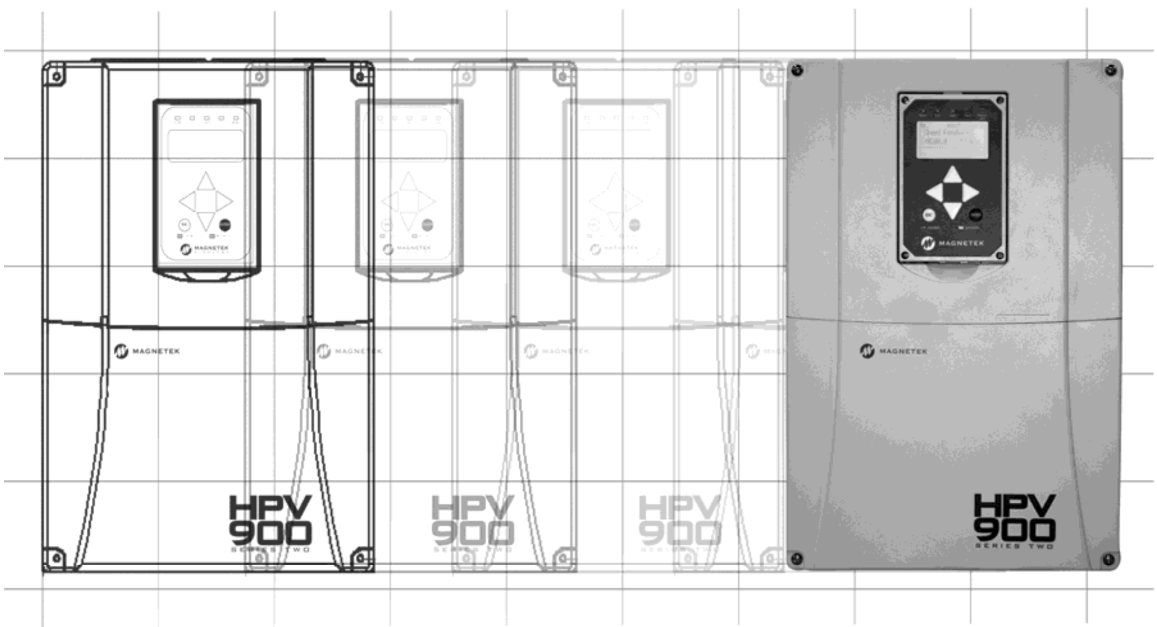
HPV 900 Series 2 AC/PM Elevator Drive

Technical Manual



Includes Quick Start Guides

TM7333 rev 08

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

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

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

IMPORTANT
Grounding Considerations

It is very important to make proper ground connections to the drive. The drive has a common ground bus terminal connection. All grounds need to land at this common point including building, motor, transformer, and filter grounds. This will limit the impedance between the grounds and noise will be channeled back to building ground. This improves the performance of the drive.

CLOSED-LOOP QUICK START-UP GUIDE

NOTE: This quick start-up guide just outlines the general parameters that should be changed / verified when a drive is installed with information that are readily available. The drive will **not** run if **only** these parameters are set. Because different controller manufacturers have different interfaces, it is recommended that the parameters in the drive be set to what is recommended by the elevator controller in their technical manual.

Closed-Loop Operation Set-up

1) Enter / verify that the drive is set to run in Closed-Loop in Drive Mode (U9)

Motor Parameter Set-up

2) Select one of the two default motors (either 4 or 6 pole) for the MOTOR ID (A5) parameter (or select a valid motor ID, if available).

   Enter / verify the following from the motor's nameplate:
   - Motor HP or KW rating (RATED MTR POWER(A5))
   - Motor Voltage (RATED MTR VOLTS(A5))
   - Motor Excitation Frequency in Hz (RATED EXCIT FREQ(A5))
   - Rated Motor current (RATED MOTOR CURR(A5))
   - Number of Motor Poles (MOTOR POLES(A5))
   - Rated Motor Speed at full load in RPM (RATED MTR SPEED(A5))

Synchronous speed	Rated motor Speed (rpm)	Number of motor poles
1800	1797 - 1495	4
1200	1198 – 997	6
900	898 – 748	8
720	719 - 598	10

Table 1 CL: Synchronous/Asynchronous Motor Speeds & Motor Poles Reference for 60Hz

Note: The rated motor rpm must be full load speed. If synchronous speed is given, the motor rated rpm can be estimated by:
– 97.5% of synchronous speed for Nema type B motor design
– 94% of synchronous speed for Nema type D motor design

Synchronous speed	Rated motor Speed (rpm)	Number of motor poles
1500	1497 - 1195	4
1000	998 - 797	6
750	748 - 598	8
600	599 - 478	10

Table 2 CL: Synchronous/Asynchronous Motor Speeds & Motor Poles Reference for 50Hz

3) Use the default value for Stator Resistance (STATOR RESIST(A5)) of 3.5% for 4 pole machines and 1.5% for all other poles.

NOTE: if you are experiencing operation issues, the stator resistance can be measured, and calculated using the following formula.

$$= \frac{\textit{measured resistance across motor windings - meter resistance}}{\text{2 x BASE IMPEDANCE (D2)}} \times 100$$

Encoder Set-up

4) Verify 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

- If possible, insulate both the encoder case and shaft from the motor.
- 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.
- Use the proper encoder supply voltage and use the highest possible voltage available. (i.e. $12V_{DC}$ is preferred because less susceptible to noise)

Mechanical Considerations

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

NOTE: Refer to Encoder Mounting on page 186 for illustrations on mounting encoder

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

Hoistway Parameter Set-up

6) Enter / verify the hoistway parameters:
   - CONTRACT CAR SPD (A1) parameter should be the elevator contract speed in ft/min.
   - CONTRACT MTR SPD (A1) parameter should be set to a RPM that will make the elevator travel at desired car speed (measured with hand tachometer).

NOTE: The above two parameters are utilized by the drive for many purposes regarding speed control of the lift, therefore its important these are set correctly.

Low speed inspection mode

7) Run the drive in low speed inspection mode and…
   - Start with default values for INERTIA (A1) and % NO LOAD CURR (A5) parameters.
   - Verify encoder polarity… the motor phasing should match the encoder phasing. If you experience ENCODER FAULT/ HIT TRQ LIM alarm the phasing may be incorrect -this can be reversed using ENCODER CONNECT(C1)
   - Verify proper hoistway direction…can be reversed with the MOTOR ROTATION (C1) parameter.

Key Drive Parameters

NOTE: Key paramters that are **not** listed below are parameters that are set for drive/controller interface in the C0 menu and A2 and A3 sub menus

A1- Drive Menu

Parameter	Description	Default	Units	Suggested Adjustment
CONTRACT CAR SPD	Elevator contract speed	400.0	fpm	Adjust to speed the installation is rated to run at.
		0.0	m/s	
CONTRACT MTR SPD	Motor speed at elevator contract speed	1130.0	rpm	Adjust this value to ensure the actual running speed of the car matches the parameter above - If the car is traveling too fast then reduce this value, if too slow then increase it.
		0.0		
RESPONSE	Sensitivity of the speed regulator	10.0	rad/sec	Set to 20 to improve the drive response to changes in speed reference. If the motor current and speed becomes unstable, reduce however if the value is too small, the response will be sluggish.

Parameter	Description	Default	Units	Suggested Adjustment
INERTIA	System inertia	2.00	sec	Determines the system inertia in terms of the time it takes the elevator to accelerate to contract speed. If the car is light, the value will be smaller than the default and vice versa if the car is heavy.
ENCODER PULSES	Encoder counts per revolution	1024	PPR	Obtain the Encoder PPR from the encoder nameplate and enter in this parameter.
MTR TORQUE LIMIT	Motoring Torque Limit. Units in percent of rated torque. Note: The Torque Limit LED will be lit once the limit defined by this parameter is reached.	200.0	%	Determines the maximum torque allowed when in the motoring mode. This is generally left at the default setting
GAIN REDUCE MULT	Percentage of response of the speed regulator used when in the low gain mode	100	%	When the RESPONSE is high, the resonant characteristics of the ropes can cause car vibration. This parameter determines the gain to be used at higher speeds.
GAIN CHNG LEVEL	Speed level to change to low gain mode (only with internal gain switch)	100.0	% rated speed	Determines the speed threshold at which the gain specified by the GAIN REDUCE MULT is effective.

Table 3 CL: Important paramters in A1 menu to set/check when seting up a drive in closed-loop

Power Convert A4

Parameter	Description	Default	Units	Suggested Adjustment
INPUT L-L VOLTS	Nominal line-line AC input Voltage, RMS	0	Volts	Adjust to match the voltage across R, S, and T of the drive. The drive uses this value for its undervoltage alarm and fault detection circuit
UV ALARM LEVEL	Voltage level for undervoltage alarm	90	% nominal dc bus	Set to 80%
UV FAULT LEVEL	Voltage level for undervoltage fault	80	% nominal dc bus	Set to 70 %
PWM FREQUENCY	Carrier frequency	10.0	kHz	It should not be necessary to change this value from 10kHz. However it can be useful to reduce this frequency to try to determine if a vibration is electrically induced or otherwise

Table 4 CL: Important parameters in A4 menu to set/check when seting up a drive in closed-loop

Motor A5

Parameter	Description	Default	Units	Suggested Adjustment
MOTOR ID	Motor Identification		none	Used to initialize the drive. Display will change to block capital letters when initialized. Enter either 4 or 6 pole motor.
RATED MTR POWER	Rated motor output power	0	HP KW	Set to motor HP/kW rating as per the motor nameplate
RATED MTR VOLTS	Rated motor terminal RMS voltage	0	Volts	Set to motor voltage rating as per the motor nameplate
RATED EXCIT FREQ	Rated excitation frequency	0	Hz	Set to motor frequency rating as per the motor nameplate
RATED MOTOR CURR	Rated motor current	0	Amps	Set to motor nameplate rated current
MOTOR POLES	Motor poles	4	none	Adjust to set number of motor poles
RATED MTR SPEED	Rated motor speed at full load	0	RPM	Adjust to motor nameplate value
STATOR LEAKAGE X	Stator leakage reactance	Per ID	% base Z	Leave at default setting unless acoustic motor noise is high. If it is then initially halve the default settings and observe any change. If

Parameter	Description	Default	Units	Suggested Adjustment
ROTOR LEAKAGE X	Rotor leakage reactance	Per ID	% base Z	there is no improvement then reset back to default values.

Table 5 CL: Important paramters in A5 menu to set/check when seting up a drive in closed-loop

Basics U9

Parameter	Description	Default	Choices	Suggested Adjustment
DRIVE MODE	Drive operation	Closed Loop	Open Loop Closed Loop PM	Leave at default unless a test is need to perform in Open Loop to validate if the encoder is working.

Table 6 CL: Important parameter in U9 menu to set/check when seting up a drive in closed-loop

OPEN-LOOP QUICK START-UP GUIDE

NOTE: This quick start-up guide just outlines the general parameters that should be changed / verified when a drive is installed with information that are readily available. The drive will **not** run if **only** these parameters are set. Because different controller manufacturers have different interfaces, it is recommended that the parameters in the drive be set to what is recommended by the elevator controller in their technical manual.

Open-Loop Operation Set-up

1) Enter / verify that the drive is set to run in Open-Loop in Drive Mode (U9)

Motor Parameter Set-up

2) Firstly select one of the default motors for the MOTOR ID (A5) parameter, as a result typical V/F patterns are loaded via the MOTOR ID (A5) a typical example is shown in Table 1 OL.

   It is possible to optimize the V/F pattern if required however often our default values will suit most motors and installations.
   Enter / verify the following from the motor's nameplate:
   - Motor HP or KW rating (RATED MTR POWER(A5))
   - Motor Voltage (RATED MTR VOLTS(A5))
   - Motor Excitation Frequency in Hz (RATED EXCIT FREQ(A5))
   - Rated Motor Current (RATED MOTOR CURR(A5))
   - Number of Motor Poles (MOTOR POLES(A5))
   - Rated Motor Speed at full load in RPM (RATED MTR SPEED (A5))

Note: The rated motor rpm must be full load speed. If synchronous speed is given, the motor rated rpm can be estimated by:
- 97.5% of synchronous speed for Nema type B motor design
- 94% of synchronous speed for Nema type D motor design

Parameter	4 & 6 poles 400v	4 & 6 poles 200V
motor mid volts (A5)	28.0V	14.0V
motor mid freq (A5)	3.0Hz	3.0Hz
motor min volts (A5)	9.0V	4.0V
motor min freq (A5)	1.0Hz	1.0Hz

Table 1 OL: V/Hz patterns via Motor ID

Synchronous speed	Rated motor Speed (rpm)	Number of motor poles
1800	1797 - 1495	4
1200	1198 – 997	6
900	898 – 748	8
720	719 - 598	10

Table 2 OL: Synchronous/Asynchronous Motor Speeds & Motor Poles Reference for 60Hz

Synchronous speed	Rated motor Speed (rpm)	Number of motor poles
1500	1497 - 1195	4
1000	998 - 797	6
750	748 - 598	8
600	599 - 478	10

Table 3 OL: Synchronous/Asynchronous Motor Speeds & Motor Poles Reference for 50Hz

3) Use the default value for Stator Resistance (STATOR RESIST(A5)) of 3.5% for 4 pole machines and 1.5% for all other motors.

NOTE: if you are experiencing operation issues, the stator resistance can be measured, and calculated using the following formula.

$$= \frac{\textit{measured resistance across motor windings - meter resistance}}{2 \text{ x BASE IMPEDANCE (D2)}} \times 100$$

Hoistway Parameter Set-up

4) Enter / verify the hoistway parameters:
- CONTRACT CAR SPD (A1) parameter should be the elevator contract speed in m/s.
- CONTRACT MTR SPD (A1) parameter should be set to a RPM that will make the elevator travel at desired car speed (measured with hand tachometer)

NOTE: The above two parameters are utilized by the drive for many purposes regarding the control of the lift, therefore it's important these are set correctly.

Key Drive Parameters

A1- Drive Menu

Parameter	Description	Default	Units	Suggested Adjustment
CONTRACT CAR SPD	Elevator contract speed	400.0	fpm	Adjust to speed the installation is rated to run at.
		0.0	m/s	
CONTRACT MTR SPD	Motor speed at elevator contract speed	1130.0	rpm	Adjust this value to ensure the actual running speed of the car matches the parameter above - If the car is traveling too fast then reduce this value, if too slow then increase it.
		0.0		
ENCODER PULSES	Encoder counts per revolution	1024	PPR	Obtain the Encoder PPR from the encoder nameplate and enter in this parameter.
MTR TORQUE LIMIT	Motoring Torque Limit. Units in percent of rated torque. Note: The Torque Limit LED will be lit once the limit defined by this parameter is reached.	200.0	%	Determines the maximum torque allowed when in the motoring mode. This is generally left at the default setting
DC START LEVEL	DC injection current to hold the motor shaft in fixed position after picking brakes.	80	%	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number
DC STOP LEVEL	DC injection current to hold the motor shaft in fixed position before brakes drop.	50	%	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number
DC STOP FREQ	Frequency that DC injection current starts when motor is decelerating	0.5	Hz	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number
DC START TIME	Time DC injection current is applied after a run command to accelerating motor	1.00	sec	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number
DC STOP TIME	Time DC injection current is applied during DC STOP LEVEL	1.00	sec	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number
SLIP COMP TIME	Adjust for slip compensation response and stability when motor is loaded	1.50	sec	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number
SLIP COMP GAIN	Multiplier of motor rated slip at torque	1.00	none	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number
TORQ BOOST TIME	Adjust for torque compensation response and stablitity	0.05	sec	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number

Parameter	Description	Default	Units	Suggested Adjustment
TORQ BOOST GAIN	Torque boost responsivness	0.00	none	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number

Table 4 OL: Important parameters in A1 menu to set/check when seting up a drive in open-loop

Power Convert A4

Parameter	Description	Default	Units	Suggested Adjustment
INPUT L-L VOLTS	Nominal line-line AC input Voltage, RMS	0	Volts	Adjust to match the voltage across R, S, and T of the drive. The drive uses this value for its undervoltage alarm and fault detection circuit
UV ALARM LEVEL	Voltage level for undervoltage alarm	90	% nominal dc bus	Set to 80%
UV FAULT LEVEL	Voltage level for undervoltage fault	80	% nominal dc bus	Set to 70 %
PWM FREQUENCY	Carrier frequency	10.0	kHz	It should not be necessary to change this value from 10kHz. However it can be useful to reduce this frequency to try to determine if a vibration is electrically induced or otherwise
ILIMIT INTEG GAIN	Stall prevention response	1.00	none	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number
HUNT PREV GAIN	Torque response of hunt prevention	1.00	none	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number
HUNT PREV TIME	Amount of time for hunt prevention function	0.20	sec	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number

Table 5 OL: Important parameters in A4 menu to set/check when seting up a drive in open-loop

Motor A5

Parameter	Description	Default	Units	Suggested Adjustment
MOTOR ID	Motor Identification		none	Used to initialize the drive. Display will change to block capital letters when initialized. Enter either 4 or 6 pole motor.
RATED MTR POWER	Rated motor output power	0	HP KW	Set to motor HP/kW rating as per the motor nameplate
RATED MTR VOLTS	Rated motor terminal RMS voltage	0	Volts	Set to motor voltage rating as per the motor nameplate
RATED EXCIT FREQ	Rated excitation frequency	0	Hz	Set to motor frequency rating as per the motor nameplate
RATED MOTOR CURR	Rated motor current	0	Amps	Set to motor nameplate rated current
MOTOR POLES	Motor poles	4	none	Adjust to set number of motor poles
RATED MTR SPEED	Rated motor speed at full load	0	RPM	Adjust to motor nameplate value
MOTOR MIN VOLTS	Voltage at minimum frequency	Per ID	Volts	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number
MOTOR MIN FREQ	Minimum frequency	1	Hz	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number
MOTOR MID VOLTS	Voltage at middle frequency	Per ID	Volts	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number
MOTOR MID FREQ	Middle frequency	3.0	Hz	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 157 dictates a different number

Table 6 OL: Important parameters in A5 menu to set/check when seting up a drive in open-loop

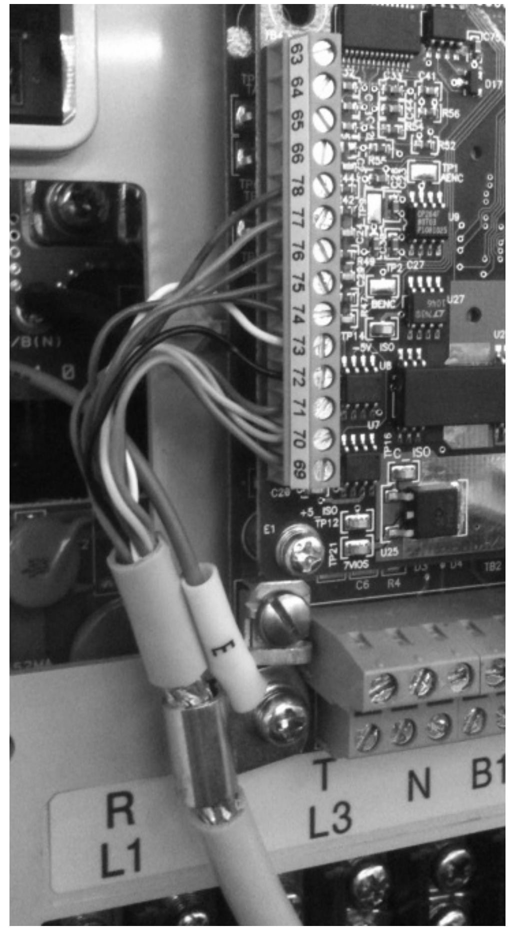
Basics U9

Parameter	Description	Default	Choices	Suggested Adjustment
DRIVE MODE	Drive operation	Closed Loop	Open Loop Closed Loop PM	Adjust to Open-Loop so drive can run motor without an encoder

Table 7 OL: Important parameter in U9 menu to set/check when seting up a drive in open-loop

PM QUICK START-UP GUIDE

NOTE: This quick start-up guide just outlines the general parameters that should be changed / verified when a drive is installed with information that are readily available. The drive will **not** run if **only** these parameters are set. Because different controller manufacturers have different interfaces, it is recommended that the parameters in the drive be set to what is recommended by the elevator controller in their technical manual.



PM Operation Set-up

1) Enter / verify that the drive is set to run in PM in Drive Mode (U9)

Encoder Set-up

2) 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.

   - Ensure that the motor power cabling is screened and correctly glanded where the braid is clamped within the gland and earthed through it (as is done with armoured cable) – twisting the screen together and terminating it to the motor frame is not recommended procedure.
   - Ensure that encoder cable routing is away from the motor cable.
   - Ensure the encoder screen is clamped at the drive end in the correct 360degree ‘P’ Clamp – again twisting braid together and connecting it to earth is not recommended.
   - After stripping off the encoder cable insulation for terminating in the drive, keep the tails as short as possible - we would recommend no more than 3.94in (100mm) is exposed.

   Table 1 PM shows the correct terminations for the HPV900S2 with the optional EnDat board and also the standard Heidenhain & Ziehl cable colour codes – if you are unsure of the correct wire colours please refer to the encoder/motor suppliers documentation and if required contact them for clarification prior to powering up the equipment – **failure to do this may result in damage to the encoder, the drive or both!** You may wish to note your encoder colours in the ‘Othercolumn for future reference.

Encoder	HPV900 S2 Termination	Cable Colour		
		Heidenhain	Ziehl	Other
A/	**A-**	**Yellow & Black**	**Red & Blue**	
A	**A+**	**Green & Black**	**Grey & Pink**	
B/	**B-**	**Red & Black**	**Red**	
B	**B+**	**Blue & Black**	**Blue**	
Data/	**DAT-**	**Pink**	**Brown**	
Data	**DAT+**	**Grey**	**White**	
Clock/	**CLK-**	**Yellow**	**Black**	
Clock	**CLK+**	**Violet**	**Violet**	
0V com **0V Sense (if present)**	**COM** **SEN-**	**White** **Green & White**	**Pink** **Yellow**	
+5V **+5V Sense (if present)**	**+5V** **SEN+**	**Brown** **Green & Blue**	**Grey** **Green**	

Table 1 PM: Connection and colour scheme of recommended absolute encoders

Motor Parameter Set-up

3) Select the PM default motor for the Motor ID (A5) parameter.

Enter / verify the following from the motor's nameplate:

- Motor HP or KW rating (RATED MTR POWER(A5))
- Motor Voltage (RATED MTR VOLTS(A5))
- Rated Motor current (RATED MOTOR CURR(A5))
- Number of Motor Poles (MOTOR POLES(A5))
- Rated Motor Speed at full load in RPM (RATED MTR SPEED(A5))

Synchronous speed at 60Hz	Synchronous speed at 50Hz	Number of motor poles
1800	1500	4
1200	1000	6
900	750	8
720	600	10

Table 2 PM: Synchronous motor speeds

NOTE: Some motors do not quote the number of motor poles however this can be simply calculated using this formula:

$$\frac{120 \times \text{Rated Motor Frequency}}{\text{Rated Motor Speed}}$$

NOTE: Motor Frequency is not directly entered in the drive however useful to note to make the above calculation if required.

In some instances the data on the motor data plate may not be 100% accurate (if the machine isn't 'made to order' they may quote the motors maximum values as opposed to what is required for your installation) – if this is the case the 'calculated' motor data that matches your installation will have to be obtained from the motor manufacturer and entered in the drive. This 'Calculated' data may have been used to select the drive and the information on the data plate may be beyond the rating of the drive. It is also important to verify and adjust the CONTRACT MOTOR SPEED parameter in the A1 Menu of the drive at this stage.

4) Enter / verify the following encoder informations

- Encoder Pulses (A1) should be set to encoder pulses on the encoder nameplate.
- Serial Cnts/Rev (A1) should be set to serial counts on encoder
- Encoder Select (C1) should be set according to the type of encoder that is being used.

Hoistway Parameter Set-up

5) Enter / verify the hoistway parameters:
   - CONTRACT CAR SPD (A1) parameter should be the elevator contract speed in ft/min.
   - CONTRACT MTR SPD (A1) parameter should be set to a RPM that will make the elevator travel at desired car speed (measured with hand tachometer).

NOTE: The above two parameters are utilized by the drive for many purposes regarding speed control of the lift, therefore its important these are set correctly.

Encoder Alignment

6) There are multiple ways to gather the encoder angle alignment, some motor manufacturers 'pre set' this to a default value to prevent any need for a motor alignment – if you have this information you can enter it in the drive, if you do not know this skip to option 2

OPTION 1 – P*redetermined Encoder angle offset*

- Clear any active faults in the drive in the F1 menu (and verify they have cleared)
- Scroll to U10 menu – ROTOR ALIGNMENT and change the parameter ALIGNMENT from DISABLED to ENABLED
- Scroll to A5 menu and to the parameter ENCODER ANG OFST press enter and manually enter the 'known' offset value – the motor should then be able to run – attempt this on test controls.

If the rotor alignment is not known as is the case on the majority of motors/encoders you will have to perform a physical alignment. The preferred way of doing this is a rotating alignment under no load **(before ropes are fitted or with the ropes lifted and clear of the sheave)** if your ropes are already fitted or it's an existing installation skip to option 3.

OPTION 2 – *Rotating alignment*

- Clear any active faults in the drive in the F1 menu (and verify they have cleared)
- Scroll to U10 menu – ROTOR ALIGNMENT and change the parameter ALIGNMENT from DISABLED to ENABLED
- Also in the U10 alignment menu ensure the parameter ALIGNMENT METHOD is set to OPEN LOOP
- Next change the parameter BEGIN ALIGNMENT to ON RUN
- The drive is now ready for alignment, so simply press and hold your RUN, RUN UP, or RUN DOWN buttons and you should see the brake lift, the motor should rotate for about 4 seconds smoothly then stop on its own accord – its important that the test buttons remain fully pressed for the duration of the tune, if the buttons are released for any reason you will need to restart this whole procedure. When the motor has stopped and the run LED on the drives operator has extinguished you may release your buttons

- Assuming this went successfully the drive will have established the encoders position relative to the motor poles and automatically saved this value, it can be checked in the drives A5 menu (parameter ENCODER ANG OFST), and also attempt to run on inspection control to verify.

NOTE: If drive ENCODER ANG OFST is set to a number other than 30000, then the alignment was most likely performed

- If this procedure didn't complete successfully and a fault was displayed, please refer to the fault section of this supplement or the drives technical manual for diagnostic information

Option 3 – *Static alignment*

If it is not possible to perform a rotating alignment the encoder angle offset can be obtained by performing a 'static' alignment where the brake is not lifted.
To perform this:

- Clear any active faults in the drive in the F1 menu (and verify they have cleared)
- Scroll to U10 menu – ROTOR ALIGNMENT and change the parameter ALIGNMENT from DISABLED to ENABLED
- Also in the U10 alignment menu ensure the parameter ALIGNMENT METHOD is set to AUTO ALIGN

Next change the parameter BEGIN ALIGNMENT to ON RUN

- The drive is now ready for alignment, so simply press and hold your RUN, RUN UP, or RUN DOWN buttons. You should see the run LED on the drive illuminate and the motor will 'buzz', the brake will **not** lift however. It will only take a couple of seconds and when completed the RUN LED on the drives operator will extinguish and you may release your buttons.
- Assuming this went successfully the drive will have established the encoders position relative to the motor poles, this value can be checked in the drives A5 menu (parameter ENCODER ANG OFFST). The procedure should be run 5 times. The value should be consistant, if not check for proper grounding. You are then able to attempt to run on inspection control to verify.
- If this procedure didn't complete successfully and a fault was displayed, please refer to the fault section of this supplement or the drives technical manual for diagnostic information

Step 4 – Motor Auto Tune

7) After the encoder angle offset is obtained and as a final optimisation procedure, it is possible to gather some further motor characteristics from the motor as part of an 'AutoTune'
   In this test the A5 Parameters D AXIS INDUCTANCE, Q AXIS INDUCTANCE & STATOR RESISTANCE are obtained and updated automatically
   To perform this:
   - Clear any active faults in the drive in the F1 menu (and verify they have cleared)

- Scroll to U11 (U12 on the HPV900S2) menu – AUTOTUNE SEL and change the parameter AUTOTUNE SELECT to ON RUN

- The drive is now ready for Auto Tune, so simply press and hold your RUN, RUN UP, or RUN DOWN buttons. You should see the run LED on the drive illuminate and the motor will 'buzz', the brake will **not** lift however. It will only take a couple of seconds and when completed the RUN LED on the drives operator will extinguish and you may release your buttons.

- The values obtained from this Auto Tune will be automatically saved and can be viewed in the A5 Menu

Step 5 – Fine Tune

8) Assuming the above steps have been carried out in full, on most occasions the alignment values obtained will give near perfect alignment results, however if you observe higher than expected motor current, vibrations or encoder related trips we do have a 'fine tune procedure' which can be used to either diagnose if the encoder alignment is correct or assist with correcting it if it is found not to be correct. This procedure is rarely required, however if you do find an application where you would like to perform it a step by step guide can be found in Fine Tune Alignment Procedure on page 154.

Key Drive Parameters

A1- Drive Menu

Parameter	Description	Default	Units	Suggested Adjustment
CONTRACT CAR SPD	Elevator contract speed	400.0	fpm	Adjust to speed the installation is rated to run at.
		0.0	m/s	
CONTRACT MTR SPD	Motor speed at elevator contract speed	1130.0	rpm	Adjust this value to ensure the actual running speed of the car matches the parameter above - If the car is traveling too fast then reduce this value, if too slow then increase it.
		0.0		
RESPONSE	Sensitivity of the speed regulator	10.0	rad/sec	Set to 20 to improve the drive response to changes in speed reference. If the motor current and speed becomes unstable, reduce however if the value is too small, the response will be sluggish.
INERTIA	System inertia	2.00	sec	Determines the system inertia in terms of the time it takes the elevator to accelerate to contract speed. If the car is light, the value will be smaller than the default and vice versa if the car is heavy.
ENCODER PULSES	Encoder counts per revolution	1024	PPR	Obtain the Encoder PPR from the encoder nameplate and enter in this parameter.
SERIAL CNTS/REV	Encoder position counts per revolution	8192	none	Obtain the Encoder serial cnts/rev from encoder nameplate and enter in this parameter.
MTR TORQUE LIMIT	Motoring Torque Limit. Units in percent of rated torque. Note: The Torque Limit LED will be lit once the limit defined by this parameter is reached.	200.0	%	Determines the maximum torque allowed when in the motoring mode. This is generally left at the default setting

Table 3 PM: Important parameters in A1 menu to set/check when seting up a drive in PM mode

Power Convert A4

Parameter	Description	Default	Units	Suggested Adjustment

Parameter	Description	Default	Units	Suggested Adjustment
INPUT L-L VOLTS	Nominal line-line AC input Voltage, RMS	0	Volts	Adjust to match the voltage across R, S, and T of the drive. The drive uses this value for its undervoltage alarm and fault detection circuit
UV ALARM LEVEL	Voltage level for undervoltage alarm	90	% nominal dc bus	Set to 80%
UV FAULT LEVEL	Voltage level for undervoltage fault	80	% nominal dc bus	Set to 70 %
PWM FREQUENCY	Carrier frequency	10.0	kHz	It should not be necessary to change this value from 10kHz. However it can be useful to reduce this frequency to try to determine if a vibration is electrically induced or otherwise
ID REG DIFF GAIN	Differential gain for current regulator flux generation	0.00	none	Enter / verify that it should be set to default.
ID REG PROP GAIN	Proportional gain for current regulator flux generation	0.700	none	Enter / verify that it should be set to default. If audible motor noise is heard, change this parameter to 0.350.
ID REG INTG GAIN	Integral gain for the current regulator flux generation	1.00	none	Enter / verify that it should be set to default. If audible motor noise is heard, change this parameter to 0.5
IQ REG DIFF GAIN	Differential gain for the current regulation of motor torque	0.00	none	Enter / verify that it should be set to default.
IQ REG PROP GAIN	Proportional gain for the current regulator torque generation	0.700	none	Enter / verify that it should be set to default. If audible motor noise is heard, change this parameter to 0.350
IQ REG INTG GAIN	Integeral gain for the current regulator torque generation	1.00	none	Enter / verify that it should be set to default. If audible motor noise is heard, change this parameter to 0.5

Table 4 PM: Important parameters in A4 menu to set/check when seting up a drive in PM mode

Motor A5

Parameter	Description	Default	Units	Suggested Adjustment
MOTOR ID	Motor Identification		none	Used to initialize the drive. Enter PM.
RATED MTR POWER	Rated motor output power	0	HP KW	Set to motor HP/kW rating as per the motor nameplate
RATED MTR VOLTS	Rated motor terminal RMS voltage	0	Volts	Set to motor voltage rating as per the motor nameplate
RATED MOTOR CURR	Rated motor current	0	Amps	Set to motor nameplate rated current
MOTOR POLES	Motor poles	4	none	Adjust to number of motor poles
RATED MTR SPEED	Rated motor speed at full load	0	RPM	Adjust to motor nameplate value
ENCODER ANG OFST	Encoder angle associated with motor pole	30000	none	Adjust to either known angle or allow drive to measure with rotor alignment

Table 5 PM: Important parameters in A5 menu to set/check when seting up a drive in PM mode

User Switches C1

Parameter	Description	Default	Choices	Suggested Adjustment
ENCODER SELECT	Encoder type	incremental	endat incremental	Adjust to encoder type being used

Table 6 PM: Important parameter in C1 menu to set/check when seting up a drive in PM mode

Basics U9

Parameter	Description	Default	Choices	Suggested Adjustment
DRIVE MODE	Drive operation	Closed Loop	Open Loop Closed Loop PM	Adjust to PM so drive can run a PM motor.

Table 7 PM: Important parameter in U9 menu to set/check when seting up a drive in PM mode

Rotor Align U10

Parameter	Description	Default	Choices	Suggested Adjustment
ALIGNMENT	Allow alignment to be performed	disable	enable disable	Adjust to enable only when trying to change ENCODER ANG OFST (A5)
BEGIN ALIGNMENT	Determine when to perform alignment	no	yes on run no	Adjust to on run when trying to obtain ENCODER ANG OFST (A5)
ALIGNMENT METHOD	How alignment will be performed	open loop	open loop auto align	Adjust to open when shaft of motor will be moving and auto align when it will be kept still. Detail is provided on Encoder Align on page x and Rotor Alignment Procedure on page 148

Table 8 PM: Important parameter in U10 menu to set/check when seting up a drive in PM mode

Autotune Sel U12

Parameter	Description	Default	Choices	Suggested Adjustment
AUTOTUNE SELECT	Allow autotune to run	disable	disable on run yes	Adjust to PM so drive can run a PM motor.

Table 9 PM: Important parameter in U12 menu to set/check when seting up a drive in PM mode

If vibration occurs:

1.) Check grounds
2.) Do not set Response (A1) higher than 10 and lower inertia (A1) to below .5
3.) Set Gain Reduce Multiplier (A1) and Gain Changes (A1) level both to 50%
4.) Set Notch Filter Frequency (A1) to 15 HZ and Depth (A1) to 20

Table of Contents

HPV 900 Series 2 Drive Ratings

Rated Input Voltage	NA[1] Rated HP	EU[1] Rated HP	NA[1] Rated kW	EU[1] Rated kW	Continuous Output Current General Purpose Rating	Continuous Output Current Elevator Duty Cycle[2] Rating	Maximum Output Current for 5 Sec	Frame Size[3]	Model Number[4]
230V	7.5	--	5.5	--	25	27	62.5	2	HPV900-2025-2E1-01
	10	--	7.5	--	31	33	77.5	2	HPV900-2031-2E1-01
	15	--	11	--	41	44	102.5	3.5/4	HPV900-2041-2E1-01
	20	--	15	--	52	56	130	3.5/4	HPV900-2052-2E1-01
	25	--	19	--	75	80	187.5	4	HPV900-2075-2E1-01
	30	--	22	--	88	94	220	4	HPV900-2088-2E1-01
	40	--	30	--	98	105	245	5	HPV900-2098-2E1-01
460V	5	5	3.7	3.7	8	9	20	1	HPV900-4008-2E1-01
	7.5	5.5	5.5	4	12	13	30	2	HPV900-4012-2E1-01
	10	7.5	7.5	5.5	16	17	40	2	HPV900-4016-2E1-01
	15	10	11	7.5	21	23	52.5	3	HPV900-4021-2E1-01
	20	15	15	11	27	29	67.5	3	HPV900-4027-2E1-01
	25	20	19	15	34	36	85	4	HPV900-4034-2E1-01
	30	25	22	18.5	41	44	102.5	4	HPV900-4041-2E1-01
	40	30	30	22	52	56	130	4	HPV900-4052-2E1-01
	50	40	37	30	65	70	162.5	5	HPV900-4065-2E1-01
	60	50	45	37	72	77	180	5	HPV900-4072-2E1-01
	75	60	56	45	96	103	240	5	HPV900-4096-2E1-01

Table 1: HPV 900 Series 2 Drive Ratings

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

For more information on altitude, temperature, and carrier frequency derating, see Drive Derating on page 15.

[1] *NA refers to drives sold in North America and ratings are based off of 460VAC input. EU refers to drives sold in Europe and are based off of 400VAC input*
[2] *For more information on the Elevator Duty Cycle Rating, see page 167*
[3] *Cube size dimensions, mounting holes, and weights are shown in Dimensions, Mounting Holes and Weights on page 171*
[4] *For more information on model numbers, see page 15.*

Submenu	Parameter	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Site Setting
A1	***Drive A1 Submenu – For details, see Drive A1 Submenu on page 44.***					
A1	Contract Car Spd	Fpm	0.0 – 1500.0	400.0	-	
		m/s	0.000 – 8.000	-	0.000	
A1	Contract Mtr Spd	Rpm	0.0 – 3000.0	1130.0 [i,iii]	0.0	
				130.0 [ii]		
A1[i,ii]	Response [i,ii]	rad/sec [i,ii]	1.0 – 50.0 [i,ii]	10.0 [i,ii]		
A1 [i,ii]	Inertia [i,ii]	sec [i,ii]	0.25 – 50.00 [i,ii]	2.00 [i,ii]		
A1	Encoder Pulses	PPR	500 – 40000	1024 [i,iii]		
				10000 [ii]		
A1[ii]	*Serial Cnts/Rev [ii]*	*none [ii]*	*0 – 25000 [ii]*	*8192 [ii]*		
A1	Mtr Torque Limit	%	0.0 – 275.0	200.0		
A1	Regen Torq Limit	%	0.0 – 275.0	200.0		
A1[i]	Flux Wkn Factor[i]	%[i]	60 – 100[i]	100 [i]		
A1	Trq Lim Msg Dly	Sec	0.00 – 10.00	0.50	2.00	
A1[i,ii]	Gain Reduce Mult [i,ii]	% [i,ii]	10 – 100 [i,ii]	100 [i,ii]		
A1[i,ii]	Gain Chng Level [i,ii]	% [i,ii]	0.0 – 100.0 [i,ii]	100.0 [i,ii]		
A1[i]	Spd Dev Hi Level[i]	%[i]	0.0 – 99.9 [i]	10.0 [i]		
A1[i,ii]	Ramped Stop Time [i,ii]	sec [i,ii]	0.00 – 2.50 [i,ii]	0.20 [i,ii]	0.50 [i,ii]	
A1	Contact Flt Time	Sec	0.10 – 5.00	0.50		
A1	Contactor DO Dly	Sec	0.00 – 5.00	0.00		
A1	Flt Reset Delay	Sec	0 – 120	5		
A1	Flt Resets / Hour	#	0 – 10	3		
A1	Brake Pick Time	Sec	0.00 – 5.00	1.00		
A1[i,ii]	Ab Zero Spd Lev [i,ii]	% [i,ii]	0.00 – 2.00 [i,ii]	0.00 [i,ii]		
A1[i,ii]	Ab Off Delay [i,ii]	sec [i,ii]	0.00 – 9.99 [i,ii]	0.00 [i,ii]		
A1[iii]	*Brake Pick Delay [iii]*	*sec [iii]*	*0.00 – 5.00 [iii]*	*0.50 [iii]*		
A1[iii]	*Brake Drop Delay [iii]*	*sec [iii]*	*0.00 – 5.00 [iii]*	*0.50 [iii]*		
A1	Brake Hold Time	Sec	0.00 – 5.00	0.20		
A1[iii]	*DC Start Level [iii]*	*% [iii]*	*0.0 – 150.0 [iii]*	*80.0 [iii]*	*50.0 [iii]*	
A1[iii]	*DC Stop Level [iii]*	*% [iii]*	*0.0 – 150.0 [iii]*	*50.0 [iii]*		
A1[iii]	*DC Stop Freq [iii]*	*Hz [iii]*	*0.0 – 10.0 [iii]*	*0.5 [iii]*		
A1[iii]	*DC Start Time [iii]*	*sec [iii]*	*0.00 – 5.00 [iii]*	*1.00 [iii]*		
A1[iii]	*DC Stop Time [iii]*	*sec [iii]*	*0.00 – 5.00 [iii]*	*1.00 [iii]*		
A1 [i,ii]	Overspeed Level [i,ii]	% [i,ii]	100.0 – 150.0 [i,ii]	115.0 [i,ii]		
A1 [i,ii]	Overspeed Time [i,ii]	sec [i,ii]	0.00 – 9.99 [i,ii]	1.00 [i,ii]		
A1	Overspeed Mult	%	100.0 – 150.0	125.0		
A1[iii]	*Stalltest Level [iii]*	*% [iii]*	*0.0 – 200.0 [iii]*	*200.0 [iii]*		
A1[iii]	*Stall Fault Time [iii]*	*sec [iii]*	*0.00 – 9.99 [iii]*	*5.00 [iii]*		
A1[iii]	*Slip Comp Time [iii]*	*sec [iii]*	*0.01 – 2.00 [iii]*	*1.50 [iii]*		
A1[iii]	*Slip Comp Gain [iii]*	*none [iii]*	*0.00 – 2.00 [iii]*	*1.00 [iii]*		
A1[iii]	*Torq Boost Time [iii]*	*sec [iii]*	*0.01 – 1.00 [iii]*	*0.05 [iii]*		
A1[iii]	*Torq Boost Gain [iii]*	*none [iii]*	*0.00 – 2.00 [iii]*	*0.00 [iii]*		
A1[i,ii]	Spd Dev Lo Level [i,ii]	% [i,ii]	0.1 – 20.0 [i,ii]	10.0 [i,ii]	20.0 [i,ii]	
A1[i,ii]	Spd Dev Time [i,ii]	sec [i,ii]	0.00 – 9.99 [i,ii]	0.50 [i,ii]	5.00 [i,ii]	
A1[ii]	*Spd Dev Alm Lvl [ii]*	% [ii]	0.00 – 99.9 [ii]	10.0 [ii]		
A1[ii]	*Spd Dev Flt Lvl [ii]*	% [ii]	0.00 – .99.9 [ii]	25.0 [ii]		
A1	Up to Spd. Level	%	0.00 – 110.00	80.00		

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Submenu	Parameter	Units	Range	Default		Site Setting
				ENGLISH (U3)	METRIC (U3)	
A1	***Drive A1 Submenu continued …***					
A1	Zero Speed Level	%	0.00 – 99.99	1.00	25.0	
A1	Zero Speed Time	Sec	0.00 – 9.99	0.10		
A1	Up/Dwn Threshold	%	0.00 – 9.99	1.00		
A1[i,ii]	Notch Filter Frq [i,ii]	Hz [i,ii]	5 – 60 [i,ii]	20 [i,ii]		
A1[i,ii]	Notch Filt Depth [i,ii]	% [i,ii]	0 – 100 [i,ii]	0 [i,ii]		
A1[i,ii]	Run Delay Timer [i,ii]	sec [i,ii]	0.00 – 0.99 [i,ii]	0.00 [i,ii]		
A1[i,ii]	Tach Rate Gain [i,ii]	none [i,ii]	0.0 – 30.0 [i,ii]	0.0 [i,ii]		
A1[i,ii]	Inner Loop Xover [i,ii]	rad/sec [i,ii]	0.1 – 20.0 [i,ii]	2.0 [i,ii]		
A1[i,ii]	Spd Phase Margin [i,ii]	degs [i,ii]	45 – 90 [i,ii]	80 [i,ii]		
A1	Spd Command Bias	Volts	-6.000 – +6.000	0.000		
A1	Spd Command Mult	None	-10.00 – +10.00	1.00		
A1[i,ii]	Pre Torque Bias [i,ii]	volts [i,ii]	-6.00 – 6.00 [i,ii]	0.00 [i,ii]		
A1[i,ii]	Pre Torque Mult [i,ii]	none [i,ii]	-10.00 – +10.00 [i,ii]	1.00 [i,ii]		
A1[i,ii]	Pre Torque Time [i,ii]	sec [i,ii]	0.00 – 10.00 [i,ii]	0.00 [i,ii]		
A1[i,ii]	Ext Torque Bias [i,ii]	volts [i,ii]	-6.00 – +6.00 [i,ii]	0.00 [i,ii]		
A1[i,ii]	Ext Torque Mult [i,ii]	none [i,ii]	-10.00 – +10.00 [i,ii]	1.00 [i,ii]		
A1	Ana 1 Out Offset	%	-99.9 – +99.9	0.0		
A1	Ana 2 Out Offset	%	-99.9 – +99.9	0.0		
A1	Ana 1 Out Gain	None	0.0 – 10.0	1.0		
A1	Ana 2 Out Gain	None	0.0 – 10.0	1.0		
A1	Ser2 Insp Spd	ft/ min	0.0 – 100.0	30.0	-	
		m/ sec	0.000 – 0.500	-	0.150	
A1	Ser2 Rs Crp Spd	ft/ min	0.0 – 300.0	10.0	-	
		m/ sec	0.000 – 1.540	-	0.050	
A1	Ser2 Rs Cpr Time	Sec	0.0 – 200.0	180.0		
A1	Ser2 Flt Tol	Sec	0.00 – 2.00	0.50		
A1[i,ii]	*Arb Start Time [i,ii]*	*sec [i,ii]*	*0.00 – 5.00 [i,ii]*	*0.30 [i,ii]*		
A1[i,ii]	*Arb Decay Rate [i,ii]*	*none [i,ii]*	*0.000 – 0.999 [i,ii]*	*0.900 [i,ii]*		
A1[i,ii]	*ARB Inertia [i,ii]*	*none [i,ii]*	*0.10 – 4.00 [i,ii]*	*1.00 [i,ii]*		
A1[i,ii]	*ARB Torque Time [i,ii]*	*sec [i,ii]*	*0.000 – 1.000 [i,ii]*	*0.015 [i,ii]*		
A1	Mains Dip Speed	%	5.00 – 99.99	25.00		
A1	Mspd Delay 1-4	Sec	0.000 – 10.000	0.000		
A1	Mid Speed Level	%	0.00 – 110.00	80.00		
A1[ii]	*Encdr Flt Sense [ii]*	*% [ii]*	*10 – 100 [ii]*	*30 [ii]*		
A1[i,ii]	*ARB Deadband [i,ii]*	*none [i,ii]*	*0 – 20 [i,ii]*	*5 [i,ii]*		
A1[ii]	*Abs Ref Offset [ii]*	*degs [ii]*	*-180.00 – +180.00 [ii]*	*0.00 [ii]*		
A1[iii]	*Cont Dwell Time [iii]*	*sec [iii]*	*0.00 – 5.00 [iii]*	*0.50 [iii]*		

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Submenu	Parameter	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Site Setting
A2	***S-Curves A2 Submenu – For details, see S-Curves A2 Submenu on page 64.***					
A2	Accel Rate 0	ft/s^2	0.00 – 7.99	3.00	-	
		m/s^2	0.000 – 3.999	-	0.800	
A2	Decel Rate 0	ft/s^2	0.00 – 7.99	3.00	-	
		m/s^2	0.000 – 3.999	-	0.800	
A2	Accel Jerk In 0	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Accel Jerk Out 0	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Decel Jerk In 0	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Decel Jerk Out 0	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Accel Rate 1	ft/s^2	0.00 – 7.99	3.00	-	
		m/s^2	0.000 – 3.999	-	0.800	
A2	Decel Rate 1	ft/s^2	0.00 – 7.99	3.00	-	
		m/s^2	0.000 – 3.999	-	0.800	
A2	Accel Jerk In 1	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Accel Jerk Out 1	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Decel Jerk In 1	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Decel Jerk Out 1	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Accel Rate 2	ft/s^2	0.00 – 7.99	3.00	-	
		m/s^2	0.000 – 3.999	-	0.800	
A2	Decel Rate 2	ft/s^2	0.00 – 7.99	3.00	-	
		m/s^2	0.000 – 3.999	-	0.800	
A2	Accel Jerk In 2	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Accel Jerk Out 2	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Decel Jerk In 2	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Decel Jerk Out 2	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Accel Rate 3	ft/s^2	0.00 – 7.99	3.00	-	
		m/s^2	0.000 – 3.999	-	0.800	
A2	Decel Rate 3	ft/s^2	0.00 – 7.99	3.00	-	
		m/s^2	0.000 – 3.999	-	0.800	
A2	Accel Jerk In 3	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Accel Jerk Out 3	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Decel Jerk In 3	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A2	Decel Jerk Out 3	ft/s^3	0.0 – 29.9	8.0	-	
		m/s^3	0.00 – 9.99	-	0.60	
A3	***Multistep Ref A3 Submenu – For details see Multistep Ref A3 Submenu on page 66.***					
A3[i]	Speed Command 1[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 2[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	

[i] Parameter only accessible when SERIAL MODE (C1) is set to NONE, MODE1, MODE2 or MODE3

Submenu	Parameter	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Site Setting
A3	***Multistep Ref A3 Submenu continued…***					
A3[i]	Speed Command 3[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 4[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 5[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 6[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 7[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 8[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 9[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 10[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 11[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 12[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 13[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 14[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[i]	Speed Command 15[i]	ft/min	-3000.0 – +3000.0	0.0	-	
		m/sec	-16.000 – +16.000	-	0.000	
A3[ii]	*V0*[ii]	*ft/min*	*-3000.0 – +3000.0*	*0.0*	-	
		m/sec	*-16.000 – +16.000*	-	*0.000*	
A3[ii]	*VN*[ii]	*ft/min*	*-3000.0 – +3000.0*	*0.0*	-	
		m/sec	*-16.000 – +16.000*	-	*0.000*	
A3[ii]	*V1*[ii]	*ft/min*	*-3000.0 – +3000.0*	*0.0*	-	
		m/sec	*-16.000 – +16.000*	-	*0.000*	
A3[ii]	*V2*[ii]	*ft/min*	*-3000.0 – +3000.0*	*0.0*	-	
		m/sec	*-16.000 – +16.000*	-	*0.000*	
A3[ii]	*V3*[ii]	*ft/min*	*-3000.0 – +3000.0*	*0.0*	-	
		m/sec	*-16.000 – +16.000*	-	*0.000*	
A3[ii]	*V4*[ii]	*ft/min*	*-3000.0 – +3000.0*	*0.0*	-	
		m/sec	*-16.000 – +16.000*	-	*0.000*	
A3[ii]	*VI*[ii]	*ft/min*	*-3000.0 – +3000.0*	*0.0*	-	
		m/sec	*-16.000 – +16.000*	-	*0.000*	
A3[ii]	*Unlock Spd Level*[ii]	*ft/min*	*0.00 – 600.0*	*8.0*	-	
		m/sec	*0.00 – 300.0*	-	*0.800*	
A3[ii]	*Lvling Spd Level*[ii]	*ft/min*	*0.00 – 600.0*	*3.0*	-	
		m/sec	*0.00 – 300.0*	-	*0.300*	
A3[ii]	*Border Spd Level*[ii]	*ft/min*	*0.00 – 600.0*	*10.0*	-	
		m/sec	*0.00 – 300.0*	-	*1.000*	
A3[ii]	*Over Spd Level*[ii]	*%*	*99.0 – 150.0*	*105*	*105*	
A3[ii]	*Re-level Spd Hi*[ii]	*ft/min*	*0.00 – 600.0*	*000.5*	-	
		m/sec	*0.00 – 3.00*	-	*0.050*	
A3[ii]	*Re-level Spd Low*[ii]	*ft/min*	*0.00 – 600.0*	*000.5*	-	
		m/sec	*0.00 – 3.00*	-	*0.005*	

[i] Parameter only accessible when SERIAL MODE (C1) is set to None, Mode1, Mode2 or Mode3

[ii] Parameter only accessible when SERIAL MODE (C1) is set to DCP 3 or DCP 4

A4	***Power Convert A4 Submenu – For details, see Power Convert A4 Submenu on page 69.***					
A4	Input L-L Volts	volts	110 – 480	000		
A4	UV Alarm Level	%	50 – 99	90	80	
A4	UV Fault Level	%	40 – 99	80	70	
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	1.00 [i,iii]		
				0.00 [ii]		
A4	ID Reg Prop Gain	none	0.15 – 3.00	0.30 [i,iii]		
				0.700 [ii]		
A4[ii]	*ID Reg Intg Gain [ii]*	*none [ii]*	*0.00 – 2.00 [ii]*	*1.00 [ii]*		
A4	IQ Reg Diff Gain	none	0.00 – 1.20	1.00 [i,iii]		
				0.00 [ii]		
A4	IQ Reg Prop Gain	none	0.15 – 3.00	0.30 [i,iii]		
				0.700 [ii]		
A4[ii]	*IQ Reg Intg Gain [ii]*	*none [ii]*	*0.00 – 2.00 [ii]*	*1.00 [ii]*		
A4[ii]	*Fine Tune Ofst [ii]*	*degs [ii]*	*-75.00 – 75.00 [ii]*	*0.00 [ii]*		
A4[ii]	*ID Ref Threshold [ii]*	*none [ii]*	*0.00 – 0.20 [ii]*	*0 [ii]*		
A4[ii]	*Flux Weaken Rate [ii]*	*none [ii]*	*0.000 – 1.000 [ii]*	*0.0000 [ii]*		
A4[ii]	*Flux Weaken Lev [ii]*	*none [ii]*	*0.70 – 1.00 [ii]*	*0.95 [ii]*		
A4[ii]	*Align Vlt Factor [ii]*	*none [ii]*	*0.05 – 1.99 [ii]*	*1.00 [ii]*		
A4[ii]	*Brake Opn Flt Lv [ii]*	*% [ii]*	*0.0 – 20.0 [ii]*	*2 [ii]*		
A4[iii]	*ID Dist Loop Gn [iii]*	*none [iii]*	*0.00 – 1.50 [iii]*	*0.50 [iii]*		
A4[iii]	*IQ Dist Loop Gn [iii]*	*none [iii]*	*0.00 – 1.50 [iii]*	*0.30 [iii]*		
A4[iii]	*ID Dist Loop Fc [iii]*	*sec [iii]*	*0.1 – 30.0 [iii]*	*5.0 [iii]*		
A4[iii]	*IQ Dist Loop Fc [iii]*	*sec [iii]*	*0.1 – 30.0 [iii]*	*5.0 [iii]*		
A4[iii]	*I Reg Cross Freq [iii]*	*% [iii]*	*0.0 – 300.0 [iii]*	*100.0 [iii]*		
A4[iii]	*Dist Lp Off Freq [iii]*	*Hz [iii]*	*0.0 – 99.9 [iii]*	*60.0 [iii]*		
A4[iii]	*Ilimit Integ Gn [iii]*	*none [iii]*	*0.00 – 9.99 [iii]*	*1.00 [iii]*		
A4[iii]	*Hunt Prev Gain [iii]*	*none [iii]*	*0.00 – 4.00 [iii]*	*1.00 [iii]*		
A4[iii]	*Hunt Prev Time [iii]*	*sec [iii]*	*0.001 – 7.000 [iii]*	*0.200 [iii]*		
A4[iii]	*Switching Delay [iii]*	*sec [iii]*	*0 – 10 [iii]*	*0 [iii]*		
A4[iii]	*Vc Correction [iii]*	*volts [iii]*	*0.00 – 5.00 [iii]*	*2.50 [iii]*		
A4	Load Sense Time	sec	0.00 – 1.50	0.00		
A4[ii]	*Autoalign Volts [ii]*	*% [ii]*	*5 – 20 [ii]*	*10 [ii]*		
A4	Fan Off Delay	sec	0 – 999	60		

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessible through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

A5	***Motor A5 Submenu – For details see Motor A5 Submenu on page 75.***				
A5	Motor ID	none	– 4 pole dflt[i,iii] – 6 pole dflt[i,iii] – *PM dflt*[ii]	4 pole dflt[i,iii] *PM dflt*[ii]	
A5	Rated Mtr Power	HP	1.0 – 500.0	0.0	
		kW	0.75 – 300.00	0.00	
A5	Rated Mtr Volts	volts	85.0 – 575.0	0.0	
A5[i,iii]	Rated Excit Freq [i,iii]	Hz [i,iii]	5.0 – 400.0 [i,iii]	0.0 [i,iii]	
A5	Rated Motor Curr	amps	1.0 – 800.0	0.0	
A5	Motor Poles	none	2 – 128	4	
A5	Rated Mtr Speed	RPM	1.0 – 3000.0	0.0	
A5[i,iii]	% No Load Curr [i,iii]	% [i,iii]	10.0 – 80.0 [i,iii]	Per ID [i,iii]	
A5[i,iii]	Stator Leakage X [i,iii]	% [i,iii]	0.0 – 20.0 [i,iii]	Per ID [i,iii]	
A5[i,iii]	Rotor Leakage X [i,iii]	% [i,iii]	0.0 – 20.0 [i,iii]	Per ID [i,iii]	
A5[i]	Flux Sat Break [i]	% [i]	0 – 100 [i]	75 [i]	
A5[i]	Flux Sat Slope 1 [i]	PU Slope [i]	0 – 200 [i]	0 [i]	
A5[i]	Flux Sat Slope 2 [i]	PU Slope [i]	0 – 200 [i]	50 [i]	
A5[iii]	*Motor Min Volts* [iii]	*volts* [iii]	*0.1 – 100.0* [iii]	*9.0* [iii]	
A5[iii]	*Motor Min Freq* [iii]	*Hz* [iii]	*0.1 – 10.0* [iii]	*1.0* [iii]	
A5[iii]	*Motor Mid Volts* [iii]	*Volts* [iii]	*0.1 – 575.0* [iii]	*28.0* [iii]	
A5[iii]	*Motor Mid Freq* [iii]	*Hz* [iii]	*0.1 – 40.0* [iii]	*3.0* [iii]	
A5	Ovld Start Level	%	100 – 150	110	
A5	Ovld Time Out	sec	5.0 – 120.0	60.0	
A5	Stator Resist	%	0.0 – 20.0	1.5 [i,iii] *7.0* [ii]	
A5	Motor Iron Loss	%	0.0 – 15.0	0.5	
A5	Motor Mech Loss	%	0.0 – 15.0	1.0	
A5[ii]	*D Axis Induct* [ii]	*none* [ii]	*0.50 – 100.00* [ii]	*10* [ii]	*30* [ii]	
A5[ii]	*Q Axis Induct* [ii]	*none* [ii]	*0.50 – 100.00* [ii]	*10* [ii]	*30* [ii]	
A5[ii]	*Trq Const Scale* [ii]	*none* [ii]	*0.50 – 2.00* [ii]	*0.78* [ii]	
A5[ii]	*Encoder Ang Ofst* [ii]	*none* [ii]	*0 – 35999* [ii]	*30000* [ii]	

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessible through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

C1	***User Switches C1 Submenu – For details, see User Switches C1 on page 81.***					
C1	Spd Command Src	none	– analog input – multi-step – ser mult step – serial	MULTI-STEP		
C1	Run Command Src	none	– external tb – serial – serial+extern	EXTERNAL TB		
C1	Motor Rotation	none	– forward – reverse	FORWARD		
C1[ii]	*Encoder Select*[ii]	*none*[ii]	– *endat*[ii] – *incremental*[ii]	*INCREMENTAL*[ii]		
C1	Encoder Connect	none	– forward – reverse	FORWARD		
C1[i,ii]	Encoder Fault[i,ii]	none[i,ii]	– disable[i,ii] – enable[i,ii]	ENABLE[i,ii]		
C1	Cont Confirm Src	none	– none – external tb	NONE	EXTER-NAL TB	
C1[i]	Fast Flux[i]	none[i]	– disable[i] – enable[i]	DISABLE[i]		
C1[i,ii]	HI/LO Gain Src[i,ii]	none[i,ii]	– external tb[i,ii] – serial[i,ii] – internal[i,ii]	INTERNAL[i,ii]		
C1[ii]	*I-Reg Inner Loop*[ii]	*none*[iii]	– *disabled*[ii] – *enabled low*[ii] – *enabled high*[ii]	*DISABLED*[ii]		
C1[i,ii]	Ramped Stop Sel[i,ii]	none[i,ii]	– none[i,ii] – ramp on stop[i,ii]	NONE[i,ii]		
C1[i,ii]	Ramp Down En Src[i,ii]	none[i,ii]	– external tb[i,ii] – run logic[i,ii] – serial[i,ii]	EXTERNAL TB[i,ii]		
C1	S-Curve Abort	none	– disable – enable	DISABLE	ENABLE	
C1	DB Protection	none	– fault – alarm	FAULT		
C1	Spd Ref Release	none	– reg release – brake picked	REG RELEASE	BRAKE PICKED	
C1	Brake Pick Src	none	– internal – serial	INTERNAL		
C1	Brake Pick Cnfm	none	– none – internal time – external tb	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[iii]	*Stall Test Ena*[iii]	*none*[iii]	– *enable*[iii] – *disable*[iii]	*ENABLE*[iii]		
C1[iii]	*Stall Prev Ena*[iii]	*none*[iii]	– *enable*[iii] – *disable*[iii]	*DISABLE*[iii]		

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessible through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

C1	***User Switches C1 Submenu continued…***				
C1	Serial Mode	none	– none – mode 1 – mode 2 – mode 3 – DCP3 – DCP4	NONE	
C1	Ser2 Flt Mode	none	– immediate – run remove – rescue	IMMEDIATE	
C1	Drv Fast Disable	none	– disable – enable	DISABLE	
C1[i,ii]	Speed Reg Type[i,ii]	none[i,ii]	– elev spd reg[i,ii] – pi speed reg[i,ii] – external reg[i,ii]	ELEV SPD REG[i,ii]	
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[i,ii]	Ext Torq Cmd Src[i,ii]	none[i,ii]	– none[i,ii] – analog input[i,ii] – serial[i,ii]	NONE[i,ii]	
C1	Fault Reset Src	None	– external tb – serial – automatic	EXTERNAL TB	
C1	Overspd Test Src	None	– external tb – serial	EXTERNAL TB	
C1[i,ii]	Pretorque Source[i,ii]	none[i,ii]	– none[i,ii] – analog input[i,ii] – serial[i,ii]	NONE[i,ii]	
C1[i,ii]	Pretorque Latch[i,ii]	none[i,ii]	– not latched[i,ii] – latched[i,ii]	NOT LATCHED[i,ii]	
C1[i,ii]	Ptorq Latch Clck[i,ii]	none[i,ii]	– serial[i,ii] – external tb[i,ii]	EXTERNAL TB[i,ii]	
C1	Dir Confirm	None	– disable – enable	DISABLE	
C1	Mains Dip Ena	None	– disable – low mains – external tb – serial	DISABLE	
C1	Mlt-Spd to Dly 1-4	None	– none – mspd 1-15	NONE	
C1	Priority Msg	None	– enable – disable	ENABLE	
C1[i,ii]	*ARB Select[i, ii]*	*none[i, ii]*	– *enable[i ii]* – *disable[i ii]*	*DISABLE[ii]*	
C1	Drive Enable Src	None	– external tb – serial – serial+extern	EXTERNAL TB	
C1	Rec Travel Dir	None	– none – geared – gearless	NONE	

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessible through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

<table>
<tr><td>C2</td><td colspan="5">Logic Inputs C2 Submenu – For details, see Logic Inputs C2 on page 97.</td></tr>
<tr><td>C2</td><td>Logic Input 1</td><td rowspan="9">– contact cfirm
– drive enable
– extrn fault 1
– extrn fault 2
– extrn fault 3
– extrn/flt 4
– fault reset
– low gain sel
– mains dip
– mech brk hold
– mech brk pick
– nc ctct cfirm
– no function
– ospd test src
– rec travel en
– pre-trq latch
– quick stop
– 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</td><td colspan="2">DRIVE ENABLE</td><td></td></tr>
<tr><td>C2</td><td>Logic Input 2</td><td>RUN</td><td>CONTCT CFIRM</td><td></td></tr>
<tr><td>C2</td><td>Logic Input 3</td><td>FAULT RESET</td><td>RUN UP</td><td></td></tr>
<tr><td>C2</td><td>Logic Input 4</td><td>UP/DWN</td><td>RUN DOWN</td><td></td></tr>
<tr><td>C2</td><td>Logic Input 5</td><td colspan="2">S-CURVE SEL 0</td><td></td></tr>
<tr><td>C2</td><td>Logic Input 6</td><td colspan="2">STEP REF B0</td><td></td></tr>
<tr><td>C2</td><td>Logic Input 7</td><td colspan="2">STEP REF B1</td><td></td></tr>
<tr><td>C2</td><td>Logic Input 8</td><td colspan="2">STEP REF B2</td><td></td></tr>
<tr><td>C2</td><td>Logic Input 9</td><td>EXTRN FAULT 1</td><td>FAULT RESET</td><td></td></tr>
<tr><td>C3</td><td colspan="5">Logic Outputs C3 Submenu – For details, see Logic Outputs C3 on page 99.</td></tr>
<tr><td>C3</td><td>Logic Output 1</td><td rowspan="7">– Alarm
– alarm+flt
– at mid speed
– auto brake
– brake alarm
– brake hold
– brake pick
– brk hold flt
– brk igbt flt
– brk pick flt
– car going dwn
– car going up
– charge fault
– close contact
– contactor flt
– curr reg flt
– drv overload
– encoder flt
– ext fan en
– fan alarm
– fault
– flt reset out
– flux confirm
– fuse fault
– ground fault
– in low gain
– rec travel dir
– motor trq lim
– mtr overload
– no function
– not alarm
– over curr flt
– overspeed flt
– overtemp flt
– overvolt flt
– ovrtemp alarm
– phase fault
– ramp down ena
– ready to run
– regen trq lim
– run commanded
– run confirm
– speed dev
– speed dev low
– speed ref rls
– speed ref rel2
– speed reg rls
– stltst active
– undervolt flt
– up to speed
– uv alarm
– zero speed
– rec travel on</td><td colspan="2">READY TO RUN</td><td></td></tr>
<tr><td>C3</td><td>Logic Output 2</td><td colspan="2">RUN COMMANDED</td><td></td></tr>
<tr><td>C3</td><td>Logic Output 3</td><td>MTR OVER-LOAD</td><td>ZERO SPEED</td><td></td></tr>
<tr><td>C3</td><td>Logic Output 4</td><td colspan="2">ENCODER FLT</td><td></td></tr>
<tr><td>C3</td><td>Relay Coil 1</td><td>FAULT</td><td>READY TO RUN</td><td></td></tr>
<tr><td>C3</td><td>Relay Coil 2</td><td>SPEED REG RLS</td><td>BRAKE PICK</td><td></td></tr>
<tr><td>C3</td><td>User LED</td><td colspan="2">ALARM</td><td></td></tr>
<tr><td>C4</td><td colspan="5">Analog Outputs C4 Submenu – For details, see Analog Outputs C4 on page 102.</td></tr>
<tr><td>C4</td><td>Analog Output 1</td><td rowspan="2">– abs pos bin
– aux torq cmd
– bus voltage
– current out
– d-current ref
– drv overload
– flux current
– flux output
– flux ref
– flux voltage
– frequency out
– mtr overload
– no function
– power output
– pretorque ref
– slip freq
– spd rg tq cmd
– speed command
– speed error
– speed feedbk
– speed ref
– tach rate cmd
– theta e
– torq current
– torq voltage
– torque output
– torque ref
– voltage out</td><td>SPEED REF</td><td>SPEED COM-MAND</td><td></td></tr>
<tr><td>C4</td><td>Analog Output 2</td><td colspan="2">SPEED FEEDBK</td><td></td></tr>
</table>

Sub menu	Parameter	Units
D1	***Elevator Data D1 Submenu***	
D1	Speed Command	ft/min or m/s
D1	Speed Reference	ft/min or m/s
D1	Speed Feedback	ft/min or m/s
D1	Encoder Speed	rpm
D1[i,ii]	Speed Error[i,ii]	ft/min or m/s [i,ii]
D1[i,ii]	Est Inertia [i,ii]	seconds [i,ii]
D1	Logic Outputs	1 = true; 0 = false
D1	Logic Inputs	1 = true; 0 = false
D1	Rx Logic In	1 = true; 0 = false
D1[i,ii]	Start Logic [i,ii]	1 = true; 0 = false [i,ii]
D1[i,ii]	Rx Com Status [i,ii]	1 = true; 0 = false [i,ii]
D1	Rx Error Count	none
D1[i,ii]	Pre-Torque Ref [i,ii]	% of rated torque [i,ii]
D1[i,ii]	Spd Reg Torq Cmd[i,ii]	% of rated torque [i,ii]
D1[i,ii]	Tach Rate Cmd [i,ii]	% of rated torque [i,ii]
D1[i,ii]	FF Torque Cmd [i,ii]	% of rated torque [i,ii]
D1	Enc Position	None
D1	Enc Revolutions	None
D1	DCP Command	1 = true; 0 = false
D1	DCP Status	1 = true; 0 = false
D2	***Power Data D2 Submenu***	
D2	DC Bus Voltage	Volts
D2	Motor Current	Amps
D2	Motor Voltage	Volts
D2	Motor Frequency	Hz
D2	Motor Torque	% rated torque
D2[i]	Est No Load Curr % [i]	% [i]
D2[i]	Est Rated RPM [i]	Rpm [i]
D2[i,ii]	Torque Reference [i,ii]	% of rated torque[i,ii]
D2[i]	Flux Reference [i]	% [i]
D2[i]	Flux Output [i]	% [i]
D2	% Motor Current	% rated current
D2	Power Output	kW
D2[ii]	*D-Curr Reference [ii]*	*% [ii]*
D2[i,iii]	Slip Frequency[i,iii]	Hz[i,iii]
D2	Motor Overload	%
D2	Drive Overload	%
D2	Flux Current	%
D2	Torque Current	% rated current
D2	Flux Voltage	% rated volts
D2	Torque Voltage	% rated volts
D2	Base Impedance	Ohms
D2[ii]	*Rated Excit Freq [ii]*	*Hz [ii]*
D2[ii]	*Rotor Position [ii]*	*none [ii]*
D2	Drive Temp	Deg C
D2	Highest Temp	Deg C

Sub menu	Parameter	Site Setting
U1	***Password U1 Submenu***	
U1	Enter password	
U1	New password	
U1	Password lockout	
U2	***Hidden Items U2 Submenu***	
U2	Hidden Items Enable	
U3	***Units U3 Submenu***	
U3	Units Selection	
U4	***Ovrspeed Test U4 Submenu***	
U4	Overspeed Test	
U5	***Restore Dflts U5 Submenu***	
U5	Rst Mtr Dflts	
U5	Rst Drive Dflts	
U6	***Drive Info U6 Submenu***	
U6	Drive Version	
U6	Boot Version	
U6	Cube ID	
U6	Drive Type	
U7	***Hex Monitor U7 Submenu***	
U7	Address	
U8	***Language Sel U8 Submenu***	
U8	Language Select	
U9	***Basics U9 Submenu***	
U9	Drive Mode	
U10[ii]	***Rotor Align U10 Submenu [ii]***	
U10[ii]	Alignment [ii]	
U10[ii]	Begin Alignment [ii]	
U10[ii]	Alignment Method [ii]	
U11	***Time U11 Submenu***	
U11	Year	
U11	Month	
U11	Day	
U11	Hour	
U11	Minute	
U11	Second	
U12 [ii]	***AutoTune U12 Submenu [ii]***	
U12[ii]	Autotune Select [ii]	
U14	***Power Meter U14 Submenu***	
U14	Motor Pwr	
U14	Regen Pwr	
U14	Energy Time	
U14	Energy Reset	
F1	***Active Faults F1 Submenu***	
F2	***Faults History F2 Submenu***	
F3	***Sorted History F3 Submenu***	
F4	***Reset Faults F4 Submenu***	
F4	Rst Active Flts	
F4	Clr Flt Hist	

[i] Parameter accessible through **CLOSED LOOP (U9)** only
[ii] Parameter accessible through ***PM (U9)*** only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** only

Introduction

Drive Specifications

Ratings

- North American Horse Power ratings
  - 230 Volt AC input:
    7.5, 10, 15, 20, 25, 30, and 40 HP
  - 460 Volt AC input:
    5, 7.5, 10, 15, 20, 25, 30, 40, 50, 60, and 75 HP
- European Horse Power ratings
  - 400 Volt AC input:
    5, 5.5, 7.5, 10, 15, 20, 25, 30, 40, 50, and 60HP
- 150% of continuous current rating (general purpose rating) for 60 seconds
- 250% of continuous current rating (general purpose rating) for 5 seconds

Performance Features

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

Input Power

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

Output Power

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

Motor Control

- Induction: Closed Loop
- Induction: Open Loop
- Permanent Magnet: Incremental
- Permanent Magnet: Endat (requires kit HPV9-ENDAT)

Digital Inputs

Nine (9) programmable opto-isolated logic inputs.

Voltage:
ON State:
Sinking Operation (High True): 18-26.4 Volts
Sourcing Operation (Low True): 0-3.5 Volts
OFF State:
Sinking Operation (High True): 0-4.5 Volts
Sourcing Operation (Low True): 22-26.4 Volts

- Off state leakage current: 1mA
- On state leakage current (nominal): 5.5mA
- Scan Rate: 2 msec.
- Update Rate: 4 msec.

Digital Outputs

Two (2) programmable Form-C relays.

- Relay 1&2: 2A at 30VDC / 250VAC resistive (inductive load)
- Update Rate: 2 msec.

Four (4) programmable opto-isolated open collectors.

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

Analog Inputs

Two (2) differential inputs.

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

Analog Outputs
Two (2) programmable differential outputs.
- Voltage: ± 10 Volts DC
- Capacity: 10 mA
- Resolution: 10 Bit, 5msec time constant
- Update Rate: 2 msec

Encoder Feedback
- Supply Voltage: 12VDC or 5VDC*
  * see Incremental encoder Voltage Selection on page 29
- Capacity: 200mA or 400mA
- PPR: 600 - 10,000 (max)
- Maximum Frequency: 300 kHz
- Input: 2 channel quadrature (A, /A, B, /B)
  Zero marker (Z,/Z)
  Endat (PM, option)

Remote Keypad
- The keypad can be remotely mounted, the maximum recommended cable length is 9.15 Meters (30ft)

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

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

Environmental
- Operating ambient air temperature range -10°C (14°F) to 45°C (110°F)
- Altitude 1000m (3300 ft) without derating
- Relative humidity 95% (non-condensing)
- Environment: protected from corrosive gases; conductive dust
- Vibration: displacement of 0.032mm < 57Hz; peak acceleration 0.5g > 57Hz
- Storage of -20°C – 65°C
- Capacitors must be reformed after storage of more than 1 year.

Standards and Reliability
- CSA listed
- CE
- Surface mount devices

Drive Derating

Altitude Derating

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

Derating for Carrier Frequency

Control ratings apply for carrier frequencies up to and including 10 kHz. See Carrier Frequency Ratings on page 193.

Derating for Single Phase Input Power

For single-phase input power, derate both the continuous and peak current levels by 60%. For single phase rating table, see Single Phase Ratings on page 192.

Drive Model Number
The HPV 900 Series 2 nameplate contains a fifteen-digit model number, which provides complete identification of the drive. Figure 1 details the model number.

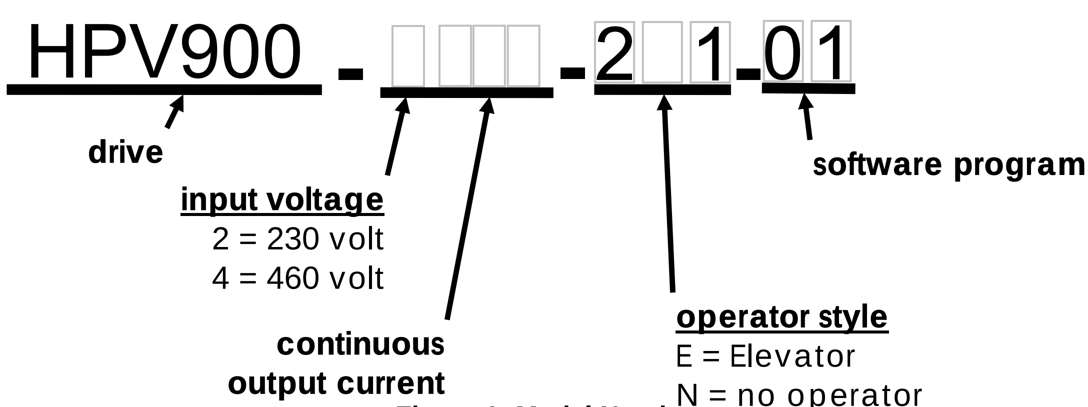


Figure 1: Model Number

General Start-Up Procedure

The following is a recommended start-up procedure:

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

Location of the HPV 900 Series 2 is important for proper operation of the drive and normal life expectancy. The installation should comply with the following:

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

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

- When necessary, the cooling should be provided by using filtered air.
- If the cooling air coming inside the control cabinet contains airborne dust, filter the incoming air as required and clean the cooling surface of the HPV 900 Series 2 regularly using compressed air and a brush. An unclean heatsink operates at an efficiency less than that of cooling design specifications. Therefore, drive may fault on thermal protection if heatsink is not cleaned periodically.

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

   Observe the following precautions:

- Use 600V vinyl sheathed wire or equivalent. Wire size should be determined considering voltage drop of leads.
- Never connect main AC power to the output terminals: U, V, and W.
- Never allow wire leads to contact metal surfaces. Short circuit may result.
- SIZE OF WIRE MUST BE SUITABLE FOR CLASS I CIRCUITS.
- Motor lead length should not exceed 45m (150 ft) and motor wiring should be run in a separate conduit from the power wiring. If lead length must exceed this distance, contact Magnetek for proper installation procedures.
- Use UL/CSA certified connectors sized for the selected wire gauge. Install connectors using the specified crimping tools specified by the connector manufacturer.
- Use twisted shielded or twisted-pair shielded wire for control and signal circuit leads. The shield sheath MUST be connected at the HPV 900 Series 2 ONLY. The other end should be dressed neatly and left unconnected (floating).
- Control wire size should be determined considering the voltage drops of the leads.
- Control wire lead length should not exceed 45m (150 ft). Signal leads and feedback leads should be run in separate conduits from power and motor wiring.

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

IMPORTANT

The drive has a common ground bus terminal connection. All grounds need to land at this common point including building, motor, transformer, and filter grounds. This will limit the impedance between the grounds and noise will be channeled back to building ground.

Pre-Power Check

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

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

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

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

9. Insure the DC Choke link is in place, if a DC choke is NOT used.
10. Insure a Dynamic Braking Resistor is connected to the drive, see page 178
11. Measure and verify transformer primary and secondary volts
12. Check for balanced Vac from phase to ground.
13. Verify the accuracy of the drive's input line-to-line voltage in parameter INPUT L-L VOLTS (A4)

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

Real Time Clock Setup

The HPV900 Series 2 operator comes with a real time clock and battery. As part of the startup, it is beneficial to the user to setup the real time clock by following the instructions below:

1. With power removed from the drive, remove the operator from the drive by unplugging the connector.
2. As seen in Figure 2, set the power switch to "1". Plug operator back into drive.

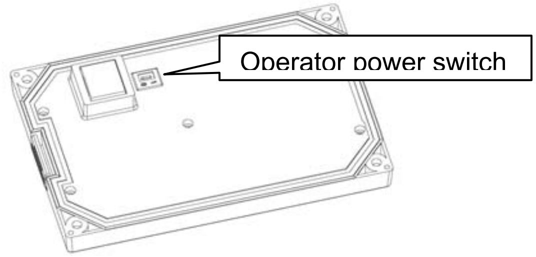


Figure 2: Back of Operator

3. Turn on power to the drive and set the following parameters in the Time, U11 submenu:
   - Year
   - Month
   - Day
   - Hour (use 24 hour clock)
   - Minute
   - Second
4. These number(s) / date(s) will be automatically stored, however, after setting these value in the U11 submenu, it may be viewed on the top of the display or logged into fault history when a fault occurs and the U11 parameter will reset back to zero.

This completes the recommended general start-up procedure. For Close-Loop Adaptive Tune procedure, please see page 139. For Open Loop Start-Up Procedure, please see page 155.

CSA Warnings

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

Caution—Risk of Electric Shock:

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

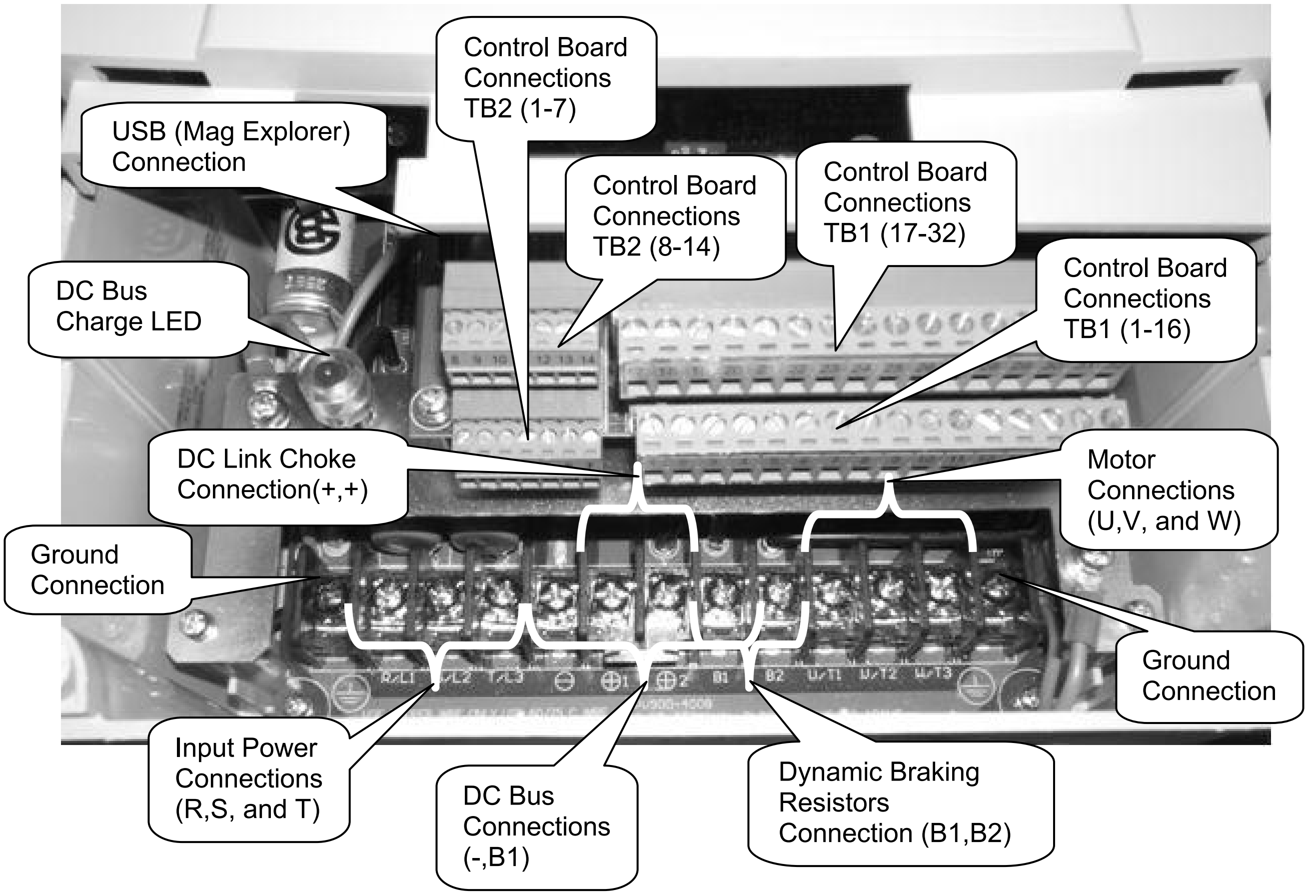
Caution—Risk of Electric Shock: More than one live circuit: See diagram

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

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

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

Terminals



Remember when servicing the HPV900 Series 2: Hazardous voltages may exist in the drive circuits even with drive circuit breaker in off position.

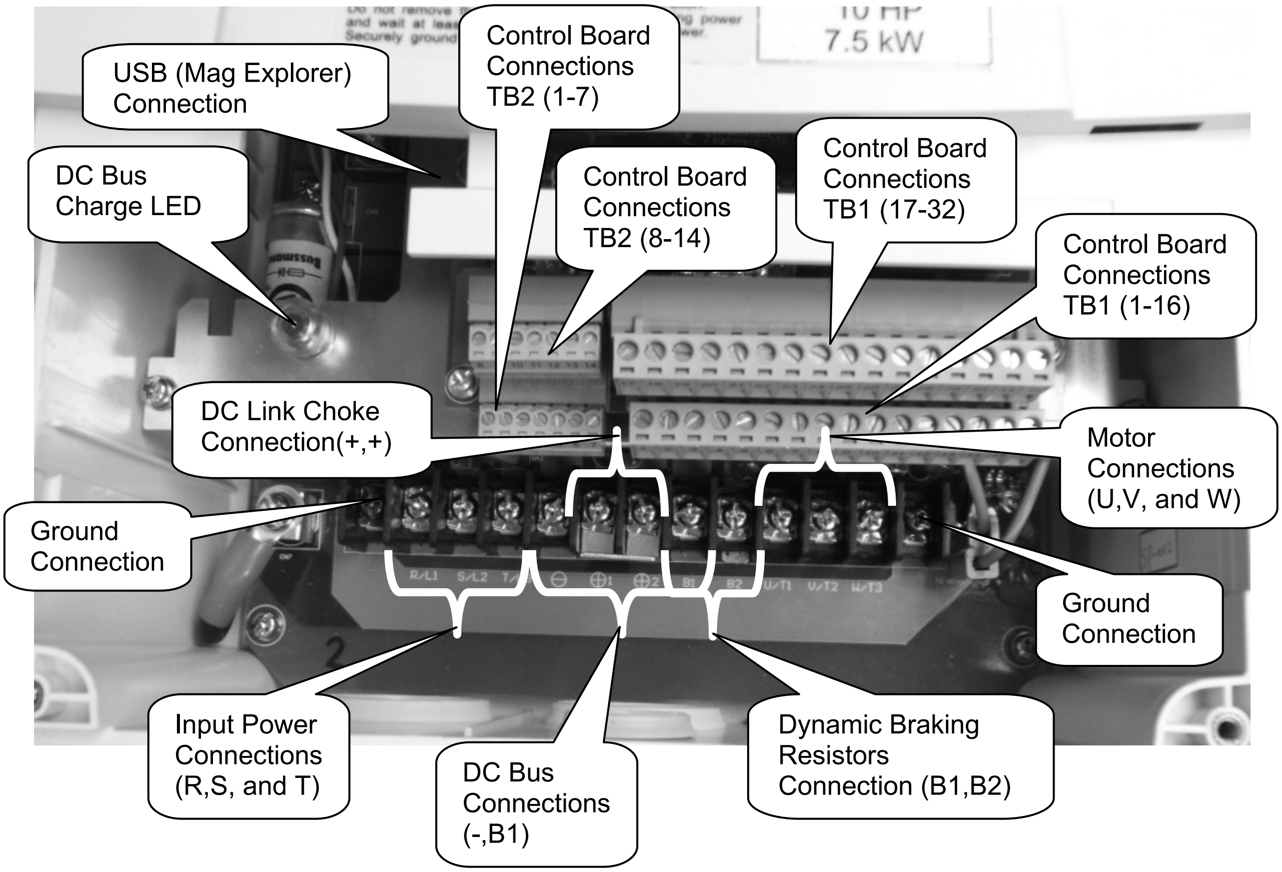
IMPORTANT: Use extreme caution: Do not touch any circuit board, the drive, or motor electrical connections without making sure that the unit is properly grounded and that no high voltage is present.

NEVER attempt maintenance unless:
The incoming three phase power (460 or 230VAC) is disconnected and locked out.
Also, ensure the DC Bus charge light is out.
Even with the light out, we recommend that you use a voltmeter between (-) and (+) to verify that no voltage is present.

CAUTION: Before continuing, ensure the DC Bus Charge LED is not illuminated.

IMPORTANT: Take ESD precautions, devices within the drive are sensitive to static damage.

Figure 3: Terminal Connections (Frame 1)



Remember when servicing the HPV900 Series 2: Hazardous voltages may exist in the drive circuits even with drive circuit breaker in off position.

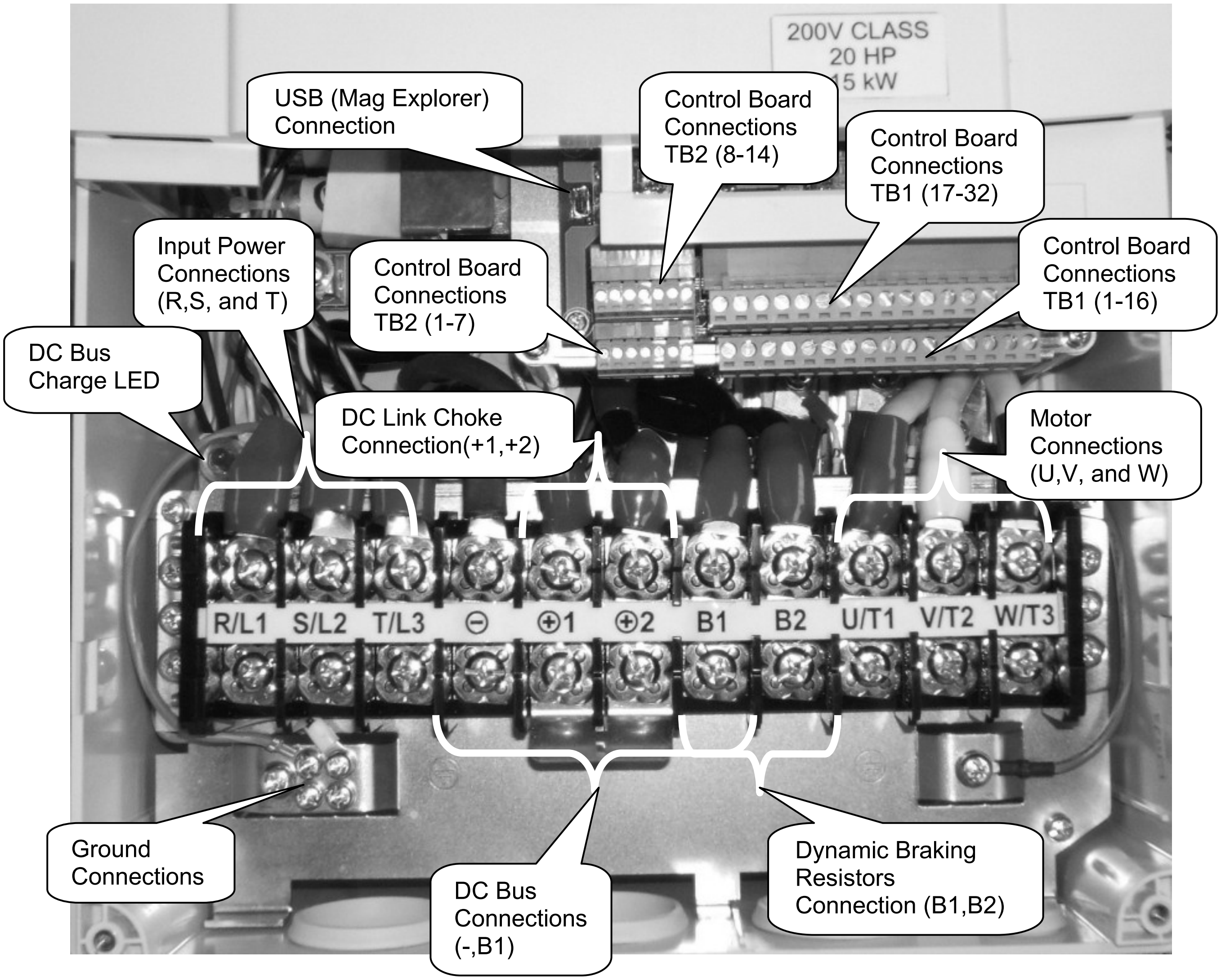
IMPORTANT: Use extreme caution: Do not touch any circuit board, the drive, or motor electrical connections without making sure that the unit is properly grounded and that no high voltage is present.

NEVER attempt maintenance unless:
The incoming three phase power (460 or 230VAC) is disconnected and locked out.
Also, ensure the DC Bus charge light is out.
Even with the light out, we recommend that you use a voltmeter between (-) and (+) to verify that no voltage is present.

CAUTION: Before continuing, ensure the DC Bus Charge LED is not illuminated.

IMPORTANT: Take ESD precautions, devices within the drive are sensitive to static damage.

Figure 4: Terminal Connections (Frame 2)



Remember when servicing the HPV900 Series 2: Hazardous voltages may exist in the drive circuits even with drive circuit breaker in off position.

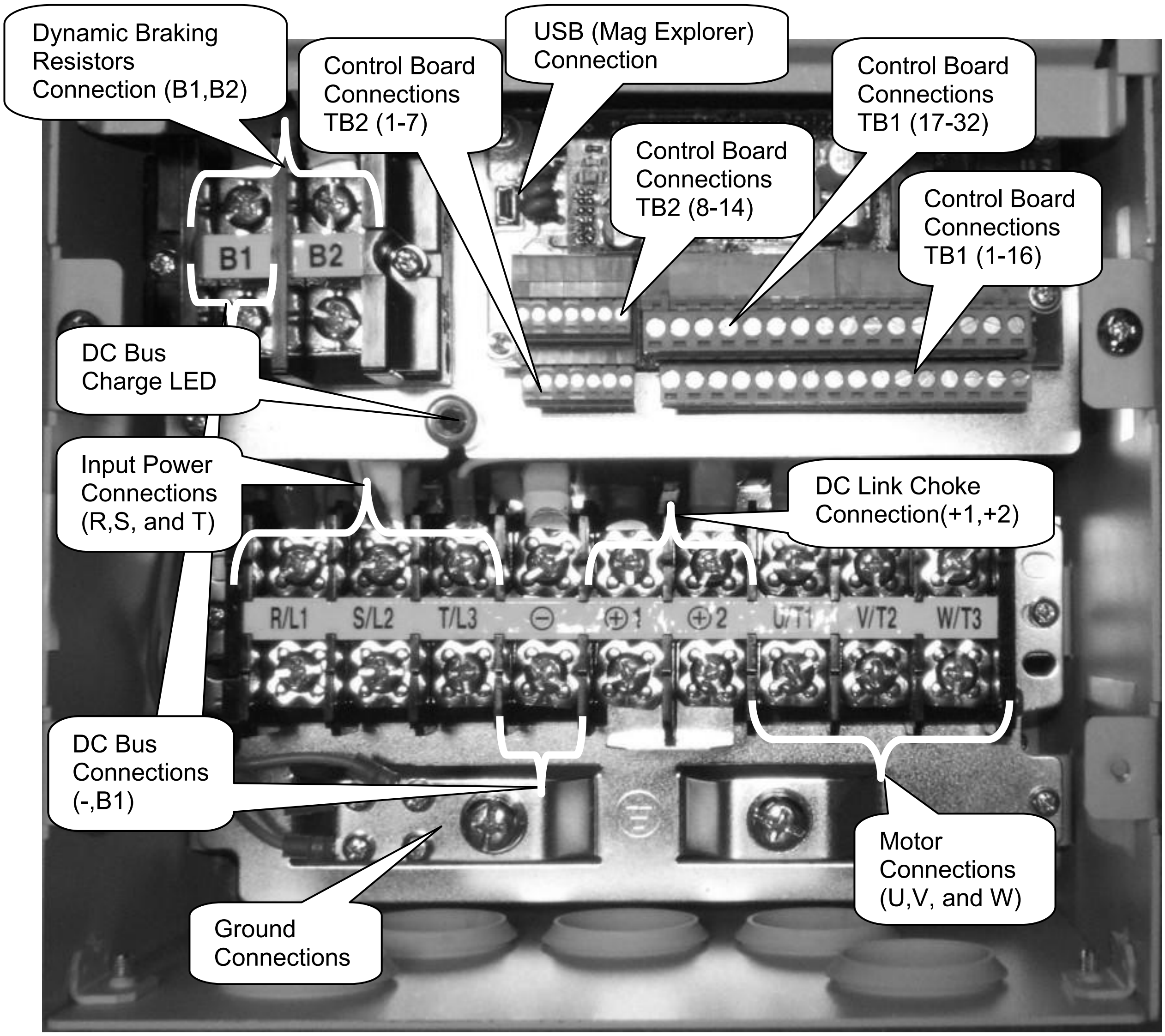
IMPORTANT: Use extreme caution: Do not touch any circuit board, the drive, or motor electrical connections without making sure that the unit is properly grounded and that no high voltage is present.

NEVER attempt maintenance unless:
The incoming three phase power (460 or 230VAC) is disconnected and locked out.
Also, ensure the DC Bus charge light is out.
Even with the light out, we recommend that you use a voltmeter between (-) and (+) to verify that no voltage is present.

CAUTION: Before continuing, ensure the DC Bus Charge LED is not illuminated.

IMPORTANT: Take ESD precautions, devices within the drive are sensitive to static damage.

Figure 5: Terminal Connections (Frame 3)



Remember when servicing the HPV900 Series 2: Hazardous voltages may exist in the drive circuits even with drive circuit breaker in off position.

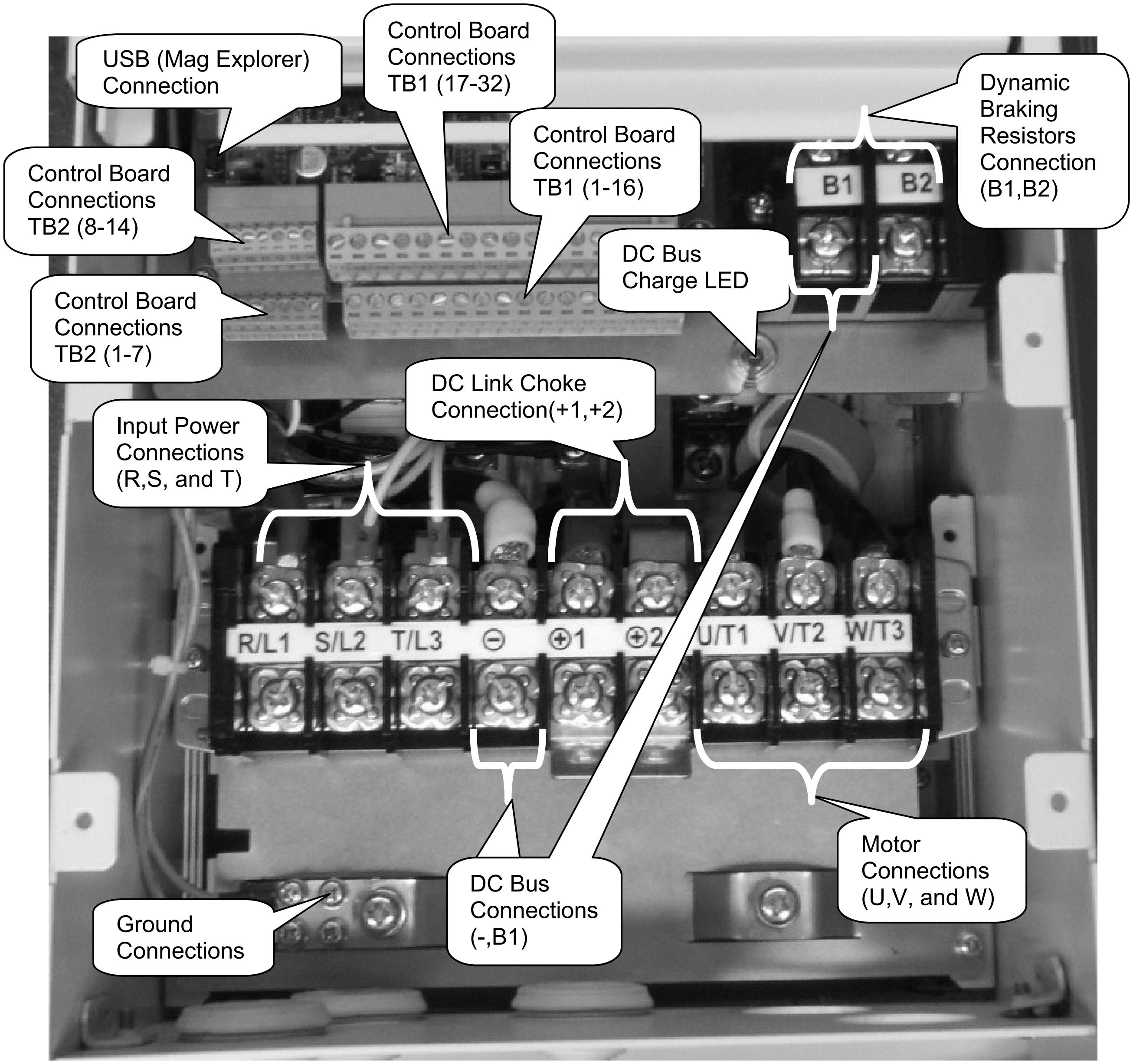
IMPORTANT: Use extreme caution: Do not touch any circuit board, the drive, or motor electrical connections without making sure that the unit is properly grounded and that no high voltage is present.

NEVER attempt maintenance unless:
The incoming three phase power (460 or 230VAC) is disconnected and locked out.
Also, ensure the DC Bus charge light is out.
Even with the light out, we recommend that you use a voltmeter between (-) and (+) to verify that no voltage is present.

CAUTION: Before continuing, ensure the DC Bus Charge LED is not illuminated.

IMPORTANT: Take ESD precautions, devices within the drive are sensitive to static damage.

Figure 6: Terminal Connections (Frame 3.5)



Remember when servicing the HPV900 Series 2: Hazardous voltages may exist in the drive circuits even with drive circuit breaker in off position.

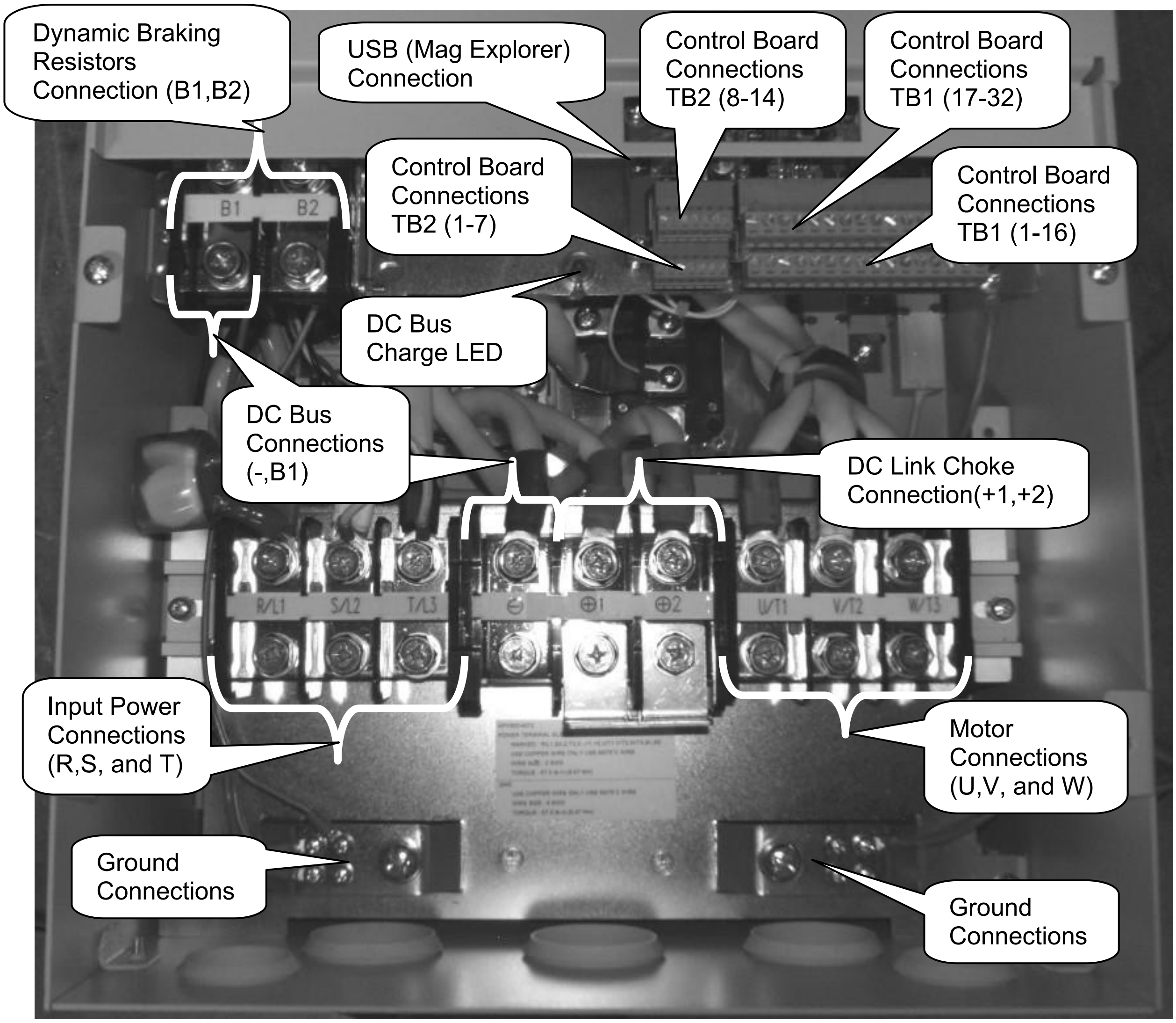
IMPORTANT: Use extreme caution: Do not touch any circuit board, the drive, or motor electrical connections without making sure that the unit is properly grounded and that no high voltage is present.

NEVER attempt maintenance unless:
The incoming three phase power (460 or 230VAC) is disconnected and locked out.
Also, ensure the DC Bus charge light is out.
Even with the light out, we recommend that you use a voltmeter between (-) and (+) to verify that no voltage is present.

CAUTION: Before continuing, ensure the DC Bus Charge LED is not illuminated.

IMPORTANT: Take ESD precautions, devices within the drive are sensitive to static damage.

Figure 7: Terminal Connections (Frame 4)



Remember when servicing the HPV900 Series 2: Hazardous voltages may exist in the drive circuits even with drive circuit breaker in off position.

IMPORTANT: Use extreme caution: Do not touch any circuit board, the drive, or motor electrical connections without making sure that the unit is properly grounded and that no high voltage is present.

NEVER attempt maintenance unless:
The incoming three phase power (460 or 230VAC) is disconnected and locked out.
Also, ensure the DC Bus charge light is out.
Even with the light out, we recommend that you use a voltmeter between (-) and (+) to verify that no voltage is present.

CAUTION: Before continuing, ensure the DC Bus Charge LED is not illuminated.

IMPORTANT: Take ESD precautions, devices within the drive are sensitive to static damage.

Figure 8: Terminal Connections (Frame 5)

Interconnections

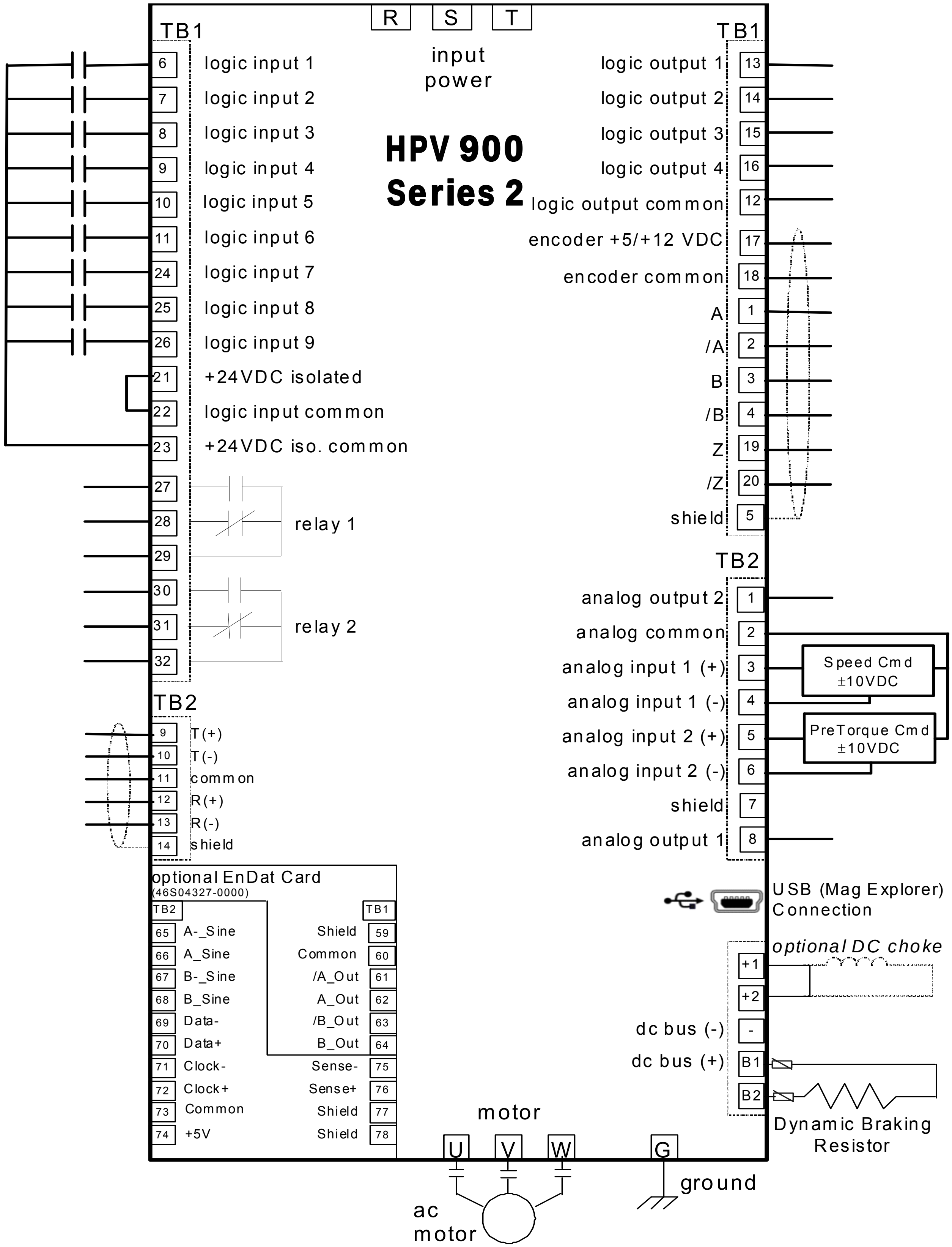


Figure 9: Interconnection Diagram

Logic Inputs

The HPV 900 Series 2's nine programmable logic inputs are opto-isolated. The inputs become "true" by closing contacts or switches between the logic input terminal and voltage source common (or voltage source). The voltage supply for the logic inputs is 24VDC.

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.

Figure 10 shows the connection for using the internal voltage supply. And in this case, the voltage source common is TB1-21 (+24VDC isolated).

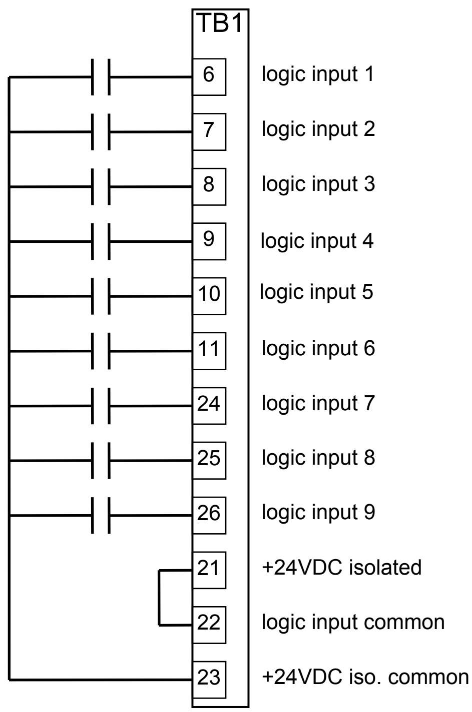


Figure 10: Logic Inputs Sourcing Operation (Low True - Internal Supply)

Figure 11 shows the connection for using the internal voltage supply. And in this case, the voltage source common is TB1-23 (+24VDC isolated common).

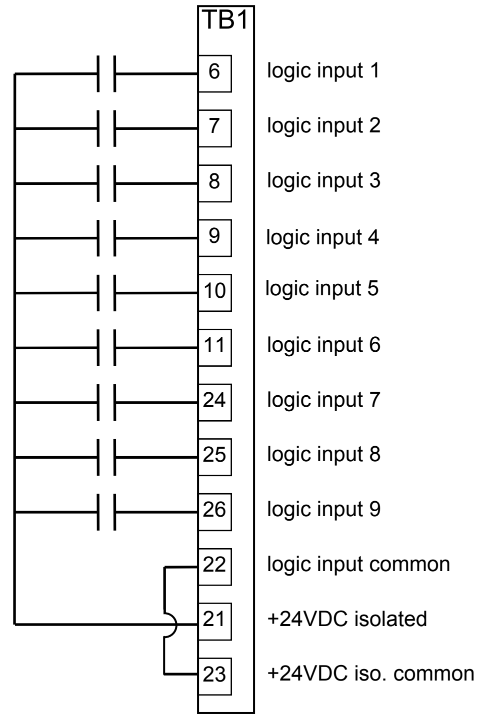


Figure 11: Logic Inputs Sinking Operation (High True - Internal Supply)

Figure 12 shows the connection for using the external voltage supply. And in this case the voltage source common is positive side of the external voltage supply.

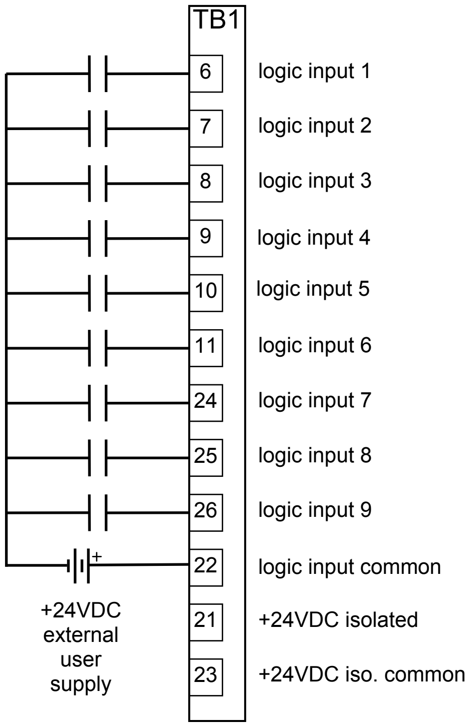


Figure 12: Logic Inputs Sourcing Operation (Low True - External Supply)

Figure 13 shows the connection for using the external voltage supply. And in this case, the voltage source common is the negative side of the external voltage supply.

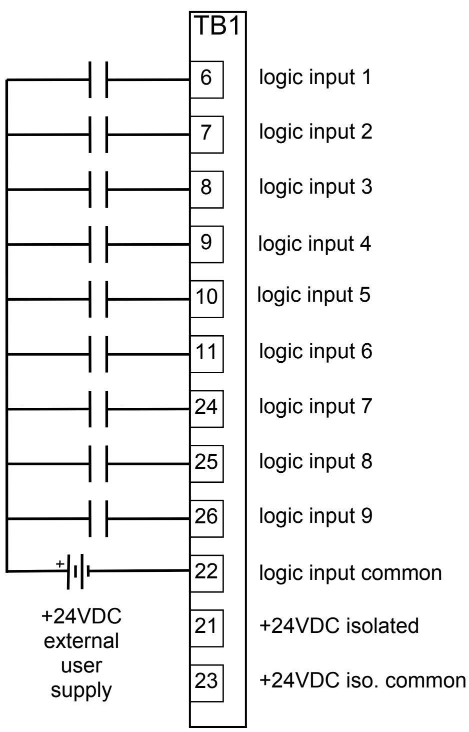


Figure 13: Logic Inputs Sinking Operation (High True - External Supply)

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

For more information on the programming the logic inputs, see Logic Inputs C2 on page 97.

As a reference, please refer to the table below if replacing an HPV900 or HPV600 with the HPV900 Series 2 drive.

Terminal Description	**Logic Input Connections**		
	HPV900 Series 2	**HPV900**	**HPV600**
Logic Input 1	TB1-6	TB1-1	TB1-16
Logic Input 2	TB1-7	TB1-2	TB1-17
Logic Input 3	TB1-8	TB1-3	TB1-18
Logic Input 4	TB1-9	TB1-4	TB1-19
Logic Input 5	TB1-10	TB1-5	TB1-20
Logic Input 6	TB1-11	TB1-6	TB1-21
Logic Input 7	TB1-24	TB1-7	TB1-22
Logic Input 8	TB1-25	TB1-8	TB1-23
Logic Input 9	TB1-26	TB1-9	TB1-24
Logic Input Common	TB1-22	TB1-10	TB1-15
+24VDC isolated	TB1-21	TB1-11	TB1-13
+24VDC iso. Common	TB1-23	TB1-12	TB1-14

Table 2: Logic Input Connections

Logic Outputs

The HPV 900 Series 2's four programmable logic outputs are opto-isolated, open collector. The outputs are normally open and can withstand an applied maximum voltage of 50VDC. When the output becomes "true", the output closes and is capable of sinking up to 150mA between the logic output terminal and the logic output common (TB1-12). Figure 14 shows the logic output terminals.

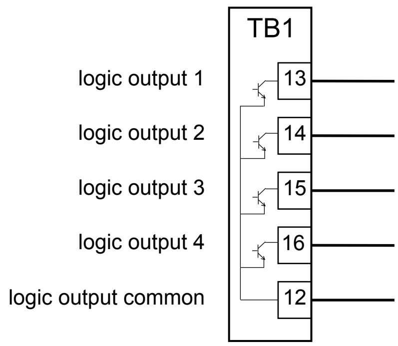


Figure 14: Logic Outputs

For more information on programming the logic outputs, see section Logic Outputs C3 on page 99.

As a reference, please refer to the table below if replacing an HPV900 or HPV600 with the HPV900 Series 2 drive.

Terminal Description	Logic Output Connections		
	HPV900 Series 2	HPV900	HPV600
Logic Output 1	TB1-13	TB1-14	TB1-9
Logic Output 2	TB1-14	TB1-15	TB1-10
Logic Output 3	TB1-15	TB1-16	TB1-12
Logic Output 4	TB1-16	TB1-17	TB1-13
Logic Output Common	TB1-12	TB1-18	TB1-8

Table 3: Logic Output Connections

Relay Outputs

The HPV 900 Series 2's two programmable relay logic outputs are Form-C relays. They have both normally open and normally closed contacts.

The specifications for the relays are as follows:

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

For more on the relay specifications, see page 196.

Figure 15 shows the relay output terminals.

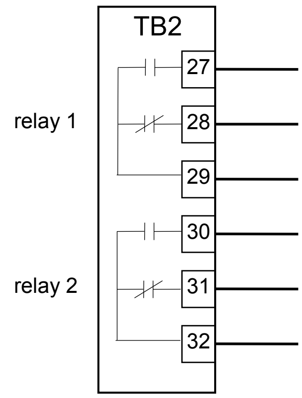


Figure 15: Relay Outputs

For more information on programming the relay outputs, see Logic Outputs C3 on page 99.

As a reference, please refer to the table below if replacing an HPV900 or HPV600 with the HPV900 Series 2 drive.

Terminal Description	Relay Output Connections		
	HPV900 Series 2	HPV900	HPV600
Relay 1 N.O. Contact	TB1-27	TB2-51	TB2-51
Relay 1 Common	TB1-29	TB2-52	TB2-52
Relay 1 N.C. Contact	TB1-28	TB2-53	TB2-53
Relay 2 N.O. Contact	TB1-30	TB2-54	TB2-54
Relay 2 Common	TB1-32	TB2-55	TB2-55
Relay 2 N.C. Contact	TB1-31	TB2-56	TB2-56

Table 4: Relay Output Connections

Serial Connections

The HPV900 Series 2 supports serial data communication between the control system and the drive using both RS-422 & RS-484 interfaces and support multiple serial protocols detailed on page 85. The serial terminations should be as detailed in Table 5.

Serial Function	**Drive Terminal/D-Type Pin**		
	HPV900 Series 2	***HPV900***	***HPV600***
TX +	TB2-9	Pin 7	Pin 7
TX -	TB2-10	Pin 3	Pin 3
RX +	TB2-12	Pin 4	Pin 4
RX -	TB2-13	Pin 8	Pin 8
Comm	TB2-11	Pin 5	Pin 5

Table 5: Serial Connections

Figure 16 shows serial terminations when using the RS-422 Interface

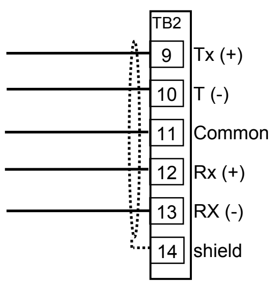


Figure 16: Serial Terminations (RS-422)

Figure 17 shows serial terminations when using the RS-485 Interface

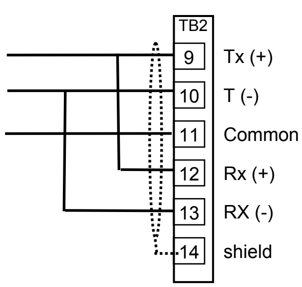


Figure 17: Serial Terminations (RS485)

USB Connection

The HPV 900 Series 2 has an onboard USB Mini socket for PC connection to enable uploading and downloading of parameters using Mag Explorer. The driver for this USB socket and also Mag Explorer Software is available for free download from our website.

Encoder

The HPV 900 Series 2 has connections for an incremental two-channel quadrature encoder. The drive's encoder circuitry incorporates resolution multiplication and complimentary outputs.

Incremental Encoder Wiring

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

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

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

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

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

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

HPV 900 Series 2 Incremental Encoder Specifications

The HPV 900 Series 2 requires the use of an encoder coupled to the motor shaft. The encoder power can be either a 5VDC or 12VDC supply. The capacity of each power supply is the following:

- supply voltage: 12VDC
200mA capacity
- supply voltage: 5VDC
400mA capacity

The HPV 900 Series 2 can accept encoder pulses of:

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

IMPORTANT

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

The encoder pulses per revolution must be entered in the ENCODER PULSES parameter, *see Drive A1 Submenu on page 44*.

The encoder connection terminals are shown in Figure 18.

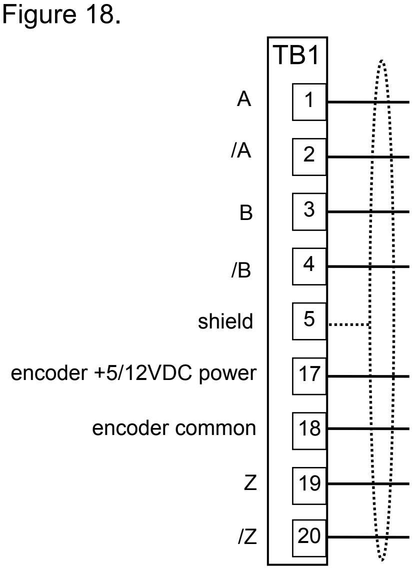


Figure 18: Encoder Connections

As a reference, please refer to the table below if replacing an HPV900 or HPV600 with the HPV900 Series 2 drive.

Terminal Description	Incremental Encoder Connections		
	HPV900 Series 2	HPV900	HPV600 option card
A	TB1-1	TB1-21	TB2-63
/A	TB1-2	TB1-20	TB2-62
B	TB1-3	TB1-23	TB2-65
/B	TB1-4	TB1-22	TB2-64
Z	TB1-19	N/A	N/A
/Z	TB1-20	N/A	N/A
encoder +5 /+12VDC	TB1-17	TB1-25 TB1-24	TB2-67 TB2-66
encdr common	TB1-18	TB1-19	TB2-61
Shield	TB1-5	TB1-26	TB2-68

Table 6: Encoder Connections

Incremental encoder Voltage Selection

The HPV 900 Series 2 drive allows for either an isolated +5VDC power supply or an isolated +12VDC power supply. The drive is defaulted with the +5VDC power supply. If the +12VDC power supply is desired, change the jumper as seen in the figure below from +5V position to the +12V position

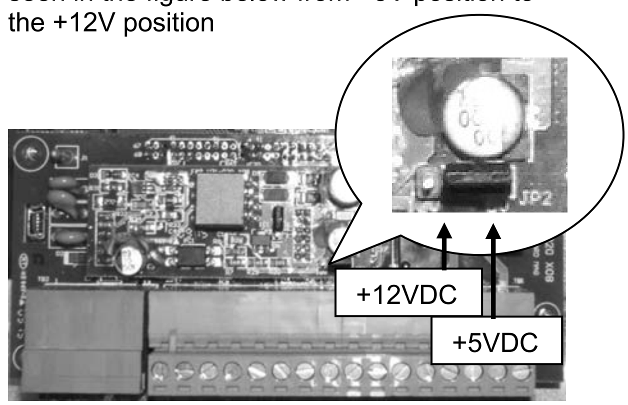


Figure 19: Encoder Voltage Selection

EnDat Encoder Connections

The HPV 900 PM 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 (8x). 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.

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 120 VAC or above control wiring for relays, fans, thermal protectors, etc.

Magnetek recommends using a 17-pin circular (M23) flange socket paired with a Heidenhain 309778-xx cable. Also acceptable are: 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 15 meters (50').

NOTE: In cases where a pigtail cable is being used, Magnetek recommends paralleling the power and the power sense connections. For connection diagram, see Figure 20.

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.

HPV 900 S2 PM EnDat Encoder Specifications

The HPV 900 S2 PM requires the use of an 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 can be easily established through open loop rotor alignment procedure. Refer to the open loop alignment section for more details. Swapping only incremental leads may be insufficient to establish proper phasing.

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 below.

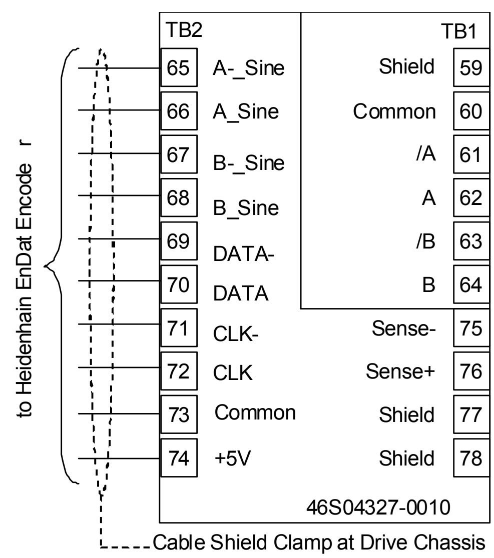


Figure 20: EnDat Encoder Option Card

The customer connections are 8 times the encoder nameplate (i.e. 16384 for a 2048 encoder). The HPV 900 S2 PM EnDat automatically accounts for the multiplication of 8 and the encoder nameplate data is required in A1.

Analog Inputs

The HPV 900 Series 2 has two non-programmable differential analog input channels.

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

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

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

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

For more on the multiplier gain or bias parameters, see Drive A1 Submenu on page 44.

The scaling of the analog input signals follows:

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

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

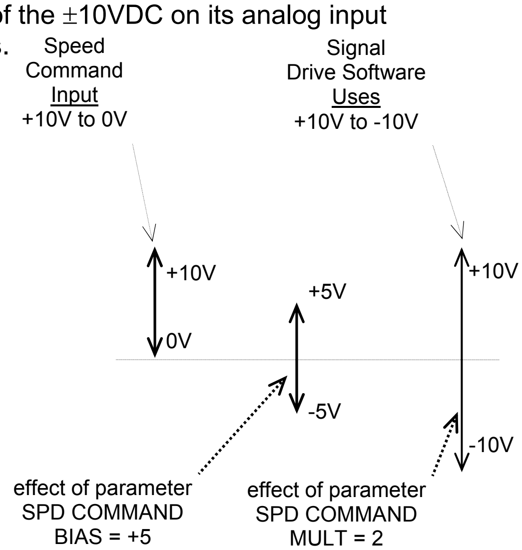


Figure 21: Analog Input Scaling

The HPV 900 Series 2 provides common mode noise rejection with the differential analog inputs. The connection of these two inputs is shown in Figure 22

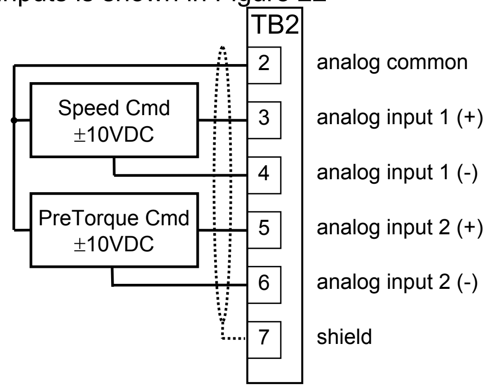


Figure 22: Analog Inputs (Differential)

Figure 23 shows the connection for the analog inputs, if they are configured to be single ended. In this configuration, the HPV 900 Series 2 noise immunity circuitry is not in effect.

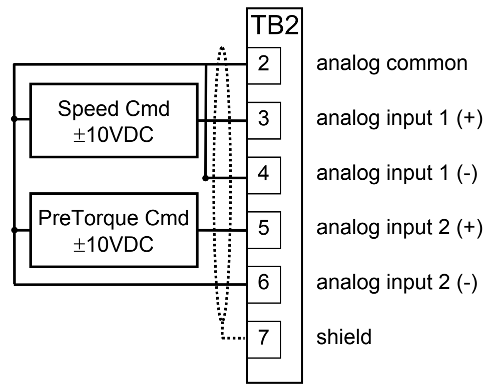


Figure 23: Analog Inputs (Single Ended)

As a reference, please refer to the table below if replacing an HPV900 or HPV600 with the HPV900 Series 2 drive.

Terminal Description	**Analog Input Connections**		
	HPV900 Series 2	**HPV900**	**HPV600**
analog common	TB2-2	TB1-29	TB1-2
analog input 1 (+)	TB2-3	TB1-28	TB1-3
analog input 1 (-)	TB2-4	TB1-27	TB1-4
analog input 2 (+)	TB2-5	TB1-31	N/A
analog input 2 (-)	TB2-6	TB1-30	N/A
shield	TB2-7	TB1-32	TB1-1

Table 7: Analog Input Connections

Analog Outputs

The HPV 900 Series 2 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 102.*

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

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

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

The scaling of the analog output signals is shown below.

The connection of these two inputs is shown in Figure 24.

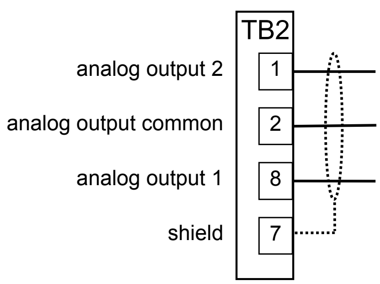


Figure 24: Analog Outputs

As a reference, please refer to the table below if replacing an HPV900 or HPV600 with the HPV900 Series 2 drive.

Terminal Description	**Analog Output Connections**		
	HPV900 Series 2	**HPV900**	**HPV600 option card**
analog common	TB2-2	TB1-34	AC
analog output 1	TB2-8	TB1-33	A1
analog output 2	TB2-1	TB1-35	A2
Shield	TB2-7	TB1-36	N/A

Table 8: Analog Output Connections

Electrical Installation

Input Power Connections

Terminals: R, S, and T provide connections for AC input power.

Motor Lead Connections

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

DC Choke Connections

Terminals +1 and +2 provide connection points for a user supplied DC choke. A two position removable link is provided to the pair of terminals. With this link, the drive can be operated without the use of a DC choke. All HPV 900 Series 2 drives contain internal DC reactors.

Brake Resistor Connections

Terminals B1 and B2 provide connection points for an external user supplied braking resistor. Connect the external brake resistor between terminals B1 and B2. Terminals: + and - are the positive and negative rails of the DC bus (see Figure 25, Figure 26, Figure 27, and Figure 28).

Equipment Grounding

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

Control Circuit

Observe the following precautions:

Refer to Figure 9 on page 24 for completing encoder connections; analog inputs; logic inputs; and logic outputs at the HPV 900 Series 2's Control Board.

IMPORTANT

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

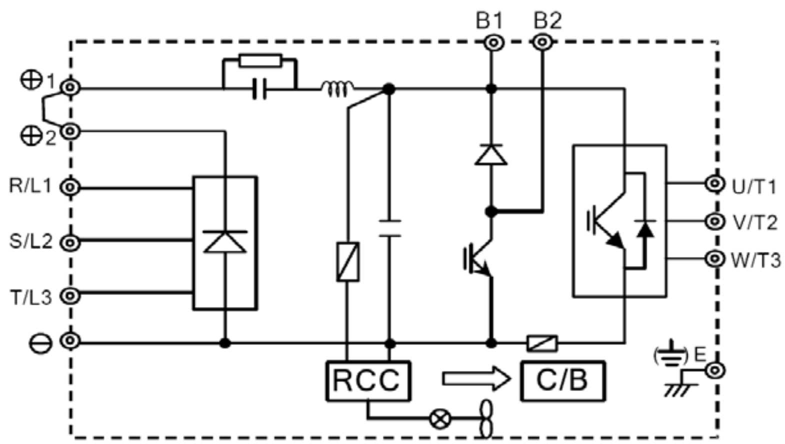


Figure 25: Main Circuit Block Diagram (230VAC 1-20HP cube)

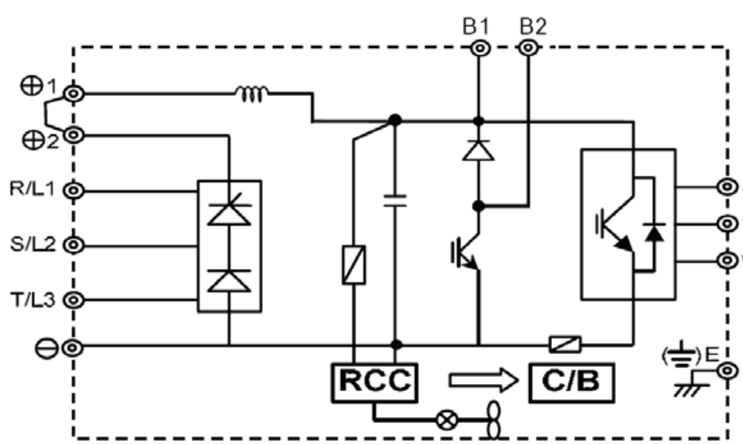


Figure 26: Main Circuit Block Diagram(230vac 25-60HP)

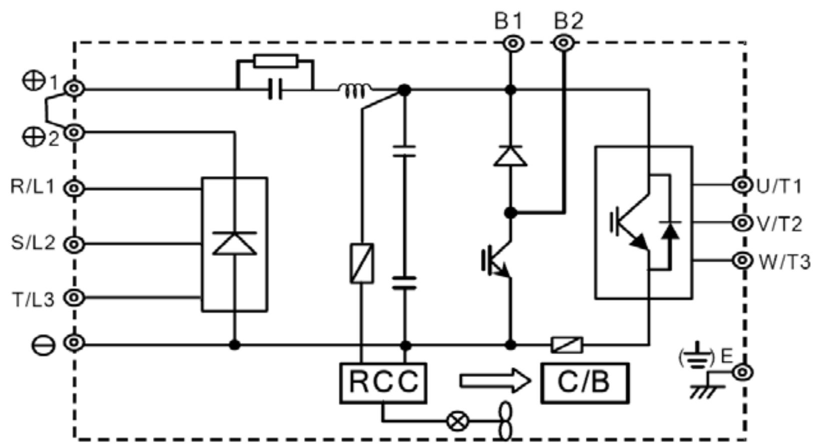


Figure 27: Main Circuit Block Diagram (460VAC 1-20HP)

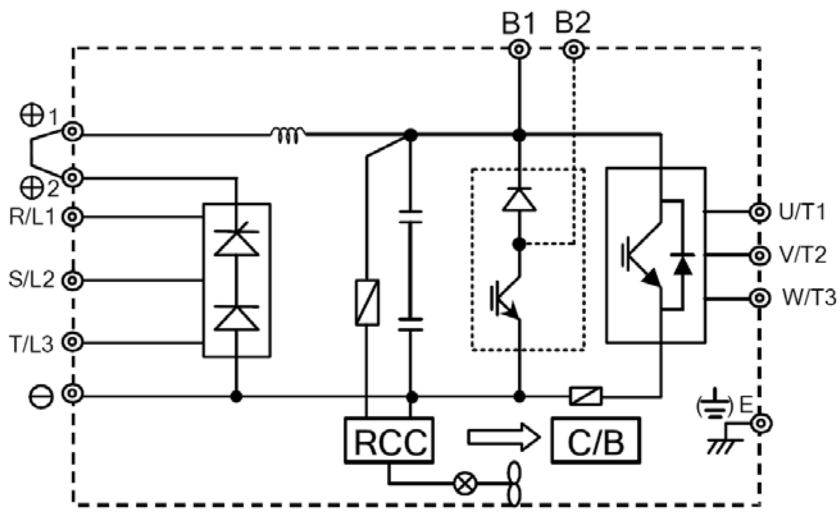


Figure 28: Main Circuit Block Diagram (460VAC 25-75HP)

Parameters

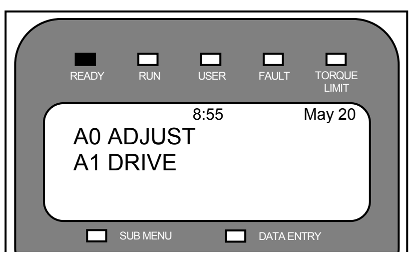
Parameter Introduction

This section describes the parameter menu structure; how to navigate this menu structure via the HPV 900 Series 2 digital operator; and a detailed description of each parameter.

Parameters are grouped under six major menus:

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

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



The menu/sub-menu tree is shown below.

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

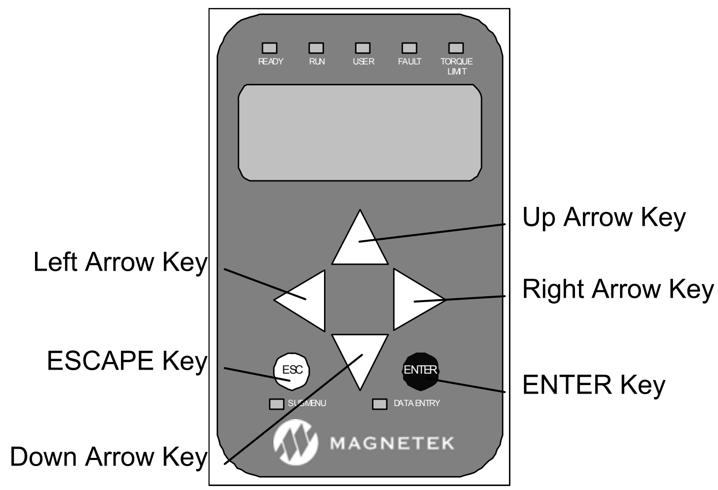


Figure 29: Digital Operator Keys

Display 1 D0
- Elevator Data D1
- Power Data D2

Adjust A0
- Drive A1
- S-Curves A2
- Multistep Ref A3
- Power Convert A4
- Motor A5

Configure C0
- User Switches C1
- Logic Inputs C2
- Logic Outputs C3
- Analog Outputs C4

Utility U0
- Password U1
- Hidden Items U2
- Units U3
- Ovrspeed Test U4
- Restore Dflts U5
- Drive Info U6
- Hex Monitor U7
- Language Sel U8
- Basics U9
- Alignment U10
- Time U11
- AutoTune U12
- Power Meter U14

Faults F0
- Active Faults F1
- Fault History F2
- Sorted History F3
- Reset Faults F4

Display 2 D0
- Elevator Data D1
- Power Data D2

Figure 30: Menu/Sub-Menu Tree

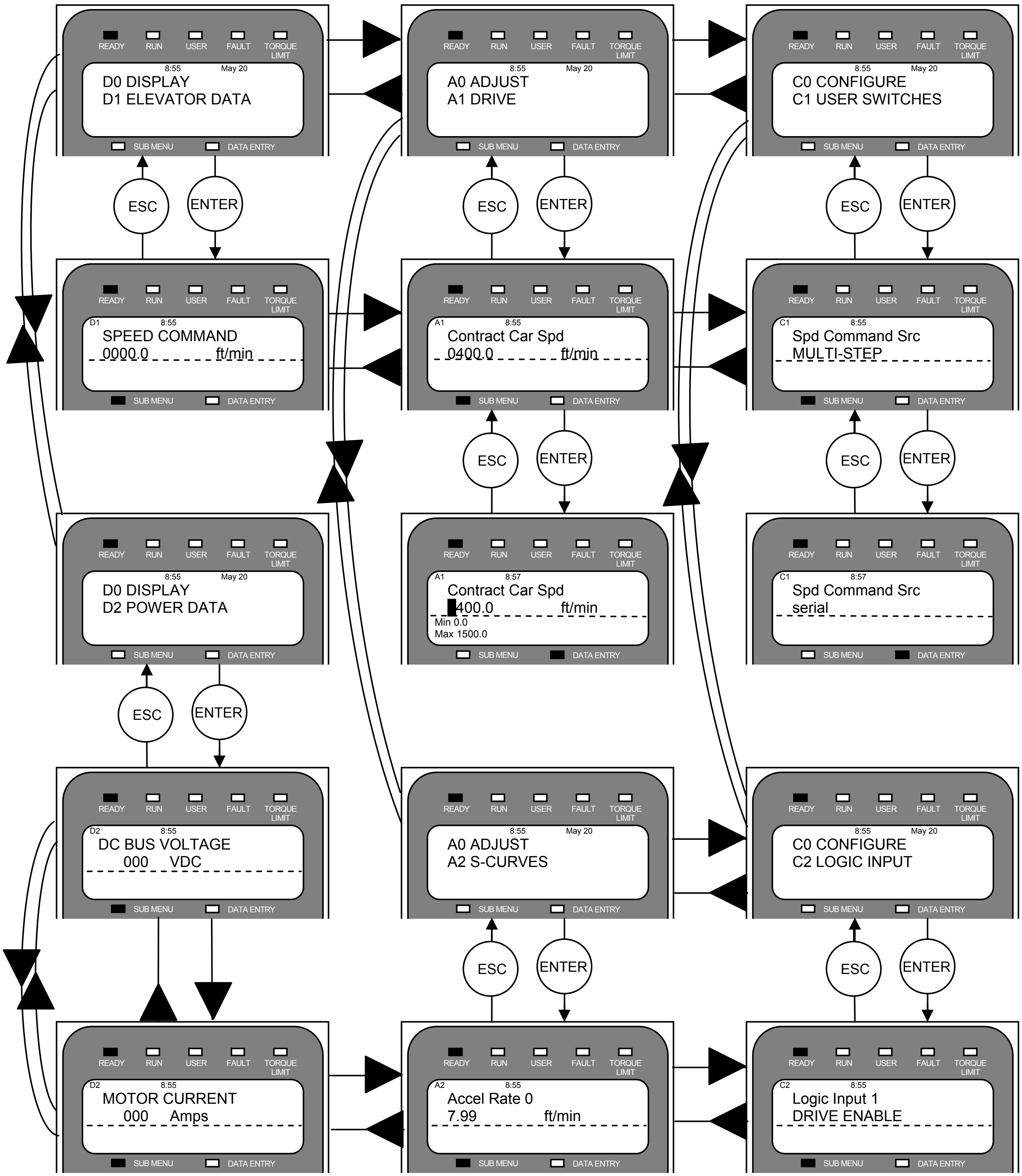


Figure 31: Operator Navigation

Menus

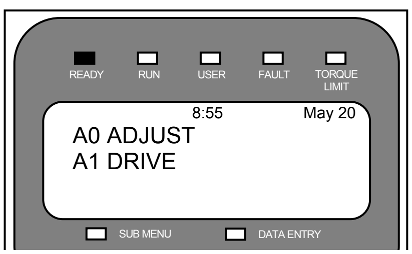
Each menu has a number of sub-menus, see Figure 30.

Menu Navigation

How these keys in Figure 29 operate is dependent on the "level" (i.e. menu, sub-menu or entry level.) In general, the "ENTER" and "ESCAPE" keys control the level. That is the ENTER key used to move to a lower level and the ESCAPE key is used to move to a higher level. The arrow keys control movement. With the up and down arrow keys controlling vertical position. And the left and right arrow keys controlling horizontal position.

Navigation at the Menu Level

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

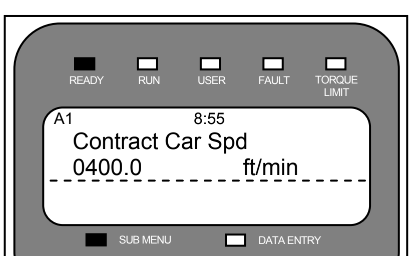


Each menu will remember the last accessed sub-menu. The left and right arrow keys will navigate between these last active sub-menus. This remembrance of last active sub-menu is volatile and will be lost at power down.

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

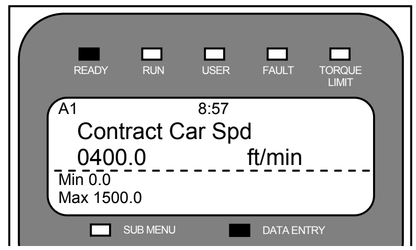
Navigation at the Sub-menu Level

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



Navigation at the Entry Level

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



Upon exiting a sub-menu via the "ESCAPE" key, the last item number is "remembered". The next time this sub-menu is entered, it is entered at the "remembered" item number. This feature can be used to obtain quick access to two monitor values. Two menus one labeled Display 1 D0 and one labeled Display 2 D0 has 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. Remember, that the "remembering" of sub-menus and sub-menu items is volatile and is lost at power-down.

Hidden Parameters

There are two types of parameters: standard and hidden. Standard parameters are available at all times. Hidden parameters are for more advanced functions and are available only if activated. Activation of the hidden parameters is accomplished by setting of a utility parameter, HIDDEN ITEMS U2. *See details in Hidden Items on page 112.*

Closed Loop Parameters

Display D0

Elevator Data D1

- Speed Command
- Speed Reference
- Speed Feedback
- Encoder Speed
- Speed Error
- Est Inertia
- Logic Outputs
- Logic Inputs
- Rx Logic In
- Start Logic
- Rx Com Status
- Rx Error Count
- Pre-Torque Ref
- Spd Reg Torq Cmd
- Tach Rate Cmd
- FF Torque Cmd
- Enc Position
- Enc Revolution
- DCP Command
- DCP Status

Power Data D2

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

Adjust A0

Drive A1

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

S-Curves A2

- Accel Rate 0
- Decel Rate 0
- Accel Jerk In 0
- Accel Jerk Out 0
- Decel Jerk In 0
- Decel Jerk Out 0
- Accel Rate 1
- Decel Rate 1
- Accel Jerk In 1
- Accel Jerk Out 1
- Decel Jerk In 1
- Decel Jerk Out 1
- Accel Rate 2
- Decel Rate 2
- Accel Jerk In 2
- Accel Jerk Out 2
- Decel Jerk In 2
- Decel Jerk Out 2
- Accel Rate 3
- Decel Rate 3
- Accel Jerk In 3
- Accel Jerk Out 3
- Decel Jerk In 3
- Decel Jerk Out 3

Multistep Ref A3

- Speed Command 1
- Speed Command 2
- Speed Command 3
- Speed Command 4
- Speed Command 5
- Speed Command 6
- Speed Command 7
- Speed Command 8
- Speed Command 9
- Speed Command 10
- Speed Command 11
- Speed Command 12
- Speed Command 13
- Speed Command 14
- Speed Command 15
- V0
- VN
- V1
- V2
- V3
- V4
- VI
- Unlock Spd Level
- Lvling Spd Level
- Border Spd Level
- Over Spd Level
- Re-level Spd Hi
- Re-level Spd Low

Power Convert A4

- Input L-L Volts
- UV Alarm Level
- UV Fault Level
- PWM Frequency
- Extern Reactance
- ID Reg Diff Gain
- ID Reg Prop Gain
- IQ Reg Diff Gain
- IQ Reg Prop Gain
- Load Sense Time
- Fan Off Delay

Motor A5

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

Configure C0

User Switches C1

- Spd Command Src
- Run Command Src
- Motor Rotation
- Encoder Connect
- Encoder Fault
- Cont Confrim Src
- Fast Flux
- Hi/Lo Gain Src
- Ramped Stop Sel
- Ramp Down En Src
- S-Curve Abort
- DB Protection
- Spd Ref Release
- Brake Pick Src
- Brake Pick Cnfm
- Motor Ovrld Sel
- Stopping Mode
- Auto Stop
- Serial Mode
- Ser2 Flt Mode
- Drv Fast Disable
- Speed Reg Type
- Brake Hold Src
- Brk Pick Flt Ena
- Brk Hold Flt Ena
- Ext Torq Cmd Src
- Fault Reset Src
- Overspd Test Src
- Pretorque Source
- Pretorque Latch
- Ptorq Latch Clck
- Dir Confirm
- Mains Dip Ena
- Mlt-Spd to Dly 1
- Mlt-Spd to Dly 2
- Mlt-Spd to Dly 3
- Mlt-Spd to Dly 4
- Priority Msg
- Arb Select
- Drive Enable Src
- Rec Travel Dir

Logic Inputs C2

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

Logic Outputs C3

- Logic Output 1
- Logic Output 2
- Logic Output 3
- Logic Output 4
- Relay Coil 1
- Relay Coil 2
- User LED

Analog Outputs C4

- Analog Output 1
- Analog Output 2

Utility U0

Password U1

- New Password
- Enter Password
- Password Lockout

Hidden Items U2

- Hidden Items Enable

Units U3

- Units Selection

Ovrspeed Test U4

- Overspeed Test?

Restore Dflts U5

- Rst Mtr Defaults
- Rst Drive Defaults

Drive Info U6

- Drive Version
- Boot Version
- Cube ID
- Drive Type

Hex Monitor U7

- Address

Language Sel U8

- Language Select

Basics U9

- Drive Mode

Time U11

- Year
- Month
- Day
- Hour
- Minute
- Second

Power Meter U14

- Motor Pwr
- Regen Pwr
- Energy Time
- Energy Reset

Faults F0

Active Faults F1

Fault History F2

Sorted History F3

Reset Faults F4

- Rst Active Flts
- Clr Flt Hist

PM Parameters

Display D0

Elevator Data D1

- Speed Command
- Speed Reference
- Speed Feedback
- Encoder Speed
- Speed Error
- Est Inertia
- Logic Outputs
- Logic Inputs
- Rx Logic In
- Start Logic
- Rx Com Status
- Rx Error Count
- Pre-Torque Ref
- Spd Reg Torq Cmd
- Tach Rate Cmd
- FF Torque Cmd
- Enc Position
- Enc Revolution
- DCP Command
- DCP Status

Power Data D2

- DC Bus Voltage
- Motor Current
- Motor Voltage
- Motor Frequency
- Motor Torque
- Torque Reference
- % Motor Current
- Power Output
- D-Curr Reference
- Motor Overload
- Drive Overload
- Flux Current
- Torque Current
- Flux Voltage
- Torque Voltage
- Base Impedance
- Rated Excit Freq
- Rotor Position
- Drive Temp
- Highest Temp

Adjust A0

Drive A1

- Contract Car Spd
- Contract Mtr Spd
- Response
- Inertia
- Encoder Pulses
- Serial Cnts/Rev
- Mtr Torque Limit
- Regen Torq Limit
- Trq Lim Msg Dly
- Gain Reduce Mult
- Gain Chng Level
- Ramped Stop Time
- Contact Flt Time
- Contactor Do Dly
- Flt Reset Delay
- Flt Resets/Hour
- Brake Pick Time
- Ab Zero Spd Lev
- Ab Off Delay
- Brake Hold Time
- Overspeed Level
- Overspeed Time
- Overspeed Mult
- Spd Dev Lo Level
- Spd Dev Time
- Spd Dev Alm Lvl
- Spd Dev Flt Lvl
- Up To Spd. Level
- Zero Speed Level
- Zero Speed Time
- Up/Dwn Threshold
- Notch Filter Frq
- Notch Filt Depth
- Run Delay Timer
- Tach Rate Gain
- Inner Loop Xover
- Spd Phase Margin
- Spd Command Bias
- Spd Command Mult
- Pre Torque Bias
- Pre Torque Mult
- Pre Torque Time
- Ext Torque Bias
- Ext Torque Mult
- Ana Out 1 Offset
- Ana Out 2 Offset
- Ana Out 1 Gain
- Ana Out 2 Gain
- Ser2 Insp Spd
- Ser2 Rs Crp Spd
- Ser2 Rs Cpr Time
- Ser2 Flt Tol
- Arb Start Time
- Arb Decay Rate
- ARB Inertia
- ARB Torque Time
- Mains Dip Speed
- Mspd Delay 1
- Mspd Delay 2
- Mspd Delay 3
- Mspd Delay 4
- Mid Speed Lvl
- Encdr Flt Sense
- ARB Deadband
- Abs Ref Offset

S-Curves A2

- Accel Rate 0
- Decel Rate 0
- Accel Jerk In 0
- Accel Jerk Out 0
- Decel Jerk In 0
- Decel Jerk Out 0
- Accel Rate 1
- Decel Rate 1
- Accel Jerk In 1
- Accel Jerk Out 1
- Decel Jerk In 1
- Decel Jerk Out 1
- Accel Rate 2
- Decel Rate 2
- Accel Jerk In 2
- Accel Jerk Out 2
- Decel Jerk In 2
- Decel Jerk Out 2
- Accel Rate 3
- Decel Rate 3
- Accel Jerk In 3
- Accel Jerk Out 3
- Decel Jerk In 3
- Decel Jerk Out 3

Multistep Ref A3

- Speed Command 1
- Speed Command 2
- Speed Command 3
- Speed Command 4
- Speed Command 5
- Speed Command 6
- Speed Command 7
- Speed Command 8
- Speed Command 9
- Speed Command 10
- Speed Command 11
- Speed Command 12
- Speed Command 13
- Speed Command 14
- Speed Command 15
- V0
- VN
- V1
- V2
- V3
- V4
- VI
- Unlock Spd Level
- Lvling Spd Level
- Border Spd Level
- Over Spd Level
- Re-level Spd Hi
- Re-level Spd Low

Power Convert A4

- Input L-L Volts
- UV Alarm Level
- UV Fault Level
- PWM Frequency
- Extern Reactance
- ID Reg Diff Gain
- ID Reg Prop Gain
- ID Reg Intg Gain
- IQ Reg Diff Gain
- IQ Reg Prop Gain
- IQ Reg Intg Gain
- Fine Tune Ofst
- ID Ref Threshold
- Flux Weaken Rate
- Flux Weaken Lev
- Align Vlt Factor
- Brake Opn Flt Lv
- Load Sense Time
- Autoalign Volts
- Fan Off Delay

Motor A5

- Motor Id
- Rated Mtr Power
- Rated Mtr Volts
- Rated Motor Curr
- Motor Poles
- Rated Mtr Speed
- Ovld Start Level
- Ovld Time Out
- Stator Resist
- Motor Iron Loss
- Motor Mech Loss
- D Axis Induct
- Q Axis Induct
- Trq Const Scale
- Encoder Ang Ofst

Configure C0

User Switches C1

- Spd Command Src
- Run Command Src
- Motor Rotation
- Encoder Select
- Encoder Connect
- Encoder Fault
- Cont Confrim Src
- Hi/Lo Gain Src
- I-Reg Inner Loop
- Ramped Stop Sel
- Ramp Down En Src
- S-Curve Abort
- DB Protection
- Spd Ref Release
- Brake Pick Src
- Brake Pick Cnfm
- Motor Ovrld Sel
- Stopping Mode
- Auto Stop
- Serial Mode
- Ser2 Flt Mode
- Drv Fast Disable
- Speed Reg Type
- Brake Hold Src
- Brk Pick Flt Ena
- Brk Hold Flt Ena
- Ext Torq Cmd Src
- Fault Reset Src
- Overspd Test Src
- Pretorque Source
- Pretorque Latch
- Ptorq Latch Clck
- Dir Confirm
- Mains Dip Ena
- Mlt-Spd to Dly 1
- Mlt-Spd to Dly 2
- Mlt-Spd to Dly 3
- Mlt-Spd to Dly 4
- Priority Msg
- Arb Select
- Drive Enable Src
- Rec Travel Dir

Logic Inputs C2

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

Logic Outputs C3

- Logic Output 1
- Logic Output 2
- Logic Output 3
- Logic Output 4
- Relay Coil 1
- Relay Coil 2
- User LED

Utility U0

Password U1

- New Password
- Enter Password
- Password Lockout

Hidden Items U2

- Hidden Items Enable

Units U3

- Units Selection

Ovrspeed Test U4

- Overspeed Test?

Restore Dflts U5

- Rst Mtr Defaults
- Rst Drive Defaults

Drive Info U6

- Drive Version
- Boot Version
- Cube ID
- Drive Type

Hex Monitor U7

- Address

Language Sel U8

- Language Select

Basics U9

- Drive Mode

Rotor Align U10

- Alignment
- Begin Alignment
- Alignment Method

Time U11

- Year
- Month
- Day
- Hour
- Minute
- Second

AutoTune Sel U12

- AutoTune Select

Power Meter U14

- Motor Pwr
- Regen Pwr
- Energy Time
- Energy Reset

Faults F0

Active Faults F1

Fault History F2

Sorted History F3

Reset Faults F4

- Rst Active Flts
- Clr Flt Hist

Open-Loop Parameters

Display D0

Elevator Data D1
- Speed Command
- Speed Reference
- Speed Feedback
- Encoder Speed
- Logic Outputs
- Logic Inputs
- Rx Logic In
- Rx Error Count
- Enc Position
- Enc Revolution
- DCP Command
- DCP Status

Power Data D2
- DC Bus Voltage
- Motor Current
- Motor Voltage
- Motor Frequency
- Motor Torque
- % Motor Current
- Power Output
- Slip Frequency
- Motor Overload
- Drive Overload
- Flux Current
- Torque Current
- Flux Voltage
- Torque Voltage
- Base Impedance
- Drive Temp
- Highest Temp

Adjust A0

Drive A1
- Contract Car Spd
- Contract Mtr Spd
- Encoder Pulses
- Mtr Torque Limit
- Regen Torq Limit
- Trq Lim Msg Dly
- Contact Flt Time
- Contactor Do Dly
- Flt Reset Delay
- Flt Resets/Hour
- Brake Pick Time
- Brake Pick Delay
- Brake Drop Delay
- Brake Hold Time
- DC Start Level
- DC Stop Level
- DC Stop Freq
- DC Start Time
- DC Stop Time
- Overspeed Mult
- Stalltest Level
- Stall Fault Time
- Slip Comp Time
- Slip Comp Gain
- Torq Boost Time
- Torq Boost Gain
- Up To Spd. Level
- Zero Speed Level
- Zero Speed Time
- Up/Dwn Threshold
- Spd Command Bias
- Spd Command Mult
- Ana Out 1 Offset
- Ana Out 2 Offset
- Ana Out 1 Gain
- Ana Out 2 Gain
- Ser2 Insp Spd
- Ser2 Rs Crp Spd
- Ser2 Rs Cpr Time
- Ser2 Flt Tol
- Mains Dip Speed
- Mspd Delay 1
- Mspd Delay 2
- Mspd Delay 3
- Mspd Delay 4
- Mid Speed Lvl
- Cont Dwell Time

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

Multistep Ref A3
- Speed Command 1
- Speed Command 2
- Speed Command 3
- Speed Command 4
- Speed Command 5
- Speed Command 6
- Speed Command 7
- Speed Command 8
- Speed Command 9
- Speed Command 10
- Speed Command 11
- Speed Command 12
- Speed Command 13
- Speed Command 14
- Speed Command 15
- V0
- VN
- V1
- V2
- V3
- V4
- VI
- Unlock Spd Level
- Lvling Spd Level
- Border Spd Level
- Over Spd Level
- Re-level Spd Hi
- Re-level Spd Low

Power Convert A4
- Input L-L Volts
- UV Alarm Level
- UV Fault Level
- PWM Frequency
- Extern Reactance
- ID Reg Diff Gain
- ID Reg Prop Gain
- IQ Reg Diff Gain
- IQ Reg Prop Gain
- ID Dist Loop Gn
- IQ Dist Loop Gn
- ID Dist Loop Fc
- IQ Dist Loop Fc
- I Reg Cross Freq
- Dist Lp Off Freq
- ILimit Integ Gn
- Hunt Prev Gain
- Hunt Prev Time
- Switching Delay
- Vc Correction
- Load Sense Time
- Fan Off Delay

Motor A5
- Motor Id
- Rated Mtr Power
- Rated Mtr Volts
- Rated Excit Freq
- Rated Motor Curr
- Motor Poles
- Rated Mtr Speed
- % No Load Curr
- Stator Leakage X
- Rotor Leakage X
- Motor Min Volts
- Motor Min Freq
- Motor Mid Volts
- Motor Mid Freq
- Ovld Start Level
- Ovld Time Out
- Stator Resist
- Motor Iron Loss
- Motor Mech Loss

Configure C0

User Switches C1
- Spd Command Src
- Run Command Src
- Motor Rotation
- Encoder Connect
- Cont Confirm Src
- S-Curve Abort
- DB Protection
- Spd Ref Release
- Brake Pick Src
- Brake Pick Cnfm
- Motor Ovrld Sel
- Stopping Mode
- Auto Stop
- Stall Test Ena
- Stall Prev Ena
- Serial Mode
- Ser2 Flt Mode
- Drv Fast Disable
- Brake Hold Src
- Brk Pick Flt Ena
- Brk Hold Flt Ena
- Fault Reset Src
- Overspd Test Src
- Dir Confirm
- Mains Dip Ena
- Mlt-Spd to Dly 1
- Mlt-Spd to Dly 2
- Mlt-Spd to Dly 3
- Mlt-Spd to Dly 4
- Priority Msg
- Drive Enable Src

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

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

Analog Outputs C4
- Analog Output 1
- Analog Output 2

Utility U0

Password U1
- New Password
- Enter Password
- Password Lockout

Hidden Items U2
- Hidden Items Enable

Units U3
- Units Selection

Ovrspeed Test U4
- Overspeed Test?

Restore Dflts U5
- Rst Mtr Defaults
- Rst Drive Defaults

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

Hex Monitor U7
- Address

Language Sel U8
- Language Select

Basics U9
- Drive Type

Time U11
- Year
- Month
- Day
- Hour
- Minute
- Second

Power Meter U14
- Motor Pwr
- Regen Pwr
- Energy Time
- Energy Reset

Faults F0

Active Faults F1

Fault History F2

Sorted History F3

Reset Faults F4
- Rst Active Flts
- Clr Flt Hist

Adjust A0 Menu

Drive A1 Submenu

NOTE: When ***Hidden Item*** appears with the parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details on page 112.*

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

Name	Description	Units	Range	Default		Hidden Item	Run lock out
				ENGLISH (U3)	METRIC (U3)		
Contract Car Spd	(Contract Car Speed) This parameter programs the elevator contract speed in feet per minute (fpm) or meters per second (m/s)	**fpm**	**0.0 – 1500.0**	**400.0**	-	N	Y
		m/s	**0.000 – 8.000**	**-**	**0.000**		
Contract Mtr Spd	(Contract Motor Speed) This parameter programs the motor speed at elevator contract speed in revolutions per minute (rpm).	**rpm**	**0.0 – 3000.0**	**1130.0**[i,iii]	**0.0**	N	Y
				130.0[ii]			
Response[i,ii]	(Response[i,ii]) 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**[i,ii]	**1.0 – 50.0**[i,ii]	**10.0**[i,ii]		N[i,ii]	N[i,ii]
Inertia[i,ii]	(System Inertia[i,ii]) 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**[i,ii]	**0.25 – 50.00**[i,ii]	**2.00**[i,ii]		N[i,ii]	N[i,ii]
Encoder Pulses	(Encoder Pulses) This parameter sets the pulses per revolution the drive receives from the encoder. This value is directly from the encoder nameplate.	**PPR**	**500 – 40000**	**1024**[i,iii]		N	Y
				10000[ii]			
Serial Cnts/ Rev[ii]	*(Serial Counts / Revolution[ii]) 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.*	***none***[ii]	***0 – 25000***[ii]	***8192***[ii]		*N*[ii]	*Y*[ii]
Mtr Torque Limit	(Motoring Current Limit) This parameter sets the maximum torque allowed when in the motoring mode. This parameter may need adjustment to reduce the effects of field weakening. Units in percent of rated torque. Note: The Torque Limit LED will be lit once the limit defined by this parameter is reached.	**%**	**0.0 – 275.0**	**200.0**		N	N

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Name	Description	Units	Range	Default		Hidden Item	Run lock out
				ENGLISH (U3)	METRIC (U3)		
Regen Torq Limit	(Regenerating Current Limit) This parameter sets the maximum amount of regenerative torque the drive will see during regeneration. This parameter may need adjustment to reduce the effects of field weakening. Units in percent of rated torque. Note: The Torque Limit LED will be lit once the limit defined by this parameter is reached.	**%**	**0.0 – 275.0**	**200.0**		N	N
Flux Wkn Factor[i]	(Flux Weakening Factor[i]) This parameter limits the maximum amount of torque available at higher speeds. When the drive is commanding higher speeds, this parameter defines a percentage of the defined torque limits (MTR TORQUE LIMIT and REGEN TORQ LIMIT). This parameter is used to reduce the effects of field weakening and reduce the amount of motor current produced at higher speeds. Units in percent of torque. For further information, see page 57.	**%**[i]	**60 – 100**[i]	**100**[i]		Y[i]	N[i]
Trq Lim Msg Dly	(Torque Limit Message Delay) This parameter determines the amount of time the drive is in torque limit before the "HIT TORQUE LIMIT" alarm message is displayed.	**sec**	**0.00 – 10.00**	**0.50**	**2.00**	Y	Y
Gain Reduce Mult [i,ii]	(Gain Reduce Multiplier [i,ii]) This parameter is the percent of 'response' the speed regulator should use in the 'low gain' mode. This value reduces the RESPONSE value when the drive is in 'low gain' mode. (i.e. setting this parameter to 100% equals no reduction in gain in the 'low gain' mode). See GAIN CHNG LEVEL on page 58.	**%** [i,ii]	**10 – 100** [i,ii]	**100** [i,ii]		Y [i,ii]	N [i,ii]
Gain Chng Level [i,ii]	(Gain Change Level [i,ii]) This parameter sets the speed level to change to low gain mode (only with internal gain switch). See GAIN CHNG LEVEL on page 58. Units in percent of rated speed.	**%** [i,ii]	**0.0 – 100.0** [i,ii]	**100.0** [i,ii]		Y [i,ii]	N [i,ii]
Spd Dev Hi Level [i]	(Speed Deviation High Level [i]) This parameter sets the level at which a speed deviation alarm will be declared. For more information, see SPD DEVIATION on page 59.	**%** [i]	**0.0 – 99.9** [i]	**10.0** [i]		Y [i]	N [i]
Ramped Stop Time [i,ii]	(Ramped Stop Time [i,ii]) 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 59.	**sec** [i,ii]	**0.00 – 2.50** [i,ii]	**0.20** [i,ii]	**0.50** [i,ii]	Y [i,ii]	N [i,ii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Name	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Contact Flt Time	(Contact Fault Time) When external logic outputs are used to control the closing of the motor contactor, this parameter sets the amount of time delay at start until the drive output is enabled and current flows. And when external logic inputs are used to confirm the closing of the motor contactor, this parameter sets the time allowed for the contactor's auxiliary contacts to reach the user commanded state before a CONTACTOR FLT occurs.	**sec**	**0.10 – 5.00**	**0.50**		Y	N
Contactor DO Dly	(Contactor Drop-out Delay) When the drive controls the motor contactor via CLOSE CONTACT logic output, this parameter, CONTACTOR DO DLY (A1), allows the user to delay the drive's dropout of the motor contactor. The CONTACTOR DO DLY Timer Delay starts when the speed regulator release signal goes false.	**sec**	**0.00 – 5.00**	**0.00**		Y	Y
Flt Reset Delay	(Fault Reset Delay) When the drive is set for automatic fault reset, this is the time before a fault is automatically reset.	**sec**	**0 – 120**	**5**		Y	N
Flt Resets / Hour	(Fault Resets per Hour) When the drive is set for automatic fault reset, this is the number of faults that is allowed to be automatically reset per hour.	**#**	**0 – 10**	**3**		Y	N
Brake Pick Time	(Brake Pick Time) If the brake pick fault is enabled, this parameter sets the time allowed for the brake pick feedback not to match the brake pick command before a BRK PICK FLT occurs. Also, when the user switch SPD REF RELEASE (C1) is set to brake picked, this parameter determines the amount of time the drive will command zero speed after the RUN command is removed (time allowed for the brake to close).	**sec**	**0.00 – 5.00**	**1.00**		Y	N
Ab Zero Spd Lev [i,ii]	(Auto Brake Zero Speed Level [i,ii]) 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 use the Auto Brake function, a logic output needs to be configured for AUTO BRAKE (C3), the parameter SPD COMMAND SRC(C1)=MULTI-STEP,SER MULTI-STEP or SERIAL, the parameter SPD REF RELEASE(C1)=BRAKE PICKED, and the parameter BRAKE PICK CFRM(C1)=INTERNAL TIME or EXTERNAL TB1.	**%** [i,ii]	**0.00 – 2.00** [i,ii]	**0.00** [i,ii]		Y [i,ii]	Y [i]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Name	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Ab Off Delay [i,ii]	(Auto Brake Off Delay [i,ii]) This parameter determines the time after zero speed is reached (level determined by the AB ZERO SPD LEV (A1) parameter) that the Auto Brake logic output goes false. The units are seconds and the parameter has a maximum value of 9.99 seconds and a default value of 0.00 seconds.	**sec** [i,ii]	**0.00 – 9.99** [i,ii]	**0.00** [i,ii]		Y [i,ii]	Y [i,ii]
Brake Pick Delay [iii]	*(Brake Pick Delay [iii]) When external logic outputs are used to control the mechanical brake, this is the time delay from a drive run command until the brake is picked. This time delay needs to be set for the following: have DC injection current before the mechanical brake is picked and have DC injection current after the mechanical brake is picked to allow the brake to fully open.*	***sec*** [iii]	***0.00 – 5.00*** [iii]	***0.50*** [iii]		*N* [iii]	*Y* [iii]
Brake Drop Delay [iii]	*(Brake Drop Delay [iii]) When external logic outputs are used to control the mechanical brake and ramp to stop is selected, this parameter sets the time delay to set the brake after decelerating to the DC Stop Freq. This time delay needs to be set for the following: have DC injection current before the mechanical brake is closed and after the mechanical brake is picked to allow the brake to fully open.*	***sec*** [iii]	***0.00 – 5.00*** [iii]	***0.50*** [iii]		*N* [iii]	*Y* [iii]
Brake Hold Time	(Brake Hold Time) If the brake hold fault is enabled, this parameter sets the time allowed for the brake hold feedback not match the brake hold command before a BRK HOLD FLT occurs.	**sec**	**0.00 – 5.00**	**0.20**		Y	N
DC Start Level [iii]	*(DC Injection Current Start Level [iii]) The level of DC injection current at start is a percent of motor rated current. The DC injection current will hold the motor shaft in a fixed position as the drive outputs a DC current to the motor. At the start, it is important to have DC injection current before the mechanical brake is picked to allow the brake to fully open*	***%*** [iii]	***0.0 – 150.0*** [iii]	***80.0*** [iii]	***50.0*** [iii]	*N* [iii]	*Y* [iii]
DC Stop Level [iii]	*(DC Injection Current Stop Level [iii]) The level of DC injection current at stop is a percent of motor rated current. To hold the motor shaft in a fixed position the drive will output a DC current to the motor. At the stop, it is important to have DC injection current before the mechanical brake is closed and to have DC injection current after the mechanical brake is closed to allow the brake to fully set.*	***%*** [iii]	***0.0 – 150.0*** [iii]	***50.0*** [iii]		*N* [iii]	*Y* [iii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Name	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
DC Stop Freq[iii]	*(DC Injection Stopping Frequency[ii]) The frequency at which DC injection begins to occur when the drive is decelerating to a stop. If ramp to stop is selected and the run command is removed, the drive decelerates from its current speed to the DC stop frequency and then DC injection is applied.*	*Hz*[iii]	*0.0 – 10.0*[iii]	*0.5*[iii]		*N*[iii]	*Y*[iii]
DC Start Time[iii]	*(DC Injection Current Start Time[iii]) The time DC injection current is applied following a valid run command until the release of the speed command. After receiving a valid run command the drive will maintain DC Start Level current for Dc Start Time in seconds before releasing the internal speed reference allowing the drive to ramp up in speed. At the start, it is important to have DC injection current before and after the mechanical brake is picked to allow the brake to fully open.*	*sec*[iii]	*0.00 – 5.00*[iii]	*1.00*[iii]		*N*[iii]	*Y*[iii]
DC Stop Time[iii]	*(DC Injection Current Stop Time[iii]) The time the level of DC injection current at stop is at DC STOP LEVEL. If ramp to stop is selected, the drive will ramp down in speed following removal of the run command to the DC Stop Freq and will then output DC Stop Level current for DC Stop Time seconds. At the stop, it is important to have DC injection current after the mechanical brake is closed to allow the brake to fully close.*	*sec*[iii]	*0.00 – 5.00*[iii]	*1.00*[iii]		*N*[iii]	*Y*[iii]
Overspeed Level[i,ii]	(Overspeed Level[i,ii]) This parameter sets the percentage of rated speed the drive uses (in conjunction with OVERSPEED TIME, below) to determine when an OVERSPEED FLT occurs. Units in percent of contract speed.	**%**[i,ii]	**100.0 – 150.0**[i,ii]	**115.0**[i,ii]		Y[i,ii]	N[i,ii]
Overspeed Time[i,ii]	(Overspeed Time[i,ii]) This parameter sets the time that the drive can be at or above the OVERSPEED LEVEL (A1), before the drive declares an OVERSPEED FLT.	**sec**[i,ii]	**0.00 – 9.99**[i,ii]	**1.00**[i,ii]		Y[i,ii]	N[i,ii]
Overspeed Mult	(Over Speed Multiplier) This parameter sets the percentage of contract speed for the OVERSPEED TEST (U4).	**%**	**100.0 – 150.0**	**125.0**		Y	N
Stalltest Level[iii]	*(Stall Test Level[iii]) This parameter sets the percentage of motor current the drive uses (in conjunction with STALL FAULT TIME(A1)) to determine when an STALL FAULT occurs. In order for a STALL TEST FAULT to occur, it must be enabled by the STALL TEST ENA (C1) parameter. Units in percent of rated motor current.*	*%*[iii]	*0.0 – 200.0*[iii]	*200.0*[iii]		*N*[iii]	*Y*[iii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Name	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Stall Fault Time[iii]	*(Stall Fault Time[iii]) This parameter sets the time that the drive can be at or above the STALL TEST LVL(A1), before the drive declares an STALL TEST FAULT. In order for a STALL TEST FAULT to occur, it must be enabled by the STALL TEST ENA (C1) parameter.*	***sec***[iii]	***0.00 – 9.99***[iii]	***5.00***[iii]		*N*[iii]	*N*[iii]
Slip Comp Time[iii]	*(Slip Compensation Time Constant[iii]) Slip compensation filter time constant. Adjusted for slip compensation response and stability. By increasing the value of the parameter, the response time of the slip compensation function will become slower. Reducing the parameter to a lower value makes the slip compensation function respond more quickly. Note: Setting the parameter too low may result in unstable motor operation or setting the parameter too high will result in very poor response.* *NOTE: it is usually best to leave this parameter set at default of 1.5 seconds.* *Slip compensation allows an open-loop drive to maintain constant motor speed regardless of loading. The function adjusts the drive's output frequency (and output voltage) to compensate for motor slip as the motor load is increased. The compensation is based on the motor rated speed, frequency and calculated motor torque, therefore a valid value must be entered for the Rated Motor Speed (RATED MTR SPEED(A5))*	***sec***[iii]	***0.01 – 2.00***[iii]	***1.50***[iii]		*N*[iii]	*N*[iii]
Slip Comp Gain[iii]	*(Slip Compensation Gain[iii]) Multiplier of motor rated slip at rated torque. Setting the parameter to 1.00 compensates the drive output frequency by rated slip at rated torque. Setting the Slip Compensation Gain to 0.00 disables the slip compensation function.* *NOTE: it is usually best to leave this parameter set at the default of 1.0.* *Slip compensation allows an open-loop drive to maintain constant motor speed regardless of loading. The function adjusts the drive's output frequency (and output voltage) to compensate for motor slip as the motor load is increased. The compensation is based on the motor rated speed, frequency and calculated motor torque, therefore a valid value must be entered for the Rated Motor Speed (RATED MTR SPEED(A5))*	***none***[iii]	***0.00 – 2.00***[iii]	***1.00***[iii]		*N*[iii]	*N*[iii]

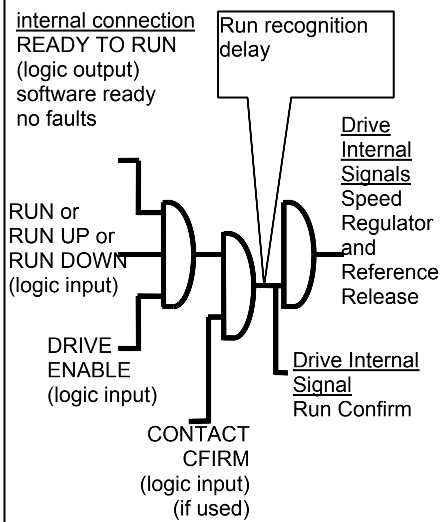
[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Name	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Torq Boost Time[iii]	*(Torque Boost Time Constant[iii]) This parameter is the torque boost filter time constant. Adjusted for torque compensation response and stability. Increasing the value of the parameter, decreases response. Reducing the parameter to a lower value increases response.* *NOTE: it is usually best to leave this parameter set at the default of 0.5 seconds.* *Torque compensation automatically boosts the drive's output voltage, in excess of the programmed V/Hz pattern, as the load demand increases. Torque compensation counters the voltage drop in the motor stator resistance. This function has the greatest effect at low speeds improving load response. When using torque compensation, a valid value must be entered for the motor's no-load current (% NO LOAD CURR(A5))*	***sec***[iii]	***0.01 – 1.00***[iii]	***0.05***[iii]		*N*[iii]	*N*[iii]
Torq Boost Gain[iii]	*(Torque Boost Gain[iii]) This gain controls the differential term in the voltage boost function. This affects the rate of response of the torque boost. Setting the Torque Boost Gain to 0.00 disables the torque boost function.* *NOTE: this function is defaulted off (TORQ BOOSTGAIN=0.0). If adjustments need to be made follow the guidelines listed in the "Performance Adjustments" on page 157.* *Torque compensation automatically boosts the drive's output voltage, in excess of the programmed V/Hz pattern, as the load demand increases. Torque compensation counters the voltage drop in the motor stator resistance. This function has the greatest effect at low speeds improving load response. When using torque compensation, a valid value must be entered for the motor's no-load current (% NO LOAD CURR(A5))*	***none***[iii]	***0.00 – 2.00***[iii]	***0.00***[iii]		*N*[iii]	*N*[iii]
Spd Dev Lo Level[i,ii]	(Speed Deviation Lo Level[i,ii]) Range around the speed reference for speed deviation low logic output. For more information, see SPD DEVIATION on page 59. Units in percent of contract speed.	**%**[i,ii]	**0.1 – 20.0**[i,ii]	**10.0**[i,ii]	**20.0**[i,ii]	Y[i,ii]	N[i,ii]
Spd Dev Time[i,ii]	(Speed Deviation Time[i,ii]) 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 59.	**sec**[i,ii]	**0.00 – 9.99**[i,ii]	**0.50**[i,ii]	**5.00**[i,ii]	Y[i,ii]	N[i,ii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Name	Description	Units	Range	Default		Hidden Item	Run lock out
				ENGLISH (U3)	METRIC (U3)		
Spd Dev Alm Lvl[ii]	*(Speed Deviation Alarm Level*[ii]*) This parameter sets the level at which a speed deviation alarm will be declared. For more information, see SPD DEVIATION on page 59.*	**%**[ii]	***0.0 – 99.9***[ii]	***10.0***[ii]		*N*[ii]	*N*[ii]
Spd Dev Flt Lvl[ii]	*(Speed Deviation Fault Level*[ii]*) This parameter sets the level at which a speed deviation fault will be declared. For more information, see SPD DEVIATION on page 59.*	**%**[ii]	***0.0 – 99.9***[ii]	***25.0***[ii]		*N*[ii]	*N*[ii]
Up to Spd. Level	(Up to Speed Level) This parameter sets the threshold for the up to speed logic output. This is only used to generate the up to speed logic output. Units in percent of contract speed.	**%**	**0.00 – 110.00**	**80.00**		Y	N
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**	**2.50**	Y	Y
Zero Speed Time	(Zero Speed Time) This parameter sets the time at which the drive is at the ZERO SPEED LEVEL (A1) before zero speed logic output is true	**sec**	**0.00 – 9.99**	**0.10**		Y	Y
Up/Dwn Thrshold	(Directional Threshold) This parameter sets the threshold for the direction sense logic outputs. If speed feedback does not reach this level, the drive will not detect a directional change. This is only used to generate the direction sense logic outputs (car going up and car going down). Units in percent of contract speed.	**%**	**0.00 – 9.99**	**1.00**		Y	Y
Notch Filter Freq[i,ii]	(Notch Filter Frequency[i,ii]) Notch filter center frequency. For more information, see NOTCH FILTER FRQ on page 60.	**Hz**[i,ii]	**5 – 60**[i,ii]	**20**[i,ii]		Y[i,ii]	Y[i,ii]
Notch Filt Depth[i,ii]	(Notch Filter Depth[i,ii]) 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 60.	**%**[i,ii]	**0 – 100**[i,ii]	**0**[i,ii]		Y[i,ii]	Y[i,ii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Name	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Run Delay Timer[i,ii]	(Run Delay Timer[i,ii]) Allows the user to delay the drive's recognition of the RUN signal.  	**sec** [i,ii]	**0.00 – 0.99** [i,ii]	**0.00** [i,ii]		Y[i,ii]	Y[i,ii]
Tach Rate Gain[i,ii]	(Tach Rate Gain[i,ii]) This parameter can be used to help reduce the effects of rope resonance. It should be adjusted only after the INERTIA (A1), and RESPONSE (A1) has been set correctly. The tach rate function is available for high performance systems that exhibit problems with rope resonance characteristics. This function subtracts a portion of the speed feedback derivative from the output of the speed regulator. The Tach Rate Gain parameter (TACH RATE GAIN (A1)) selects a unit less gain factor that determines how much of the derivative is subtracted.	**none** [i,ii]	**0.0 – 30.0** [i,ii]	**0.0** [i,ii]		Y[i,ii]	N[i,ii]
Inner Loop Xover[i,ii]	(Inner Loop Cross Over[i,ii]) This parameter sets the inner speed loop cross over frequency. This parameter is only used by the Elevator Speed Regulator (Ereg).	**rad/ sec** [i,ii]	**0.1 – 20.0** [i,ii]	**2.0** [i,ii]		N[i,ii]	N[i,ii]
Spd Phase Margin[i,ii]	(Speed Phase Margin[i,ii]) This parameter sets the phase margin of the speed regulator assuming a pure inertial load. This parameter is only used by the PI speed regulator.	**degs** [i,ii]	**45 – 90** [i,ii]	**80** [i,ii]		Y[i,ii]	N[i,ii]
Spd Command Bias	(Speed Command Bias) This parameter subtracts an effective voltage to the actual analog speed command voltage signal. $\left(\begin{matrix}\text{analog}\\\text{channel\#1}\\\text{input}\\\text{voltage}\end{matrix} - \begin{matrix}\text{SPD}\\\text{COMMAND}\\\text{BIAS}\end{matrix}\right) \times \begin{matrix}\text{SPD}\\\text{COMMAND}\\\text{MULT}\end{matrix} = \begin{matrix}\text{signal}\\\text{drive}\\\text{software}\\\text{uses}\end{matrix}$	**volts**	**-6.000 – +6.000**	**0.000**		Y	Y

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Name	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Spd Command Mult	(Speed Command Multiplier) This parameter scales the analog speed command. $\left(\text{analog channel\#1 input voltage} - \text{SPD COMMAND BIAS}\right) \times \text{SPD COMMAND MULT} = \text{signal drive software uses}$	**none**	**-10.00 - +10.00**	**1.00**		Y	Y
Pre Torque Bias[i,ii]	(Pre-Torque Bias[i,ii]) This parameter subtracts an effective voltage to the actual analog pre torque command (channel 2) voltage signal. $\left(\text{analog channel\#2 input voltage} - \text{PRE TORQUE BIAS}\right) \times \text{PRE TORQUE MULT} = \text{signal drive software uses}$	**volts** [i,ii]	**-6.00 – 6.00** [i,ii]	**0.00** [i,ii]		Y[i,ii]	Y[i,ii]
Pre Torque Mult [i,ii]	(Pre-Torque Multiplier[i,ii]) This parameter scales the analog pretorque command (channel 2). $\left(\text{analog channel\#2 input voltage} - \text{PRE TORQUE BIAS}\right) \times \text{PRE TORQUE MULT} = \text{signal drive software uses}$	**none** [i,ii]	**-10.00 - +10.00**[i,ii]	**1.00**[i,ii]		N[i,ii]	Y[i,ii]
Pre Torque Time[i,ii]	(Pre Torque Time[i,ii]) 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. Setting this parameter to zero will disable the Pre Torque Ramp Up function. With a non-zero setting for Pre Torque Time, the torque reference will be linearly ramped from zero to the value given through the Analog Input Channel or the serial channel.	**sec**[i,ii]	**0.00 – 10.00**[i,ii]	**0.00**[i,ii]		N[i,ii]	N[i,ii]
Ext Torque Bias [i,ii]	(External Torque Bias[i,ii]) This parameter subtracts an effective voltage to the actual analog pre torque / torque command (channel 2) voltage signal. For more information, see Analog Inputs on page 31. $\left(\text{analog channel\#2 input voltage} - \text{EXT TORQUE BIAS}\right) \times \text{EXT TORQUE MULT} = \text{signal drive software uses}$	**volts** [i,ii]	**-6.00 – 6.00**[i,ii]	**0.00**[i,ii]		N[i,ii]	N[i,ii]
Ext Torque Mult[i,ii]	(External Torque Multiplier[i,ii]) This parameter scales the analog pretorque / torque command (channel 2). If this function is set to 1.00, a 10V signal will call for 100% torque. For more information, see Analog Inputs on page 31. $\left(\text{analog channel\#2 input voltage} - \text{EXT TORQUE BIAS}\right) \times \text{EXT TORQUE MULT} = \text{signal drive software uses}$	**none** [i,ii]	**-10.00 - +10.00**[i,ii]	**1.00**[i,ii]		N[i,ii]	N[i,ii]
Ana 1 Out Offset	(Digital to Analog #1 Output Offset) Offset for scaling Analog Output Channel #1. $\left(\text{signal drive software creates} - \text{ANA OUT OFFSET}\right) \times \text{ANA OUT GAIN} = \text{analog channel output voltage}$	**%**	**-99.9 – +99.9**	**0.0**		Y	N

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Name	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Ana 2 Out Offset	(Digital to Analog #2 Output Offset) Offset for scaling Analog Output Channel #2. $\left(\text{signal drive software creates} - \text{ANA OUT OFFSET}\right) \times \text{ANA OUT GAIN} = \text{analog channel output voltage}$	**%**	**-99.9 – +99.9**	**0.0**		Y	N
Ana 1 Out Gain	(Digital to Analog #1 Output Gain) Adjusts the scaling for the Analog Output Channel #1. NOTE: value of 1.0 = 0 to 10VDC signal. $\left(\text{signal drive software creates} - \text{ANA OUT OFFSET}\right) \times \text{ANA OUT GAIN} = \text{analog channel output voltage}$	**none**	**0.0 – 10.0**	**1.0**		Y	N
Ana 2 Out Gain	(Digital to Analog #2 Output Gain) Adjusts the scaling for the Analog Output Channel #2. NOTE: value of 1.0 = 0 to 10VDC signal. $\left(\text{signal drive software creates} - \text{ANA OUT OFFSET}\right) \times \text{ANA OUT GAIN} = \text{analog channel output voltage}$	**none**	**0.0 – 10.0**	**1.0**		Y	N
Ser2 Insp Spd	(Serial Mode 2 Inspection Speed) *Used only with custom serial protocol (mode 2)* When in Serial Mode 2, this parameter defines the inspection speed to be used. To run in inspection speed via serial mode 2 requires that the run command for inspection speed come from two sources, a command sent in a serial message and via hardware as a logic input defined as "SER2 INSP ENA".	**ft/ min**	**0.0 – 100.0**	**30.0**	**-**	Y	Y
		m/sec	**0.000 – 0.500**	**-**	**0.150**		
Ser2 Rs Crp Spd	(Serial Mode 2 Rescue Creep Speed) *Used only with custom serial protocol (mode 2)* When in Serial Mode 2 and SER2 FLT MODE (C1)=rescue, this parameter defines the creep speed that will be used in the "rescue mode".	**ft/ min**	**0.0 – 300.0**	**10.0**	**-**	Y	Y
		m/sec	**0.000 – 1.540**	**-**	**0.050**		
Ser2 Rs Cpr Time	(Serial Mode 2 Rescue Creep Time) *Used only with custom serial protocol (mode 2)* When in Serial Mode 2 and SER2 FLT MODE (C1)=rescue, this parameter defines the maximum time the drive will continue to run at rescue creep speed (defined by SER2 RS CRP SPD (A1) parameter) when reacting to a serial fault. The time is defined as the time running at creep speed. It does not include the time it takes to decelerate to creep speed.	**sec**	**0.0 – 200.0**	**180.0**		Y	Y
Ser2 Flt Tol	(Serial Mode 2 Fault Tolerance) *Used only with custom serial protocol (mode 2)* When in Serial Mode 2, this parameter defines the maximum time that may elapse between valid run time messages while in serial run mode before a serial fault is declared.	**sec**	**0.00 – 2.00**	**0.50**		Y	Y

Name	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Arb Start Time[i,ii]	*(Anti-Rollback Start Time [i,ii]) ARB Start Time (A1) is the dwell time between the logic output SPD REG RLS and the brake starting to pick. ARB will not become activated until ARB START TIME (A1) has occurred. Setting this value too long will cause major rollback to occur. Setting this value too short will cause ARB to begin while the brake is still set. Adjust the ARB START TIME (A1) to begin just as the brake is lifting. For more information, see* ANTI-ROLLBACK *on page 61.*	*sec [i,ii]*	*0.00 – 5.00 [i,ii]*	*0.30 [i,ii]*		*N [i,ii]*	*Y [i,ii]*
Arb Decay Rate[i,ii]	*(Anti-Rollback Decay Rate [i,ii]) ARB Decay Rate determines the slew rate for torque while in ARB mode. The higher the value, the more torque change may occur while the lower the value, the less torque change may occur. Setting this value to the maximum 0.99 indicates limited decay. The faster the brake lifts, the higher this value should be. For more information, see ANTI-ROLLBACK on page 61*	*none [i,ii]*	*0.000 – 0.999 [i,ii]*	*0.900 [i,ii]*		*N [i,ii]*	*Y [i,ii]*
ARB Inertia[i,ii]	*(Anti-Rollback Inertia[i,ii]) ARB INERTIA (A1) is the Inertia/Gain setting when the drive is in ARB Mode. 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. It is best to start this value at the same value of system inertia (see INERTIA (A1)). For more information, see ANTI-ROLLBACK on page 61*	*none [i,ii]*	*0.10 – 4.00 [i,ii]*	*1.00 [i,ii]*		*N [i,ii]*	*Y [i,ii]*
ARB Torque Time[i,ii]	*(Anti-Rollback Torque Time [i,ii]) This parameter helps smooth out the torque requirement from the drive to the motor. With this set at zero, the drive will step up torque as required to hold the motor. The higher this value is, the smoother the torque transition to the motor, however, the more rollback may occur. For information on setting ARB, see ANTI-ROLLBACK on page 61*	*sec [i,ii]*	*0.000 – 1.000 [i,ii]*	*0.015 [i,ii]*		*N [i,ii]*	*Y [i,ii]*
Mains Dip Speed	(Mains Dip Speed Multiplier) This parameter sets the percentage of contract speed for the speed to be reduced when the drive goes into 'low voltage' mode. The Mains Dip function is enabled by the Mains Dip Enable (MAINS DIP ENA(C1)) parameter. When the drive goes into 'low voltage' mode, it reduces the speed by the percentage defined by this parameter. 'Low voltage' mode is defined as when the drive declares a UV alarm, which is defined by the Input line-to-line voltage (INPUT L-L VOLTS(A4)) parameter and the Undervoltage Alarm Level (UV ALARM LEVEL(A4)).	**%**	**5.00 – 99.99**	**25.00**		Y	N
Mspd Delay 1-4	(Multi-Step Speed Delay 1-4) Determines the recognition time delay for a defined multi-step speed command. For more information, see p. 63.	**sec**	**0.000 – 10.000**	**0.000**		Y	Y

Name	Description	Units	Range	Default		Hidden Item	Run lock out
				ENGLISH (U3)	METRIC (U3)		
Mid Speed Lvl	(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**		Y	Y
Encdr Flt Sense[ii]	*(Encoder Fault Sensitivity*[ii]*) 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 (A5)*	***%***[ii]	***10 – 100***[ii]	***30***[ii]		*N*[ii]	*Y*[ii]
ARB[i,ii] ***Deadband***	*(Anti-Rollback Deadband*[i,ii]*)* This parameter determines the amount of encoder pulses the drive will ignore before starting the ARB sequence. Setting too low and you may experience motor noise especially at balanced car, setting too high will result in excessive rollback	***none***[ii]	***0 – 20***[i,ii]	***5***[i,ii]		*N*[i,ii]	***N***[i,ii]
Abs Ref Offset[ii]	*For Magnetek personnel – This parameter sets angular offset for absolute position reference signal that can be used for position feedback/ alignment testing.*	***deg***[ii]	***-180.00 – +180.00***[ii]	***0.00***[ii]		*Y*[ii]	*N*[ii]
Cont Dwell Time[iii]	*(Contact Dwell Time*[iii]*) When external logic outputs are used to control the closing of the motor contactor, this parameter sets the amount of time delay from disabling the drive outputs following a stop until the motor contactor opens. And when external logic inputs are used to confirm the closing of the motor contactor, this parameter extends the time allowed for the contactor's auxiliary contacts to reach the user commanded state before a CONTACTOR FLT occurs.*	***sec***[iii]	***0.00 – 5.00***[iii]	***0.50***[iii]		*N*[iii]	*N*[iii]

Table 9: Drive A1 Submenu

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Detailed descriptions

FLUX WEAKENING[i]

The HPV 900 Series 2 will calculate the rated flux level by using the following motor parameters:

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

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

In the HPV 900 Series 2 , flux weakening begins before the motor reaches rated speed.

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

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

Flux Weakening Parameters

The following three HPV 900 Series 2 parameters affect both the available torque curve and flux level curve:

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

The highest of the two torque limits is used as the torque limit that defines the two curves. An example of the effects of the torque limit on the amount of flux weakening needed and the amount of torque available through the entire speed range is shown below.

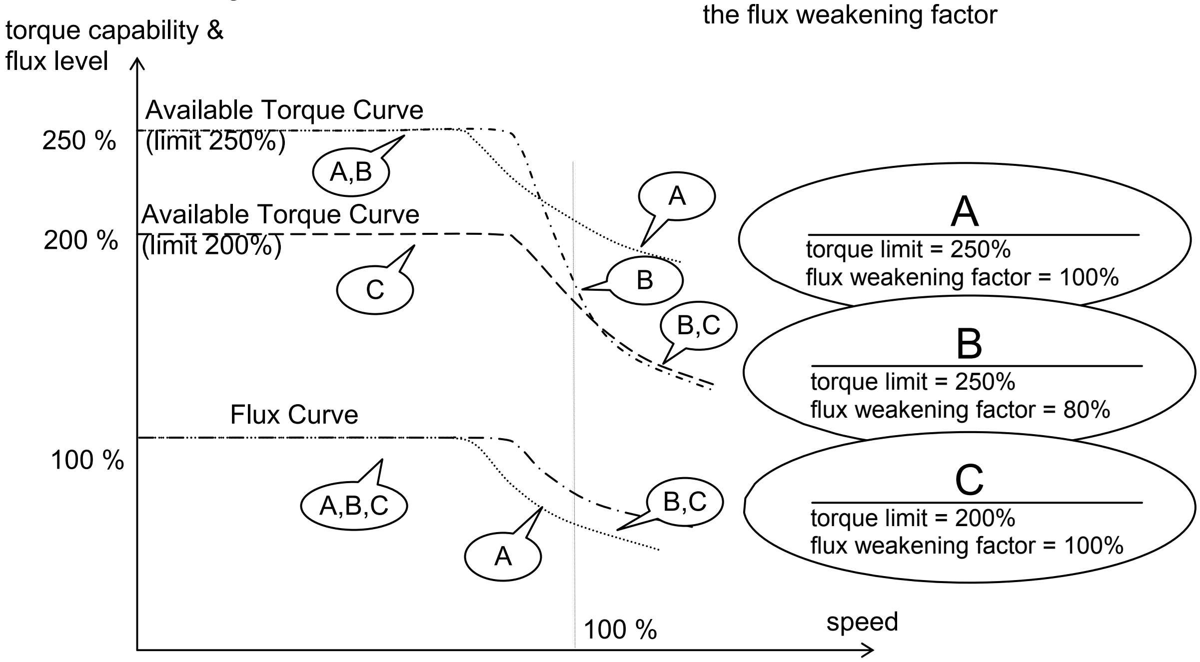
By lowering the torque limit you can effectively reduce the amount of field weakening needed and reduce the amount of current needed by the motor at motor's rated speed. The trade-off is you have lower over-all torque available.

In order to have more torque available at the lower speeds, the HPV 900 Series 2 has the Flux Weakening Factor parameter, which effectively reduces the amount of torque available only at the higher speeds. This will allow the HPV 900 Series 2 to have a higher flux level at the motor's rated speed and require less current to produce rated torque.

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

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

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



[i] Parameter accessible through **CLOSED LOOP (U9)** only
[ii] Parameter accessibly through ***PM (U9)*** only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** only

GAIN CHNG LEVEL[i,ii]
(Gain Change Level)
Note: This parameter is only accessible and usable when the drive is set for Closed Loop Operation.

When the gain control is set to internal, the drive will control the high/low gain switch. This parameter sets the speed reference level, when the drive is in ‘low gain’ mode.

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

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

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

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

The high / low gain switch determines when the HPV 900 Series 2 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(C1)) allows for this external or internal selection.

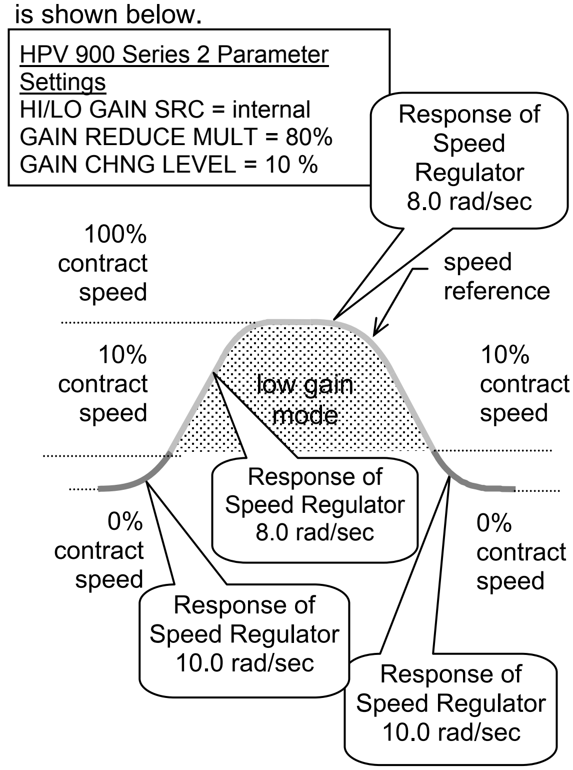
The high / low gain switch can be controlled externally by either:
- a logic input
- the serial channel

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

- the gain change level parameter (GAIN CHNG LEVEL(A1)), 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

---
[i] Parameter accessible through **CLOSED LOOP (U9)** only
[ii] Parameter accessibly through ***PM (U9)*** only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** only

RAMPED STOP TIME[i,ii]

(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 command removal
- The serial channel

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

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

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

The time it takes for the HPV 900 Series 2 to perform its ramped stop is determined by the Ramped Stop Time Parameter. The Ramped Stop Time parameter (RAMPED STOP TIME(A1)) selects the amount of time it would take for the drive to ramp from the rated torque to zero torque.

SPEED DEVIATION

(Speed Deviation)

The following two functions are available to indicate how the speed feedback is tracking the speed reference.

- Speed Deviation Low[i,ii] – indicates that the speed feedback is tracking the speed reference within a defined range.
- Speed Deviation High[i] – indicates that the speed feedback is failing to properly track the speed reference.
- Speed Deviation Alm Level[ii] - the point at which a Speed Deviation Alarm will be declared by the software.
- SPD DEV FLT LVL[ii] - the point at which a Speed Deviation Fault will be declared

The Speed Deviation Low function has the ability to set a configurable logic output *(C3 Submenu).* The logic output will be true, when the speed feedback is tracking the speed reference within a defined range around the speed reference for a defined period of time, see Figure 32. The defined range is determined by the Speed Deviation Low Level parameter (SPD DEV LO LEVEL(A1)) and the defined time is determined by the Speed Deviation Time parameter (SPD DEV TIME(A1)).

The Speed Deviation High function annunciates a Speed Deviation Alarm and has the ability to set a configurable logic output*, see Logic Outputs C3 on page 99.* The alarm will be annunciated and the logic output will be true, when the speed feedback is not properly tracking the speed reference and is outside a defined range around the speed reference. The defined range is determined by the Speed Deviation High Level parameter (SPD DEV HI LEVEL(A1)).

[i] Parameter accessible through **CLOSED LOOP (U9)** only
[ii] Parameter accessibly through ***PM (U9)*** only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** only

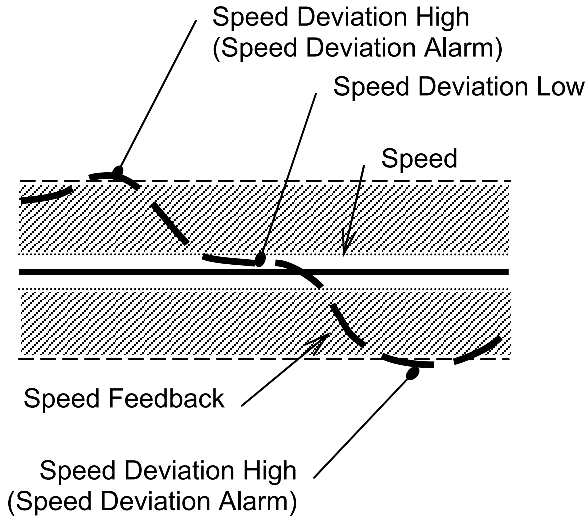


Figure 32: Speed Deviation Example for CLOSED LOOP (U9) [i]

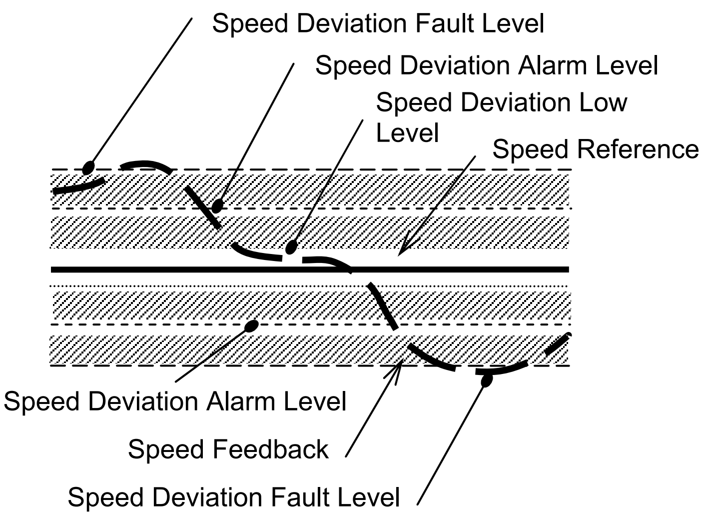


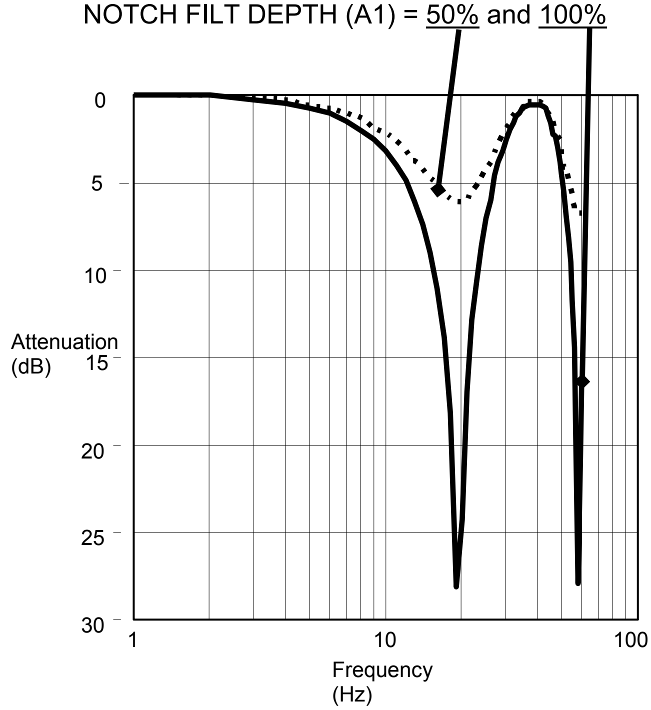
Figure 33: Speed Deviation Example for PM (U9) [ii]

NOTCH FILTER FRQ [i,ii]
(Notch Filter Center Frequency)
This parameter determines the notch filter center frequency.

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

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

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



---
[i] Parameter accessible through **CLOSED LOOP (U9)** only
[ii] Parameter accessibly through ***PM (U9)*** only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** only

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. See Figure 34 for help in adjusting and setting up ARB for a HPV900 S2 drive. **Please note:** ARB should be a final adjustment. All adjustments in tuning the drive for smooth car ride (high speed, slowing and stop) should occur before attempting to tune ARB.

CAUTION
ARB cannot be used in conjunction with PreTorque. PRETORQUE SRC (C1) = NONE when ARB SELECT (C1) is set to ENABLE.

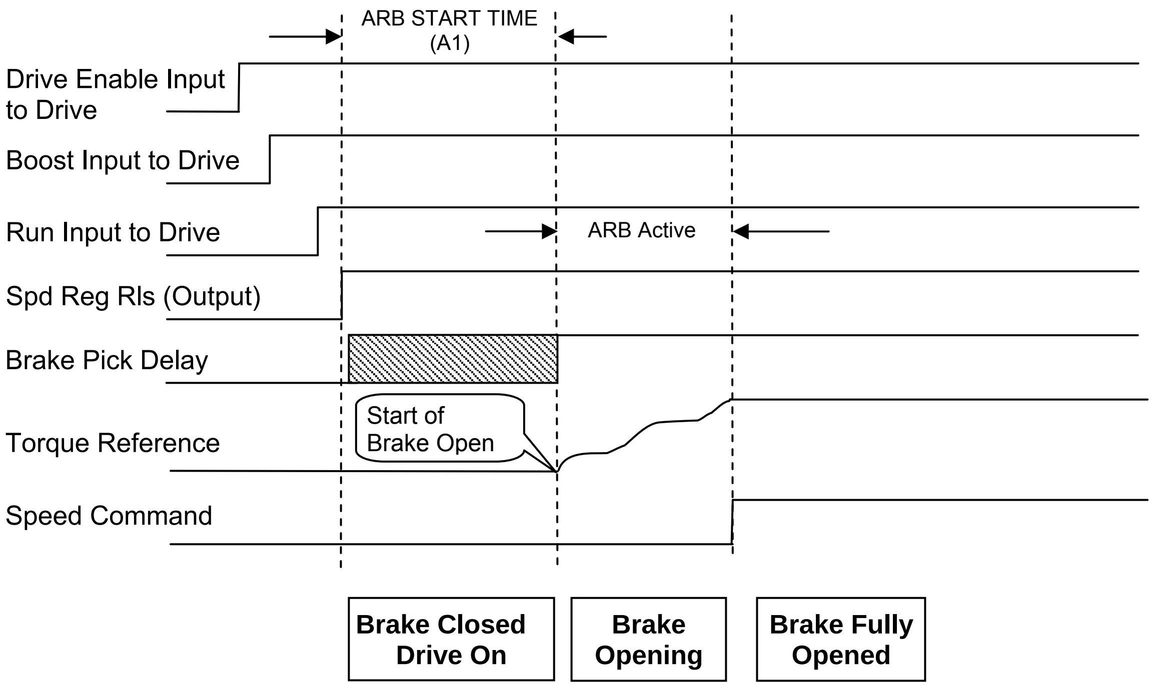


Figure 34: ARB Timing Diagram

1. Set car in middle of the hoistway so rollback will not cause the elevator to go past 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	ENABLE
ARB START TIME (A1)	0.00s	0.00s
ARB DECAY RATE (A1)	0.990s	0.990s
ARB INERTIA (A1)	1.00s	Set to Inertia (A1)
ARB TORQUE TIME (A1)	0.01s	0.01s
ARB DEADBAND (A1)	5	5

3. Once Anti-Rollback has been enabled, six parameters will help adjust the software to work best in the application

   ARB START TIME (A1) introduces a delay to the start of the ARB sequence so that it starts as the brake starts to pick. ARB will not become activated until ARB START TIME (A1) has occurred. Setting this value too long will cause major rollback to occur. Setting this value too short may cause issues with the drive reacting to noise on the speed feedback channels and start ARB too early which may result in motor vibration. Adjust the ARB START TIME (A1) to begin just as the brake is lifting, a good starting point is the same as BRAKE PICK TIME (if used).

ALARM! ARB START TIME HIGH
If this alarm is displayed, it is an indication that ARB saw sheave movement ***before*** ARB was active. Decrease the value of ARB START TIME (A1) in this instance.

Begin by adjusting ARB START TIME (A1). Below are some expected results based on timing of this parameter

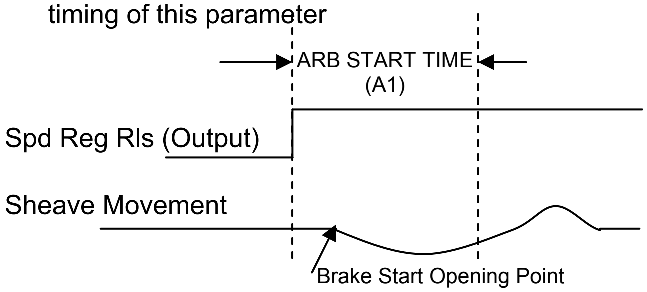


Figure 35: ARB Start Time set too long

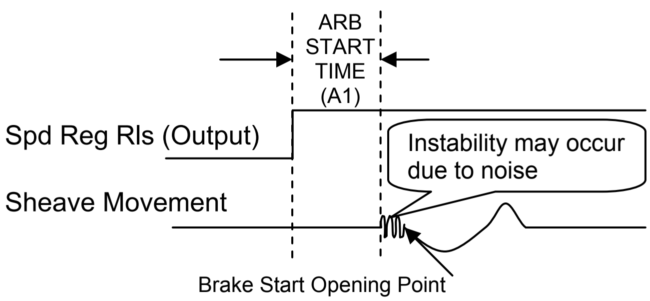


Figure 36: ARB Start Time set too short

Once ARB Start Time has been adjusted to occur right when the brake is beginning to open, the next step is to adjust the ARB INERTIA

ARB INERTIA (A1) is the Inertia/Gain setting when the drive is in ARB Mode. 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. It is best to start this value at same value of system inertia (see INERTIA (A1)) then slowly increase as required.

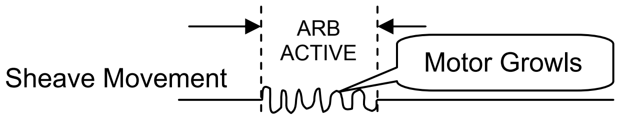


Figure 38: ARB INERTIA (A1) too high

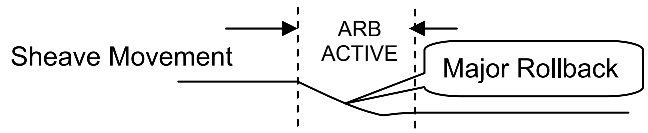


Figure 37: ARB INERTIA (A1) too low

ARB TORQUE TIME (A1) determines the angle of torque ramp applied when ARB is introduced. The higher the number, the smoother the torque will be introduced, however, this may cause more rollback. if set too low a bump may be felt in the car as the torque is applied too sharply.

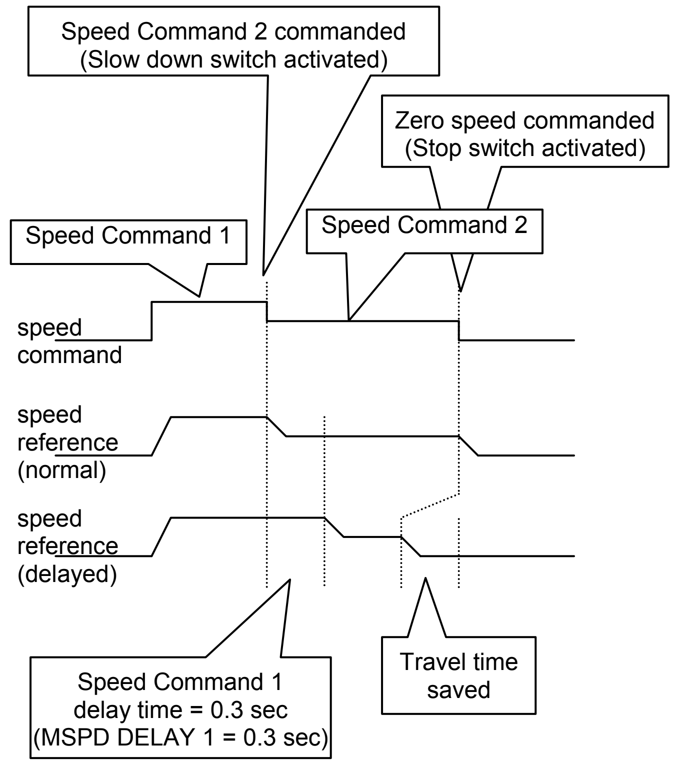
ARB DECAY RATE (A1) determines the slew rate for torque introduction while in ARB mode. The higher the value, the more torque change may occur while the lower the value, the less torque change may occur. Setting this value to the maximum 0.99 indicates limited decay. The faster the brake lifts, the higher this value should be.

ARB DEADBAND (A1) determines the amount of encoder pulses the drive should ignore before recognizing rollback is occurring. Lowering this value may allow the drive to catch rollback quicker however it also makes it more likely to react to electrical noise or mechanical float as torque is applied to the motor, particularly noticeable when the car is balanced.

4. Start by giving the car a zero speed command with full load, worst case scenario and adjust the above to achieve as little movement as is possible without causing the motor to growl. After the ARB parameters have been adjusted, set the car controller to give the drive a non-zero speed command and fine tune if required. The drive will exit ARB mode when it see a non-zero speed command, adjust when this non-zero speed command is given to the drive to occur directly after the brake has fully lifted.
5. For advanced setup, if the analogue outputs are not in use and an oscilloscope is available, set analog output 1 (gain of 1) to ARB STATE and analog output 2 (gain of 1) to TORQUE REF to help determine if ARB INERTIA (A1), ARB TORQUE TIME (A1) and ARB DECAY RATE (A1) are optimized.

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

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



S-Curves A2 Submenu

Detailed descriptions

The HPV 900 Series 2 speed command is passed through an internal S-curve in order to produce the speed reference. In general, the S-curve function takes an arbitrary speed command and generates a speed reference subject to the conditions that the maximum accel, decel and jerk rates not be exceeded. The speed command is typically the target speed that the reference is headed to.

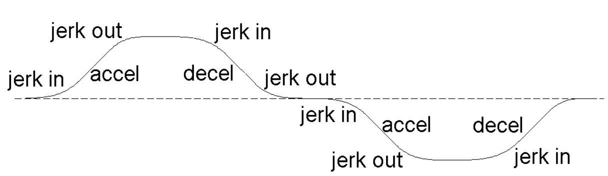
Note: If the car controller is feeding the drive a speed profile including s-curves, the s-curve settings on the drive need to be placed out of the way. In those cases, set ACCEL RATE 0 and DECEL RATE 0 to the maximum (7.99 ft/s^2 or 3.999 m/s^2) and set ACCEL JERK IN 0, ACCEL JERK OUT 0, DECEL JERK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

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

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

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

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



S-Curve

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

Parameters for S-curve-0 (SC0):

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

Parameters for S-curve-1 (SC1):

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

Parameters for S-curve-2 (SC2):

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

Parameters for S-curve-3 (SC3):

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

S-Curve Pattern Selection

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

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

S-curve Availability

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

Selecting S-curves

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

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

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**	**0.800**		
Decel Rate 0	Deceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Accel Jerk In 0	Rate of increase of acceleration, up to ACCEL RATE, when increasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.60**		
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**	**0.60**		
Decel Jerk In 0	Rate of increase of deceleration, up to DECEL RATE, when decreasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.60**		
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**	**0.60**		
Accel Rate 1	Acceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Decel Rate 1	Deceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Accel Jerk In 1	Rate of increase of acceleration, up to ACCEL RATE, when increasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.60**		
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**	**0.60**		
Decel Jerk In 1	Rate of increase of deceleration, up to DECEL RATE, when decreasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.60**		
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**	**0.60**		
Accel Rate 2	Acceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Decel Rate 2	Deceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Accel Jerk In 2	Rate of increase of acceleration, up to ACCEL RATE, when increasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.60**		
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**	**0.60**		
Decel Jerk In 2	Rate of increase of deceleration, up to DECEL RATE, when decreasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.60**		
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**	**0.60**		
Accel Rate 3	Acceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Decel Rate 3	Deceleration rate limit	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Accel Jerk In 3	Rate of increase of acceleration, up to ACCEL RATE, when increasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.60**		
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**	**0.60**		
Decel Jerk In 3	Rate of increase of deceleration, up to DECEL RATE, when decreasing elevator speed	**ft/s³**	**0.0 – 29.9**	**8.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.60**		
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**	**0.60**		

Table 10: S-Curve A2 Submenu

Multistep Ref A3 Submenu

Detailed descriptions (non DCP operation)

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

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

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

IMPORTANT

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

logic input STEP REF B3	B2	B1	B0	multi-step speed 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.

Detailed descriptions (DCP operation)

If the drive is being controlled serially via DCP (serial mode set to DCP3 or DCP4) then the user has the ability to set 7 speed commands within this menu. Additionally within this menu the user can also adjust some additional DCP specific threshold settings which are used to provide feedback to the control system serially.

During operation in DCP3 mode the control system will select which speed command the drive should run at serially, in which direction the elevator should travel and will also will remove the applicable high speed command (V1, V2, V3 & V4) when approaching floor level and replace with a leveling speed command (V0). On nearing arrival at floor level the control system will remove the V0 speed command and the drive will slow the motor to a stop, the brake will set and travel will complete.

During DCP4 operation the control system largely leaves the drive to control the slow down and stopping sequence by simply advising the drive the exact distance from the desired floor at any given point in time, the drive than calculates based on its S-Curves (A2) the point at which it must slow to allow the elevator to stop directly at the floor level without a leveling speed. When the machine stops the brake sets and travel will complete.

Parameter	Description	Units	Range	Default	Hidden Item	Run lock out
Speed Command 1[i]	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[i]	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[i]	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[i]	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[i]	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[i]	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[i]	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[i]	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[i]	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[i]	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[i]	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[i]	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[i]	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[i]	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[i]	Multi-step speed command #15	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
V0[ii]	Leveling Speed	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
VN[ii]	Re-Leveling Speed	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		

[i] Parameter only accessible when SERIAL MODE (C1) is set to None, Mode1, Mode2 or Mode3
[ii] Parameter only accessible when SERIAL MODE (C1) is set to DCP3 or DCP4

Parameter	Description	Units	Range	Default	Hidden Item	Run lock out
V1[ii]	Speed Reference 1	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
V2[ii]	Speed Reference 2	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
V3[ii]	Speed Reference 3	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
V4[ii]	Speed Reference 4	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
VI[ii]	Inspection Speed	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
Unlock Spd Level[ii]	When the elevator is traveling at or below this speed the drive will advise the control system serially (used for pre-opening of doors)	**ft/min**	**0.00 – 600.0**	**8.0**	N	Y
		m/sec	**0.00 – 300.0**	**0.800**		
Lvling Spd Level[ii]	When the elevator is traveling at or below this speed the drive will advise the control system serially (used by the control system when releveling with the doors open)	**ft/min**	**0.00 – 600.0**	**3.0**	N	Y
		m/sec	**0.00 – 300.0**	**0.300**		
Border Spd Level[ii]	When the elevator is traveling at or below this speed the drive will advise the control system serially (used for speed monitoring on approaching terminal floors)	**ft/min**	**0.00 – 600.0**	**10.0**	N	Y
		m/sec	**0.00 – 300.0**	**1.000**		
Over Spd Level[ii]	The drive advises the control system serially if the car exceeds this % of contract speed	**%**	**99.0 – 150.0**	**105**	N	Y
Re-level Spd Hi[ii]	For Magnetek personnel – Used when optimizing final stopping sequence (DCP4 only)	**ft/min**	**0.00 – 600.0**	**000.5**	N	Y
		m/sec	**0.00 – 3.00**	**0.050**		
Re-level Spd Low[ii]	For Magnetek personnel – Used when optimizing final stopping sequence (DCP4 only)	**ft/min**	**0.00 – 600.0**	**000.5**	N	Y
		m/sec	**0.00 – 3.00**	**0.005**		

Table 11: Multistep Ref A3 Submenu

[i] Parameter only accessible when SERIAL MODE (C1) is set to None, Mode1, Mode2 or Mode3
[ii] Parameter only accessible when SERIAL MODE (C1) is set to DCP3 or DCP4

Power Convert A4 Submenu

NOTE: When ***Hidden item*** appears above a parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details on page 112.*

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

Parameter	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Input L-L Volts	(Input Line to Line Voltage) This parameter sets the input voltage or AC line input voltage to the drive.	**Vrms**	**110 – 480**	**0**		N	N
UV Alarm Level	(Undervoltage Alarm Level) This parameter sets the level (as a percentage of the INPUT L-L VOLTS) at which an under voltage alarm will be declared. Units in percent of nominal bus.	**%**	**50 – 99**	**90**	**80**	Y	N
UV Fault Level	(Undervoltage Fault Level) This parameter sets the level (as a percentage of the INPUT L-L VOLTS) at which an under voltage fault will occur. Units in percent of nominal bus.	**%**	**40 – 99**	**80**	**70**	Y	N
PWM Frequency	(Carrier Frequency) This parameter sets the PWM or 'carrier' frequency of the drive. The carrier is defaulted at 10.0 kHz, which is well out of audible range. The drive does not derate when the PWM frequency is set to 10kHz or below. *For more information on derating see page 15.*	**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 reactance.	**%**	**0.0 – 10.0**	**0.0**		Y	N
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**	**0.00 – 1.20**	**1.00**[i,iii] **0.00**[ii]		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**	**0.15 – 3.00**	**0.30**[i,iii] ***0.700***[ii]		Y	N

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Id Reg Intg Gain[ii]	*(Current Regulator Integral Gain for Flux Generation[ii]) 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***[ii]	***0.00 – 2.00***[ii]	***1.00***[ii]		*N*[ii]	*N*[ii]
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**	**0.00 – 1.20**	**1.00** [i,iii] **0.00** [ii]		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**	**0.15 – 3.00**	**0.30** [i,iii] **0.700** [ii]		Y	N
Iq Reg Intg Gain[ii]	*(Current Regulator Integral Gain for Torque Generation[ii])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***[ii]	***0.00 – 2.00***[ii]	***1.00***[ii]		*N*[ii]	*N*[ii]
Fine Tune Ofst[ii]	*This parameter is used to manually offset the absolute position feedback for testing purposes. This parameter is only valid when ENCODER SELECT (C1) = ENDAT. 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***[ii]	***-75.00 – +75.00***[ii]	***0.00***[ii]		*Y*[ii]	*N*[ii]
Id Ref Threshld[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***[ii]	***0.00 – 0.20***[ii]	***0.00***[ii]		*Y*[ii]	*N*[ii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Units	Range	Default		Hidden Item	Run lock out
				ENGLISH (U3)	METRIC (U3)		
Flux Weaken Rate[ii]	*(Flux Weakening Slew Rate[ii]) 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 74. Locked by ENGR PARM LOCK (C1).*	***none***[ii]	***0.000 – 1.000***[ii]	***0.000***[ii]		*Y*[ii]	*N*[ii]
Flux Weaken Lev[ii]	*(Flux Weakening Level[ii]) 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 74. Locked by ENGR PARM LOCK (C1).*	***none***[ii]	***0.70 – 1.00***[ii]	***0.95***[ii]		*Y*[ii]	*N*[ii]
Align Vlt Factor[ii]	*(Open Loop Alignment Voltage Reference Scaling Factor[ii]) This parameter is used to scale open loop voltage reference at the initial phase of the open loop alignment.*	***none***[ii]	***0.05 – 1.99***[ii]	***1.00***[ii]		*N*[ii]	*N*[ii]
Brake Opn Flt Lv[ii]	*(Brake Fault Level[ii]) This parameter determines the level of speed feedback the drive sees before declaring the fault BRAKE IS OPEN. This is only valid during either the Auto-Tune or Auto Alignment procedures. Units are in percent of contract speed.*	***%***[ii]	***0.0 – 20.0***[ii]	***2.0***[ii]		*N*[ii]	*N*[ii]
Id Dist Loop Gn[iii]	*(Distortion Loop Gain on Flux Current Generation[iii]) This parameter is meant for advanced operation; therefore, the parameter will rarely need to be changed from the default value.*	***none***[iii]	***0.00 – 1.50***[iii]	***0.50***[iii]		*Y*[iii]	*N*[iii]
Iq Dist Loop Gn[iii]	*(Distortion Loop Gain on Torque Current Generation[iii]) This parameter is meant for advanced operation; therefore, the parameter will rarely need to be changed from the default value.*	***none***[iii]	***0.00 – 1.50***[iii]	***0.30***[iii]		*Y*[iii]	*N*[iii]
Id Dist Loop Fc[iii]	*(Corner Frequency on Distortion Loop for Flux Current[iii]) This parameter is the high-pass corner frequency on the distortion loop regulator for flux current. This parameter is meant for advanced operation; therefore, the parameter will rarely need to be changed from the default value.*	***sec***[iii]	***0.1 – 30.0***[iii]	***5.0***[iii]		*Y*[iii]	*N*[iii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Iq Dist Loop Fc[iii]	*(Corner Frequency on Distortion Loop for Torque Current[iii]) The parameter is the high-pass corner frequency on the distortion loop regulator for torque current. This parameter is meant for advanced operation; therefore, the parameter will rarely need to be changed from the default value.*	***sec***[iii]	***0.1 – 30.0***[iii]	***5.0***[iii]		*Y*[iii]	*N*[iii]
I Reg Cross Freq[iii]	*(Current Regulator Crossover Frequency[iii]) Transition frequency between control at low frequency and higher frequency. This parameter is meant for advanced operation; therefore, the parameter will rarely need to be changed from the default value. Units in percent of DC Stop Freq.*	***%***[iii]	***0.0 – 300.0***[iii]	***100.0***[iii]		*Y*[iii]	*N*[iii]
Dist Lp Off Freq[iii]	*(Distortion Loop Rolloff Frequency[iii]) The frequency at which the distortion loops begins to be phased out. This parameter is meant for advanced operation; therefore, the parameter will rarely need to be changed from the default value.*	***Hz***[iii]	***0.0 – 99.9***[iii]	***60.0***[iii]		*Y*[iii]	*N*[iii]
ILimit Integ Gn[iii]	*(Current Limit Integral Gain[iii]) The Stall Prevention (Current Limit) function's integral gain. This determines the response of the function. Stall prevention causes the drive to deviate from the commanded speed to limit motor current to a user set level. When the motoring current limit is reached (MTR TORQUE LIMIT(A1)), the stall prevention function will reduce speed. When the regenerating current limit is reached (REGEN TORQ LIMIT(A1)), the stall prevention function will increase speed in an effort to shed load. Stall prevention can optionally be disabled in regeneration by the Stall Prevention Regen Enable (STALLP REGEN ENA(C1)) parameter.*	***none***[iii]	***0.00 – 9.99***[iii]	***1.00***[iii]		*N*[iii]	*N*[iii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Hunt Prev Gain[iii]	*(Hunt Prevent Gain[iii]) Determines the response to changes in torque (torque slew rate gain). Increasing the gain slows drive torque response (more dampening). Be cautious not to set the parameter too high or the drive will become unstable.* *NOTE: it is usually best to leave this parameter set at the default of 1.0 second.* *Hunting can occur following a load change, but it may also occur when the motor is settling into a steady speed. Hunting may cause the motor to vibrate at lower speeds. The Hunt Prevention function will help to reduce or suppress this oscillation.*	***none***[iii]	***0.00 – 4.00***[iii]	***1.00***[iii]		*N*[iii]	*N*[iii]
Hunt Prev Time[iii]	*(Hunt Prevention Time Constant[iii]) Hunt prevention filter time constant. Adjusted for hunt prevention response and stability. By increasing the value of the parameter, the response time of the hunt prevention function will become slower. Reducing the parameter to a lower value makes the hunt prevention function respond more quickly. Note: the function works better with a lower time constant.* *NOTE: it is usually best to leave this parameter set at the default of 0.2 seconds.* *Hunting can occur following a load change, but it may also occur when the motor is settling into a steady speed. Hunting may cause the motor to vibrate at lower speeds. The Hunt Prevention function will help to reduce or suppress this oscillation.*	***sec***[iii]	***0.001 – 7.000***[iii]	***0.200***[iii]		*N*[iii]	*N*[iii]
Switching Delay[iii]	*(Transistor Switching Delay[iii]) This parameter is hardware dependent and should not be adjusted.*	***sec***[iii]	***0 - 10***[iii]	***0***[iii]		*Y*[iii]	*N*[iii]
Vc Correction[iii]	*(Conduction Voltage Correction[iii]) This parameter is hardware dependent and should not be adjusted.*	***V***[iii]	***0.00 – 5.00***[iii]	***2.50***[iii]		*Y*[iii]	*N*[iii]
Load Sense Time	(Load Sense Time) Load Sense Time is only used when SERIAL MODE (C1) = DCP3 or DCP4.	**Sec**	**0.00 – 1.50**	**0.00**		N	N

---

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Units	Range	Default		Hidden Item	Run lock out
				ENGLISH (U3)	METRIC (U3)		
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.*	***%***[ii]	***5 – 20***[ii]	***10***[ii]		*N*[ii]	*N*[ii]
Fan Off Delay	(Fan Off Delay) This parameter sets the amount of time the drive will wait after the run has been removed until the fans turn off. Setting this value to maximum of 999 indicates the fans will never shut off.	**Sec**	**0 – 999**	**60**		N	N

Table 12: Power Convert A4 Submenu

FLUX WEAKENING[ii] AT VOLTAGE LIMITS

Flux Weakening Parameters

The following HPV 900 S2 PM parameters affect flux weakening:

- Flux Weakening Slew (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 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 HPV 900 S2 PM will automatically adjust the current to keep the output voltage from reaching the voltage limits. The HPV 900 S2 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 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.

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

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Motor A5 Submenu

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

IMPORTANT

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

NOTE: When ***Hidden Item*** appears above a parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details on page 112.*

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

<table>
<tr><th rowspan="2">Parameter</th><th rowspan="2">Description</th><th rowspan="2">Units</th><th rowspan="2">Range</th><th colspan="2">Default</th><th rowspan="2">Hidden Item</th><th rowspan="2">Run lock out</th></tr>
<tr><th>ENGLISH (U3)</th><th>METRIC (U3)</th></tr>
<tr><td>Motor ID</td><td>(Motor Identification) This parameter allows for the selection of motor parameters. A listing of each Motor ID with its corresponding set of motor parameters is shown below.
<table>
<tr><th rowspan="2">motor parameter</th><th colspan="2">Motor ID</th></tr>
<tr><th>4 pole dflt[i,iii]</th><th>6 pole dflt[i,iii]</th></tr>
<tr><td>Rated Mtr Power</td><td>0.0 HP</td><td>0.0 HP</td></tr>
<tr><td>Rated Mtr Volts</td><td>0.0 V</td><td>0.0 V</td></tr>
<tr><td>Rated Excit Freq</td><td>0.0 Hz</td><td>0.0 Hz</td></tr>
<tr><td>Rated Motor Curr</td><td>0.0 A</td><td>0.0 A</td></tr>
<tr><td>Motor Poles</td><td>0</td><td>0</td></tr>
<tr><td>Rated Mtr Speed</td><td>0.0 rpm</td><td>0.0 rpm</td></tr>
<tr><td>% No Load Curr</td><td>35.00%</td><td>45.00%</td></tr>
<tr><td>Stator Leakage X</td><td>9.00%</td><td>7.50%</td></tr>
<tr><td>Rotor Leakage X</td><td>9.00%</td><td>7.50%</td></tr>
<tr><td>Stator Resist</td><td>1.50%</td><td>1.50%</td></tr>
<tr><td>Motor Iron Loss</td><td>0.50%</td><td>0.50%</td></tr>
<tr><td>Motor Mech Loss</td><td>1.00%</td><td>1.00%</td></tr>
<tr><td>Flux Sat Break</td><td>75%</td><td>75%</td></tr>
<tr><td>Flux Sat Slope 1</td><td>0%</td><td>0%</td></tr>
<tr><td>Flux Sat Slope 2</td><td>50%</td><td>50%</td></tr>
</table>
Table 13: Motor ID Defaults
NOTE: The default motor selections need to have the motor nameplate information entered in the appropriate motor parameters. The other motor parameters are already set to nominal values.
IMPORTANT
Whichever Motor ID is used, the Adaptive Tune Procedure should be followed to obtain maximum motor performance. See Using the Adaptive Tune on page 139 or Auto Tune on page 153 to Obtain Maximum Motor Performance.</td><td>none</td><td>– 4 pole dflt[i,iii]
– 6 pole dflt[i,iii]
– PM dflt[ii]</td><td>4 POLE DFLT [i,iii]
PM Dflt[ii]</td><td>4 POLE DFLT[i,iii]
PM Dflt[ii]</td><td>N[i]</td><td>Y[i]</td></tr>
</table>

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Rated Mtr Pwr	(Rated Motor Power) This parameter sets the rated power in horsepower (HP) or kilowatts (kW) of the motor. Note: value should be obtained from the motor nameplate	**HP**	**1.0 – 500.0**	**0.0**		N	Y
		kW	**0.75 – 300.00**	**0.00**			
Rated Mtr Volts	(Rated Motor Voltage) This parameter sets the rated motor voltage. Note: value should be obtained from the motor nameplate	**Volts**	**85.0 – 575.0**	**0.0**		N	Y
Rated Excit Freq[i,iii]	(Rated Motor Excitation Frequency[i,iii]) This parameter sets the excitation frequency of the motor. Note: value should be obtained from the motor nameplate	**Hz**[i,iii]	**5.0 – 400.0**[i,iii]	**0.0**[i,iii]		N[i,iii]	Y[i,iii]
Rated Motor Curr	(Rated Motor Amps) This parameter sets the rated motor current. Note: value should be obtained from the motor nameplate.	**Amps**	**1.0 – 800.0**	**0.0**		N	Y
Motor Poles	(Motor Poles) This parameter sets the number of poles in the motor. NOTE: This must be an even number or a Setup Fault #3 will occur. Note: value should be obtained from the motor nameplate.	**none**	**2 – 128**	**4**		N	Y
Rated Mtr Speed	(Rated Motor Speed) This parameter sets the rated rpm of the motor (nameplate speed). NOTE: This is a function of the motor only and does not need to be the same as the CONTRACT MTR SPD (A1) parameter setting. Note: value should be obtained from the motor nameplate. Rated Mtr Speed is defined as the synchronous speed minus the slip. At times, the motor manufacturer will place the synchronous speed on the data nameplate. The Adaptive Tune procedure on page 139 calculates the amount of slip of the motor. $\left(\begin{array}{c}\text{synchronous}\\\text{speed of}\\\text{motor}\end{array}\right)=\frac{120*\left(\begin{array}{c}\text{rated}\\\text{excitation}\\\text{frequency}\end{array}\right)}{\#\text{ of Poles}}$	**RPM**	**1.0 – 3000.0**	**0.0**		N	Y
% No Load Current[i,iii]	(Percent No Load Current[i,iii]) This parameter sets the percent no load current of the motor. This parameter sets the window (±25%) around which the adaptive tune can adjust the motor's percent no load current. Units in percent of current. *For more information on the adaptive tune, see Adaptive Tune on page 139.*	**%**[i,iii]	**10.0 – 80.0**[i,iii]	**per MOTOR ID**[i,iii]		N[i,iii]	N[i,iii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Units	Range	Default		Hidden Item	Run lock out
				ENGLISH (U3)	METRIC (U3)		
Stator Leakage X[i,iii]	(Stator Leakage Reactance[i,iii]) 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.	**%**[i,iii]	**0.0 – 20.0**[i,iii]	**per MOTOR ID**[i,iii]		Y[i,iii]	N[i,iii]
Rotor Leakage X[i,iii]	(Rotor Leakage Reactance[i,iii]) This parameter sets the rotor reactance leakage, as a percent of the BASE IMPEDANCE, which appears in the Power Data D2 Submenu.	**%**[i,iii]	**0.0 – 20.0**[i,iii]	**per MOTOR ID**[i,iii]		Y[i,iii]	N[i,iii]
Flux Sat Break[i]	(Flux Saturation Break Point[i]) This parameter sets the flux saturation curve slope change point. Units in percent of flux.	**%**[i]	**0 – 100**[i]	**75**[i]		Y[i]	Y[i]
Flux Sat Slope 1[i]	(Flux Saturation Slope #1[i]) 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.	**PU**[i]	**0 – 200**[i]	**0**[i]		Y[i]	Y[i]
Flux Sat Slope 2[i]	(Flux Saturation Slope #2[i]) 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.	**PU**[i]	**0 – 200**[i]	**50**[i]		Y[i]	Y[i]
Motor Min Volts[iii]	*(V/Hz Pattern Voltage at Minimum Frequency[iii]) This parameter sets voltage at the V/Hz pattern minimum frequency. Note: a SETUP FLT #9 will occur if the below formula is not meet.* (*MOTOR MIN VOLTS*) < (*MOTOR MID VOLTS*) < (*RATED MTR VOLTS*)	***Volts***[iii]	***0.1 – 100.0***[iii]	***Per ID***[iii]		*N*[iii]	*Y*[iii]
Motor Min Freq[iii]	*(V/Hz Pattern Minimum Frequency[iii]) This parameter sets minimum frequency used to define the V/Hz pattern. Note: a SETUP FLT #9 will occur if the below formula is not meet.* (*MOTOR MIN FREQ*) < (*MOTOR MID FREQ*) < (*RATED EXCIT FREQ*)	***Hz***[iii]	***0.1 – 10.0***[iii]	***1.0***[iii]		*N*[iii]	*Y*[iii]
Motor Mid Volts[iii]	*(V/Hz Pattern Voltage at Middle Frequency[iii]) This parameter sets rated voltage at the V/Hz pattern middle frequency. This setting is limited by the motor's rated voltage (RATED MTR VOLTS(A5)). Note: a SETUP FLT #9 will occur if the below formula is not meet.* (*MOTOR MIN VOLTS*) < (*MOTOR MID VOLTS*) < (*RATED MTR VOLTS*)	***Volts***[iii]	***0.1 – 575.0***[iii]	***Per ID***[iii]		*N*[iii]	*Y*[iii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lock out
Motor Mid Freq[iii]	*(V/Hz Pattern Middle Frequency[iii]) This parameter sets middle frequency used to define the V/Hz pattern. Note: a SETUP FLT #9 will occur if the below formula is not meet.* (MOTOR MIN FREQ) < (MOTOR MID FREQ) < (RATED EXCIT FREQ)	*Hz*[iii]	*0.1 – 40.0*[iii]	*3.0*[iii]		*N*[iii]	*Y*[iii]
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 79.	**%**	**100 – 150**	**110**		Y	Y
Ovld Time Out	(Motor Overload Time Out) This parameter defines the amount of time before a motor overload alarm occurs when the motor is running at the current level defined below: (OVLD START LEVEL :) + (40% rated motor current) This is the other parameter used to define the overload curve. For more information, see OVLD START LEVEL on page 79.	**sec**	**5.0 – 120.0**	**60.0**		Y	Y
Stator Resist	(Stator Resistance) This parameter sets the amount of resistance in the motor stator, as a percent of the BASE IMPEDANCE, which appears in the Power Data D2 Submenu.	**%**	**0.0 – 20.0**	**1.5**[i,iii] ***7.0***[ii]		Y	N
Motor Iron Loss	(Motor Iron Losses) This parameter sets the motor iron loss at rated frequency. Units in percent of rated power.	**%**	**0.0 – 15.0**	**0.5**		Y	N
Motor Mech Loss	(Motor Mechanical Losses) This parameter sets the motor mechanical losses at rated frequency. Units in percent of rated power.	**%**	**0.0 – 15.0**	**1.0**		Y	N
D Axis Inductance[ii]	*(Magnet/Flux Axis Equivalent Circuit Inductance[ii]) 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***[ii]	***0.50 – 100.00***[ii]	***10.00***[ii]	***30.00***[ii]	*N*[ii]	*N*[ii]
Q Axis Inductance[ii]	*(Torque Axis Equivalent Circuit Inductance[ii]) 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***[ii]	***0.50 – 100.00***[ii]	***10.00***[ii]	***30.00***[ii]	*N*[ii]	*N*[ii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Units	Range	Default		Hidden Item	Run lock out
				ENGLISH (U3)	METRIC (U3)		
Trq Const Scale[ii]	*(Torque Constant Scale[ii]) The drive automatically calculates the torque constant. This value can scale the calculated torque constant to provide better performance.*	***none***[ii]	***0.50 – 2.00***[ii]	***0.78***[ii]		*N*[ii]	*N*[ii]
Encoder Ang Ofst[ii]	*(Encoder Angle Offset[ii]) This parameter contains the value of the alignment determined during the alignment procedure. For more information on the alignment procedure, see Magnetek PM Start-Up Procedure on page 146.*	***none***[ii]	***0 – 35999***[ii]	***30000***[ii]		*N*[ii]	*Y*[ii]

Table 14: Motor A5 Submenu

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

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

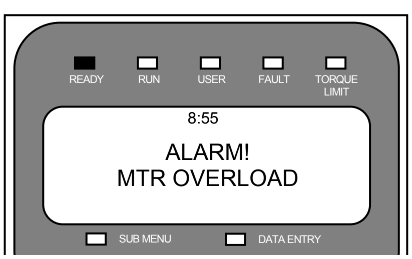
- motor current overload start level (OVLD START LEVEL(A5)) parameter
- motor current time out (OVLD TIME OUT(A5)) parameter

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

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

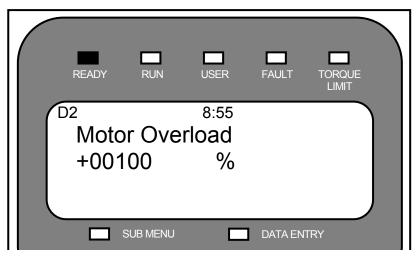
Motor Overload Parameters

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



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

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

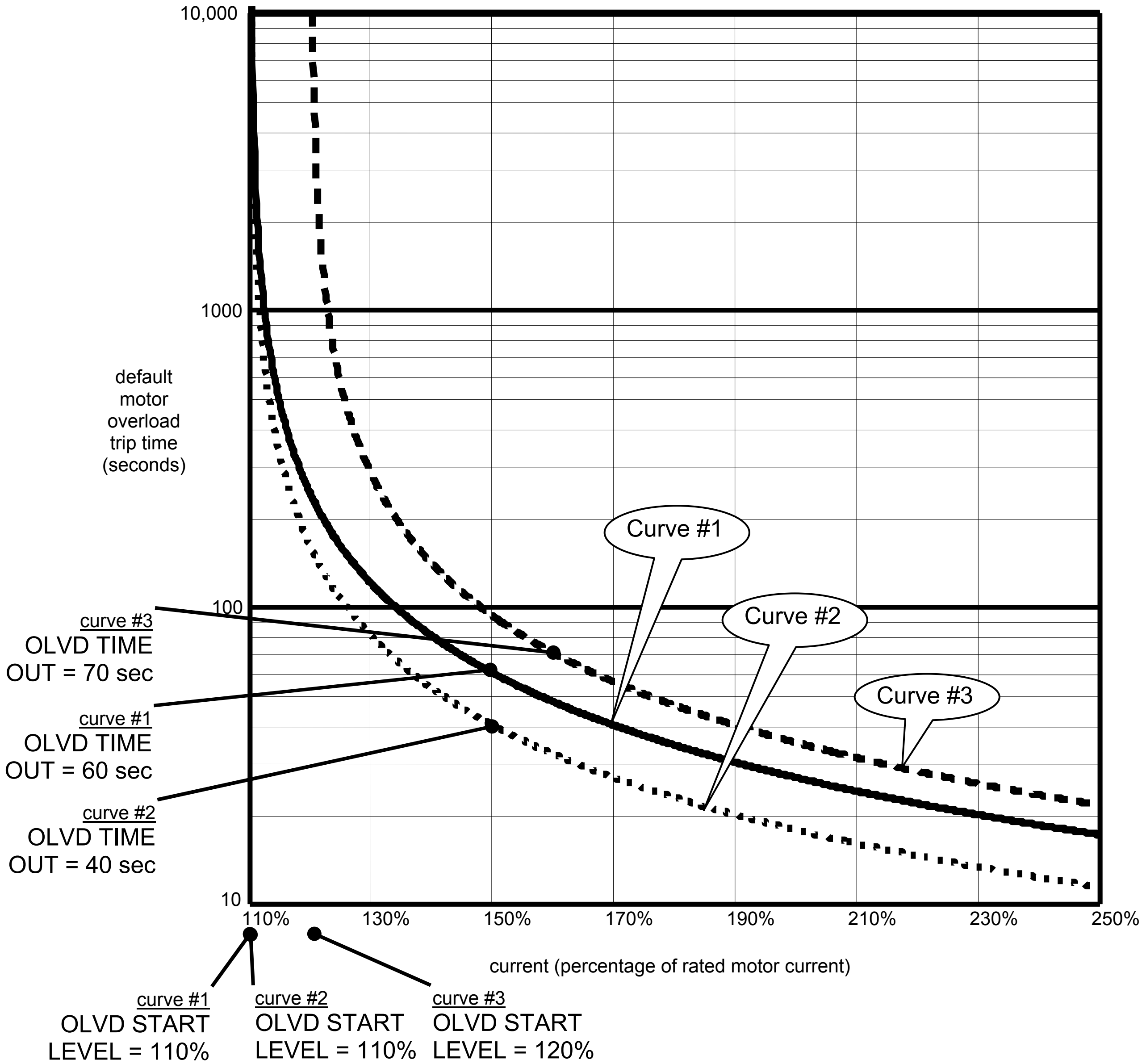


The drive will only declare a motor overload and the user is responsible for action.

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

- logic output configured to MTR OVERLOAD
- logic input configured to EXT FAULT
- wire the EXT FAULT logic input terminal to the 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
			ENGLISH (U3)	METRIC (U3)		
Spd Command Src	(Speed Command Source) This parameter designates the source of the drive's speed command. The three possible sources for the speed command are following: • Serial Channel – Over the serial communication terminals located on the drive control board (either speed profile or multi-step speed commands) – serial – speed profile – ser mult step – serial multi-step speed commands (only used in serial mode 2) • Analog Channel – a bipolar (±10V) signal. Available with the analog channel is a Speed Command Multiplier (SPD COMMAND MULT(A1)) and Speed Command Bias (SPD COMMAND BIAS(A1)). These parameters are used to scale the user's analog speed command to the proper range for use by the drive software. • Multi-Step Command - user defined fifteen discrete speed commands (CMD1 - CMD15). Four logic inputs are used as speed command selections (CMD0 is reserved for zero speed. But, the user can specify CMD1 - CMD15 to be any speed command either positive or negative)	– **analog input** – **multi-step** – **serial** – **ser mult step**	**MULTI-STEP**		Y	Y
Run Command Src	(Run Command Source) This parameter allows the user to choose the source of the run command from one of the following sources: an external run signal from a logic input (external tb), a run signal transferred across a serial channel (serial), or a signal from both the serial channel and a logic input (serial+extrn). If a signal is required from a logic input (either external tb or serial+extrn), the Run signal on TB1 must be selected.	– **external tb** – **serial** – **serial+extrn**	**EXTERNAL TB**		Y	Y
Motor Rotation	(Motor Rotation) This parameter allows the user to change the direction of the motor rotation. As an example, if the car controller is commanding the up direction and the car is actually going in a down direction, this parameter can be changed to allow the motor rotation to match the car controller command.	– **forward** – **reverse**	**FORWARD**		Y	Y

Parameter	Description	Choices	Default ENGLISH (U3)	Default METRIC (U3)	Hidden item	Run lock out
Encoder Select[ii]	*(Encoder Selection[ii]) HPV900 S2 PM drives can run either with an incremental encoder or with an Heidenhain Endat encoder. This parameter sets the feedback option for the drive.*	– ***endat***[ii] – ***incremental***[ii]	***INCREMENTAL***[ii]		*Y*[ii]	*Y*[ii]
Encoder Connect	(Encoder Connection) This parameter allows the user to electronically switch A and /A signals from the encoder without moving any wiring.	– **forward** – **reverse**	**FORWARD**		Y	Y
Encoder Fault[i,ii]	(Encoder Fault Enable[i,ii]) This parameter allows the user to temporarily disable the Encoder Fault. Adding this feature allows the user to temporarily disable the Encoder Fault during the initial start-up process, when the motor model (defined by the A5 Motor Parameters) is not clearly defined. When the Encoder Fault is disabled (ENCODER FAULT (C1) = disabled), the drive will display the warning message "EncoderFault OFF", every time the RUN command is removed. IMPORTANT: After the motor parameters in A5 have been established, the Encoder Fault should be enabled (ENCODER FAULT (C1) = enabled).	– **disable**[i,ii] – **enable**[i,ii]	**ENABLE**[i,ii]		Y[i,ii]	Y[i,ii]
Cont Confirm Src	(Contactor Confirm Source) This switch selects if hardware confirmation of motor contactor closure is necessary before drive attempts to pass current through motor. If hardware confirmation is available set to EXTERNAL TB and select the Contact Cnfirm signal on a logic input terminal.	– **none** – **external tb**	**NONE**	**EXTER-NAL TB**	Y	Y
Fast Flux[i]	(Fast Flux Enable[i]) This parameter addresses the method the HPV 900 Series 2 uses to build up flux in the motor. Enabling the Fast Flux function can decrease the motor fluxing time significantly. By decreasing the motor's flux time, the starting takeoff time will also be decreased. For more information, see Fast Flux on page 92.	– **disable**[i] – **enable**[i]	**DISABLE**[i]		Y[i]	Y[i]
HI/LO Gain Src[i,ii]	(High / Low Gain Source[i,ii]) High / low gain change switch source. For more information, see HI/LO GAIN SRC on page 92.	– **external tb**[i,ii] – **serial**[i,ii,iii] – **internal**[i]	**INTERNAL**[i,ii]		Y[i,ii]	Y[i,ii]
I-Reg Inner Loop[ii]	*(Current Regulator Inner Loop[ii]) This switch is used to disable/enable the current regulator inner loop function. It is used to enhance the current loop performance.*	– ***disabled***[ii] – ***enabled low***[ii] – ***enabled high***[ii]	***DISABLED***[ii]		*N*[ii]	*N*[ii]
Ramped Stop Sel[i,ii]	(Ramp Stop Select[i,ii]) Chooses between normal stop and torque ramp down stop. For more information, see RAMPED STOP SEL on page 93.	– **none**[i,ii] – **ramp on stop**[i,ii]	**NONE**[i,ii]		Y[i,ii]	Y[i,ii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Choices	Default		Hidden item	Run lock out
			ENGLISH (U3)	METRIC (U3)		
Ramp Down En Src[i,ii]	(Ramp Down Enable Source[i,ii]) If RUN LOGIC is selected, the user can remove the run command and the drive will delay in dropping the run command until torque ramp down stop function is complete. If EXTERNAL TB or SERIAL is selected, the user must keep the run command while allowing the Torque Ramp Down Stop function to be completed.	– **external tb**[i,ii] – **run logic**[i,ii] – **serial**[i,ii]	**EXTERNAL TB**[i,ii]		Y[i,ii]	Y[i,ii]
S-Curve Abort	(S-Curve Abort) This parameter, S-CURVE ABORT (C1), addresses how the S-Curve Speed Reference Generator handles a reduction in the speed command before the S-Curve Generator has reached its target speed. For more information, see S-Curve Abort on page 94.	– **disable** – **enable**	**DISABLE**	**ENABLE**	Y	Y
DB Protection	(Dynamic Braking Resistor Protection Selection) The dynamic braking IGBT is limited as to when it can be turned "on" (i.e. send power to the dynamic braking resistors). The dynamic braking IGBT is allowed to be "on" while the drive is running (i.e. while the speed regulator is released) and for a period of ten (10) seconds after the drive is stopped. If the dynamic braking IGBT is still "on" ten seconds after the drive stops running, the drive will turn "off" the dynamic braking IGBT (thus stop sending power to the dynamic braking resistors) and declare a "DB VOLTAGE" fault or alarm (whether fault or alarm, depends on setting of this parameter).	– **fault** – **alarm**	**FAULT**		Y	Y
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**	**BRAKE PICKED**	Y	Y
Brake Pick Src	(Brake Pick Source) If the BRAKE PICK SRC (C1) is set to INTERNAL, the HPV 900 Series 2 will attempt to pick (lift) the brake when magnetizing current has been developed in the motor.	– **internal** – **serial**	**INTERNAL**		Y	Y

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Choices	Default		Hidden item	Run lock out
			ENGLISH (U3)	METRIC (U3)		
Brake Pick Cnfm	(Brake Pick Confirm) If this switch is set to EXTERNAL TB, the HPV 900 Series 2 will wait for brake pick confirmation before releasing the speed reference. When set to EXTERNAL TB, the MECH BRK PICK signal on TB1 must also be selected.	– **none** – **external tb** – **internal time**	**NONE**		Y	Y
Motor Ovrld Sel	(Motor Overload Select) This parameter selects the action to be taken by drive when declaring a user selectable Motor Overload. When the motor overload level is reached, the options are: • Alarm – the drive only declares a motor overload and the user is responsible for action • Flt immediate – the drive will immediately declare a fault and turn-off the drive's output • Fault at stop – the drive will delay declaring a fault until the run command is removed	– **alarm** – **flt immediate** – **fault at stop**	**ALARM**		Y	Y
Stopping Mode	(Multi-step Stopping Mode Selection) When the speed command source is set to multi-step (SPD COMMAND SRC (C1)=multi-step), the parameter, STOPPING MODE (C1), determines the stopping mode of the HPV 900 Series 2 . The two selectable methods for the Stopping Mode parameter are "Immediate" and "Ramp to stop". Note: If the SPD COMMAND SRC (C1) parameter is set to any other definition other than "multi-step", the drive will behave to the "immediate" stopping mode (independent of the setting of the STOPPING MODE (C1) parameter). The "Immediate" stopping mode requires the drive to be at zero speed prior to removing the "Run" command. The "Immediate" selection is how the HPV 900 Series 2 has traditionally behaved prior to the addition of this parameter. The "Ramp to stop" stopping mode is intended for use when removing the "Run" command prior to the drive reaching zero speed (as defined by the AB ZERO SPD LEV (A1) parameter). When the "Run" command is removed and the speed reference is above zero speed, the speed reference will ramp to zero speed following the selected s-curve.	– **immediate** – **ramp to stop**	**IMMEDIATE**		Y	Y

Parameter	Description	Choices	Default ENGLISH (U3)	Default METRIC (U3)	Hidden item	Run lock out
Auto Stop	(Auto Stop Function Enable) The Auto Stop function determines how the drive logic will respond to a zero or non-zero speed command. The function will only work when the speed command source is either multi-step or serial (SPD COMMAND SRC (C1)=multi-step or serial). For more information, see Auto Stop on page 95.	– **disable** – **enable**	**DISABLE**		Y	Y
Stall Test Ena[iii]	*(Stall Test Enable[iii]) When enabled, the function checks that motor current goes at or above a percentage (defined by STALL TEST LVL(A1)) for defined amount of time (defined by STALL FAULT TIME(A1)). If the motor current exceeds the defined parameters a STALL TEST FAULT will be declared.*	– ***disable[iii]*** – ***enable[iii]***	***ENABLE[iii]***		*N[iii]*	*Y[iii]*
Stall Prev Ena[iii]	*(Regeneration Stall Prevention Enable[iii]) When enabled, the Stall Prevention (Current Limit) function is enabled during regeneration. When the defined regeneration current limit is reached (REGEN TORQ LIMIT(A1)), the stall prevention function will increase speed in an effort to shed load. Also, the responsiveness of the stall prevention function is determined by the Current Limit Integral Gain (ILIMT INTEG GAIN(A4)) parameter.*	– ***disable[iii]*** – ***enable[iii]***	***DISABLE[iii]***		*N[iii]*	*Y[iii]*
Serial Mode	(Serial Mode Selection) This parameter selects between serial protocols. The choices are: • Mode 1 – selects the Magnetek standard protocol. • Mode 2 – selects a Magnetek alternative protocol. • Mode 3 - selects a Magnetek alternative protocol. • DCP3 – Drive Control Position Protocol 3 . • DCP4 – Drive Control Position Protocol 4	– **None** – **mode 1** – **mode 2** – **mode 3** – **DCP3** – **DCP4**	**NONE**		Y	Y

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Choices	Default		Hidden item	Run lock out
			ENGLISH (U3)	METRIC (U3)		
Ser2 Flt Mode	(Serial Mode 2 Fault Mode) *Used only with serial protocol (mode 2)* This parameter defines the reaction to a serial communications fault while in Serial Mode 2. There are three possible settings: • Immediate – upon sensing a serial communications fault while in the run mode will result in an immediate stop. The equivalent to removal of the “Drive Enable” logic input. • Run Remove – upon sensing a serial communications fault while in the run mode, the drive will react in the same manner that removal of the run command would react. In this case, the type of stop will be defined by the STOPPING MODE (C1) parameter. • Rescue – upon sensing a serial communications fault while in the run mode, an attempt will be made to continue to run at a low speed to the next floor. Upon sensing the fault, the drive will decelerate to a creep speed and continue to run at that speed until the first of the two following termination conditions are reached. – The hardware “Drive Enable” logic input is removed. – A timer set by parameter SER2 RS CPR TIME (A1) has elapsed.	– **Immediate** – **run remove** – **rescue**	**IMMEDIATE**		Y	Y
Drv Fast Disable	(Drive Fast Disable) Addresses how fast the drive responds to the removal of the DRIVE ENABLE logic input.	– **Disable** – **Enable**	**DISABLE**		Y	Y
Speed Reg Type[i,ii]	(Speed Regulator Type[i,ii]) Chooses speed regulator: Ereg or PI regulator. Magnetek recommends the use of the Elevator Speed Regulator (Ereg) for better elevator performance. If set to external regulator, the drive will be configured as a torque controller. **IMPORTANT** This assumes the car controller is doing its own closed-loop speed regulation. (i.e. a completely closed outer speed loop with the car controller having its own encoder feedback). The source of the external torque command is determined by the EXT TORQ CMD SRC (C1) parameter. For more information, see SPEED REG TYPE on page 95.	– **elev spd reg**[i,ii] – **pi speed reg**[i,ii] – **external reg**[i,ii]	**ELEV SPD REG**[i,ii]		Y[i,ii]	Y[i,ii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Choices	Default		Hidden item	Run lock out
			ENGLISH (U3)	METRIC (U3)		
Brake Hold Src	(Brake Hold Source) If set to internal, the drive will command the mechanical brake to hold mode until confirmation of brake picked exists.	– **internal** – **serial**	**INTERNAL**		Y	Y
Brk Pick Flt Ena	(Brake Pick Fault Enable) When this parameter is set to ENABLE, the brake pick command and confirmation must match within the specified time in BRK PICK TIME (A1) parameter or a brake pick fault is declared.	– **disable** – **enable**	**DISABLE**		Y	Y
Brk Hold Flt Ena	(Brake Hold Fault Enable) When this parameter is set to ENABLE, the brake hold command and confirmation must match within the specified time in BRK HOLD TIME (A1) parameter or a brake hold fault is declared.	– **disable** – **enable**	**DISABLE**		Y	Y
Ext Torq Cmd Src[i,*ii*]	(Torque Command Source[i,*ii*]) Sets the source of the external torque command when the SPEED REG TYPE (C1) is set to external reg. NOTE: • if SPEED REG TYPE is set to external reg and EXT TORQ CMD SRC is set to serial, the drive is a torque controller • if SPEED REG TYPE is set for a speed regulator (either pi speed reg or elev spd reg) and EXT TORQ CMD SRC is set to either serial, the torque command is an auxiliary torque command (torque feedforward command)	– **none**[i,*ii*] – **serial**[i,*ii*] – **analog input**[i,*ii*]	**NONE**[i,*ii*]		Y[i,*ii*]	Y[i,*ii*]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[*ii*] Parameter accessibly through ***PM (U9)*** Operation only
[*iii*] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Choices	Default		Hidden item	Run lock out
			ENGLISH (U3)	**METRIC (U3)**		
Fault Reset Src	(Fault Reset Source) This parameter determines the source of the drive's external fault reset from one of the following sources: an external fault reset signal from a logic input (external tb), a fault reset signal transferred across a serial channel (serial), or the drive automatically resets the faults (automatic). The user also has the option to reset faults directly through the operator. Automatic Fault Reset If the fault reset source is set to automatic, the faults will be reset according to the setting of the FLT RESET DELAY (A1) and FLT RESETS/HOUR (A1) parameters. When a logic input is defined as "fault reset" and this logic input signal is transitioned from false to true: an active fault will be reset and automatic fault reset counter (defined by FLT RESETS/HOUR(A1)) will be reset to zero. **CAUTION** If the run signal is asserted at the time of a fault reset, the drive will immediately go into a run state. Unless using the auto-fault reset function (FAULT RESET SRC (C1)=automatic), then the run command needs to be cycled to be reset automatically, but will reset if initiated by a logic input without cycling the run command.	– **external tb** – **serial** – **automatic**	**EXTERNAL TB**		Y	Y
Overspd Test Src	(Overspeed Test Source) This switch determines the source of the overspeed test. Operation of the overspeed test function is specified by the OVRSPEED MULT (A1) parameter. Regardless of the setting of this parameter, the user can call for the overspeed test via the Digital Operator.	– **external tb** – **serial**	**EXTERNAL TB**		Y	Y

Parameter	Description	Choices	Default		Hidden item	Run lock out
			ENGLISH (U3)	METRIC (U3)		
PreTorque Source[i,ii]	(Pre-Torque Source[i,ii]) This switch determines if a pre torque command is used and with what source. Pre-torque is the value of torque that the drive should produce as soon as the speed regulator is released to prevent rollback due to unbalanced elevator loads. This 'priming' of the speed regulator is done with the pre-torque command, which is used when the speed regulator release is asserted. The two possible sources for the pre-torque command are following: • serial channel • analog channel The serial channel is RS-422 or 485 depending on configuration. 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[i,ii]** – **analog input[i,ii]** – **serial[i,ii]**	**NONE[i,ii]**		Y[i,ii]	Y[i,ii]
PreTorque Latch[i,ii]	(Pre-Torque Latch[i,ii]) This parameter determines if the pre-torque signal is latched. NOTE: If PreTorque Source has been set to NONE, the setting does not have any effect on the operation of the drive. Some car controllers send both pre-torque and speed commands. To facilitate this, the HPV 900 Series 2 has the option of latching the pre-torque command. If pre-torque latching is selected using the Pre-Torque Latch parameter, a FALSE to TRUE transition on the pre-torque latch clock latches the value on the pre-torque channel into the drive. This channel is allowed to change any time except during this transition without affecting the value of the latched pre-torque command. The Pre-Torque Latch Clock controls when the pre-torque command is latched. The Pre-Torque Latch clock parameter (PTorq LATCH CLCK) determines the source of this latch control. The two choices for latch control are the serial channel or a logic input (EXTERNAL TB). The speed regulator uses the latched pre-torque command when the internal Speed Regulator Release signal is asserted. Once the pre-torque command is used the latch and the pre-torque command is cleared.	– **latched[i,ii]** – **not latched[i,ii]**	**NOT LATCHED[i,ii]**		Y[i,ii]	Y[i,ii]

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Choices	Default		Hidden item	Run lock out
			ENGLISH (U3)	METRIC (U3)		
PTorq Latch Clck[i,ii]	(Pre-Torque Latch Clock[i,ii]) If the PRE-TORQUE LATCH has been set to LATCHED, then this parameter chooses the source for latch control. If set to EXTERNAL TB, the Pre-Trq Latch signal on TB1 must be selected.	– **serial**[i,ii] – **external tb**[i,ii]	**EXTERNAL TB**[i,ii]		Y[i,ii]	Y[i,ii]
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. • If however, the logic input Run Up is true and the polarity is negative or the logic input Run Down is true and the polarity is positive, then the speed command is held at zero.	– **disabled** – **enabled**	**DISABLED**		Y	Y
Mains Dip Ena	(Mains Dip Enable) When enabled, the function will reduce the speed (by the percentage defined by the MAINS DIP SPEED parameter) when the drive goes into 'low voltage' mode. 'Low voltage' mode is defined as when the drive declares a UV alarm, which is defined by the Input line-to-line voltage (INPUT L-L VOLTS) parameter and the Undervoltage Alarm Level (UV ALARM LEVEL)	– **disable** – **enable**	**DISABLE**		Y	Y
Mlt-Spd to Dly 1	(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 **Error! Bookmark not defined.**.	– **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**		Y	Y
Mlt-Spd to Dly 2			**NONE**		Y	Y
Mlt-Spd to Dly 3			**NONE**		Y	Y

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Choices	Default		Hidden item	Run lock out
			ENGLISH (U3)	METRIC (U3)		
Mlt-Spd to Dly 4			**NONE**		Y	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**		Y	N
ARB Select[i,ii]	*(Anti-Rollback Select*[ii]*)* *With ARB SELECT set to enable, the drive will calculate pretorque values when movement is seen on the shaft. For information on how to setup ARB, see on page 61.*	– ***enable***[ii] – ***disable***[ii]	***DISABLE***[ii]		*N*[ii]	*Y*[ii]
Drv Enable 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 externaltb1 or serial+extrn), the drive enable signal on TB1 must be selected.	– **external tb** – **serial** – **serial+extrn**	**EXTERNAL TB**		N	Y
Rec Travel Dir	(Recommended Travel Direction) This parameter allows the user to enable and select the appropriate installation type to allow the drive to travel in the lightest load direction (generally for use with a UPS to allow the rescue of trapped passengers when mains power is not available). This function can be enabled by assertion of any logic input (C2) configured to 'REC TRAVEL EN'	– **none** – **geared** – **gearless**	**NONE**		N	Y

Table 15: User Switches C1 Submenu

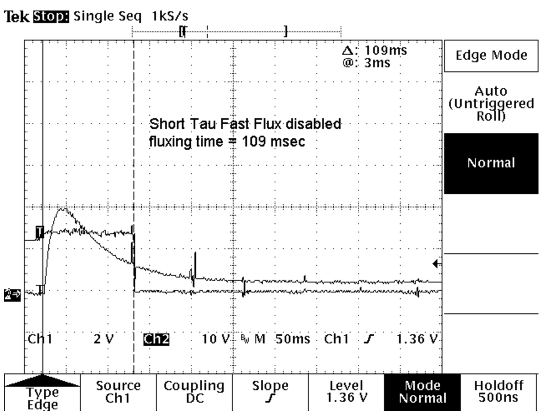
[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Detailed descriptions

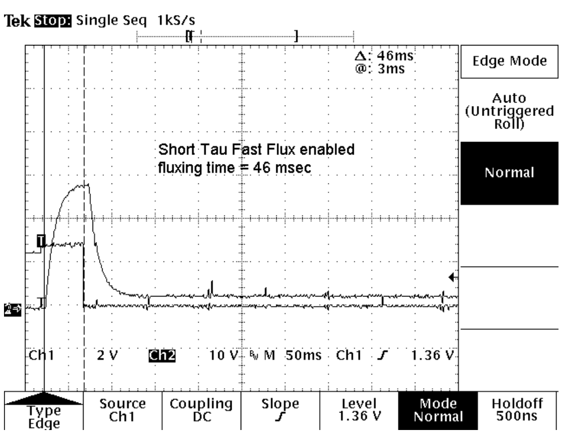
FAST FLUX[i]
(Fast Flux Enable)
This parameter addresses the method the HPV 900 Series 2 uses to build up flux in the motor. Enabling the Fast Flux function can decrease the motor fluxing time significantly. By decreasing the motor's flux time, the starting takeoff time will also be decreased.

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

Fast Flux Function with FAST FLUX = disabled
In this example, the motor fluxing time was 109 msec.



Fast Flux Function with FAST FLUX = enabled
With the same motor example, the motor fluxing time was reduced to 46 msec.



HI/LO GAIN SRC[i,ii]
(High / Low Gain Source)
This parameter determines the source of the high / low gain switch. Note: this parameter is only accessible and available during closed loop operation.

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

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

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

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

The high / low gain switch determines when the HPV 900 Series 2 is in 'low gain' mode. In the 'low gain' mode, the gain reduce multiplier has an effect on the speed regulator's response (gain).

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

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

- a logic input
- the serial channel

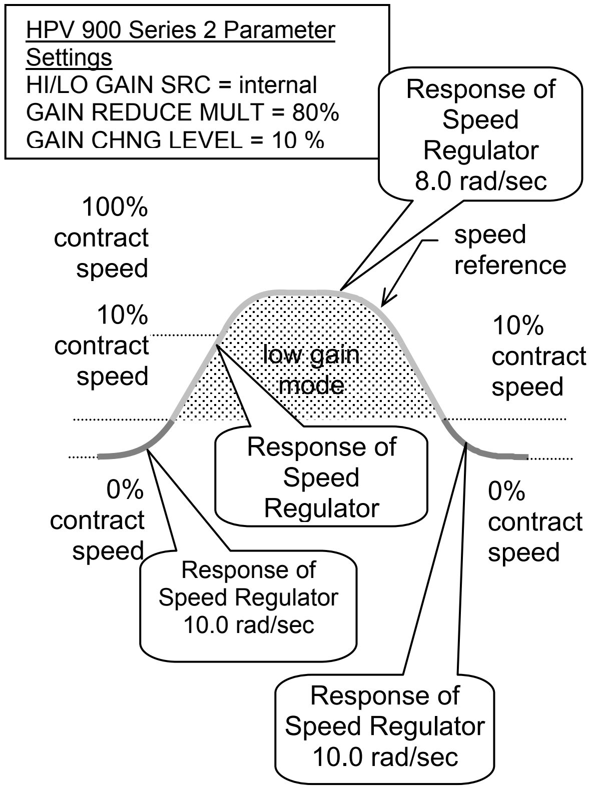
The high / low gain switch can also be controlled internal by:

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

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

[i] Parameter accessible through **CLOSED LOOP (U9)**
[ii] Parameter accessibly through ***PM (U9)***
[iii] Parameter accessible through ***OPEN LOOP(U9)***

determined by the gain change level parameter.
An example of internal high / low gain control is shown below.



High / Low Gain Example[i,ii]

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

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

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

The Ramp Down Enable has the following three possible sources:

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

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

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

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

The time it takes for the HPV 900 Series 2 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.

[i] Parameter accessible through **CLOSED LOOP (U9)**
[ii] Parameter accessibly through ***PM (U9)***
[iii] Parameter accessible through ***OPEN LOOP(U9)***

S-CURVE ABORT

This parameter, S-CURVE ABORT (C1), addresses how the HPV 900 Series 2's S-Curve Speed Reference Generator handles a *reduction* in the speed command before the S-Curve Generator has reached its target speed.

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

S-curve Function with S-CURVE ABORT = disabled

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

Figure 39 below shows this type of operation. Note the jerk rates are very low to exaggerate proportion of S in the curve to clearly show the overshoot in speed so that the maximum jerk rate is not violated. In this figure, a reduction in the speed command occurs from a high-speed command (which was not yet achieved on the output of the S-Curve) to a low speed command. Note that the speed reference (S-Curve output) continued to increase after the speed command was reduced. This increase is speed was necessary to avoid violation of the jerk rate setting.

S-curve Function with S-CURVE ABORT = enabled

In Figure 40 below, the optional S-Curve abort has been selected. In this case when the speed command is reduced, the speed reference immediately starts to reduce violating the jerk limit (thus no jerk out phase), which could be felt in the elevator.

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

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

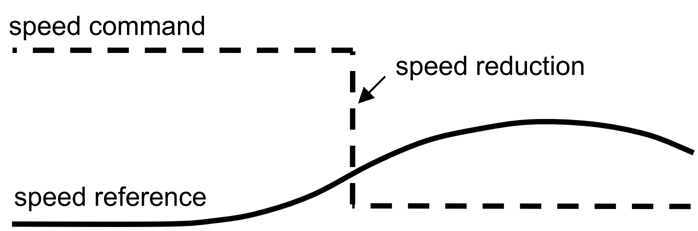


Figure 39: Normal S-curve Abort

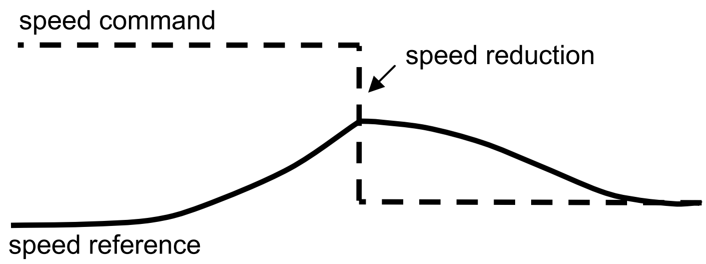


Figure 40: Optional S-curve Abort

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

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

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 the drive
- Either the removal of the Run command or the setting the speed command to zero will initiate a stop.

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

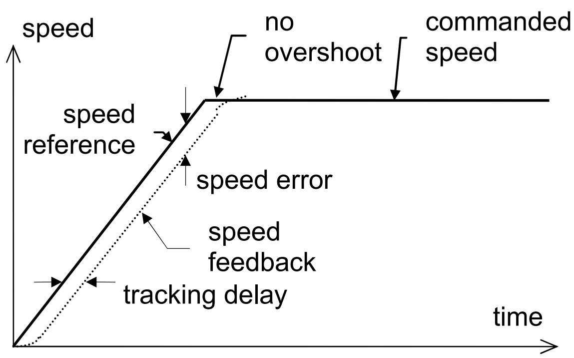
SPEED REG TYPE[i,ii]
(Speed Regulator Type)
This switch toggles between the Elevator Speed Regulator (Ereg) and the PI Speed Regulator. Magnetek recommends the use of the Elevator Speed Regulator for better elevator performance. If this parameter is set to external regulator, the drive will be configured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

The source of the external torque command is determined by the EXT TORQ CMD SRC (C1) parameter. The HPV 900 Series 2 has the following three closed loop speed regulation options and an option for turning off the internal speed regulator:
- Elevator Speed Regulator (Ereg)
- PI Speed Regulator
- External Speed Regulator

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

Elevator Speed Regulator (Ereg)
The use of the Elevator Speed Regulator allows the overall closed loop response between speed reference and speed to be ideal for elevator applications. The desirable features of the Elevator Speed Regulator are:
- no overshoot at the end of accel period
- no overshoot at the end of decel period

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



Ereg Example

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

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

[i] Parameter accessible through **CLOSED LOOP (U9)**
[ii] Parameter accessibly through ***PM (U9)***
[iii] Parameter accessible through ***OPEN LOOP(U9)***

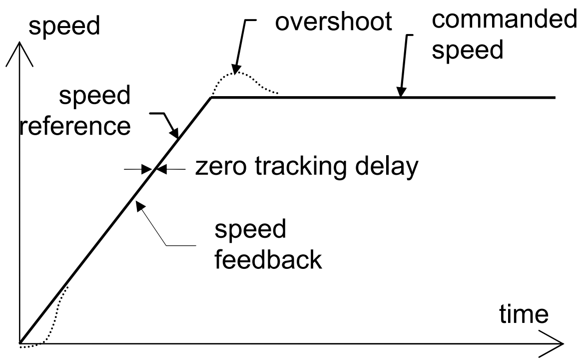
The inner loop crossover parameter (INNER LOOP XOVER(A1)) should not need to be changed. But if the number is changed, it must satisfy the following formula:

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

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, the end of each accel and decel period, there will be an overshoot. The amount of overshoot will be a function of the defined phase margin and response parameters.

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



PI Speed Regulator Example

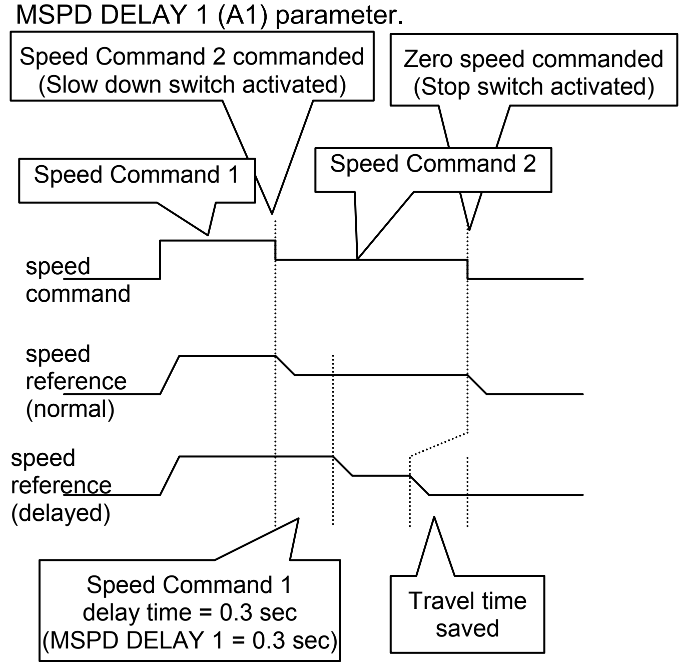
The PI Speed Regulator is tuned by:

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

MULTI-STEP COMMAND DELAYS

When setting up an elevator, slow-down and stop switches are set at fixed locations in the shaft. Once the drive is tuned, it might require the user to move the switches in the shaft in order to minimize the time spent at leveling speed.

Under "normal" operation, the drive speed reference follows the speed command. By configuring for "delayed" operation and setting speed command 1 for a delay (MLT-SPD TO DLY 1 = MSPD 1), the recognition of the speed command change from speed command 1 to any other speed command (in this case speed command 2) will be delayed by the setting of MSPD DELAY 1 (A1) parameter.



Logic Inputs C2 Submenu
NOTE: The user can assign particular functions to each input terminal. Only one function per terminal is allowed and multiple terminals cannot have the same function. When a function is assigned to an input terminal, it is removed from the list of possible selections for subsequent terminals.

NOTE: When ***Hidden Item*** appears with the parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. See details on page 112.

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

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

Parameter	Description	Default		Hidden Item	Run lock out
		ENGLISH (U3)	METRIC (U3)		
Logic Input 1	Logic Input 1	**DRIVE ENABLE**		Y	Y
Logic Input 2	Logic Input 2	**RUN**	**CONTACT CFIRM**	Y	Y
Logic Input 3	Logic Input 3	**FAULT RESET**	**RUN UP**	Y	Y
Logic Input 4	Logic Input 4	**UP/DWN**	**RUN DOWN**	Y	Y
Logic Input 5	Logic Input 5	**S-CURVE SEL 0**		Y	Y
Logic Input 6	Logic Input 6	**STEP REF B0**		Y	Y
Logic Input 7	Logic Input 7	**STEP REF B1**		Y	Y
Logic Input 8	Logic Input 8	**STEP REF B2**		Y	Y
Logic Input 9	Logic Input 9	**EXTRN FAULT 1**	**FAULT RESET**	Y	Y

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

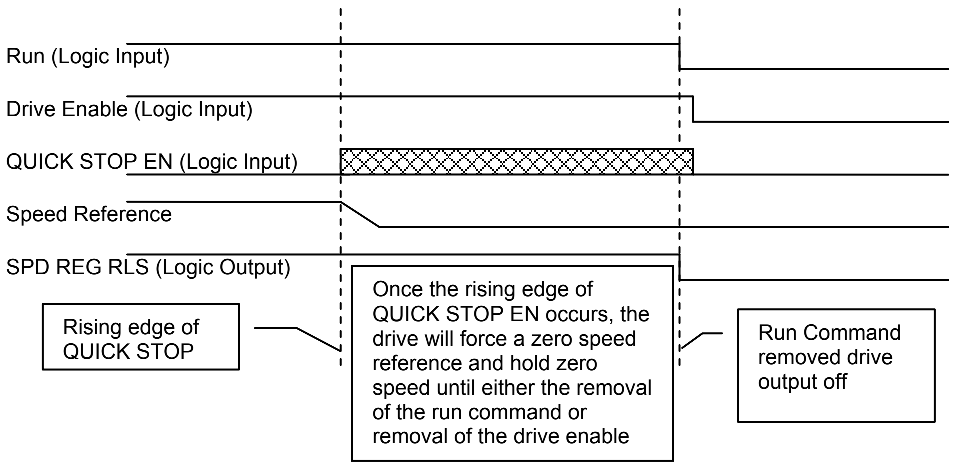
<table>
<tr><th>choices…</th><th colspan="2">choice descriptions…</th></tr>
<tr><td>pre-trq latch</td><td colspan="2">(Pre-Torque Latch) Transition from false to true latches pre torque command.</td></tr>
<tr><td>quick stop</td><td colspan="2">(Quick Stop) This functions works when quick stop input becomes true, the drive will ramp to zero speed quickly using the deceleration curve of DECEL RATE 3, DECEL JERK IN 3, and DECEL JERK OUT 3 settings. Once the rising edge of QUICK STOP EN occurs, the drive will force a zero speed reference and hold zero speed until either the removal of the run command or removal of the drive enable.

</td></tr>
<tr><td>rec travel en</td><td colspan="2">(Recommended Travel Enable) When this input is given, the drive will automatically select travel direction to ensure the lowest current draw from the mains supply based on feedback from the encoder as the mechanical brake is lifting (usually used with a UPS as a means to rescue trapped passengers where mains power is not available).</td></tr>
<tr><td>run</td><td colspan="2">(Run) If drive is enabled through the DRIVE ENABLE logic input, this function will start drive operation.</td></tr>
<tr><td>run down</td><td colspan="2">(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.</td></tr>
<tr><td>run up</td><td colspan="2">(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.</td></tr>
<tr><td>s-curve sel 0</td><td>(S-Curve Select 0) Bit 0 of S-curve selection</td><td rowspan="2">These two bits are used to select one of four s-curve selections. For more information, see S-Curve A2 Submenu on page 64</td></tr>
<tr><td>s-curve sel 1</td><td>(S-Curve Select 1) Bit 1 of S-curve selection</td></tr>
<tr><td>ser2 insp ena</td><td colspan="2">(Serial Mode 2 Inspection Enable) defines one of the two sources of inspection run command (only serial mode 2)</td></tr>
<tr><td>step ref b0</td><td>(Step Reference Bit 0) Bit 0 of multi-step speed command selection</td><td rowspan="4">Four inputs, which must be used together as a 4-bit command for multi-step speed selection. For more information, see Multi-step Ref A3 Submenu on page 66.</td></tr>
<tr><td>step ref b1</td><td>(Step Reference Bit 1) Bit 1 of multi-step speed command selection</td></tr>
<tr><td>step ref b2</td><td>(Step Reference Bit 2) Bit 2 of multi-step speed command selection</td></tr>
<tr><td>step ref b3</td><td>(Step Reference Bit 3) Bit 3 of multi-step speed command selection</td></tr>
<tr><td>trq ramp down</td><td colspan="2">(Torque Ramp Down) Asserting this ramps torque output to zero at “Ramped Stop Time parameter” rate.</td></tr>
<tr><td>up/dwn</td><td colspan="2">(Up/Dwn) This logic can be used to change the sign of the speed command.
false = no inversion, true = inverted.</td></tr>
</table>

Table 16: Logic Inputs C2 Submenu

Logic Outputs C3 Submenu

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

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

Parameter	Description	Default		Hidden item	Run lockout
		ENGLISH (U3)	METRIC (U3)		
Logic Output 1	logic output #1	**READY TO RUN**		Y	Y
Logic Output 2	logic output #2	**RUN COMMANDED**		Y	Y
Logic Output 3	logic output #3	**MTR OVERLOAD**	**ZERO SPEED**	Y	Y
Logic Output 4	logic output #4	**ENCODER FLT**		Y	Y
Relay Coil 1	relay output #1	**FAULT**	**READY TO RUN**	Y	Y
Relay Coil 2	relay output #2	**SPEED REG RLS**	**BRAKE PICK**	Y	Y
User LED	User LED located at the top of the operator	**ALARM**		Y	N

choices…	*choice descriptions…*
alarm	(Alarm) The output is true when an alarm is declared by the drive.
alarm+flt	(Alarm and/or Fault) The output is true when a fault and/or an alarm is declared by the drive.
at mid speed	(At Mid Speed) The output is true when the speed is above the level set by AT MID SPEED (A1) parameter.
auto brake	(Auto Brake) The output is controlled by the Auto Brake function and is used to open the mechanical brake.
brake alarm	(Brake Alarm) The output is true when the dynamic brake resistor is in an overcurrent condition and the drive is in a run condition.
brake hold	(Brake Hold) The output is true when the brake pick confirmation is received. It is used to show the mechanical brake is remaining open. This function is used with brakes that need to have less than 100% voltage to hold the brake open.
brake pick	(Brake Pick) The output is true when the speed regulator is released and is used to open the mechanical brake.
brk hold flt	(Brake Hold Fault) The output is true when the brake hold command and the brake feedback do not match for the user specified time.
brk igbt flt	(Brake IGBT Fault) The output is true when the dynamic brake resistor is in an overcurrent condition and the drive is not in a run condition.
brk pick flt	(Brake Pick Fault) The output is true when the brake pick command and the brake feedback do not match for the user specified time.
car going dwn	(Car Going Down) The output is true when the motor moves in negative direction faster than the user specified speed.
car going up	(Car Going Up) The output is true when motor moves in positive direction faster than user specified speed.
charge fault	(Charging Fault) The output is true when the DC bus voltage has not stabilized above the voltage fault level or the charge contactor has not closed after charging.
close contact	(Close Motor Contactor) The output is true when the run command is given, the drive is enabled, the software has initialized, and no faults are present.
contactor flt	(Contactor Fault) The output is true when the command to close the contactor and the contactor feedback do not match before the user specified time.
curr reg flt	(Current Regulator Fault) The output is true when the actual current measurement does not match commanded current.
drv overload	(Drive Overload) The output is true when the drive has exceeded the drive overload curve.
encoder flt	(Encoder Fault) The output is true when the drive is declaring an encoder fault
ext fan en	(External Fan Indicator) The output is true when the drive fan is on and false when the drive fan is off.
fan alarm	(Fan Alarm) The output is true when the fan on the drive is not functioning.
fault	(Fault) The output is true when a fault is declared by the drive.
flt reset out	(Fault Reset Output) The output is true when a fault reset is requested by the drive. The drive will only issue a fault reset command when FAULT RESET SRC (C1) is set to automatic.

choices…	***choice descriptions…***
flux confirm	(Motor Flux Confirmation) The output is true when the drive has confirmed there is enough flux to issue a speed regulator release (the drive's estimate of flux must reach 75% of reference).
fuse fault	(Fuse Fault) The output is true when the DC bus fuse has blown.
ground fault	(Ground Fault) The output is true when the sum of all phase current exceeds 50% of rated current of the drive.
in low gain	(In Low Gain) The output is true when the speed regulator is in "low gain" mode.
motor trq lim	(Motor Torque Limit) The output is true when the torque limit has been reached while the drive is in the motoring mode. The motoring mode is defined as the drive delivering energy to the motor.
mtr overload	(Motor Overload) The output is true when the motor has exceeded the user defined motor overload curve.
no function	(No Function) This setting indicates that the terminal or relay will not change state for any operating condition; i.e. the output signal will be constantly false.
not alarm	(Not Alarm) The output is true when an alarm is NOT present.
over curr flt	(Motor overload current fault) The output is true when the phase current has exceeded 300% of rated current.
overspeed flt	(Overspeed Fault) The output is true when the motor has gone beyond the user defined percentage contract speed for a specified amount of time.
overtemp flt	(Heatsink Over Temperature Fault) The output is true when the drive's heatsink has exceeded 90°C (194°F).
overvolt flt	(Over Voltage Fault) The output is true when the DC bus voltage exceeds 850VDC for a 460V class drive or 425VDC for a 230V class drive.
ovrtemp alarm	(Drive Over Temperature Alarm) The output is true when the drive's heatsink temperature has exceeded 80°C (176°F).
phase fault	(Phase Loss) The output is true when the drive senses an open motor phase.
ramp down ena	(Ramp Down Enable) The output is true after a torque ramp down stop has been initiated by either a logic input, the serial channel, or internally by the drive. When this output is true the torque is being ramped to zero.
ready to run	(Ready to Run) The output is true when the drive's software has been initialized and no faults are present.
rec travl dir	(Recommended Travel Direction) This output advises the travel direction of the elevator when the travel direction feature is active. A high output is given when the elevator is traveling up, a low output is given when the elevator is traveling down
rec travel on	(Recommended Travel On) This output goes high after the run is initiated when the Recommended Travel Dir (C1) is set to 'geared' or 'gearless' and the drive receives a Recommended Travel En logic input (C2) and the recommended travel direction feature is active
regen trq lim	(Regeneration Torque Limit) The output is true when the torque limit has been reached while the drive is in the regenerative mode. The regenerative mode is defined as when the motor is returning energy to the drive. When the drive is in regenerative mode, the energy is dissipated via the dynamic brake circuitry (internal brake IGBT and external brake resistor).
run commanded	(Run Commanded) The output is true when the drive is being commanded to run.
run confirm	(Run Command Confirm) The output is true after the software has initialized, no faults are present, the drive has been commanded to run, the contactor has closed and the IGBTs are firing.
speed dev	(Speed Deviation) The output is true when the speed feedback is failing to properly track the speed reference. The speed deviation needs to be above a user defined level. (Speed Dev. = reference – feedback)
speed dev low	(Speed Deviation Low Level) The output is true when the speed feedback is properly tracking the speed reference. The speed deviation needs to be within a user defined range for a user defined period of time. (Speed Dev. = reference – feedback)
speed ref rls	(Speed Reference Release) The output is true when the flux is confirmed and drive is NOT in DC injection.
Spd ref rel2	(Speed Reference Release 2) The output is true when: • software initialized and no faults present • drive being commanded to run (contact confirm true, if used) • not in DC injection • SPEED COMMAND SRC(C1) parameter = multi-step

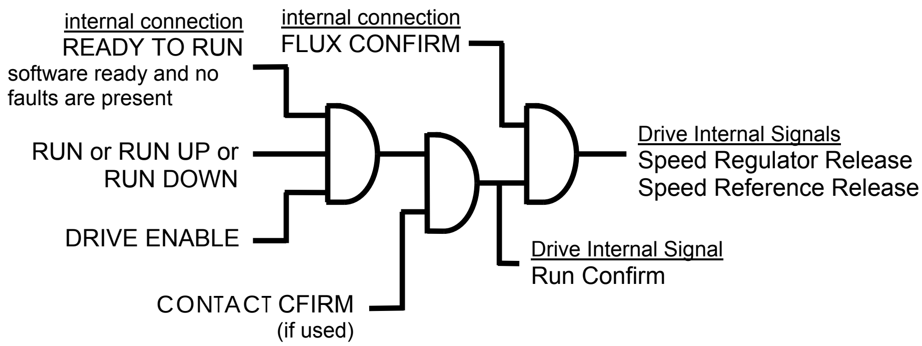
choices…	***choice descriptions…***
speed reg rls	(Speed Regulator Release) The output is true when the flux is confirmed at 75% and brake is commanded to be picked (if used) 
stltst active	(Stall Test Active) The output is true when the drive is declaring a Stall Test Fault. The Stall Test Fault checks that motor current goes at or above a percentage (defined by STALL TEST LVL(A1)) for defined amount of time (defined by STALL FAULT TIME(A1)). If the motor current exceeds the defined parameters a STALL TEST FAULT will be declared.
Undervolt flt	(Low Voltage Fault) The output is true when the DC bus voltage drops below the user specified percent of the input line-to-line voltage.
Up to speed	(Up to Speed) The output is true when the motor speed is above the user specified speed
uv alarm	(Low Voltage Alarm) The output is true when the DC bus voltage drops below the user specified percent of the input line-to-line voltage.
Zero speed	(Zero Speed) The output is true when the motor speed is below the user specified speed for the user specified time.

Table 17: 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.

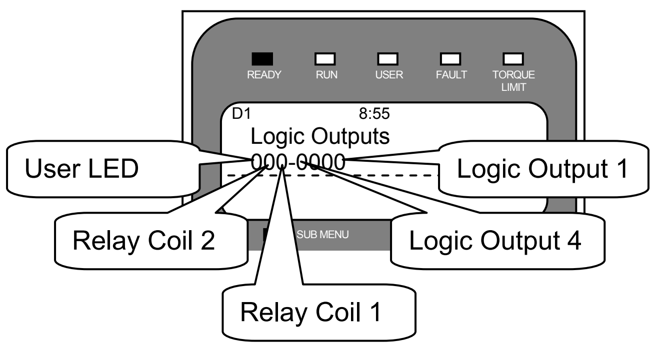
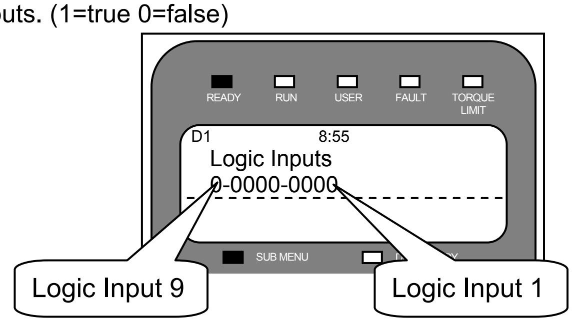
Parameter	Description	Default		Hidden item	Run lock out
		ENGLISH (U3)	METRIC (U3)		
Analog Output 1	analog output #1	**SPEED REF**	**SPEED COMMAND**	Y	N
Analog Output 2	analog output #2	**SPEED FEEDBACK**		Y	N

choices…	*choice descriptions…*	*D/A units…*
abs pos bin	(Absolute Position Binary) Raw absolute position reading from the absolute encoder.	Counts
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	(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.	%
drv overload	(Drive Overload) Percent of drive overload trip level reached.	% of trip point
flux current	(Flux Producing Current) Measured flux producing current.	% rated current
flux output	(Flux Output) Measured flux output.	% rated flux
flux ref	(Flux Reference) Flux reference used by vector control	% rated flux
flux voltage	(Flux Producing Voltage) Flux producing voltage reference.	% rated volts
frequency out	(Frequency Output) Electrical frequency.	% rated freq
mtr overload	(Motor Overload) Percent of motor overload trip level reached.	% of trip point
no function	(No Function) This setting indicates that the analog output will not change state for any operating condition; i.e. the output signal will be constantly false.	None
power output	(Power Output) Calculated power output.	% rated power
pretorque ref	(PreTorque Reference) Pre-torque reference.	% base torque
slip frequency	(Motor Slip Frequency) Commanded slip frequency.	% rated frequency
spd rg tq cmd	(Speed Regulator Torque Command) Torque command from speed regulator.	% base torque
speed command	(Speed Command) Speed command before S-Curve	% rated speed
speed error	(Speed Error) Speed reference minus speed feedback.	% rated speed
speed feedbk	(Speed Feedback) Speed feedback used by speed regulator.	% rated speed
speed ref	(Speed Reference) Speed reference after S-Curve	% rated speed
tach rate cmd	(Tachometer Rate Command) Torque command from tach rate gain function.	% base torque
theta e	(Polarity Error Signal) Magnet polarity estimation error signal used for PM motor characterization with respect to quick align.	Internal drive unit
torq current	(Torque Producing Current) Measured torque producing current.	% rated current
torq voltage	(Torque Producing Voltage) Torque producing voltage reference.	% rated volts
torque output	(Torque Output) Calculated torque output.	% rated torque
torque ref	(Torque Reference) Torque reference used by vector control.	% base torque
voltage out	(Voltage Output) RMS motor terminal voltage.	% rated volts

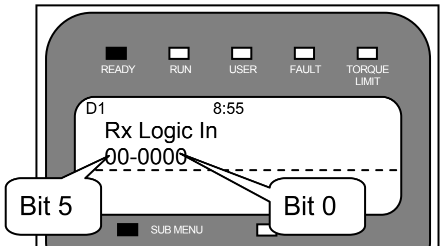
Table 18: Analog Outputs C4 Submenu

Display D0 Menu

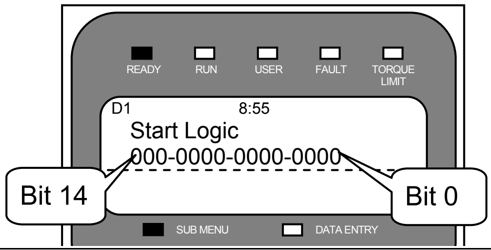
Elevator Data D1 Submenu

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 a 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 encoder speed in rpm.	**rpm**	N
Speed Error[i,ii]	(Speed Error[i,ii]) Monitors the speed error between the speed reference and the speed feedback. It is equal to the following equation: $\left\| \begin{pmatrix} speed \\ reference \end{pmatrix} - \begin{pmatrix} speed \\ feedback \end{pmatrix} \right\| = \begin{matrix} speed \\ error \end{matrix}$	**ft/min or m/s**[i,ii]	N[i,ii]
Est Inertia[i,ii]	(Estimated Inertia[i,ii]) Estimated elevator system inertia.	**secs**[i,ii]	N[i,ii]
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

---
[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

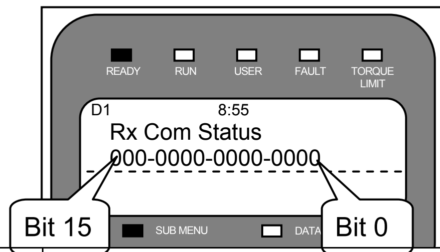
<table>
<tr><th>Parameter</th><th>Description</th><th>Units</th><th>Hidden item</th></tr>
<tr><td>Rx Logic In</td><td>(Serial Communications Logic Inputs)


<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 Request Bit from car controller</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>Start Logic[i,ii]</td>
<td>(Start Logic Status[i,ii]) This display shows the condition of certain starting logic bits. (1=true 0=false)


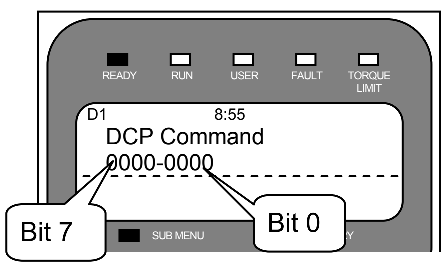
<table>
<tr><th>Bit</th><th>Name Description/Reason</th></tr>
<tr><td>0</td><td>RUN_BIT Software recognized input run command</td></tr>
<tr><td>1</td><td>BRAKE_RUN_BIT Run command after internal brake control delay</td></tr>
<tr><td>2</td><td>DRIVE_RUN)BIT Drive Run command after all drop out delays</td></tr>
<tr><td>3</td><td>RDY_FOR_RUN_BIT Drive is ready for run command, no faults present</td></tr>
<tr><td>4</td><td>CLOSE_CONTACTOR_BIT Indicates the drive is enabled, run command has been received, the software is initialized and no faults are present</td></tr>
<tr><td>5</td><td>CNTCT_CONFIRM_BIT Software indication that it has received the confirmation that the contactor has closed</td></tr>
<tr><td>6</td><td>RAMP_DWN_EN_BIT Bit is true after a torque ramp down stop has been initiated by either a logic input, the serial channel, or internally by the drive.</td></tr>
<tr><td>7</td><td>RUN_CONFIRM_BIT When 1, no faults are present, drive has been commanded to run, the contactor has closed and the IGBTs are firing</td></tr>
</table>
</td>
<td>1=true
0=false[i,ii]</td>
<td>N[i,ii]</td>
</tr>
</table>

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

<table>
<tr><th>Parameter</th><th>Description</th><th>Units</th><th>Hidden item</th></tr>
<tr><td>Start Logic[i,ii] (continued)</td><td>
<table>
<tr><th>Bit</th><th>Name Description/Reason</th></tr>
<tr><td>8</td><td>SPD_REG_REL_BIT Bit is true when the speed regulator is released.</td></tr>
<tr><td>9</td><td>SPD_REF_REL_BIT Bit is true when the speed regulator is release if SPD REF RLS (C1) = SPD REG RLS, else, the bit is true when the brake confirm has become active</td></tr>
<tr><td>10</td><td>BRAKE_PICK_BIT Bit is true when the speed regulator is released and is used to open the mechanical brake</td></tr>
<tr><td>11</td><td>BRAKE_IS_PICKED_BIT Bit is true when brake confirm is active</td></tr>
<tr><td>12</td><td>BRAKE_HOLD_BIT Bit is true when the brake pick confirmation is received</td></tr>
<tr><td>13</td><td>LOW_GAIN_BIT Bit is true when the speed regulator is in “low gain” mode</td></tr>
<tr><td>14</td><td>DOWN_BIT Bit is true when a down direction command has been received</td></tr>
</table>
</td><td>1=true 0=false[i,ii]</td><td>N[i,ii]</td></tr>
<tr><td>Rx Com Status[i,ii]</td><td>
(Serial Communications Status[i,ii])
Serial communication status display.


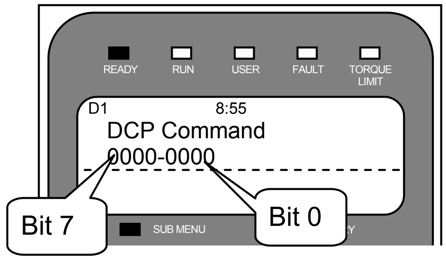
<table>
<tr><th>Bit</th><th>Severity</th><th>Name Description/Reason</th></tr>
<tr><td>0</td><td>Info</td><td>RX_INVALID_SETUP_ID; Invalid setup id on setup msg</td></tr>
<tr><td>1</td><td>Info</td><td>RX_SETUP_IN_RUN; A setup message to write was received while the serial run bit was set.</td></tr>
<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</td></tr>
<tr><td>10</td><td>Info</td><td>Fault_Mode_2 (Not available in Mode 1) Immediate Shutdown Mode</td></tr>
<tr><td>11</td><td>Info</td><td>Fault_Mode_2_Run_Removal (Not available in Mode 1) Run Removal Shutdown Mode</td></tr>
<tr><td>12</td><td>Info</td><td>Fault_Mode_2_Rescue (Not available in Mode 1) Rescue Shutdown Mode</td></tr>
<tr><td>13</td><td>Info</td><td>Fault_Mode_3 (Not available in Mode 1 or 2) Immediate Shutdown Fault</td></tr>
<tr><td>14</td><td></td><td>N/a</td></tr>
</table>
</td><td>1=true, 0=false[i,ii]</td><td>N[i,ii]</td></tr>
</table>

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

<table>
<tr><th>Parameter</th><th>Description</th><th>Units</th><th>Hidden item</th></tr>
<tr><td></td><td><table><tr><td>15</td><td>Fatal</td><td>RX_COMM_FAULT; COMM FAULT has been declared by the drive</td></tr></table></td><td></td><td></td></tr>
<tr><td>RX Error Count</td><td>(Serial Communication Error Counter) This function will monitor invalid serial messages and increase the count per invalid message. This is used as a diagnostic tool.</td><td>none</td><td>N</td></tr>
<tr><td>Pre-Torque Ref[i,ii]</td><td>(Pre-Torque Reference[i,ii]) Monitors the pre torque reference, coming from either analog channel #2 or the serial channel.</td><td>% rated torque[i,ii]</td><td>N[i,ii]</td></tr>
<tr><td>Spd Reg Torq Cmd[i,ii]</td><td>(Regulator Torque Command[i,ii]) 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[i,ii]</td><td>N[i,ii]</td></tr>
<tr><td>Tach Rate Cmd[i,ii]</td><td>(Tachometer Rate Command[i,ii]) Monitors the torque command from the tach rate gain function, (if used).</td><td>% rated torque[i,ii]</td><td>N[i,ii]</td></tr>
<tr><td>FF Torque Cmd[i,ii]</td><td>(Feed Forward Torque Command[i,ii]) Monitors the feedforward torque command from auxiliary source, when used.</td><td>% rated torque[i,ii]</td><td>N[i,ii]</td></tr>
<tr><td>Enc Position</td><td>(Encoder Position) The parameter will display the position of the rotor with respect to zero. The value will change from 0 to 65535 when the motor makes one rotation in a clockwise direction and will count down from 65535 to 0 when the motor makes 1 full rotation in the counter-clockwise direction. This value is reset on every power up.</td><td>None</td><td>N</td></tr>
<tr><td>Enc Revolutions</td><td>(Encoder Revolutions) This parameter will display the number of full revolutions the motor has made. When the car is moving up, this parameter will count from 0 to 65535. When the car is moving down, this parameter will count from 0 to -65535. This value is reset on every power up.</td><td>None</td><td>N</td></tr>
<tr><td>DCP Command</td><td>(DCP Command Monitoring) – Used for monitoring signals given to the drive serially from the control system when using DCP.


<table>
<tr><td>Bit</td><td>Name Description/Reason</td></tr>
<tr><td>B0</td><td>Drive controller enable</td></tr>
<tr><td>B1</td><td>Travel command (DCP3); Change of actual distance (DCP4)</td></tr>
<tr><td>B2</td><td>Stop switch</td></tr>
<tr><td>B3</td><td>Transfer of travel commands in the 3rd</td></tr>
<tr><td>B4</td><td>Direction of travel</td></tr>
<tr><td>B5</td><td>Speed change</td></tr>
<tr><td>B6</td><td>Desired distance / actual distance</td></tr>
<tr><td>B7</td><td>Error in last replay message</td></tr>
</table></td><td>1=true, 0=false</td><td>N</td></tr>
</table>

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

<table>
<tr><th>Parameter</th><th>Description</th><th>Units</th><th>Hidden item</th></tr>
<tr><td>DCP Status</td><td>(DCP Status Monitoring) – Used for monitoring signals given by the drive serially to the control system when using DCP


<table>
<tr><td>Bit</td><td>Name Description/Reason</td></tr>
<tr><td>S0</td><td>Drive controller ready</td></tr>
<tr><td>S1</td><td>Travel active</td></tr>
<tr><td>S2</td><td>Advance warning active</td></tr>
<tr><td>S3</td><td>General fault active</td></tr>
<tr><td>S4</td><td>speed below leveling value (v < 0,3 m/s)</td></tr>
<tr><td>S5</td><td>Desired distance / speed accepted (bit cleared for emergency stop)</td></tr>
<tr><td>S6</td><td>Mechanical brake</td></tr>
<tr><td>S7</td><td>Error in last message received</td></tr>
</table></td><td>1=true, 0=false</td><td>N</td></tr>
</table>

Table 19: Elevator Data D1 Submenu

Power Data D2 Submenu

Parameter	Description	Units	Hidden item
DC Bus Voltage	(DC Bus Voltage) Measured voltage of the DC bus.	**Volts**	N
Motor Current	(RMS Motor Current Output) Monitors the RMS motor output current.	**Amps**	N
Motor Voltage	(Motor Voltage Output) Monitors the RMS motor terminal line-line voltage.	**Volts**	N
Motor Frequency	(Motor Frequency Output) Monitors the electrical frequency of the motor output.	**Hz**	N
Motor Torque	(Motor Torque Output) Calculated motor output torque in terms of percent rated torque.	**% rated torque**	N
Est No Load Curr %[i]	(Estimated No Load Current[i]) Estimated no load current of the motor calculated by the HPV 900 Series 2's adaptive tune.	**%**[i]	N[i]
Est Rated RPM[i]	(Estimated Rated RPM[i]) Estimated rated rpm of the motor calculated by the HPV 900 Series 2's adaptive tune.	**RPM**[i]	N[i]
Torque Reference[i,ii]	(Torque Reference[i,ii]) Monitors the torque reference used by the drive control.	**% rated torque**[i,ii]	N[i,ii]
Flux Reference[i]	(Flux Reference[i]) Flux reference used by the vector control of the drive.	**% rated flux**[i]	N[i]
Flux Output[i]	(Flux Output[i]) Measured value of the flux output.	**% rated flux**[i]	N[i]
% Motor Current	(Percent Motor Current) Monitors the motor current as a percent of rated motor current.	**% rated current**	N
D-Curr Reference[ii]	(*D-Axis Current Reference*[ii]) *This current is the measured D-Axis Component of Current. It will be non-zero at no-load and flux-weakening states*	***%***[ii]	*N*[ii]
Power Output	(Power Output) Calculated drive power output.	**KW**	N

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Parameter	Description	Units	Hidden item
Slip Frequency[i,iii]	(Slip Frequency[i,iii]) Displays the commanded slip frequency of the motor	**Hz**[i,iii]	N[i,iii]
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
Rated Excit Freq[ii]	*(Rated Excitation Frequency of Motor[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 A5 menu.*	***Hz***[ii]	*N*[ii]
Rotor Position[ii]	*(Absolute Rotor Position[ii]) Displays the raw rotor mechanical position reading from the absolute encoder. May be helpful during installations to verify encoder is being read properly.*	***None***[ii]	*N*[ii]
Drive Temp	(Drive Temperature) Displays the value of the drive heatsink.	**deg C**	N
Highest Temp	(Highest Temperature) Displays the highest recorded value of the drive heatsink. May be reset to zero.	**deg C**	N

Table 20: Power Data D2 Submenu

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Utility U0 Menu

U0	Parameter	Description	Default	Choices	Hidden item	Run lock out
U1	**PASSWORD**	*For more information, see PASSWORD on page 112.*				
	ENTER PASSWORD	Allows the user to enter in a password	12345	0 – 65535	N	N
	NEW PASSWORD	Used to change the 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 112.*				
	HIDDEN ITEMS	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 112.*				
	UNITS SELECTION	Choose either Metric units or standard English measurements units	ENGLISH	English Metric	N	Y
U4	**OVRSPEED TEST**	*For more information, see OVERSPEED TEST on page 113.*				
	OVERSPEED TEST?	Allows for Overspeed Test to be enabled via the digital operator	NO	no yes	N	Y
U5	**RESTORE DFLTS**	*For more information, see RESTORE DFLTS on page 114.*				
	Rst Drive Dflts	Resets all parameters to default values except parameters in MOTOR A5 and Utility U menus			N	Y
	Rst Mtr Dflts	Resets the parameters in the MOTOR A5 to the defaults defined by the MOTOR ID			N	Y
U6	**DRIVE INFO**	*For more information, see DRIVE INFO on page 114.*				
	DRIVE VERSION	Shows the software version of the drive software			N	N
	BOOT VERSION	Shows the lower level software version of the drive			N	N
	CUBE ID	Displays the cube identification number of the drive. If the main control board is replaced on the drive, this value will need to be re-entered.			N	N
	DRIVE TYPE	Displays the drive type as HPV900-Series 2.			N	N
U7	**HEX MONITOR**	*For Magnetek personnel, see HEX MONITOR on page 115.*			N	N
U8	**LANGUAGE SEL**	*For more information, see LANGUAGE SEL on page 115.*				
	LANGUAGE SELECT	Selects language for operator text	ENGLISH	English Deutsch	N	N
U9	**BASICS**	*For more information, see BASICS on page 115*				
	Drive Mode	Selects open-loop, closed-loop, or permanent magnet drive operation	CLOSED LOOP	Open loop Closed loop PM	N	Y

U0	Parameter	Description	Default	Choices	Hidden item	Run lock out
U10	***ROTOR ALIGN***[ii]	*For more information, see ROTOR ALIGN on page 115.*				
	ALIGNMENT[ii]	*Enabling this parameter allows the alignment procedure or value ENCODER ANG OFST (A5) to be changed*	*DISABLE*	*enable* *disable*	*N*	*Y*
	BEGIN ALIGNMENT[ii]	*Selecting YES beings the alignment procedure*	*NO*	*yes* *on run* *no*	*N*	*Y*
	ALIGNMENT METHOD[ii]	*Chooses between open loop and auto align*	*OPEN LOOP*	*open loop* *auto align*	*N*	*Y*
U11	**TIME**	*For more information, see TIME on page 115.*				
	Year	Sets the year for the real time clock			N	N
	Month	Sets the month for the real time clock			N	N
	Day	Sets the day for the real time clock			N	N
	Hour	Sets the hour for the real time clock			N	N
	Minute	Sets the minute for the real time clock			N	N
	Second	Sets the second for the real time clock			N	N
U12	***AUTOTUNE SEL***[ii]	*For more information, see AUTOTUNE on page 116.*				
	AUTOTUNE SELECT[ii]	*Setting this parameter to something other than Disable allows the AutoTune feature to run.*	*DISABLE*	*disable* *on run* *yes*	*N*	*Y*
U14	***Power Meter***	*For more information see Power Meter on page116*				
	Motor Pwr	*Displays the power (in kWh) used by the drive since last 'Energy Reset'*			*N*	*N*
	Regen Pwr	*Displays the power (in kWh) regenerated (saved) by the drive since last 'Energy Reset'*			*N*	*N*
	Energy Time	*Displays the hours of use since last 'Energy Reset'*			*N*	*N*
	Energy Reset	*This allows the user to reset all U14 counters to zero*			*N*	*N*

Table 21: Utilities Menu

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation only
[ii] Parameter accessibly through ***PM (U9)*** Operation only
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation only

Detailed Description

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

- ENTER PASSWORD
- NEW PASSWORD
- PASSWORD LOCKOUT

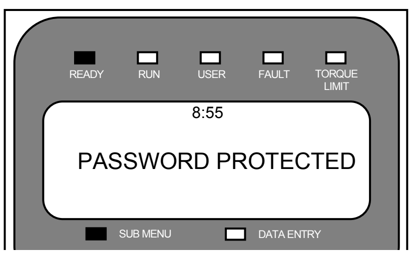
Password Function

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

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

Parameter Protection

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

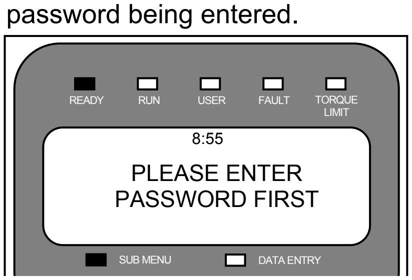


In order to change a parameter after password lockout has been enabled, the following two steps must be followed in the PASSWORD sub-menu:
1) A valid password must be entered in the ENTER PASSWORD screen.
2) The password lockout must be DISABLED in the PASSWORD LOCKOUT screen.

PASSWORD Sub-menu Protection

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

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



ENTER PASSWORD Screen

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

NEW PASSWORD Screen

This screen is used to change the established password.

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

PASSWORD LOCKOUT Screen

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

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

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

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

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

An overspeed test can be initiated by:

- an external logic input
- the serial channel
- directly from the digital operator

Overspeed Test via Logic Input

The external logic input can be used by:

- Setting the Overspeed Test Source parameter to external tb1.
- Defining a logic input terminal to ospd test src.

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

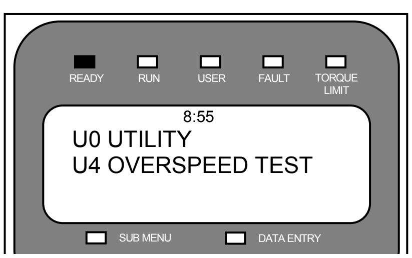
Overspeed Test via Serial Channel

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

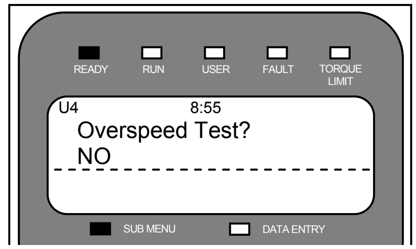
Overspeed Test via Operator

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

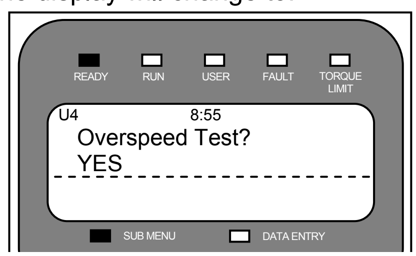
- While the Digital Operator display shows



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



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



- Press the ENTER key to begin the overspeed test.

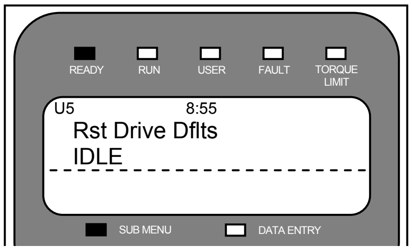
The value in the Overspeed Mult parameter is applied to the speed reference and the overspeed level, so that the elevator can be operated at greater than contract speed and not trip on an Overspeed Fault.
When the Run command is remove after the overspeed test, overspeed test reverts back to its default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

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

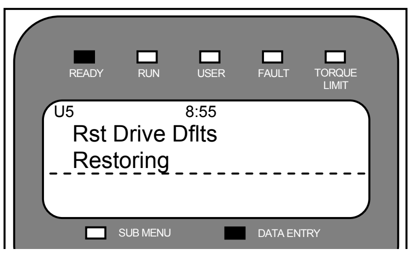
RESTORE DRIVE DEFAULTS

This function resets all parameters to their default values except the parameters in the MOTOR A5 sub-menu and Utiliity U menus.

The following shows how to restore the drive defaults:



Press the enter key. Scroll until the following displays on the operator:

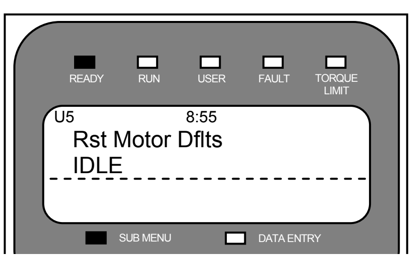


Press the enter key again. If the esc key is pressed, instead the reset action will be aborted.

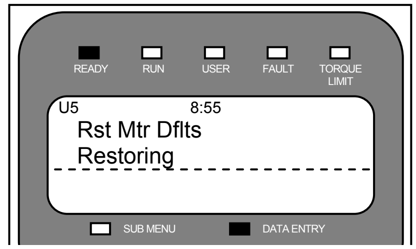
RESTORE MOTOR DEFAULTS

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

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



Press the enter key. Scroll until the following displays on the operator:

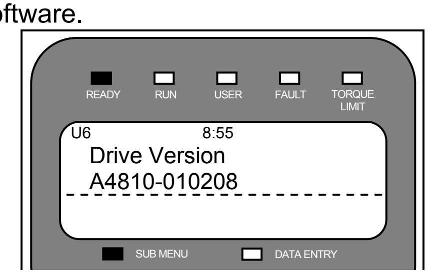


Press the enter key again. If the esc key is pressed, instead the reset action will be aborted.

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

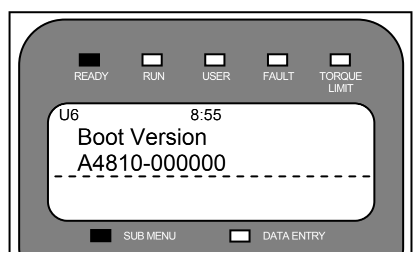
DRIVE VERSION Screen

Shows the software version of the drive software.



BOOT VERSION Screen

Shows the lower level software version of the drive.

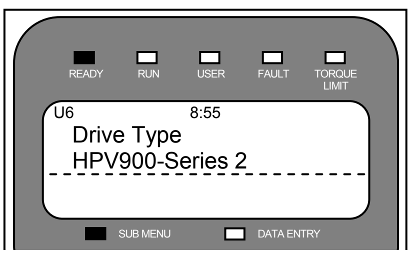


CUBE ID Screen
Displays the cube identification number of the drive.

Model	cube size	ID#
HPV900-4008-2E1-01	1	4008
HPV900-4012-2E1-01	2	4012
HPV900-4016-2E1-01	2	4016
HPV900-4021-2E1-01	3	4021
HPV900-4027-2E1-01	3	4027
HPV900-4034-2E1-01	4	4034
HPV900-4041-2E1-01	4	4041
HPV900-4052-2E1-01	4	4052
HPV900-4065-2E1-01	5	4065
HPV900-4072-2E1-01	5	4072
HPV900-4096-2E1-01	5	4096
HPV900-2025-2E1-01	2	2025
HPV900-2031-2E1-01	2	2031
HPV900-2041-2E1-01	3.5	2041
HPV900-2052-2E1-01	3.5	2052
HPV900-2075-2E1-01	4	2075
HPV900-2088-2E1-01	4	2088
HPV900-2098-2E1-01	5	2098

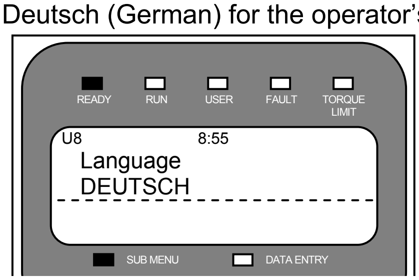
Cube ID Numbers

DRIVE TYPE Screen
Shows the drive software type HPV 900 Series 2

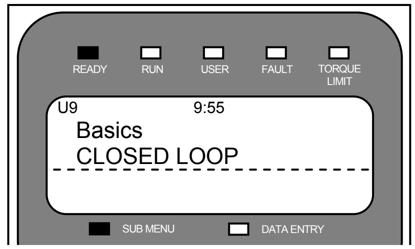


HEX MONITOR
(Hex Monitor)
The hex monitor was designed for fault and parameter diagnostics. It is intended for use by Magnetek personnel.

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



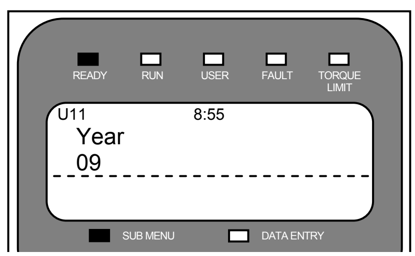
BASICS
(Basics)
When the Basics sub-menu is displayed, the user can choose either open-loop or closed-loop operation of the drive via the Operation (U9) parameter.



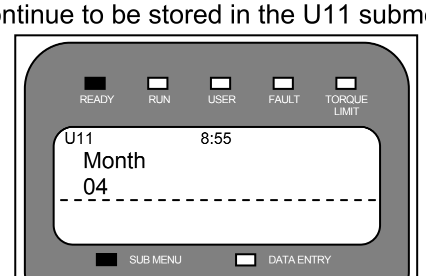
ROTOR ALIGN[ii]
(Rotor Alignment Function)
The Rotor Align submenu is meant for aligning the rotor with the magnets in the motor. For a detailed procedure see PM Start-Up Procedure on page 146.

TIME
(Time Setting Function)
The clock located at the top of the operator under the user LED, will set after the SECOND parameter has been enter.

For the year, enter the last two digits corresponding to the current year. This will update and continue to be stored in the U11 submenu.

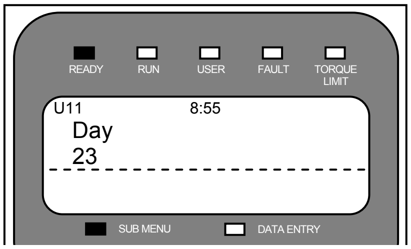


Enter the month based off of a 12 month calendar. This will automatically update and continue to be stored in the U11 submenu.

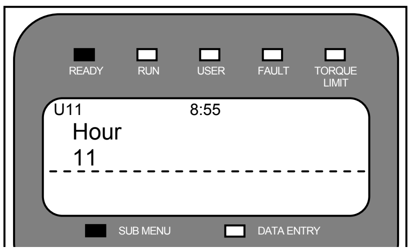


[ii] *Parameter accessibly through* ***PM (U9)*** *Operation only*

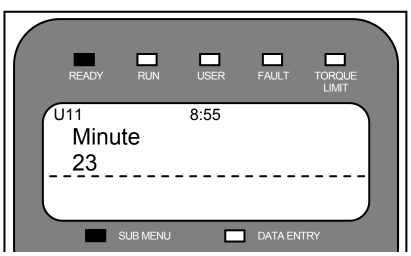
Next, enter the current day. This will automatically update and continue to be stored in the U11 submenu.



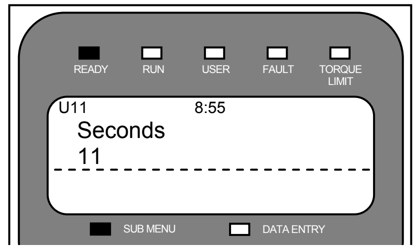
The hour is based off a 24 hour clock. This number will be automatically stored, however, after setting this value in the U11 submenu, it may be viewed on the top of the display and the U11 parameter will reset back to zero.



Enter the Minute next. This number will be automatically stored, however, after setting this value in the U11 submenu, it may be viewed on the top of the display and the U11 parameter will reset back to zero.



And finally enter the seconds. This number will be automatically stored, however, after setting this value in the U11 submenu, it may be viewed on the top of the display and the U11 parameter will reset back to zero.



AUTOTUNE SEL[ii]
(AutoTune Selection)
The AutoTune feature allows for the drive to automatically measure the D and Q Axis inductances. The procedure itself may be found in the Appendix on page 153.

Power Meter
(Energy Monitor)
Within this menu a user can monitor the power drawn by the motor and also regenerated from the motor in a given period. Within this menu the user can reset all counters also if required. Note: It is assumed a regenerative device is fitted in conjunction with the HPV900S2 when monitoring REGEN PWR, if this is not the case REGEN PWR informs you how much you could save should you add a regenerative device

[ii] *Parameter accessibly through* ***PM (U9)*** *Operation only*

Fault F0 Menu

F0	parameter	Description	hidden item	run lock out
F1	ACTIVE FAULTS	Contains a list of the active faults	N	N
F2	FAULT HISTORY	Contains a list of up to the last sixteen faults with time stamps	N	N
F3	SORTED HISTORY	Contains a list of all potential faults and the number of times they have occurred	N	N
F4	RESET FAULTS			
	RST ACTIVE FLTS	Clears the active faults listed in F1 submenu	N	N
	CLR FLT HIST	Clears the Fault History listed in the F2 submenu and the Sorted History listed in the F3 submenu	N	N

Detailed Descriptions

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

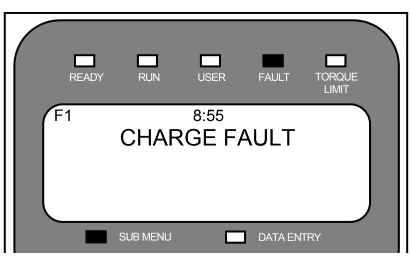
ACTIVE FAULTS
(Active Faults)

This sub-menu contains a list of the active faults.

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.



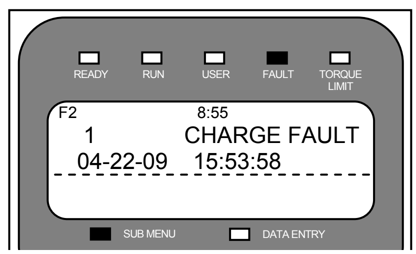
FAULT HISTORY
(Fault History)

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 the F4 RESET FLTS submenu

Fault History

All faults are on the fault history. The fault history displays the last 16 faults that have occurred and a time stamp indicating when each happened. The time stamp (month-day-year hour:min:sec) is set in the U11 TIME submenu.
Press the enter key to enter the fault history. Use the up and down arrow keys to scroll through the faults.



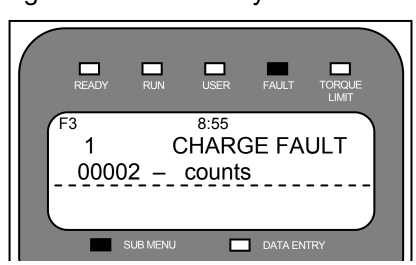
SORTED HISTORY
(Sorted History)

This sub-menu contains a list of faults to occur on the drive with the number of times they have occurred since the last fault history clear.

Sorted History

The sorted history displays all faults and the number of times they have occurred since that last fault history clearing. The faults are listed by occurrence. The most numerous occurrences will appear at the top of the list.

Press the enter key to enter the sorted history list. Use the up and down arrow keys to scroll through the sorted history.



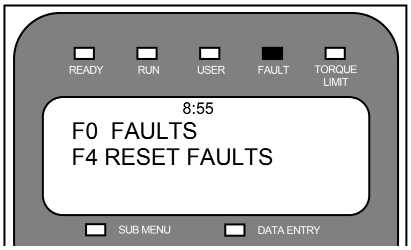
RESET FAULTS
(Reset Faults)

This sub-menu allows the user to reset both the active fault and the fault history.

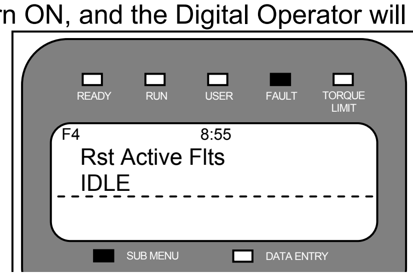
Rst Active Flts

The active faults may be reset by the user function as described below.

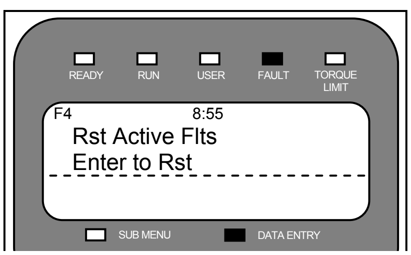
While the digital operator display shows:



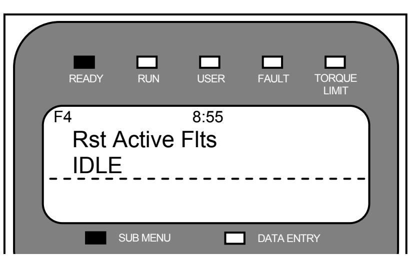
Press the enter key. The submenu LED will turn ON, and the Digital Operator will display:



Press the enter key, then use the down arrow to get the following display:



Press the enter key. The drive will reset the active fault list and display the following:

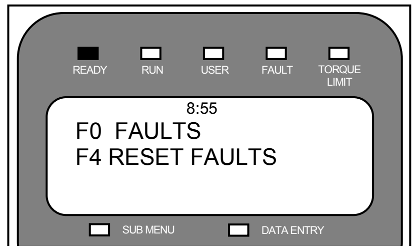


Note: if an active fault still exists on the drive, the FAULT LED will continue to be lit. Clear the condition causing the fault and attempt to reset the faults again.

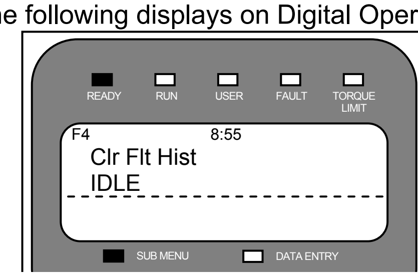
Clr Flt Hist

The fault history list and sorted history list may be reset by the user function as described below.

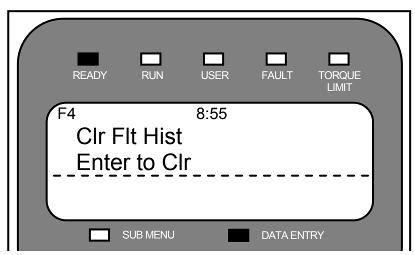
While the digital operator display shows:



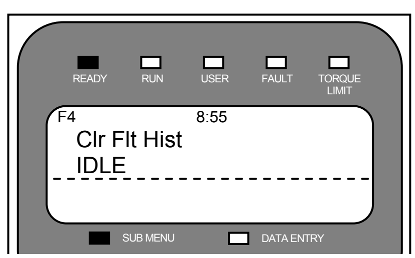
Press the enter key. The submenu LED will turn ON, using the down arrow key, scroll until the following displays on Digital Operator:



Press the enter key, then use the down arrow to get the following display:



Press the enter key. The drive will reset the active fault list and display the following:



Maintenance

Maintenance Overview

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

Is their sufficient airflow to cool the drive?

Has vibration loosened any connections?

The HPV 900 Series 2 needs to have sufficient air flow for long, reliable operation. Accumulated dust and dirt accumulation can reduce airflow and cause the heat sinks to overheat. The heat sinks can be kept clean by brushing, while using a vacuum cleaner.

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

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

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

WARNING

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

Drive Servicing

Remember when servicing the HPV 900 Series 2: Hazardous voltages may exist in the drive circuits even with drive circuit breaker in off position.

IMPORTANT

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

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

If after 5 minutes the DC bus charge light remains ON or voltage remains between terminals (B1) and (-):

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

IMPORTANT

Use extreme caution when connecting the bleeding resistor.

Using a 250ohm/100 watt “bleeder” resistor, connect the resistor leads to the (B1) and (-) terminals located on the brake resistor terminal.

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

Once the DC bus charge light is out, verify with a voltmeter that no voltage exists between the (B1) and (-) terminals.

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

Reforming Bus Capacitors

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

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

The bus capacitors in the HPV 900 Series 2 can be reformed *without removing them from the drive.* To reform the capacitors, voltage must be gradually increased as follows: Increase the AC input voltage from zero at a very slow rate, approximately 7 VAC per minute, reaching full rated voltage after about an hour.

This will reform the capacitors.

Lifetime Maintenance

The HPV 900 Series 2 is an AC digital drive. It is intended to last for twenty years in the field assuming the drive is installed and run according to Magnetek specifications and recommendations. The following recommendations for part replacement to ensure twenty-year life is as follows:

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

Troubleshooting

Faults and Alarms

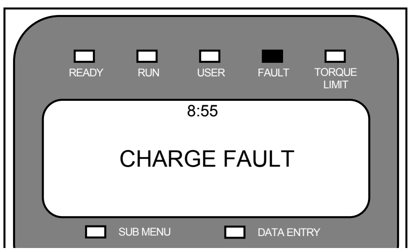
The HPV 900 Series 2 reports two classes of warnings; these are identified as Faults and Alarms.

Faults and Fault Annunciation

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

There are four means of fault annunciation.

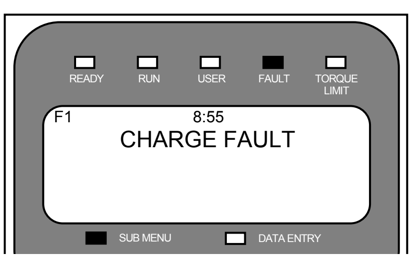
A priority message will be seen on the Digital Operator:



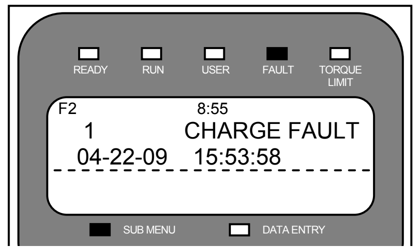
A priority message will overwrite whatever is currently displayed. The user can clear this message by pressing any key on the Digital Operator keypad. If another fault is present, the next fault will appear as a priority message.

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.



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



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

Fault Clearing

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

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

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

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

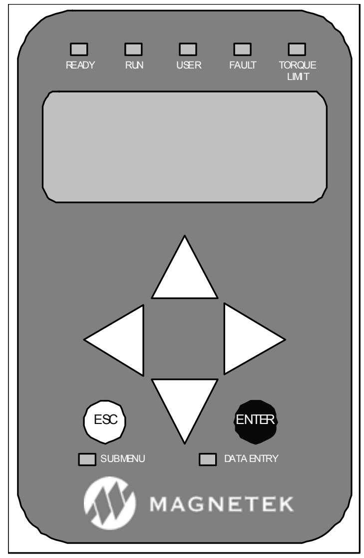
A fault reset can also be done via the Digital Operator.

Troubleshooting Guide

Below lists the HPV 900 Series 2's faults, alarms, and operator messages along with possible causes and corrective actions.

Note:

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



Status LED	Description	Possible Causes & Corrective Action
READY (red)	The drive is ready to run meaning: • The software is up and ready. • No faults are present.	N/A
RUN (red)	The drive is in operation. • RUN & DRIVE ENABLE logic inputs true • Current being sent to the motor	N/A
USER (red)	This LED is directly related to the programming of USER LED (C3)	**Check Parameter Setting** ⇩ Check setting of USER LED (C3)
FAULT (red)	The drive has declared a fault.	**Fault Present in the Drive** ⇩ Use digital operator to check the fault
TORQUE LIMIT (red)	The drive has reached its torque limit.	**Incorrect Wiring** ⇩ Motor phasing should match the encoder feedback phasing. If the phasing is not correct, the motor will not accelerate up to speed. It will typically oscillate back and forth at zero speed, and the current will be at the torque limit. ⇩ Switch either two motor phases or swap two encoder wires (A and /A). **Drive and/or Motor is Undersized** ⇩ Verify drive and/or motor sizing. May need a larger capacity HPV 900 Series 2 and or motor. **Check Parameter Settings** ⇩ Check the torque limit parameters MTR TORQUE LIMIT and REGEN TORQ LIMIT (A1) – maximum 250% of drive continuous current ⇩ Check speed regulator parameters RESPONSE and INERTIA (A1)

Table 22: Status LED Troubleshooting Guide

The following table lists the HPV 900 Series 2's faults and alarms along with possible causes and corrective actions.

Note:

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

Name	Description	Possible Causes & Corrective Action
Alignment is Done *(alarm)*	Annunciation that alignment has finished	**Parameter Settings** ⇩ Alignment procedure was enabled in the U10 submenu ⇩ Drive had no errors and completed the requested alignment
AT Cont Flt	Drive sees an open phase during Autotune or Auto Align	**Check Parameter Settings and Contactor** ⇩ If using drive output to close contactor, verify it is set to CLOSE CONTACT and Autotune or Autoalign has been enables using the ON RUN selection ⇩ Verify contactor is already closed if using Autotune or Autoalign YES selection ⇩ Contactor or wiring hardware problem
Autotune is Done *(alarm)*	Annunciation that autotune has finished	**Parameter Settings** ⇩ Autotune procedure was enabled in the U12 submenu ⇩ Drive had no errors and completed the requested autotune
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 Fault	Dynamic brake resistor overcurrent.	**Brake Resistor problem** ⇩ Braking Resistor is shorted. ⇩ When this fault occurs while the elevator is in motion, it will be declared as a brake fault alarm until the run condition is removed. If the drive is in regeneration an Overvolt Fault may occur instead.
Brk Hold Flt	The brake hold command and the brake feedback did not match for the time specified with Brake Hold Time parameter.	**Check Parameter Settings** ⇩ Check BRAKE HOLD SRC (C1) parameter for the correct source of brake hold feedback ⇩ Check BRAKE HOLD TIME (A1) parameter for the correct brake hold time. If nuisance fault, the fault can be disabled by BRK HOLD FLT ENA (C1) parameter.

Name	Description	Possible Causes & Corrective Action
Brk Open Flt	The drive saw movement during either the AutoTune (U11) or the Auto Alignment (U12)	**Elevator Brake is not set** ⇩ Verify the elevator brake is clamped and no visual movement occurred **Check Parameter Settings** ⇩ Check BRK FLT LEVEL (A4) ⇩ If the brake is set, increase BRK FLT LEVEL (A4) until fault no longer occurs
Brk Pick Flt	The brake pick command and the brake feedback did not match for the time specified with Brake Pick Time parameter.	**Check Parameter Settings and Mechanical Brake Pick Signal Wiring** ⇩ Check the correct logic input is configured for the correct TB1 terminal and set to MECH BRK PICK (C2) ⇩ Check wiring between the mechanical brake and the terminal on TB1. ⇩ Check BRAKE PICK SRC (C1) parameter for the correct source of brake pick feedback ⇩ Check BRAKE PICK TIME (A1) parameter for the correct brake hold time. If nuisance fault, the fault can be disabled by BRK PICK FLT ENA (C1) parameter.
Charge Fault	The DC bus voltage has not stabilized above the voltage fault level within 2 seconds or the charge contactor has not closed after charging. OR The DC bus voltage is below the UV Fault level as defined by the INPUT L-L VOLTS (A4) and UV FAULT LEVEL (A4) parameters	**DC Choke Connection** ⇩ Check that the DC choke link is present or if using DC choke, check DC choke connections **Low Input Voltage** ⇩ Check INPUT L-L VOLTS (A4) and UV FAULT LEVEL (A4) parameters ⇩ Disconnect Dynamic Braking resistor and re-try. ⇩ Verify proper input voltage and increase, if necessary, the input AC voltage within the proper range ⇩ Check for a missing input phase ⇩ Check power line disturbances due to starting of other equipment **Drive Accurately Reading the Dc Bus** ⇩ Measure the dc bus with a meter between B1 and - terminals ⇩ Compare that with the value on the digital operator, DC BUS VOLTAGE (D2) Drive may need to be replaced

Name	Description	Possible Causes & Corrective Action
Contactor Flt	The command to close the contactor and the contactor feedback do not match before the time specified by the Contact Flt Time parameter.	**Check Parameter Settings and Contactor** ⇩ Check CONTACT FLT TIME (A1) parameter for the correct contactor fault time. ⇩ Check wiring to logic input configured as CONTACT CFIRM ⇩ Contactor hardware problem **Run Command / Contact Confirm Timing** ⇩ Check Contact Cfirm logic input vs. Run command ⇩ Increase CONTACT FLT TIME (A1) enough for both CONTACT CFIRM and RUN to be active If nuisance fault, the fault can be disabled by CONT CONFIRM SRC (C1) parameter (set to none).
Cube ID Fault	The identification number for the drive is invalid.	**Hardware Problem** ⇩ Power cycle the drive. ⇩ If re-occurs, replace Drive Control board ⇩ If re-occurs, the drive needs to be replaced
Curr Reg Flt	Actual current does not match the command current. The drive is commanding more motor voltage then is available on the input.	**Current Regulation problem** ⇩ Check for a low input line ⇩ Check if drive accurately reading the dc bus • Measure the dc bus with a meter across terminals +3 and – • Compare that with the value on the digital operator, DC BUS VOLTAGE (D2) ⇩ Complete Adaptive Tune and Inertia procedure, *see pages 139-142.* ⇩ Check for a possible motor open phase ⇩ Check if contactor is closing. ⇩ Check for accurate motor parameters (A5) • Verify motor nameplate values are entered correctly • Complete Adaptive Tune and Inertia procedure, *see pages 139-142.* • As a last step, calculate motor parameters from motor's equivalent circuit, *see page 143.* ⇩ Otherwise, replace the drive

Name	Description	Possible Causes & Corrective Action
DB VOLTAGE or **DB VOLTAGE** *(alarm)*	Dynamic braking IGBT is still on ten seconds after the drive stops running	**Too High of Braking Resistor Value** ⇩ Check for no braking resistor ⇩ Possible Brake IGBT Failure ⇩ Possible brake resistor is open **Dynamic Braking Wiring Problem** ⇩ Check dynamic brake hardware wiring **High Input Voltage** ⇩ Decrease input AC voltage with the proper range (see specifications in technical manual) ⇩ Use reactor to minimize voltage spikes **Drive Accurately Reading the DC Bus** ⇩ Measure the dc bus with a meter between B1 and - terminals ⇩ Compare that with the value on the digital operator, DC BUS VOLTAGE (D2) **Hardware Problem** ⇩ Replace Drive Control board ⇩ Replace Drive
DCU data Flt	The DCU parameters checksum is invalid.	**Parameters Corrupted** ⇩ Check & re-enter parameters and power cycle the drive ⇩ If re-occurs, replace Drive Control board
Dir Conflict *(alarm)*	Declared when the speed command is held at zero due conflict with the analog speed command polarity and the run up / run down logic DIR CONFIRM (C1) must be enabled. *For more information on this function, see User Switches C1 Submenu on page 81.*	**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.	**Excessive Field Weakening** ⇩ Decrease FLUX WKN FACTOR (A1) parameter ⇩ Decrease both MTR TORQUE LIMIT (A1) and REGEN TORQ LIMIT (A1) parameters ⇩ Watch for the Torque Limit LED (see Table 22 on page 121), if lit the torque limits or the flux weakening factor parameters were decreased too much. **Accurate Motor Parameters** ⇩ Verify motor nameplate values are entered correctly ⇩ Complete Adaptive Tune and Inertia procedure, *see pages 139-142.* ⇩ As a last step, calculate motor parameters from motor's equivalent circuit, *see Motor Parameter Calculations on page 143.* **Excessive Current Draw** ⇩ Decrease accel/decel rate ⇩ Is elevator car being held in position? (i.e. mechanical brake not releasing) ⇩ Mechanical brake may not have properly released **Encoder Problem** ⇩ Check encoder coupling: align or replace ⇩ Encoder failure (replace encoder) ⇩ Check encoder count parameter ENCODER PULSES (A1) **Motor Problem** ⇩ Check for motor failure **Drive Sizing** ⇩ Verify drive sizing. May need a larger capacity HPV 900 Series 2
Drive Temp Alarm *(alarm)*	The heatsink on the drive has exceeded 85°C.	**Excessive Heat** ⇩ Reduce Ambient Temperature ⇩ Clean heat sink ⇩ Check for cooling fan failure

Name	Description	Possible Causes & Corrective Action
Encdr Crc Err ***(EnDat PM)***	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 pins 19 and 25 for +5V on TB1. If supply is low, verify encoder voltage sense and ground sense wires are not connected together. ⇩ Encoder failure – replace encoder and REALIGN rotor. ⇩ Inadequate encoder type – the absolute encoder option board will only support sin/cos absolute encoders **Option Board Problem** ⇩ Also verify JM2 is connected to position 1-2, or 2-3 ⇩ Check power to encoder on pins 73 and 74 of the EnDat Option card ⇩ Replace the option board
Encod Out of Tol ***(Incremental PM)***	Z pulse channel not pulsing within a preset window the drive expects to see.	**Sheave position changed** ⇩ Drive must be on looking at encoder feedback anytime the machine moves ⇩ Redo the alignment procedure **Encoder Problem** ⇩ Encoder wiring problem – check for broken encoder leads.

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

Name	Description	Possible Causes & Corrective Action
Extrn Fault 3	User defined external logic fault input	**Check Parameter Settings and External Fault Signal Wiring** ⇩ Check the correct logic input is configured for the correct TB1 terminal and set to EXTRN FAULT 3 (C2) ⇩ Check external fault is on the correct terminal on TB1.
Extrn 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) ⇩ Check external fault is on the correct terminal on TB1.
Fuse Fault	The DC bus fuse on the drive is open.	**Hardware Problem** ⇩ Check if motor is faulty ⇩ Check if any output phases shorted to ground. ⇩ The drive may need to be replaced.
Ground Fault	The sum of all phase currents has exceeded 50% of the rated amps of the drive.	**Improper Wiring** ⇩ Reset drive faults. Retry. If cleared, reconnect motor and control. If problem continues possible short between the motor windings and chassis ⇩ If problem continues, check system grounding ⇩ Also, the drive may need to be replaced.
HIT TORQUE LIMIT *(alarm)*	The drive has reached its torque limit.	**Incorrect Wiring** ⇩ Motor phasing should match the encoder feedback phasing. If the phasing is not correct, the motor will not accelerate up to speed. It will typically oscillate back and forth at zero speed, and the current will be at the torque limit. ⇩ Switch either two motor phases or swap two encoder wires (A and /A). **Drive and/or Motor is Undersized** ⇩ Verify drive and/or motor sizing. May need a larger capacity HPV 900 Series 2 and or motor. **Check Parameter Settings** ⇩ Check the torque limit parameters MTR TORQUE LIMIT and REGEN TORQ LIMIT (A1) ⇩ Check speed regulator parameters RESPONSE and INERTIA (A1) ⇩ Alarm sensitivity - TRQ LIM MSG DELAY (A1) parameter determines the amount of time the drive is in torque limit before the alarm message is displayed.

Name	Description	Possible Causes & Corrective Action
Motor Ovrload *(fault or alarm)*	The motor had exceeded the user defined motor overload curve. Note: fault or alarm setting dependant on setting of MOTOR OVRLD SEL (C1) parameter.	**Verify Overload Curve Parameters** ⇩ Check both OVLD START LEVEL (A5) and OVLD TIME OUT (A5) parameters. **Excessive Field Weakening** ⇩ Decrease FLUX WKN FACTOR (A1) parameter ⇩ Decrease both MTR TORQUE LIMIT (A1) and REGEN TORQ LIMIT (A1) parameters ⇩ Watch for the "**Hit Torque Limit" alarm message**, if message appears the torque limits or the flux weakening factor parameters were decreased too much. **Accurate Motor Parameters** ⇩ Verify motor nameplate values are entered correctly ⇩ Complete Adaptive Tune and Inertia procedure (*see pages 139-142).* ⇩ As a last step, calculate motor parameters from motor's equivalent circuit. **Excessive Current Draw** ⇩ Decrease accel/decel rate ⇩ Is elevator car being held in position? (i.e. mechanical brake not releasing) ⇩ Mechanical brake may not have properly released **Encoder Problem** ⇩ Check encoder coupling: align or replace ⇩ Encoder failure (replace encoder) ⇩ Check encoder count parameter ENCODER PULSES (A1) **Motor Problem** ⇩ Check for motor failure
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	This fault is declared if any motor nameplate data information in the A5 submenu is 0.	**Check parameter Settings:** ⇩ Check RATED MTR POWER (A5) ⇩ Check RATED MTR VOLTS (A5) ⇩ Check RATED EXCIT FREQ (A5) ⇩ Check RATED MOTOR CURR (A5) ⇩ Check MOTOR POLES (A5) ⇩ Check RATED MTR SPEED (A5)

Name	Description	Possible Causes & Corrective Action
OLA Endt Flt (EnDat 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 both motor phase leads and encoder inputs at the same time.* **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 TRQ CONST SCALE (A5). **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 A5 menu. ⇩ Increase OLA Vq REF SCALE 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 REALIGN the rotor). **Motor Parameter Problems** ⇩ Verify values in Motor (A5) menu are correct

Name	Description	Possible Causes & Corrective Action
OLA Inc Flt	Open Loop Alignment Incremental Fault	**Phasing Problem – EnDat PM** ⇩ Swap two encoder leads (e.g. A and –A) to establish proper phasing ***Note:*** *Swapping encoder leads is* ***NOT*** *the same as swapping motor wiring. Do not swap both motor phase leads and encoder inputs at the same time.* **Phasing Problem – Incremental PM** ⇩ Swap two encoder leads (e.g. A and –A) to establish proper phasing or swap two motor leads (e.g. U and V) **Encoder Problem** ⇩ Check encoder coupling: align or replace ⇩ Check encoder wiring ⇩ Encoder failure (replace encoder and REALIGN the rotor) ⇩ Option board failure (replace option board). ⇩ Z-Pulse channel not working correctly
Overcurr Flt	The phase current exceeded 300% of rated current.	**Encoder Problem** ⇩ Check encoder coupling: align or replace ⇩ Encoder failure (replace encoder) **Motor Problem** ⇩ Possible motor lead short ⇩ Check for motor failure **Excessive Load** ⇩ Verify motor and drive sizing. May need a larger capacity HPV 900 Series 2 **Accurate Motor Parameters** ⇩ Verify motor nameplate values are entered correctly ⇩ Complete Adaptive Tune and Inertia procedure, *see pages 139-142.* ⇩ As a last step, calculate motor parameters from motor's equivalent circuit, *see Motor Parameter Calculations on page 143.* **Inaccurate Parameters** ⇩ Check setting of FAST FLUX (C1) ⇩ Disable if enabled **Timing Issue** ⇩ Check Contactor Timing ⇩ Check for a steady RUN command (usually only able to be viewed on a scope) **Hardware Problem** ⇩ The drive may need to be replaced.
Overspeed Flt *(closed loop)*	Generated when the motor has gone beyond the user defined percentage contract speed for a specified amount of time.	**Check Parameter Settings** ⇩ Check OVERSPEED LEVEL (A1) parameter for the correct level. ⇩ Check OVERSPEED TIME (A1) parameter for the correct time. ⇩ Note: This fault is defined by Overspeed Level parameter and Overspeed Time parameter.

Name	Description	Possible Causes & Corrective Action
Overtemp Flt	The heatsink on the drive has exceeded 95°C (194°F).	**Excessive Heat** ⇩ Reduce Ambient Temperature ⇩ Clean heat sink ⇩ Check for cooling fan failure
Overvolt Flt	The DC bus voltage of the drive exceeded: 850 Volts for a 460V class drive 425 Volts for a 230V class drive.	**Too High of Braking Resistor Value** ⇩ Check for no braking resistor ⇩ Possible Brake IGBT Failure ⇩ Possible brake resistor is open **Dynamic Braking Wiring Problem** ⇩ Check dynamic brake hardware wiring **High Input Voltage** ⇩ Decrease input AC voltage with the proper range ⇩ Use reactor to minimize voltage spikes **Drive Accurately Reading the Dc Bus** ⇩ Measure the dc bus with a meter across terminals B1 and – ⇩ Compare that with the value on the digital operator, DC BUS VOLTAGE (D2) **Hardware Problem** ⇩ Replace Drive Control board
Phase Loss	The drive senses an open motor phase. The drive senses more than one motor phase crossing zero at the same time.	**Motor Problem** ⇩ Check motor wiring ⇩ Check for motor failure ⇩ Check for bad contactor or contactor timing issue.
Reverse Tach	See ENCODER FLT	See ENCODER FLT
RTR NOT ALIGN (PM)	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.
Ser2 Spd Flt	This fault is declared if the SER2 INSP SPD (A1) or SER2 RS CRP SPD (A1) parameters have exceeded contract speed (CONTRACT CAR SPD (A1) parameter).	**Check Parameters Settings:** ⇩ Check SER2 INSP SPD (A1) parameter, if greater than CONTRACT CAR SPD (A1) parameter. ⇩ Check SER2 RS CRP SPD (A1) parameter, if greater than CONTRACT CAR SPD (A1) parameter.
Setup Fault 1	This fault is declared if the rated motor speed and excitation frequency do not satisfy: $9.6 < \left[120\begin{pmatrix}rated\\excitation\\frequency\end{pmatrix}\right] - \left[\begin{pmatrix}\#\\poles\end{pmatrix}\begin{pmatrix}rated\\motor\\speed\end{pmatrix}\right] < 1222.3$ *…checks for too low or too high value of slip*	**Check Parameters Settings:** ⇩ Check RATED EXCIT FREQ (A5) parameter for correct setting ⇩ Check RATED MTR SPEED (A5) parameter for correct setting ⇩ Check MOTOR POLES (A5) parameter for correct setting

Name	Description	Possible Causes & Corrective Action
Setup Fault 2 ***(closed loop)***	This fault is declared if the number of poles and encoder pulses per revolution do not satisfy: $\frac{\left(\text{encoder pulses}\right)}{\left(\#\ \text{poles}\right)} > 64$	**Check Parameters Settings:** ⇩ Check ENCODER PULSES (A1) parameter for correct setting ⇩ Check MOTOR POLES (A5) parameter for correct setting
Setup Fault 3	This fault is declared if the number of poles is not an even number.	**Check Parameters Settings:** ⇩ Check MOTOR POLES (A5) parameter for correct setting
Setup Fault 4 ***(closed loop only)***	This fault is declared if the contract motor speed (in rpm) and encoder pulses/revolution do not satisfy: $300{,}000 \langle \left(\text{contract motor speed}\right)\left(\text{encoder pulses}\right) \langle 18{,}000{,}000$	**Check Parameters Settings:** ⇩ Check ENCODER PULSES (A1) parameter for correct setting ⇩ Check CONTRACT MTR SPD (A1) parameter for correct setting
Setup Fault 5	This fault is declared if the rated motor power (in watts) and rated motor voltage do not satisfy: $(0.07184)\left[\frac{\left(\text{rated motor power}\right)}{\left(\text{rated motor voltage}\right)}\right] \langle \text{general purpose current rating of drive}$	**Check Parameters Settings:** ⇩ Check RATED MOTOR PWR (A5) parameter for correct setting ⇩ Check RATED MTR VOLTS (A5) parameter for correct setting
Setup Fault 6	This fault is declared if the multi-step speed references have exceeded a defined limit, which is defined in terms of a percentage of contract speed (CONTRACT CAR SPD parameter).	**Check Parameters Settings:** ⇩ Check SPEED COMMAND1-16 (A3) parameters, if greater than 110% of CONTRACT CAR SPD (A1) parameter
Setup Fault 7	This fault is declared if the run logic inputs are defined incorrectly. You can either choose group #1 (RUN and UP/DWN) or group #2 (RUN UP and RUN DOWN). But you cannot mix and match or this fault will be declared.	**Check Parameters Settings:** ⇩ Check configurations of logic inputs (C2) – either RUN & UP/DWN or RUN UP & RUN DOWN
Setup Fault 8	This fault is declared if the DIR CONFIRM (C1) parameter is enabled and any of the following conditions are not met: A logic input (C2) must be assigned to RUN UP. A logic input (C2) must be assigned to RUN DOWN. The SPD COMMAND SRC (C1) parameter must be set to ANALOG INPUT *... Confirms proper set-up of Analog Speed Command direction confirm function*	**Check Parameters Settings:** ⇩ Check configurations of logic inputs (C2) for two logic input defined as RUN UP & RUN DOWN ⇩ Verify SPD COMMAND SRC (C1) is set to ANALOG INPUT ⇩ If nuisance fault and not using Up-Down Confirm function disabled by setting the DIR CONFIRM (C1) parameter to DISABLED
Setup Fault 9	This fault is declared if the same value is listed as multiple logic inputs	**Check Parameters Settings:** ⇩ Check configurations of logic inputs (C2) ⇩ Verify selections are only set once between Logic Input 1 and Logic Input 9

Name	Description	Possible Causes & Corrective Action
Setup Fault 10	This fault is declared if the Input L-L Volts is set to 000.00	**Check Parameters Settings:** ⇩ Check Input L-L Volts (A4) ⇩ Verify setting of Input L-L Volts matches measure AC Input to Drive
Setup Fault 11	This fault is declared if ENCODER SELECT (C1) = ENDAT ABSOLUTE and the number of pulses entered in ENCODER PULSES (A1) is greater than 3125	**Check Parameters Settings:** ⇩ Verify the setting of ENCODER SELECT (C1) ⇩ If an EnDat Absolute Encoder is used and ENCODER SELECT (C1) is set to ENDAT ABSOLUTE – verify the value placed in ENCODER PULSES (A1) is between 500 – 3125
Setup Fault 12	This fault is declared if the DRIVE MODE (U9) is changed and a previously entered value falls outside the acceptable range. Upon issue of this setup fault all applicable parameters will be restored to defaults to bring them within the acceptable range	**Check Parameters Settings:** ⇩ Verify the setting of all parameters and re-program if required
Short Circuit	The integrated power module is sensing an overcurrent or over temperature condition	**Overcurrent Problem** ⇩ Check for a possible short between the motor windings. ⇩ Verify dynamic brake resistor size (could be too small) **Overtemperature Problem** ⇩ Reduce Ambient Temperature ⇩ Clean heat sink ⇩ Check for cooling fan failure The drive may need to be replaced, if no other problem found.

Name	Description	Possible Causes & Corrective Action
Spd Dev Flt (PM) *&* **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 **Motor Runaway Condition – (PM)** ⇩ Encoder is slipping on the shaft – fix the encoder coupling and repeat the alignment ⇩ Wrong ENCODER ANG OFFSET (A5) 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. If Encoder Flt is set after swapping the motor leads, switching encoder leads (A and /A). ⇩ For Incremental PM an auto alignment will occur at the beginning of the next run. ⇩ Verify FINE TUNE OFST (A4) is 0.00 (for ENDAT PM) or value consistent with previous value found during Incremental startup. **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) ⇩ Verify drive and/or motor sizing. May need a larger capacity HPV 900 PM and/or motor. **Check Parameter Settings – PM** ⇩ 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 runaway conditions! **Check Parameter Settings – Closed Loop** ⇩ 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 HI LVL parameter is set too low for required acceleration/deceleration rate.

Name	Description	Possible Causes & Corrective Action
Srl Timeout	The drive is being operated by serial communications and one of the following has occurred: • Communication time-out – if the serial run bit is set and the drive does not receive a run-time message for 40 msec • Bad message checksum – drive has detected three consecutive bad message checksums	**Bad Serial Connection** ⇩ Remove and re-seat the serial cable ⇩ Check car controller serial driver board ⇩ Check the serial cable connected to the drive ⇩ Also, the drive's control board may need to be replaced. **Check Parameter Setting** ⇩ If not using serial communications, check SERIAL MODE (C1) = none
Start Time High ***(alarm)***	The drive saw movement during ARB mode before ARB START TIME (A1) is active	**Check Parameter Setting** ⇩ Lower ARB START TIME (A1) to occur before the brake lifts **Possible noise issue** ⇩ Verify grounding shield of encoder cable is directly wired to solid ground
Stall Fault ***(open loop)***	Generated when the motor current goes at or above a percentage (defined by STALL TEST LVL) for defined amount of time (defined by STALL FAULT TIME).	**Check Parameter Settings** ⇩ Check STALL TEST LVL (A1) parameter for the correct percentage of motor current ⇩ Check CONTACT FLT TIME (A1) parameter for the correct time ⇩ If nuisance fault, the fault can be disabled by STALL TEST ENA (C1) parameter (set to disabled) **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 **Motor Problem** ⇩ Check for motor failure **Accurate Motor Parameters** ⇩ Verify motor nameplate values are entered correctly ⇩ Complete Adaptive Tune and Inertia procedure ⇩ As a last step, calculate motor parameters from motor's equivalent circuit
Tq Lim 2Hi 4cube	The torque limits (based on the defined motor) exceed the cube's capacity	**Check Parameters Settings** ⇩ Verify motor nameplate values are entered correctly in the A5 sub-menu ⇩ Decrease both MTR TORQUE LIMIT (A1) and REGEN TORQ LIMIT (A1) parameters **Drive Sizing** ⇩ Verify drive sizing. May need a larger capacity HPV 900 S2

Name	Description	Possible Causes & Corrective Action
Undervolt Flt	Generated during a run condition when the DC bus voltage drops below the user specified percent of the input line-to-line voltage. The input line-to-line voltage is specified by the Input L-L Volts parameter and the fault level is specified by the Undervoltage Fault Level parameter.	**Low Input Voltage** ⇩ Check INPUT L-L VOLTS (A4) and UV FAULT LEVEL (A4) parameters ⇩ Disconnect Dynamic Braking resistor and re-try. ⇩ Verify proper input voltage and increase, if necessary, the input AC voltage within the proper range ⇩ Check for a missing input phase ⇩ Check power line disturbances due to starting of other equipment **Drive Accurately Reading the Dc Bus** ⇩ Measure the dc bus with a meter across terminals B1 and – ⇩ Compare that with the value on the digital operator, DC BUS VOLTAGE (D2) **Hardware Problem** ⇩ The drive may need to be replaced.
Uv Alarm *(alarm)*	Generated during a run condition when the DC bus voltage drops below the user specified percent of the input line-to-line voltage. The input line-to-line voltage is specified by the Input L-L Volts parameter and the fault level is specified by the Undervoltage Alarm Level parameter.	**Low Input Voltage** ⇩ Check INPUT L-L VOLTS (A4) and UV ALARM LEVEL (A4) parameters ⇩ Disconnect Dynamic Braking resistor and re-try. ⇩ Verify proper input voltage and increase, if necessary, the input AC voltage within the proper range ⇩ Check for a missing input phase ⇩ Check power line disturbances due to starting of other equipment **Drive Accurately Reading the Dc Bus** ⇩ Measure the dc bus with a meter across terminals B1 and – ⇩ Compare that with the value on the digital operator, DC BUS VOLTAGE (D2) **Hardware Problem** ⇩ The drive may need to be replaced.
V/Hz Fault ***(open loop)***	This fault is following two formulas are not satisfied: $\begin{pmatrix} MOTOR \\ MIN \\ VOLTS \end{pmatrix} < \begin{pmatrix} MOTOR \\ MID \\ VOLTS \end{pmatrix} < \begin{pmatrix} RATED \\ MTR \\ VOLTS \end{pmatrix}$ $\begin{pmatrix} MOTOR \\ MIN \\ FREQ \end{pmatrix} < \begin{pmatrix} MOTOR \\ MID \\ FREQ \end{pmatrix} < \begin{pmatrix} RATED \\ EXCIT \\ FREQ \end{pmatrix}$	**Check Parameters Settings:** ⇩ Check RATED MTR VOLTS (A5) parameter for correct setting ⇩ Check MOTOR MID VOLTS (A5) parameter for correct setting ⇩ Check MOTOR MIN VOLTS (A5) parameter for correct setting ⇩ Check RATED EXCIT FREQ (A5) parameter for correct setting ⇩ Check MOTOR MID FREQ (A5) parameter for correct setting ⇩ Check MOTOR MIN FREQ (A5) parameter for correct setting

Appendix

Closed Loop Adaptive Tune

The adaptive tune automatically calculates, under certain operating conditions, the percentage no load current and the rated rpm (slip frequency). The HPV 900 Series 2 software uses these two adaptive tune calculated values to obtain the maximum performance from the motor.

Adaptive Tune Operating Conditions

The HPV 900 Series 2 software estimates the motor's percent no load current and the motor's rated rpm. These estimated values are only estimated around a window of ±25% of the parameter settings for:

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

The adaptive tune will estimate:

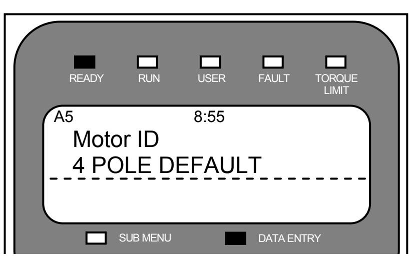
- the motor's percent no load current when the motor torque is below 20%.
- the motor's rated rpm when the motor torque is above 30%.

Using the Adaptive Tune to Obtain Maximum Motor Performance

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

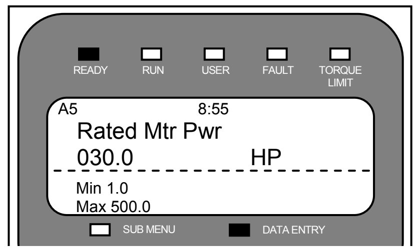
Initial Set-up

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



The default motor selections for the motor id will place a zero values in the motor nameplate parameters (see Figure 41). This selection will also load nominal values for the other motor parameters listed in Table 23

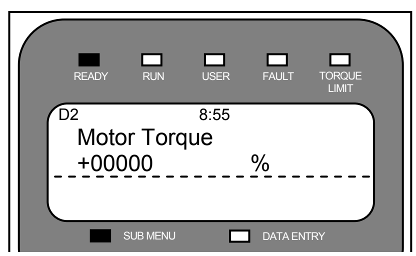
- Now, enter the motor nameplate data into the needed motor nameplate parameters (see Figure 41)



Tuning Motor No-Load Current

With a <u>balanced car, run the car at 70% contract speed</u> 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.



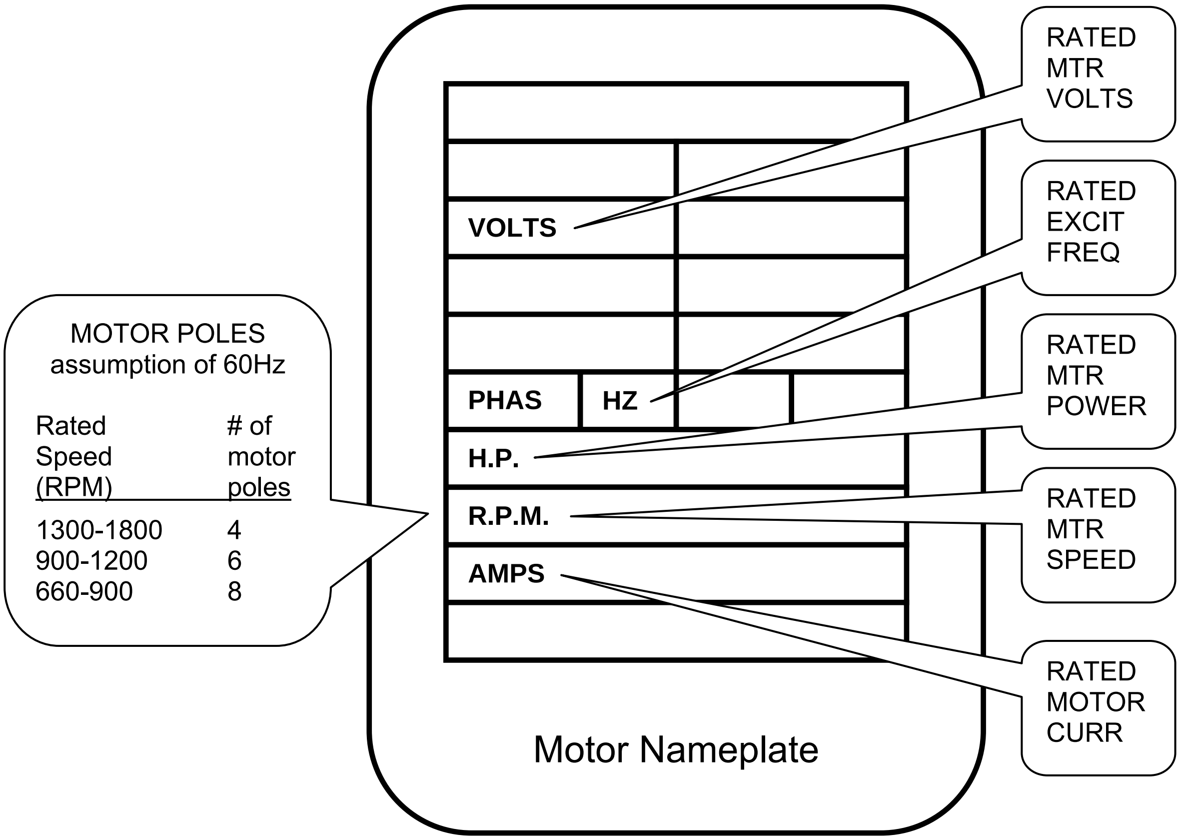


Figure 41: Motor Parameters Entered from Motor Nameplate

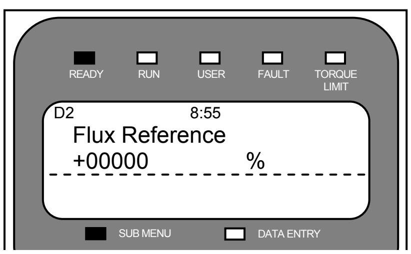
description	*Parameter*	*4 pole dflt*	*6 pole dflt*
percentage no load current	% NO LOAD CURR	35.0 %	45.0 %
stator leakage reactance	STATOR LEAKAGE X	9.0 %	7.5 %
rotor leakage reactance	ROTOR LEAKAGE X	9.0 %	7.5 %
stator resistance	STATOR RESIST	1.5 %	1.5 %
motor loss - motor iron loss	MOTOR IRON LOSS	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 23: Nominal Values for Motor Parameters

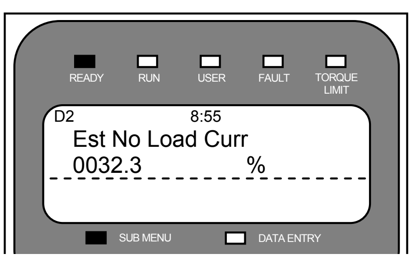
NOTE: If you are having problems getting the motor torque under 15% the cause may be:

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

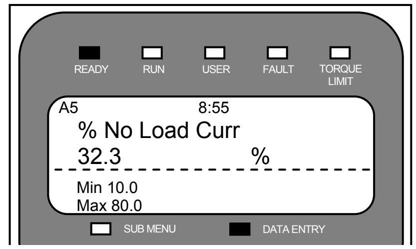
- Also, verify that the FLUX REFERENCE is 100%. If the value is not equal to 100% reduce the speed to less then 70% contract speed and check again.



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



Enter this estimated value into the motor parameter.

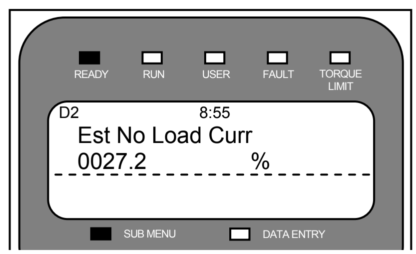


- Continue iterating the above two steps until the two values are within 2%. If the values do not converge after two iterations, verify the information entered in the initial set-up is correct.
- After the values converge, again verify the MOTOR TORQUE < 15% and the FLUX REFERENCE = 100%.

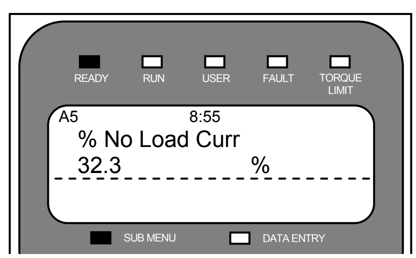
Tuning Motor's Flux Saturation Curve

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

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

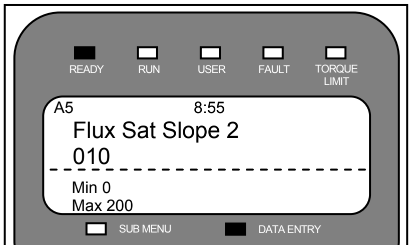


- Compare the displayed value EST NO LOAD CURR with the value entered for % NO LOAD CURR under the ADJUST MENU - MOTOR A5



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

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



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

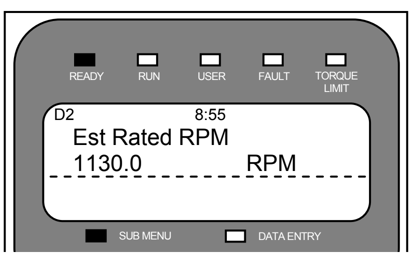
- Continue iterating FLUX SAT SLOPE 2 in 10% increments until the EST NO LOAD CURR and % NO LOAD CURR are within 2% of each other.

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

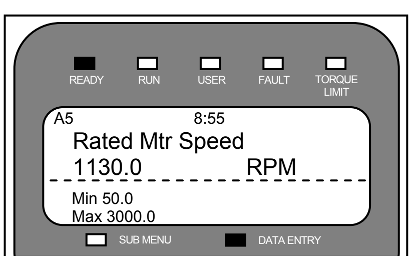
Tuning Rated Motor RPM

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 to 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).

Estimating System Inertia

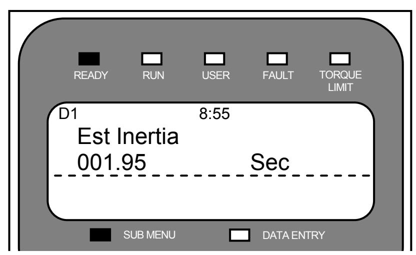
The HPV 900 Series 2 software can be used to calculate the inertia of the entire elevator, which is used for accurate tuning of the speed regulator.

The following is a step-by-step procedure for using the HPV 900 Series 2 to estimate the elevator system inertia.

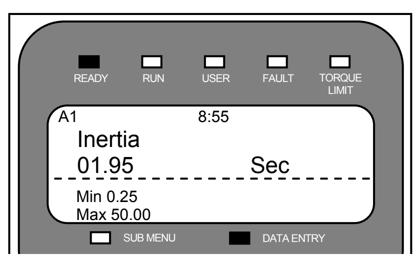
Using the Software to Estimate the System's Inertia

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.



Appendix

Motor Parameter Calculations - Induction

The default motor selections (4 POLE DFLT or 6 POLE DFLT will load nominal values (see Table 13 on page 75) for the following motor parameters: % NO LOAD CURR, STATOR LEAKAGE X, ROTOR LEAKAGE X, STATOR RESIST, MOTOR IRON LOSS, and MOTOR MECH LOSS.

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

Motor Manufacturer Data

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

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

Calculation from the Motor's Equivalent Circuit

This section details how to calculate the following HPV 900 Series 2 motor parameters, which are entered as a percentage of the base impedance:

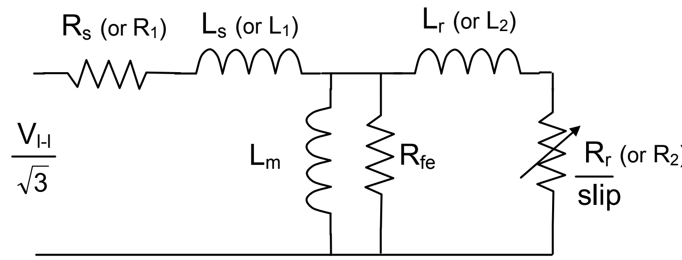
- Stator Leakage Reactance (STATOR LEAKAGE X)
- Rotor Leakage Reactance (ROTOR LEAKAGE X)
- Stator Resistance (STATOR RESIST)

Also,

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

The following data is required:

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



R_s, R_{fe}, R_r in ohms
L_s, L_m, L_r in henry

Figure 42: Equivalent single-phase circuit of the motor (Y connected)

Calculate Base Impedance

Calculate Z_{base} (base impedance)

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

Note: KW = HP × 0.746

Calculate Stator Resistance

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

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

Note: R_s is per phase (Y connected)

Calculate Stator Reactance

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

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

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

Calculate Rotor Reactance

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

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

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

Calculate Motor Iron Loss

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

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

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

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

Calculate Motor Mechanical Loss

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

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

Note: KW = HP × 0.746

Calculate Percentage No Load Current

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

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

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

After this initial value is entered, use the adaptive tune procedure (see Adaptive tune on page 139) to properly tune.

Appendix

Motor Parameter Calculations – Permanent Magnet

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:

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

Appendix

PM Start-Up Procedure

The following is a recommended PM start-up procedure:

EnDat Encoder[i] Set-Up

1) Verify the absolute encoder option card has been installed correctly. 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 one of the following Heidenhain EnDat EncodersECN113, 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 per Figure 43 and the encoder cable shield.
   Note: For Heidenhain cable 309778-xx, see Figure 44 for cable connections.

   Additional jumpers on the EnDat Encoder Card allow for encoder lengths up to 300ft long. For Encoder Cables greater than 50ft, JM1 should be set in position 2-3. Also, if the sense wires are connected on pins 75 and 76, the drive will automatically adjust its power output on pins 73 and 74. To use this feature of the drive, verify the position of JM2 is set to 2-3.

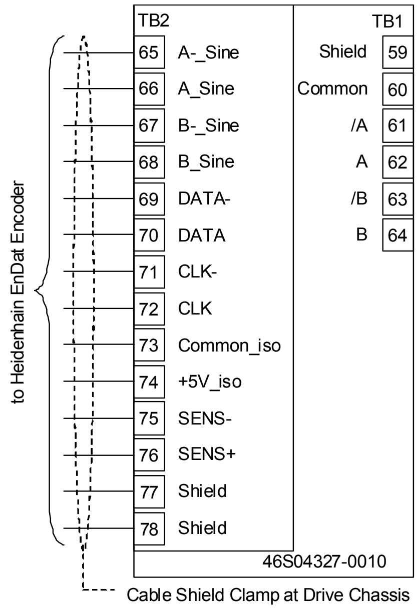


Figure 43: EnDat Encoder Connections

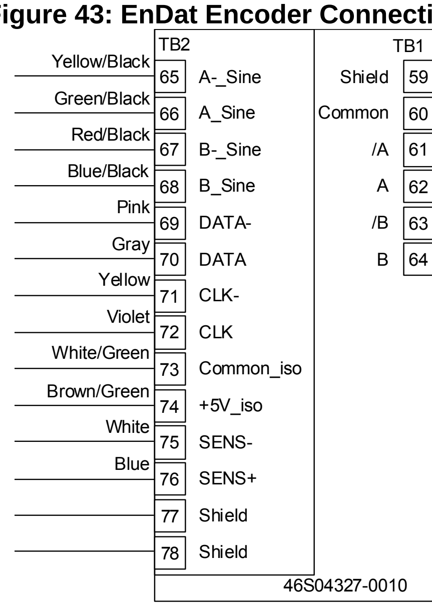


Figure 44: Heidenhain Cable Color Code

[i] only valid when ENCODER SELECT (C1) = ENDAT

Incremental Encoder Set-Up

1) Verify the encoder has been selected and installed in accordance with the following:
   - Supply Voltage: 12VDC or 5VDC
   - Capacity: 200mA or 400mA
   - PPR: 600 - 40,000
   - Maximum Frequency: 300 kHz
   - Input: 2 channel quadrature
   - 5 or 12 volts dc differential (A, /A, B, /B, Z, /Z)

   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 2 channel quadrature incremental encoder with Z-Pulse
   - Follow encoder manufacturer's mounting and wiring recommendations

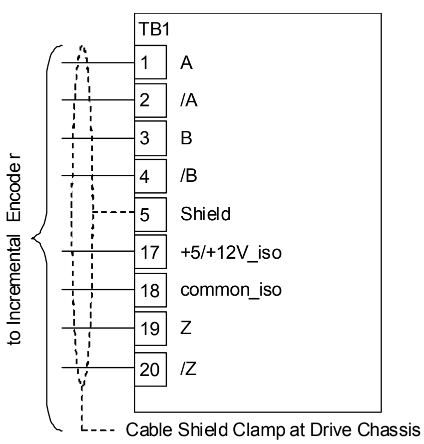


Figure 45: Incremental Encoder Connections

   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

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

Motor Parameter Set-Up

1) Verify the following parameters are set correctly with the motor nameplate data:
   - Motor Id (A5)
   - Rated Motor Pwr (A5)
   - Rated Mtr Volts (A5)
   - Rated Motor Curr (A5)
   - Motor Poles (A5)
   - Rated Mtr Speed (A5)
2) Verify D Axis Induct (A5) and Q Axis Induct (A5) are between 5 and 40 mH

Hoistway Parameter Set-Up

3) Enter / Verify following hoistway parameters:
   - Contract Car Speed (A1)
   - Contract Mtr Speed (A1)

Incremental Control of Permanent Magnet machines

There are a couple of considerations when running permanent magnet machines with an incremental encoder. When initially starting an incrementally controlled PM machine, an alignment still needs to be done to determine the rotor position. After an alignment has been done, run the car at 40% of contract car speed to verify alignment is proper. Once proper alignment has been established, the drive will auto correct alignment using the Z-pulse channel of the encoder.

WARNING

If the motor shaft is rotated at any time while the drive is not reading the encoder (i.e. drive is off and free fall is done), an alignment procedure needs to be redone.

At the first run after power up, the drive will take a couple of seconds and redo the auto alignment to verify alignment. This will be done with the brake set and the contactor closed. The drive will not assert SPD REG RLS and BRAKE PICK until after the auto alignment is completed.

In addition, if the drive receives a SPD DEV FAULT or ENCODER FLT, after the fault is cleared, upon the next requested run, the drive will redo an auto alignment. The drive will always accept a new tuned value after SPD DEV FLT, but will compare against the previous working value after power-up or ENCODER FLT.

Furthermore, if the drive is pulling more current than expected after an alignment and outside systems items have been checked, the user may fine tune the alignment by changing the value of FINE TUNE OFST (A4). See FINE TUNE PROCEDURE on page 154.

Rotor Alignment Procedure

Magnetek offers two (2) methods of initial rotor alignment with both an absolute encoder and an incremental encoder. These include Open Loop Alignment and Auto Alignment. A third method, Manual Alignment, is only valid when using an absolute encoder (EnDat). 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 (A5) parameter. The procedures for each method may be found on the following pages:

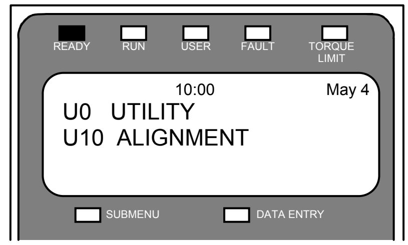
- Open Loop Alignment Procedure may be found on page 148
- Auto Alignment Procedure may be found on page 150
- Manual Setup Method[i] may be found on page 151

<u>Open Loop Alignment</u>

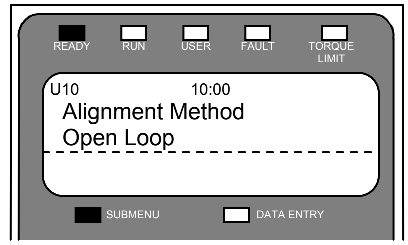
1) In order to accurately measure the alignment, the motor has to operate in a no-load condition. This can be achieved by…
   a. Removing the ropes from the sheave of the motor

      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.

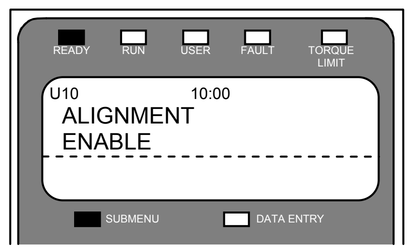


Press Enter, then the UP Arrow to display:

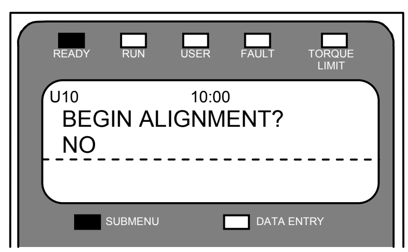


Verify ALIGNMENT METHOD is set to OPEN LOOP.

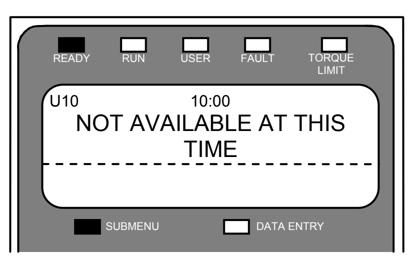
Scroll to ALIGNMENT and press Enter to change parameter ALIGNMENT from DISABLE to ENABLE. Press Enter.



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



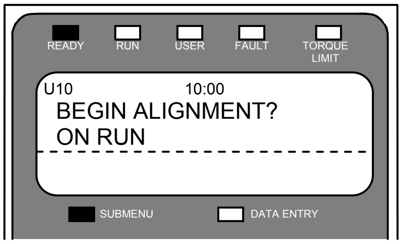
Note: If the operator displays the following screen, verify ALIGNMENT (U10) is set to enable, there are no active faults, and the drive is not in a RUN mode.



[i] only valid when ENCODER SELECT (C1) = ENDAT

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 (false)) 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.
  If the fault **ENCDR CRC ERR**[i] is displayed, verify the encoder wiring as shown in Figure 43. Also verify JM2 is connected to position 1-2, or 2-3. Retry alignment procedure.
- If the alarm **SPD DEV ALM** is displayed, increase the value of SPD DEV ALARM LVL (A1) then retry 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**[1] is displayed; decrease ALIGN VLT FACTOR (A4) and retry alignment procedure
- If **OLA ENDT FLT**[1] occurs while BEGIN ALIGNMENT? Was set to ON RUN, verify the run command was not removed before the alignment was complete. In addition, verify the brake is open and the contactor is closed.
- If the motor was running rough, jerky, or stalled immediately before the drive declared an **OLA ENDT FLT**[1], increase the value located in TRQ CONST SCALE (A5).

  If the motor was running smoothly immediately before the drive declared an **OLA ENDT FLT**[1], 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:** When using an EnDat absolute encoder, the user may not swap 2 motor leads to clear the fault. A and –A must be changed. When using an Incremental encoder, either the motor wires or the encoder wires may be changed.*

9) View the value of ENCODER ANG OFST(A5). If the value is 30000, the alignment procedure did not work and must be redone. When using an ***incremental encoder***, ENCODER ANG OFST (A5) will auto fill with 00000.

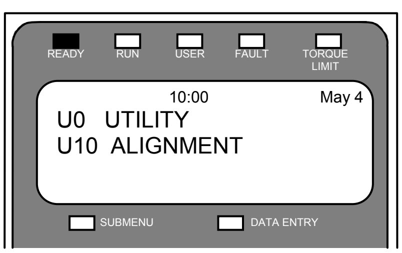
[i] only valid when ENCODER SELECT (C1) = ENDAT

10) Otherwise, record value of ENCODER ANG OFST (A5).
    ENCODER ANG OFST = ___________
11) 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.
12) 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.
13) If the directions do not coincide with each other, change MOTOR ROTATION parameter in C1.
14) Run the drive in inspection speed up and down the hoistway.

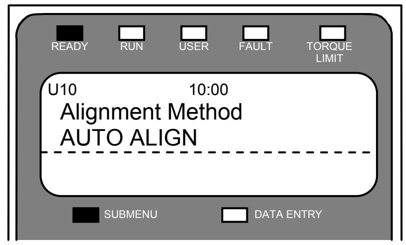
Auto Alignment Procedure

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.

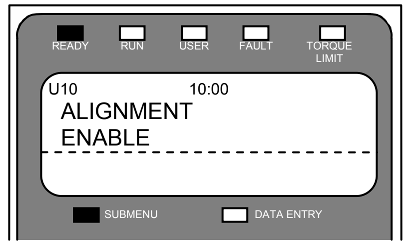


Press Enter, then the UP Arrow to display:

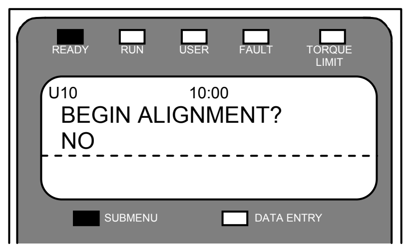


Verify ALIGNMENT METHOD is set to AUTO ALIGN.

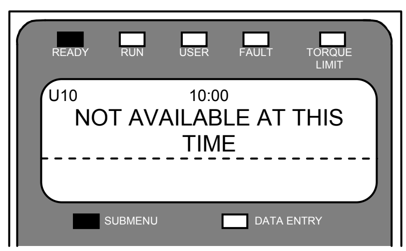
Scroll to ALIGNMENT and press Enter to change parameter ALIGNMENT from DISABLE to ENABLE. Press Enter.



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***.

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, a slight buzzing noise should come from the motor for approximately two seconds and the RUN light will be lit for the duration of the procedure.

- If the fault **AT CONTACT 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 and minimal movement has occurred, increase BRK FLT LEVEL (A4).
- ENCODER ANG OFST[i] (A5) will automatically populate

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[1] (A5). If the value is 30000, the alignment procedure did not work and must be redone. When using an ***incremental encoder***, ENCODER ANG OFST (A5) will auto fill with 00000. Otherwise, record value of ENCODER ANG OFST[ii] (A5).

ENCODER ANG OFST[1] = _________

6) Run motor at 10% 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. An Open Loop Alignment will automatically check phasing.
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.
9) If motor current is high while using an incremental encoder, but running, the user may adjust FINE TUNE OFST (A4) to better align the motor to the drive. The drive will always check against the original value on the first run after one of the following conditions occur:
   a. Power cycle
   b. SPD DEV FLT
   c. ENCODER FLT

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

Manual Setup Method[1] – Absolute Encoder

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 A5 menu:

   If replacing the FLASH, copy the ENCODER ANG OFST (A5) value before removing the memory and/or replacing the drive. If the original offset value was recorded when the alignment is first performed, use that value.

   WARNING

   ENCODER ANG OFST (A5) can also be uploaded using the Magnetek Explorer. ALIGNMENT (U10) must be enabled for the ENCODER ANG OFST (A5) value in the *.par file to be downloaded into the drive.

   OR

   a. Find θ_{0_spec} [in degrees] from the manufacturer supplied data and use the following formula to convert it.
2) Enable the Alignment in the U10 menu.
3) Enter value determined in Step 1) into ENCODER ANG OFST (A5).
4) Run the motor at inspection speed

> **WARNING**
> The motor may run away if the incorrect value for ENCODER ANG OFST (A5) is used. Be prepared to remove the run command.

i only valid when ENCODER SELECT (C1) = ENDAT
ii only valid when ENCODER SELECT (C1) = ENDAT

$$ENCODER\ ANG\ OFST = \frac{2 \times SERIAL\_CPR}{POLES} \times \frac{\theta_0\_spec\ [^\circ]}{360^\circ}$$

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

Appendix

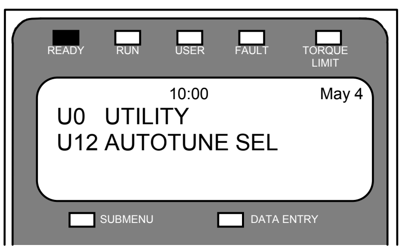
Auto-Tune Procedure

Auto-Tune is a function used only on **PM (U9)** that will automatically calculate 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 two separate ways, one way is to enable the function through the operator and the other is to enable Auto-Tune 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.

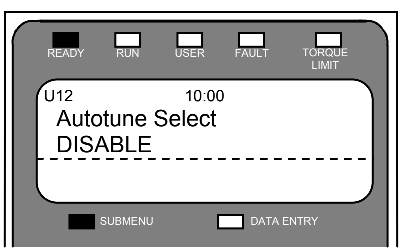
Setting Auto-Tune

Note: Absolute Encoder Alignment Procedure should precede this Auto-Tune function. Alignment will affect the accuracy of the D and Q Axis Stator Inductances.

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 (U11) to run the Auto-tune function. No Faults may be present on the drive when engaging Auto-Tune.



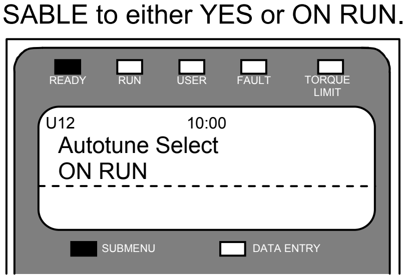
Press Enter to display:



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

Note: The contactor needs to be in for Auto-Tune to run. If necessary, manually hold the contactor in while the test is running.

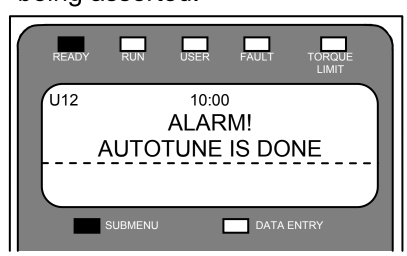
3) Press Enter to change the data from DISABLE to either YES or ON RUN.



4) If the selection ***YES*** is made, the drive will immediately start applying current to the motor and calculating the motor measurements.
5) If the selection ***ON RUN*** is made, the drive expects the following sequence to occur prior to the drive applying current to motor:

   Command run (inspection) on 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 stay false during the Auto-Tune)
   d. Motor Contactor closes
   e. Drive starts the Auto-Tune procedure
   f. When the Auto-Tune is finished, the drive will simulate the removal of the run command even if Run Command is still being asserted.



   g. Run Command is removed

During Auto-Tune, a slight buzzing noise should come from the motor for approximately two seconds and the RUN LED 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 and minimal movement has occurred, increase BRK FLT LEVEL (A4).
- The following parameters will populate:
   a. D Axis Induct (A5)
   b. Q Axis Induct (A5)
   c. Stator Resist (A5)

Appendix

Fine Tune Alignment Procedure

Test Measurements (EnDat)

1. Set Id REF THRESHOLD (A4) to 0.00
2. Set FINE TUNE OFST (A4) to –30.00. If Encoder Fault or another fault occurs, set FINE TUNE OFST (A4) to –20.00.
3. Run car up and down and note the peak current displayed in MOTOR CURR (D2) in table below
4. Set FINE TUNE OFST (A4) to +10.00 and note peak current in table below
5. 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

6. With the two currents equal, use the following formula to determine the value in ENCODER ANG OFSET (A5)

$$\begin{pmatrix}\textit{ENCODER}\\ \textit{ANG}\\ \textit{OFSET (A5)}\\ \textbf{new}\end{pmatrix} = \begin{pmatrix}\textit{ENCODER}\\ \textit{ANG}\\ \textit{OFSET (A5)}\\ \textbf{old}\end{pmatrix} - \left(\frac{\begin{pmatrix}\textit{FINE TUNE}\\ \textit{OFST (A4)}\\ \textit{positive}\\ \textit{value}\end{pmatrix} + \begin{pmatrix}\textit{FINE TUNE}\\ \textit{OFST (A4)}\\ \textit{negative}\\ \textit{value}\end{pmatrix}}{360 \times \textit{number of poles}} \right) \times 8192$$

Example: ENCODER ANG OFSET (A5) old value = 185

FINE TUNE OFST positive value (A4) = 40

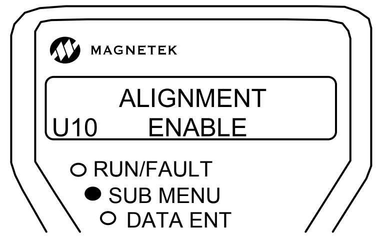
FINE TUNE OFST negative value (A4) = (-70)

Number of poles = 16

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

Enter new ENCODER ANG OFSET

7. Enable Alignment by setting ALIGNMENT (U10) to ENABLE, then change the value in ENCODER ANG OFSET (A5) from the previous one, to the one calculated in the formula above



8. Set FINE TUNE OFST (A4) to 0.0
9. Set Id REF THRESHOLD (A4) back to the original value (0.10 is default value)

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

Test Measurements (Incremental)

1. Set Id REF THRESHOLD (A4) to 0.00
2. Set FINE TUNE OFST (A4) to +10.00. If Encoder Fault or another fault occurs, set FINE TUNE OFST (A4) to -10.00.
3. Run car in inspection in the direction of pulling load (i.e. empty car down) and note the peak current displayed in MOTOR CURR (D2) in table below
4. Make the absolute value of FINE TUNE OFST (A4) larger
5. Reiterate Steps 4 and 5 increasing FINE TUNE OFST (A4) until current is the lowest in the table.

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

6. Leave FINE TUNE OFST (A4) at value where the current draw was the lowest.

Appendix

Open-loop Start-Up Procedure

The following is a recommended open-loop start-up procedure:

Motor Parameter Set-up

1) Select one of the four default motors (listed in Table 24) for the MOTOR ID (A5) parameter (or select a valid motor ID, if available).
   These typical V/Hz patterns are selectable via the MOTOR ID (A5) are given in the following table. It is best to start with one of the default V/Hz patterns.

parameter	4 pole 400 v	4 pole 200 v	6 pole 400 v	6 pole 200 v
motor mid volts (A5)	28.0V	14.0V	28.0V	14.0V
motor mid freq (A5)	3.0Hz	3.0Hz	3.0Hz	3.0Hz
motor min volts (A5)	9.0V	4.0V	9.0V	4.0V
motor min freq (A5)	1.0Hz	1.0Hz	1.0Hz	1.0Hz

Table 24: V/Hz patterns via Motor ID

2) Enter / Verify the following from the motor's nameplate:
   - Motor HP or KW rating (RATED MTR POWER(A5))
   - Motor Voltage (RATED MTR VOLTS(A5))
   - Motor Excitation Frequency in Hz (RATED EXCIT FREQ(A5))
   - Rated Motor Current (RATED MOTOR CURR(A5))
   - Number of Motor Poles (MOTOR POLES(A5))

rated motor speed (rpm)	# of motor poles
1800-1500	4
1200-1000	6
900-750	8
720-600	10

Table 25: Motor Poles Reference

   - Rated Motor Speed at full load in RPM (RATED MTR SPEED (A5))
     Note: The rated motor rpm must be full load speed. If synchronous speed is given, the motor rated rpm can be estimated by:
     – 97.5% of synchronous speed for Nema type B motor design
     – 94% of synchronous speed for Nema type D motor design

# of motor poles	rated motor speed (rpm)	
	at 60 Hz	at 50 Hz
4	1800	1500
6	1200	1000
8	900	750
10	700	600

Table 26: Synchronous Motor Speeds Reference

3) Use the default value of 2.5% for Stator Resistance (STATOR RESIST(A5))
   NOTE: if there are operation issues, the stator resistance can be measured, refer the procedure detailed on page 162.

Hoistway Parameter Set-up

4) Enter / Verify the hoistway parameters:
   - CONTRACT CAR SPD (A1) parameter programs the elevator contract speed in ft/min or m/s.
   - CONTRACT MTR SPD (A1) parameter programs the motor speed at elevator contract speed in RPM.

   NOTE: The above two parameters create the interaction that allow engineering units to be used throughout the HPV 900 software.

Verify Parameters at Default

5) Verify that the following A1 and A4 parameters are set at default:

parameter name	*default*
DC START LEVEL (A1)	80.0
DC STOP LEVEL (A1)	50.0
DC STOP FREQ (A1)	0.5
DC START TIME (A1)	1.00
DC STOP TIME (A1)	1.00
SLIP COMP TIME (A1)	1.50
SLIP COMP GAIN (A1)	1.00
TORQ BOOST TIME (A1)	0.05
TORQ BOOST GAIN (A1)	0.00
MTR TORQUE LIMIT (A1)	200.0
REGEN TORQ LIMIT (A1)	200.0
ILIMT INTEG GAIN (A4)	1.00
HUNT PREV GAIN (A4)	1.00
HUNT PREV TIME (A4)	0.20

Low speed inspection mode

6) Run the drive in low speed inspection mode and…
   - Verify proper hoistway direction…can be reversed with the MOTOR ROTATION (C1) parameter.
   - Verify that the Safety Chain / Emergency Stop works

Adjust Motor RPM (Slip)

7) At Empty Car, run the drive at 10% of contract speed and complete the Motor RPM Adjustment Procedure detailed on page 156.
8) At Full-load, run the drive at 10% of contract speed and complete the Motor RPM Adjustment Procedure detailed on page 156.

High-speed mode

9) Run the drive in high-speed mode (Balanced, Full-load and Empty Car) and observe operation…if operational issues please refer to the Performance Adjustments section.

This completes the recommended open-loop start-up procedure.

Motor RPM Adjustment Procedure

- Run the car in the UP direction
  - measure and record the car speed using a hand tach on the sheave (wait for speed to stabilize)

  OR
  - time one complete rotation of the sheave and record the time (in seconds) it takes for exactly one sheave rotation
- Run the car in the DOWN direction
  - measure and record the car speed using a hand tach on the sheave (wait for speed to stabilize)

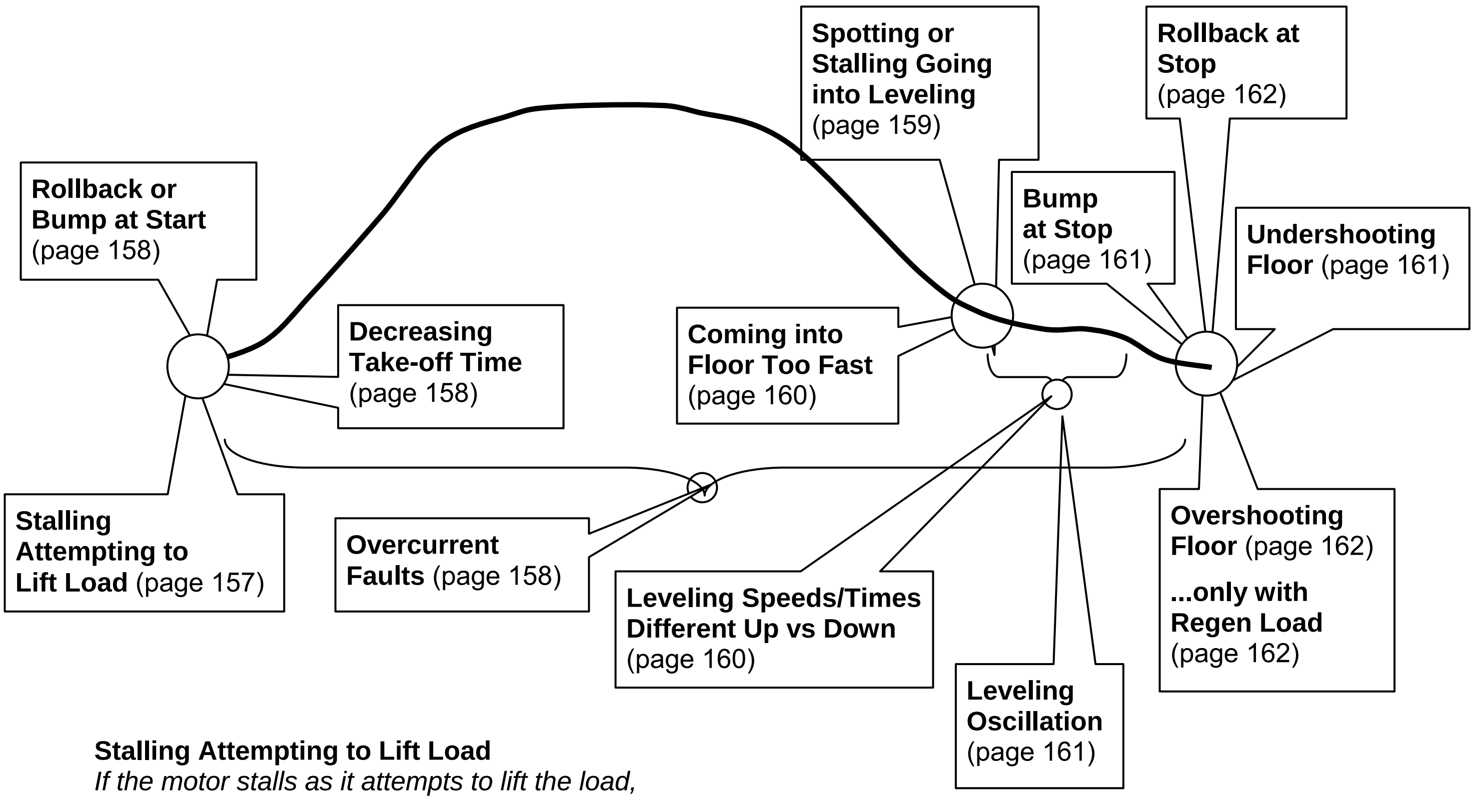
  OR
  - time one complete rotation of the sheave and record the time (in seconds) it takes for exactly one sheave rotation
- If the speeds/times are different UP vs. DOWN…increment or decrement the RATED MTR SPEED (A5) parameter and run UP and DOWN again
- Continue until the speeds/times UP vs. DOWN are the same.

  Note: If an OVERCURR FLT occurs, refer to “Overcurrent Faults” in the Performance Adjustments section (page 158)

  Note: If stalling occurs when attempting to lift the load, refer to “Stalling Attempting to Lift Load” in the Performance Adjustments section (page 157). Additionally, sometimes the adjustments made to help with stalling attempting to lift load can be set to default once the RATED MTR SPEED (A5) parameter is adjusted properly.

Appendix

Open-Loop Performance Adjustments



Stalling Attempting to Lift Load

If the motor stalls as it attempts to lift the load, then until resolved, try the following (in order):

1. Increase the Torque Boost Gain parameter
2. Adjust the Motor Stator Resistance parameter
3. Adjust the Motor Mid Voltage parameter

Note: if no performance change is observed after any one step, set any changed value(s) back to the original value(s) before proceeding onto the next step.

<u>Increase the Torque Boost Gain Parameter</u>

- The Torque Boost function is defaulted off (TORQ BOOST GAIN (A1)= 0).
- Increase the TORQ BOOST GAIN (A1) in 0.1 intervals and observe performance.

<u>Adjust the Motor's Stator Resistance</u>

- Measure the stator resistance by completing the procedure detailed on page 162.
- If still stalling after measuring stator resistance, additionally increase STATOR RESIST (A5) parameter by increments of 0.1 and observe performance

<u>Adjust the Motor Mid Voltage Parameter</u>

- Complete the Mid-volts Adjustment Procedure detailed on page 163.
- If still stalling after completing mid-volts adjustment procedure, additionally increase MOTOR MID VOLTS (A5) parameter by increments of 0.5 and observe performance

Note: Avoid increasing the MOTOR MID VOLTS (A5) parameter too high, since this effects stopping performance (i.e. coming into the floor too fast) or can create Overcurrent Faults

Rollback or Bump at Start

If rollback is observed or a bump is felt at the start, then until resolved, try the following (in order):

1. Verify Mechanical Brake Timing
2. Increase DC Injection Start Level

Note: if no performance change is observed after any one step, set any changed value(s) back to the original value(s) before proceeding onto the next step.

<u>Verify Mechanical Brake Timing</u>

- The mechanical brake should be picked during the DC injection start time (DC START TIME (A1) parameter), see “Mechanical Brake Timing at Start” on page 163.

<u>Increase DC Injection Start Level</u>

- Increase the DC START LEVEL (A1) parameter by increments of 5% and observe performance.

Decreasing Take-off Time

The following can help to decrease take-off time, try the following (in order):

1. Increase DC Injection Start Level
2. Increase the Accel S-curve parameters
3. Increase the Torque Boost Gain parameter

Note: if no performance change is observed after any one step, set any changed value(s) back to the original value(s) before proceeding onto the next step.

<u>Increase DC Injection Start Level</u>

- Increase the DC START LEVEL (A1) parameter by increments of 5% and observe performance.

<u>Increase the Accel S-curve parameters</u>

- Increase take-off jerk rate via ACCEL JERK IN x (A2) parameter
- Increase acceleration rate via ACCEL x (A2) parameter

Note: When increasing both jerk and accel rates, watch for Overcurrent Faults or decreased ride quality. If these occur, set the rates back to the original values.

<u>Increase the Torque Boost Gain Parameter</u>

- The Torque Boost function is defaulted off (TORQ BOOST GAIN (A1)= 0).
- Increase the TORQ BOOST GAIN (A1) in 0.1 intervals and observe take-off time and performance.

Note: When increasing the torque boost, watch for Overcurrent Faults or decreased ride quality. If these occur, set the gain back.

Overcurrent Fault

If an “OVERCURR FLT” occurs it can indicate the s-curve settings are too high (jerk, accel, decel rates) or too much motor voltage is generated. Until resolved, try the following (in order):

1. Verify Mechanical Brake Timing
2. Verify Torque Limits
3. Decrease the S-curve parameters
4. Verify Motor Min/Mid Voltage parameters
5. Increase DC Injection Start Level
6. Measure the Motor’s Stator Resistance
7. Decrease the Torque Boost

Note: if no change is observed after any one step, set any changed value(s) back to the original value(s) before proceeding onto the next step.

<u>Verify Mechanical Brake Timing</u>

- The mechanical brake should be lifted before the drive is given a non-zero speed command
- The mechanical brake should be picked during the DC injection start time (DC START TIME (A1) parameter), see “Mechanical Brake Timing at Start” on page 163.

<u>Verify Torque Limits</u>

- The Torque Limits are defaulted at 200% (MTR TORQUE LIMIT(A1) and REGEN TORQ LIMIT(A1)= 200%).
- Decrease MTR TORQUE LIMIT (A1) and REGEN TORQ LIMIT (A1) parameters until default (200%). Note: may need to set torque limits below 200% if motor’s current rating is larger than the drive’s current rating

<u>Decrease the S-curve Parameters</u>

- Decrease jerk rates via
  - ACCEL JERK IN x (A2),
  - ACCEL JERK OUT x (A2)
  - DECEL JERK IN x (A2)
  - DECEL JERK OUT x (A2)
- Decrease accel/decel rates via
  - ACCEL x (A2),
  - DECEL x (A2)

<u>Verify Motor Min/Mid Voltage Parameters</u>

- MOTOR MID VOLTS (A5) and MOTOR MIN VOLTS (A5) parameters should usually be set at default, see Table 24 on page 155.
- These parameters would only be adjusted slightly with certain issues (see Stalling Attempting to Lift Load (page 157); Spotting or Stalling Going

into Leveling (page 159); or Overshooting Floor only with Regen Load (page 162)).

Increase DC Injection Start Level

- Increase the DC START LEVEL (A1) parameter by increments of 5% and observe performance.

Measuring the Stator Resistance

- Complete the procedure detailed on page 162.

Decrease the Torque Boost

- Decrease TORQ BOOST GAIN (A1) parameter in increments of 0.1 until the fault goes away or zero is reached (and the function is turned off)
- Secondly, decrease STATOR RESIST (A5) parameter in increments of 0.1% Note: set TORQ BOOST GAIN (A1)=0, before adjusting STATOR RESIST (A5))

Spotting or Stalling Going into Leveling

If the motor stalls or spots as it transitions from deceleration to leveling speed then until resolved, try the following (in order):

1. Decrease Decel Jerk Out and Decel Rates
2. Increase the Torque Boost Gain parameter
3. Measure the Stator Resistance
4. Adjust the Motor Mid Volts parameter

Note: if no performance change is observed after any one step, set any changed value(s) back to the original value(s) before proceeding onto the next step.

Decrease Decel Jerk Out and Decel Rates

- Decrease jerk rate via DECEL JERK OUT x (A2) parameter and observe performance
- Secondly, decrease decel rate via DECEL RATE x (A2) parameter and observe performance

Note: the combination of these two parameters is usually primary cause of spotting or stalling going into leveling

Increase the Torque Boost Gain Parameter

- The Torque Boost function is defaulted off (TORQ BOOST GAIN (A1)= 0).
- Increase the TORQ BOOST GAIN (A1) in 0.1 intervals and observe performance.

Measure the Stator Resistance

- Measure the stator resistance by completing the procedure detailed on page 162 and observe performance.

Adjust the Motor Mid Volts parameter

- Complete the Mid-volts Adjustment Procedure detailed on page 163 and observe performance.

Note: Avoid increasing the MOTOR MID VOLTS (A5) parameter too high, since this effects stopping performance (i.e. coming into the floor too fast) or can create Overcurrent Faults

Coming into Floor Too Fast

If the car is coming into the floor too fast then until resolved, try the following (in order):

1. Decrease Decel Jerk Out and Decel Rates
2. Decrease Motor Mid Voltage parameter

Note: if no performance change is observed after any one step, set any changed value(s) back to the original value(s) before proceeding onto the next step.

Decrease Decel Jerk Out and Decel Rates

- Decrease jerk rate via DECEL JERK OUT x (A2) parameter and observe performance
- Secondly, decrease decel rate via DECEL RATE x (A2) parameter and observe performance

Decrease the Motor Mid Voltage Parameter

- MOTOR MID VOLTS (A5) and MOTOR MIN VOLTS (A5) parameters should usually be set at default, see Table 24 on page 155.
- These parameters would only be adjusted slightly with certain issues (see Stalling Attempting to Lift Load (page 157); Spotting or Stalling Going into Leveling (page 159); or Overshooting Floor only with Regen Load (page 162)).
- Decrease MOTOR MID VOLTS (A5) parameter (decrease increments of 0.5 and observe performance)

Note: When decreasing the Motor Mid Volts parameter, watch that the drive does not start stalling (especially with full-load)

Leveling Times Different Up vs. Down

If the elevator exhibits significantly different leveling speeds/times up vs. down then until resolved, try the following (in order):

1. Verify the Slip Compensation parameters
2. Complete Motor RPM Adjustment Procedure

Verify Slip Compensation parameters

- Verify SLIP COMP TIME (A1) parameter is at default of 1.50.
- Verify SLIP COMP GAIN (A1) parameter is at default of 1.00.

Complete Motor RPM Adjustment Procedure

- At Empty Car, run the drive at 10% of contract speed and complete the Motor RPM Adjustment Procedure detailed on page 156.
- At Full-load, run the drive at 10% of contract speed and complete the Motor RPM Adjustment Procedure detailed on page 156.

Leveling Oscillation

If the elevator exhibits a leveling speed oscillation then until resolved, try the following (in order):

1. Increase the Hunt Prevention Time Parameter
2. Decrease Distortion Loop Gain parameters

Note: if no performance change is observed after any one step, set any changed value(s) back to the original value(s) before proceeding onto the next step.

<u>Increase the Hunt Prevention Time Parameter</u>

- The Hunt Prevention Time Constant is defaulted as 0.2 seconds (HUNT PREV TIME (A4)= 0.2).
- Increase the HUNT PREV TIME (A4) parameter in 0.1 intervals and observe performance.
- Note: if no performance change is observed, set the values back to default

<u>Decrease the Distortion Loop Gain Parameters</u>

- The Distortion Loop Gain parameters are defaulted at Id DIST LOOP GN (A4) = 0.50 and Iq DIST LOOP GN (A4) = 0.30
  Note: to view these parameter enabled hidden items (HIDDEN ITEMS (U2) = enabled)
- Decrease Id DIST LOOP GN (A4) and Iq DIST LOOP GN (A4) parameters in 0.1 intervals and observe performance.
- Note: if no performance change is observed, set the values back to default

Bump at Stop

If a bump is felt at the stop, then until resolved, try the following (in order):

1. Verify Mechanical Brake Timing
2. Decrease Decel Jerk Out Rate
3. Decrease DC Injection Stop Frequency

Note: if no performance change is observed after any one step, set any changed value(s) back to the original value(s) before proceeding onto the next step.

<u>Verify Mechanical Brake Timing</u>

The mechanical brake should be dropped during the DC injection stop time (DC STOP TIME (A1) parameter), see “Mechanical Brake Timing at Stop” on page 163.

<u>Decrease Decel Jerk Out Rate</u>

- Decrease jerk rate via DECEL JERK OUT x (A2) parameter and observe performance.

<u>Decrease DC Injection Stop Frequency</u>

- Decrease the DC STOP FREQ (A1) parameter in increments of 0.1 Hz and observe performance.

Undershooting Floor

If the car is undershooting the floor then until resolved, try the following (in order):

1. Verify Mechanical Brake Timing
2. Increase Leveling Speed
3. Decrease Decel Jerk Out and Decel Rates

Note: if no performance change is observed after any one step, set any changed value(s) back to the original value(s) before proceeding onto the next step.

<u>Verify Mechanical Brake Timing</u>

The mechanical brake should be dropped during the DC injection stop time (DC STOP TIME (A1) parameter), see “Mechanical Brake Timing at Stop” on page 163.

<u>Increase Leveling Speed</u>

- Increase leveling speed and observe performance

<u>Increase Decel Jerk Out and Decel Rates</u>

- Decrease jerk rate via DECEL JERK OUT x (A2) parameter and observe performance
- Secondly, decrease decel rate via DECEL RATE x (A2) parameter and observe performance

Overshooting Floor

If the car is overshooting the floor then until resolved, try the following (in order):

- Verify Mechanical Brake Timing
- Decrease Leveling Speed
- Increase Decel Jerk Out and Decel Rates
- Decrease Motor Mid Voltage parameter

Note: if no performance change is observed after any one step, set any changed value(s) back to the original value(s) before proceeding onto the next step.

Verify Mechanical Brake Timing

The mechanical brake should be dropped during the DC injection stop time (DC STOP TIME (A1) parameter), see “Mechanical Brake Timing at Stop” on page 163.

Decrease Leveling Speed

- Decrease leveling speed and observe performance
- Note: practical minimum for leveling speed is about 2.5 Hz.

Increase Decel Jerk Out and Decel Rates

- Increase jerk rate via DECEL JERK OUT x (A2) parameter and observe performance
- Secondly, increase decel rate via DECEL RATE x (A2) parameter and observe performance
- Note: When increasing the Decel and Jerk Rates watch for spotting or stalling.

Decrease the Motor Mid Voltage Parameter

- Decrease MOTOR MID VOLTS (A5) parameter (decrease increments of 0.5 and observe performance)
- Note: When decreasing the Motor Mid Volts parameter, watch that the drive does not start stalling (especially with full-load)

Overshooting Floor only with Regen Load

If the car overshoots the floor only with a regen load (i.e. empty-up) then:

- Verify the car DOES NOT overshoot with balanced car and empty-down…if it does refer to Overshooting Floor section on page 162.
- If only overshoots empty-up, increase MOTOR MIN VOLTS (A5) in increments of 0.1 V and observe performance.

Note: if no performance change is observed, set the Motor Min Volts parameter to the original value.

Rollback at Stop

If rollback is observed at the stop, then until resolved, try the following (in order):

1. Verify Mechanical Brake Timing
2. Decrease Decel Jerk Out Rate
3. Increase DC Injection Stop Level

Note: if no performance change is observed after any one step, set any changed value(s) back to the original value(s) before proceeding onto the next step.

Verify Mechanical Brake Timing

The mechanical brake should be dropped during the DC injection stop time (DC STOP TIME (A1) parameter), see “Mechanical Brake Timing at Stop” on page 163.

Decrease Decel Jerk Out Rate

- Decrease jerk rate via DECEL JERK OUT x (A2) parameter and observe performance.

Increase DC Injection Stop Level

- Increase the DC STOP LEVEL (A1) parameter in increments of 5% and observe performance.

Measuring Stator Resistance Procedure

The stator resistance value can be measured by:

- Remove any two motor wires directly at the terminals of the motor. Since the stator resistance is low, the resistance needs to be measured at the motor terminals in order to avoid the resistance of the motor wires
- Connect the two meter leads together and measure the resistance of the meter leads in ohms (*meter resistance*). Since the stator resistance is low, the resistance of the meter leads need to be taken into account.

- Measure the resistance between the two motor terminals in ohms (*stator resistance*)
- With the motor nameplate values entered in the A5 menu, use the BASE IMPEDANCE (D2) value (in ohms) to calculate the STATOR RESIST (A5) parameter (as a percentage of base impedance):

$$= \frac{\textit{stator resistance - meter resistance}}{\text{2 x BASE IMPEDANCE (D2)}} \times 100$$

Mid-volts Adjustment Procedure

- Run the drive (Balanced) at 10% of contract speed
- Verify the running currents are approximately equal in both directions. The middle voltage level (via MOTOR MID VOLTS (A5) parameter) should be adjusted in 1 or 2 volt increments and the current monitored in both the up and down directions until the running currents are approximately equal.
- Note: If the middle voltage is set too high, the drive will begin to trip on over current faults during normal operation or effect stopping performance (i.e. coming into the floor too fast)
- Note: If after raising the midpoint voltage spotting again begins to occur, set mid voltage back to previous value

Mechanical Brake Timing at Start

The mechanical brake should be picked during the DC injection start time (DC START TIME (A1) parameter).

- But allow 0.5 seconds for the motor to build up flux before lifting the mechanical brake.
- Also, do not have the DC injection last more than 0.5 seconds after the mechanical brake is lifted.
- If drive controls the mechanical brake, the DC inject start time should be at least 0.5 seconds greater than the brake pick delay (BRAKE PICK DELAY (A1)).
- AUTO STOP EN (C1) parameter
  - Enabled - The drive will start DC injection phase when it receives a run command and a non-zero speed command.
  - Disabled - The drive will start DC injection phase when it receives a run command.

Mechanical Brake Timing at Stop

The mechanical brake should be dropped during the DC injection stop time (DC STOP TIME (A1) parameter).

- But allow additional stopping dc injection time after the mechanical brake is dropped for it to close.
- If drive controls the mechanical brake via BRAKE PICK logic output, the DC inject stop time should be greater than the brake pick delay (BRAKE PICK DELAY (A1)) by the time it takes for the mechanical brake to close.
- AUTO STOP ENA (C1)=DISABLED STOPPING MODE SEL (C1) =
  - RAMP
    - Run command removed - the drive will ramp to DC injection phase.
    - Commanding zero speed - the drive will try to hold zero speed (not DC injection).
  - IMMEDIATE
    - Run command removed - the drive will immediate turn off its outputs (coast to stop).
    - Commanding zero speed - the drive will ramp to DC injection phase.
- AUTO STOP ENA (C1) =ENABLED STOPPING MODE SEL (C1) =
  - RAMP
    - Run command removed - the drive will ramp to DC injection phase.
    - Commanding zero speed - the drive will ramp to DC injection phase.
  - IMMEDIATE
    - Run command removed - the drive will immediately turn off its outputs (coast to stop).
    - Commanding zero speed - the drive will immediately turn off its outputs (coast to stop).

Appendix

DCP 4 Setup and Calibration

The commissioning and setup of the HPV900S2 in DCP 4 mode is relatively simple, all that is required is the calibration of the drive to ensure the actual elevator speed exactly matches our commanded speed – this is essential for accurate leveling accuracy and good performance

Activating DCP4

To activate DCP4 simply navigate to SERIAL MODE (C1) parameter and change to DCP4. **Note**: The control system need to have the ability to operate in DCP4 mode and must also have the relevant settings enabled.

Equalizing speeds

Once the elevator is traveling at contract speed and all learn runs have been completed the calibration can take place.

In the HPV900S2, navigate to the CONTRACT CAR SPEED (A1) parameter and make a note of the speed entered (this should be the same as the V4 speed in the A3 menu of the drive).

Next navigate to the CONTRACT MOTOR SPEED (A1) parameter and make a note of the value also.

Next you need to run the elevator and accurately monitor the speed at which the elevator is traveling, this is usually possible within the control system however if required the speed of the elevator could be monitored with a hand tachometer.

Take the elevator to the top floor and then run it to the bottom floor at high speed, make a note of the speed displayed whilst the elevator is traveling record the actual speed the elevator is traveling at (either from within the control systems processor or my manually monitoring it).

If this speed is not exactly the same as the speed displayed in the CONTRACT CAR SPEED, use the previously noted data in to the following formula:

$$\left(\frac{\begin{pmatrix}\text{Contract}\\ \text{Car Spd}\end{pmatrix}}{\begin{pmatrix}\text{Actual}\\ \text{Travel Spd}\end{pmatrix}}\right)\times\begin{pmatrix}\text{Contract}\\ \text{Motor Spd}\end{pmatrix}=\begin{pmatrix}\text{New Contract}\\ \text{Motor Spd}\end{pmatrix}$$

It is then recommended the process is repeated to verify the actual speed now accurately reflects the commanded speed. If it matches then the process is complete, if not restart the process.

Appendix

Testpoints (Control Board)

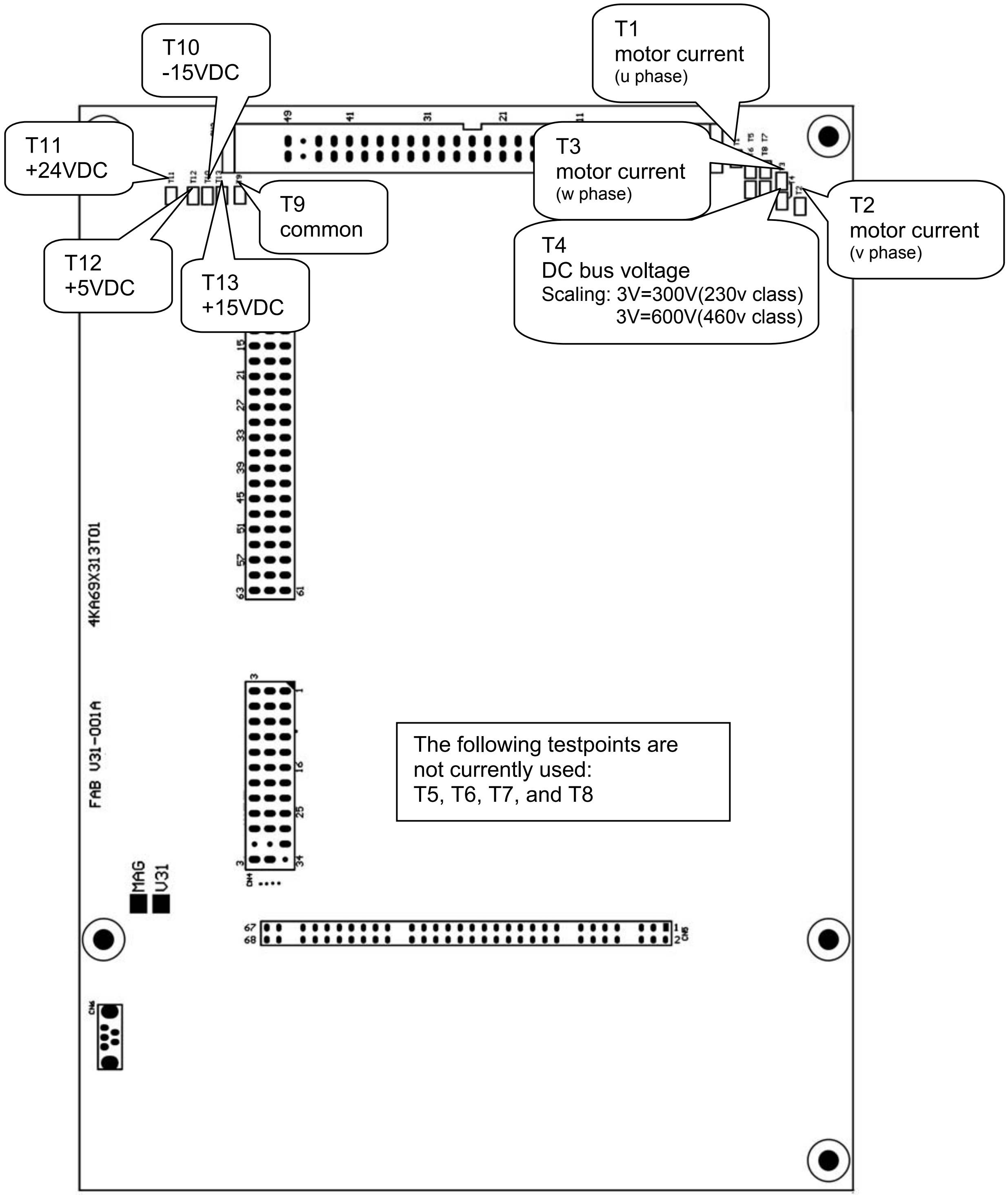


Figure 46: Main Board Testpoints

Appendix

Testpoints (EnDat Option Card - Power Supplies)

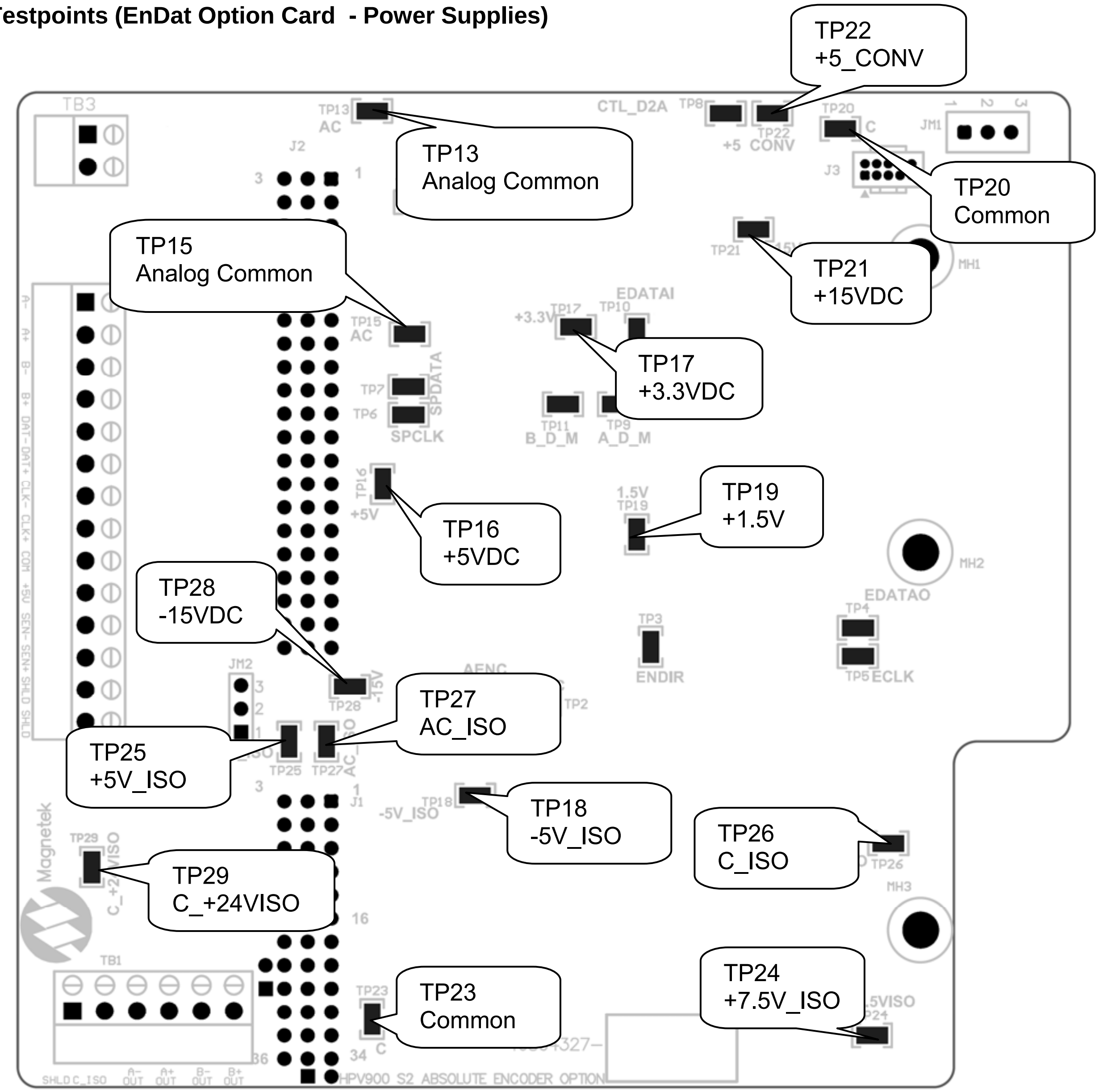


Figure 47: EnDat Option Card Power Supply Testpoints

Appendix

Testpoints (EnDat Option Card - Other)

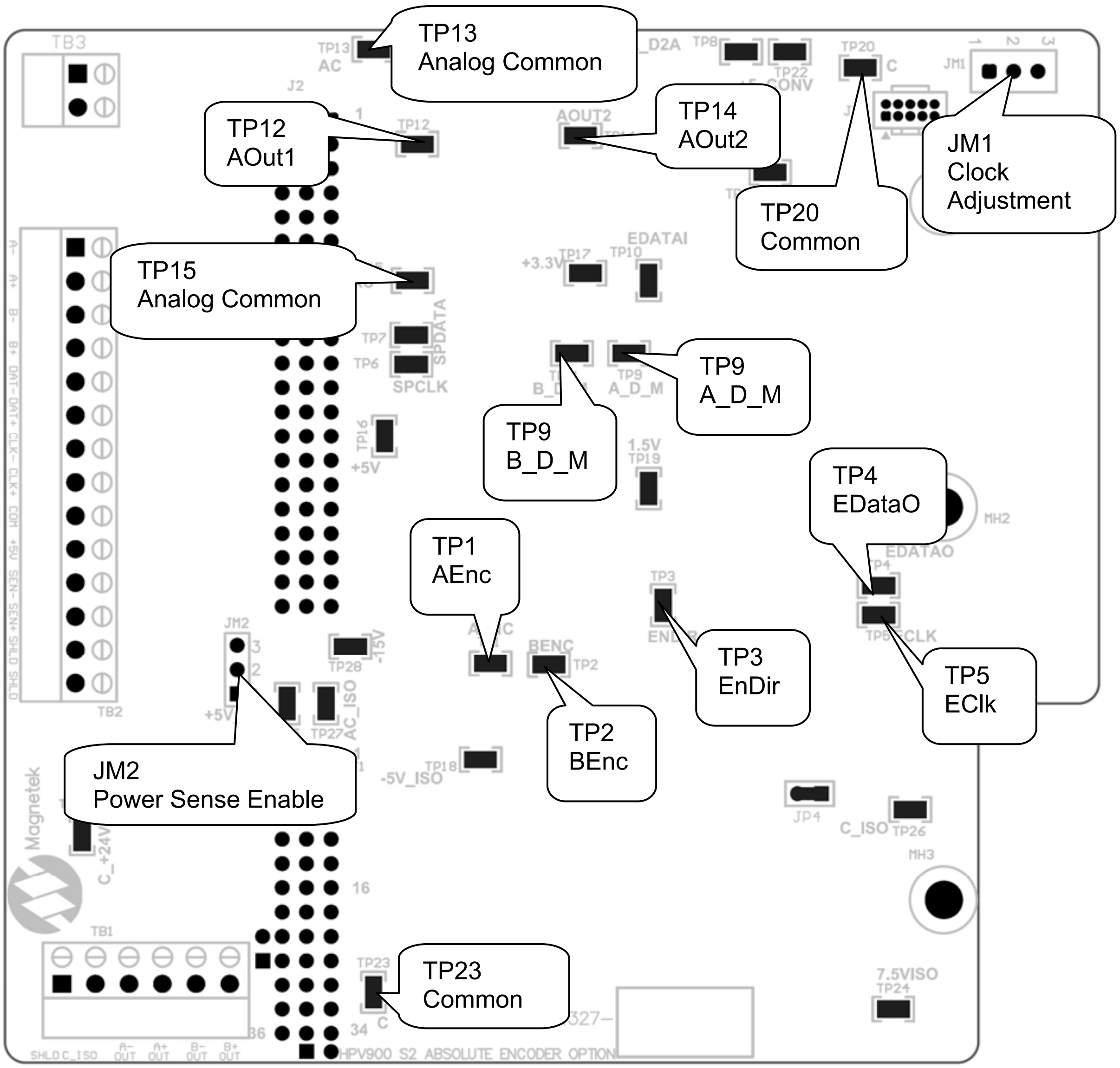


Figure 48: EnDat Option Card Other Testpoints

For long encoder cables (15m/50ft), it is recommended to connect the –SENSE and +SENSE lines into the terminal block. The drive will automatically produce proper voltage on the encoder if JM2 is set to position 2-3. If JM2 is set to position 1-2, the remote power sense is disabled and the sense wires do not need to be connected.

In addition to remote power sense for long cable lengths, JM1, the serial clock, should be set to position 2-3. For shorter cable lengths, JM1 should stay in position 1-2.

Appendix

Elevator Duty Cycle

The HPV 900 Series 2 Ratings Table has the following two continuous current ratings:

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

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

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

Rated Full-Load Current

Rated Current From the Elevator System Load Profile

Rated Input Voltage	NA* Rated HP	EU* Rated HP	NA* Rated kW	EU* Rated kW	Continuous Output Current General Purpose Rating	Continuous Output Current Elevator Duty Cycle** Rating	Maximum Output Current for 5 Sec	Frame Size***	Model Number****
230V	7.5	--	5.5	--	25	27	62.5	2	HPV900-2025-2E1-01
	10	--	7.5	--	31	33	77.5	2	HPV900-2031-2E1-01
	15	--	11	--	41	44	102.5	4	HPV900-2041-2E1-01
	20	--	15	--	52	56	130	4	HPV900-2052-2E1-01
	25	--	19	--	75	80	187.5	4	HPV900-2075-2E1-01
	30	--	22	--	88	94	220	4	HPV900-2088-2E1-01
	40	--	30	--	98	105	245	5	HPV900-2098-2E1-01
460V	5	5	3.7	3.7	8	9	20	1	HPV900-4008-2E1-01
	7.5	5.5	5.5	4	12	13	30	2	HPV900-4012-2E1-01
	10	7.5	7.5	5.5	16	17	40	2	HPV900-4016-2E1-01
	15	10	11	7.5	21	23	52.5	3	HPV900-4021-2E1-01
	20	15	15	11	27	29	67.5	3	HPV900-4027-2E1-01
	25	20	19	15	34	36	85	4	HPV900-4034-2E1-01
	30	25	22	18.5	41	44	102.5	4	HPV900-4041-2E1-01
	40	30	30	22	52	56	130	4	HPV900-4052-2E1-01
	50	40	37	30	65	70	162.5	5	HPV900-4065-2E1-01
	60	50	45	37	72	77	180	5	HPV900-4072-2E1-01
	75	60	56	45	96	103	240	5	HPV900-4096-2E1-01

Range for continuous current operation

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

For more information on altitude, temperature, and carrier frequency derating, see Drive Derating on page 15.
** NA refers to drives sold in North America and ratings are based off of 460VAC input. EU refers to drives sold in Europe and are based off of 400VAC input*
*** For more information on the Elevator Duty Cycle Rating, see page 168*
**** Cube size dimensions, mounting holes, and weights are shown in Dimensions, Mounting Holes and Weights on page 172*
***** From more information on model numbers, see page 15.*

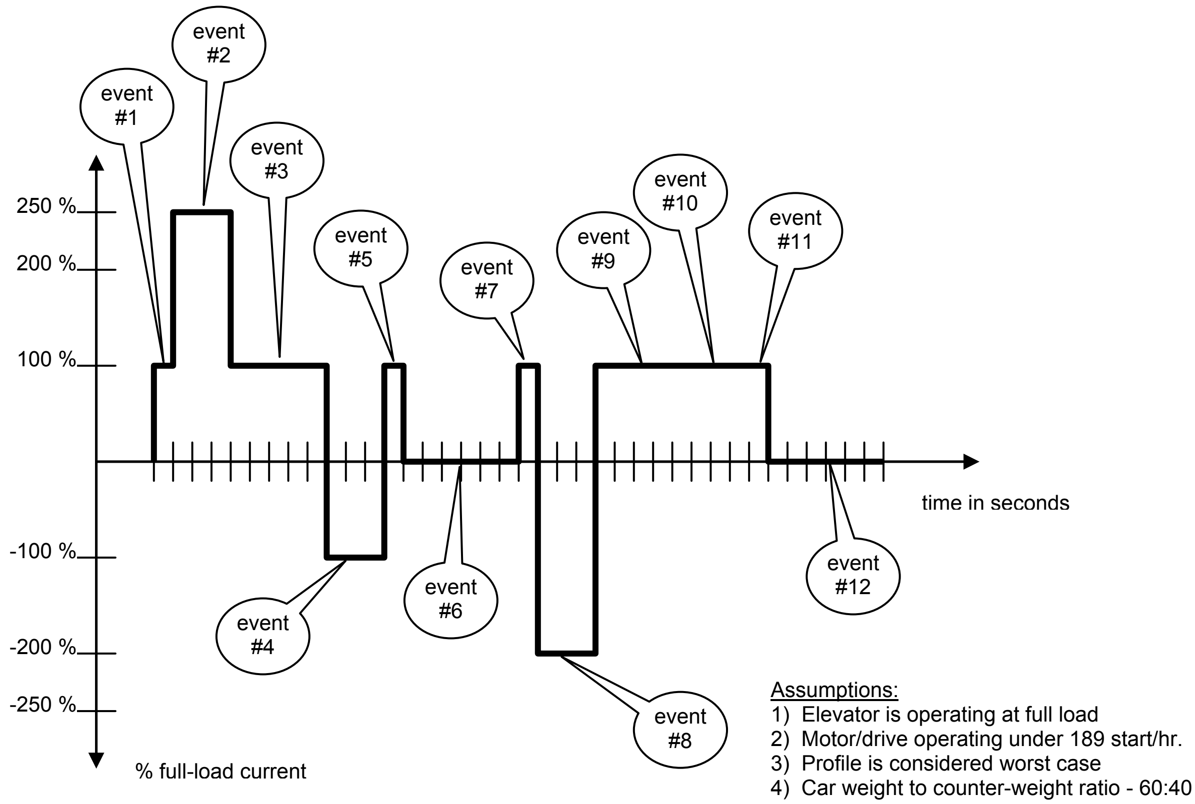


Figure 49: Elevator System Load Profile

Event	Description	Time (s)	Current (per unit)	Current (% full load)	(I^2t)
1	Pre torque	1	1	100%	1.0
2	Accel up	3	2.5	250%	18.75
3	Cruise	5	1	100%	5.0
4	Decel up	3	1	100%	3.0
5	Post torque	1	1	100%	1.0
6	Rest	6	0	0%	0.0
7	Pre torque	1	1	100%	1.0
8	Accel down	3	2	200%	12
9	Cruise	5	1	100%	5.0
10	Decel down	3	1	100%	3.0
11	Post torque	1	1	100%	1.0
12	Rest	6	0	0%	0.0
	Total	38			50.75
				RMS Per Unit Current for Load Profile	1.16
				Percentage of Full-Load Current for Load Profile	107%
				Cycles per hour	95
				Starts per hour	189

Table 27: Elevator System Load Profile

Appendix

CE Guidelines

Below are guidelines for CE compliance.

Standards

EN 12015	Electromagnetic compatibility Emission
EN 12016	Electromagnetic compatibility Immunity

Recommended Line Filter

A line filter must be connected between the main power supply and input three phase input terminals to comply with the standards listed above. Line Filter Selection on page 184 lists the recommended line filters to be used with HPV 900 Series 2 drives.

Installation Guidelines for EMI/RFI Issues

The HPV 900 Series 2 drive should be installed in a control panel or metal enclosure. Enclosure manufacturers' designs vary and it is not the intent of this document to cover all designs. Some designs require different countermeasures than other designs. This paper covers only the general points of enclosure design when the HPV 900 Series 2 drive is used.

Countermeasures For the Enclosure

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

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

Problems related to these emissions include:

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

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

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

Modifications to the enclosure include the following:

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

Enclosure Door Construction

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

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

Wiring External to the Enclosure

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

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

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

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

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

Wiring Internal to the Enclosure

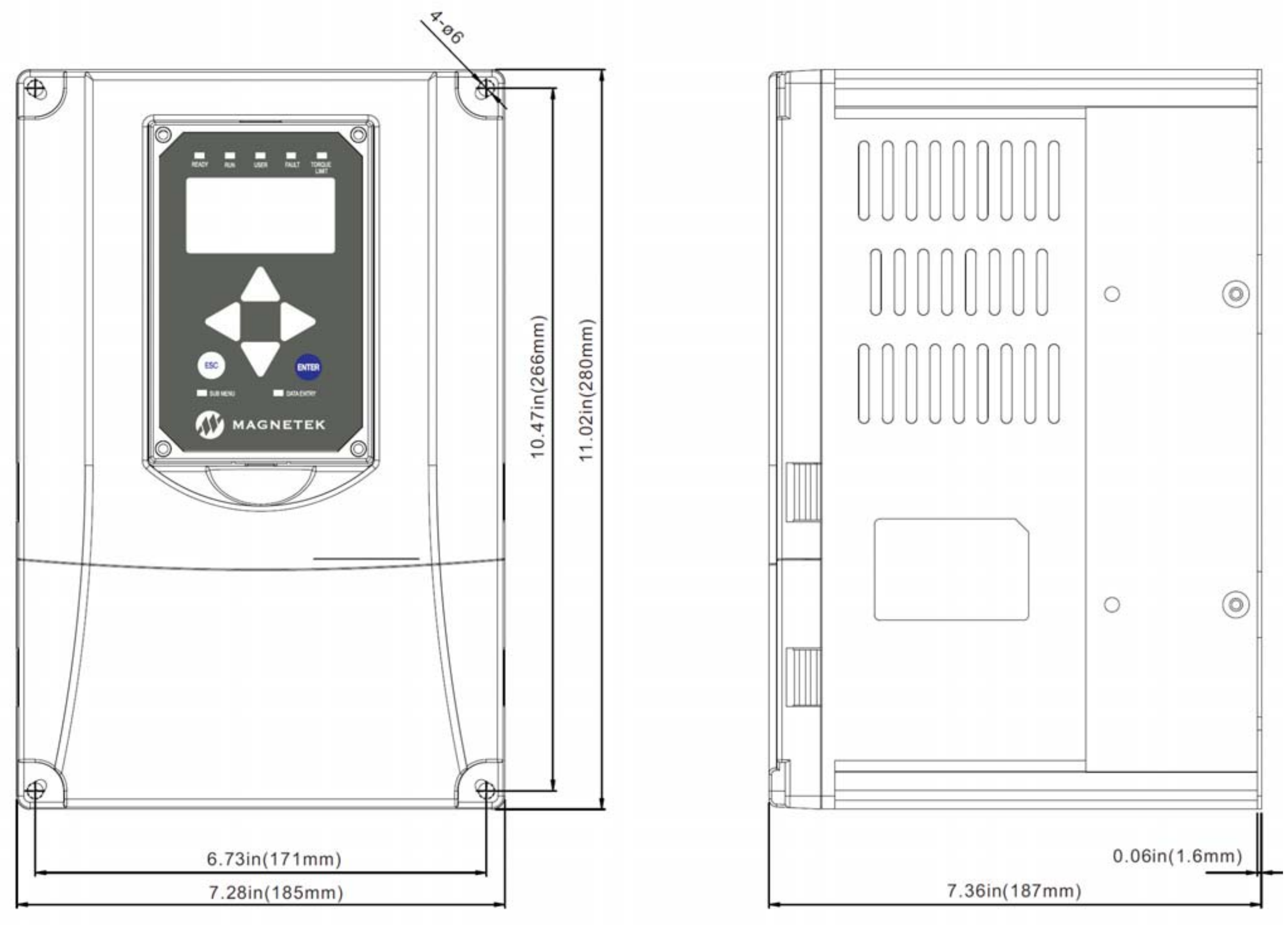
The most effective treatment for cables is shielding. Screened / shielded cable is recommended within the control panel. Use cables with a woven screen. The screen of the cable should be securely grounded using the largest area and shortest distance practical. Shield terminations must be as short as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

Panel Layout

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

Appendix

Dimensions, Mounting Holes, & Weights



Notes : Weight =14.7lbs (6.7kg)

Figure 50: Frame 1 Dimensions and Mounting Holes

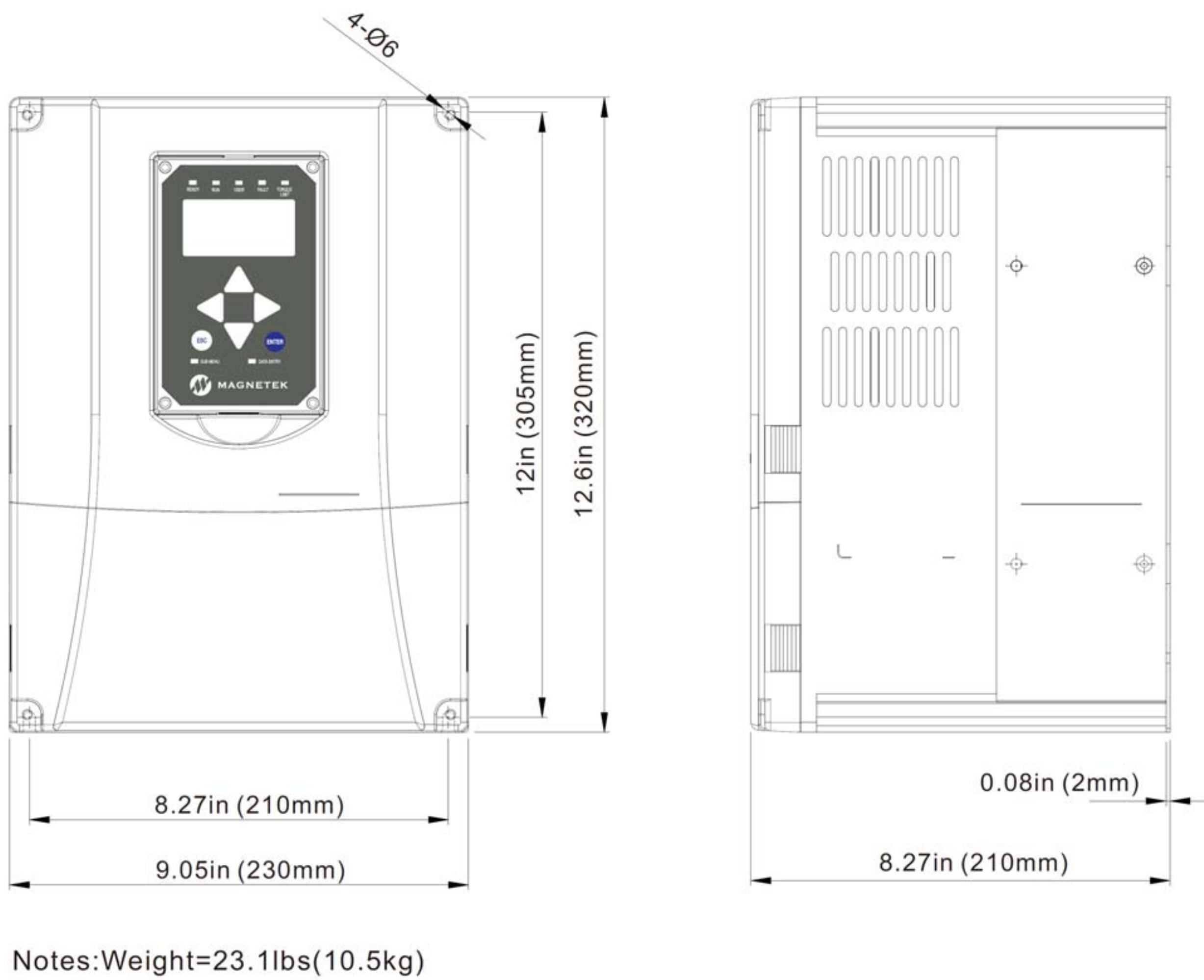


Figure 51: Frame 2 Dimensions and Mounting Holes

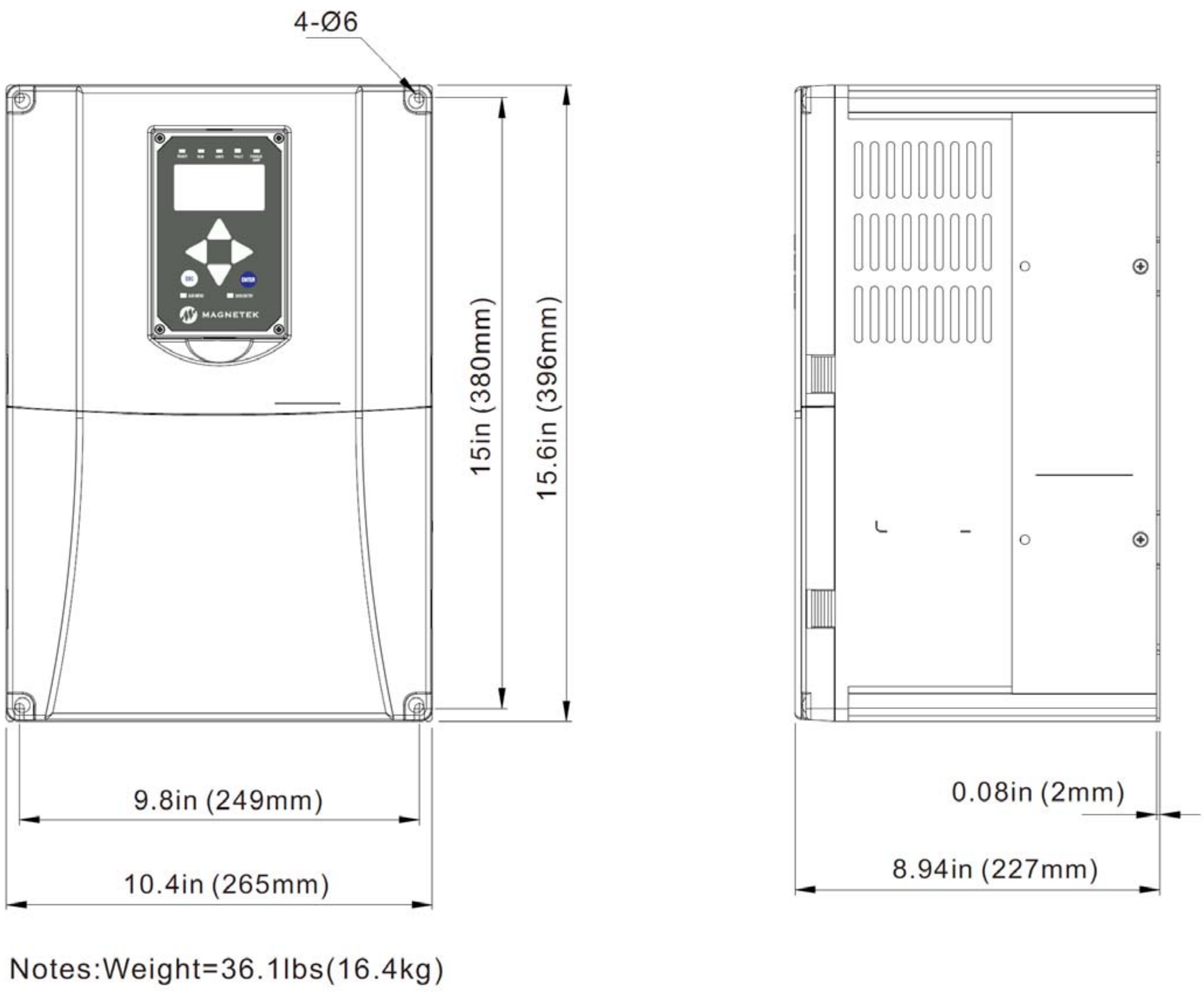
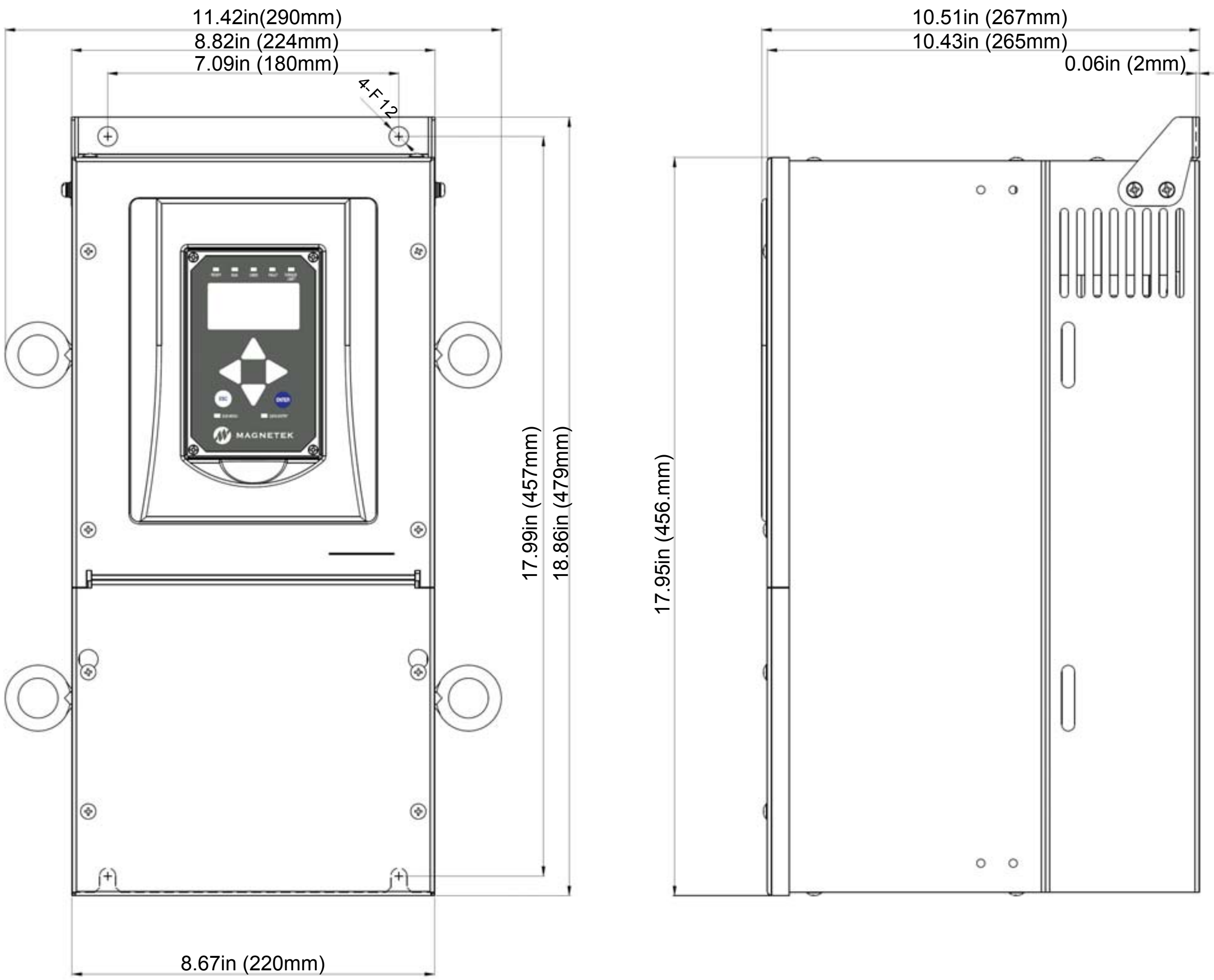


Figure 52: Frame 3 Dimensions and Mounting Holes



Notes: Weight = 70.6lbs (32kg)

Figure 53: Frame 3.5 Dimensions and Mounting Holes

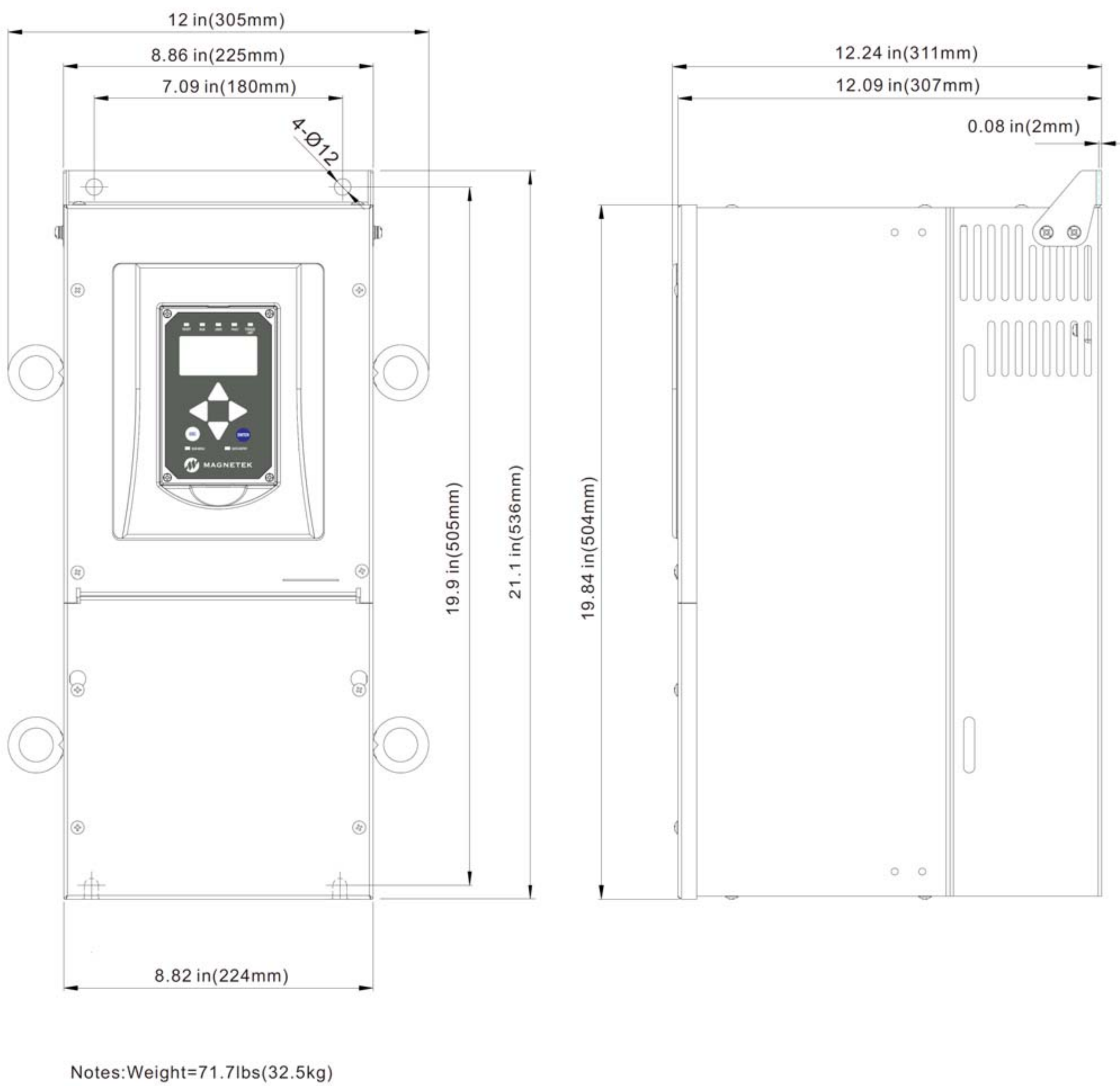
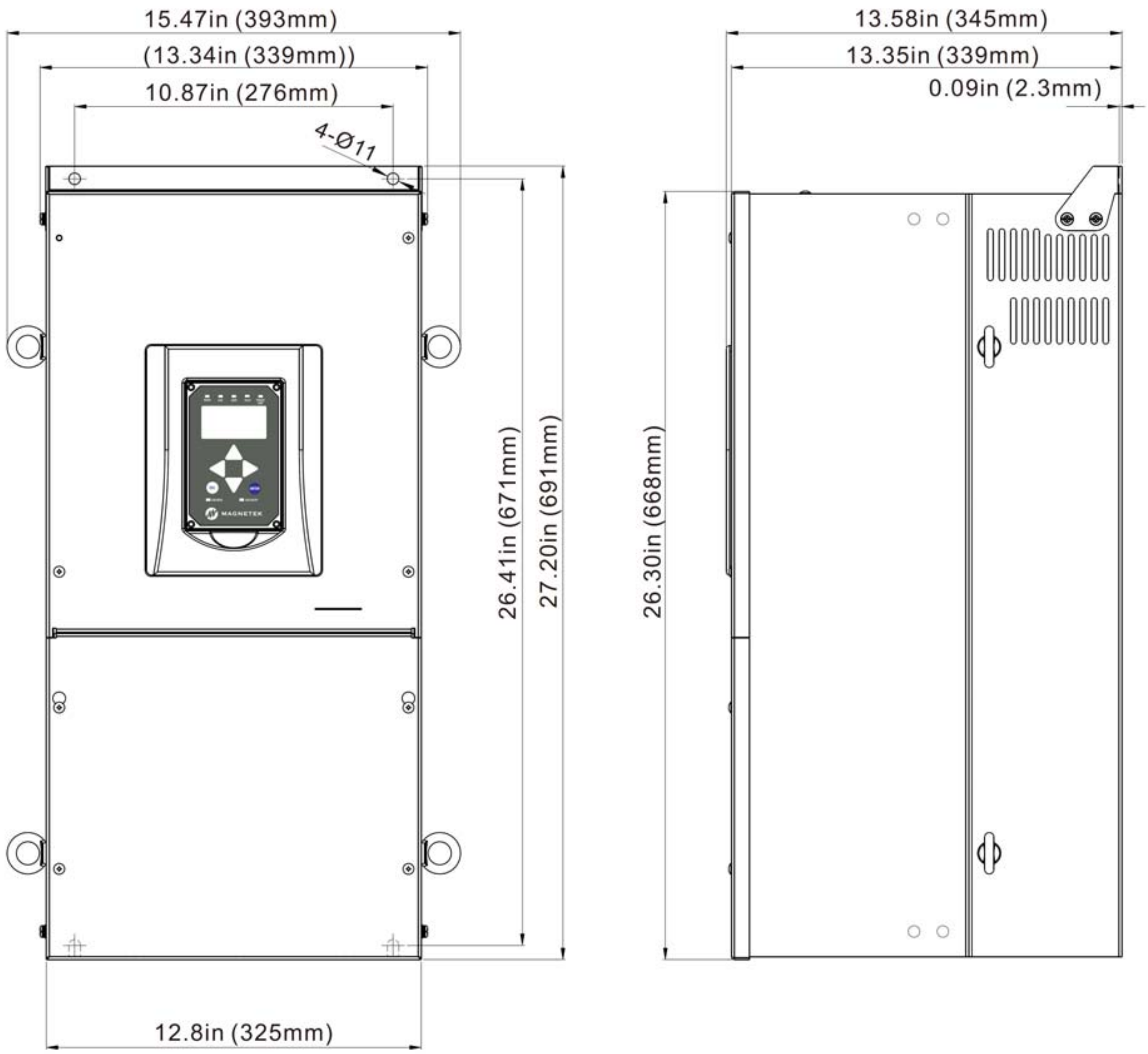


Figure 54: Frame 4 Dimensions and Mounting Holes



Notes : Weight =121lbs (55kg)

Figure 55: Frame 5 Dimensions and Mounting Holes

Appendix

Dynamic Braking Resistor Selection – Worm Gear

Drive Model	Power Dissipation kW (Worm Gear)	Resistor Value Range (Worm Gear)	Magnetek Part Number (North America)	Magnetek Part Number (Europe)
HPV900-4008-2E1-01	0.8	162Ω - 53Ω	HPV-00856-DB	DBR-4008-WG
HPV900-4012-2E1-01	1.2	109Ω - 32Ω	HPV-01735-DB	DBR-4012/16-WG
HPV900-4016-2E1-01	1.6	80Ω - 32Ω	HPV-01735-DB	DBR-4012/16-WG
HPV900-4021-2E1-01	2.4	53Ω - 16Ω	HPV-02523-DB	DBR-4021/27-WG
HPV900-4027-2E1-01	3.2	40Ω - 16Ω	HPV-03521-DB	DBR-4021/27-WG
HPV900-4034-2E1-01	4.0	33Ω - 8Ω	HPV-05308-DB	DBR-4034/41-WG
HPV900-4041-2E1-01	4.8	27Ω - 8Ω	HPV-05308-DB	DBR-4034/41-WG
HPV900-4052-2E1-01	6.4	20Ω - 8Ω	HPV-08709-DB	DBR-4052-WG
HPV900-4065-2E1-01	8.0	16Ω - 5.3Ω	HPV-09106-DB	DBR-4065/72-WG
HPV900-4072-2E1-01	9.6	13Ω - 5.3Ω	HPV-12906-DB	DBR-4065/72-WG
HPV900-4096-2E1-01	12.0	11Ω - 4Ω	HPV-12906-DB	DBR-4096-WG

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

Table A2. 1 - 460V Brake Resistor Recommendations

Drive Model	Power Dissipation kW (Worm Gear)	Resistor Value Range (Worm Gear)	Magnetek Part Number (North America)	Magnetek Part Number (Europe)
HPV900-2025-2E1-01	1.2	27Ω - 8Ω	HPV-01311-DB	N/A
HPV900-2031-2E1-01	1.6	20Ω - 8Ω	HPV-01709-DB	N/A
HPV900-2041-2E1-01	2.4	14Ω - 4Ω	HPV-02506-DB	N/A
HPV900-2052-2E1-01	3.2	10Ω - 4Ω	HPV-03505-DB	N/A
HPV900-2075-2E1-01	4.0	8.3Ω - 2.7Ω	HPV-04004-DB	N/A
HPV900-2088-2E1-01	4.8	6.8Ω - 2.7Ω	HPV-06206-DB	N/A
HPV900-2098-2E1-01	6.4	5Ω - 2Ω	HPV-06703-DB	N/A

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

Table A2. 2 - 230V Brake Resistor Recommendations

Assumptions for Brake Resistor Recommendations

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

Appendix

Dynamic Braking Resistor Selection – Planetary Gear

Drive Model	Power Dissipation kW (Planetary Gear)	Resistor Value Range (Planetary Gear)	Magnetek Part Number (North America)	Magnetek Part Number (Europe)
HPV900-4008-2E1-01	1.7	77 Ω - 53 Ω	HPV-01860-DB	DBR-4008-PM
HPV900-4012-2E1-01	2.5	52 Ω - 32 Ω	HPV-02536-DB	DBR-4012/16-PM
HPV900-4016-2E1-01	3.4	38 Ω - 32 Ω	HPV-03633-DB	DBR-4012/16-PM
HPV900-4021-2E1-01	5	25 Ω - 16 Ω	HPV-05519-DB	DBR-4021/27-PM
HPV900-4027-2E1-01	6.8	19 Ω - 16 Ω	HPV-08020-DB	DBR-4021/27-PM
HPV900-4034-2E1-01	8.5	16 Ω - 8 Ω	HPV-08709-DB	DBR-4034/41-PM
HPV900-4041-2E1-01	10	13 Ω - 8 Ω	HPV-10510-DB	DBR-4034/41-PM
HPV900-4052-2E1-01	14	9 Ω - 8 Ω	HPV-16808-DB	DBR-4052-PM
HPV900-4065-2E1-01	17	7.7Ω - 5.3Ω	HPV-24805-DB	DBR-4065-PM
HPV900-4072-2E1-01	20	6.3Ω - 5.3Ω	HPV-24805-DB	DBR-4072-PM
HPV900-4096-2E1-01	25	5.2 Ω - 4 Ω	HPV-25104-DB	DBR-4096-PM

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

Table A2. 3 - 460V Brake Resistor Recommendations

Drive Model	Power Dissipation kW (Planetary Gear)	Resistor Value Range (Planetary Gear)	Magnetek Part Number (North America)	Magnetek Part Number (Europe)
HPV900-2025-2E1-01	2.5	13 Ω - 8 Ω	HPV-04109-DB	N/A
HPV900-2031-2E1-01	3.4	9.5 Ω - 8 Ω	HPV-04109-DB	N/A
HPV900-2041-2E1-01	5	6.4 Ω - 4 Ω	HPV-05505-DB	N/A
HPV900-2052-2E1-01	6.8	4.7 Ω - 4 Ω	HPV-07005-DB	N/A
HPV900-2075-2E1-01	8.5	3.9Ω - 2.7Ω	HPV-11803-DB	N/A
HPV900-2088-2E1-01	10	3.2Ω - 2.7Ω	HPV-11803-DB	N/A
HPV900-2098-2E1-01	14	2.4Ω - 2Ω	HPV-16802-DB	N/A

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

Table A2. 4 - 230V Brake Resistor Recommendations

Assumptions for Brake Resistor Recommendations

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

Appendix

Dynamic Braking Resistor Fusing Selection

All fuses should be rated for 800VDC

Drive Model	Fuse Type (Bussmann pn)	Fuse Size (in Amps)
HPV900-4008-2E1-01	FWS-10A20F	10A
HPV900-4012-2E1-01	FWS-15A20F	15A
HPV900-4016-2E1-01	FWJ-20A14F	20A
HPV900-4021-2E1-01	FWJ-25A14F	30A
HPV900-4027-2E1-01	FWJ-30A14F	30A
HPV900-4034-2E1-01	FWJ-50A	50A
HPV900-4041-2E1-01	FWJ-70A	70A
HPV900-4052-2E1-01	FWJ-70A	70A
HPV900-4065-2E1-01	FWJ-100A	100A
HPV900-4072-2E1-01	FWJ-100A	100A
HPV900-4096-2E1-01	FWJ-150A	150A

Table 28: 460V DB Fusing Recommendations

All fuses should be rated for at least 400VDC

Drive Model	Fuse Type (Bussmann pn)	Fuse Size (in Amps)
HPV900-2025-2E1-01	FWH-23A14F	25A
HPV900-2031-2E1-01	FWH-40A	40A
HPV900-2041-2E1-01	FWH-70B	70A
HPV900-2052-2E1-01	FWH-70B	70A
HPV900-2075-2E1-01	FWH-100B	100A
HPV900-2088-2E1-01	FWH-100B	100A
HPV900-2098-2E1-01	FWH-150B	150A

Table 29: 230V DB Fusing Recommendations

IMPORTANT

Dynamic Braking Resistor Fusing:

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

Appendix

Three-Phase AC Input Reactor Selection

An input reactor can help minimize most drive nuisance tripping and faults caused by over-voltage and input line disturbances including line spikes. The parts listed below are based on 3% impedance and allow for ambient temperatures of 45°C. All reactors listed contain the following marks: CE, UL-508, and CSA.

Input Voltage	Cube HP	Cube KW	Model	Inductance (mH)	Amps	Weight (lbs)	Watts Loss	Magnetek Part Number
460 V	5	3.7	-4008	2.10mH	11A	4.2lbs	40.9W	05P00620-0150
	7.5	5.5	-4012	1.60 mH	14A	4.3lbs	48.2W	05P00620-0165
	10	7.5	-4016	1.10 mH	21A	7.2lbs	57.4W	05P00620-0151
	15	11	-4021	0.82 mH	28A	9.5lbs	66.8W	05P00620-0152
	20	15	-4027	0.71 mH	35A	13lbs	102W	05P00620-0153
	25	18	-4034	0.55 mH	46A	17lbs	99W	05P00620-0164
	30	22	-4041	0.38 mH	65A	22lbs	105W	05P00620-0155
	40	30	-4052	0.38 mH	65A	22lbs	105W	05P00620-0155
	50	37	-4065	0.29 mH	83A	26lbs	155W	05P00620-0156
	60	45	-4072	0.29 mH	83A	26lbs	155W	05P00620-0156
	75	55	-4096	0.18 mH	130A	37lbs	152W	05P00620-0169

Table 30: 460V Input Reactor Recommendations

Input Voltage	Cube HP	Cube KW	Model	Inductance (mH)	Amps	Weight (lbs)	Watts Loss	Magnetek Part Number
230 V	7.5	5.5	-2025	0.39 mH	28A	5.1lbs	48.2W	05P00620-0158
	10	7.5	-2031	0.27 mH	55A	18lbs	67W	05P00620-0159
	15	11	-2041	0.19 mH	65A	18lbs	87W	05P00620-0160
	20	15	-2052	0.17 mH	83A	19lbs	119W	05P00620-0161
	25	18	-2075	0.17 mH	83A	19lbs	119W	05P00620-0161
	30	22	-2088	0.12 mH	104A	22lbs	94W	05P00620-0162
	40	30	-2098	0.08 mH	160A	34lbs	110W	05P00620-0168

Table 31: 230V Input Reactor Recommendations

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

- Repeated 250% overloads current values
- Heating of inductors due to overloads and harmonics
- Saturation of inductor
- Life of reactor
- Ambient temperature vs. inductor current curve. The drive can operate at 45°C (110°F).

Appendix

Three-Phase AC Harmonic Filter Selection

A harmonic filter can help minimize harmonic distortion caused by diode switching. The parts listed below provide performance levels of 5% total harmonic current distortion (THID) and can be used to meet IEEE-519. Open panel filters allow for ambient temperatures of 50°C while NEMA1 filters allow for ambient temperatures of 40°C. All harmonic filters listed contain the following marks: cUL, UL-508, and CSA.

Input Voltage	Cube HP	Cube KW	Model	Amps	Watts Loss	Magnetek Part Numbers	
						Open Panel	NEMA1
460 V	5	3.7	-4008	11A	197	05P00058-1321	05P00058-1338
	7.5	5.5	-4012	14A	232	05P00058-1322	05P00058-1339
	10	7.5	-4016	21A	294	05P00058-1323	05P00058-1340
	15	11	-4021	27A	343	05P00058-1324	05P00058-1341
	20	15	-4027	34A	399	05P00058-1325	05P00058-1342
	25	18	-4034	44A	472	05P00058-1326	05P00058-1343
	30	22	-4041	52A	533	05P00058-1327	05P00058-1344
	40	30	-4052	66A	621	05P00058-1328	05P00058-1345
	50	37	-4065	83A	735	05P00058-1329	05P00058-1346
	60	45	-4072	83A	735	05P00058-1329	05P00058-1346
	75	55	-4096	103A	844	05P00058-1330	05P00058-1347

Table 32: 460V Input Reactor Recommendations

Input Voltage	Cube HP	Cube KW	Model	Amps	Watts Loss	Magnetek Part Numbers	
						Open Panel	NEMA1
230 V	7.5	5.5	-2025	27A	254	05P00058-1314	05P00058-1331
	10	7.5	-2031	34A	286	05P00058-1315	05P00058-1332
	15	11	-2041	44A	338	05P00058-1316	05P00058-1333
	20	15	-2052	66A	439	05P00058-1317	05P00058-1334
	25	18	-2075	83A	506	05P00058-1318	05P00058-1335
	30	22	-2088	103A	591	05P00058-1319	05P00058-1336
	40	30	-2098	128A	664	05P00058-1320	05P00058-1337

Table 33: 230V Input Reactor Recommendations

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

- Repeated 250% overloads current values
- Heating of inductors due to overloads and harmonics
- Saturation of inductor
- Ambient temperature vs. inductor current curve. The drive can operate at 45°C (110°F).

Appendix

AC Input Fusing Selection

Drive Model	Recommendation 1			Recommendation 2		
	Fuse Mfg	Fuse Model No.	Fuse Rating (Amps/Volts)	Fuse Mfg	Fuse Model No.	Fuse Rating (Amps/Volts)
HPV900-4008-2E1-01	Ferraz	A60Q25-2	25A/600V	Ferraz	A70QS25-14F	25A/690V
HPV900-4012-2E1-01	Ferraz	A60Q30-2	30A/600V	Ferraz	A70QS40-14F	40A/690V
HPV900-4016-2E1-01	Ferraz	A60Q30-2	30A/600V	Bussmann	FWH-80B	80A/500V
HPV900-4021-2E1-01	Ferraz	A70P50-4	50A/700V	Bussmann	FWH-80B	80A/500V
HPV900-4027-2E1-01	Ferraz	A70P70-4	70A/700V	Bussmann	FWH-100B	100A/500V
HPV900-4034-2E1-01	Ferraz	A70P80-4	80A/700V	Bussmann	FWH-125B	125A/500V
HPV900-4041-2E1-01	Ferraz	A70P80-4	80A/700V	Bussmann	FWH-125B	125A/500V
HPV900-4052-2E1-01	Ferraz	A70P100-4	100A/700V	Bussmann	FWH-125B	125A/500V
HPV900-4065-2E1-01	Ferraz	A70P125-4	125A/700V	Bussmann	FWH-150B	150A/500V
HPV900-4072-2E1-01	Ferraz	A70P150-4	150A/700V	Bussmann	FWH-175B	175A/500V
HPV900-4096-2E1-01	Ferraz	A70P200-4	200A/700V	Bussmann	FWH-200B	200A/500V

Table 34: 460V Fusing Recommendations

Drive Model	Recommendation 1			Recommendation 2		
	Fuse Mfg	Fuse Model No.	Fuse Rating (Amps/Volts)	Fuse Mfg	Fuse Model No.	Fuse Rating (Amps/Volts)
HPV900-2025-2E1-01	Ferraz	A50P50-4	50A/500V	Bussmann	FWH-80B	80A/500V
HPV900-2031-2E1-01	Ferraz	A50P80-4	80A/500V	Bussmann	FWH-80B	80A/500V
HPV900-2041-2E1-01	Ferraz	A50P80-4	80A/500V	Bussmann	FWH-80B	80A/500V
HPV900-2052-2E1-01	Ferraz	A50P125-4	125A/500V	Bussmann	FWH-100B	100A/500V
HPV900-2075-2E1-01	Ferraz	A50P150-4	150A/500V	Bussmann	FWH-175B	175A/500V
HPV900-2088-2E1-01	Ferraz	A50P150-4	150A/500V	Bussmann	FWH-175B	175A/500V
HPV900-2098-2E1-01	Ferraz	A50P200-4	200A/500V	Bussmann	FWH-225B	225A/500V

Table 35: 230V Fusing Recommendations

Appendix

Line Filter Selection

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

- EN 12015:2004
- EN 12016:2004

Note: also see CE Guidelines on page 170 for additional installation guidelines

Drive Model	Magnetek Filter Part Number	
	Stand Alone	Footprint
HPV900-4008-2E1-01	H9-4008/12-SA	H9-FP1
HPV900-4012-2E1-01	H9-4008/12-SA	H9-FP2
HPV900-4016-2E1-01	H9-4016/21-SA	H9-FP2
HPV900-4021-2E1-01	H9-4016/21-SA	H9-FP3
HPV900-4027-2E1-01	H9-4027-SA	H9-FP3
HPV900-4034-2E1-01	H9-4034/41-SA	N/A
HPV900-4041-2E1-01	H9-4034/41-SA	N/A
HPV900-4052-2E1-01	H9-4052/65-SA	N/A
HPV900-4065-2E1-01	H9-4052/65-SA	N/A
HPV900-4072-2E1-01	H9-4072-SA	N/A
HPV900-4096-2E1-01	H9-4096-SA	N/A

Table 36: 460V Line Filter Recommendations

Model	Filter Part Number	
	Stand Alone	Footprint
HPV900-2025-2E1-01	KMF-336	N/A
HPV900-2031-2E1-01	KMF-336	N/A
HPV900-2041-2E1-01	KMF-350	N/A
HPV900-2052-2E1-01	KMF-370	N/A
HPV900-2075-2E1-01	KMF-370	N/A
HPV900-2088-2E1-01	KMF-3100	N/A
HPV900-2098-2E1-01	KMF-3100	N/A

Table 37: 230V Line Filter Recommendations

Appendix

Selecting and Mounting of Encoder

Encoder Specification

The HPV 900 Series 2 has connections for an incremental two-channel quadrature encoder.

For better noise immunity, the HPV 900 Series 2 provides…

- an isolated power supply, which separates the processor power from the encoder
- optically isolated encoder signals from the HPV 900 Series 2's processor

Encoder Feedback

- Supply Voltage: 12VDC or 5VDC
- Capacity: 200mA or 400mA
- PPR: 600 - 40,000
- Maximum Frequency: 300 kHz
- Input: 2 channel quadrature
5 or 12 volts dc differential
(A, /A, B, /B) {Z,/Z for Incremental PM}

Encoder Considerations

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

IMPORTANT

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

Electrical Considerations

- If possible, insulate both the encoder case and shaft from the motor. For more information, see Insulating Encoder from Motor on page 185.
- Use twisted pair cable with shield tied to chassis ground at drive end. For more information, see Encoder Wiring on page 28.
- Use limited slew rate differential line drivers. For more information, see Differential Line Drivers on page 187.
- Do not allow capacitors from internal encoder electronics to case. For more information, see Capacitors from Electronics to Case on page 188.
- Do not exceed the operating specification of the encoder/drive. For more information, see Exceeding Operating Specification on page 188.
- Use the proper encoder supply voltage and use the highest possible voltage available (i.e. HPV 900 Series 2 - 12VDC preferred). For more information, see Encoder Supply Voltage on page 189.

Mechanical Considerations

- Use direct motor mounting without couplings. For more information, see Direct Motor Mounting on page 185186.
- Use hub or hollow shaft encoder with concentric motor stub shaft. For more information, see motor stub shaft on page 186.
- If possible, use a mechanical protective cover for exposed encoders. For more information, see Encoder Protective Covers on page 187.

Encoder Mounting

Insulating Encoder from Motor

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

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

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

Figure 59 shows how to insulate a hollow-shaft encoder from the motor (similar mounting hardware and insulating insert can be used for hub-shaft encoders).

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

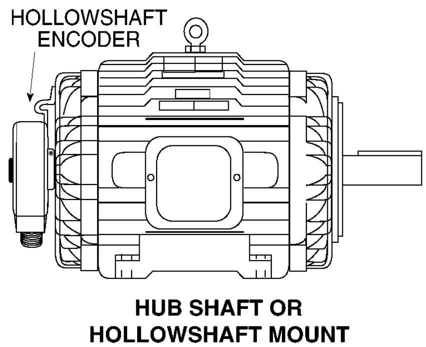


Figure 56: Direct Motor Mount

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

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

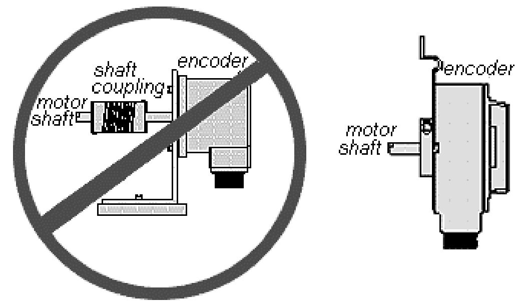


Figure 57: Avoiding Couplings

Motor Stub Shaft

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

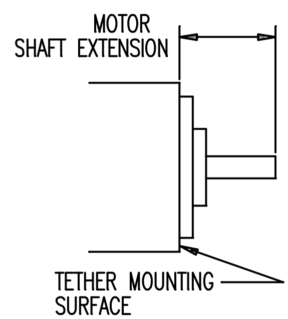


Figure 58: Motor Stub Shaft

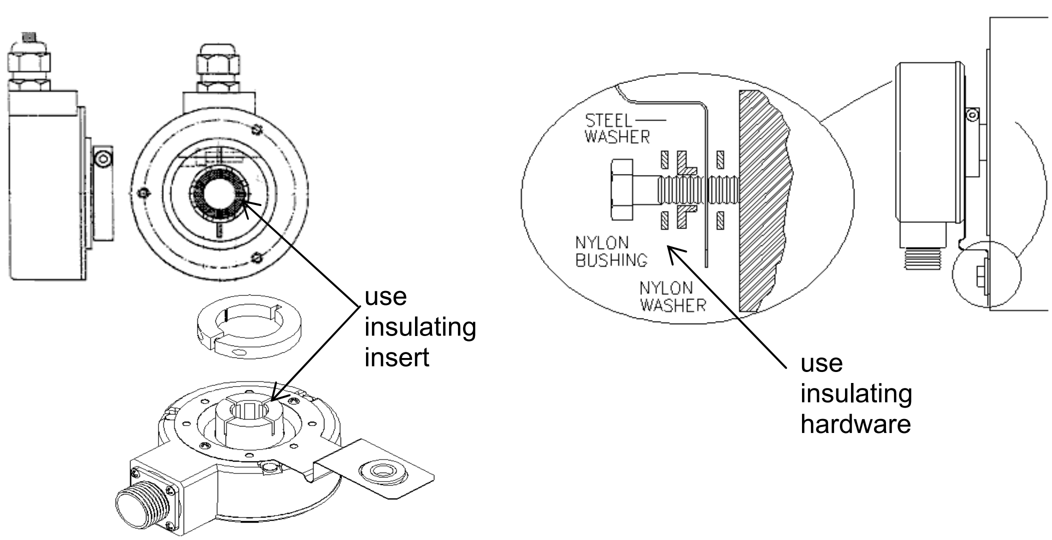


Figure 59: Insulating Encoder from Motor

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

Although it is not the preferred method, installations that employ a screwed on sub shaft adapter should:

- use the original hole used to machine the motor shaft
- use locktight to hold the thread in position
- align the stub shaft to 0.002 inches TIR or less with a dial indicator

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

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

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

Encoder Protective Covers

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

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

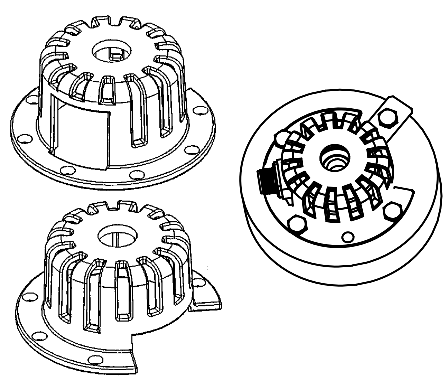


Figure 60: Protective Encoder Covers

Differential Line Drivers

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

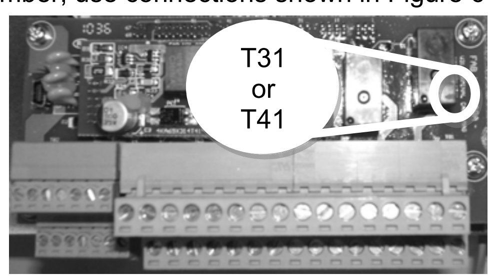
Encoder's line drivers transition from logic states in a fraction of a microsecond. The fast rise and fall times of the driver's circuitry can interact with the cable impedance and create significant ringing on the receiver end of the cable. This can interfere with the encoder signals and the operation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

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

Single-Ended Encoders

Although not recommended due to the absence of noise immunity, the HPV900 S2 drive can be run with singled ended encoders. Connections are dependent on what revision of board is used.

For boards with T31 as part of the part number, use connections shown in Figure 61.



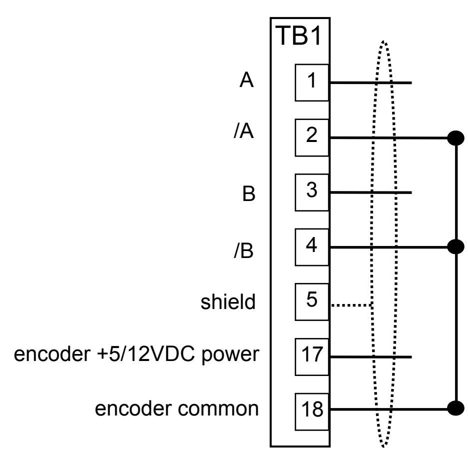


Figure 61: Single-Ended Encoder on T31 Board

For boards with T41 as part of the part number, use connections shown in Figure 62.

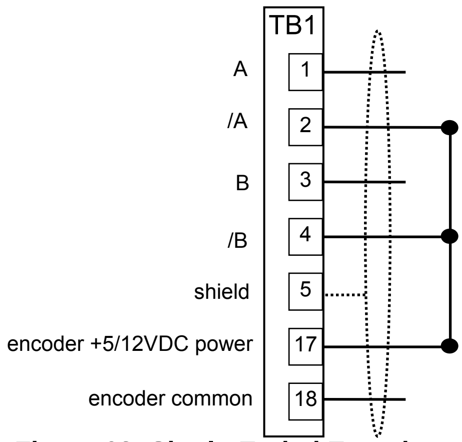


Figure 62: Single-Ended Encoder on T41 Board

Capacitors from Electronics to Case

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

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

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

The above analysis assumes that the electrical wiring is correct and that the shield on the encoder cable is properly grounded, *see Encoder Wiring on page 28.*

The scope traces in Figure 63 and Figure 64 show a noise comparison of output signals from similar encoders with and without internal capacitors, both connected to a motor with typical PWM switching noise on the frame.

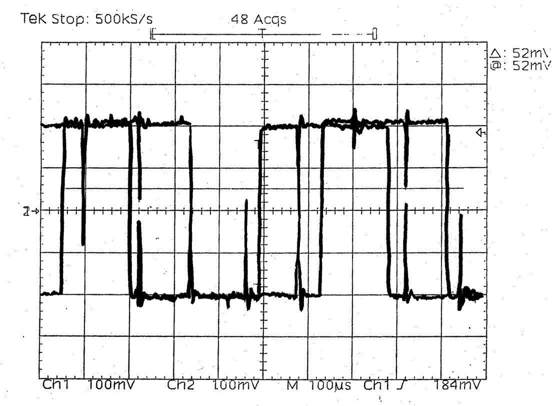


Figure 63: Encoder with a capacitor (common to ground)

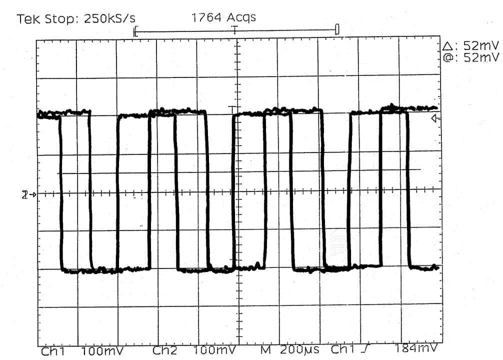


Figure 64: Encoder with no capacitor (common to ground)

Exceeding Operating Specification

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

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

To determine the encoder's maximum operating speed:

Step 1: Determine maximum electronic operating speed in RPM.

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

Step 2:

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

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

Step 3:

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

To determine if the application exceeds the operating specification of the HPV 900 Series 2:

- Calculate the maximum pulses per revolution (PPR) for this application (using the HPV 900 Series 2 frequency limit of 300 kHz and 120% of the application's top speed)

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

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

Encoder Supply Voltage

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

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

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

It is also preferred that the encoder be powered by the HPV 900 Series 2's 12VDC power supply in order to help with noise immunity by having the signals at a higher voltage level.

Appendix

Suggested Wire Sizes

Drive Model	Input Power (R,S,T) and Output Power (U,V,W),⊕1, ⊕2, ⊖		Ground Terminals	
	Wire size range AWG (mm^2)	Torque Spec lb•in (N•m)	Wire size range AWG (mm^2)	Torque Spec lb•in (N•m)
HPV900-2025-2E1-01	8 (8.4) [i]	15.6 (1.76)[1]	8 (8.4) [1]	15.6 (1.76)
HPV900-2031-2E1-01	8 (8.4)[1]	15.6 (1.76) [1]	8 (8.4) [1]	15.6 (1.76)
HPV900-2041-2E1-01	6 (14)	57.3 (6.47)	8 (8)	57.3 (6.47)
HPV900-2052-2E1-01	4 (22)	57.3 (6.47)	8 (8)	57.3 (6.47)
HPV900-2075-2E1-01	4 (22)	57.3 (6.47)	6 (14)	57.3 (6.47)
HPV900-2088-2E1-01	2 (38)	57.3 (6.47)	4 (22)	57.3 (6.47)
HPV900-2098-2E1-01	1 (42.4)	104.2 (11.76)	4 (22)	57.3 (6.47)
HPV900-4008-2E1-01	14-10 (2.1-5.3)	15.6 (1.76)	12-10 (3.5-5.5)	15.6 (1.76)
HPV900-4012-2E1-01	12-10 (3.5-5.5)	15.6 (1.76)	12-10 (3.5-5.5)	15.6 (1.76)
HPV900-4016-2E1-01	10 (5.5)	15.6 (1.76)	10 (5.5)	15.6 (1.76)
HPV900-4021-2E1-01	8-6 (8-14)	26.0 (2.94)	8 (8)	26.0 (2.94)
HPV900-4027-2E1-01	6 (14)	26.0 (2.94)	8 (8)	26.0 (2.94)
HPV900-4034-2E1-01	6 (14)	26.0 (2.94)	8 (8)	26.0 (2.94)
HPV900-4041-2E1-01	6 (14)	26.0 (2.94)	8 (8)	26.0 (2.94)
HPV900-4052-2E1-01	4 (22)	26.0 (2.94)	6 (14)	26.0 (2.94)
HPV900-4065-2E1-01	4 (22)	57.3 (6.47)	4 (22)	57.3 (6.47)
HPV900-4072-2E1-01	2 (38)	57.3 (6.47)	4 (22)	57.3 (6.47)
HPV900-4096-2E1-01	1 (42.4)	57.3 (6.47)	4 (22)	57.3 (6.47)

Drive Model	B1, B2		Control Wiring Terminals			
			TB1		TB2	
	Wire size range AWG (mm^2)	Torque Spec lb•in (N•m)	Wire size range AWG (mm^2)	Torque Spec lb•in (N•m)	Wire size range AWG (mm^2)	Torque Spec lb•in (N•m)
HPV900-2025-2E1-01	8 (8.4)	15.6 (1.76) [1]	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-2031-2E1-01	8 (8.4)	15.6 (1.76) [1]	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-2041-2E1-01	6 (14)	26.0 (2.94)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-2052-2E1-01	4 (22)	26.0 (2.94)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-2075-2E1-01	4 (22)	26.0 (2.94)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-2088-2E1-01	2 (38)	26.0 (2.94)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-2098-2E1-01	1 (42.4)	57.3 (6.47)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-4008-2E1-01	14-10 (2.1-5.3)	15.6 (1.76)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-4012-2E1-01	12-10 (3.5-5.5)	15.6 (1.76)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-4016-2E1-01	10 (5.5)	15.6 (1.76)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-4021-2E1-01	8-6 (8-14)	26.0 (2.94)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-4027-2E1-01	6 (14)	26.0 (2.94)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-4034-2E1-01	6 (14)	26.0 (2.94)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-4041-2E1-01	6 (14)	26.0 (2.94)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-4052-2E1-01	4 (22)	26.0 (2.94)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-4065-2E1-01	4 (22)	57.3 (6.47)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-4072-2E1-01	2 (38)	57.3 (6.47)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)
HPV900-4096-2E1-01	2 (38)	57.3 (6.47)	28-14 (0.1-2)	1.73 (0.2)	28-14 (0.1-2)	4.34 (0.5)

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

Table 38: Suggested Wire Sizes

[i] Recommended Lug for Frame 2 is Molex 19099-0050 due to terminal size

Appendix

Input / Output Rating

Drive Model	Input			Output	
	Voltage V	Current A	Short Circuit Withstand Rating	Voltage V	Current A
HPV900-2025-2E1-01	200-240	27.7	10KA	0-input voltage	25
HPV900-2031-2E1-01	200-240	34.4	10KA	0-input voltage	31
HPV900-2041-2E1-01	200-240	45.5	10KA	0-input voltage	41
HPV900-2052-2E1-01	200-240	57.7	10KA	0-input voltage	52
HPV900-2075-2E1-01	200-240	83.3	10KA	0-input voltage	75
HPV900-2088-2E1-01	200-240	97.7	10KA	0-input voltage	88
HPV900-2098-2E1-01	200-240	108.8	10KA	0-input voltage	98
HPV900-4008-2E1-01	380-480	8.8	10KA	0-input voltage	8
HPV900-4012-2E1-01	380-480	13.3	10KA	0-input voltage	12
HPV900-4016-2E1-01	380-480	17.7	10KA	0-input voltage	16
HPV900-4021-2E1-01	380-480	23.3	10KA	0-input voltage	21
HPV900-4027-2E1-01	380-480	30.0	10KA	0-input voltage	27
HPV900-4034-2E1-01	380-480	37.7	10KA	0-input voltage	34
HPV900-4041-2E1-01	380-480	45.5	10KA	0-input voltage	41
HPV900-4052-2E1-01	380-480	57.7	10KA	0-input voltage	52
HPV900-4065-2E1-01	380-480	72.2	10KA	0-input voltage	65
HPV900-4072-2E1-01	380-480	80.0	10KA	0-input voltage	72
HPV900-4096-2E1-01	380-480	106.6	10KA	0-input voltage	96

Table 39: Input / Output Ratings

Appendix

Single Phase Ratings

The HPV900 Series 2 drives may be run with a single phase VAC input. However, in order to run the drive single phased, the drive must be derated by 60%. See Table 40 below for the single phased ratings.

Rated Input Voltage	Continuous Output Current General Purpose Rating	Continuous Output Current Elevator Duty Cycle Rating	Maximum Output Current for 5 Sec	Frame Size	Model Number
230V	10	10.7	25	2	HPV900-2025-2E1-01
	12.4	13.3	31	2	HPV900-2031-2E1-01
	16.4	17.6	41	3.5	HPV900-2041-2E1-01
	20.8	22.2	52	3.5	HPV900-2052-2E1-01
	30	32.1	75	4	HPV900-2075-2E1-01
	35.2	37.7	88	4	HPV900-2088-2E1-01
	39.2	42	98	5	HPV900-2098-2E1-01
460V	3.2	3.4	8	1	HPV900-4008-2E1-01
	4.8	5.1	12	2	HPV900-4012-2E1-01
	6.4	6.8	16	2	HPV900-4016-2E1-01
	8.4	9	21	3	HPV900-4021-2E1-01
	10.8	11.6	27	3	HPV900-4027-2E1-01
	13.6	14.6	34	4	HPV900-4034-2E1-01
	16.4	17.6	41	4	HPV900-4041-2E1-01
	20.8	22.2	52	4	HPV900-4052-2E1-01
	26	27.8	65	5	HPV900-4065-2E1-01
	28.8	30.8	72	5	HPV900-4072-2E1-01
	38.4	41.1	96	5	HPV900-4096-2E1-01

Table 40: Single Phase Ratings

Appendix

Carrier Frequency Ratings

The HPV900 Series 2 drives may be run with a high PWM switching Frequency. The default drive ratings are based off of 10kHz setting. The drive will be derated according to the table below if the setting for PWM Freq is greater than 10kHz.

Drive Model Number	Continuous Output Current General Purpose Rating						Continuous Output Current Elevator Duty Cycle** Rating						Maximum Output Current for 5 Sec					
	11 kHz	12 kHz	13 kHz	14 kHz	15 kHz	16 kHz	11 kHz	12 kHz	13 kHz	14 kHz	15 kHz	16 kHz	11 kHz	12 kHz	13 kHz	14 kHz	15 kHz	16 kHz
2025	24.6	24.2	23.8	23.3	22.9	22.5	26.5	26.1	25.6	25.2	24.8	24.3	61.5	60.4	59.4	58.3	57.3	56.3
2031	30	28.9	27.9	26.9	25.8	24.8	32.4	31.2	30.1	29.0	27.9	26.8	74.9	72.3	69.8	67.2	64.6	62
2041	40.3	39.6	38.9	38.3	37.6	36.9	43.5	42.8	42.1	41.3	40.6	39.8	101	99.1	97.4	95.7	94.0	92.3
2052	50.3	48.5	46.8	45.1	43.3	41.6	54.3	52.4	50.5	48.7	46.8	44.9	126	121	117	113	108	104
2075	73.8	72.5	71.3	70	68.8	67.5	79.7	78.3	77	75.6	74.3	72.9	184	181	178	175	172	169
2088	85.1	82.1	79.2	76.3	73.3	70.4	91.9	88.7	85.5	82.4	79.2	76	213	205	198	191	183	176
2098	94.7	91.5	88.2	84.9	81.7	78.4	102	98.8	95.3	91.7	88.2	84.7	237	229	221	212	204	196

Table 41: 200V Series Drives Carrier Frequency Ratings

Appendix

Carrier Frequency Ratings

The HPV900 Series 2 drives may be run with a high PWM switching Frequency. The default drive ratings are based off of 10kHz setting. The drive will be derated according to the table below if the setting for PWM Freq is greater than 10kHz.

Drive Model Number	Continuous Output Current General Purpose Rating						Continuous Output Current Elevator Duty Cycle** Rating						Maximum Output Current for 5 Sec					
	11 kHz	12 kHz	13 kHz	14 kHz	15 kHz	16 kHz	11 kHz	12 kHz	13 kHz	14 kHz	15 kHz	16 kHz	11 kHz	12 kHz	13 kHz	14 kHz	15 kHz	16 kHz
4008	7.9	7.7	7.6	7.5	7.3	7.2	8.5	8.4	8.2	8.1	7.9	7.8	19.7	19.3	19	18.7	18.3	18
4012	11.8	11.6	11.4	11.2	11	10.8	12.7	12.5	12.3	12.1	11.9	11.7	29.5	29	28.5	28	27.5	27
4016	15.5	14.9	14.4	13.9	13.3	12.8	16.7	16.1	15.6	15	14.4	13.8	38.7	37.3	36	34.7	33.3	32
4021	20.7	20.3	20	19.6	19.3	18.9	22.3	21.9	21.6	21.2	20.8	20.4	51.6	50.8	49.9	49	48.1	47.3
4027	26.1	25.2	24.3	23.4	22.5	21.6	28.2	27.2	26.2	25.3	24.3	23.3	65.3	63	60.8	58.5	56.3	54
4034	33.4	32.9	32.3	31.7	31.2	30.6	36.1	35.5	34.9	34.3	33.7	33.1	86.6	82.2	80.8	79.3	77.9	76.5
4041	40	39	37.9	36.9	35.9	34.9	43.2	42.1	41	39.9	38.8	37.6	99.9	97.4	94.8	92.3	89.7	87.1
4052	50.3	48.5	46.8	45.1	43.3	41.6	54.3	52.4	50.5	48.7	46.8	44.9	126	121	117	113	108	104
4065	63.9	62.8	61.7	60.7	59.6	58.5	69	67.9	66.7	65.5	64.4	63.2	160	157	154	152	149	146
4072	70.2	68.4	66.6	64.8	63	61.2	75.8	73.9	71.9	70.0	68.0	66.1	118	171	167	162	158	153
4096	92.8	89.6	86.4	83.2	80	76.8	100	96.8	93.3	90	86.4	82.9	232	224	216	208	200	192

Table 42: Carrier Frequency Ratings

Appendix

Watts Loss

460V	Power loss
HPV900-4008-2E1-01	132 watts
HPV900-4012-2E1-01	275 watts
HPV900-4016-2E1-01	314 watts
HPV900-4021-2E1-01	360 watts
HPV900-4027-2E1-01	499 watts
HPV900-4034-2E1-01	606 watts
HPV900-4041-2E1-01	842 watts
HPV900-4052-2E1-01	1173 watts
HPV900-4065-2E1-01	1280 watts
HPV900-4072-2E1-01	1877 watts
HPV900-4096-2E1-01	2819 watts

230V	Power loss
HPV900-2025-2E1-01	229 watts
HPV900-2031-2E1-01	294 watts
HPV900-2041-2E1-01	378 watts
HPV900-2052-2E1-01	481 watts
HPV900-2075-2E1-01	759 watts
HPV900-2088-2E1-01	969 watts
HPV900-2098-2E1-01	989 watts

Note: values calculated from the worse case condition of 107% of general purpose continuous current rating, 10kHz carrier frequency.

Table 43: Watts Loss per Drive Rating

Appendix

Relay Specifications
RELAY 1 & 2

Contact Data

	Resistive load (p.f. = 1)	
Load	N.O. Contact	N.C. Contact
Rated Load	5A at 277VAC 10A at 125VAC 5A at 30VDC	3A at 277VAC 3A at 30VDC
Carry Current	10A	3A
Max. operating voltage	277VAC, 30VDC	
Max. operating current	10A	3A
Max. operating capacity	1,385VA, 150W	831VA, 90W

<u>Operating Time</u>

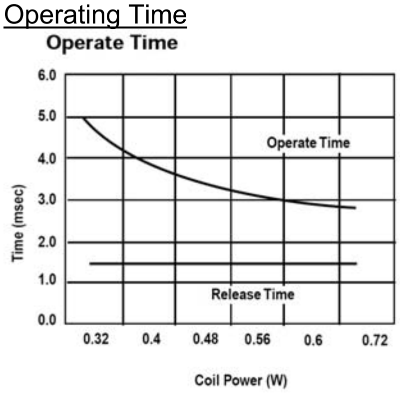


Figure 65: Operate Time

<u>Coil Temperature Rise</u>

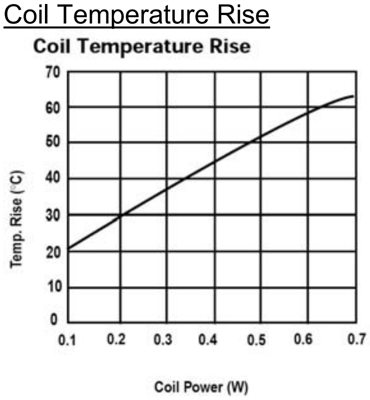


Figure 66: Coil Temperature

<u>Life Expectancy</u>

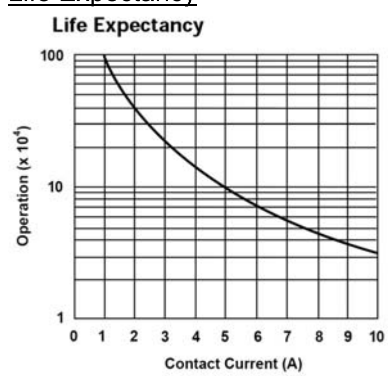


Figure 67: Relay Life Expectancy

Appendix

Replacement Parts

Part Number	Description	Detailed Description
HPV9-CTL0020-01	FRU,HPV900 Series 2,Ctl PCB, Std Sfw	*Includes the control PCB with standard software*
HPV9-ENDAT-01	FRU,HPV900 Series 2, EnDat Option Card and hardware	*Includes EnDat Option card and hardware*
HPV9-ENDAT-02	FRU,HPV900 Series 2, EnDat Option Card hardware only	*EnDat hardware only*
HPV9-TER0010	FRU,HPV900 Series 2,Control Terminal Board	*Terminal board, including terminal blocks*
HPV9-TER0010TB	FRU,HPV900 Series 2,Control TBs	*Terminal blocks for terminal board*
HPV9-OPERATOR	FRU, HPV900 Series 2 Operator, Elevator	*Digital operator*
HPV9-RS422CBL	FRU,HPV900 Series 2, Serial Cable, RS422	*Includes DB9, RS422 connection to discrete wires and instructions*
HPV9-COVRTOP1	FRU,HPV900 Series 2, TOP, FRAME 1	*Includes the top front plastic cover for Frame 1*
HPV9-COVRTOP2	FRU,HPV900 Series 2, TOP, FRAME 2	*Includes the top front plastic cover for Frame 2*
HPV9-COVRTOP3	FRU,HPV900 Series 2, TOP, FRAME 3	*Includes the top front plastic cover for Frame 3*
HPV9-COVRTOP4	FRU,HPV900 Series 2, TOP, FRAME 4	*Includes the top front metal cover for Frame 4*
HPV9-COVRTOP5	FRU,HPV900 Series 2, TOP, FRAME 5	*Includes the top front metal cover for Frame 5*
HPV9-COVRBOT1	FRU,HPV900 Series 2, BOTTOM, FRAME 1	*Includes the bottom front plastic cover for Frame 1*
HPV9-COVRBOT2	FRU,HPV900 Series 2, BOTTOM, FRAME 2	*Includes the bottom front plastic cover for Frame 2*
HPV9-COVRBOT3	FRU,HPV900 Series 2, BOTTOM, FRAME 3	*Includes the bottom front plastic cover for Frame 3*
HPV9-COVRBOT4	FRU,HPV900 Series 2, BOTTOM, FRAME 4	*Includes the bottom front metal cover for Frame 4*
HPV9-COVRBOT5	FRU,HPV900 Series 2, BOTTOM, FRAME 5	*Includes the bottom front metal cover for Frame 5*

Table 44: Replacement Parts

Index

E

F

G

H

I

L

S

T

U

V

W

Z

HPV 900 Series 2

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

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

MAGNETEK
ELEVATOR