected a missing or loose connector on the motor side.	**Missing Connector** ⇩ Verify JP7 connector is connected and seated properly. ⇩ Verify the current tranducers, CT1, CT2 and CT3 connections are connected and seated properly.
LS IGBT 1	A de-saturation condition has been detected on the line side IGBT power module. *NOTE: Module 2 or 3 IGBT fault should not occur. If that is reported, change the line side product interface board.*	**Bridge failure** ⇩ *ENCLOSED:* With an ohm meter, check on the upper gate board from phase A, B, C to + then – (on the cap board) then reverse the leads and check again from + then -. Next, do the same check on the lower MS gating board, check from the X output to the + then – connections on the cap board, then Y output to the + then – on the cap board, then Z output to the + then – on the cap board, reverse the leads and do it again. If anything reads shorted, then that would indicate an IGBT failure. Call Magnetek to confirm results and get advice on what to do next. **Motor Problem** ⇩ Check motor and wiring for short circuits. **Product Interface Problem** ⇩ Try replacing the board.
LS IP Comm	A fault has occurred in the communications channel between the Line Side and Motor Side processors. This was detected on the Line Side.	**Miscommunication problem** ⇩ Verify proper software installed in Line Side and Motor Side processors. ⇩ If re-occurs, replace PCB A2.
LS Overcurr	The hardware has detected an over-current condition on the line side power converter.	**Overcurrent Problem** ⇩ Check for a possible short circuit in motor or external power wiring. ⇩ This fault sometimes occurs as a result of another fault being declared first. Verify it in the Fault History (F2) **Noise Glitch** ⇩ Power Cycle drive. ⇩ If re-occurs, check wiring for EMC Compliance. **Poor Regulator Tuning** ⇩ Check LS parameters, these are in the A5 menu. These are factory set and shouldn't need to be adjusted. Verify that they are at default.
LS Overload	An overload condition has been detected on the line side power bridge.	**Excessive Current Draw** ⇩ Decrease accel/decel rate. ⇩ Mechanical brake not releasing properly. **Drive Sizing** ⇩ Verify drive sizing with motor ampere requirements. May need a larger capacity drive.

Name	Description	Possible Causes & Corrective Action
LS Overtemp *(fault)*	One or more of the IGBT modules on the line side power bridge has exceeded 95°C (203°F).	**Overtemperature Problems** ⇩ Verify LS Module Temp (D2) exceeds Overtemp rating. ⇩ *ENCLOSED:* Inspect and clean air intake filters. ⇩ Verify ambient temperature is less than 45°C. ⇩ Verify drive is sized correctly. ⇩ Possible defective temperature sensor. **Excessive Current Draw** ⇩ Decrease Accel/Decel rates. ⇩ Mechanical brake not releasing properly.
LS Over Temp *(alarm)*	One or more of the IGBT modules on the line side power bridge has exceeded 85°C (185°F).	**Overtemperature Problems** ⇩ Verify LS Module Temp (D2) exceeds Overtemp rating. ⇩ Inspect and clean air intake filters. ⇩ Verify ambient temperature is less than 45°C. ⇩ Verify drive is sized correctly. ⇩ Possible defective temperature sensor. **Excessive Current Draw** ⇩ Decrease Accel/Decel rates. ⇩ Mechanical brake not releasing properly.
LS Overvolt	The line side power converter has detected an over-voltage condition.	**Line Converter Problem** ⇩ Verify the line converter did not shut down while the motor controller was in process of regeneration. This fault sometimes occurs as a result of another fault being declared first. Verify it in the Fault History (F2) **Check Parameter Settings** ⇩ Bad tuning of the line side regulators. **Contactor Problem** ⇩ Verify motor contactor did not open while motoring. **Check for the Root Fault** ⇩ Verify in the FAULT HISTORY (F2) that the LS Overvolt is not the only fault that is being declared. ○ Sometimes LS Overvolt Fault is not the primary fault that caused the shut down. It is more like an underlining / secondary fault that occurred because of the primary.
LS PCU Data	PCU parameters checksum is invalid on the line side.	**Parameters Corrupted** ⇩ Check & re-enter Line Side parameters and power cycle the drive. ⇩ Set parameters to factory defaults and re-enter the field setting parameter

Name	Description	Possible Causes & Corrective Action
LS Phase	The line side converter has detected the loss of one or more phases of the AC line.	**Check Parameter Settings** ⇩ Verify INPUT L-L VOLTS (A5) is set correctly. **Contactor Problem** ⇩ Verify wiring to/from contactor UTM (phase sensitive). ⇩ Verify that contactor UTM picks after PCM relay drops after the pre-charge sequencse as explained in Quattro AC/PM Pre-Charge on page 34 ⇩ Replace contactor UTM **Drive Board Problem** ⇩ Verify the pin jumper is on JP1 and JP9 on the Line Side Product Interface Board A3. ⇩ Verify the Current Transducer (CT) are connected properly ⇩ *CUBE:* verify 3-phase signal wiring to Line Side IGBT Assembly A11. ⇩ *CUBE:* if re-occurs replace Line Side IGBT Assembly A11. ⇩ *ENCLOSED:* verify 3-phase signal wiring to PCB A8. ⇩ *ENCLOSED:* if re-occurs, replace A8.
LS Size	The line side power converter has detected that the power bridge and cube I.D. size does not match.	**Hardware Mismatch** ⇩ Size of the power bridge does not match the rating as defined on the cube ID board. ○ *ENCLOSED:* Call tech support to verify that the jumpers on the gating boards are in the correct positions ⇩ Check for correct Cube ID board is plugged on A3 board. ⇩ Verify that the drive is reading the correct cubeID number in U7. *NOTE: This fault cannot be reset; unit must be powered down before fault will clear.*
LS SW BUS OV	The line side power converter has detected an over-voltage condition above setting SW BUS OV LEVEL (A5).	**Line Converter Problem** ⇩ Verify the line converter did not shutdown while the motor controller was in process of regeneration. ⇩ This fault sometimes occurs as a result of another fault being declared first. Verify it in the Fault History (F2) **Check Parameter Settings** ⇩ Verify setting of SW BUS OV LEVEL (A5). ⇩ Bad tuning of the line side regulators. **Contactor Problem** ⇩ Verify motor contactor did not open while motoring.

Name	Description	Possible Causes & Corrective Action
LS Undr Voltg *(alarm)*	The DC Bus has fallen below the under-voltage alarm level. The alarm level is set by UV ALARM LEVEL (A4) parameter.	**Low Input Voltage** ⇩ Check INPUT L-L VOLTS (A5) and UV ALARM LEVEL (A4). ⇩ Verify proper input voltage and increase, if necessary, the input AC voltage within the proper range. ⇩ Check for 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) or DC BUS VOLTS (D3).
LS Undrvolt *(fault)*	The DC Bus has fallen below the under-voltage fault level. The fault level is set by UV FAULT LEVEL (A4) parameter.	**Low Input Voltage** ⇩ Check INPUT L-L VOLTS (A5) and UV FAULT LEVEL (A4). ⇩ Verify proper input voltage and increase, if necessary, the input AC voltage within the proper range. ⇩ Check for 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) or DC BUS VOLTS (D3).
Module A IGBT	A de-saturation condition has been detected on the specified motor side IGBT power module. *NOTE: Module B or C IGBT fault should not occur. If that is reported, change the motor side product interface board.*	**Bridge failure** ⇩ Turn the power off on the drive; wait for the bus to drop to zero. Measure at + and – on cap board for DC voltage. Once at zero volts go to the next step. ⇩ With an ohm meter, check on the upper gate board from phase A, B, C to + then – (on the cap board) then reverse the leads and check again from + then -. Next, do the same check on the lower MS gating board, check from the (+) output to the + then – connections on the cap board, then (-) output to the + then – on the cap board, reverse the leads and do it again. If anything reads shorted, then that would indicate an IGBT failure. Call Magnetek to confirm results and get advice on what to do next. **Motor Problem** ⇩ Check motor and wiring for short circuits. **Product Interface Problem** ⇩ Try replacing the board. **Check Parameter Settings** ⇩ Verify motor nameplate values are entered correctly in the A6 submenu.
Monitor Rev	The revision level of the monitor data structure shared between the line and motor side processors does not match.	**Software Problem** ⇩ Re-load proper software into both processors.

Name	Description	Possible Causes & Corrective Action
Motor ID	The motor submenu (A6) does not have properly defined motor parameters.	**Incorrect Parameter Settings** ⇩ Verify the Motor Submenu (A6) contains valid values. *NOTE: These must be changed to values within their respective ranges before the fault can be cleared. Those parameters are: RATED MTR POWER, RATED MTR VOLTS, RATED EXCIT FREQ, RATED MOTOR CURR, MOTOR POLES, and RATED MTR SPEED.*
MS I Conn Off	The motor side power interface board has detected a missing or loose connector on the motor side.	**Missing Connector** ⇩ Verify JP7 connector on the motor side PI board and the current transducers CT4, CT5 and CT6 connections are connected and seated properly.
MS-LS Mismatch	The revision level for parameter data shared between the line side and motor side processors does not match.	**Misplaced Jumper** ⇩ Verify the Line Side and Motor Side Programming jumper on JM13 is in NORMAL mode, not in PROGRAM mode. **Software Incompatibility** ⇩ Contact Factory. *NOTE: This fault cannot be reset; unit must be powered down before fault will clear.*
MS Size	The motor side power converter has detected that the power bridge and cube ID size does not match.	**Hardware Mismatch** ⇩ Size of the power bridge does not match the rating as defined on the cube ID board. ○ *ENCLOSED:* Call tech support to verify that the jumpers on the gating boards are in the correct positions ⇩ Check for correct Cube ID board is plugged on A4 board. *NOTE: This fault cannot be reset; unit must be powered down before fault will clear.*
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.	**Parameters Corrupted** ⇩ Check & re-enter Motor Side (A6) parameters and power cycle the drive. ⇩ Set parameters to factory defaults and re-enter the field setting parameter ⇩ If re-occurs, replace Drive Control board A2.

Name	Description	Possible Causes & Corrective Action
Mtr Overload *(fault or alarm)*	The motor had exceeded the user-defined motor overload curve. *NOTE: Fault or alarm setting dependent on setting of MOTOR OVRLD SEL (C1) parameter.*	**Verify Overload Curve Parameters** ⇩ Check both OVLD START LEVEL (A6) and OVLD TIME OUT (A6) parameters. **Accurate Motor Parameters** ⇩ Verify motor nameplate values are entered correctly. **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. ⇩ Inaccurate motor alignment – erroneous absolute rotor position feedback may cause excessive current draw. Redo the alignment after making sure that the encoder coupling is correct. **Endat Encoder Should Match Motor Phasing** ⇩ Encoder wiring – check for correct wiring ⇩ Swap 2 motor phase wires and re-ALIGN rotor. ⇩ Perform an OPEN-LOOP alignment to verify motor and encoder phasing. **Incremental Encoder Phasing** ⇩ Swap /A and A on TB1-34 and TB1-35. **Encoder Power Supply Loss** ⇩ Check power supply on encoder. ○ Incremental: 12V or 5V on TB1 ○ EnDat: 5V on IP and IG on EnDat Board **Motor Problem** ⇩ Check for motor failure.
No Drv Handshake *(operator serial link error)*	The operator lost communications with the drive's control board.	**Bad Connector Connection** ⇩ Remove and re-seat the operator in its cradle. ⇩ Verify that the control boards has proper voltages ⇩ Check the drive power supply voltages: $24V_{DC}$, $\pm 15V_{DC}$, and $5V_{DC}$ ⇩ If re-occurs, the operator or the drive's control board may need to be replaced.
No Option Crd	Motor Side Main Control Board is not detecting Option Card.	**Missing Option Card** ⇩ Verify Option Card is properly seated. ⇩ Recycle power. **Hardware Problem** ⇩ Replace Main Control Board and Option Card.

Name	Description	Possible Causes & Corrective Action

NTSD LOGIC IN	The parameter selection for NTSD Mode (C1) and the setting of the NTSD inputs in LOGIC INPUTS (C2) does not match
	
	• NTSD Mode (C1) set to External or 1 Threshold
	  ○ NTSD Input 1 can **ONLY** be set in LOGIC INPUTS (C2)
	
	• NTSD Mode (C1) set to 2 Thresholds or 3 Thresholds
	  ○ NTSD Input 1 **AND** NTSD Input 2 has to be set in LOGIC INPUTS (C2)
		Parmeter Settings
		⇩ Verify the setting of NTSD Input 1 and/or NTSD Input 2 in the LOGIC INPUTS (C2) menu matches the NTSD Mode (C1).
		⇩ Verify that the correct NTSD Mode (C1) is selected.

NTSD SPEED	This fault is declared if the following speed condition is not satisfied: contract car speed (A1) ≥ NTSD Threshold 3 (A1) > NTSD Threshold 2 (A1) > NTSD Threshold 1 (A1)	**Parameter Settings** ⇩ Check Contract Car Spd (A1) parameter for correct setting. ⇩ Check NTSD Threshold 1 (A1) parameter for correct setting. ⇩ Check NTSD Threshold 2 (A1) parameter for correct setting. ⇩ Check NTSD Threshold 3 (A1) parameter for correct setting.

Name	Description	Possible Causes & Corrective Action
OLA Endt Flt *(PM)*	Open Loop Alignment EnDat Fault.	**Phasing Problem** ⇩ If the motor was running smoothly immediately before the drive declared an **OLA ENDT FLT**, swap two motor leads (e.g. U and W) to establish proper phasing between absolute position data (EnDat, serial) and motor. *NOTE: Swapping encoder leads is **NOT** the same as swapping motor wiring. Do not swap encoder inputs.* **Torque Constant Scale needs to be adjusted** ⇩ If the motor was running rough, jerky, or stalled immediately before the drive declared an **OLA ENDT FLT**, increase the value located in OL ALIGN SCALE (A6). **Rotor is Not Moving when Open Loop Alignment Commanded** ⇩ Verify that the brake is picked and that the car is properly balanced. ⇩ Verify that the motor contactor is closed during the alignment. ⇩ Verify motor parameters in A6 menu. ⇩ Increase OL ALIGN SCALE (A6) factor to overcome excessive static friction that may exist in the elevator. **Run command was removed during Open Loop Alignment** ⇩ Verify the run command stayed active while alignment was occurring. *NOTE: This is only true when BEGIN ALIGNMENT? = ON RUN* **Encoder Problem** ⇩ Encoder failure (replace encoder and re-ALIGN the rotor). **Motor Parameter Problems** ⇩ Verify values in Motor (A6) menu are correct.

Name	Description	Possible Causes & Corrective Action
OLA Inc Flt *(PM)*	Open Loop Alignment Incremental Fault.	**Phasing Problem** ⇩ Encoder wiring – check for correct wiring ⇩ Swap 2 motor phase wires and re-ALIGN rotor. ⇩ Verify that the brakes are lifting so the motor can spin freely. ⇩ Check that the motor contactor is closed so current can flow out to motor **Encoder Problem** ⇩ Check encoder coupling: align or replace. ⇩ Encoder failure (replace encoder and re-ALIGN the rotor). ⇩ Option board failure (replace option board). **Parameter Setting** ⇩ Increase OL ALIGN SCALE (A6) factor to overcome excessive static friction that may exist in the elevator.
Overcurr Flt	The motor side power coverter has detected that 285% rated amps has been detected by the current transducers through the A4 – Motor Side Product Interface PCB.	**Overcurrent Problem** ⇩ Check for a possible short circuit in motor or external power wiring. **Poor Regulator Tuning** ⇩ Check parameters. **Missing Current Transducer Cable** ⇩ Look on both the Line Side Product Interface board and the Motor Side Product Interface board for the LEDs labeled CON_FLT (see page 183). ⇩ The board that has at least one red LED labeled CON_FLT lit is missing the Current Transducer cable. **Noise Glitch** ⇩ Verify connectors aren't loose on the A4 – Motor Side Product Interface Board and all the grounding screws are in place **Hardware Problem** ⇩ Swap both the A3 - Line and A4 - Motor Side Product Interface Board to see if problem becomes a Line Side fault ⇩ Replace A4 – Motor Side Product Interface Board **Encoder Problem** ⇩ Reference Possible Causes & Correction Action for ENCODER FAULT **Check Motor Parameter Settings** ⇩ Verify motor nameplate values are entered correctly in the A6 submenu.

Name	Description	Possible Causes & Corrective Action
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. **Poor Regulator Tuning** ⇩ Check INERTIA (A1) and RESPONSE (A1) for speed regulator tuning. **Speed Request** ⇩ Excessive speed dictation signal from car controller. ⇩ Improper feed forward signal. *NOTE: This fault is defined by Overspeed Level parameter and Overspeed Time parameter.*
Overvolt Flt	The DC bus voltage has exceeded the maximum allowed value.	**Line Converter Problem** ⇩ Verify the line converter did not shutdown while the motor controller was in process of regeneration. ⇩ Verify AC line didn't lose a phase while drive was in the process of regen. **Check Parameter Settings** ⇩ Bad tuning of the motor side regulators. **Contactor Problem** ⇩ Verify motor contactor did not open while motoring.
PCU data Flt	PCU parameters checksum is invalid on the motor side.	**Parameters Corrupted** ⇩ Check parameters and power cycle. ⇩ Write down all parameters and set the drive parameters to factor default. Re-enter all parameters back into the drive. ⇩ If re-occurs, replace Main Control PCB A2.
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 issues. ⇩ Check Base Enable is made on TB2-7 and TB2-14 ○ Verify / Reseat JP9 on A3 Product Interface Board ⇩ Verify / Reseat connector on CT4 through CT6
Power On	Annunciation that the drive has successfully powered up.	**No Corrective Action needed.**

Name	Description	Possible Causes & Corrective Action
Ready, Waiting For Drive *(operator)*	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 may need to be replaced. **Hardware Problem** ⇩ Bad Power Supply o Measure drive low voltage DC power suppies ⇩ If re-seating of the operator does not work, replace Main Control Board
Reverse Tach	See ENCODER FLT.	See ENCODER FLT. *NOTE: This fault cannot be reset; unit must be powered down before fault will clear.*
Rtr Not Align	Run command given before aligning the rotor. *(Clears automatically)*	**Initial Setup Not Performed** ⇩ Perform rotor alignment. **Alignment Failed** ⇩ Repeat the alignment. If any fault gets posted during the alignment, the setup offset will be set out of the range causing this alignment to fault.
Safe Off Open	Safe Open Fault declaration - If the safe off input TB2-7 to TB2-14 is open while the drive is in the Ready state, the Drive Enable and Run inputs closed the software will declare a Safe Open Fault after 1s. - If TB2-7 to TB2-14 is open while the drive is in the Run state, AND has the Drive Enable and Run inputs closed the software will declare a Safe Open Fault after 50ms. *In any instance, the drive will disable the IGBTs as soon as TB2-7 to TB2-14 becomes open.*	**Verify the input** ⇩ This contact must be closed when in run mode.
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) when SERIAL MODE (C1) is set to Mode 2.	**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. ⇩ Check if SERIAL MODE (C1) is set to the correct mode

Name	Description	Possible Causes & Corrective Action
Setup Fault 1 *(Induction)*	This fault is declared if the rated motor speed, motor poles, and excitation frequency do not satisfy: $9.6 < \left[120\left(\begin{matrix}rated\\excitation\\frequency\end{matrix}\right)\right] - \left[\left(\begin{matrix}\#\\poles\end{matrix}\right)\left(\begin{matrix}rated\\motor\\speed\end{matrix}\right)\right] < 1222.3$	**Check Parameters Settings:** ⇩ Check Rated Mtr Speed (A6) for correct setting. ⇩ Check Rated Excit Freq (A6) for correct setting. ⇩ Check Motor Poles (A6) 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 (A6) 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 (A6) 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: $(0.1178) \times \left[\frac{\left(\begin{matrix}rated\\motor\\power\end{matrix}\right)}{\left(\begin{matrix}rated\\motor\\voltage\end{matrix}\right)}\right] < \begin{matrix}general\\purpose\\current\\rating\\of\\drive\end{matrix}$	**Check Parameters Settings:** ⇩ Check RATED MOTOR PWR (A6) parameter for correct setting. ⇩ Check RATED MTR VOLTS (A6) 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. *NOTE: This fault is only declared with SPD CMD SRC (C1) equals MULTISTEP.*
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 .

Name	Description	Possible Causes & Corrective Action
SFT CN NOT CL	Safety Chain not closed is declared when the safety chain is open when the drive attempts to start.	**Contactor Problem** ⇩ Check motor contactor power. ⇩ Verify safety chain was closed. **Parameter Settings** ⇩ Verify C2 Logic Inputs contains setting CTR PWR SENSE. **Wire Problem** ⇩ *ENCLOSED:* Verify the wire A8TB4-1 & A8TB4-4 are not loose. ⇩ *CUBE:* Verify the safety chain input wires are not loose ⇩ Verify the wire in A6TB1-2 is not loose **Hardware Problem** ⇩ *ENCLOSED:* Replace A8 – Electrical Control Board ⇩ *CUBE:* Replace A12 – Motor Side Power Board ⇩ If I/O does not operate, replace the A6 – Customer Interface Board
SFT CN OPENED	<u>At the start of a run:</u> Safety Chain is open and motor contactor power was not available when the drive was commanded to start. <u>If declared during a run:</u> Contactor power sense on A6TB1-2 was opened for 20mS when the regulator release is active and the speed reference is greater than 20% of contract speed.	**Improper drive On-Run-Stop sequencing** ⇩ Verify Safety Chain operation. ⇩ Verify Safety Chain timing. **Hardware problem** ⇩ Verify wiring to A6TB1-2; this input is on if the contactor power is on. ⇩ *CUBE:* If the above point is not on, check at safety chain input TB1-1 and TB1-2; this is the input for the $230V_{AC}$ control power. ⇩ *ENCLOSED:* If the above point is not on, check at A8TB4-1 & A8TB4-4; this is the input for the $230V_{AC}$ control power.

Name	Description	Possible Causes & Corrective Action
Spd Dev Flt *&* **Spd Dev Alm**	The speed feedback is failing to properly track the speed reference.	**Encoder Cable not properly grounded** ⇩ Verify Encoder Cable is properly grounded using the shield clamp provided on the drive. ⇩ For more information, see Encoder Connections on page 31. **PM Motor Runaway Condition – Rotor Alignment Issues:** ⇩ Encoder is slipping on the shaft – fix the encoder coupling and repeat the alignment. ⇩ Wrong ENCODER ANG OFST (A6) value is uploaded or entered – enter correct value or repeat the alignment. ⇩ The absolute position encoder is not in sync with motor phasing (would be detected during the open loop alignment, but NOT if manual or auto alignment methods were used). Swap two motor leads. **Drive and/or Motor is Undersized** ⇩ Usually drive's "HIT TORQUE LIMIT" alarm message is displayed (depending on setting of TRQ LIM MSG DLY (A1) parameter). **Check Parameter Settings** ⇩ Usually drive's "HIT TORQUE LIMIT" alarm message is displayed (depending on setting of TRQ LIM MSG DLY (A1) parameter). ⇩ Check speed regulator parameters RESPONSE and INERTIA (A1). ⇩ Fault/Alarm sensitivity – SPD DEV FLT LVL or SPD DEV ALM LVL (A1) parameter is set too low for required acceleration/deceleration rate. *NOTE: Setting SPD DEV FLT LVL too high will reduce drive's sensitivity to dangerous runaway conditions!*
Srl Timeout	The drive is being operated by serial communications and one of the following has occurred: Communication time-out – The drive did not receive a valid run-time message within 40ms while running or Bad message checksum – Drive has detected 3 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. ⇩ The Customer I/O PCB on the drive may need to be replaced. ⇩ Possible problem with car controller serial communication. **Grounding Issue** ⇩ Check grounding between car controller and drive. ⇩ Noise on serial channel due to the cable.

Name	Description	Possible Causes & Corrective Action
TQ Lim 2Hi 4Cube	The torque limits exceed the cube's capacity. This fault is declared when Rated Motor Curr (A6) * Torque Limit (A1) > 2.5 * Drive Rated Current	**Check Parameter Settings** ⇩ Verify motor nameplate values are entered correctly in the A6 submenu. ⇩ Decrease TORQUE LIMIT (A1). **Drive Sizing** ⇩ Verify drive sizing.
Undervolt Flt	Generated during a run condition when the DC bus voltage drops below the UV FAULT LEVEL (A4) which is in percentage of the nominal DC voltage. • DC Bus Volt < UV Alarm level (A4) * nominal DC voltage • nominal DC voltage = [1.414 * Input L – L Volts (A5)] + DC Bus Boost (A5)	**Low Input Voltage** ⇩ Check INPUT L-L VOLTS (A5) and UV FAULT LEVEL (A4). ⇩ Verify proper input voltage and increase, if necessary, the input AC voltage within the proper range. ⇩ Check for 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, MS BUS VOLTAGE (D2) or DC BUS VOLTS (D3).
Util Data Sum	The line side calculated checksum is not the same as the stored checksum.	**Hardware Failure** ⇩ Cycle power to the Drive. ⇩ If re-occurs, replace line side main control board (A1).
Utility Temp	One or more of the IGBT modules on the line side power bridge has exceeded 95°C (203°F).	**Overtemperature Problems** ⇩ Verify LS Module Temp (D2) exceeds Overtemp rating. ⇩ *ENCLOSED:* Inspect and clean air intake filters. ⇩ Verify ambient temperature is less than 45°C. ⇩ Verify drive is sized correctly. ⇩ Possible defective temperature sensor. **Excessive Current Draw** ⇩ Decrease Accel/Decel rates. ⇩ Mechanical brake not releasing properly.
UV Alarm *(alarm)*	Generated during a run condition when the DC bus voltage drops below the UV ALARM LEVEL (A4) which is in percentage of the nominal DC voltage. • DC Bus Volt < UV Alarm level (A4) * nominal DC voltage • nominal DC voltage = [1.414 * Input L – L Volts (A5)] + DC Bus Boost (A5)	**Low Input Voltage** ⇩ Check INPUT L-L VOLTS (A5) and UV ALARM LEVEL (A4). ⇩ Verify proper input voltage and increase, if necessary, the input AC voltage within the proper range. ⇩ Check for 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, MS BUS VOLTAGE (D2) or DC BUS VOLTS (D3).

Table 20: Troubleshooting Guide

Appendix
Motor Calculations

There are times when the motor nameplate data does not contain rated motor speed or possibly does not contain motor excitation frequency.

If given rated motor speed and the number of poles, use the following calculation:

$$\frac{(\#\ \text{of poles})(\text{Rated Motor Speed})}{2*60} = \begin{pmatrix}\text{Motor}\\ \text{Excitation}\\ \text{Frequency}\end{pmatrix}$$

If given rated excitation frequency and the number of poles, use the following calculation:

$$\frac{(2*60)(\text{Motor Excitation Frequency})}{(\#\ \text{of poles})} = \begin{pmatrix}\text{Rated}\\ \text{Motor}\\ \text{Speed}\end{pmatrix}$$

If given rated excitation frequency and the rated motor speed, use the following calculation:

$$\frac{(2*60)(\text{Motor Excitation Frequency})}{(\text{Rated Motor Speed})} = \begin{pmatrix}\#\\ \text{of}\\ \text{Poles}\end{pmatrix}$$

Appendix

Induction Motor Adaptive Tune

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

Adaptive Tune Operating Conditions

The Quattro AC software estimates the motor's percent no load current and the motor's rated rpm. These 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%, and
- the motor's rated rpm when the motor torque is above 30%.

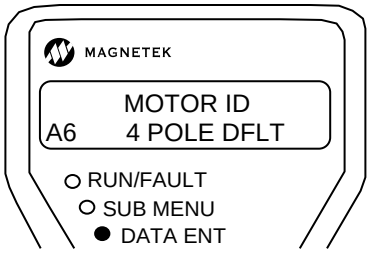
Using the Adaptive Tune to Obtain Maximum Motor Performance

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.

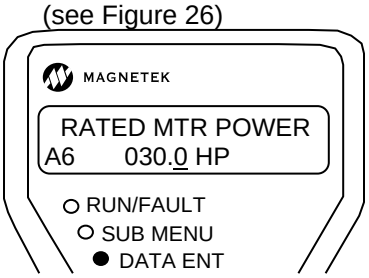
Initial Set-up

- 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 21.

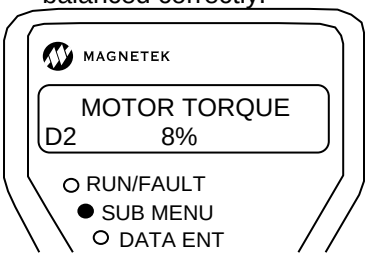
- Now, enter the motor nameplate data into the needed motor nameplate parameters (see Figure 26)



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.



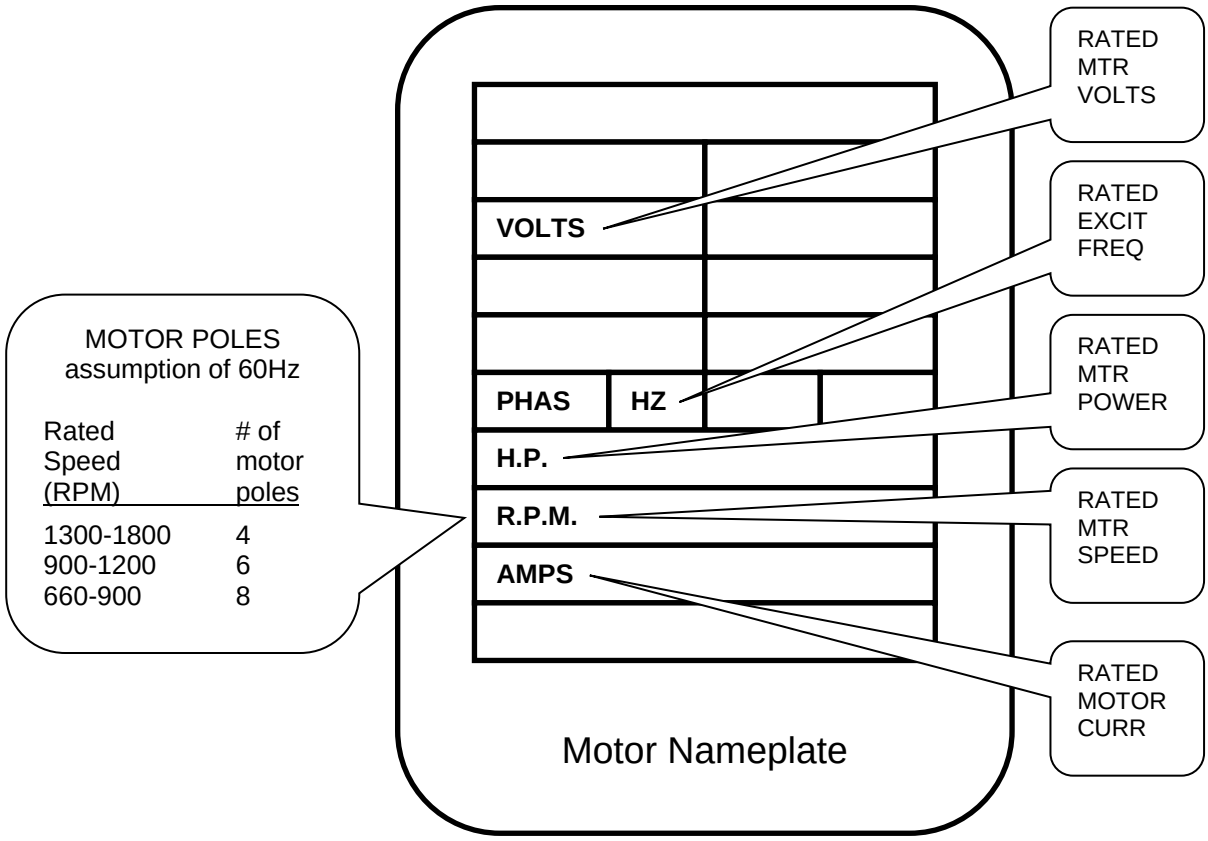


Figure 26: Motor Parameters Entered from Motor Nameplate

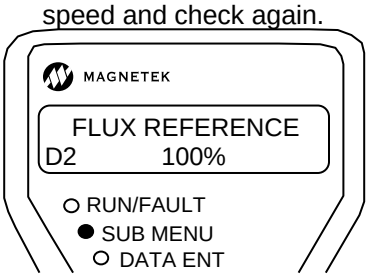
description	Parameter	4 pole dflt	6 pole dflt
percentage no load current	% NO LOAD CURR	35.0 %	45.0 %
stator leakage reactance	STATOR LEAKAGE X	9.0 %	7.5 %
rotor leakage reactance	ROTOR LEAKAGE X	9.0 %	7.5 %
stator resistance	STATOR RESIST	1.5 %	1.5 %
motor loss - motor iron loss	MOTOR IRON LOSS	0.5 %	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 21: Nominal Values for Motor Parameters

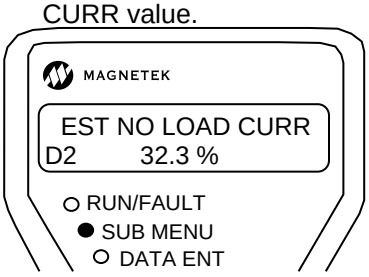
NOTE: If you are having problems getting the motor torque under 15% the cause may be:

- No compensation chains
  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.
- High elevator system friction
  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, 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.

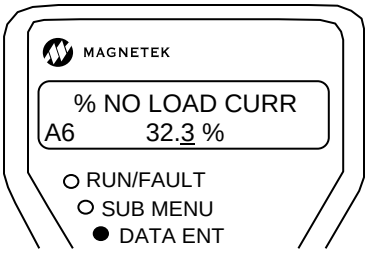
- Also, verify that the FLUX REFERENCE is 100%. If the value is not equal to 100% reduce the speed to less than 70% contract speed and check again.



- 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.

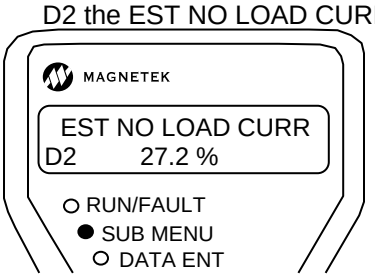


- Continue iterating the above two steps until the two values are within 2%. If the values do not converge after two iterations, verify the information entered in the initial set-up is correct.
- After the values converge, again verify the MOTOR TORQUE < 15% and the FLUX REFERENCE = 100%.

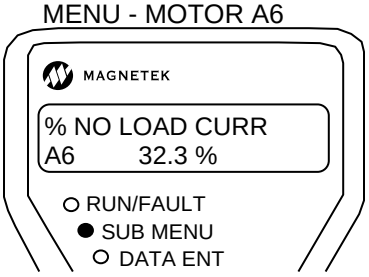
Tuning Motor's Flux Saturation Curve

With a balanced car, run the car at 100% contract speed 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.

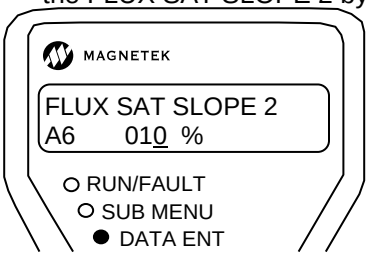


- Compare the displayed value EST NO LOAD CURR with the value entered for % NO LOAD CURR under the ADJUST MENU - MOTOR A6



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.

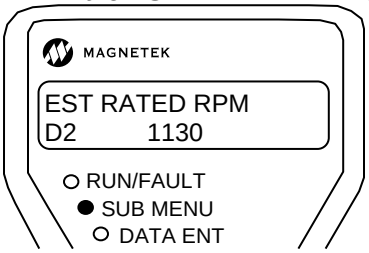
- Continue iterating FLUX SAT SLOPE 2 in 10% increments until the EST NO LOAD CURR and % NO LOAD CURR are within 2% of each other.

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

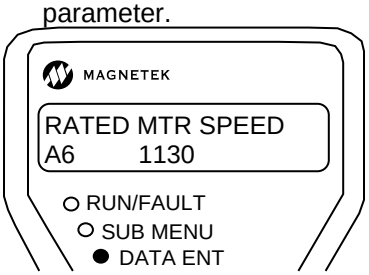
Tuning Rated Motor RPM

With a full-load car, run the car at 100% contract speed 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 two steps until the two values are within 3 RPM.

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

PM Start-Up Procedure

Control Method
Verify in the U6 menu under MS Code Version that the PM software is uploaded on the MS control board. A designator of PU will indicate PM motor control software.

Encoder Set-Up
Verify the absolute encoder option card has been installed correctly on the MS main control board as shown in Figure 47 on page 177 and the encoder has been selected and installed in accordance with the following:

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:
- Use a Heidenhain EnDat Encoder, specifically: ECN113, ECN1313, ECN413, or ROC413.
- Follow encoder manufacturer's mounting and wiring recommendations.
- Use Heidenhain extension Cable p/n 309778-xx (with xx less than or equal to 15) to connect the encoder to the drive.
- Connect Encoder Cable using a Heidenhain extension cable per and the encoder cable shield using the provided encoder clamp.

NOTE: For Heidenhain cable 309778-xx, see Table 22 *for cable connections.*

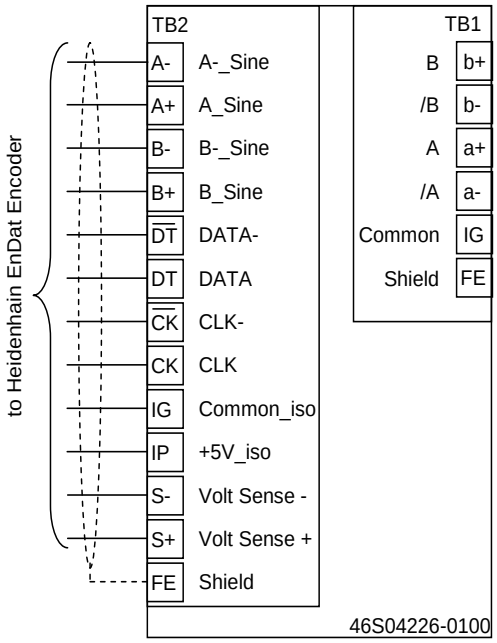


Figure 27: EnDat Encoder Connections

Encoder	Quattro PM Terminals	Cable Color Codes		
		Heidenhain	Green Encoder Cable	Torin Encoder Cable
-A	A-	Yellow/Black	Yellow	Brown
A	A+	Green/Black	Green	Green
-B	B-	Red/Black	Red	Yellow
B	B+	Blue/Black	Blue	Blue
/Data	/DT	Pink	Pink	Transparent
Data	DT	Grey	Grey	Grey
/Clock	/CK	Yellow	Violet	White
Clock	CK	Violet	Black	Violet
$0V_{com}$	IG	Green/White	White	Orange / White & Black
$+5V_{DC}$	IP	Green/Brown	Brown	Orange & Red
-Sense	S-	White	-	-
+Sense	S+	Blue	-	-
cable shield	FE	Encoder cable shield	Encoder cable shield	Big Yellow

Table 22: EnDat Encoder Cable Color Codes

Mechanical considerations:

- Use direct motor mounting without couplings.
- Use hub or hollow shaft encoder with concentric motor stub shaft.
- If possible, use a mechanical protective cover for exposed encoders.

Enter/verify the encoder pulses entered in the ENCODER PULSES (A1) parameter from the encoder nameplate.

Motor Parameter Set-Up

Verify the following parameters are set correctly with the motor nameplate data:

- Rated Motor Pwr (A6)
- Rated Mtr Volts (A6)
- Rated Motor Curr (A6)
- Motor Poles (A6)
- Rated Mtr Speed (A6)

Verify that the D Axis Induct (A6) and Q Axis Induct (A6) are between 5 and 40 mH.

Hoistway Parameter Set-Up

Enter/verify the following hoistway parameters:

- Contract Car Speed (A1)
- Contract Mtr Speed (A1)

Rotor Alignment

Perform the rotor alignment so the drive can locate the magnets in the motor in order to rotate the motor under controlled speeds. Steps to perform any of the alignments are explained in detail in Rotor Alignment Procedure on page 144.

If the alignments values are not accurate, a fine tune alignment can be performed on the drive to obtain a more accurate value. This process is explained in detail in Fine Tune Alignment Procedure on page 148.

Motor Auto-tune

After the rotor alignment has been done, an auto-tune to measure motor characteristics should be next. Steps to perform the auto-tune are explained in further detail in Setting up PM Auto-Tune on page 149.

Appendix

Rotor Alignment Procedure

Magnetek offers three (3) methods of aligning the rotor. These include Open Loop Alignment, Auto Alignment, and Manual Alignment. Open Loop Alignment requires the car to be in a fully balanced condition. Auto Alignment requires the brake to be set while it controls current into the motor. For Manual Alignment the encoder value must be known and may be placed into the ENCODER ANG OFST (A6) parameter. The procedures for each method may be found on the following pages:

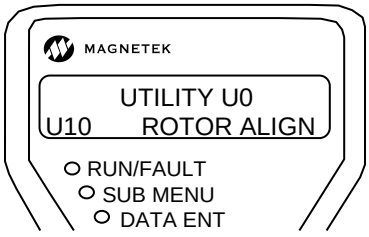
- Open Loop Alignment Procedure may be found below
- Auto Alignment Procedure may be found on page 146
- Manual Setup Method may be found on page 147

Rotor Alignment Procedure: Open Loop Procedure

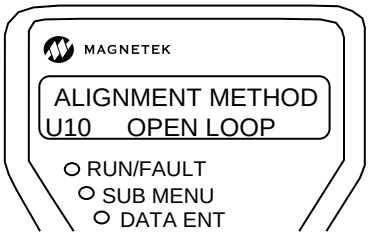
1) In order to accurately measure the alignment, the motor has to operate in a no-load condition. This can be achieved by:
   a. Removing the ropes from the sheave of the motor,

      or

   b. Balancing the car in the middle of the hoistway. With the car balanced and positioned in the middle of the hoistway, lift the mechanical brake with the drive off and verify the car is balanced. If the car moves, adjust the weights in the car accordingly (more weights if the car moves in an upward direction and less weights if the car moves in a downward direction). *NOTE: If the car is not properly balanced, finding initial position in the PM motor will not work.*
2) Run the Open Loop Alignment (U10) to determine the position of the motor poles.

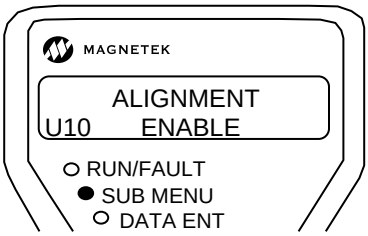


Press Enter, then the UP Arrow to display:

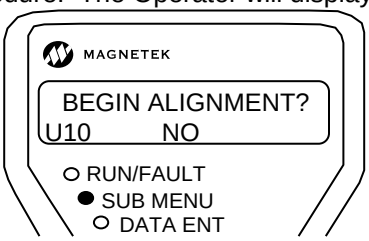


Verify ALIGNMENT METHOD is set to OPEN LOOP.

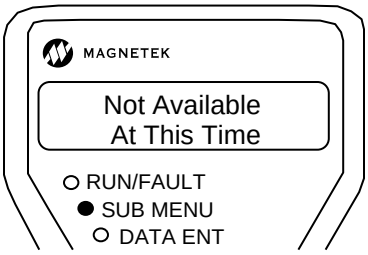
Scroll to ALIGNMENT and press Enter to change parameter ALIGNMENT from DISABLE to ENABLE. Press Enter.



Press the down arrow to start the alignment procedure. The Operator will display:

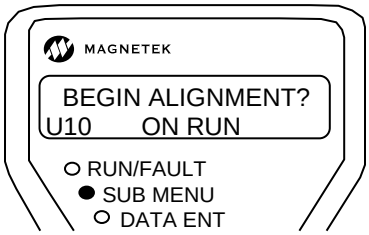


NOTE: If the operator displays the following screen, verify ALIGNMENT (U10) is set to enable, there are no active faults, and the drive is not in a RUN mode.



Press Enter to change the data from NO to either ***YES*** or ***ON RUN***.

NOTE: For either selection, any speed command issued to the drive will be ignored; however, it may be necessary for the car controller to anticipate the motor moving at 1/8th rated motor speed.



3) If ***YES*** is selected, the motor will immediately start applying current to the motor and calculating the alignment value.

4) If ***ON RUN*** is selected, the drive expects the following items to occur:
   a. Car Controller asserts DRIVE ENABLE
   b. Car Controller issues Run Command
   c. Drive asserts SPD_REG_RLS and CLOSE_CONTACT (all other outputs will operate as programmed and have no special status or benefit during the Alignment Procedure)
   d. Motor Contactor closes
   e. Drive asserts BRAKE_PICKED, if used
   f. Brake is lifted
5) If ropes are attached, car will now be hanging balanced in hoistway.
6) Drive starts the Open Loop Alignment running at approximately 1/8th of the Contract Car Speed (A1).
7) When the Alignment is finished, the drive will go to zero speed and simulate removal of the run command (i.e. SPD REG RLS = 0 (false); CLOSE CONTACT = 0) even if Run Command is still being asserted.
8) Run Command is removed.

During the test, the motor should rotate for about four seconds, and the RUN light will be lit for the duration of the procedure.

- Erratic movement of the motor may occur during acceleration and deceleration segments of the alignment, but constant speed operation will be smooth.

9) View the value of ENCODER ANG OFST (A6). If the value is 30000, the alignment procedure did not work and must be redone. Otherwise, record the value of ENCODER ANG OFST (A6).

ENCODER ANG OFST = _____

10) Run motor at 20% contract speed and verify alignment is correct.
    - If ropes are not attached, set INERTIA (A1) to 0.25 seconds
    - If the SPD DEV FLT occurs, check if TORQ CURR (D2) is greater than 5% (>5%). If this is the case, repeat the alignment procedure.

If the fault **ENCDR CRC ERR** is displayed, verify the encoder wiring as shown in. Retry the alignment procedure.

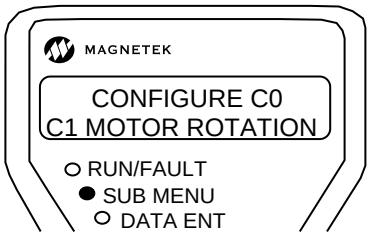
- If the alarm **SPD DEV ALM** is displayed, increase the value of SPD DEV ALARM LVL (A1), and then retry the procedure to see what fault the drive may actually be getting. The SPD DEV ALM will not allow the alignment procedure to finish and must be moved out of the way to proceed.
- If the fault **SPD DEV FLT** is displayed, first verify the shield of the encoder cable is properly grounded using the provided clamp on the drive. Then retry the alignment procedure. If the fault still exists, increase SPD DEV FLT LVL (A1), and then retry alignment procedure.
- If the fault **OVERCURR FLT** is displayed, decrease OL ALGN Vq SCALE (A4) and retry the alignment procedure.
- If **OLA ENDT FLT** occurs while BEGIN ALIGNMENT? Was set to ON RUN, verify the run command was not removed before the alignment was complete.
- If the motor was running rough, jerky, or stalled immediately before the drive declared an **OLA ENDT FLT**, increase the value located in OL ALIGN SCALE (A6).

  If the motor was running smoothly immediately before the drive declared an **OLA ENDT FLT**, swap two motor leads (e.g. U and W) to establish proper phasing between absolute position data (EnDat, serial) and motor.

  NOTE: Only swap the two motor leads. This is not the same as swapping two encoder leads.
- If fault **OLA INC FLT** occurs, swap two encoder leads (e.g. A and -A) to establish proper phasing between incremental position data and motor.

  NOTE: Do not swap both motor phase leads and encoder inputs at the same time.

11) Put ropes back onto the sheave, if necessary, and run the motor on inspection speed. Verify the direction requested is the same as the direction of the motor.
12) If the directions do not coincide with each other, change MOTOR ROTATION parameter in C1.

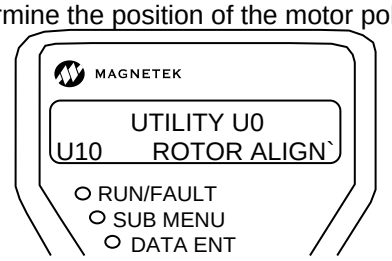


Run the drive in inspection speed up and down the hoistway.

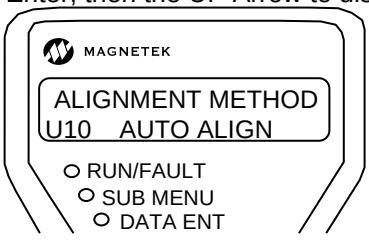
Rotor Alignment Procedure: Auto Alignment Procedure

Auto Alignment is a function that will calculate the alignment angle without the need to spin the motor. This procedure may be done with the brake set and the ropes on. This is especially useful for replacement encoders. Auto Alignment may be enabled two separate ways: one way is to enable the function through the operator and the other is to enable Auto Align by giving the drive a run command. In order for the function to properly work, all faults must be cleared, the brake must be set, and the motor contactor must pull in.

1) In order to accurately measure the alignment, the brake must be set and the motor contactor must be closed. Depending on the method used for enabling Auto Alignment, drive signals may be used in conjunction with the contactor and the brake.
2) Run the Auto Alignment (U10) to determine the position of the motor poles.



Press Enter, then the UP Arrow to display:



3) If ***YES*** is selected, the drive will immediately start applying current to the motor and calculating the alignment value.
4) If ***ON RUN*** is selected, the drive expects the following sequence to occur:
   a. Car Controller asserts DRIVE ENABLE
   b. Car Controller issues RUN Command
   c. Drive asserts CLOSE_CONTACT (all other outputs will stay false during the Alignment excluding READY TO RUN which will stay active)
   d. Motor Contactor closes
   e. Drive starts the Alignment procedure

During Alignment, 5 buzzing noise should come from the motor for approximately 10 seconds (2 seconds per alignment) and the RUN light will be lit for the duration of the procedure.

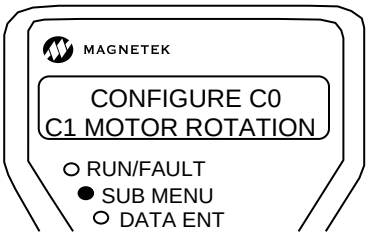
- If the fault **CONTACTOR FLT** is displayed, verify the motor contactor is closed.
- If the fault **BRAKE IS OPEN** is displayed, the drive has detected motion; verify the brake is set. If the brake is set and minimal movement has occurred, increase BRK FLT LEVEL (A1).
- The following parameters will automatically populate:
  a. ENCODER ANG OFST (A6)

When the Alignment is finished, the drive will simulate the removal of the run command even if Run Command is still being asserted.

5) View the value of ENCODER ANG OFST (A6). If the value is 30000, the alignment procedure did not work and must be redone. Otherwise, record value of ENCODER ANG OFST (A6).

ENCODER ANG OFST = _____

6) Run motor at 0% contract speed and verify alignment is correct.
   - If ropes are not attached, set INERTIA (A1) to 0.25 seconds
   - If the **SPD DEV FLT** occurs, it may mean that the motor phasing is incorrect. The drive requires accurate U, V, and W phasing. Verify phasing and redo alignment procedure.
7) Put ropes back onto the sheave, if necessary, and run the motor on inspection speed and verify the direction requested is the same as the direction of the motor.
8) If the directions do not coincide with each other, change MOTOR ROTATION parameter in C1.



Run the drive in inspection speed up and down the hoistway.

Rotor Alignment Procedure: Manual Setup Method

The manual setup method can be used if the PM motor is already supplied with an offset value predetermined by the motor manufacturer, or when either the No Ropes Attached Method or Ropes Attached Method has already been applied to align the rotor and the drive or software is replaced.

WARNING
If the encoder was removed from the motor for any reason, the Manual Setup Method ***CANNOT*** be used

1) Determine ENCODER ANG OFST value in the A6 menu:

   If replacing the FLASH, copy the ENCODER ANG OFST (A6) value before removing the memory and/or replacing the drive. If the original offset value was recorded when the alignment was first performed, use that value.

   WARNING
   ENCODER ANG OFST (A6) can also be uploaded using the Magnetek Explorer. ALIGNMENT (U10) must be enabled for the ENCODER ANG OFST (A6) value in the *.par file to be downloaded into the drive.

   OR

   Find θ_{0_spec} [in degrees] from the manufacturer supplied data and use the following *ENCODER ANG OFST* formula to convert it.

2) Enable the Alignment in the U10 menu.
3) Enter value determined in Step 1) into ENCODER ANG OFST (A6).
4) Run the motor at inspection speed.

   WARNING
   The motor may run away if the incorrect value for ENCODER ANG OFST (A6) is used. Be prepared to remove the run command.

5) Run the drive in inspection speed up and down the hoistway.

$$ENCODER\ ANG\ OFST = \frac{2 \times SERIAL\_CPR}{POLES} \times \frac{\theta_{0\_spec}[^\circ]}{360^\circ}$$

Example:

32 pole motor, 8192 cpr (13 bit) absolute encoder,

$\theta_{0\_spec} = 22.5°$

$$ENCODER\ ANG\ OFST = \frac{2 \times 8192}{32} \times \frac{22.5^\circ}{360^\circ} = 512 \times \frac{1}{16}$$

$$ENCODER\ ANG\ OFST = 32$$

Appendix

Fine Tune Alignment Procedure

Fine tune alignment is perform on rare occasions where near perfect alignment were not obtained after a successful rotor alignment (unperfect alignment can exhibit itself as excessive motor current, vibrations, or encoder fault). This iteration process will help zero in on the correct encoder angle.

Test Measurements

1. Set ENGR PARM LOCK (C1) to UNLOCKED.
2. Set Id REF THRESHOLD (A4) to 0.00.
3. Set FINE TUNE OFST (A4) to –30.00. If Encoder Fault or another fault occurs, set FINE TUNE OFST (A4) to –20.00.
4. Run car up and down and note the peak current displayed in MOTOR CURR (D2) in table below.
5. Set FINE TUNE OFST (A4) to +10.00 and note peak current in table below.
6. Reiterate Steps 4 and 5 increasing FINE TUNE OFST (A4) until peak current equals the value found when FINE TUNE OFST (A4) was set to in Step 3.

FINE TUNE OFST (A4) Value	MOTOR CURRENT (D2)

Calculate new ENCODER ANG OFSET

7. With the two currents equal, use the following formula to determine the value in ENCODER ANG OFSET (A6):

$$\begin{pmatrix}\text{ENCODER ANG OFSET (A6)}\\ \textbf{new}\end{pmatrix} = \begin{pmatrix}\text{ENCODER ANG OFSET (A6)}\\ \textbf{old}\end{pmatrix} - \left(\frac{\begin{pmatrix}\text{FINE TUNE OFST (A4) positive value}\end{pmatrix} + \begin{pmatrix}\text{FINE TUNE OFST (A4) negative value}\end{pmatrix}}{360 \times \text{number of poles}} \times 8192 \right)$$

Example: ENCODER ANG OFSET (A6) old value = 185

FINE TUNE OFST positive value (A4) = 40

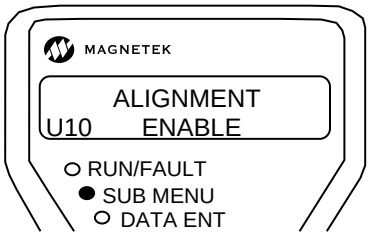
FINE TUNE OFST negative value (A4) = (-70)

Number of poles = 16

$$(228) = (185) - \left(\frac{(40) + (-70)}{360 \times 16} \right) \times 8192$$

Enter new ENCODER ANG OFSET.

8. Enable Alignment by setting ALIGNMENT (U10) to ENABLE, then change the value in ENCODER ANG OFSET (A6) from the previous one, to the one calculated in the formula above.



9. Set FINE TUNE OFST (A4) to 0.0.
10. Set Id REF THRESHOLD (A4) back to the original value (0.10 is default value).
11. Set ENGR PARM LOCK (C1) to LOCKED.

This completes the fine-tuning procedure for the EnDat Alignment. With a balanced car, peak current and voltage should be the same in both directions.

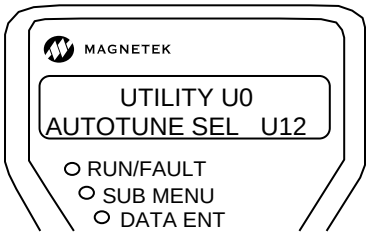
Appendix

Setting up PM Auto-Tune

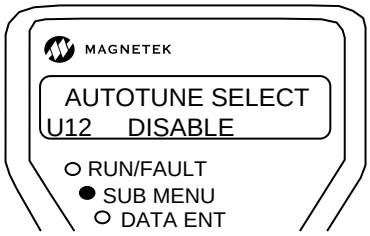
The Auto-Tune function will automatically measure the D and Q Axis Inductances and the Stator Resistance based on the calculated value of the motor's Base Impedance. Auto-Tune may be enabled by either manually starting the function through the operator, or allowing Auto-Tune to start by the external controls giving the drive a run command. In order for the function to properly work, all faults must be cleared, the motor contactor must pull in, and the brake must remain set during the Auto-Tune process.

NOTE: (PM application) The Rotor Alignment Procedure should precede this Auto-Tune function as encoder-rotor alignment can affect the accuracy of the D and Q Axis Stator Inductances. It may be advantageous to repeat the Absolute Encoder Alignment Procedure after performing an Auto-Tune.

1) In order to accurately measure the motor parameters, the brake must be set and the motor contactor must be closed. Depending on the method used for enabling Auto-Tune, drive signals may be used in conjunction with the contactor and the brake.
2) Scroll to AUTOTUNE SEL (U12) to run the Auto-Tune function. No Faults may be present on the drive when engaging Auto-Tune.



Press Enter to display:

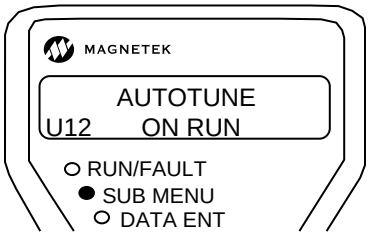


Press Enter and use down arrow keys to select ON RUN or YES to enable a manual Auto-Tune.

NOTE: The logic conditions for Ready to Run and Ready 2 Start must also be met before the drive will be allowed to perform the Auto-Tune function. If either of these logic indicators is selected to operate a Programmable Logic Output channel, those outputs and any output programmed as a FAULT indicator will remain active during the Auto-Tune testing. The status condition of these signals may change if drive faults occur during the tests.

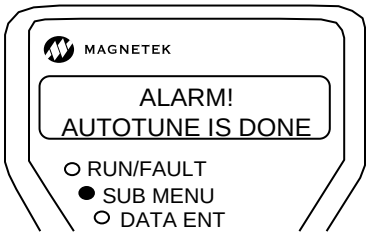
Running Auto-Tune via ON RUN function

In menu U12 use the up/down arrow keys to select then Press Enter to change the data from DISABLE to ON RUN.



Command RUN (inspection) from the car controller. The speed command must be set to zero (0) speed. The following sequence must be observed by the car controller to properly perform Auto-Tune via Car Controller:

a. Car Controller asserts DRIVE ENABLE
b. Car Controller issues RUN Command
c. Drive asserts CLOSE_CONTACT (all other outputs will remain de-energized during the Auto-Tune, except Ready_2_Start, Ready to Run and FAULT which may change if one should occur.)
d. Motor Contactor closes
e. Drive starts the Auto-Tune procedure
f. When the Auto-Tune is completed, the drive will internally remove the run command even if Run Command is still being asserted. Then the following will be displayed:



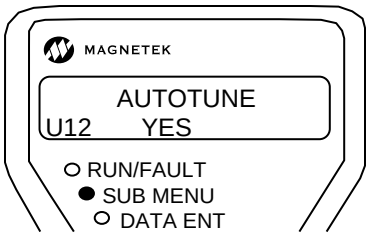
g. Run Command is removed

During Auto-Tune, a slight buzzing noise should come from the motor for about two seconds and the RUN light will be lit for the duration of the procedure.

- If the fault **CONTACTOR FLT** is displayed, verify the motor contactor is closed.
- If the fault **BRAKE IS OPEN** is displayed, the drive has detected motion; verify the brake is set. If brake is set, the movement may be due to noise; increase parameter BRAKE FLT LEVEL (A4).
- The following parameters will automatically populate:
  a. D Axis Induct (A6)
  b. Q Axis Induct (A6)
  c. Stator Resist (A6)

Running Auto-Tune via a manual YES function

In menu U12 use the up/down arrow keys to select then Press Enter to change the data from DISABLE to YES.

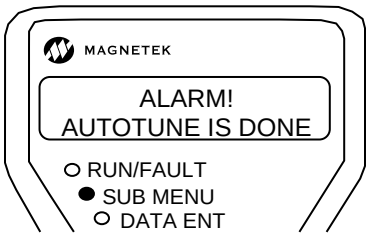


The drive will immediately:

a. Issue a CLOSE_CONTACT command to close the motor contactor (all other Logic Outputs will remain de-energized during the Auto-Tune, except Ready_2_Start, Ready to Run and FAULT which may change if one should occur.)

b. When the contactor is confirmed to be closed, current will flow to the motor to measure the motor characteristics

c. When the Auto-Tune is completed, the drive will de-energize the motor contactor and display the following:



During Auto-Tune, a slight buzzing noise should come from the motor for about two seconds and the RUN light will be lit for the duration of the procedure.

- If the fault **CONTACTOR FLT** is displayed, verify that the motor contactor closed.
- If the fault **BRAKE IS OPEN** is displayed, the drive has detected motion; verify the brake is set. If brake is set, false movement sensing may be due to noise; increase parameter BRAKE FLT LEVEL (A4).
- The following parameters will automatically populate:
  a. D Axis Induct (A6)
  b. Q Axis Induct (A6)
  c. Stator Resist (A6)

Appendix

Inertia Calculations

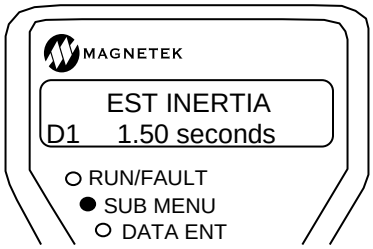
The Quattro AC/PM software can be used to calculate the inertia of the entire elevator, which is used for accurate tuning of the speed regulator.

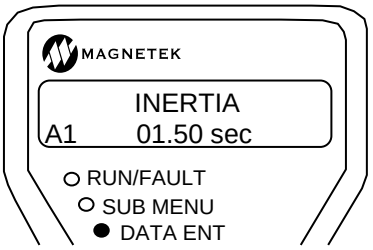
The following is a step-by-step procedure for using the Quattro AC/PM to estimate the elevator system inertia.

Using the Software to Estimate the System's Inertia

With a balanced car, run the car at 100% contract speed 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. Once this value is calculated and set, it should not require further adjusting.

Appendix
Drive Overload Curve

When the drive is running an output frequency of less than or equal to 1 Hertz, the drive will use an adjusted overload curve. See the graph below for current vs. time.

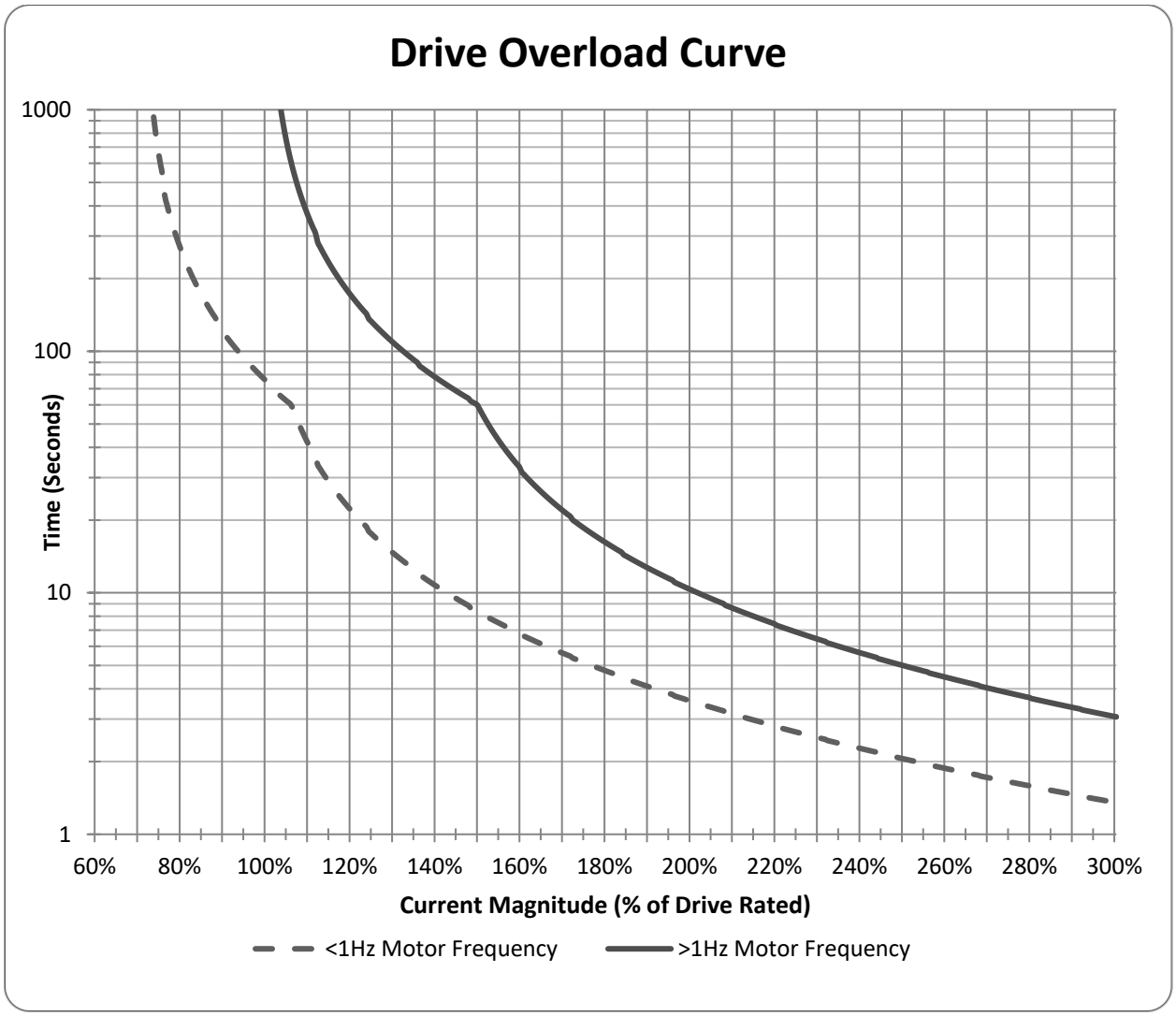


Figure 28: Drive Overload Curve

Appendix
CE Guidelines

EMC for Quattro Cube
Below are guidelines for CE compliance for the Quattro Cube.

Standards

EN 12015	Electromagnetic compatibility Emission
EN 12016	Electromagnetic compatibility Immunity

Recommended Line Filter for Cube
A line filter must be connected between the main power supply and drive input three phase input terminals to comply with the standards listed above. The filter should be connected to the drive with shielded cable not exceeding 0.6 meters or 23.6 inches in length. The parts below must be ordered along with drive.

Quattro Cube Models	Magnetek Part Number	TDK/Epcos Part Number
QAC028-…	05P00010-0740	B84243A8033W000
QAC034-…	05P00010-0739	B84243A8044X000
QAC042-…		
QAC052-…	05P00010-0738	B84243A8060W000
QAC068-…	05P00010-0737	B84143A90R105
QAC085-…		

Table 23: Selection Table for EMC Filters

Installation Guidelines for EMI/RFI Issues
The Quattro Cube 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 Quattro Cube 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). It is essential 360° screened glands are used at both the Cube and the motor ends of the cable to ensure compliance. Below is the optional kit LAQAC-CUBE-CE that should be ordered seperately when bonding the gland to the Cube.

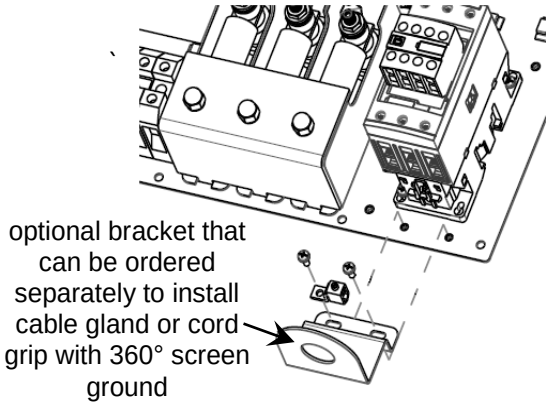


Figure 29: Cube Gland Bracket

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 cables by clamping the cable to the grounding plate as shown in Figure 30.

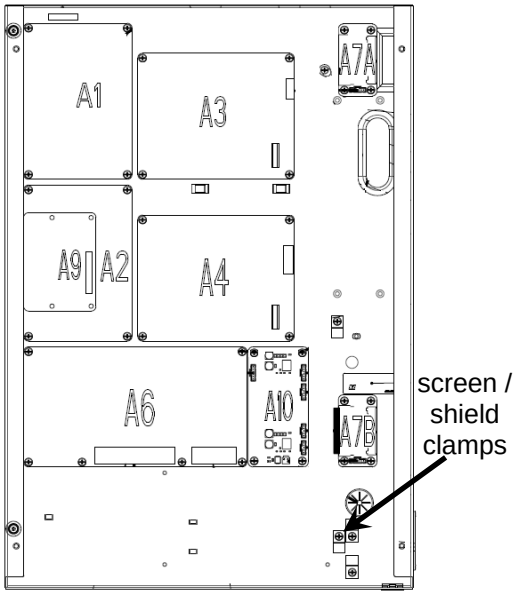


Figure 30: Cube Control Signal Cable Shield Clamp

In addition to the above, proper cable routing should also be considered. Keep power wires and signal wires at least 12 inches away from each other. Also avoid routing the power and signal cable in parallel.

NOTE: avoid using an extension cable on the drive operator

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.

EMC for Quattro Enclosed
Below is an installation guideline for field personnel regarding proper metallic bonding for EMC compliance for the Quattro Enclosed. All necessary metallic bonding within the Quattro AC/PM cabinet will be performed at the factory.

In order to be compliant with conducted and radiated emissions standards, it is critical that the motor leads are coupled correctly to the chassis of the Quattro Enclosed. Ensuring proper connections through the conduit plate does this. The conduit plate is located on the upper right hand corner of the cabinet.

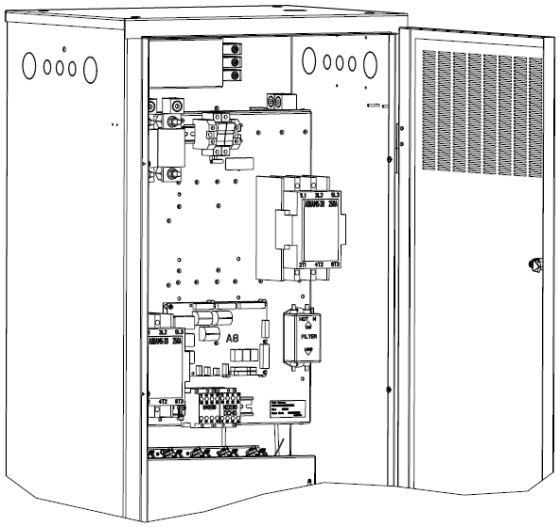


Figure 31: Conduit Access

Proper bonding of motor wiring can be achieved by using one of the following two methods:

Method 1:

1. Use rigid conduit combined with appropriate conduit couplings for an acceptable metallic bond to the conduit plate. *NOTE: The conduit can only contain the motor lines. No communication or encoder feedback wires can be run through this conduit.*
2. Verify proper conduit connections to the galvanized side panels located on the Quattro AC/PM drive.

Method 2:

1. Use braided, shielded leads for the motor leads. *NOTE: When shielded multi-conductor wire is used, it is very important to use termination couplings that are designed for this type of installation. These couplings are designed to make a bond to the braid, which will complete the metallic connection to the chassis.*
2. Verify proper connection of the braided shield to the galvanized side panels located on the Quattro AC/PM drive.

Proper bonding of encoder cables and communication wiring may be seen in Figure 32. All shielded multi-conductor cables used for communications or for the encoder feedback must be the braided type.

There are several places along the edge of the lower part on the card cage near the customer I/O board to mount a braided clamp.

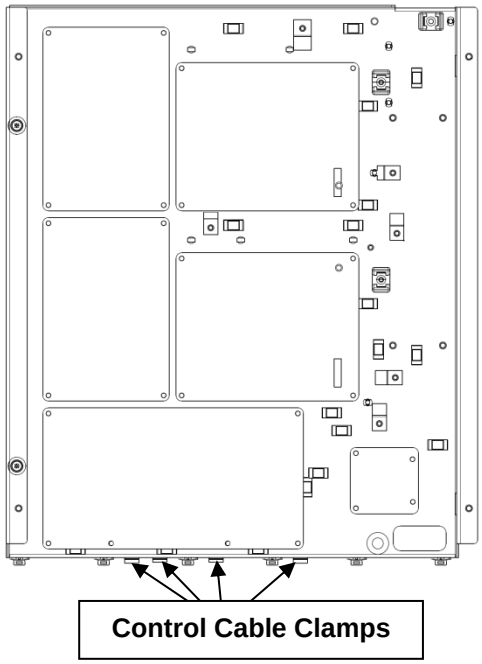


Figure 32: Enclosed Control Signal Cable Clamp

Appendix

Safe Off

The Safe-Off function is way to positively disable the drive so it cannot cause a motor runaway.
The Safe Off signal is TRUE, meaning IGBT gating is DISABLED, when the 24V from Terminal TB2-7 is NOT present at TB2-14.
IGBT gating can only occur when the Safe-Off Signal is FALSE. This will occur when the 24V signal at TB2-7 is available at TB2-14

The Safe-Off input to the drive uses only hardware to positively turn IGBT gating off. This is achieved by opening and closing the circuit between TB2-7 and TB2-14

1. The drive uses only hardware to turn on/off IGBT gating, however it also monitors the status of the Safe Off signal in software.

2. If the Safe-Off function is set up correctly and the drive receives other enabling/command logic to start but the Safe-Off signal is NOT yet in the 'safe to-run' state (Safe-Off signal = FALSE), the drive will not start.
   The drive will not get to a state where regulators are released unless the Safe-Off input is low (connection fromTB2-7 and TB2-14 closed) when the other enabling/command logic is received. If the signals do not match at the start, the drive will declare a 'Safe-Off Open' Fault (As diagnostic information and to avoid remaining indefinitely poised to run). The drive will not be allowed to become engaged with IGBTs disabled. This prevents speed or current integrators from starting that may cause significant 'bumps' when/if IGBT gating should become enabled. During this time Regulator Release will not be indicated, because the drive has not yet started.

3. Safe Open Fault declaration
   a. If the safe off input TB2-7 to TB2-14 is open while the drive is in the Ready state, the Drive Enable and Run inputs closed the software will declare a Safe Open Fault after 1s.
   b. If TB2-7 to TB2-14 is open while the drive is in the Run state, AND has the Drive Enable and Run inputs closed the software will declare a Safe Open Fault after 50ms.
   c. In any instance, the drive will disable the IGBTs as soon as TB2-7 to TB2-14 becomes open.

4. In case of the safe-off function disabling the drive while it is running, the drive shall declare a safe-off open fault, along with other expected faults resulting from a crash stop, depending on speed.

Enabling the safe off feature

The safe off feature uses terminals TB2-7 and TB2-14. This allows the IGBTs to be enabled when TB2-7 to TB2-14 is closed (Safe Off Low), and disabled when TB2-7 to TB2-14 is open (Safe Off High).

The car controller will need to supply this feed in the same way that they would usually supply the signal for the contactors to close, albeit that the drive will require the usual 24V feed as in the case of the rest of the logic inputs. Asserting and De-asserting the Safe Off signal is achieved by connecting a normally open switch (either a relay or an optically isolated open-collector transistor) between terminals 7 and 14 of TB2.

Input

The IGBTs will not fire unless this feed is present between terminals 7 and 14 of TB2. Although the "Safe Off" function is a purely hardware feature, the drive's software will still monitor the status of the Safe Off signal, and has been designed to give intuitive feedback based on the state of this input. The drive can give diagnostic information if and when the IGBTs are shut off (in the event of a crash stop for example), much in the same way that it would declare a contactor fault if contactor monitoring were

enabled. The drive will also monitor the status of its own systems and provide faults if any discrepancies are detected.

Output

One of the drive's logic outputs can be set to "Safe Off". This provides feedback to the controller, much in the same way an auxiliary of a motor contactor would. The car controller should monitor the state of this output, in the same way that motor contactors would be monitored. The car controller can also use the status of this output to verify that the "Safe Off" function has been set up correctly, i.e. the logic output matches the status that the controller would expect from a contactor auxiliary. The controller can therefore determine if the installation has been set up in an unsafe manner if only one contactor is used, but the drive's "Safe-Off" function is not implemented correctly.
This output will be HIGH when the drive's internal Safe Off circuitry is active (IGBTs are disabled and torque CANNOT be produced in the motor). The output will be LOW when the drive's internal Safe Off is inactive (IGBTs are enabled, and torque CAN be produced in the motor).

Parameter Settings

The parameters for the "Safe Off" function should be configured as follows:

Parameter Name	Setting	Function
Logic Output 4* (C3)	SAFE-OFF	Provides feedback to the car controller of the status of the Safe Off Input, and therefore the status of the IGBTs (Enabled or Disabled). Used to determine if the drive has been correctly set for the "Safe Off" function, and provide similar feedback to that of a contactor auxiliary. Can be configured to any free output. This Output will be HIGH when the drive's IGBTs are disabled by the Safe Off circuitry, and LOW when the drive's IGBT are enabled by the Safe Off circuitry. The status of this output can be monitored in the D1 menu under Logic Outputs as a 1 or 0 as with any other output.

* Any free Logic Output can be used.

Figure 1. *Drive parameter table*

Appendix

Backup Power Option

This configuration allows the use of three or single phase backup. The general principle of operating in this mode, is that the car controller activates a logic input either external TB or serially to disable the active front end on the Quattro drive. The regenerative power would either be absorbed by the losses in the elevator system or would be modulated into a resistor through an external braking module.

Sizing rules for using an external braking module:

1. Selecting the external braking module

Step 1 - definition of the application variables

A - Rated current of the motor
X1 - Efficiency of the Motor (0.75 for IM, 0.85 for PM)
X2 - Efficiency of the gearbox (0.45 worm gear, 0.75 for Planetary, 1.0 for Gearless)
X3 - Drive OL, 150% = 1.5, 200% = 2.0, 250% = 2.5

Step 2 - Calculate the Peak regenerative Current

Peak Regen Current = A x X1 x X2 x X3

Step 3 - Select a module which has a listed peak current higher than the calculated number.

Order number	Voltage	Model	Amps discharge	Amps discharge 10% duty	Minimum DB Resistance (ohms)
05P00671-1603	200V	2022D	20	60	6.8
05P00671-0105	200V	2037D	24	80	5.0
05P00671-1612	200V	2055D	40	120	3.2
05P00671-1604	200V	2110D	80	250	1.6
05P00671-1605	400V	4030D	15	40	20
05P00671-0103	400V	4045D	18	60	13.3
05P00671-1607	400V	4090D	30	100	8.0
05P00671-1606	400V	4220D	80	250	3.2

2. Select the external braking resistor module.

Step 1 - Determine the Dynamic Braking (DB) current

DB current = N.P. motor amps x factor listed below
IM motors (geared) - 110% rating of the motor
PM motors (gearless) - 200% rating of the motor

Step 2 - Determine Dynamic Braking Resistor (DBR) value in ohms.

Resistance (ohms) = DBR voltage / DB current

note:
- The default DBR voltage is 380V for 230V class, 760V for 400V class.
- Do not go under the minimum resistance listed in the table.

Step 3 - Determine Dynamic Braking Resistor (DBR) power rating in kW

kW - (motor curent) x (power factor)

power factor	200V	400V
IM (geared)	0.0625	0.125
PM (gearless)	0.1250	0.250

<u>This braking module needs to be enabled when operating in emergency backup mode.</u>

Step 1. Set the dip switches on the CDBR module S1 Sinking and S4 should be set for B(N.C.)

Step 2. On the Quattro drive determine if the car controller is going to send the enable via external logic input or serial input. Select in C1 ***bu pwr mode*** *[none, external tb, external tb + serial, serial].*

Step 3. To select the external logic input, use the C2 Logic input menu and determine which input is free and program it to ***bu pwr enable***.

Step 4. To set up the logic output on the Quattro to drive the enable on the CDBR, select an unused LO2 -7 and in the C3 menu program that output to ***bu pwr active***.

Step 4. Wire the SB terminal on the CDBR to LO2-7 and the SC on the CDBR to the C_24VISO.

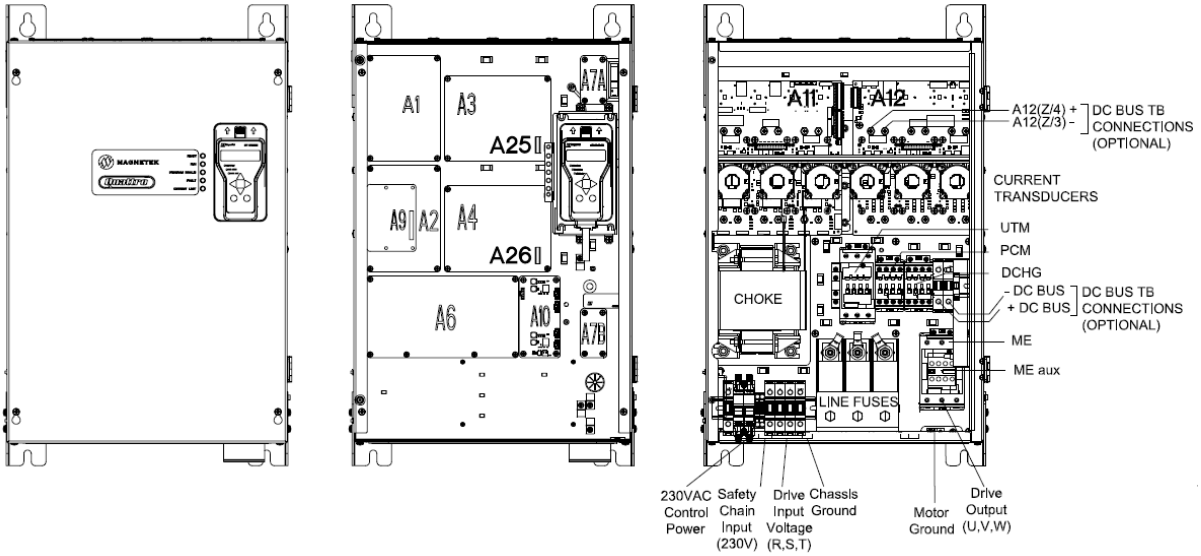
<u>DC BUS TERMINAL BLOCKS</u>

To use the external braking module the drive needs to be configured with access to the DC bus, the Quattro Cube can be purchased with these terminal blocks installed. However, if this feature is required to be added to an existing drive, the terminal block kit will need to be purchased.

Order part numbers;
CUBE-DCBUS-054 28-54A drives
CUBE-DCBUS-085 68-85A drives

see below for the location of the terminal blocks and the correct wiring terminations.

- DC BUS A12(Z/3)
+ DC BUS A12(Z/4)



Appendix

Control Power Consumption (Enclosed)

Drive Model Number	Control Power ($230V_{AC}$) consumption (max)*		
	kVA	Watts	Current (Amps)
Qxx085-xxxx-xx	0.525	525	2.25
Qxx115-xxxx-xx	0.525	525	2.25
Qxx140-xxxx-xx	0.525	525	2.25
Qxx170-xxxx-xx	0.600	600	2.60

**NOTE: Does not include the Elevator Brake.*

Watts Loss (Enclosed)

Drive Model Number	Total System Power Loss (max)** no Auto Transformer	
	Watts	BTU/hr
Qxx085-xxxx-xx	8,400	28,700
Qxx115-xxxx-xx	11,200	38,200
Qxx140-xxxx-xx	13,500	46,100
Qxx170-xxxx-xx	16,300	55,600

***NOTE: Includes both Control Power and 3-Phase Input Power Consumption.*

Input / Output Ratings (Enclosed)

Drive Model Number	Input		Output		
	Voltage (V)	Current (A)	Voltage (V)***	Current (A)	Power (kVA)****
Qxx085-xxxx-xx	200 – 480	94.4	200 - 480	85	70.7
Qxx115-xxxx-xx	200 – 480	127.8	200 - 480	115	95.6
Qxx140-xxxx-xx	200 – 480	155.5	200 - 480	140	116.4
Qxx170-xxxx-xx	200 – 480	188.9	200 - 480	170	141.3

***NOTE: Output voltage is proportional to input voltage
****NOTE: Operating at 480V

Appendix

Control Power Consumption (Cube)

Drive Model Number	Control Power ($230V_{AC}$) consumption (max)*		
	kVA	Watts	Current (Amps)
QAC028-1110-xx	0.525	525	2.25
QAC034-1110-xx	0.525	525	2.25
QAC042-1110-xx	0.525	525	2.25
QAC054-1110-xx	0.525	525	2.25
QAC068-1110-xx	0.525	525	2.25
QAC085-1110-xx	0.525	525	2.25

**NOTE: Does not include the Elevator Brake.*

Watts Loss (Cube)

Drive Model Number	Total System Power Loss (at rated output)**	
	Watts	BTU/hr
QAC028-1110-xx	1,300	4,400
QAC034-1110-xx	1,500	5,100
QAC042-1110-xx	1,700	5,800
QAC054-1110-xx	2,000	6,800
QAC068-1110-xx	2,400	8,200
QAC085-1110-xx	2,900	9,900

***NOTE: Includes both Control Power and 3-Phase Input Power Consumption.*

Input / Output Ratings (Cube)

Drive Model Number	Input		Output		
	Voltage (V)	Current (A)	Voltage (V)***	Current (A)	Power (kVA)****
QAC028-1110-xx	200 - 480	30.4	200 - 480	28	23.3
QAC034-1110-xx	200 - 480	37.0	200 - 480	34	28.3
QAC042-1110-xx	200 - 480	45.7	200 - 480	42	34.9
QAC054-1110-xx	200 - 480	58.7	200 - 480	54	44.9
QAC068-1110-xx	200 - 480	73.9	200 - 480	68	56.5
QAC085-1110-xx	200 - 480	92.4	200 - 480	85	70.7

***NOTE: Output Voltage is proportional to input voltage
****NOTE: Operating at 480V

Appendix

Wire Terminal Specs (Enclosed)

Power Terminals

English / Imperial Units

Drive Ampere Rating	Input Power Terminals *TB1-1,2,3*		Ground Terminals				Control Power Terminals (F1 & F2) *230V$_{AC}$*		Motor Connections (U,V,W)		Control Wiring Terminals *TB1*		Control Wiring Terminals *TB2*	
			PE		Lugs									
	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[i] (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)
ALL	#6-350 MCM	275	#6-1/0	40	#6-350 MCM	275	#18-10	18	#6-350 MCM	275	#16-#24	1.8-2.2	#14-#24	3.6-4.4

Metric Units

Drive Ampere Rating	Input Power Terminals *TB1-1,2,3*		Ground Terminals				Control Power Terminals (F1 & F2) *230V$_{AC}$*		Motor Connections (U,V,W)		Control Wiring Terminals *TB1*		Control Wiring Terminals *TB2*	
			PE		Lugs									
	Wire Size range (mm^2)	Torque Spec (N-m)	Wire Size range (mm^2)	Torque Spec (N-m)	Wire Size range (mm^2)	Torque Spec (N-m)	Wire Size range (mm^2)	Torque Spec[i] (N-m)	Wire Size range (mm^2)	Torque Spec (N-m)	Wire Size range (mm^2)	Torque Spec (N-m)	Wire Size range (mm^2)	Torque Spec (N-m)
ALL	10-175	31	10-50	4.5	10-175	31	0.6-4	2	10-120	13.6	0.2-1.5	0.2-0.25	0.2-2.5	0.4-0.5

[i] These torque specifications are only applicable to the older Quattro Enclosed that has the older terminal blocks with screws. The new drives have spring loaded terminal blocks.

Appendix

Wire Terminal Specs (Cube)

Power Terminals

English / Imperial Units

Drive Ampere Rating	Input Power Terminals (TB1-R,S,T)		Ground Terminals		Control Power Terminals (TB1-F1,F2) 230V_{AC}		Motor Connections (2T1,4T2,6T3)		Control Wiring Terminals (TB1-1,2)	
	Wire Size Range (awg)	Torque Spec[i] (in-lb)	Wire Size Range (awg)	Torque Spec[i] (in-lb)	Wire Size Range (awg)	Torque Spec[i] (in-lb)	Wire Size Range (awg)	Torque Spec (in-lb)	Wire Size Range (awg)	Torque Spec (in-lb)
QAC028	12…2	35…44	12…2	35…44	18…4	18…35	14-8	22	16…6	11…21
QAC034							10-2	35		
QAC042							10-2	35		
QAC054							10-2	35		
QAC068							6-1	53		
QAC085							6-1	53		

Metric Units

Drive Ampere Rating	Input Power Terminals (TB1-R,S,T)		Ground Terminals		Control Power Terminals (TB1-F1,F2) 230V_{AC}		Motor Connections (2T1,4T2,6T3)		Control Wiring Terminals (TB1-1,2)	
	Wire Size Range (mm^2)	Torque Spec[i] (N-m)	Wire Size Range (mm^2)	Torque Spec[i] (N-m)	Wire Size Range (mm^2)	Torque Spec[i] (N-m)	Wire Size Range (mm^2)	Torque Spec (N-m)	Wire Size Range (mm^2)	Torque Spec (N-m)
QAC028	2.5…50	4.0…5.0	2.5…50	4.0…5.0	1.5…25	2.0…4.0	2.5-10	2.5	1.31…16	1.2…2.4
QAC034							6.0-35	4.0		
QAC042							6.0-35	4.0		
QAC054							6.0-35	4.0		
QAC068							6.0-70	6.0		
QAC085							6.0-70	6.0		

[i] These torque specifications are only applicable to the older Quattro Cubes that has the older terminal blocks with screws. The new drives have spring loaded terminal blocks.

Appendix

Dimensions / Weights Standard

Excluding customer I/O panel Enclosed Version

Drive Model Number	Dimensions						Weight	
	Height		Width		Depth			
	inches	mm	inches	mm	inches	mm	lbs	kg
Q_ _085-xxxx-xx	72	1829	24	610	19	483	380	173
Q_ _115-xxxx-xx	72	1829	24	610	19	483	380	173
Q_ _140-xxxx-xx	72	1829	24	610	19	483	390	177
Q_ _170-xxxx-xx	72	1829	24	610	19	483	410	186

With Optional Customer I/O panel Enclosed Version

Drive Model Number	Dimensions						Weight	
	Height		Width		Depth			
	inches	mm	inches	mm	inches	mm	lbs	kg
Q_ _085-xxxx-xx	72	1829	32	813	19	483	540	245
Q_ _115-xxxx-xx	72	1829	32	813	19	483	540	245
Q_ _140-xxxx-xx	72	1829	32	813	19	483	560	255
Q_ _170-xxxx-xx	72	1829	32	813	19	483	580	264

Cube Version

Drive Model	Dimensions						Weight	
	Height		Width		Depth			
	inches	mm	inches	mm	inches	mm	lbs	kg
All Cubes	28.13	714.5	17.6	447	12.09	307	110	50

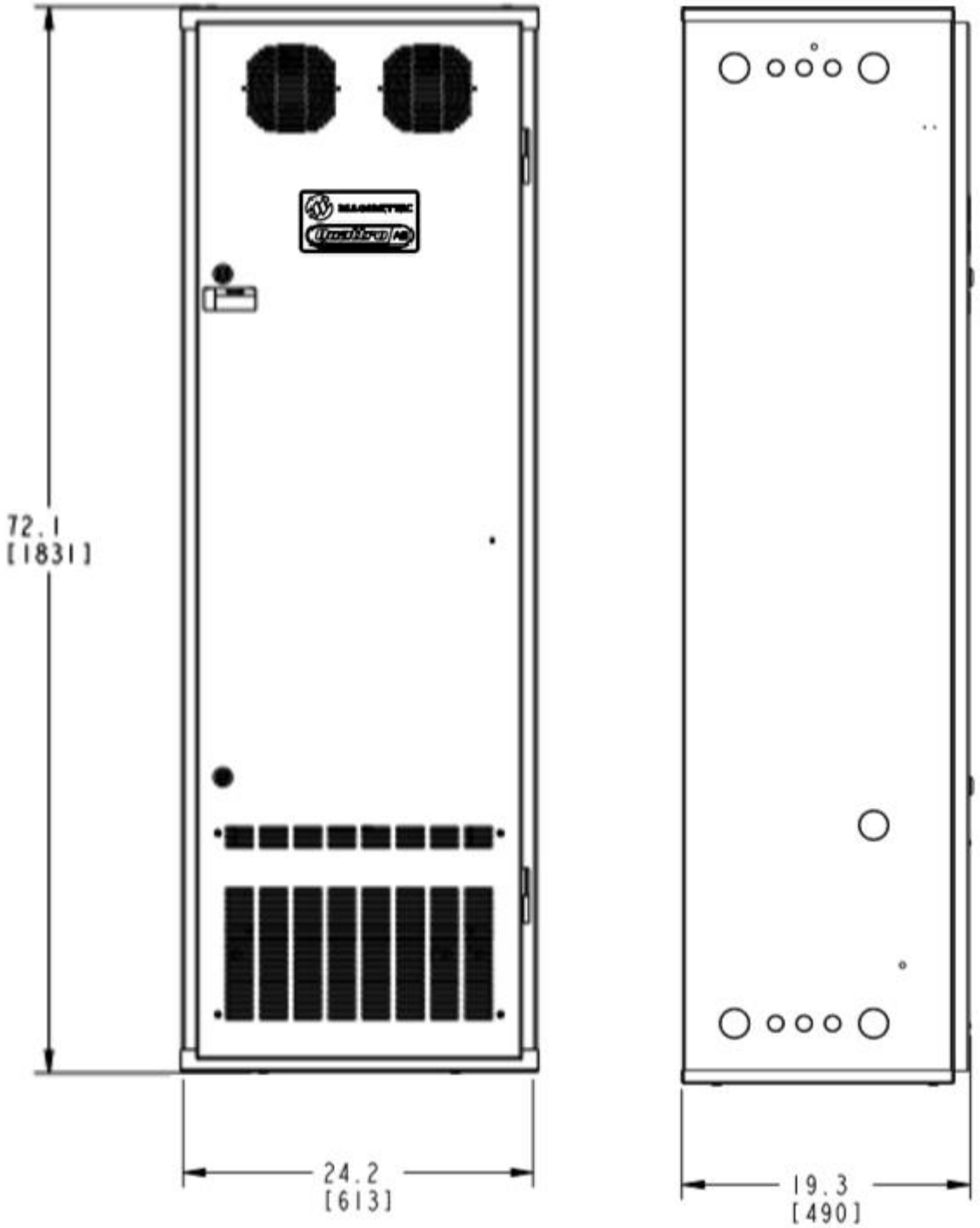


Figure 33: Dimensions without optional Customer I/O Panel (Enclosed)

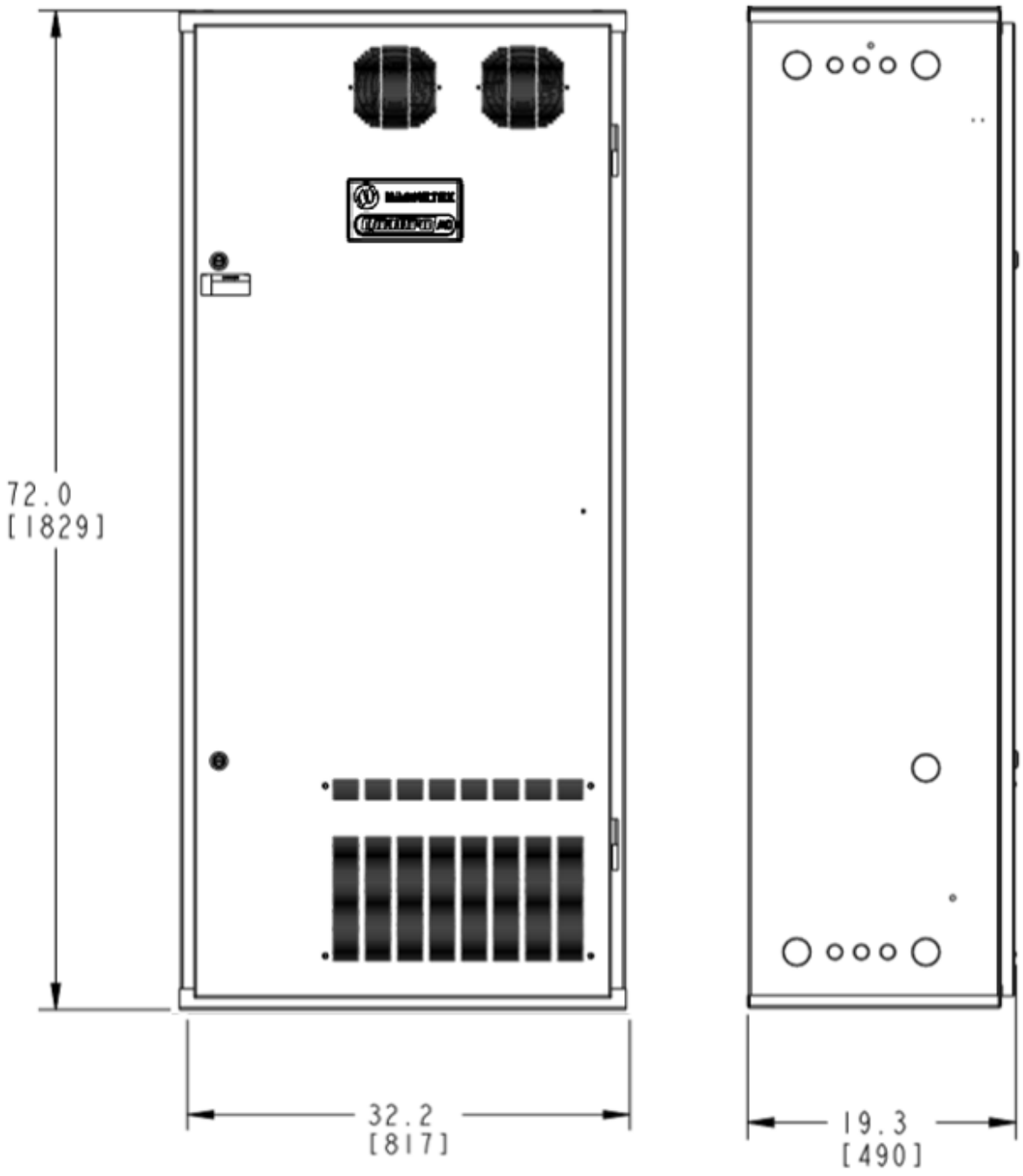


Figure 34: Dimensions with optional Customer I/O Panel (Enclosed)

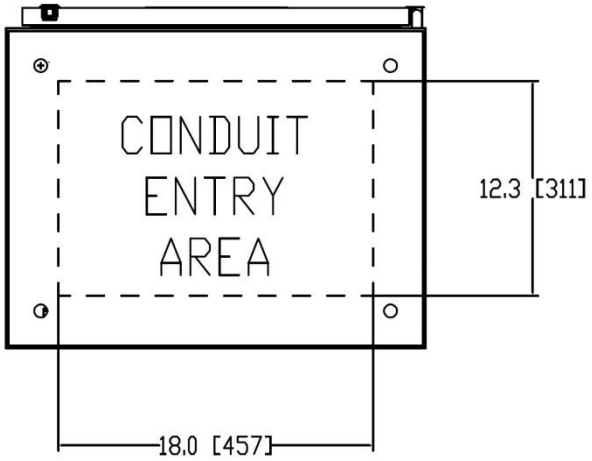


Figure 35: Top Dimensions, no Customer I/O Panel (Enclosed)

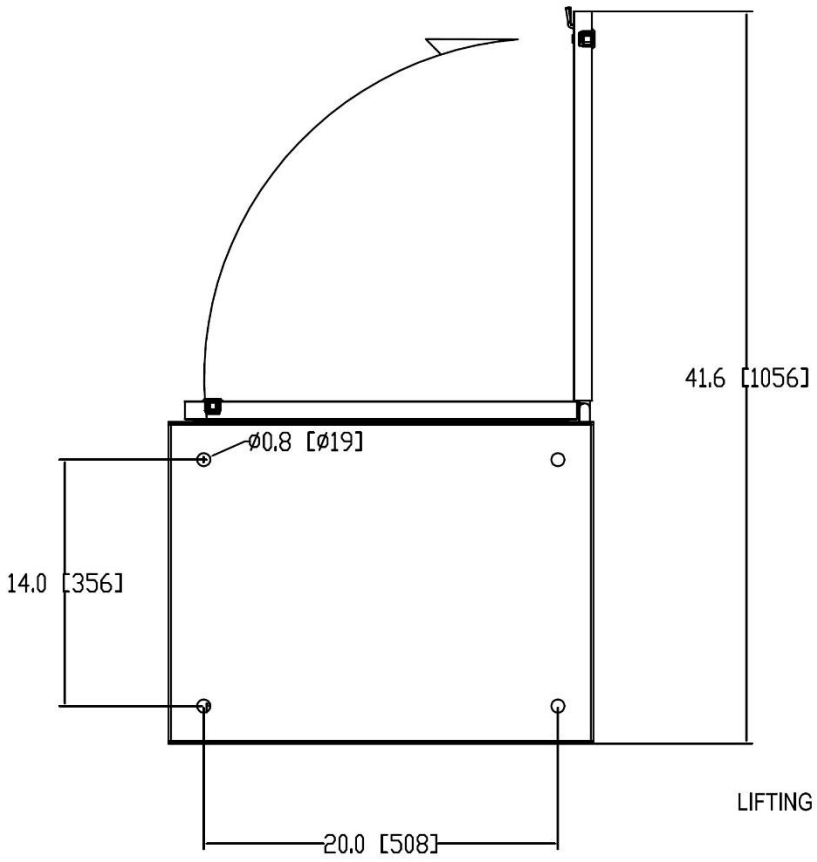


Figure 36: Bottom Dimensions, no Customer I/O Panel (Enclosed)

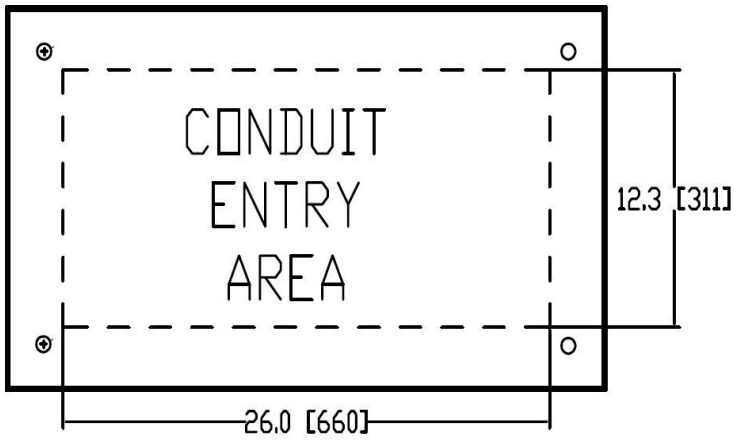


Figure 37: Top Dimensions, Customer I/O Panel (Enclosed)

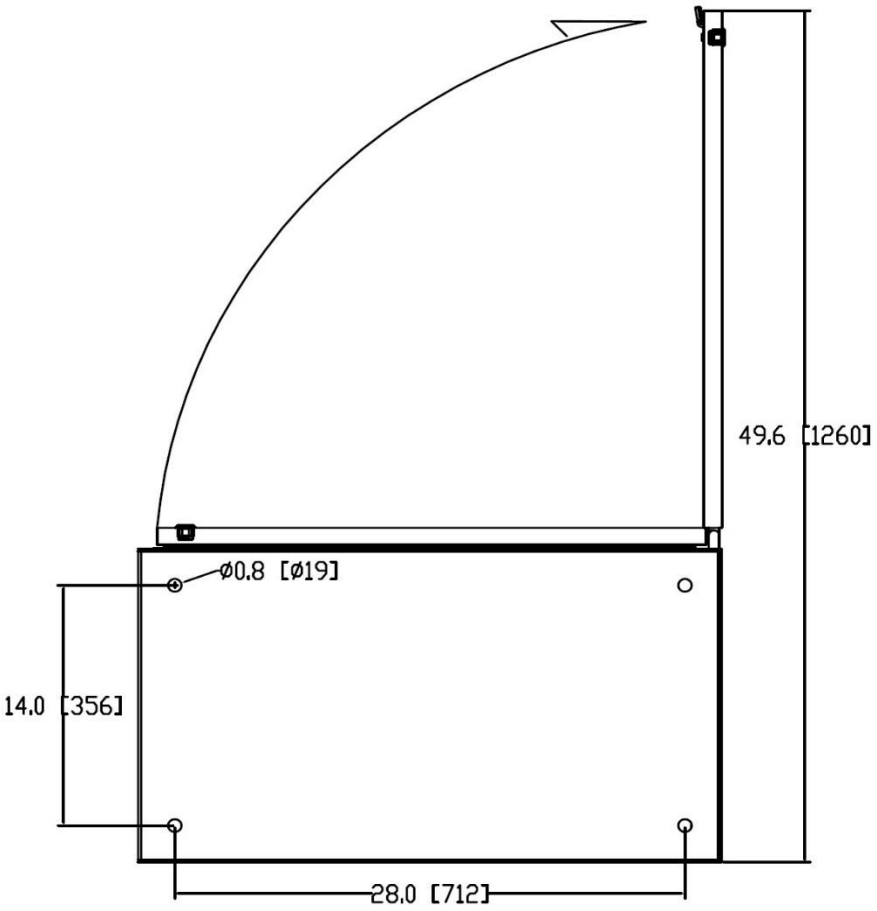


Figure 38: Bottom Dimensions, Customer I/O Panel (Enclosed)

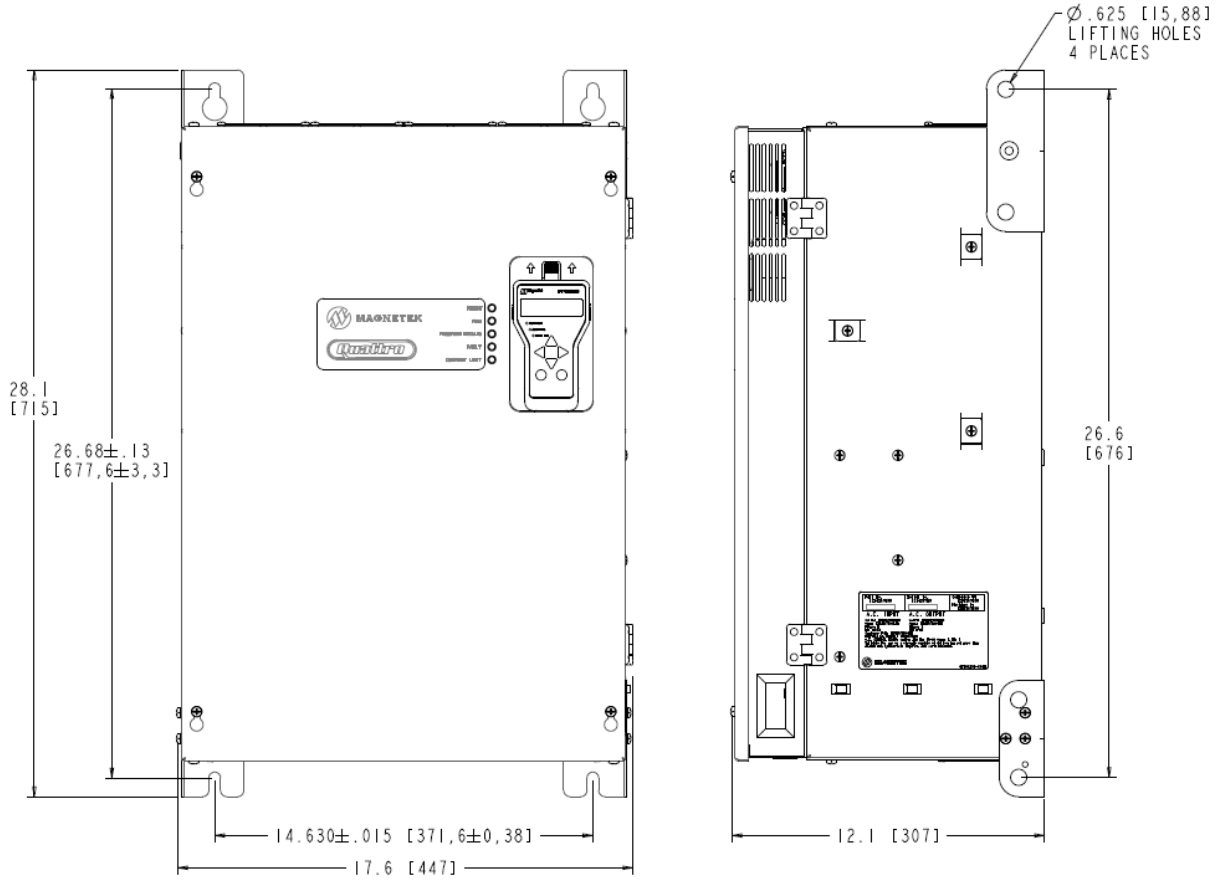


Figure 39: Frontal Dimensions (Cube)

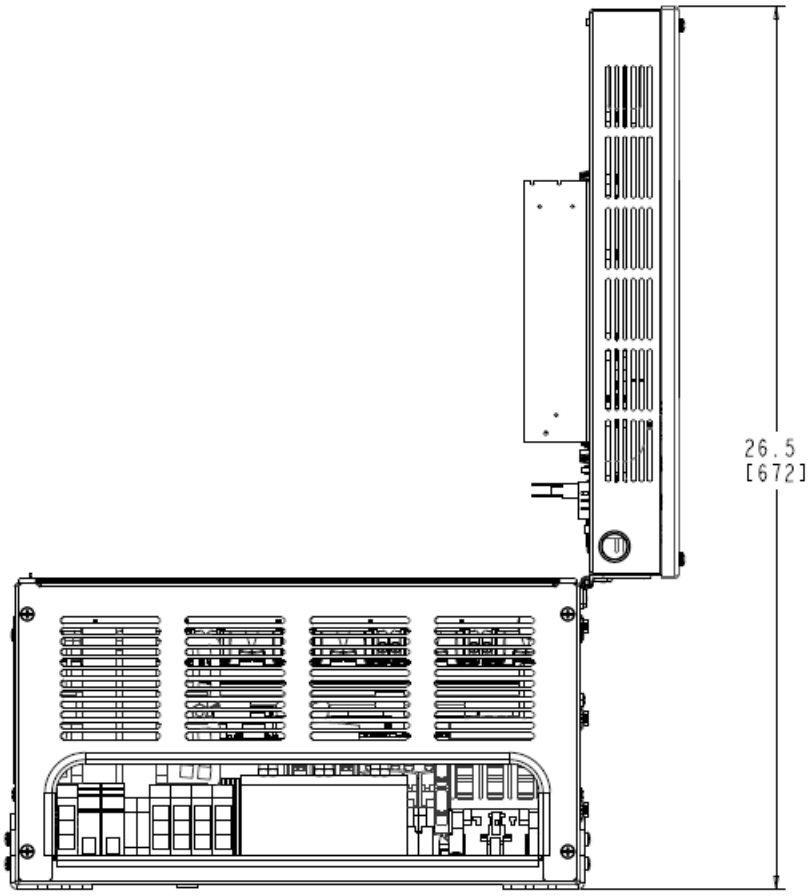


Figure 40: Bottom Dimensions (Cube)

Appendix

Component Locations - Enclosed

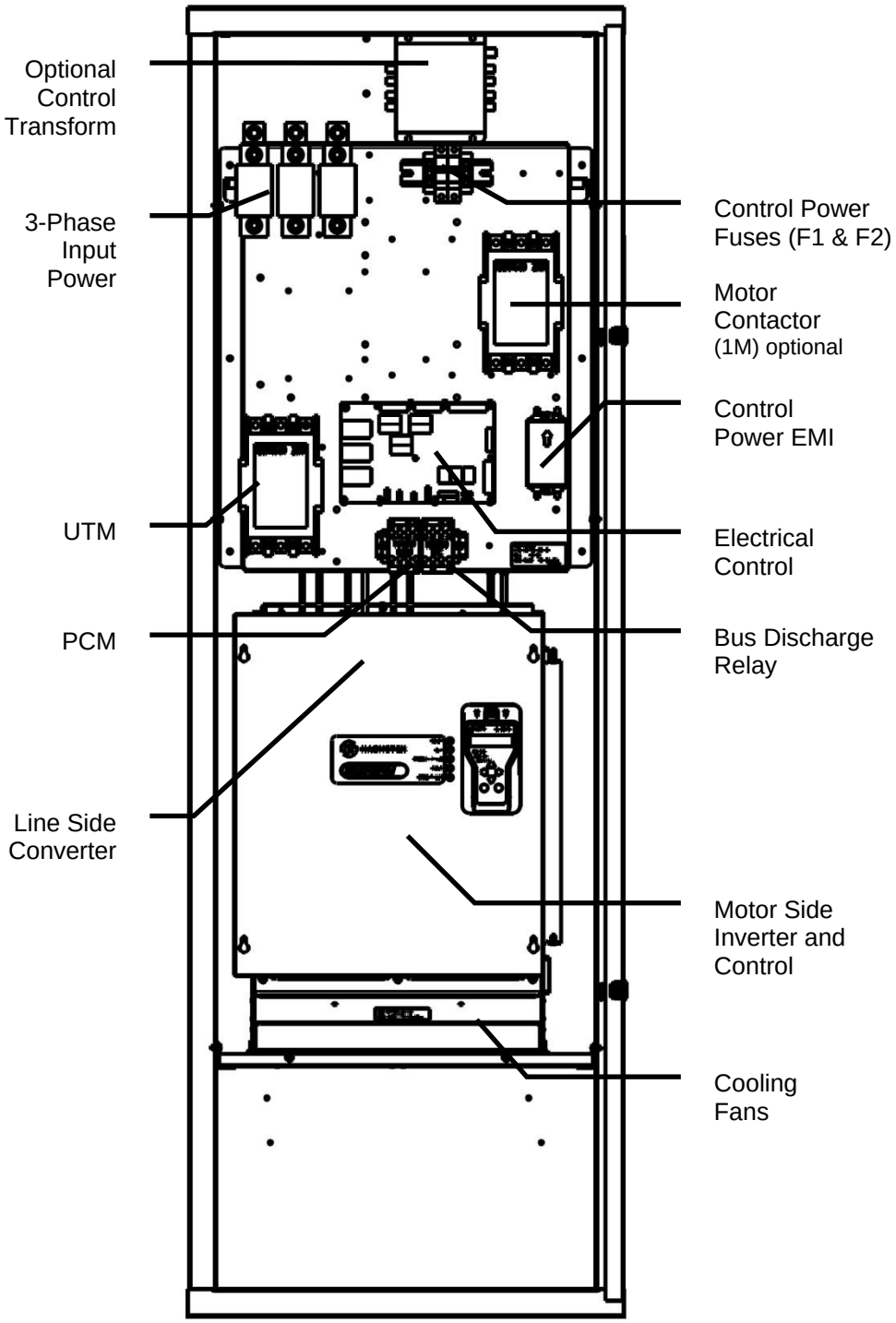


Figure 41: Component Locations in Front of Drive (Enclosed)

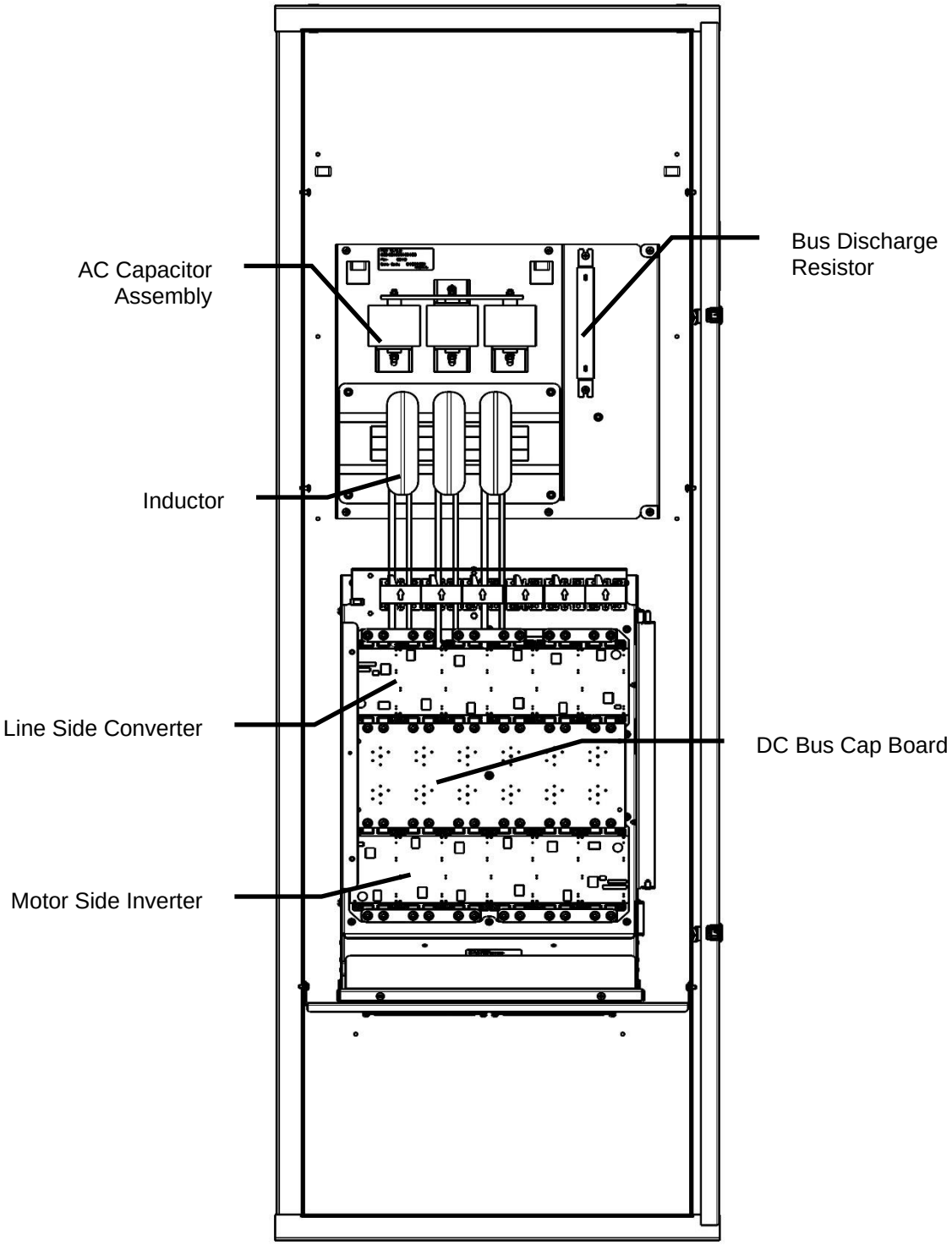


Figure 42: Component Locations with Front End Removed (Enclosed)

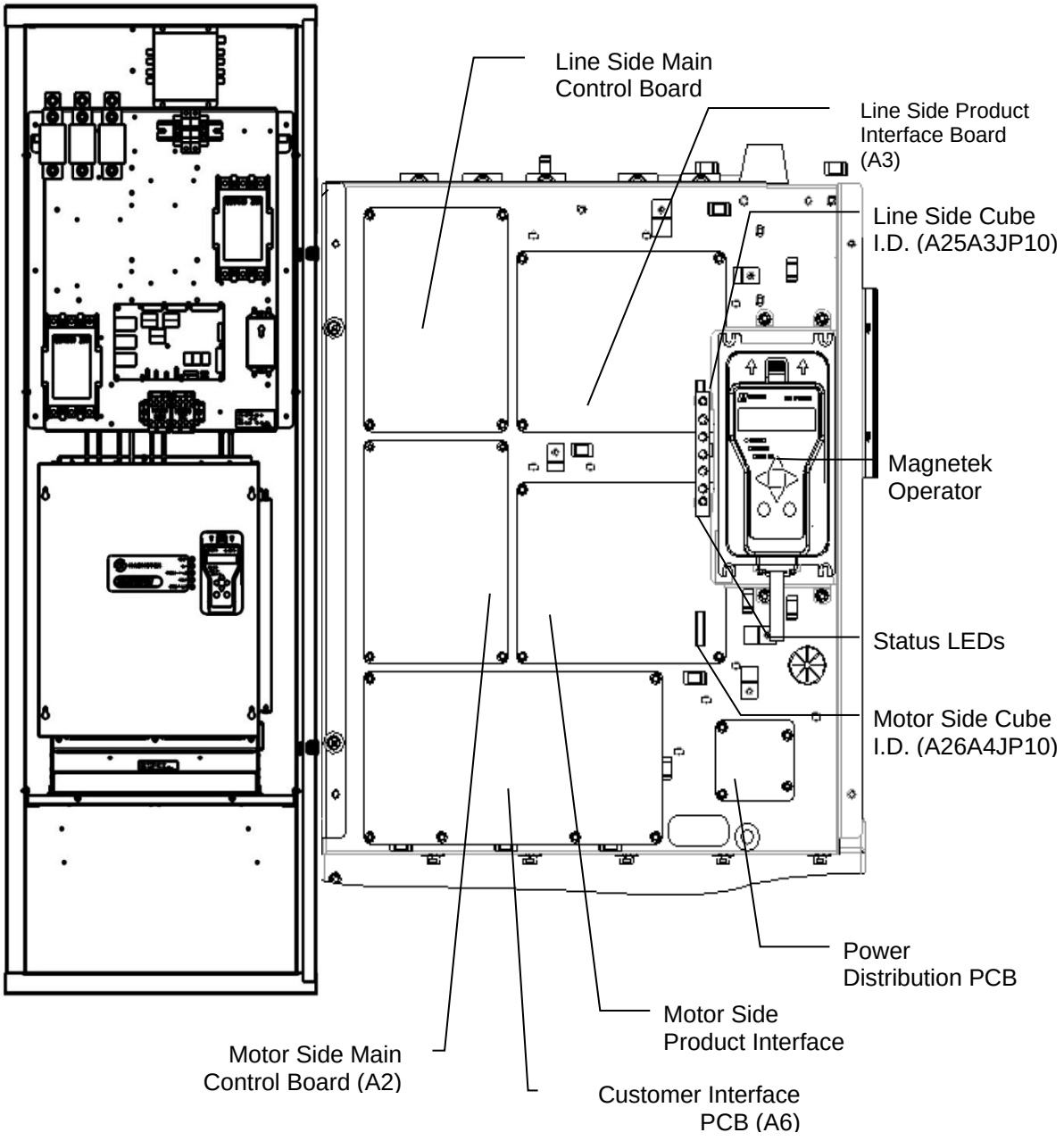


Figure 43: Circuit Board Locations (Enclosed)

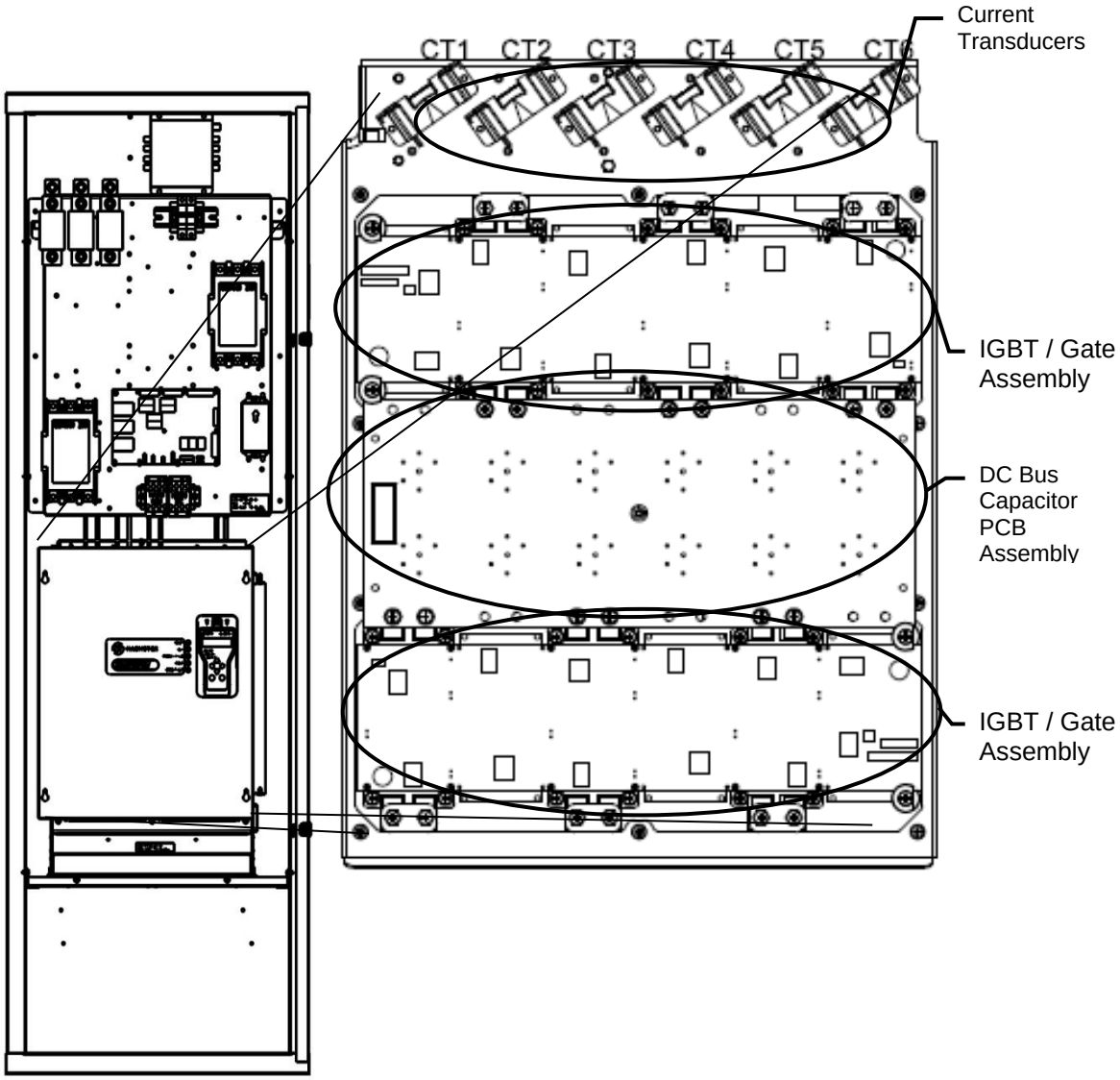


Figure 44: IGBT Heatsink Assembly (Enclosed)

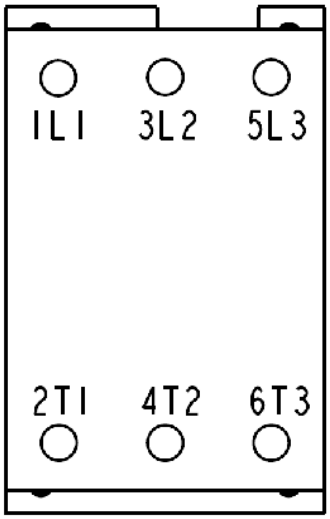


Figure 45: Motor Connections (All)

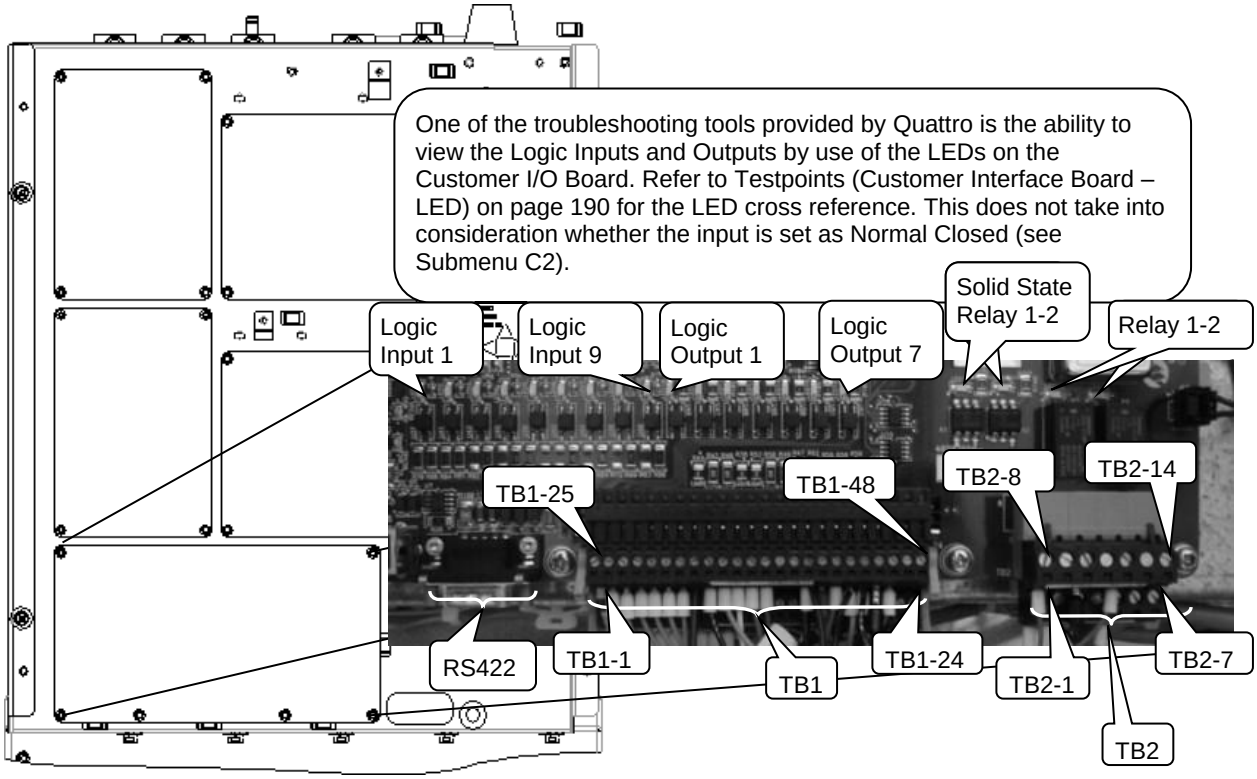


Figure 46: Customer Input / Output Connections (All)

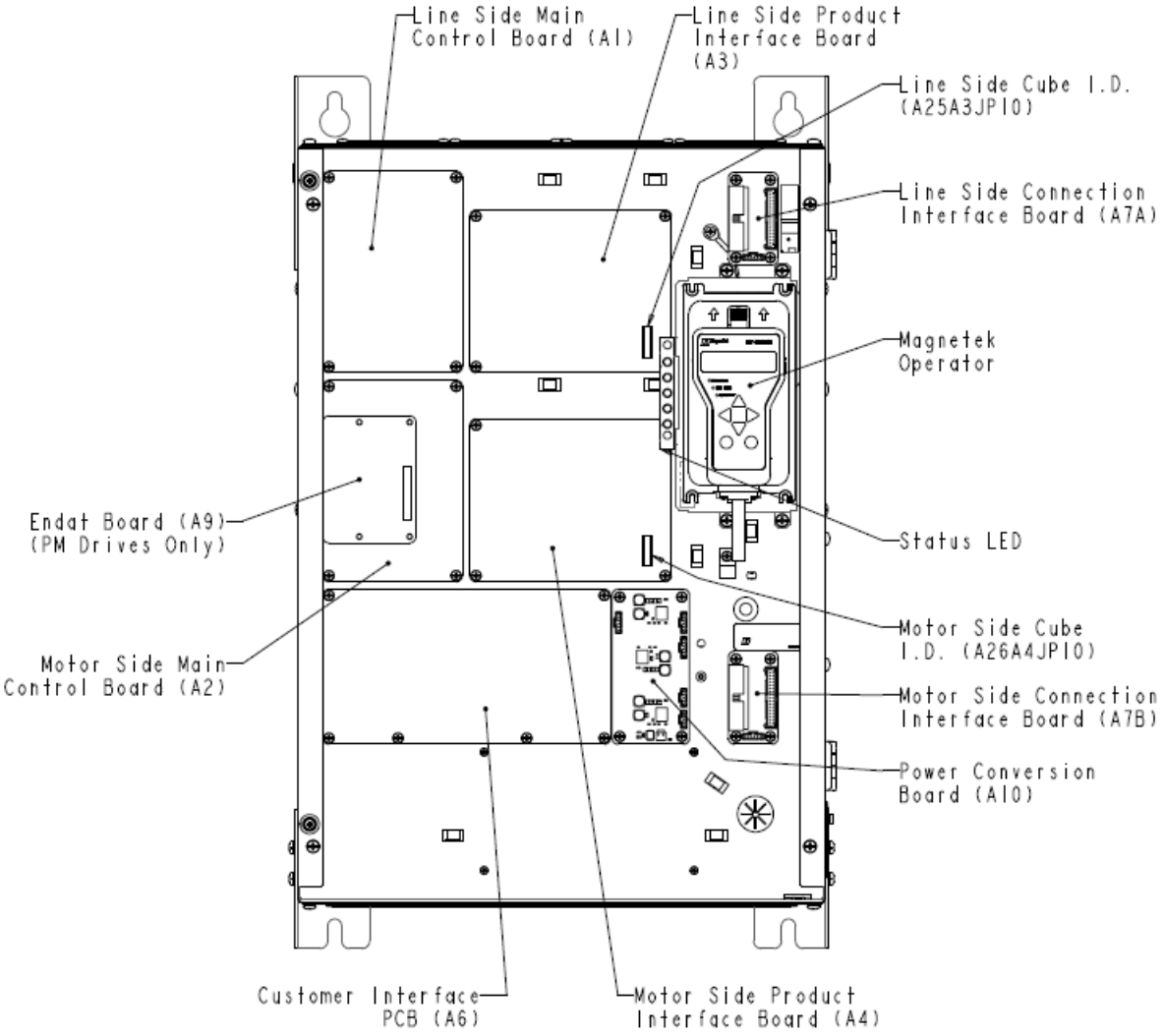


Figure 47: Circuit Board Locations (Cube)

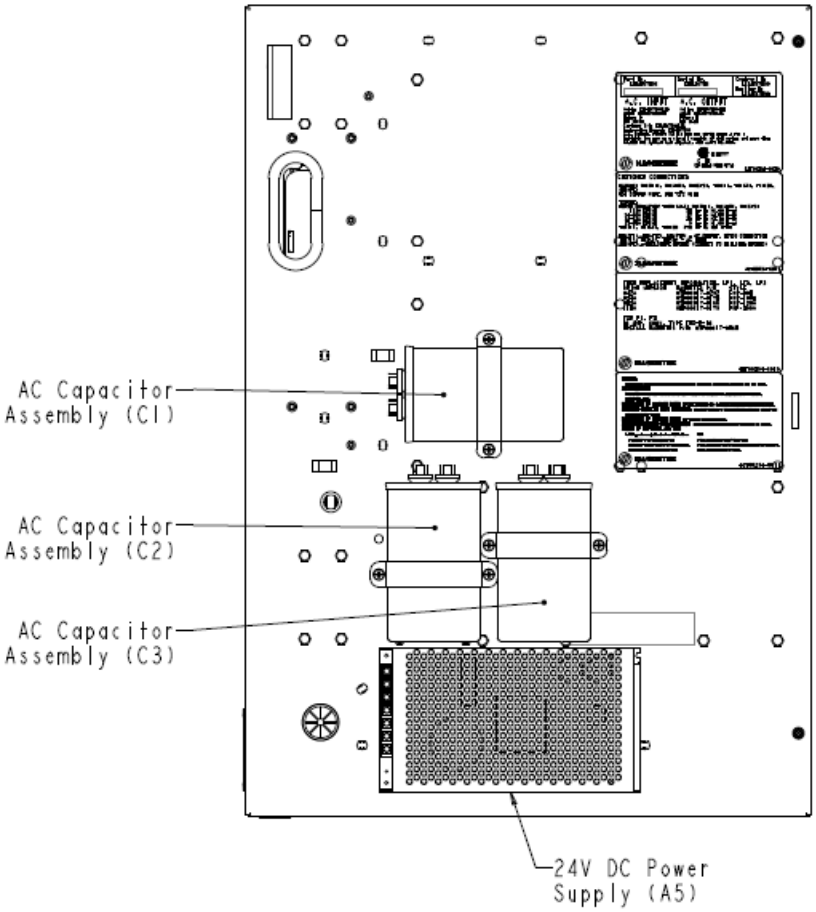


Figure 48: Power Supply Location (Cube)

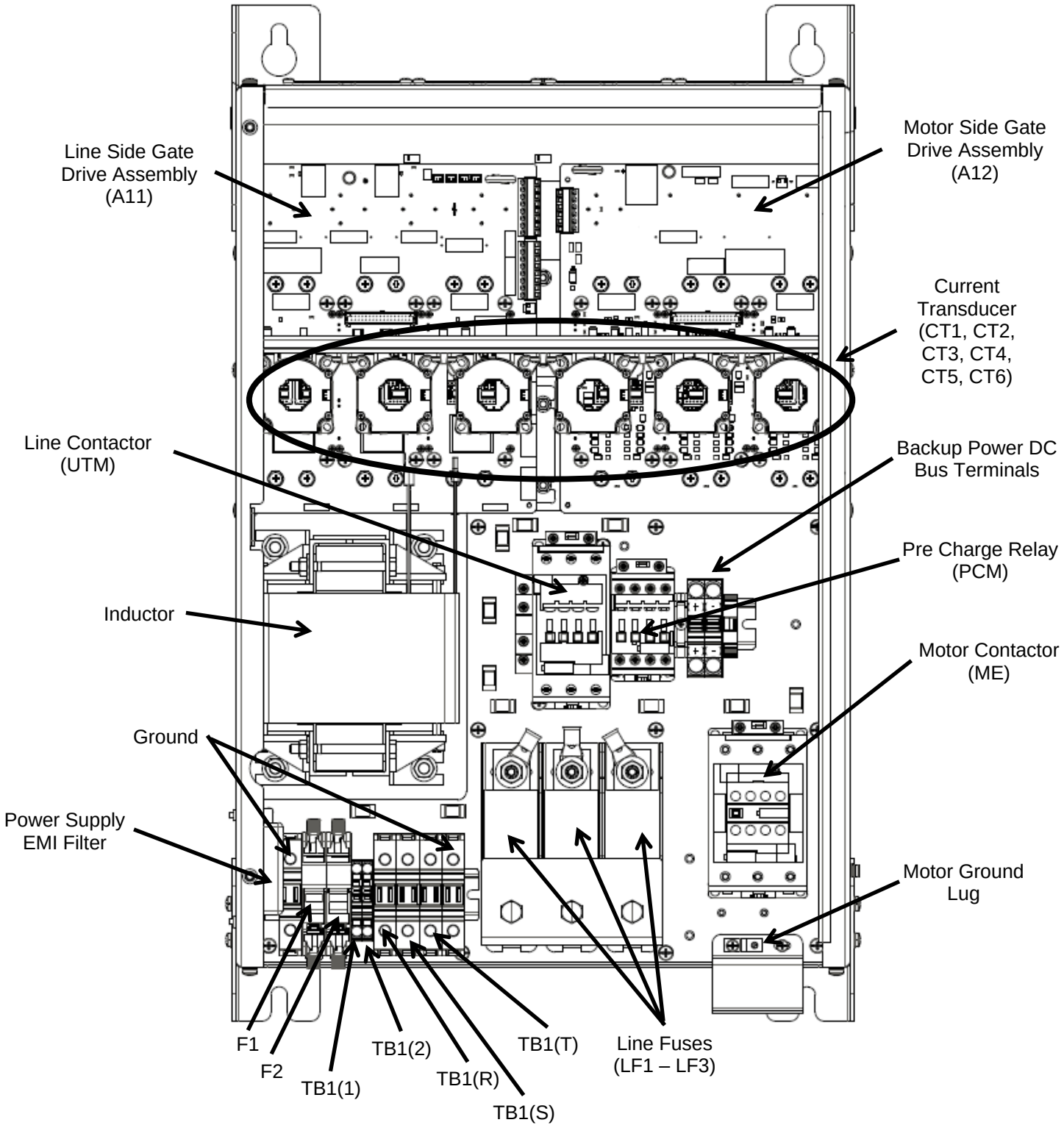
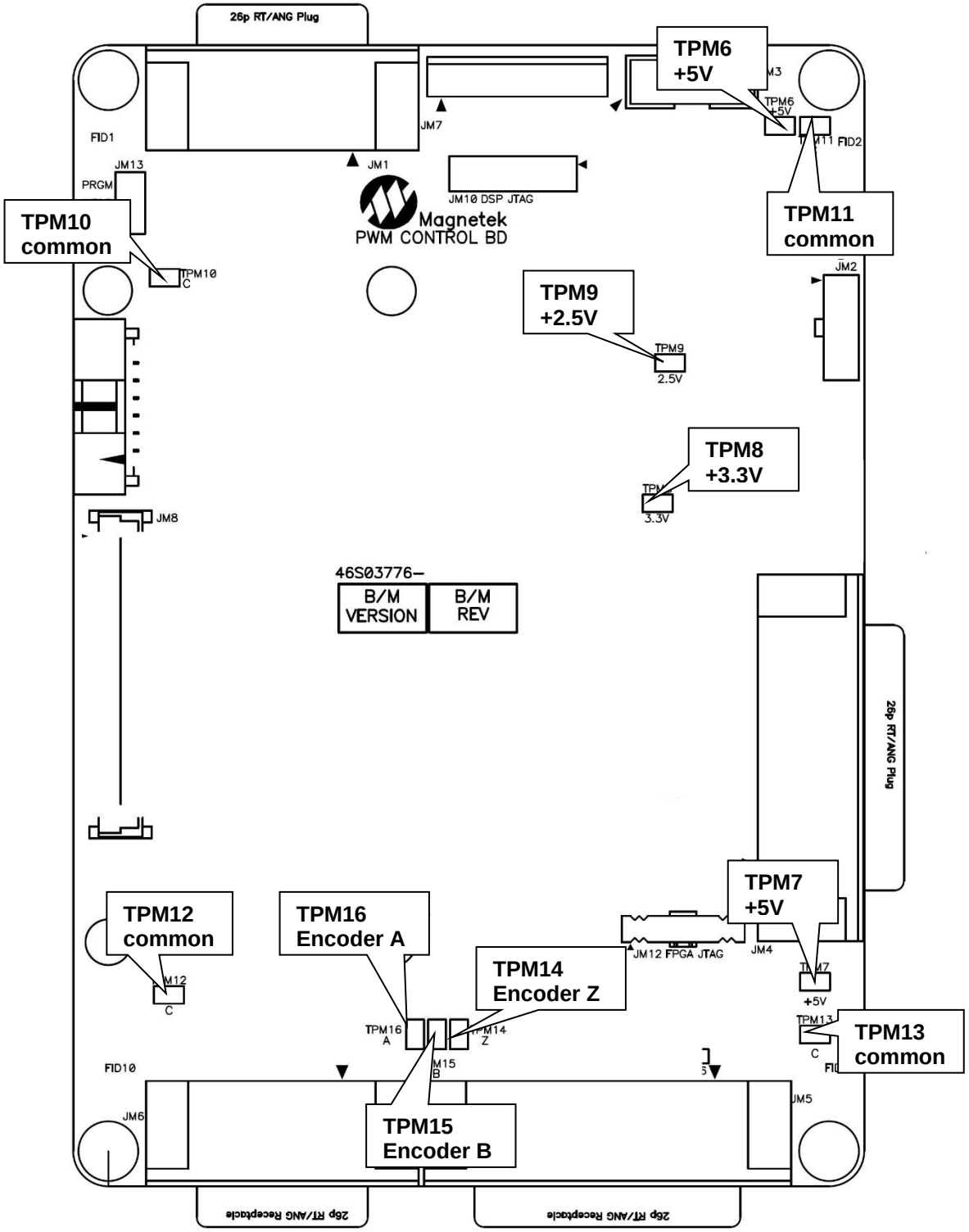


Figure 49: Circuit Board Locations (Cube)

Appendix

Testpoints (Main Control Board – Power Supplies)

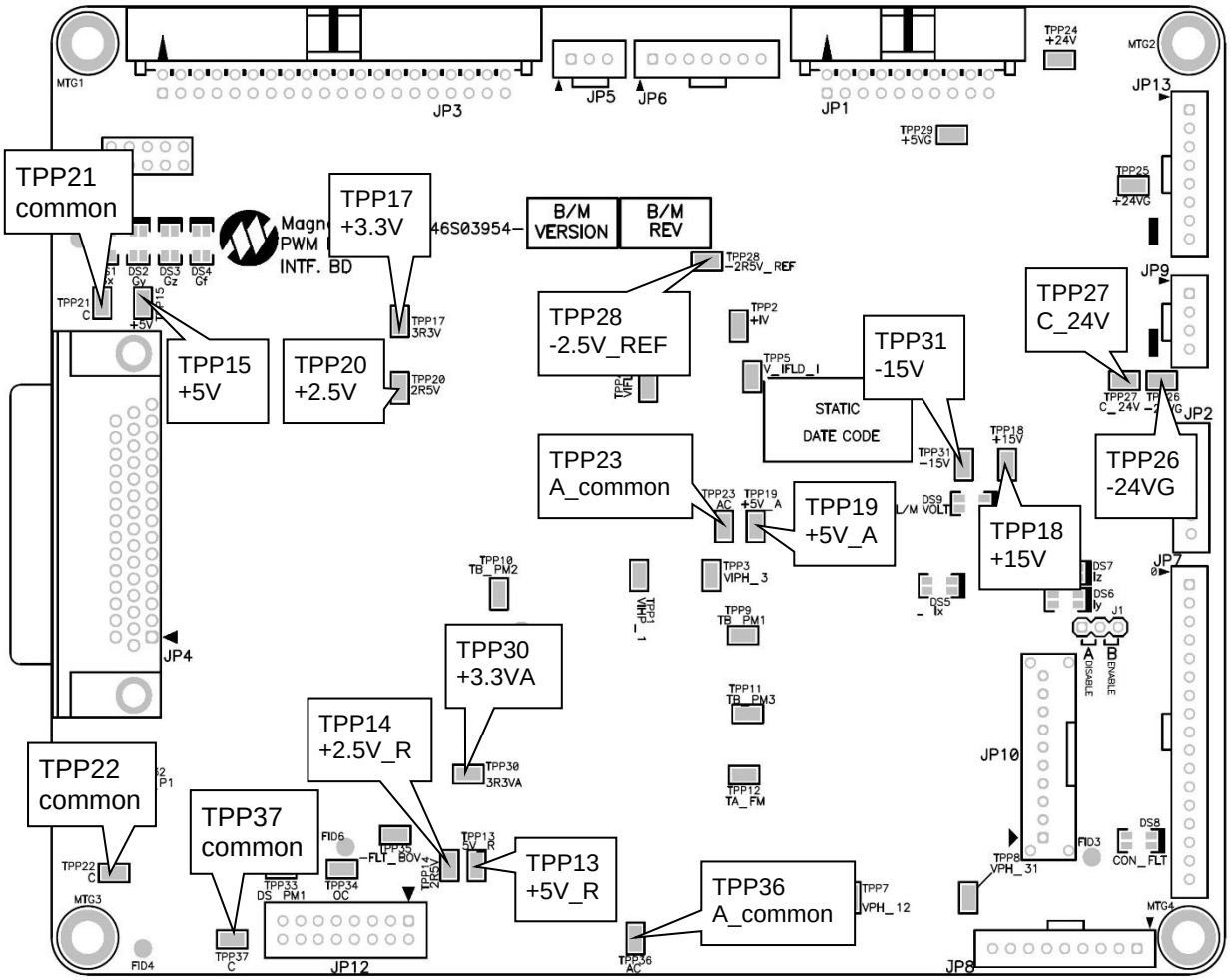
Part Number 46S03776-0030; Reference Designators A1 and A2



Appendix

Testpoints (Product Interface Board – Power Supplies)

Part Number 46S03954-0040; Reference Designators A3 and A4



Use TPP21 or TPP22 or TPP37 (common) as common for the following testpoints:
- **TPP15 (+5V)**
- **TPP17 (+3.3V)**
- **TPP20 (+2.5V)**

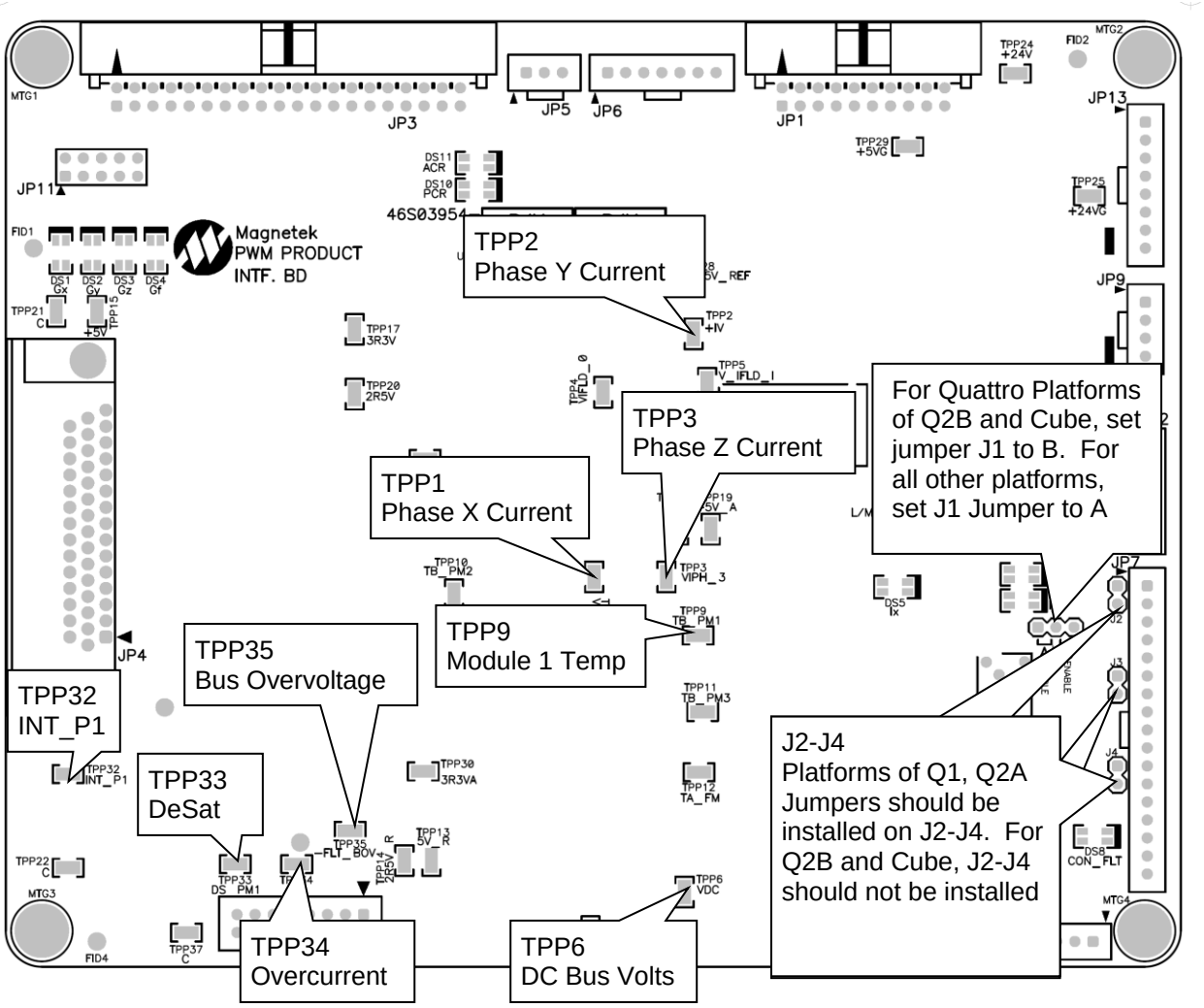
Use TPP23 or TPP36 (A_Common) as common for the following testpoints:
- **TPP13 (+5V_REF)**
- **TPP14 (+2.5V_REF)**
- **TPP18 (+15V)**
- **TPP19 (+5V_A)**
- **TPP28 (-2.5V_REF)**
- **TPP31 (-15V)**
- **TPP30 (+3.3VA)**

Use TPP27 (C_24V) as common for the following testpoints:
- **TPP24 (+24V)**

Appendix

Testpoints (Product Interface Board – Other)

Part Number 46S03954-0040; Reference Designators A3 and A4

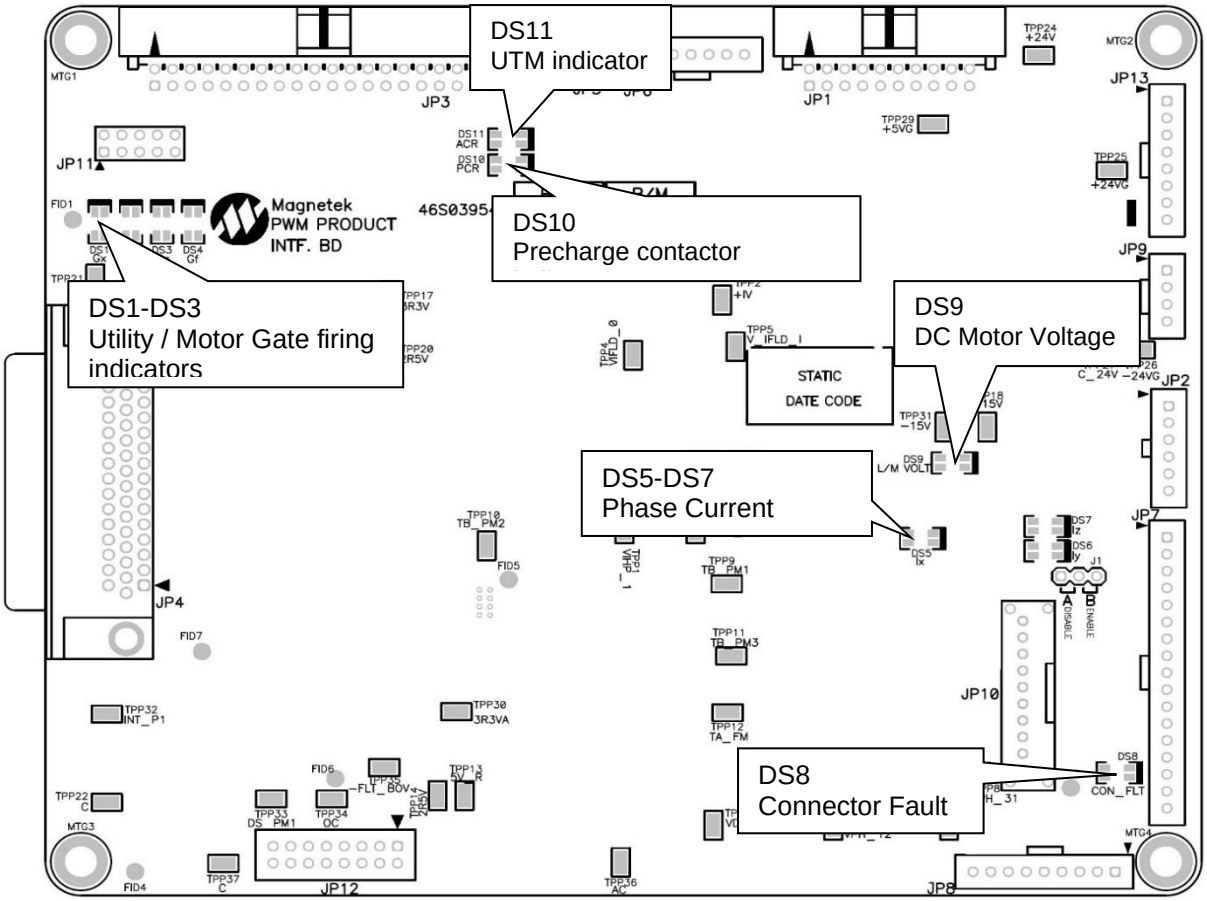


Appendix

Testpoints (Product Interface Board - LED definitions)

Part Number 46S03954-0040; Reference Designators A3 and A4

The PWM product interface board has added LEDs for easier troubleshooting. Although the LEDs have the same basic functionality on both the A3 and the A4, the referenced parts differ.

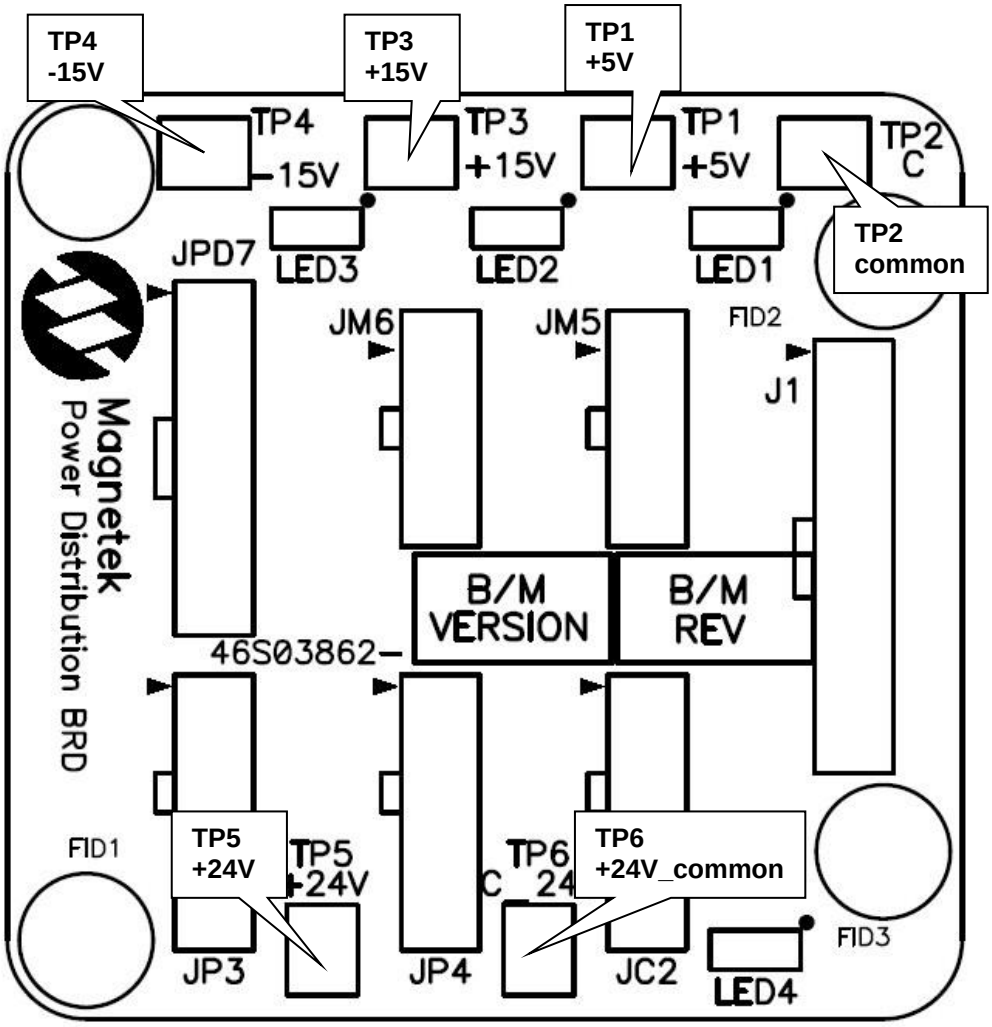


- DS1-DS3 will be Amber when the appropriate gates are firing. On the line side Product Interface Board, they refer to the line side IGBTs. On the motor side Product Interface Board, DS1-DS3 refer to the motor IGBTs.
- DS5-DS7 will be Amber in the line side PI Board when AC Current is flowing. Brightness is proportional to load power. On the motor side PI Board, DS7 indicates current flowing through CT6, DS6 indicates current flowing through CT5, and DS5 indicates current flowing through CT4. Red shows negative current and green shows positive current.
- DS8 will be red if any of the current sensor cables are disconnected. On the line side these include the following current transducers: CT1, CT2, and CT3. On the motor side these include the following current transducers: CT4, CT5, and CT6. This may also indicate JP7 is not properly connected (refer to Testpoints (Product Interface Board – Other) on page 182).
- DS9 on the line side PI board will be Amber when the 3-phase voltage is applied and sensed by the drive. DS9 on the motor side PI Board will be green when the motor voltage is in reverse mode and red in forward. Brightness is proportional to speed.
- DS10-DS11 are only used on the line side PI Board.

Appendix

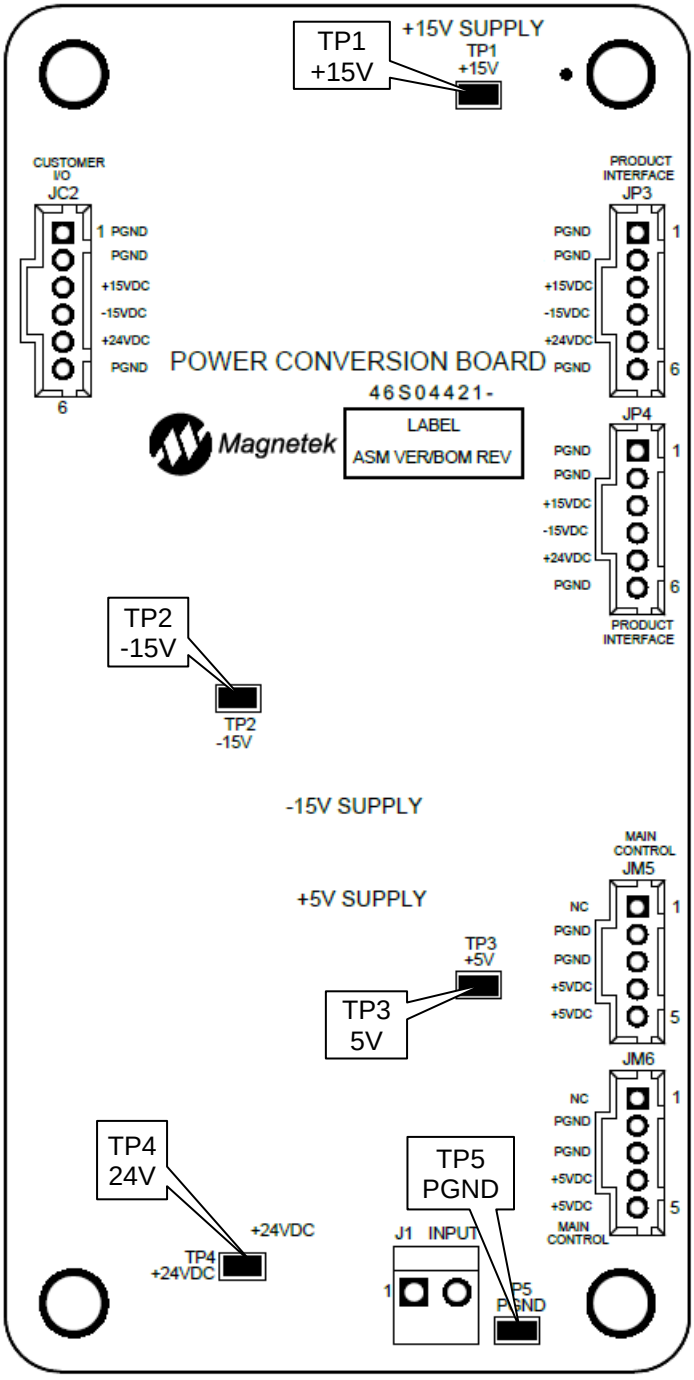
Testpoints (Power Distribution Board Enclosed – Power Supplies)

Part Number 46S03862-0010; Reference Designator A10 Enclosed only



Testpoints (Power Conversion Board Cube – Power Supplies)

Part Number 46S04421-0030; Cube Only

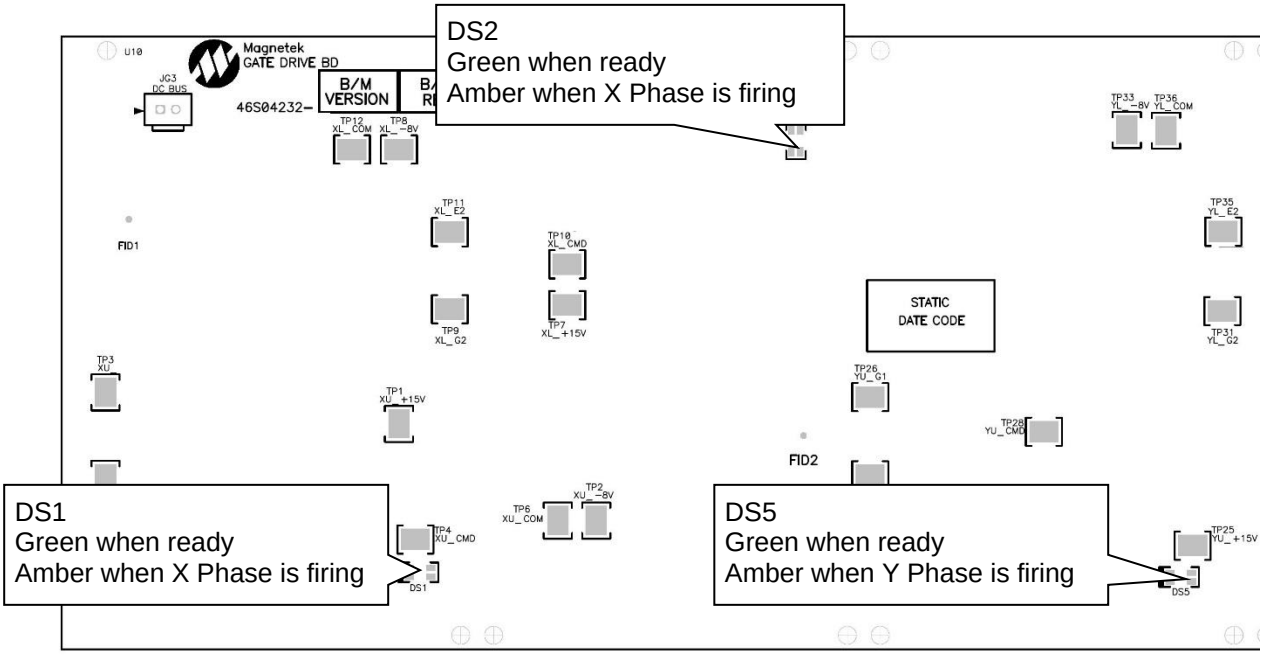


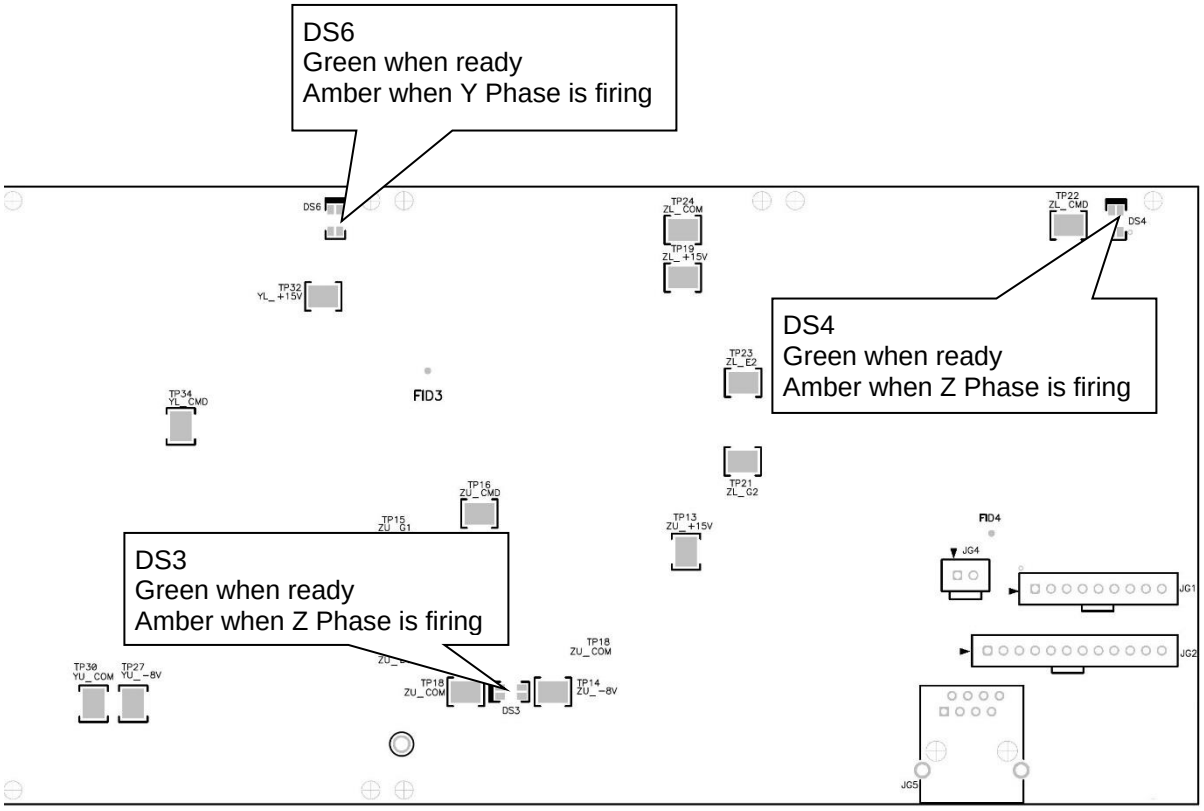
Appendix

Testpoints (Gate Drive Board Enclosed – LED definitions)

Part Number 46S04232-0010

The LEDs contained on the Gate Drive Board are for visual inspection only. This is for a secondary reference to the gate firing LEDs on the Product Interface Board (see page Testpoints (Product Interface Board - LED definitions) on page 183). *NOTE: The Amber color will vary depending on the frequency of the PWM signal.*

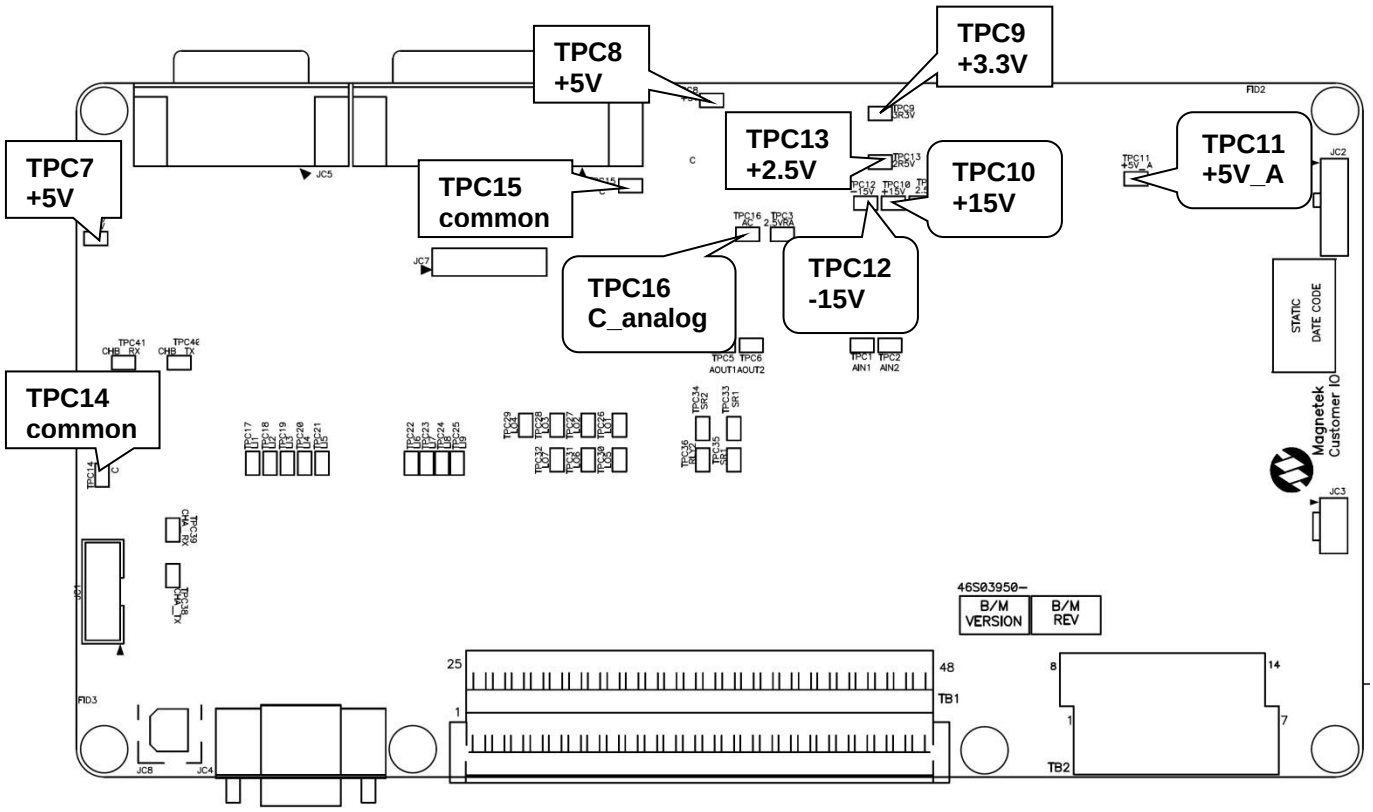



DS6
Green when ready
Amber when Y Phase is firing
DS4
Green when ready
Amber when Z Phase is firing
DS3
Green when ready
Amber when Z Phase is firing
DS6
TP24 ZL_COM
TP19 ZL_+15V
TP32 YL_+15V
TP22 ZL_CMD
DS4
TP23 ZL_E2
TP21 ZL_G2
FID3
TP34 YL_CMD
TP16 ZU_CMD
TP15 ZU_G1
TP13 ZU_+15V
FID4
JG4
JG1
JG2
JG5
TP18 ZU_COM
TP30 YU_COM
TP27 YU_-8V
TP18 ZU_COM
TP14 ZU_-8V
DS3

Appendix

Testpoints (Customer Interface Board – Power Supplies)

Part Number 46S03950-0010; Reference Designator A6



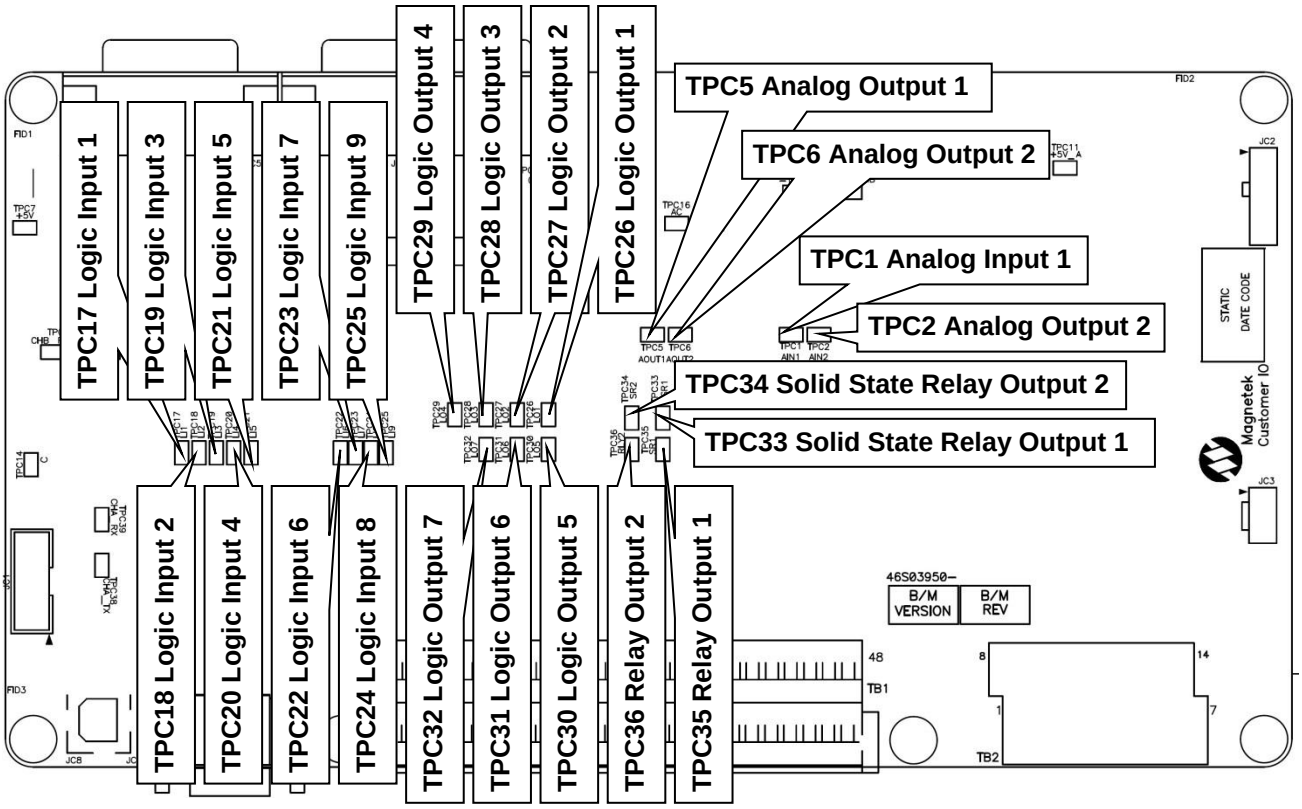
Use TPC14 or TPC15 (common) as common for the following testpoints:
- TPC7 (+5V)
- TPC8 (+5V)
- TPC9 (+3.3V)
- TPC13 (+2.5V)

Use TPC16 (C_analog) as common for the following testpoints:
- TPC10 (+15V)
- TPC11 (+5V_A)
- TPC12 (-15V)

Appendix

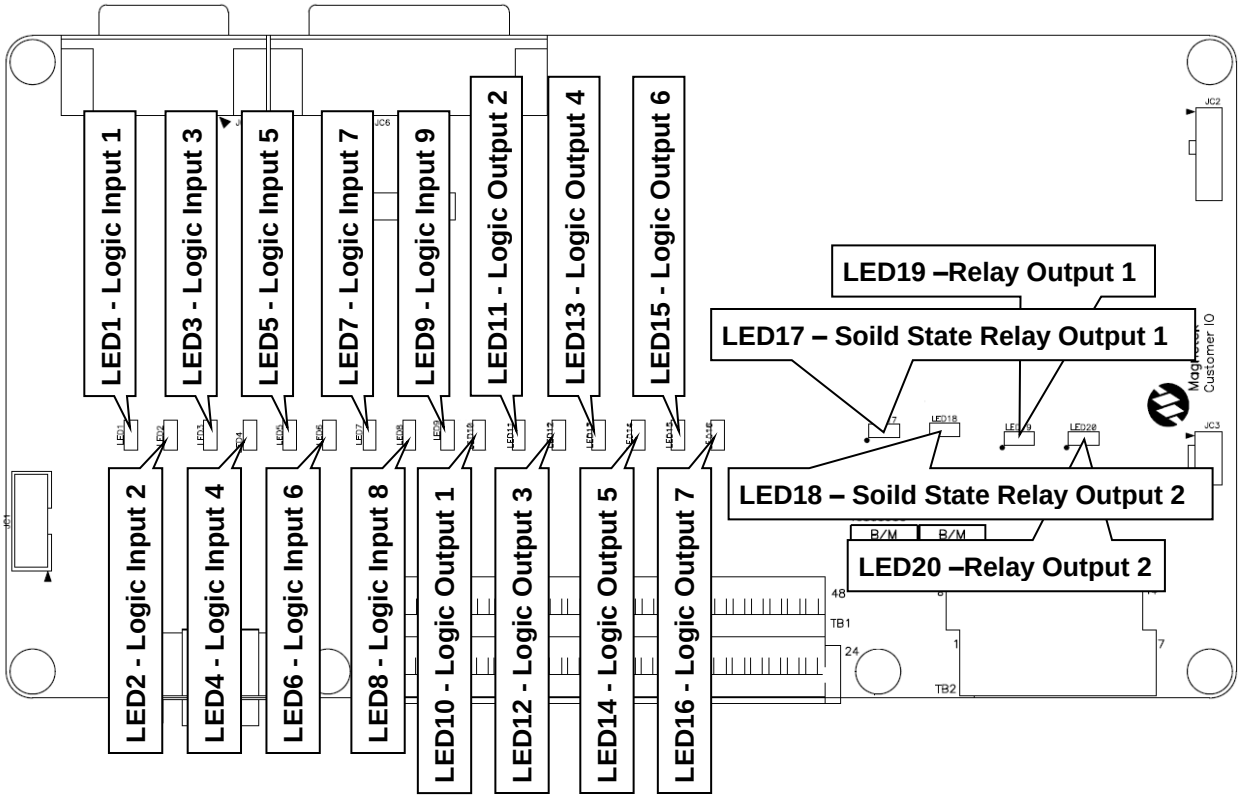
Testpoints (Customer Interface Board – Other)

Part Number 46S03950-0010; Reference Designator A6



Testpoints (Customer Interface Board – LED)

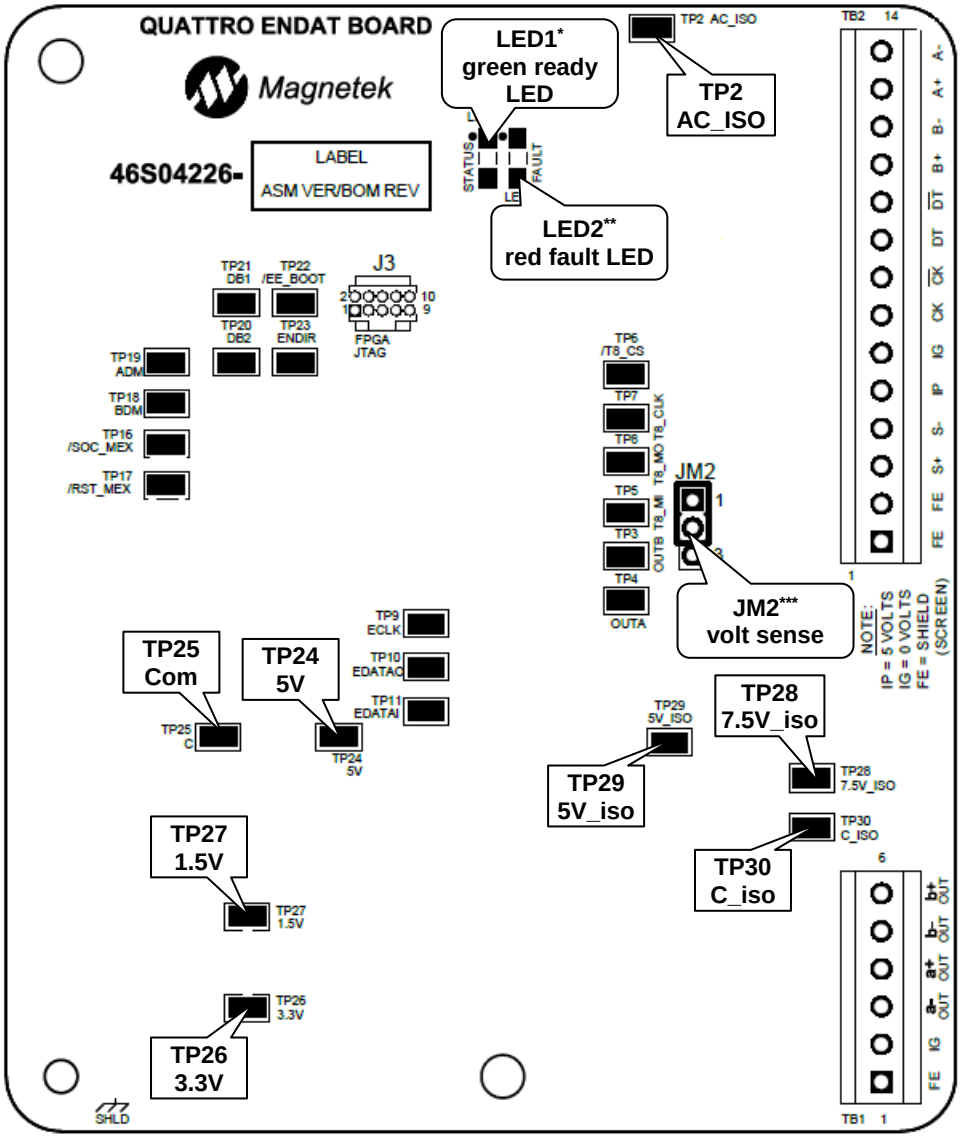
Part Number 46S03950-0010; Reference Designator A6



- LEDs on the Customer Interface Board turns on/off depending on the state of the drive I/O.

Testpoints (EnDat Optional Board – Other)

Part Number 46S04226-0100; Reference Designator A9



- *the LED will luminate green when the board is powered up
- **the LED will luminate red when the EnDat board is not communicating with the encoder or JM2 is set to pins 2 and 3 but the S+ and S- are not used.
- ***the voltage sense feature will be disabled if jumper is in pins 1 and 2 (default). It is recommended that the volt sense be enabled when encoder cable exceeds 15m (50ft). The encoder sense wires needs to be landed on S+ and S- and the jumper should be placed on pins 2 and 3 on JM2.

  NOTE: 100m (325ft) is the maximum encoder length. Refer to Table 22 on page 142 for encoder wiring.

Appendix

Input Voltage Requirements

The voltage required on the Quattro's 3 phase input terminals should be greater than or equal to rated motor voltage. If an increase in voltage is required, then refer to Table 24 to select the correct transformer for the AC cube Version. These are NEMA 1 enclosed transformers and will accommodate a primary line voltage of 208 / 240V and 480V on the secondary. The enclosed version drive has built in auto transformers available, the options are shown on page 7.

Primary Voltage	Secondary Voltage	Quattro Cube Models	kVA	Transformer Part Number
$208V_{AC}$ / $240V_{AC}$	$480V_{AC}$	QAC028	30	05P00058-1447
		QAC034		
		QAC042	45	05P00058-1448
		QAC054		
		QAC068	70	05P00058-1449
		QAC085		

Table 24: Cube Auto Transformer

Appendix

Quattro Cube PM Winding Shorting Contactor (ME2)

The following is a guideline for installing a second motor contactor on the Quattro Cube to short the windings in a PM motor for back EMF braking. NOTE: the second contactor will be outside the drive.

The second motor contactor (shown as ME2) should at least be a 2-pole normally-closed contactor. It should be wired such that all three motor windings are shorted through ME2 when ME2 is not energized and the drive stops feeding voltage to the coil of ME.

To ensure that both ME and ME2 pick and drop at the same time, the coils of both contactors should be wired in parallel. As a redundancy check, the drive always verifies that the auxillary of ME opens to confirm that ME picked. A normally-closed auxillary of ME2 needs to be wired in parallel into this redundancy check to ensure that both contactors are picked. To do this, one end of the normally-closed auxillary off ME2 has to be terminated at 32 on ME and the other end of the same normally-closed auxiliary needs to be terminated on 31 on ME.

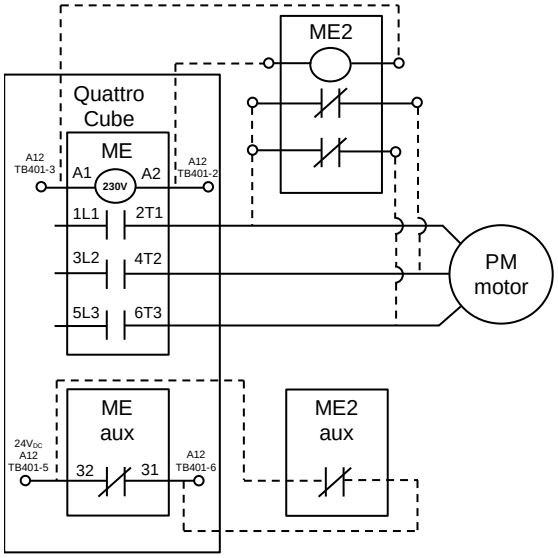
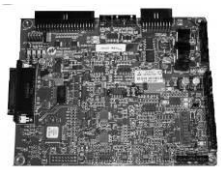
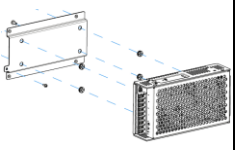
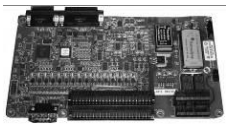
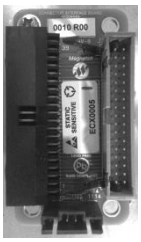
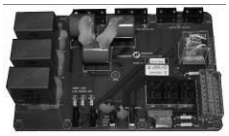
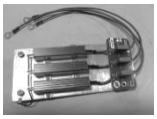
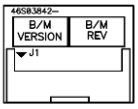
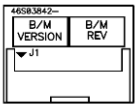
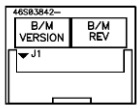
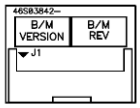
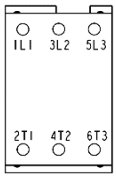
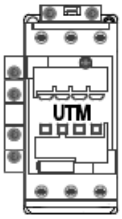
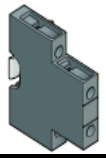
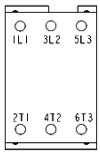


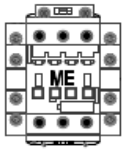
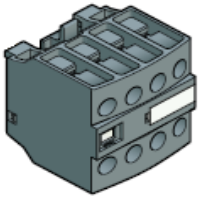
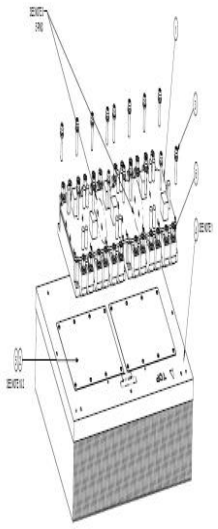
Figure 50: Cube ME2 Installation Diagram

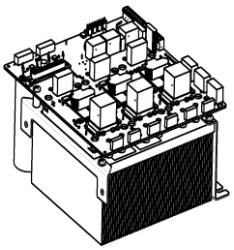
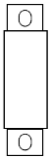
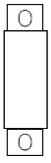
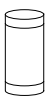
Appendix
Spare Parts Quattro AC/PM Drive

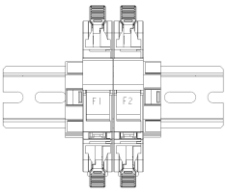
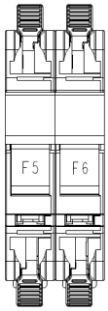
Description	Pictorial Reference	Drive Rating	Reference Designator	Magnetek kit Number	Quantity Kit Per Drive
Main Control Board (Line Side) Controls Line Side power conversion		ALL	A1	LA46S03776-4110	1
Main Control Board (Motor Side) Controls Motor Side Conversion		ALL (PM ONLY)	A2	LA46S03776-3110	1
		ALL (IM ONLY)		LA46S03776-3210	
Product Interface Board Kit Includes: • Qty 1 PCB Converts signals from the respective main control boards to drive hardware *NOTE: these PCBs are interchangeable except for the cube IDs* *NOTE: no cube ID will be sent with kit*		ALL	A3, A4	LA46S03954-0030	2
Power Supply Provides low voltage control power		ALL ENCLOSED	A5	LA05P00090-0668	1
		ALL CUBE		LA05P00090-0910	1
Old Power Supply Kit Kit to retrofit the new power supply with the old power supply (PN 05P00090-0881) 05P00090-0881 below 		ALL CUBE with the older power supply mounting holes	A5	LA46S04498-0010	1
Customer Interface PCB Contains customer inputs and outputs		ALL	A6	LA46S03950-0010	1

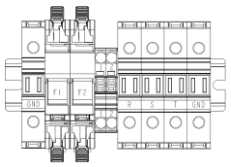
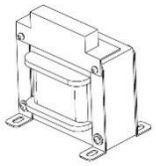
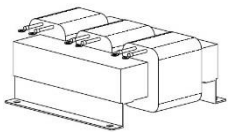
Description	Pictorial Reference	Drive Rating	Reference Designator	Magnetek kit Number	Quantity Kit Per Drive
Connection Interface Board [for Cube only] Kit Includes: • Qty 1 board Connects the product interface board and the gate driver board via the different connector styles.		ALL CUBE	A7A, A7B	LA46S04449-0010	2
Electrical Control Board [for Enclosed only] Contains line and motor sense and Pre-charge control relay logic		ALL ENCLOSED	A8	LA46S04174-0010	1
EnDat Encoder Card Interface between Heidenhain EnDat Encoder and Magnetek Drive		ALL (PM ONLY)	A9	LA46S04226-0100	1
Power Distribution PCB [for Enclosed only] Distributes voltage from the Power Supply (A5)		ALL ENCLOSED	A10	LA46S03862-0010	1
Power Conversion Board [for Cube only] Converts 24VDC from power supply to +15VDC, -15VDC, and 5VDC. Also distributes voltage to the control circuits.		ALL CUBE	A10	LA46S04421-0030	1
DC Bus Cap Board [for Enclosed only] DC Bus Capacitors		ALL ENCLOSED	A17	LA46S04259-0010	1
Filter Board [for Enclosed only] Filter for reduction of RFI/EMI to and from the drive and the line utility		ALL ENCLOSED	A23	LA46S04431-0020	1
Cube ID PCB (Line Side) [for Enclosed style only] Defines size of drive and gives the Product Interface Board (A3) its identification. *NOTE: These will only work with the LF Series transducers*.		85A ENCLOSED	A25	LA46S04187-2550	1
		115A ENCLOSED		LA46S04187-2570	1
		140A ENCLOSED		LA46S04187-2670	1
		170A ENCLOSED		LA46S04187-2730	1
Cube ID PCB (Motor Side) [for Enclosed style only] Defines size of drive and gives the Product Interface Board (A4) its identification. *NOTE: These will only work with the LF Series transducers*.		85A ENCLOSED	A26	LA46S04187-2560	1
		115A ENCLOSED		LA46S04187-2580	1
		140A ENCLOSED		LA46S04187-2680	1
		170A ENCLOSED		LA46S04187-2740	1

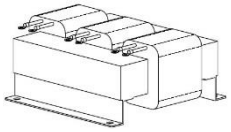
Description	Pictorial Reference	Drive Rating	Reference Designator	Magnetek kit Number	Quantity Kit Per Drive
Cube ID PCB (Line Side) **[for Cube style only]** Defines size of drive and gives the Product Interface Board (A3) its identification. *NOTE: These will only work with the LF Series transducers*.		28A CUBE	A25	LA46S04187-4591	1
		34A CUBE		LA46S04187-4601	1
		42A CUBE		LA46S04187-4611	1
		54A CUBE		LA46S04187-4621	1
		68A CUBE		LA46S04187-4631	1
		85A CUBE		LA46S04187-4641	1
Cube ID PCB (Motor Side) **[for Cube style only]** Defines size of drive and gives the Product Interface Board (A4) its identification. *NOTE: These will only work with the LF Series transducers.*		28A CUBE	A26	LA46S04187-4590	1
		34A CUBE		LA46S04187-4600	1
		42A CUBE		LA46S04187-4610	1
		54A CUBE		LA46S04187-4620	1
		68A CUBE		LA46S04187-4630	1
		85A CUBE		LA46S04187-4640	1
Precharge Relay Pre-charge relay		ALL	PCM	LA05P00032-0163	1
Line Contactor **[for Enclosed only]** 230V_{AC} Control Power Line Contactor (UTM)		85A ENCLOSED	UTM	LA05P00032-0201	1
		115A ENCLOSED		LA05P00032-0201	1
		140A ENCLOSED		LA05P00032-0201	1
		170A ENCLOSED		LA05P00032-0202	1
Line Side Contactor **[for Cube only]** Kit Includes: • Contactor • QTY 1 05P00032-0233 auxillary relay 230V_{AC} Control Power Line Contactor (UTM)		28A CUBE	UTM	CUBE-UTM-0230	1
		34A CUBE		CUBE-UTM-0229	1
		42A CUBE		CUBE-UTM-0229	1
		54A CUBE		CUBE-UTM-0228	1
		68A CUBE		CUBE-UTM-0228	1
		85A CUBE		CUBE-UTM-0228	1
Line Contactor Auxilary **[for Cube only]** Side mount auxilary relay for the input line contactor (UTM)		ALL CUBE	-	LA05P00032-0233	1
Motor Contactor **[for Enclosed only]** Motor Contactor (ME)		85A ENCLOSED	ME	LA05P00032-0201	1
		115A ENCLOSED		LA05P00032-0201	1
		140A ENCLOSED		LA05P00032-0201	1
		170A ENCLOSED		LA05P00032-0202	1

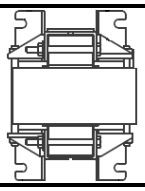
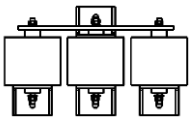
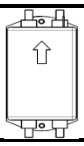
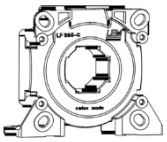
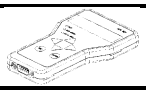
Description	Pictorial Reference	Drive Rating	Reference Designator	Magnetek kit Number	Quantity Kit Per Drive
Motor Side Contactor [for Cube only] Motor Contactor (ME) Kit Includes: • QTY 1 Contactor • QTY 1 05P00032-0234 auxilary block		28A CUBE	ME	CUBE-ME-0229	1
		34A CUBE		CUBE-ME-0228	1
		42A CUBE		CUBE-ME-0228	1
		54A CUBE		CUBE-ME-0228	1
		68A CUBE		CUBE-ME-0227	1
		85A CUBE		CUBE-ME-0227	1
Motor Side Contactor Auxilary [for Cube only] Front mount auxilary block for the output contactor/motor contactor (ME)		ALL CUBE	-	LA05P00032-0234	1
IGBT Assembly only [for Enclosed only] Kit Includes: • gate driver board with IGBT soldered on • miscellaneous hardware • harness • thermal coumpound • The kit will contain instruction and tools to change just the IGBT and re-install back onto the heatsink. *NOTE: This kit **does not** include the heatsink; it is shown for illustration purposes only.*		85A ENCLOSED	Line side	LA46S04256-7085	1
			Motor side	LA46S04256-8085	1
		115A ENCLOSED	Line side	LA46S04256-7115	1
			Motor side	LA46S04256-8115	1
		140A ENCLOSED	Line side	LA46S04256-7140	1
			Motor side	LA46S04256-8140	1
		170A ENCLOSED	Line side	LA46S04256-7170	1
			Motor side	LA46S04256-8170	1

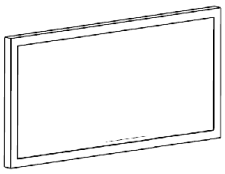
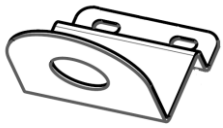
Description	Pictorial Reference	Drive Rating	Reference Designator	Magnetek kit Number	Quantity Kit Per Drive
Gate Drive Assembly [for Cube only] Kit Includes: • IGBT and gate power board with bus caps • miscelaeous hardware • thermal compound • joint al-z *NOTE: This kit **does not** include the heatsink or bracket; it is shown for illustration purposes only.*		28A CUBE	A11 (Line Side)	LA46S04442-0042	1
			A12 (Motor Side)	LA46S04443-0028	1
		34A CUBE	A11 (Line Side)	LA46S04442-0042	1
			A12 (Motor Side)	LA46S04443-0028	1
		42A CUBE	A11 (Line Side)	LA46S04442-0042	1
			A12 (Motor Side)	LA46S04443-0042	1
		54A CUBE	A11 (Line Side)	LA46S04442-0042	1
			A12 (Motor Side)	LA46S04443-0068	1
		68A CUBE	A11 (Line Side)	LA46S04442-0042	1
			A12 (Motor Side)	LA46S04443-0115	1
		85A CUBE	A11 (Line Side)	LA46S04442-0068	1
			A12 (Motor Side)	LA46S04443-0115	1
AC Input Fuses [for Enclosed only] Kit Includes: • Qty 3 fuses Replacement fuses for the AC input to the drive		85A ENCLOSED	LF1, LF2, LF3	ENC-FUSE-085	1
		115A ENCLOSED		ENC-FUSE-115	1
		140A ENCLOSED		ENC-FUSE-140	1
		170A ENCLOSED		ENC-FUSE-170	1
AC Input Fuses [for Cube only] Kit Includes: • Qty 3 fuses Replacement fuses for the AC input to the drive		28A CUBE	LF1, LF2, LF3	CUBE-FUSE-028	1
		34A CUBE		CUBE-FUSE-034	1
		42A CUBE		CUBE-FUSE-042	1
		54A CUBE		CUBE-FUSE-054	1
		68A CUBE		CUBE-FUSE-068	1
		85A CUBE		CUBE-FUSE-085	1
Control Fuses 230V_{AC} Control Power Fuses Kit Includes: • Qty 2 fuses		ALL	F1, F2	LA05P00017-0360	1

Description	Pictorial Reference	Drive Rating	Reference Designator	Magnetek kit Number	Quantity Kit Per Drive
Control Fuse Blocks [for Enclosed only] $230V_{AC}$ Control Power Fuse Block Assemby Kit Includes: • Qty 2 fuse blocks • Qty 2 fuses • DIN rail • Qty 2 end stops		ALL ENCLOSED	F1, F2	LA46S04415-0030	1
Control Transformer Fuses [for Enclosed only] Kit Includes: • Qty 2 fuses Fuses to fuse the primiary side of the control transformer		**Input L-L**	-	-	-
		ALL $208V_{AC}$ ENCLOSED	F5, F6	LA05P00017-0584	1
		ALL $230V_{AC}$ ENCLOSED		LA05P00017-0361	1
		ALL $240V_{AC}$ ENCLOSED		LA05P00017-0361	1
		ALL $416V_{AC}$ ENCLOSED		LA05P00017-0379	1
		ALL $460V_{AC}$ ENCLOSED		LA05P00017-0379	1
		ALL $480V_{AC}$ ENCLOSED		LA05P00017-0379	1
		ALL $550V_{AC}$ ENCLOSED		LA05P00017-0358	1
		ALL $575V_{AC}$ ENCLOSED		LA05P00017-0358	1
		ALL $600V_{AC}$ ENCLOSED		LA05P00017-0358	1
Control Transformer Fuse Blocks [for Enclosed only] Fuse blocks that holds the fuse for the primary side of the control transformer Kit Includes: • Qty 2 fuse blocks **NOTE**: fuses NOT included		ALL ENCLOSED	F5, F6	LA46S04415-0040	1
DC Bus terminals Includes terminal and wiring, required with alternate power mode.		27-54A	-, +	CUBE-DCBUS-054A	1
		68-85A		CUBE-DCBUS-085A	1

Description	Pictorial Reference	Drive Rating	Reference Designator	Magnetek kit Number	Quantity Kit Per Drive
Input Terminal Assembly [for Cube only] Input din rail assembly for input terminals Kit Includes: • Qty 2 fuse blocks • Qty 7 terminals • Qty 2 fuses • DIN rail		ALL CUBE	F1, F2, TB1(1), TB1(2), TB1(R), TB1(S), TB1(T), GND	LA46S04415-0200	1
Control Transformer [for Enclosed only] Optional transformer providing 230V_{AC} control power. Selectable input voltage of 208V, 230V, 240V, 416V, 460V, 480V, 550V, 575V, or 600V		ALL ENCLOSED	-	LA05P00058-1436	1
Auto Transformer (480:380) [for Enclosed only] Optional Transformer input to drive. 480V_{AC} primary, 380V_{AC} secondary, 60Hz.		85A ENCLOSED	-	LA46S04263-1100	1
		115A ENCLOSED	-	LA46S04263-1110	1
		140A ENCLOSED	-	LA46S04263-1120	1
		170A ENCLOSED	-	LA46S04263-1130	1
Auto Transformer (575:380) [for Enclosed only] Optional Transformer input to drive. 575V_{AC} primary, 380V_{AC} secondary, 60Hz.		85A ENCLOSED	-	LA46S04263-1101	1
		115A ENCLOSED	-	LA46S04263-1111	1
		140A ENCLOSED	-	LA46S04263-1121	1
		170A ENCLOSED	-	LA46S04263-1131	1
Auto Transformer (208/240:380) [for Enclosed only] Optional Transformer input to drive. 208/240V_{AC} primary, 380V_{AC} secondary, 60Hz.		85A ENCLOSED	-	LA46S04263-1103	1
		115A ENCLOSED	-	LA46S04263-1113	1
		140A ENCLOSED	-	LA46S04263-1123	1
		170A ENCLOSED	-	LA46S04263-1133	1
Auto Transformer (208/240:480) [for Enclosed only] Optional Transformer input to drive. 208/240V_{AC} primary, 480V_{AC} secondary, 60Hz.		85A ENCLOSED	-	LA46S04263-1104	1
		115A ENCLOSED	-	LA46S04263-1114	1
		140A ENCLOSED	-	LA46S04263-1124	1
		170A ENCLOSED	-	LA46S04263-1134	1
Auto Transformer (380/400/415:480) [for Enclosed only] Optional Transformer input to drive. 380/400/415V_{AC} primary, 480V_{AC} secondary 50/60Hz.		85A ENCLOSED	-	LA46S04263-1105	1
		115A ENCLOSED	-	LA46S04263-1115	1
		140A ENCLOSED	-	LA46S04263-1125	1
		170A ENCLOSED	-	LA46S04263-1135	1

Description	Pictorial Reference	Drive Rating	Reference Designator	Magnetek kit Number	Quantity Kit Per Drive
Auto Transformer (575:480) [for Enclosed only] Optional Transformer input to drive. 575V_{AC} primary, 480V_{AC} secondary 60Hz.	continued… 	85A ENCLOSED	-	LA46S04263-1106	1
		115A ENCLOSED	-	LA46S04263-1116	1
		140A ENCLOSED	-	LA46S04263-1126	1
		170A ENCLOSED	-	LA46S04263-1136	1
Auto Transformer (600:380) [for Enclosed only] Optional Transformer input to drive. 600V_{AC} primary, 380V_{AC} secondary 60Hz.		85A ENCLOSED	-	LA46S04263-1107	1
		115A ENCLOSED	-	LA46S04263-1117	1
		140A ENCLOSED	-	LA46S04263-1127	1
		170A ENCLOSED	-	LA46S04263-1137	1
Auto Transformer (600:480) [for Enclosed only] Optional Transformer input to drive. 600V_{AC} primary, 480V_{AC} secondary 60Hz.		85A ENCLOSED	-	LA46S04263-1108	1
		115A ENCLOSED	-	LA46S04263-1118	1
		140A ENCLOSED	-	LA46S04263-1128	1
		170A ENCLOSED	-	LA46S04263-1138	1
Auto Transformer (600:240) [for Enclosed only] Optional Transformer input to drive. 600V_{AC} primary, 240V_{AC} secondary 60Hz.		85A ENCLOSED	-	LA46S04263-1109	1
		115A ENCLOSED	-	LA46S04263-1119	1
		140A ENCLOSED	-	LA46S04263-1129	1
		170A ENCLOSED	-	LA46S04263-1139	1
Auto Transformer (600:150) [for Enclosed only] Optional Transformer input to drive. 600V_{AC} primary, 150V_{AC} secondary 60Hz.		85A ENCLOSED	-	LA46S04263-110A	1
		115A ENCLOSED	-	LA46S04263-111A	1
		140A ENCLOSED	-	LA46S04263-112A	1
		170A ENCLOSED	-	LA46S04263-113A	1
Auto Transformer (415:240) [for Enclosed only] Optional Transformer input to drive. 415V_{AC} primary, 240V_{AC} secondary 50/60Hz.		85A ENCLOSED	-	LA46S04263-110B	1
		115A ENCLOSED	-	LA46S04263-111B	1
		140A ENCLOSED	-	LA46S04263-112B	1
		170A ENCLOSED	-	LA46S04263-113B	1

Description	Pictorial Reference	Drive Rating	Reference Designator	Magnetek kit Number	Quantity Kit Per Drive
Inductor **[for Cube only]** 3 phase inductor for harmonics filtering		28A - 34A CUBE	-	LA05P00010-0712	1
		42A CUBE		LA05P00010-0713	1
		54A CUBE		LA05P00010-0714	1
		68A - 85A CUBE		LA05P00010-0715	1
AC Capacitor Assembly **[for Enclosed only]** Along with the L1 Inductor, creates a filter to minimize harmonics and better the power factor		85A ENCLOSED	C1, C2, C3	LA46S03948-0010	3
		115A ENCLOSED		LA46S03948-0020	3
		140A ENCLOSED		LA46S03948-0020	3
		170A ENCLOSED		LA46S03948-0020	3
AC Capacitor **[for Cube only]** Kit Includes: • Qty 1 capacitor Along with the Inductor, creates a filter to minimize harmonics and better the power factor		ALL CUBE	C1, C2, C3	LA05P00003-0816	3
Control Power EMI Filter Filter for reduction of RFI/EMI to and from the drive and the $230V_{AC}$ Control Power		ALL	L3	LA05P00010-0586	1
Current Transducer (CT) Kit Includes: • Qty 1 CT Module that mesures the both the input and output currents	 LF series	ALL	CT1, CT2, CT3, CT4, CT5, CT6	LA05P00217-0091	6
Cooling Fans **[for Enclosed only]** $230V_{AC}$ Cooling Fan		ALL ENCLOSED	-	LA05P00016-0107	2
Door Fan Kit Includes adaptor plate, fans, cabled to upgrade drive that weren't manufactured with fans in the door.	24IN Enclosure	ALL ENCLOSED	-	Q2B-24IN-DOORFAN	1
	32IN Enclosure			Q2B-32IN-DOORFAN	1
Cooling Fans **[for Cube only]** Kit Includes: • Qty 1 fan • Qty 1 fan guard • Qty 4 screws • Qty 4 nuts $24V_{DC}$ Cooling Fan		ALL CUBE	-	LA05P00016-0135	4
Operator Keypad Drive Programming Tool		ALL	-	ELEV-ELOP	1

Description	Pictorial Reference	Drive Rating	Reference Designator	Magnetek kit Number	Quantity Kit Per Drive
Lifting Kit **[for Enclosed only]** Optional Lifting Kit includes qty (4) M8 Eyebolts and instructional sheet		ALL ENCLOSED	-	QDC2-LIFTKIT	1
Door Filter, 18 x 9.5 **[for Enclosed only]** Disposable air filter located in the door		ALL ENCLOSED	FLTR1	LA05P00015-0049	1
Motor Cable Gland Bracket **[for Cube only]** Optional braket with 1in (25mm) diameter hole for gland installation		ALL CUBE	-	LAQAC-CUBE-CE	1
Heidenhain EnDat Encoder Cables M23 female, coupling ring connector to 14 discrete wire termination at different cable lengths		ALL (PM ONLY)	-	05P00671-0140 (10m [32ft])	1
				05P00671-0107 (15m [49ft])	1
				05P00671-0141 (20m [65ft])	1
				05P00671-0145 (25m [82ft])	1
				05P00671-0108 (30m [98ft])	1
				05P00671-0142 (40m [131ft])	1
				05P00671-0143 (50m [164ft])	1
				05P00671-0144 (100m [328ft])	1
Drive Software Flash Drive Kit Includes: • Flash drive containing drive firmware, PDF of newest manual revision, and PC software. • The computer cables are not supplied and would need to be ordered separately. These parts are **ELEV-USB-RS232** and **ELEV-CABLE**	-	ALL (IM ONLY)	-	46S04413-AU02	1
		ALL (PM ONLY)		46S04413-PU02	1

Description	Pictorial Reference	Drive Rating	Reference Designator	Magnetek kit Number	Quantity Kit Per Drive
RS232 to USB Adaptor Kit Includes: • Qty 1 RS232 to USB Adaptor This adaptor is used to link a PC that does NOT have a RS232 port to the drive. This is used to upload firmware and upload/download drive parameters.	-	ALL	-	ELEV-USB-RS232	1
Operator Extension Cable Kit Includes: • Qty 1 standard RS232 male-to-female cable This cable can be used to extend the reach of the operator for ease of setting drive parameters.		ALL	-	ELEV-CABLE	1

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Quattro® AC/PM

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