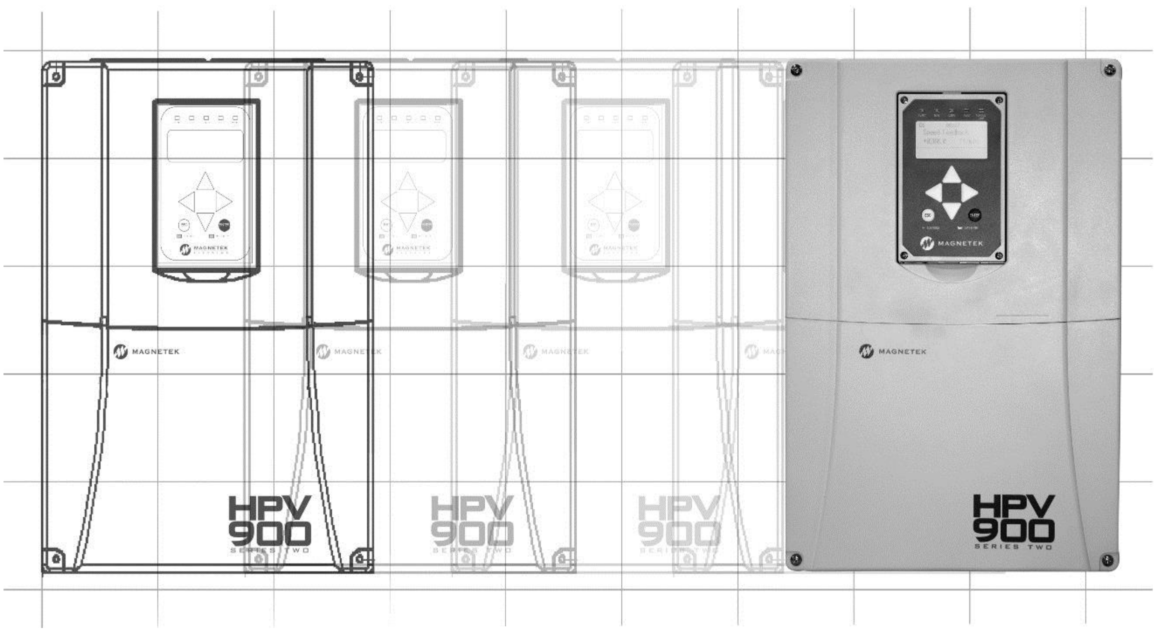
HPV 900 Series 2 AC/PM Elevator Drive

Technical Manual



Includes Quick Start Guides
Drive Firmware: 97SA4810-010220.41

TM7333 rev 21

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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.

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

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

Drive Menu A1

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 parameters in A1 menu to set/check when setting 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 (8kHz for 200% overload). 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 setting 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 can be heard (**TRY ADJUSTING THE ID/IQ Gains IN THE A4 submenu before these parameters**). If there is then initially halve both default settings and observe any change. If there is no improvement then lower both values to as low as 1%. If still no change, reset back to default values.
ROTOR LEAKAGE X	Rotor leakage reactance	Per ID	% base Z	

Table 5 CL: Important parameters in A5 menu to set/check when setting 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 needed to perform in Open Loop to validate if the encoder is working.

Table 6 CL: Important parameter in U9 menu to set/check when setting 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. An encoder does not need to be connected for open-loop.

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.

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

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

Drive Menu A1

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 167 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 167 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 167 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 167 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 167 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 167 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 167 dictates a different number
TORQ BOOST TIME	Adjust for torque compensation response and stability	0.05	sec	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 167 dictates a different number

Parameter	Description	Default	Units	Suggested Adjustment
TORQ BOOST GAIN	Torque boost responsiveness	0.00	none	Enter / verify that it is set at default until the Open-Loop Performance Adjustments on page 167 dictates a different number

Table 4 OL: Important parameters in A1 menu to set/check when setting 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 167 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 167 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 167 dictates a different number

Table 5 OL: Important parameters in A4 menu to set/check when setting 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 167 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 167 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 167 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 167 dictates a different number

Table 6 OL: Important parameters in A5 menu to set/check when setting 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 setting 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.

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 at TB2-77, keep the tails as short as possible - we would recommend no more than 3.94in (100mm) is exposed.
    - Ensure that TB2-78 is connected to the upper left mounting screw of the Terminal board for proper grounding.

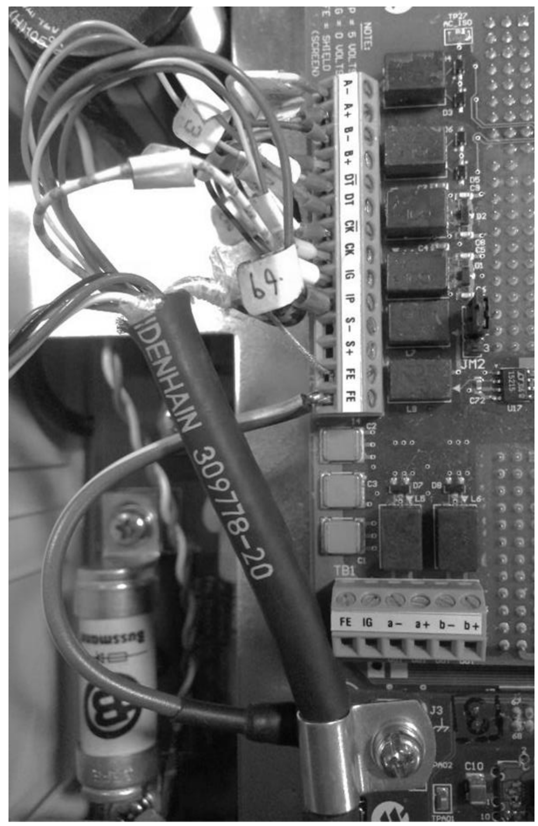

Table 1 PM shows the correct terminations for the HPV900S2 with the optional EnDat board and also the standard Heidenhain & Ziehl cable color codes – if you are unsure of the correct wire colors please refer to the encoder/motor suppliers documentation and if required contact them for clarification prior 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 colors in the other column for future reference.

Encoder	HPV900 S2 EnDat Termination		Cable Color				
	46S04327-1100	Previous versions	Black Heidenhain	Ziehl	Green Encoder Cable	Torin Encoder Cable	On Site Color
A/	A-	TB2-65	Yellow/Black	Red & Blue	Yellow	Brown	
A	A+	TB2-66	Green/Black	Grey & Pink	Green	Green	
B/	B-	TB2-67	Red/Black	Red	Red	Yellow	
B	B+	TB2-68	Blue & Black	Blue	Blue	Blue	
Data/	/DT	TB2-69	Pink	Brown	Pink	Silver	
Data	DT	TB2-70	Grey	White	Grey	Gray	
Clock/	/CK	TB2-71	Yellow	Black	Violet	White	
Clock	CK	TB2-72	Violet	Violet	Black	Violet	
0V com	IG	TB2-73	Green/White	Pink	White	Orange/White & Red	
+5V	IP	TB2-74	Green/Brwn	Grey	Brown	Orange & Black	
0V Sense (if present)	S-	TB2-75	White	Yellow	-	-	
+5V Sense (if present)	S+	TB2-76	Blue	Green	-	-	
Cable Shield	FE	TB2-77	Encoder Cable Shield	Encoder Cable Shield	Encoder Cable Shield	Big Yellow	
EnDat Board Ground (Magnetek GRN factory wire tied to ground stud)	FE	TB2-78	-	-	-	-	

Table 1 PM: Connections and color scheme of recommended absolute encoders

Motor Parameter Set-up

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:

$$\frac{(2*60)(\text{MotorExcitationFrequency})}{(\text{RatedMotorSpeed})} = \begin{pmatrix} \# \\ \text{of} \\ \text{Poles} \end{pmatrix}$$

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))

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

<u>120 x Rated Motor Frequency</u>
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.

<u>Hoistway Parameter Set-up</u>

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.

<u>Encoder Alignment</u>

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

<u>OPTION 1 – P*redetermined Encoder angle offset*</u>

- 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 – R*otating 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 – it's 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).

- 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 – S*tatic 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 HF INJECT or AUTO ALIGN

Next change the parameter BEGIN ALIGNMENT to ON RUN

- The drive is now ready for alignment, so simply press and hold the 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 consistent, 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 optimization 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 U12 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.

Key Drive Parameters

Drive Menu A1

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	10000	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 2 PM: Important parameters in A1 menu to set/check when setting up a drive in PM mode

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
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.
ID REG INTG GAIN	Integral gain for the current regulator flux generation	1.00	None	Enter / verify that it should be set to default.
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.

Parameter	Description	Default	Units	Suggested Adjustment
IQ REG INTG GAIN	Integral gain for the current regulator torque generation	1.00	None	Enter / verify that it should be set to default.

Table 3 PM: Important parameters in A4 menu to set/check when setting 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	0	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 4 PM: Important parameters in A5 menu to set/check when setting 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 5 PM: Important parameter in C1 menu to set/check when setting 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 6 PM: Important parameter in U9 menu to set/check when setting 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 hf inject auto align	Adjust to open when shaft of motor will be moving and auto align or hf inject when it will be kept still. Detail is provided on Encoder Align on page xi.

Table 7 PM: Important parameter in U10 menu to set/check when setting 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 8 PM: Important parameter in U12 menu to set/check when setting up a drive in PM mode

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HPV 900 Series 2 Drive Ratings

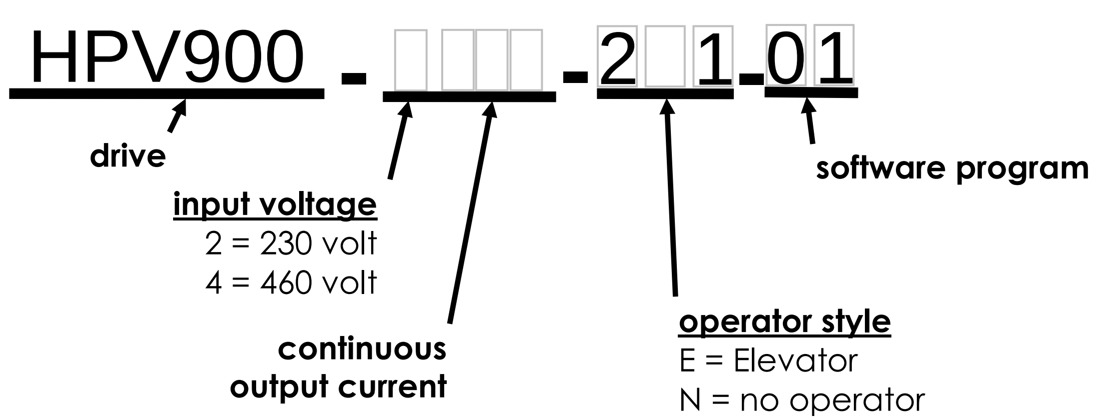
Rated Input Voltage	NA Rated HP[1]	EU Rated HP[1]	NA Rated kW[1]	EU Rated kW[1]	Overload Selection[4]	Carrier Freqency[5] (kHz)	Continuous Output Current General Purpose Rating	Continuous Output Current Elevator Duty Cycle Rating	Maximum Output Current for 5 Sec	Frame Size[2]	Model Number[3]
230V	7.5	--	5.5	--	250%	10	25	29	63	2	HPV900-2025-2E1-01
					200%	8	31	33	63		
	10	--	7.5	--	250%	10	31	36	78	2	HPV900-2031-2E1-01
					200%	8	39	41	78		
	15	--	11	--	250%	10	41	48	103	3.5	HPV900-2041-2E1-01
					200%	8	51	55	103		
	20	--	15	--	250%	10	52	60	130	3.5	HPV900-2052-2E1-01
					200%	8	65	70	130		
	25	--	19	--	250%	10	75	87	187.5	4	HPV900-2075-2E1-01
	30	--	22	--	250%	10	88	102	220	4	HPV900-2088-2E1-01
	40	--	30	--	250%	10	98	114	245	5	HPV900-2098-2E1-01
460V	5	5	3.7	3.7	250%	10	8	9	20	1	HPV900-4008-2E1-01
					200%	8	10	11	20		
	7.5	5.5	5.5	4	250%	10	12	14	30	2	HPV900-4012-2E1-01
					200%	8	15	16	30		
	10	7.5	7.5	5.5	250%	10	16	19	40	2	HPV900-4016-2E1-01
					200%	8	20	21	40		
	15	10	11	7.5	250%	10	21	24	53	3	HPV900-4021-2E1-01
					200%	8	26	28	53		
	20	15	15	11	250%	10	27	31	68	3	HPV900-4027-2E1-01
					200%	8	34	36	68		
	25	20	19	15	250%	10	34	39	85	4	HPV900-4034-2E1-01
					200%	8	43	45	85		
	30	25	22	18.5	250%	10	41	48	103	4	HPV900-4041-2E1-01
					200%	8	51	55	103		
	40	30	30	22	250%	10	52	60	130	4	HPV900-4052-2E1-01
					200%	8	65	70	130		
	50	40	37	30	250%	10	65	75	162.5	5	HPV900-4065-2E1-01
	60	50	45	37	250%	10	72	84	180	5	HPV900-4072-2E1-01
	75	60	56	45	250%	10	96	111	240	5	HPV900-4096-2E1-01

Table 1: HPV 900 Series 2 Drive Ratings

NOTE: all ratings at 60/50Hz and bases on a geared elevator appilcation

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. Cube size dimensions, mounting holes, and weights are shown in Dimensions, Mounting Holes and Weights, see technical manual
3. Based on Overload Select (C1) parameter selection
4. Maximum Carrier Frequency before derating

Drive Model Number



Submenu	Parameter	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Site Setting
A1	***Drive A1 Submenu – For details, see Drive A1 Submenu on page 40.***					
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 – 3.00[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]	

[i] Parameter accessible through **CLOSED LOOP (U9)** Operation

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

[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

Submenu	Parameter	Units	Range	Default		Site Setting
				ENGLISH (U3)	METRIC (U3)	
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		
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]	10.0 [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	Spd Zero Band	Volts	0.000 – 1.000	0.000		
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	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 Advance [i,ii]*	*Sec [i,ii]*	*0.00 – 2.00 [i,ii]*	*0.30 [i,ii]*		
A1[i,ii]	*ARB Decay [i,ii]*	*Sec [i,ii]*	*0.00 – 2.00 [i,ii]*	*0.20 [i,ii]*		
A1[i,ii]	*ARB Timeout [i,ii]*	*Sec [i,ii]*	*0.00 – 2.00 [i,ii]*	*0.80 [i,ii]*		
A1[i,ii]	*ARB Deadband [i,ii]*	*none*	*0 – 5.00 [i,ii]*	*1.00 [i,ii]*		
A1[i,ii]	*ARB KP1 [i,ii]*	*none [i,ii]*	*0.00 – 320.00 [i,ii]*	*1.00 [i,ii]*		
A1[i,ii]	*ARB KI1 [i,ii]*	*none [i,ii]*	*0.00 – 320.00 [i,ii]*	*1.00 [i,ii]*		
A1[i,ii]	*ARB2 KP2 [i,ii]*	*none [i,ii]*	*0.00 – 320.00 [i,ii]*	*1.00 [i,ii]*		
A1[i,ii]	*ARB2 KI2 [i,ii]*	*none [i,ii]*	*0.00 – 320.00 [i,ii]*	*1.00 [i,ii]*		
A1[i,ii]	*ARB FFWD [i,ii]*	*none [i,ii]*	*0 - 100 [i,ii]*	*0 [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]*		
A1	NTSD Target Spd	ft/ min	0 – 50.0	0.0		
		m/ sec	0 – 0.250			

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

Submenu	Parameter	Units	Range	Default		Site Setting
				ENGLISH (U3)	METRIC (U3)	
A1	NTSD Threshold 1	ft/ min	0 – 1500.0	0.0		
		m/ sec	0 – 7.600			
A1	NTSD Threshold 2	ft/ min	0 – 1500.0	0.0		
		m/ sec	0 – 7.600			
A1	NTSD Threshold 3	ft/ min	0 – 1500.0	0.0		
		m/ sec	0 – 7.600			
A2	***S-Curves A2 Submenu – For details, see S-Curves A2 Submenu on page 61.***					
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	
A2	Accel Rate 4	ft/s^2	0.00 – 7.99	5.00	-	
		m/s^2	0.000 – 3.999	-	1.500	
A2	Decel Rate 4	ft/s^2	0.00 – 7.99	5.00	-	
		m/s^2	0.000 – 3.999	-	1.50	

Submenu	Parameter	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Site Setting
A2	Accel Jerk In 4	ft/s^3	0.0 – 29.9	0.0	-	
		m/s^3	0.00 – 9.99	-	0.00	
A2	Accel Jerk Out 4	ft/s^3	0.0 – 29.9	0.0	-	
		m/s^3	0.00 – 9.99	-	0.00	
A2	Decel Jerk In 4	ft/s^3	0.0 – 29.9	0.0	-	
		m/s^3	0.00 – 9.99	-	0.00	
A2	Decel Jerk Out 4	ft/s^3	0.0 – 29.9	0.0	-	
		m/s^3	0.00 – 9.99	-	0.00	
A3	***Multistep Ref A3 Submenu – For details see Multistep Ref A3 Submenu on page 63.***					
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	
A3[ii]	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	-16.000 – +16.000	0.0	-	
		m/sec	-3000.0 – +3000.0	-	0.000	
A3[i]	Speed Command 8[i]	ft/min	-16.000 – +16.000	0.0	-	
		m/sec	-3000.0 – +3000.0	-	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[iii]	*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*	

[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 None, Mode1, Mode2 or Mode3
[iii] Parameter only accessible when SERIAL MODE (C1) is set to DCP 3 or DCP 4

Submenu	Parameter	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Site Setting
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]	*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*	*-*	*0.050*	
A4	***Power Convert A4 Submenu – For details, see Power Convert A4 Submenu on page 67.***					
A4	Input L-L Volts	volts	110 – 480	000		
A4	UV Alarm Level	%	40 – 99	90		
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 – 3.99	1.00 [i,iii]		
				0.00 [ii]		
A4	ID Reg Prop Gain	none	0.00 – 3.99 [i,iii]	0.10 [i,iii]		
			0.00 – 3.00 [ii]	*0.700 [ii]*		
A4[ii]	*ID Reg Intg Gain [ii]*	*none [ii]*	*0.00 – 3.99 [ii]*	*1.00 [ii]*		
A4	IQ Reg Diff Gain	none	0.00 – 3.99	1.00 [i,iii]		
				0.00 [ii]		
A4	IQ Reg Prop Gain	none	0.00 – 3.99 [i,iii]	0.10 [i,iii]		
			0.00 – 3.00 [ii]	*0.700 [ii]*		
A4[ii]	*IQ Reg Intg Gain [ii]*	*none [ii]*	*0.00 – 3.99 [ii]*	*1.00 [ii]*		
A4[ii]	*Fine Tune Ofst [ii]*	*degs [ii]*	*-100 – 100 [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]*	*2.0 [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]*		

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

Submenu	Parameter	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Site Setting
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]*	*0.000 – 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	Travel Dir Spd	%	0.0 – 100.0	0.0		
A4[ii]	*Autoalign Volts [ii]*	*% [ii]*	*5 – 30 [ii]*	*10 [ii]*		
A4	Fan Off Delay	sec	0 – 999	20		
A5	***Motor A5 Submenu – For details see Motor A5 Submenu on page 74.***					
A5	Motor ID	none	– 4 pole dflt[i,iii] – 6 pole dflt[i,iii]	4 pole dflt[i,iii]		
			– *PM dflt[ii]*	*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[i,iii]		
				0[ii]		
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 – 25.0	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 – 150.00 [ii]*	*10 [ii]*		
A5[ii]	*Q Axis Induct [ii]*	*none [ii]*	*0.50 – 150.00 [ii]*	*10 [ii]*		
A5[ii]	*OL Align 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
[ii] Parameter accessible through ***PM (U9)*** Operation
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

C1	***User Switches C1 Submenu – For details, see User Switches C1 on page 80.***					
C1	Spd Command Src	none	– multi-step – ser mult step – analog input – 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]*	– *incremental[ii]* – *endat[ii]*	*INCREMENTAL[ii]*		
C1[i,ii]	Encoder Connect[i,ii]	None[i,ii]	– forward[i,ii] – reverse[i,ii]	FORWARD[i,ii]		
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]	– internal[i,ii] – external tb[i,ii] – serial[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
[ii] Parameter accessible through ***PM (U9)*** Operation
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

C1	***User Switches C1 Submenu continued…***				
C1	Serial Mode	none	– none – DCP4 – mode 1 – DCP3 – mode 2 – mode 2 – mode 3 test	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 – active	DISABLE	
C1	Brk Hold Flt Ena	none	– disable – enable – active	DISABLE	
C1[i,ii]	Ext Torq Cmd Src [i,ii]	none [i,ii]	– none [i,ii] – serial [i,ii] – analog input [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]	– external tb [i,ii] – serial [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 – multispeed 1-15	NONE	
C1	Priority Msg	none	– enable – disable	ENABLE	
C1[i,ii]	*ARB Select [i, ii]*	*none [i, ii]*	– *disable [i,ii]* – *ARB2 [i,ii]* – *ARB3 [i,ii]*	*DISABLE [i,ii]*	
C1 [ii]	*Endat Interp [ii]*	*none [ii]*	– *8 [ii]* – *32 [ii]* – *256 [ii]* – *64 [ii]* – *512 [ii]* – *128 [ii]* – *1024 [ii]*	*128 [ii]*	
C1 [ii]	*Endat Out Mult [ii]*	*none [ii]*	– *8 [ii]* – *1 [ii]* – *2 [ii]* – *4 [ii]*	*8 [ii]*	

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

C1	Drive Enable Src	none	– external tb – serial – serial+extern	EXTERNAL TB	
C1	Rec Travel Dir	none	– none – geared – gearless	NONE	
C1	Phase Loss Check	none	– high sens. – low sens. – disabled	HIGH SENS.	
C1	Overload Select	%	– 250 – 200	250	
C1	NTSD Mode	none	– external – 1 Threshold – 2 Thresholds – 3 Thresholds	EXTERNAL	
C1	Balance Comp	none	– Disable – Enable	DISABLE	
C1	Fan PWM Enable	none	– Enable – Disable	ENABLE	
C1	PPT Select	none	– Enable – Disable	DISABLE	

C2	***Logic Inputs C2 Submenu – For details, see Logic Inputs C2 on page 100.***				
C2	Logic Input 1	– 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 1 – mech brk pick 2 – nc ctct cfirm – no function – NTSD Input 1 – NTSD Input 2 – ospd test src – pre-trq latch – quick stop – rec travel en – run – run down – run up – s-curve sel 0 – s-curve sel 1 – safe-off *(LI 9 only)* – ser2 insp ena – step ref b0 – step ref b1 – step ref b2 – step ref b3 – trq ramp down – up/dwn	DRIVE ENABLE		
C2	Logic Input 2		RUN	CONTCT CFIRM	
C2	Logic Input 3		FAULT RESET	RUN UP	
C2	Logic Input 4		UP/DWN	RUN DOWN	
C2	Logic Input 5		S-CURVE SEL 0		
C2	Logic Input 6		STEP REF B0		
C2	Logic Input 7		STEP REF B1		
C2	Logic Input 8		STEP REF B2		
C2	Logic Input 9		SAFE-OFF		
C3	***Logic Outputs C3 Submenu – For details, see Logic Outputs C3 on page 103.***				
C3	Logic Output 1	– 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 – motor trq lim – mtr overload – no function – not alarm – NTSD active – over curr flt – overspeed flt – overtemp flt – overvolt flt – ovrtemp alarm – phase fault – probe 1 – probe 2 – ramp down ena – ready to run – rec travel on – rec travel dir – regen trq lim – run commanded – run confirm – safe-off input – 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	READY TO RUN		
C3	Logic Output 2		RUN COMMANDED		
C3	Logic Output 3		MTR OVER-LOAD	ZERO SPEED	
C3	Logic Output 4		ENCODER FLT		
C3	Relay Coil 1		FAULT	READY TO RUN	
C3	Relay Coil 2		SPEED REG RLS	BRAKE PICK	
C3	User LED		ALARM		

<table>
<tr><th>C4</th><th colspan="6">Analog Outputs C4 Submenu – For details, see Analog Outputs C4 on page 106.</th></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</td><td rowspan="2">– pretorque ref
– probe 1
– probe 2
– slip freq
– spd rg tq cmd
– speed command
– speed error
– speed feedbk
– speed ref
– tach rate cmd
– theta e
– torq current
– torque ref
– torq voltage
– torque output
– 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	Analog Spd Cmd	volts
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
D1	Measured PPR	PPR
D1	Endat Abs Fdbk[ii]	None
D1	Z Edge Count[ii]	None
D1	NTSD 1 Spd Fdbk	ft/min or m/s
D1	NTSD 2 Spd Fdbk	ft/min or m/s
D1	NTSD 3 Spd Fdbk	ft/min or m/s
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]

Sub menu	Parameter	Units
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
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	Probe Addr1	
U7	Probe Ctrl 1	
U7	Probe Addr 2	
U7	Probe Ctrl 2	
U7	Probe Addr 3	
U7	Probe Ctrl 3	
U7	Probe Addr 4	
U7	Probe Ctrl 4	
U7	Cycle Sim	
U7	Debug Enable	
U8	***Language Sel U8 Submenu***	
U8	Language Select	
U9	***Basics U9 Submenu***	
U9	Drive Mode	

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

Sub menu	Parameter	Units
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]	
U13	***Upload / DL U13 Submenu***	
U13	Drive to Op Xfer	

Sub menu	Parameter	Units
U13	Op to Drive Xfer	
U14	***Power Meter U14 Submenu***	
U14	Motor Pwr	
U14	Regen Pwr	
U14	Energy Time	
U14	Energy Reset	
U15	***Overload Test U15 Submenu***	
U15	Overload Test	
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	

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
- 200% of continuous current for 5 seconds on select models (see ratings table, page 3)

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

It is recommended that true 3-phase power is used. If you are using 3-phase power from a delta-high leg source, running through a Scott-T transformer, you can use a Delta to Wye transformer and a line filter at the incoming power to improve performance and help prevent nussiance faults.

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)

Isolated 24 Volt DC Power Supply
- Supply voltage range: 24 V_{DC} (± 10 %)
- Maximum capacity: 250 mA

Digital Inputs
Nine (9) programmable optically isolated logic input circuits.

For sinking operation (high true):
- Off state voltage range:
  0 to 4.5 volts
- On state voltage range:
  18 to 26.4 volts

For sourcing operation (low true):
- Off state voltage range:
  (logic input common voltage) to (logic input common voltage) – 4.5 volts
  The nominal case is 24 to 19.5V. The range moves up and down with the tolerance of the 24V DC supply
- On state voltage range:
  0 to 3.5 volts

For either sinking or sourcing operation
- Off state leakage current: 1 mA
- Nominal on state current: 5.5 mA
- Input response time: 10 µs to 2 µs
- Input scan rate: 500 Hz (every 2 ms)

Digital Outputs

Two (2) programmable Form-C relays

- Relay 1&2: 2A at 30VDC / 250VAC resistive (inductive load)
- Update Rate: 2 msec.
- Minimum recommended load 100mA, 5Vdc

Four (4) programmable opto-isolated open-collectors

- Voltage: 50 Volts DC (max.)
- Capacity: ≤ 100 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 31

- 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 195.

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 194.

PM Derating:

When drive is running at an output frequency of less than 3 Hertz the drive overload current is derated to 175% of rated current.

See page 148 for drive overload curves.

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 1, set the power switch to "1". Plug operator back into drive.

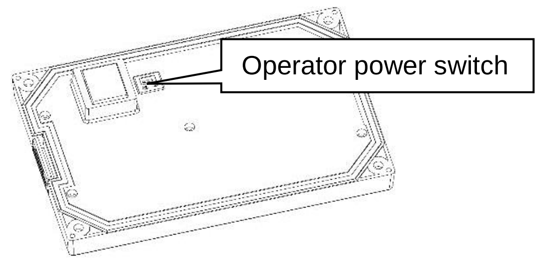


Figure 1: Back of Operator

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 152.

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

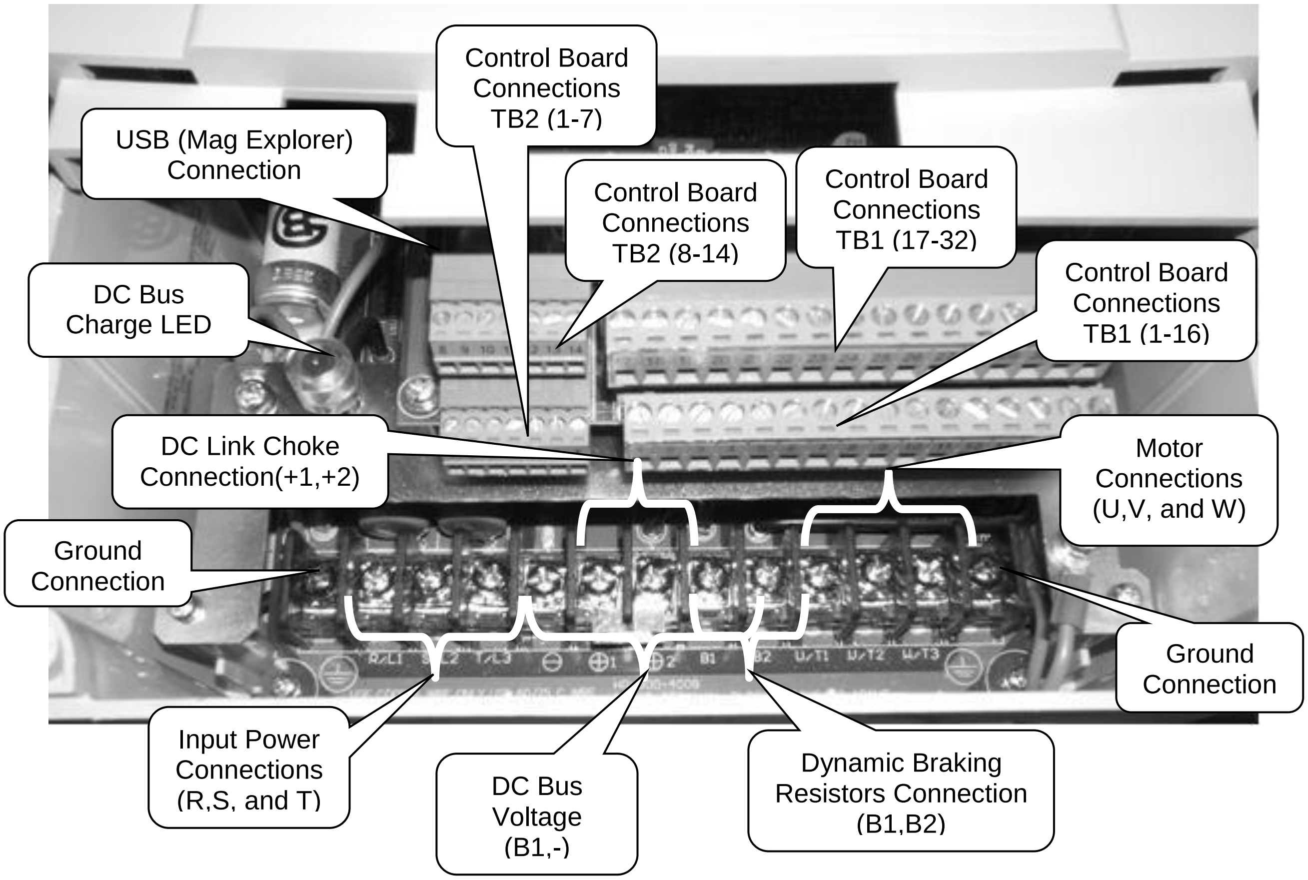
Caution—Risk of Electric Shock: More than one live circuit: See diagram

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.

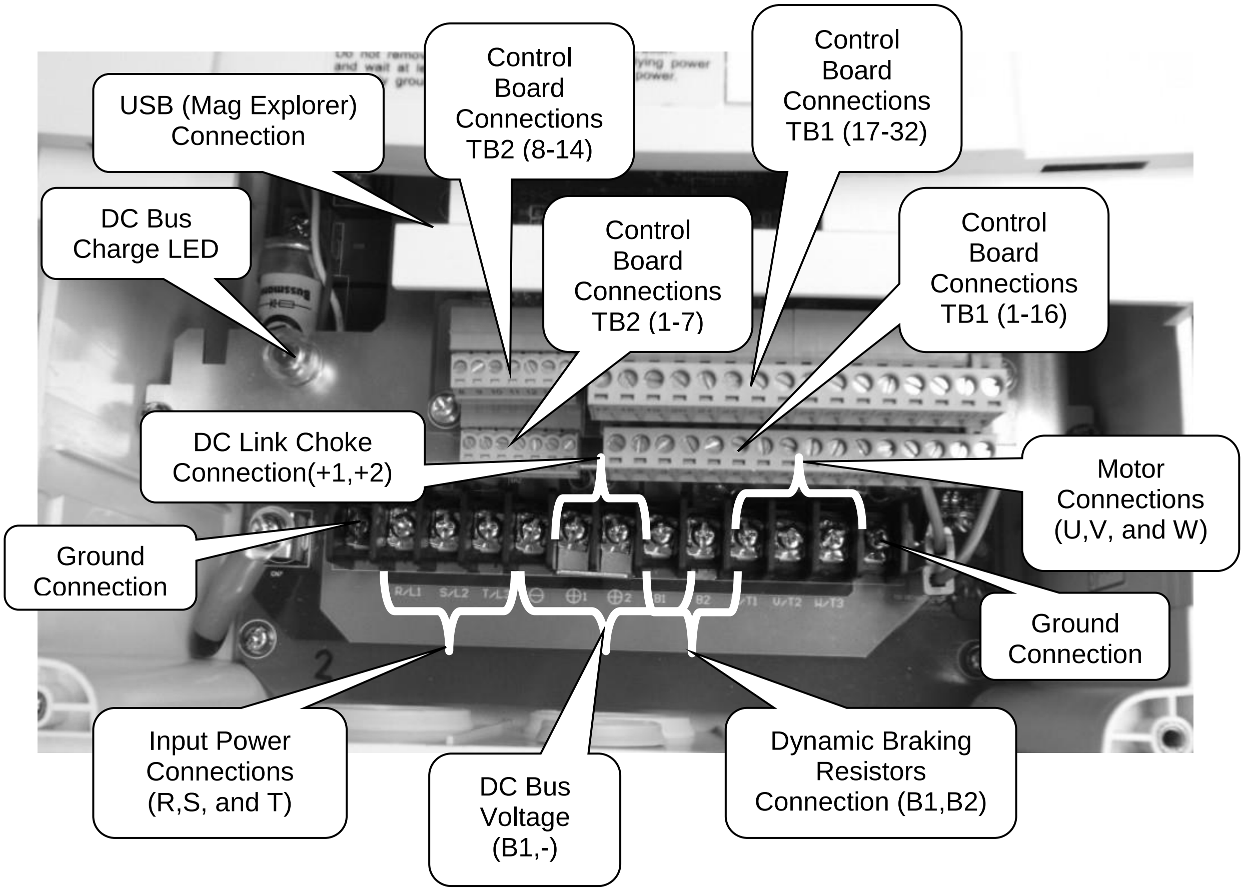
NEVER attempt maintenance unless:
The incoming three phase power (460 or 230VAC) is disconnected and locked out.
Also, ensure the DC Bus charge light is out.
Even with the light out, we recommend that you use a voltmeter between (B1) and (-) to verify that no voltage is present.

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 2: Terminal Connections (Frame 1)

Terminals



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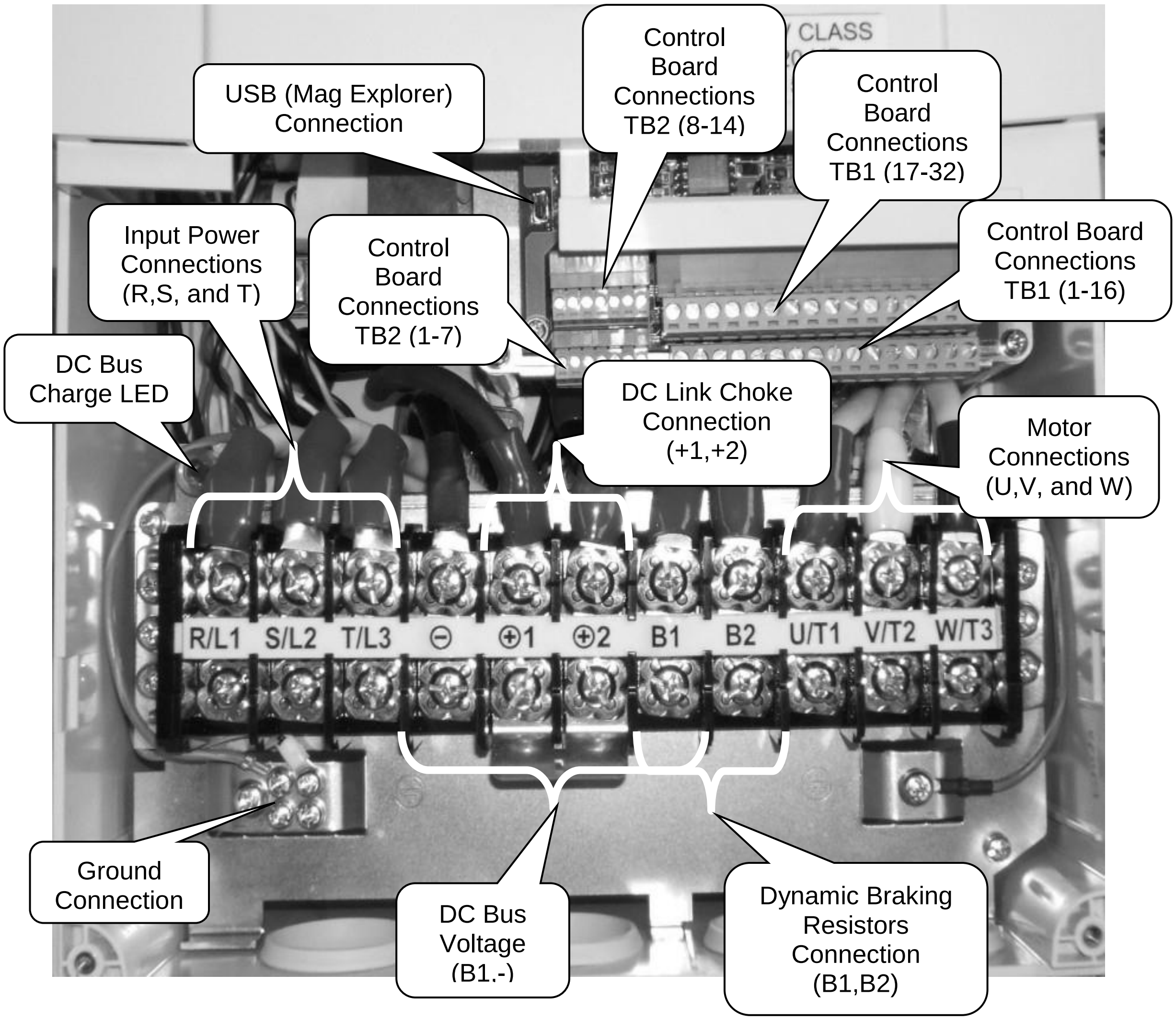
CAUTION: Before continuing, ensure the DC Bus Charge LED is not illuminated.

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

Figure 3: Terminal Connections (Frame 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.

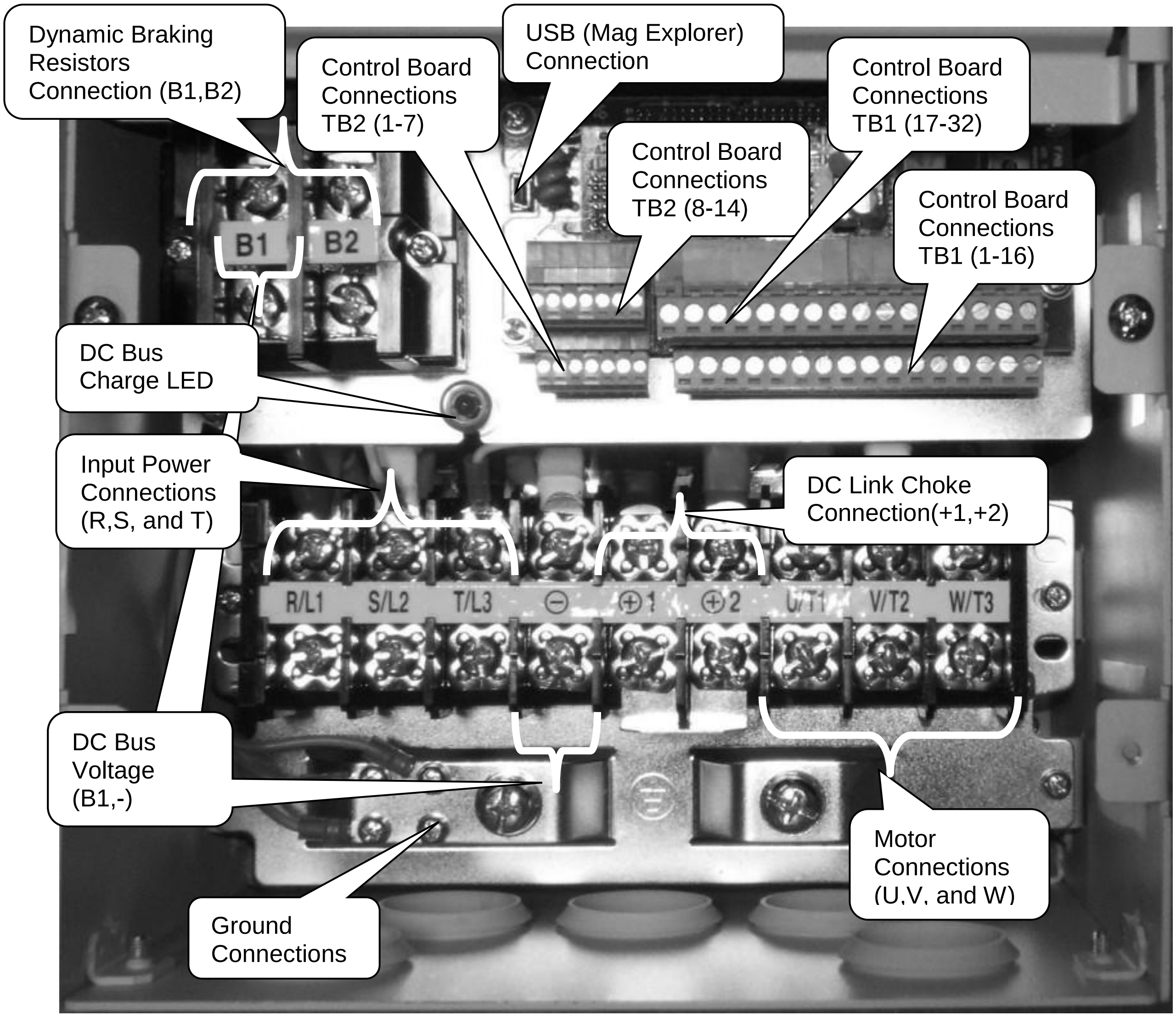
NEVER attempt maintenance unless:
The incoming three phase power (460 or 230VAC) is disconnected and locked out.
Also, ensure the DC Bus charge light is out.
Even with the light out, we recommend that you use a voltmeter between (B1) and (-) to verify that no voltage is present.

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 3)

Terminals



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

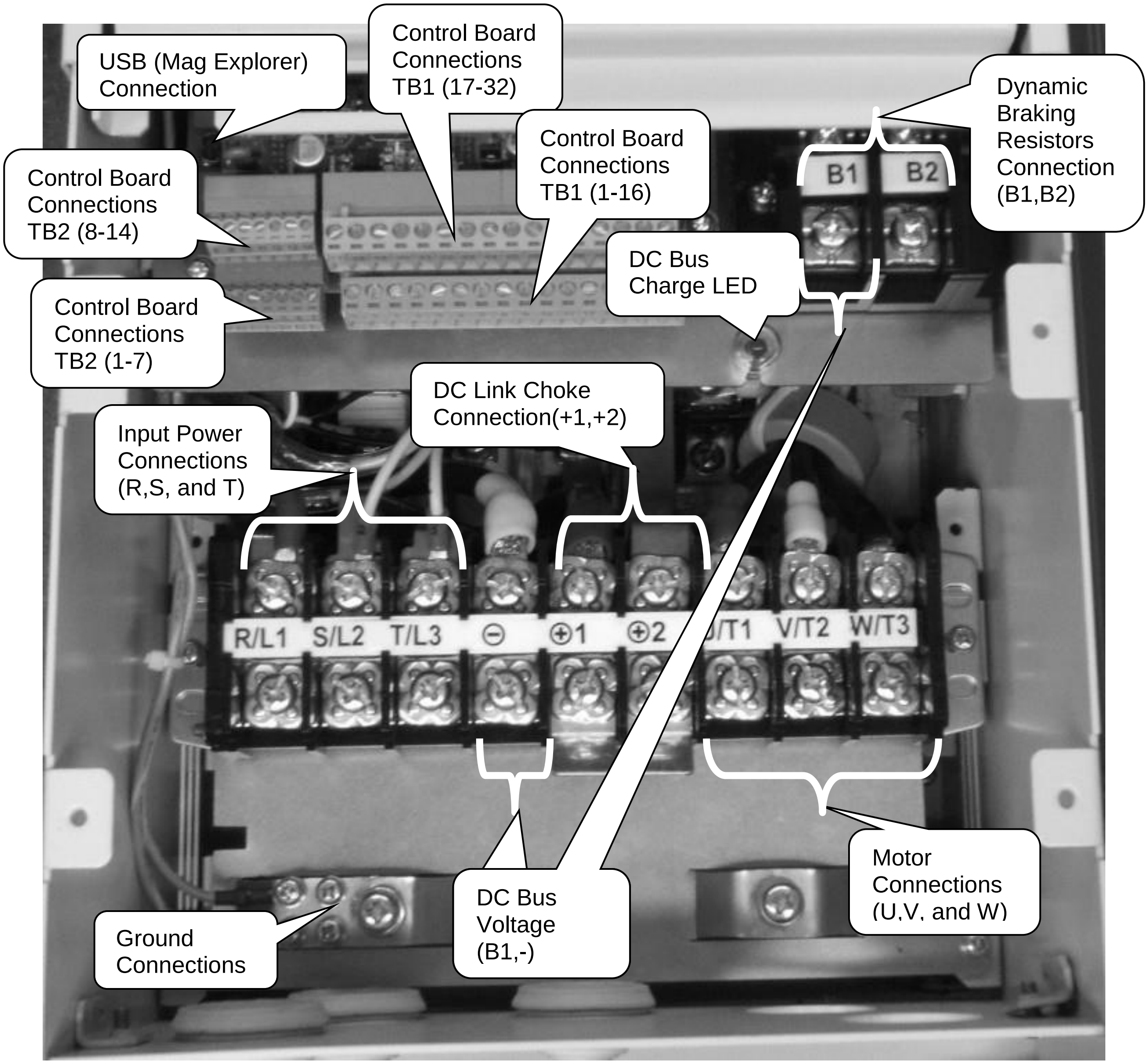
IMPORTANT: Use extreme caution: Do not touch any circuit board, the drive, or motor electrical connections without making sure that the unit is properly grounded and that no high voltage is present.

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 (B1) 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 3.5)



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

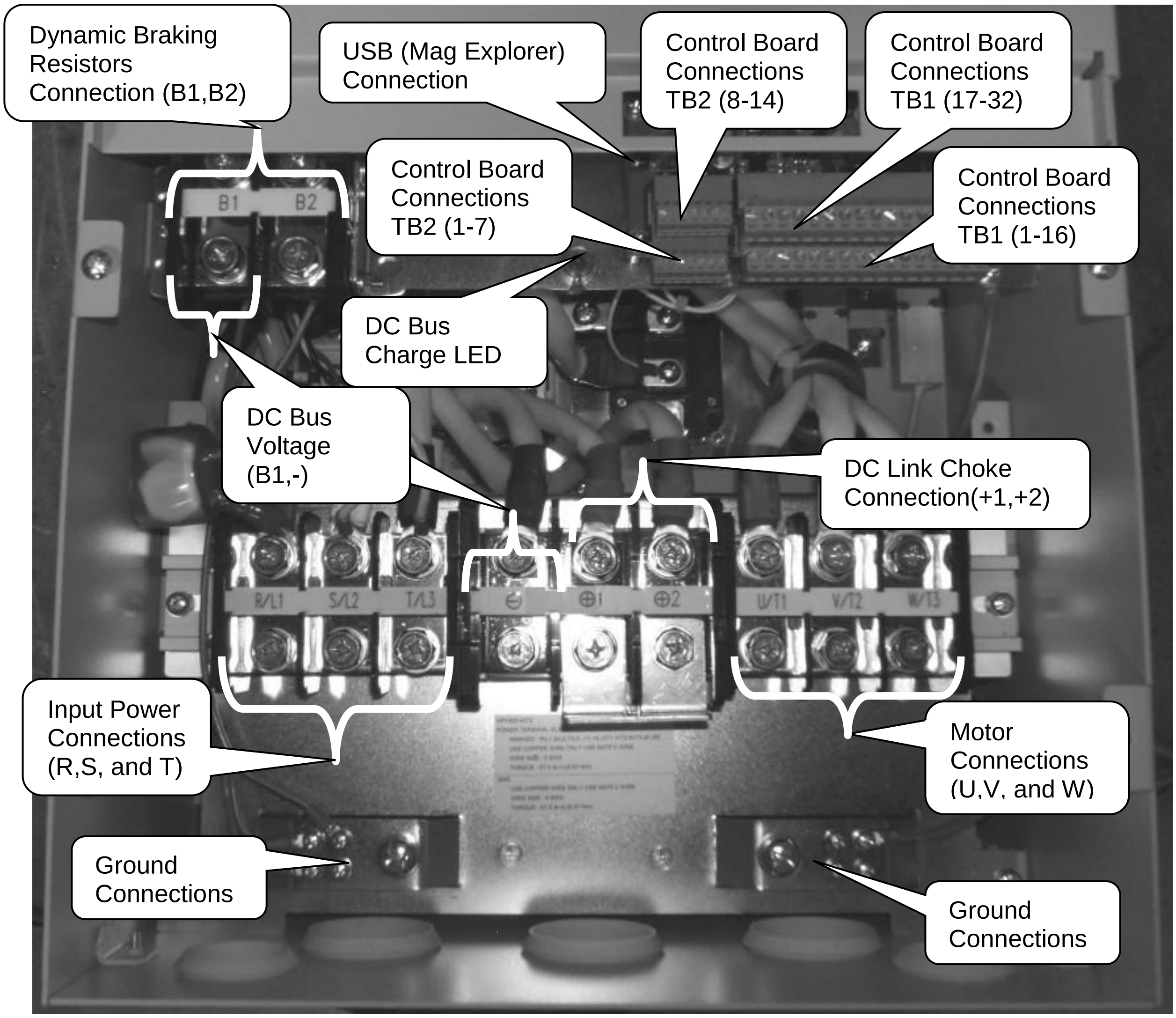
IMPORTANT: Use extreme caution: Do not touch any circuit board, the drive, or motor electrical connections without making sure that the unit is properly grounded and that no high voltage is present.

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 (B1) 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 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 (B1) 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 5)

Interconnections

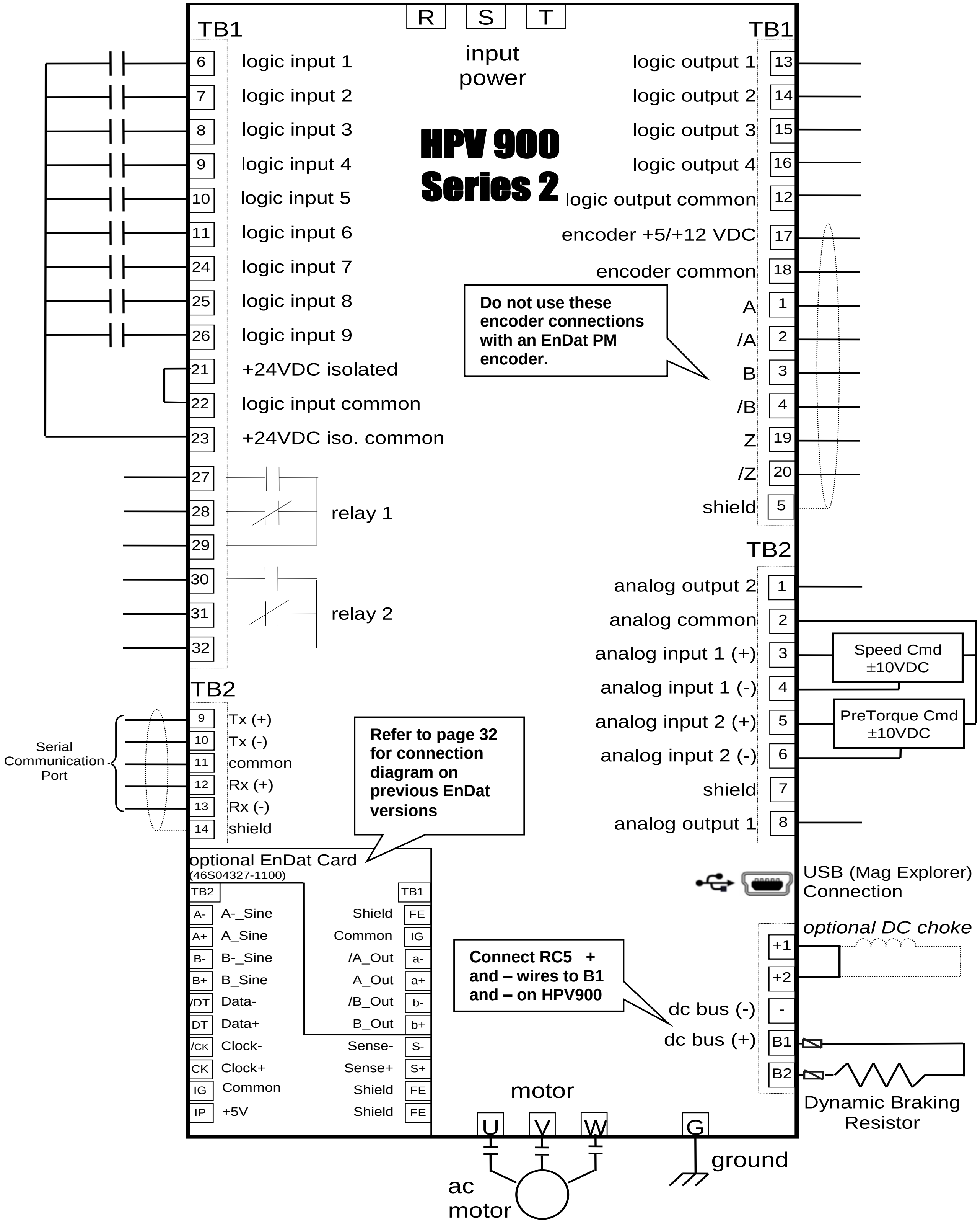


Figure 8: Interconnection Diagram

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

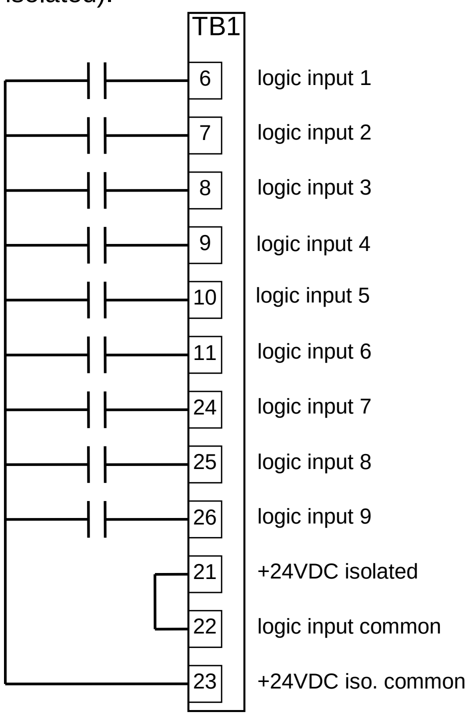


Figure 9: Logic Inputs Sourcing Operation (Low True - Internal Supply)

Figure 10 shows the connection for using the internal voltage supply. And in this case, the voltage source common is TB1-23 (+24VDC isolated common).

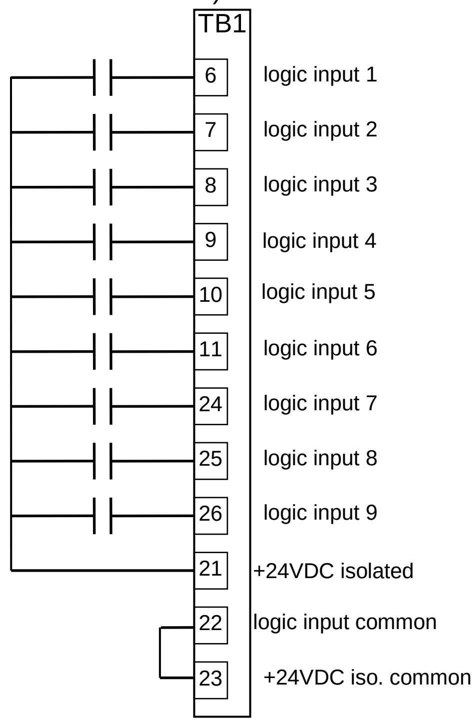


Figure 10: Logic Inputs Sinking Operation (High True - Internal Supply)

Figure 11 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.

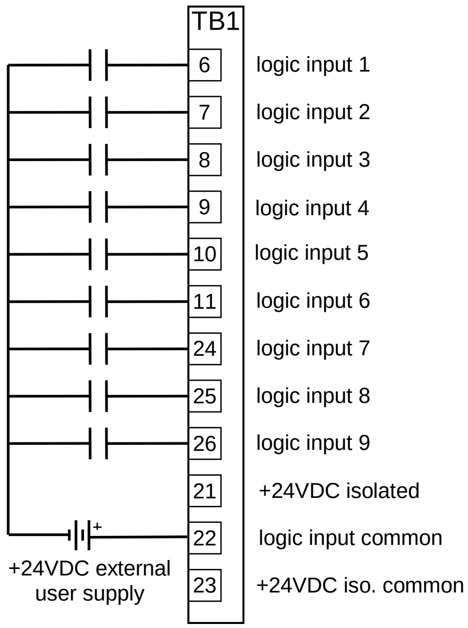


Figure 11: Logic Inputs Sourcing Operation (Low True - External Supply)

Figure 12 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.

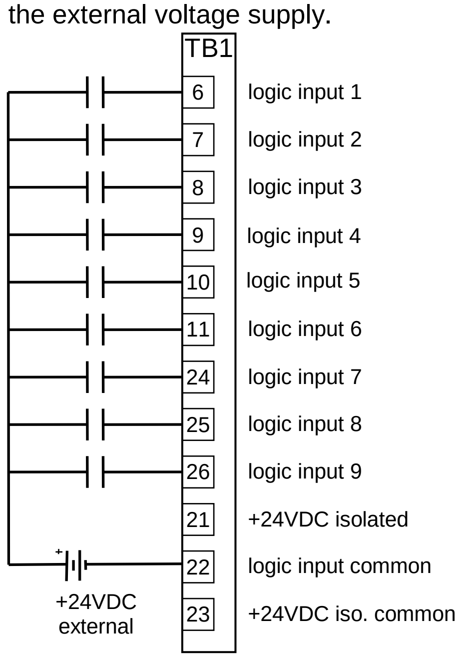


Figure 12: Logic Inputs Sinking Operation (High True - External Supply)

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 100.

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 13 shows the logic output terminals.

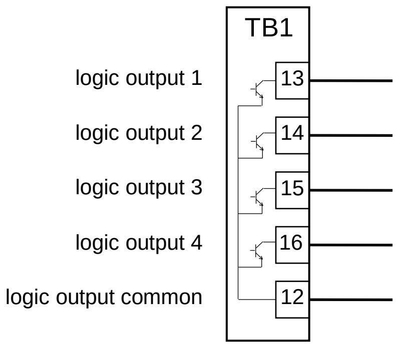


Figure 13: Logic Outputs

For more information on programming the logic outputs, see section Logic Outputs C3 on page 103.

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	TB1-11
Logic Output 4	TB1-16	TB1-17	TB1-12
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 198.

Figure 14 shows the relay output terminals.

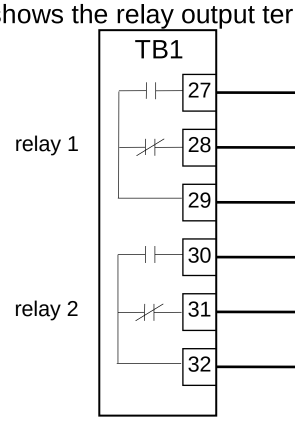


Figure 14: Relay Outputs

For more information on programming the relay outputs, see Logic Outputs C3 on page 103.

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-485 interfaces and support multiple serial protocols detailed on page 84. The serial terminations should be as detailed in Table 5.
DB9 to flying lead connector available. See spare parts list.

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 15 shows serial terminations when using the RS-422 Interface

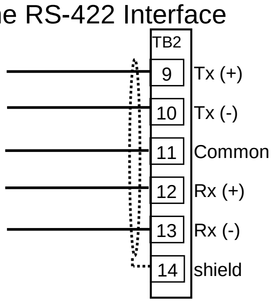


Figure 15: Serial Terminations (RS-422)

Figure 16 shows serial terminations when using the RS-485 Interface

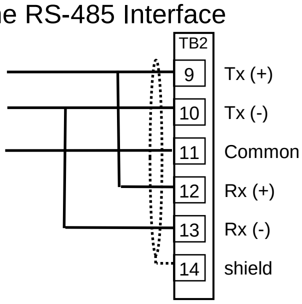


Figure 16: Serial Terminations (RS485)

Set SW1 to the "on" position if you are using a long communication cable. This will put a 120k ohm resistor between Rx(+) and Rx(-) to help prevent ringing.

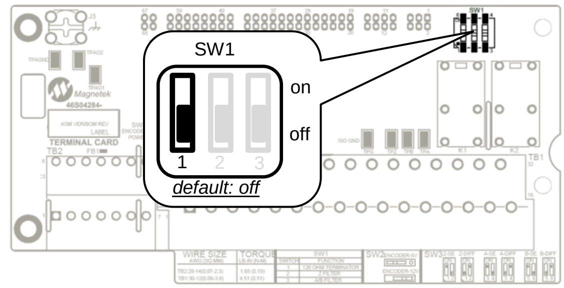


Figure 17: TerMag Board Serial DIP switch

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. www.elevatordrives.com

Encoder

The HPV 900 Series 2 can be configured for an incremental two-channel quadrature encoder. The drive's encoder circuitry incorporates resolution multiplication and complimentary outputs. It is recommended that a diferential line driver encoder of type 7272 is used. Push-pull type encoders can be used but only for TerMag boards at 46S04284-1020. See appendix Selecting and Mounting of Encoder page 187.

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 40*.

The encoder connection terminals are shown in Figure 18.

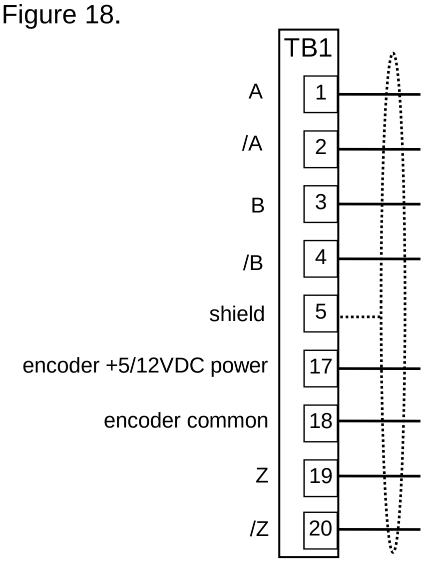


Figure 18: Encoder Connections

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
encoder 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 SW2 switch as seen in the figure below from +5V position to the +12V position

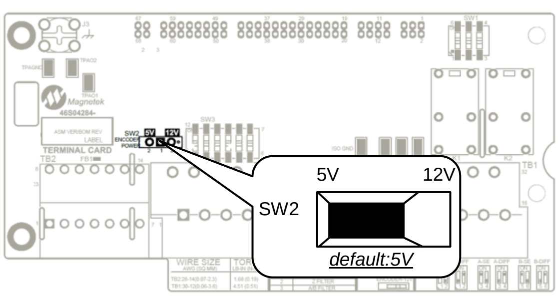


Figure 19: TerMag Board Encoder Voltage Selection

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.

NOTE: If a EnDat board is installed in the drive with a TerMag board with a part number 46S04284-1020, the A/B and Z filters on SW1 on the TerMag board should be turned off (SW1-2 and SW1-3 in down position).

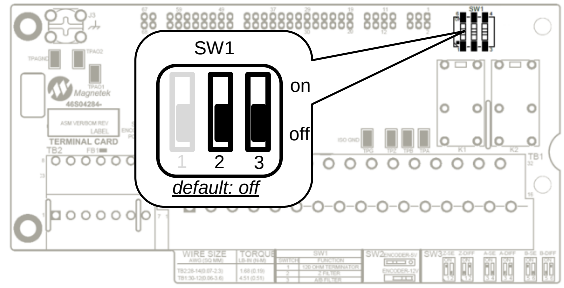


Figure 20: TerMag Board Encoder Filters

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.

HPV 900 S2 PM EnDat Encoder

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’). For Cables longer than 15 meters (50’) the sense wires should be connected and JP1 and/or JP2 on the EnDAT board should be set to the 2-3 position.

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 22. 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.

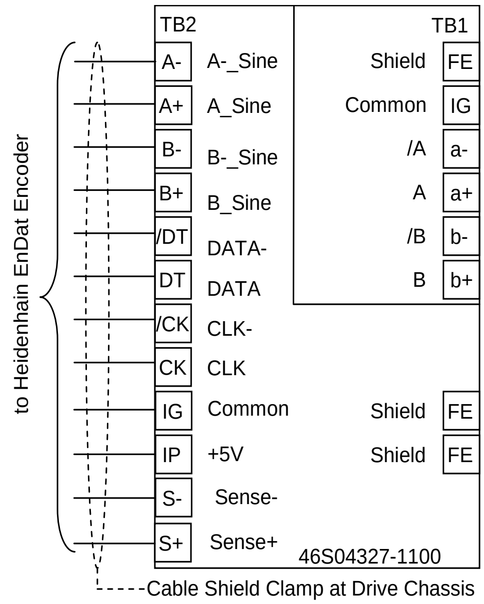


Figure 21: EnDat Encoder Option Card Part Number 46S04327-1100

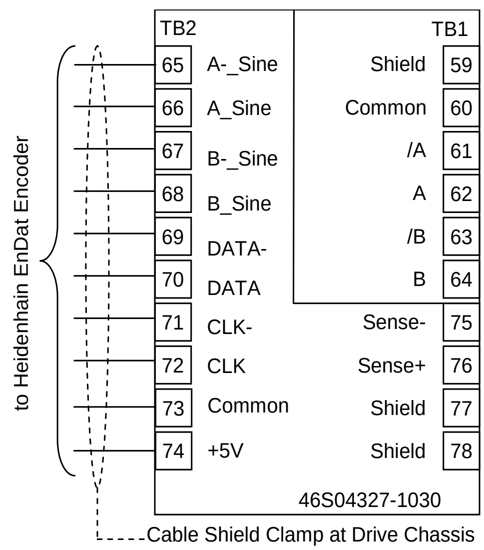


Figure 22: Previous EnDat Encoder Option Card Versions

NOTE: Refer to Encoder Set-up on page ix for details on wire color schemes on different EnDat encoder cables

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.

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

For more on the multiplier gain or bias parameters, see Drive A1 Submenu on page 40.

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.

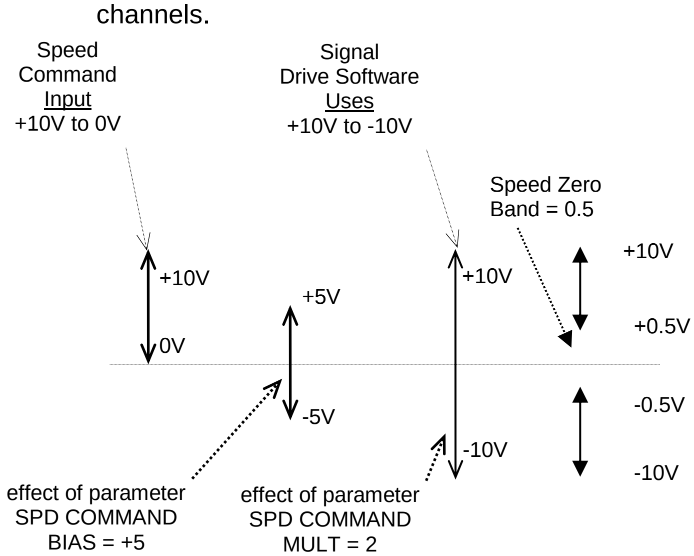


Figure 23: Analog Input Scaling

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 24

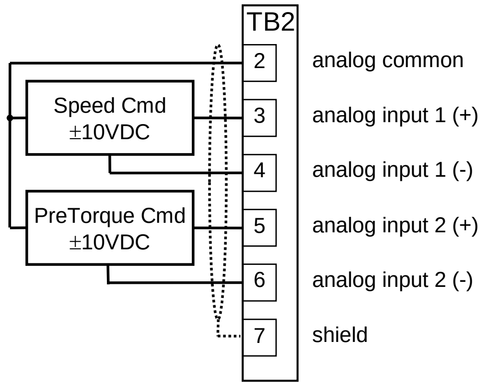


Figure 24: Analog Inputs (Differential)

Figure 25 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.

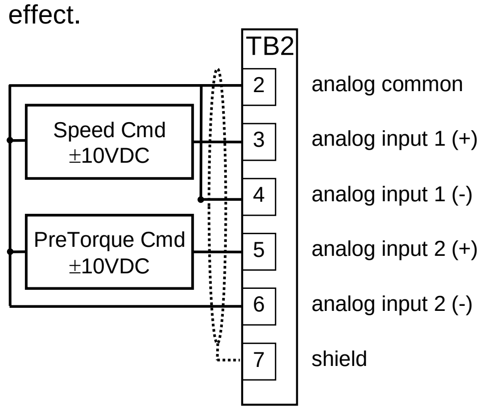


Figure 25: Analog Inputs (Single Ended)

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 106.* 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 26.

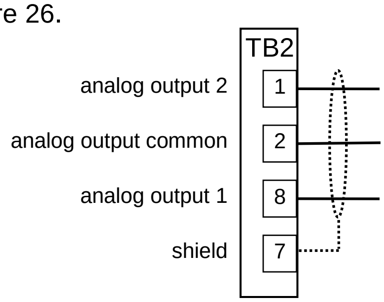


Figure 26: Analog Outputs

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 27, Figure 28, Figure 29, and Figure 30).

Equipment Grounding

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

Control Circuit

Observe the following precautions:

Refer to Figure 8 on page 25 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.

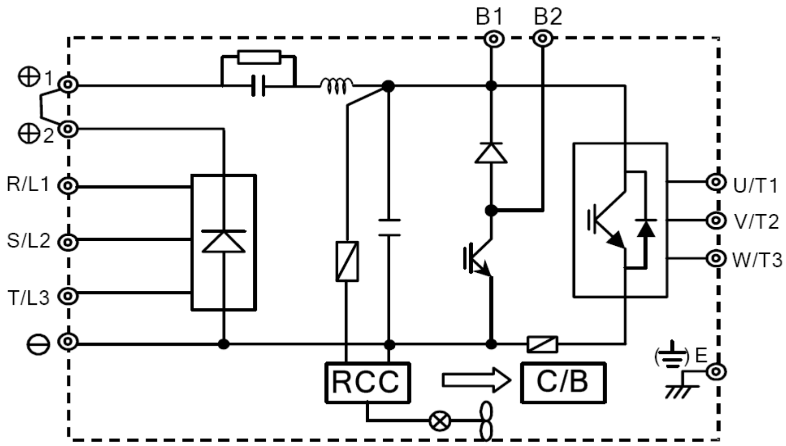


Figure 27: Main Circuit Block Diagram (230VAC 1-20HP cube)

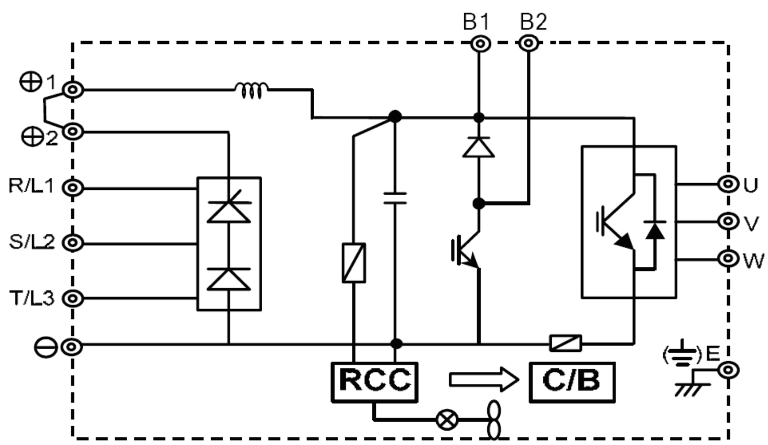


Figure 28: Main Circuit Block Diagram (230vac 25-60HP)

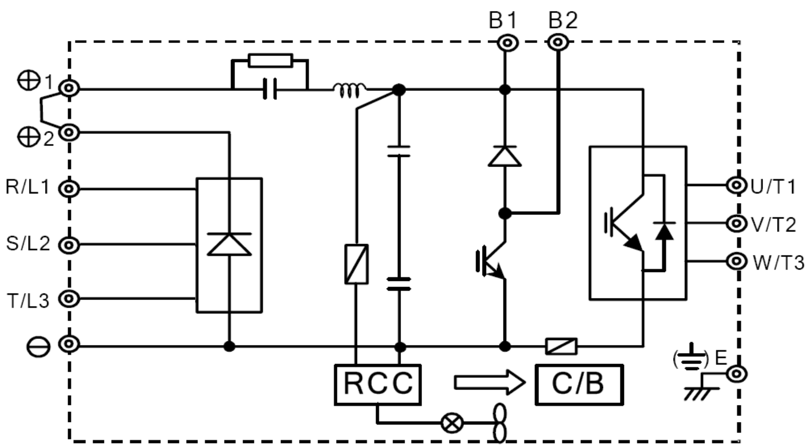


Figure 29: Main Circuit Block Diagram (460VAC 1-20HP)

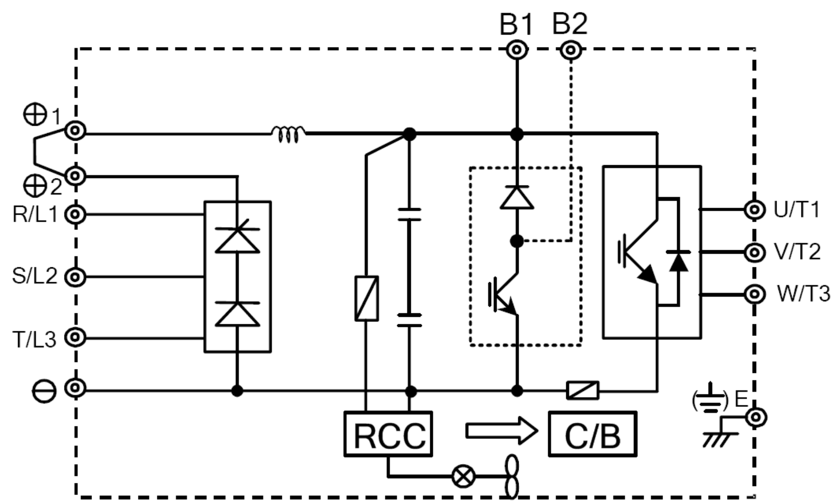


Figure 30: Main Circuit Block Diagram (460VAC 25-75HP)

Parameters

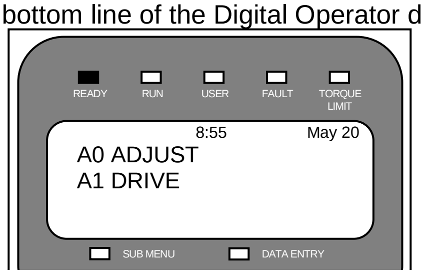
Parameter Introduction

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 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:

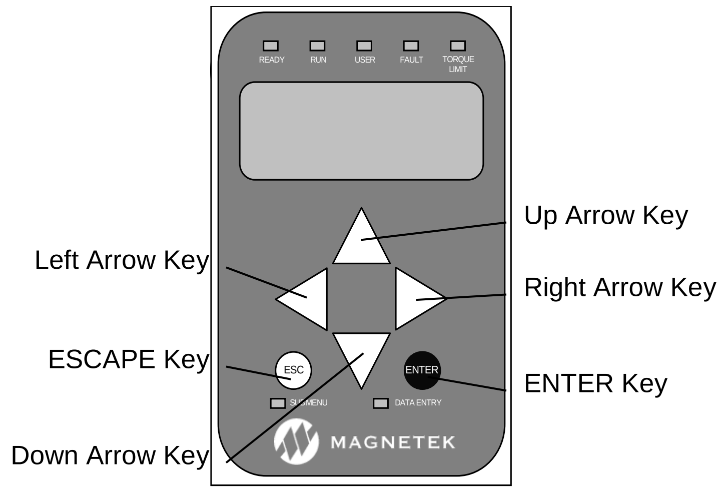


Figure 31: Digital Operator Keys

The menu/sub-menu tree is shown below.

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
- UPLOAD/DL U13
- Power Meter U14
- OVERLOAD TEST U15

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

Display 2 D0
- Elevator Data D1
- Power Data D2

Figure 32: Menu/Sub-Menu Tree

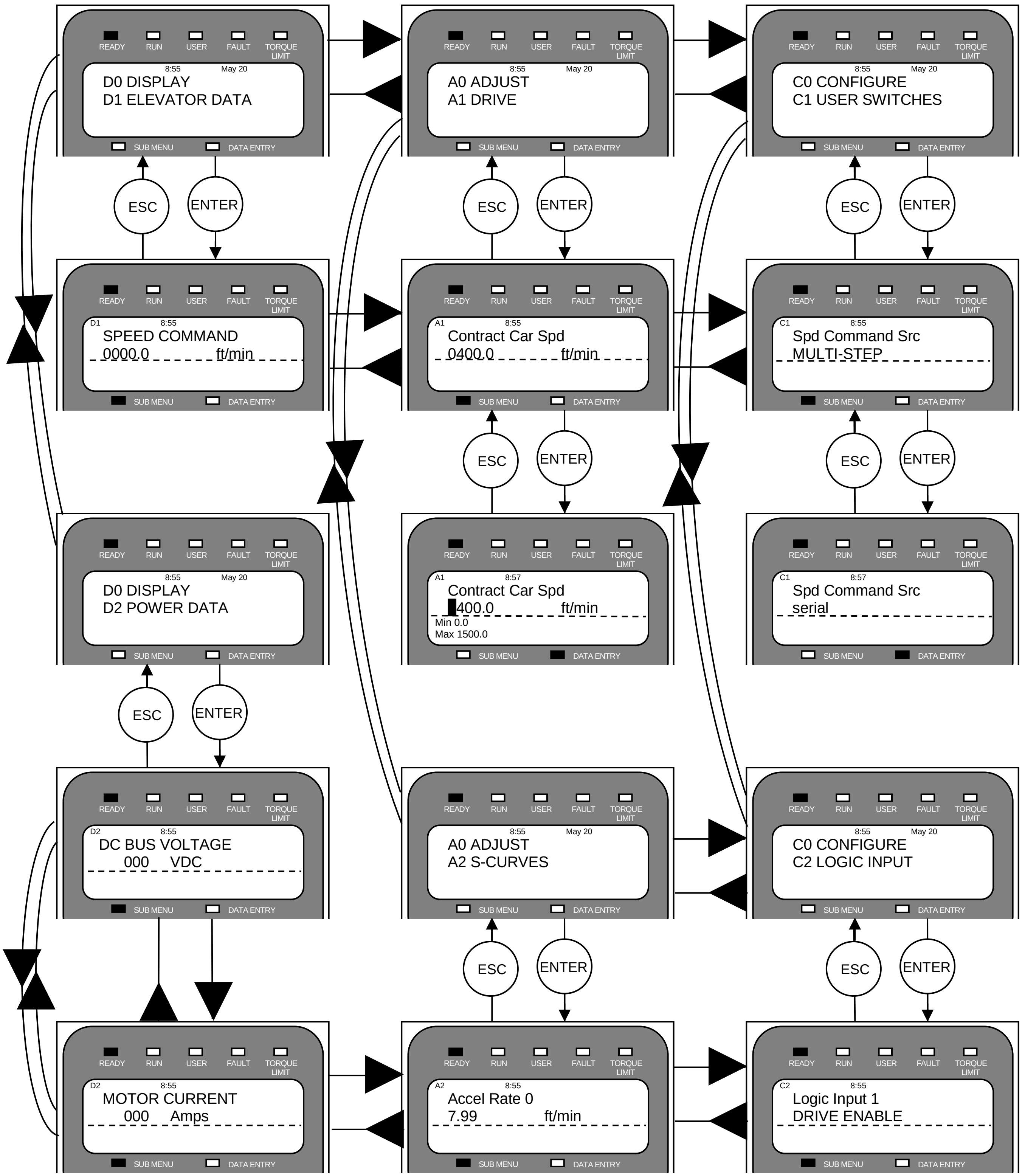


Figure 33: Operator Navigation

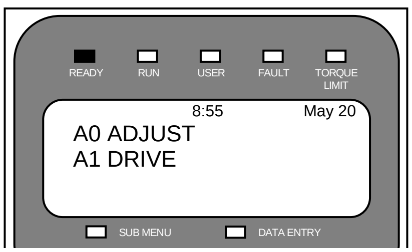
Menus
Each menu has a number of sub-menus, see Figure 32.

Menu Navigation

How these keys in Figure 31 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.

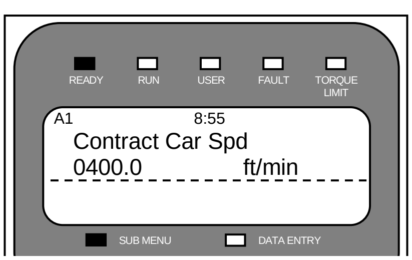


Each menu will remember the last accessed sub-menu. The left and right arrow keys will navigate between these last active sub-menus. This remembrance of last active sub-menu is volatile and will be lost at power down.

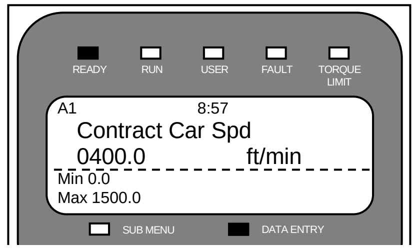
When any sub-menu is displayed, pressing the "ENTER" key will place the operator in the sub-menu level.

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 119.*

Magnetek Explorer

Magnetek Explorer is a program available at www.elevatordrives.com. This allows you to use a computer to download and upload the parameters in the A and C menus. Version 3.4.5 or later should be used.

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 119.*

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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	METRIC (U3)	**Hidden Item**	**Run lockout**
Contract Car Spd *[A101]*	(Contract Car Speed) This parameter programs the elevator contract speed in feet per minute (fpm) or meters per second (m/s)	**fpm** **m/s**	**0.0 – 1500.0** **0.000 – 8.000**	**400.0** **-**	- **0.000**	N	Y
Contract Mtr Spd *[A102]*	(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] **130.0**[ii]	**0.0**	N	Y
Response[i,ii] *[A103]*	(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] *[A104]*	(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 *[A105]*	(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] ***10000*** [ii]		N	Y
Serial Cnts/ Rev[ii] *[A106]*	*(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 *[A107]*	(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
[ii] Parameter accessibly through ***PM (U9)*** Operation
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

Parameter *[Alphanumeric]*	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lockout
Regen Torq Limit *[A108]*	(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] *[A109]*	(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 54.	**%**[i]	**60 – 100**[i]	**100**[i]		Y[i]	N[i]
Trq Lim Msg Dly *[A110]*	(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] *[A111]*	(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 55.	**%**[i,ii]	**10 – 100**[i,ii]	**100**[i,ii]		Y[i,ii]	N[i,ii]
Gain Chng Level[i,ii] *[A112]*	(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 55. 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] *[A113]*	(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 56.	**%**[i]	**0.0 – 99.9**[i]	**10.0**[i]		Y[i]	N[i]
Ramped Stop Time[i,ii] *[A114]*	(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 56.	**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
[ii] Parameter accessibly through ***PM (U9)*** Operation
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	**Default** METRIC (U3)	**Hidden Item**	**Run lockout**
Contact Flt Time *[A115]*	(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 *[A116]*	(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 *[A117]*	(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 *[A118]*	(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 *[A119]*	(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] *[A122]*	(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
[ii] Parameter accessibly through ***PM (U9)*** Operation
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

Parameter [Alphanumeric]	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lockout
Ab Off Delay [i,ii] *[A123]*	(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] *[A120]*	*(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] *[A121]*	*(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 *[A124]*	(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] *[A125]*	*(DC Injection Current Start Leveli[ii]) 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] *[A126]*	*(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
[ii] Parameter accessibly through ***PM (U9)*** Operation
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

Drive A1 Submenu

Parameter [*Alphanumeric*]	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	METRIC (U3)	**Hidden Item**	**Run lockout**
DC Stop Freq[iii] *[A127]*	*(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] *[A128]*	*(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] *[A129]*	*(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] *[A130]*	(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] *[A131]*	(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 – 3.00**[i,ii]	**1.00**[i,ii]		Y[i,ii]	N[i,ii]
Overspeed Mult *[A132]*	(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] *[A133]*	*(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
[ii] Parameter accessibly through ***PM (U9)*** Operation
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

Parameter [Alphanumeric]	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lockout
Stall Fault Time[iii] [A134]	(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] [A135]	(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] [A136]	(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]

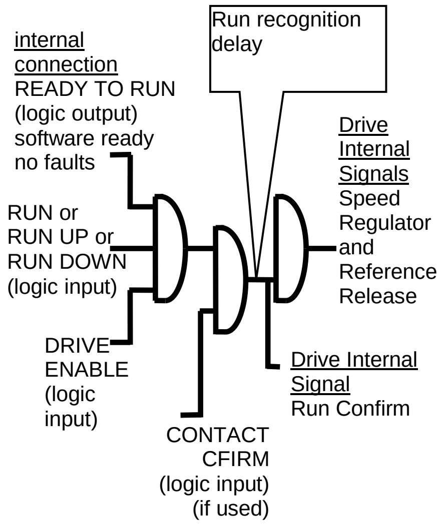
[i] Parameter accessible through **CLOSED LOOP (U9)** Operation
[ii] Parameter accessibly through ***PM (U9)*** Operation
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	METRIC (U3)	**Hidden Item**	**Run lockout**
Torq Boost Time[iii] *[A137]*	*(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] *[A138]*	*(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 page181.* *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] *[A139]*	(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 56. 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] *[A140]*	(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 56.	**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
[ii] Parameter accessibly through ***PM (U9)*** Operation
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

Parameter [*Alphanumeric*]	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	**Default** METRIC (U3)	**Hidden Item**	**Run lockout**
Spd Dev Alm Lvl[ii] *[A141]*	*(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 56.*	***%***[ii]	***0.0 – 99.9***[ii]	***10.0***[ii]		*N*[ii]	*N*[ii]
Spd Dev Flt Lvl[ii] *[A142]*	*(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 56.*	***%***[ii]	***0.0 – 99.9***[ii]	***25.0***[ii]		*N*[ii]	*N*[ii]
Up to Spd. Level *[A143]*	(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 *[A144]*	(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 *[A145]*	(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 *[A146]*	(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] *[A147]*	(Notch Filter Frequency[i,ii]) Notch filter center frequency. For more information, see NOTCH FILTER FRQ on page 57.	**Hz**[i,ii]	**5 – 60**[i,ii]	**20**[i,ii]		Y[i,ii]	Y[i,ii]
Notch Filt Depth[i,ii] *[A148]*	(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 57.	**%**[i,ii]	**0 – 100**[i,ii]	**0**[i,ii]		Y[i,ii]	Y[i,ii]

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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	METRIC (U3)	**Hidden Item**	**Run lockout**
Run Delay Timer[i,ii] *[A149]*	(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] *[A150]*	(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] *[A151]*	(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]	**10.0** [i,ii]		N[i,ii]	N[i,ii]
Spd Phase Margin[i,ii] *[A152]*	(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 *[A153]*	(Speed Command Bias) This parameter subtracts an effective voltage to the actual analog speed command voltage signal. $\left(\begin{array}{c}\text{analog}\\ \text{channel\#1}\\ \text{input}\\ \text{voltage}\end{array} - \begin{array}{c}\text{SPD}\\ \text{COMMAND}\\ \text{BIAS}\end{array}\right) \times \begin{array}{c}\text{SPD}\\ \text{COMMAND}\\ \text{MULT}\end{array} = \begin{array}{c}\text{signal}\\ \text{drive}\\ \text{software}\\ \text{uses}\end{array}$	**volts**	**-6.000 – +6.000**	**0.000**		Y	Y

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

Parameter [Alphanumeric]	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lockout
Spd Command Mult *[A154]*	(Speed Command Multiplier) This parameter scales the analog speed command. $\left(\textit{analog channel\#1 input voltage} - \textit{SPD COMMAND BIAS}\right) \times \textit{SPD COMMAND MULT} = \textit{signal drive software uses}$	**none**	**-10.00 - +10.00**	**1.00**		Y	Y
Spd Zero Band *[A155]*	(Speed Zero Band) Voltage range that is considered to be a zero speed command when analog speed commands are used. Typical value less than 50 mV. Can be determined by shorting together +/- analog speed command inputs and view results in ANALOG SPD CMD (D1).	**volts**	**0.000 – 1.000**	**0.000**		N	Y
Pre Torque Bias[i,ii] *[A156]*	(Pre-Torque Bias[i,ii]) This parameter subtracts an effective voltage to the actual analog pre torque command (channel 2) voltage signal. $\left(\textit{analog channel\#2 input voltage} - \textit{PRE TORQUE BIAS}\right) \times \textit{PRE TORQUE MULT} = \textit{signal drive software uses}$	**volts** [i,ii]	**-6.00 – 6.00** [i,ii]	**0.00** [i,ii]		Y[i,ii]	Y[i,ii]
Pre Torque Mult [i,ii] *[A157]*	(Pre-Torque Multiplier[i,ii]) This parameter scales the analog pretorque command (channel 2). $\left(\textit{analog channel\#2 input voltage} - \textit{PRE TORQUE BIAS}\right) \times \textit{PRE TORQUE MULT} = \textit{signal drive software uses}$	**none** [i,ii]	**-10.00 - +10.00**[i,ii]	**1.00**[i,ii]		N[i,ii]	Y[i,ii]
Pre Torque Time[i,ii] *[A158]*	(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] *[A159]*	(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 32. $\left(\text{analog channel\#2 input voltage} - \text{EXT TORQUE BIAS}\right) \times \text{EXT TORQUE MULT} = \text{signal drive software uses}$	**volts** [i,ii]	**-6.00 – 6.00**[i,ii]	**0.00**[i,ii]		N[i,ii]	N[i,ii]
Ext Torque Mult[i,ii] *[A160]*	(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 32. $\left(\text{analog channel\#2 input voltage} - \text{EXT TORQUE BIAS}\right) \times \text{EXT TORQUE MULT} = \text{signal drive software uses}$	**none** [i,ii]	**-10.00 - +10.00**[i,ii]	**1.00**[i,ii]		N[i,ii]	N[i,ii]

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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	**Default** METRIC (U3)	**Hidden Item**	**Run lockout**
Ana 1 Out Offset *[A161]*	(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
Ana 2 Out Offset *[A162]*	(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 *[A163]*	(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 *[A164]*	(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 *[A165]*	(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 *[A166]*	(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 *[A167]*	(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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	METRIC (U3)	**Hidden Item**	**Run lockout**
Ser2 Flt Tol *[A168]*	(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
Mains Dip Speed *[A169]*	(Mains Dip Speed Multiplier) This parameter sets a limit on the speed the drive will turn the motor, as a percentage of contract speed. 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 limits the speed to 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 *[A170]*	(Multi-Step Speed Delay 1) Determines the recognition time delay for a defined multi-step speed command. For more information, see p. 59.	**sec**	**0.000 – 10.000**	**0.000**		Y	Y
Mspd Delay 2 *[A171]*	(Multi-Step Speed Delay 2) Determines the recognition time delay for a defined multi-step speed command. For more information, see p. 59.	**sec**	**0.000 – 10.000**	**0.000**		Y	Y
Mspd Delay 3 *[A172]*	(Multi-Step Speed Delay 3) Determines the recognition time delay for a defined multi-step speed command. For more information, see p. 59.	**sec**	**0.000 – 10.000**	**0.000**		Y	Y
Mspd Delay 4 *[A173]*	(Multi-Step Speed Delay 4) Determines the recognition time delay for a defined multi-step speed command. For more information, see p. 59.	**sec**	**0.000 – 10.000**	**0.000**		Y	Y
Mid Speed Lvl *[A174]*	(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]** *[A175]*	*(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 Advance [i,ii] *[A176]*	(Anti-Rollback Advance time [i,ii]) Set to the amount of time from when the drive detects motion to when the brake is opened. *Used with ARB Select (C1) set to ARB2 or ARB3.*	**sec** [i,ii]	**0.00 - 2.00** [i,ii]	**0.30** [i,ii]		N [i,ii]	Y [i,ii]
ARB Decay [i,ii] *[A178]*	(Anti-Rollback Decay time [i,ii]) Stabilization period after ARB advance. Typical value is 0.2s to 0.4s *Used with ARB Select (C1) set to ARB2 or ARB3*	**sec** [i,ii]	**0.00 - 2.00** [i,ii]	**0.20** [i,ii]		N [i,ii]	Y [i,ii]

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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	METRIC (U3)	**Hidden Item**	**Run lockout**
ARB Timeout [i,ii] *[A179]*	(Anti-Rollback Timeout [i,ii]) Time from when the drive is turned on and ARB stops looking for motion. Typical value are ARB Advance + ARB Decay + 0.2. Both ARB modes, ARB2 and ARB3 use this parameter.	**sec** [i,ii]	**0.60 - 2.00** [i,ii]	**0.8** [i,ii]		N [i,ii]	Y [i,ii]
ARB Deadband [i,ii] *[A180]*	(Anti-Rollback Deadband [i,ii]) Scaling value of encoder pulses that the drive ignores before acknowledging rollback is occurring. Both ARB modes, ARB2 and ARB3 use this parameter.	**none** [i,ii]	**0 – 5.00** [i,ii]	**1.00** [i,ii]		N [i,ii]	Y [i,ii]
ARB KP1 [i,ii] *[A181]*	(Anti-Rollback KP1 [i,ii]) KP inner velocity loop proportional gain for ARB. Both ARB modes, ARB2 and ARB3 use this parameter.	**none** [i,ii]	**0.00 - 320.00** [i,ii]	**1.00** [i,ii]		Y [i,ii]	Y [i,ii]
ARB KI1 [i,ii] *[A182]*	(Anti-Rollback KI1 [i,ii]) KI inner velocity loop integral gain for ARB. Both ARB modes, ARB2 and ARB3 use this parameter.	**none** [i,ii]	**0.00 - 320.00** [i,ii]	**1.00** [i,ii]		Y [i,ii]	Y [i,ii]
ARB2 KP2 [i,ii] *[A183]*	(Anti-Rollback 2 KP2[i,ii]) KP outer position loop proportional gain for ARB2 ONLY.	**none** [i,ii]	**0.00 - 320.00** [i,ii]	**1.00** [i,ii]		Y [i,ii]	Y [i,ii]
ARB2 KI2 [i,ii] *[A184]*	(Anti-Rollback 2 KI2 [i,ii]) KI outer position loop integral gain for ARB2 ONLY.	**none** [i,ii]	**0.00 - 320.00** [i,ii]	**1.00** [i,ii]		Y [i,ii]	Y [i,ii]
ARB FFWD [i,ii] *[A185]*	(Anti-Rollback Feedforward [i,ii]) Feedfoward gain, should be set as small as possible to improve ARB stability. Adjust after ARB Decay and ARB Advance have been set. Both ARB modes, ARB2 and ARB3 use this parameter.	**none** [i,ii]	**0 - 100** [i,ii]	**0** [i,ii]		N [i,ii]	Y [i,ii]
Abs Ref Offset [ii] *[A186]*	*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] *[A177]*	*(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]

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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default ENGLISH (U3)**	**Default METRIC (U3)**	**Hidden Item**	**Run lockout**
NTSD Target Spd *[A187]*	(Normal Terminal Stopping Device Target Speed) Maximum speed at which drive will run when NTSD is active.	**ft/min**	**0.0 – 50.0**	**0.0**		N	Y
		m/s	**0.000 – 0.250**		**0.000**		
NTSD Threshold 1 *[A188]*	(Normal Terminal Stopping Device Threshold 1) Magnitude of the maximum allowable speed at the first NTSD check point in the hoistway.	**ft/min**	**0.0 – 1500.0**	**0.0**		N	Y
		m/s	**0.000 – 7.600**		**0.000**		
NTSD Threshold 2 *[A189]*	(Normal Terminal Stopping Device Thresholds 2) Magnitude of the maximum allowable speed at the second NTSD check point in the hoistway.	**ft/min**	**0.0 – 1500.0**	**0.0**		N	Y
		m/s	**0.000 – 7.600**		**0.000**		
NTSD Threshold 3 *[A190]*	(Normal Terminal Stopping Device Thresholds 3) Magnitude of the maximum allowable speed at the third NTSD check point in the hoistway.	**ft/min**	**0.0 – 1500.0**	**0.0**		N	Y
		m/s	**0.000 – 7.600**		**0.000**		

Table 9: Drive A1 Submenu

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.

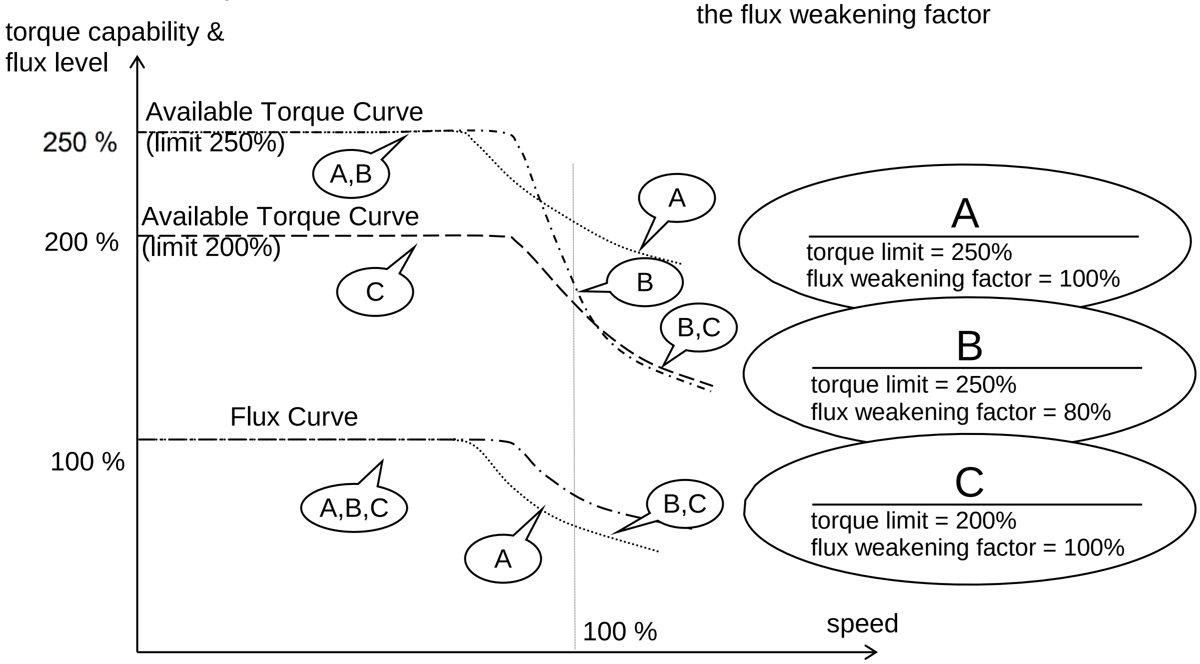
By lowering the torque limit you can effectively reduce the amount of field weakening needed and reduce the amount of current needed by the motor at motor's rated speed. The trade-off is you have lower over-all torque available.

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

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:

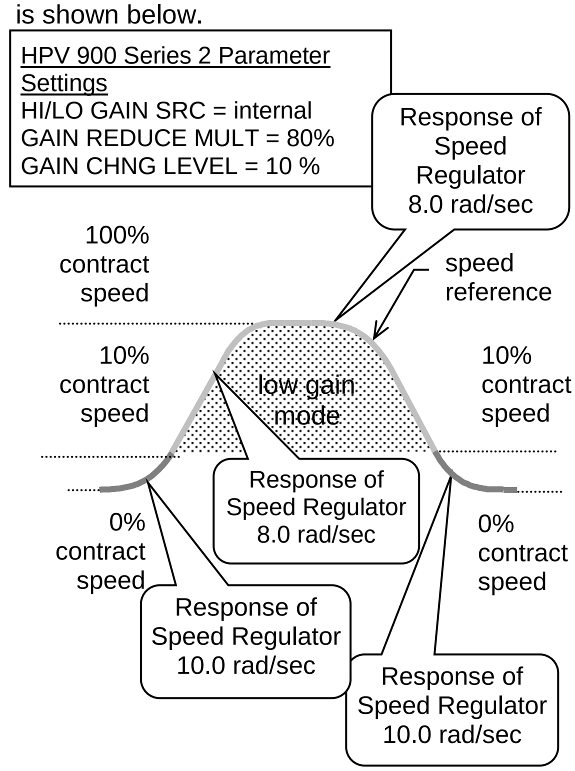
- a logic input
- the serial channel

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

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 34**.**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 103.* 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)**

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

[iii] Parameter accessible through ***OPEN LOOP(U9)***

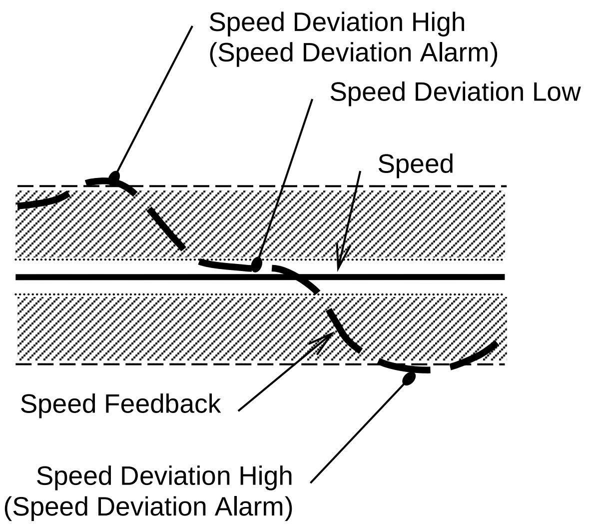


Figure 34: Speed Deviation Example for CLOSED LOOP (U9)

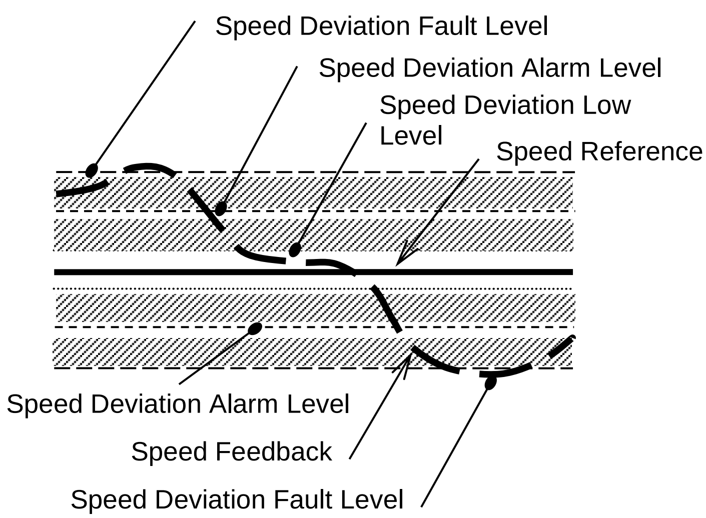


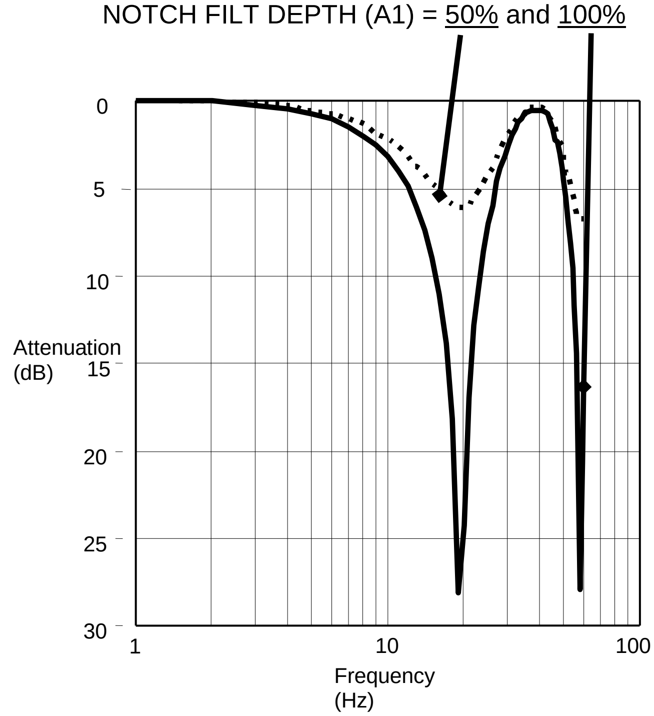
Figure 35: Speed Deviation Example for PM (U9)

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%



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 below 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 ARB2 or ARB3.

To set-up ARB2:

1. Set car in middle of the hoistway so rollback will not cause the elevator to go pass the final limits while adjusting ARB2
2. Set the controller to run on Inspection Speed at 0 speed (allows you to see the actual rollback). The 0 speed can be done either in the controller by setting inspection speed from where it is to 0 speed or on the drive by changing the Speed Command Source (C1) from what it is currently set for to some other type (either Multistep, Serial, or Analog). NOTE: make sure to write down what was the Speed Command Source (C1) set to before changing it because the motor will not rotate if this is set incorrectly.
3. The KI1, KP1, KI2, and KP2 gains, ARB Feed Forward, and the ARB Deadband should NOT have to be change from default but if needed to, KI and KP should be adjusted in increments of 0.100 while ARB Deadband and ARB feed forward, should ONLY be change by increments of 1. Too high of a number can cause oscillation/jerking and too low of a number will cause rollback.
4. The time set in ARB Timeout should be set to a time slightly longer than the rollback observed on the sheave.
5. ARB Advance time should be increased/decrease by 0.05s until the rollback is removed.
6. ARB Decay Time should be set to a time that will allow the drive to stabilize without oscillating. This value should rarely need to be below 0.2s.
7. Then set the controller/drive back up to run on automatic and observe for rollback

Name	Description	Units	Range	Recommended Settings ENGLISH (U3) METRIC (U3)
ARB Advance	Time period from when motion is detected and brake is opened	**sec**	**0 – 2.00**	0.30
ARB Decay	Drop off time from ARB Advance to ARB turned off. Typically 0.2 to 0.4 seconds.	**sec**	**0 – 2.00**	0.40
ARB Timeout	Time period from when the drive is enabled and ARB stops looking for motion. Set to ARB Advance + ARB Decay + 0.2.	**sec**	**0.80 – 2.00**	1.00
ARB Deadband	The amount of encoder pulses the drive ignores before acknowledging rollback is occurring	**-**	**0-20**	4
ARB Feed Forward	Feedfoward gain, should be set as small as possible to improve ARB stability. Adjust after ARB Decay and ARB Advance have been set.	**-**	**0-100**	0
ARB KP1	Gains that should normally not need changing.	**-**	**0.0 – 32.000**	1.0
ARB KI1		**-**	**0.0 – 32.000**	0.50
ARB KP2		**-**	**0.0 – 32.000**	6.00
ARB KI2		**-**	**0.0 – 32.000**	6.00

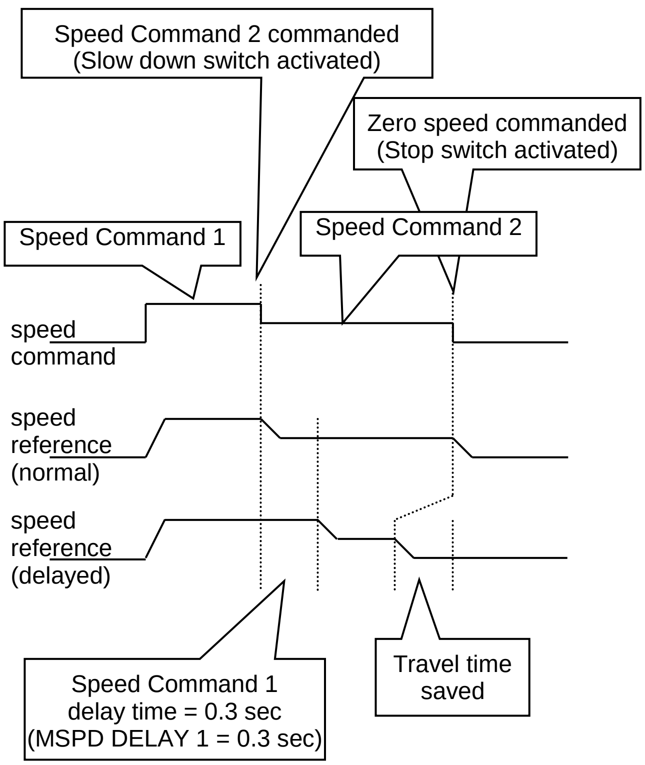
To set up ARB3:

1. Verify that the Pre Torque Src (C1) is set to none so it does not affect the ARB function.
2. ARB3 is enabled by setting ARB Select (C1) to ARB3.
3. After enabling the function in ARB Select (C1 Submenu), in most cases ARB3 will work well with all related A1 Submenu parameters at their default values. There are only three parameters that may need any adjustment by the user.
4. Parameters that should <u>left at default</u> are ARB Deadband, ARB KP1, ARB KI1, and ARB FFWD. It is rare where would need to be adjusted.
   a. The following are symptoms that may be encountered after enabling ARB3 and parameter adjustments that may be attempted in the order listed.
      i. **Vibration at start** – This applies if the vibration only occurs only after enabling ARB3. If the same vibration occurs with ARB Select set to DISABLED then there is an unrelated cause that should be investigated and corrected before enabling ARB3.
         - Try decreasing ARB Advance in decrements of .05 sec. If vibration is completely eliminated then leave ARB Advance set to the largest value which eliminates it and disregard the next step. If no improvement is achieved set ARB Advance back to the default of 0.30 sec. and move on to the next step. If some, but not complete improvement is achieved, leave ARB Advance set to the largest value below which no further improvement is observed and move on to the next step.
         - If vibration is still present at start, try decreasing ARB Decay in decrements of 0.05 sec. If vibration is completely eliminated leave ARB Decay set to the largest value which eliminates it. If no improvement is achieved, set ARB Decay back to the default of 0.20 sec and contact Technical Support. If some, but not complete improvement is achieved, leave ARB Decay set to the largest value below which no further improvement is observed contact Technical Support.
      ii. **Still some rollback at start**
         - If rollback is still present at start, try increasing ARB Advance in increments of 0.05 sec. If rollback is completely eliminated then leave ARB Advance set to the smallest value which eliminates it and disregard the next step. If no improvement is achieved set ARB Advance back to the default of 0.30 sec. and move on to the next step. If some, but not complete improvement is achieved, leave ARB Advance set to the smallest value above which no further improvement is observed and move on to the next step.
         - If rollback is still present at start, try increasing ARB Decay in increments of 0.05 sec. If rollback is completely eliminated then leave ARB Decay set to the smallest value which eliminates it. If no improvement is achieved, set ARB Decay back to the default of 0.20 sec and contact Technical Support. If some, but not complete improvement is achieved, leave ARB Decay set to the smallest value above which no further improvement is observed and contact Technical Support.

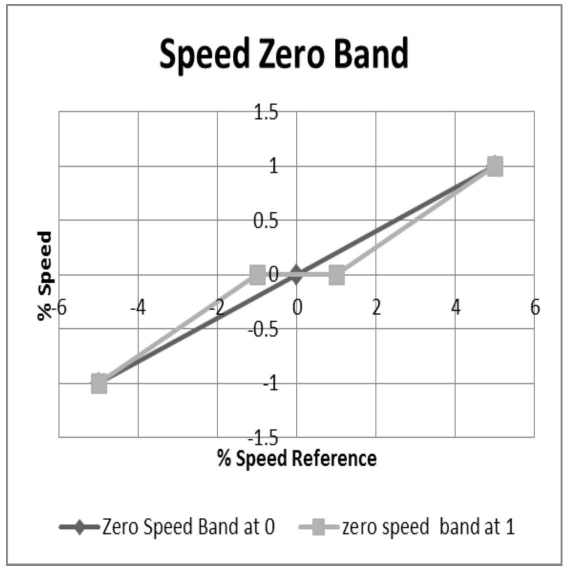
If either ARB Advance or ARB Decay has been modified then ARB Timeout needs to be set to a value which is 0.20 – 0.30 sec. **greater than the sum** of ARB Advance and ARB Decay.

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.



SPD ZERO BAND (A1)
(Speed Zero Band)
This parameter sets the voltage range that the analog voltage is seen as a zero speed command. The value is a plus and minus voltage value typically in the millivolt range, less than 50mV.



The zero speed band adjusts what value of voltage the drive will see as 0v. This basically creates a "dead band" as seen by the horizontal part of the graph. In the graph ZERO SPD BAND is set to 1v. The maximum values do not change, but the slope of the graph does change.

ANALOG SPD CMD (D1)
(Analog Speed Command)
This parameter displays the analog speed command voltage before adjusting for SPD CMD BIAS, SPD CMD MULT, and SPD ZERO BAND. It can be used to determine the SPD ZERO BAND by shorting together the +/- analog speed inputs and the analog common input and viewing the value at ANALOG SPD CMD.

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.

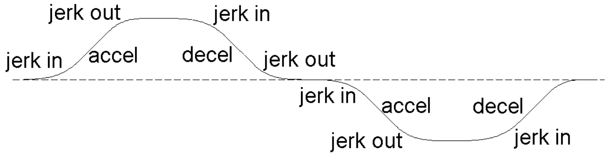
Note: If the car controller is feeding the drive a speed profile including s-curves, the s-curve settings on the drive need to be placed out of the way. In those cases, set ACCEL RATE 0 and DECEL RATE 0 to the maximum (7.99 ft/s^2 or 3.999 m/s^2) and set ACCEL JERK IN 0, ACCEL JERK OUT 0, DECEL JERK 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 4 (SC4) is for NTSD operation only

S-Curve Pattern Selection

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

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

S-curve Availability

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

Selecting S-curves

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

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

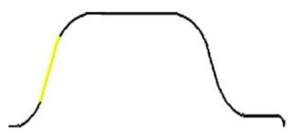
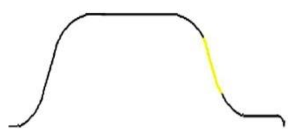
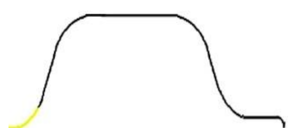
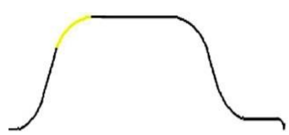
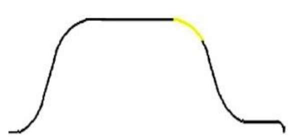
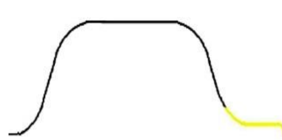
S-Curves A2 Submenu

Parameter *[Alphanumeric]*	Description	Units	Range	Default	Hidden item	Run lockout
Accel Rate 0 *[A201]*	Acceleration rate	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Decel Rate 0 *[A202]*	Deceleration rate	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Accel Jerk In 0 *[A203]*	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 *[A204]*	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 *[A205]*	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 *[A206]*	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 *[A207]*	Acceleration rate	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Decel Rate 1 *[A208]*	Deceleration rate	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Accel Jerk In 1 *[A209]*	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 *[A210]*	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 *[A211]*	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 *[A212]*	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 *[A213]*	Acceleration rate	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.80**		
Decel Rate 2 *[A214]*	Deceleration rate	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.80**		
Accel Jerk In 2 *[A215]*	Rate of increase of acceleration, up to ACCEL RATE, when increasing elevator speed	**ft/s³**	**0.0 – 29.9**	**0**	N	Y
		m/s³	**0.00 – 9.99**	**0**		
Accel Jerk Out 2 *[A216]*	Rate of decrease of acceleration to zero when approaching contract elevator speed	**ft/s³**	**0.0 – 29.9**	**0**	N	Y
		m/s³	**0.00 – 9.99**	**0**		
Decel Jerk In 2 *[A217]*	Rate of increase of deceleration, up to DECEL RATE, when decreasing elevator speed	**ft/s³**	**0.0 – 29.9**	**0**	N	Y
		m/s³	**0.00 – 9.99**	**0**		
Decel Jerk Out 2 *[A218]*	Rate of decrease of deceleration to zero when slowing the elevator to leveling speed	**ft/s³**	**0.0 – 29.9**	**0**	N	Y
		m/s³	**0.00 – 9.99**	**0**		
Accel Rate 3 *[A219]*	Acceleration rate	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Decel Rate 3 *[A220]*	Deceleration rate	**ft/s²**	**0.00 – 7.99**	**3.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Accel Jerk In 3 *[A221]*	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 *[A222]*	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 *[A223]*	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 *[A224]*	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 4 *[A225]*	NTSD Acceleration rate	**ft/s²**	**0.00 – 7.99**	**5.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default**	**Hidden item**	**Run lockout**
Decel Rate 4 *[A226]*	NTSD Deceleration rate	**ft/s²**	**0.00 – 7.99**	**5.00**	N	Y
		m/s²	**0.000 – 3.999**	**0.800**		
Accel Jerk In 4 *[A227]*	NTSD Rate of increase of acceleration, up to ACCEL RATE, when increasing elevator speed	**ft/s³**	**0.0 – 29.9**	**0.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.00**		
Accel Jerk Out 4 *[A228]*	NTSD Rate of decrease of acceleration to zero when approaching contract elevator speed	**ft/s³**	**0.0 – 29.9**	**0.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.00**		
Decel Jerk In 4 *[A229]*	NTSD Rate of increase of deceleration, up to DECEL RATE, when decreasing elevator speed	**ft/s³**	**0.0 – 29.9**	**0.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.00**		
Decel Jerk Out 4 *[A230]*	NTSD Rate of decrease of deceleration to zero when slowing the elevator to leveling speed	**ft/s³**	**0.0 – 29.9**	**0.0**	N	Y
		m/s³	**0.00 – 9.99**	**0.00**		

Table 10: S-Curve A2 Submenu

Setting Acceleration, Deceleration and Jerk Rates

parameter	**description**		**default**	**units**	**Suggested adjustment**
ACCEL RATE 0	Acceleration rate limit		0.8	m/s^2	Reduce if the acceleration is too aggressive. Increase if the acceleration is too gentle
DECEL RATE 0	Deceleration rate limit		0.8	m/s^2	Reduce if the deceleration is too aggressive. Increase if the deceleration is too gentle
ACCEL JERK IN 0	Rate of increase of acceleration, up to ACCEL RATE, when increasing elevator speed		0.6	m/s^3	Reduce to give a softer acceleration from standstill into the acceleration segment Increase to give a more aggressive transition into the acceleration segment
ACCEL JERK OUT 0	Rate of decrease of acceleration to zero when approaching contract elevator speed		0.6	m/s^3	Reduce to give a softer transition to commanded speed from acceleration segment Increase to give a more aggressive transition to commanded speed from acceleration segment
DECEL JERK IN 0	Rate of increase of deceleration, up to DECEL RATE, when decreasing elevator speed		0.6	m/s^3	Reduce to give a softer transition to the deceleration segment from commanded speed into the deceleration segment. Increase to give a more aggressive transition from commanded speed into the deceleration segment.
DECEL JERK OUT 0	Rate of decrease of deceleration to zero when slowing the elevator to leveling speed		0.6	m/s^3	Reduce to give a softer transition to Leveling speed and to stop from the deceleration segment. Increase to give a more aggressive transition to Leveling speed and to stop from the deceleration segment.

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

Multi-step Selection

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

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

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

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 *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default**	**Hidden Item**	**Run lockout**
Speed Command 1[i] *[A301]*	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] *[A302]*	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] *[A303]*	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] *[A304]*	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] *[A305]*	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] *[A306]*	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] *[A307]*	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] *[A308]*	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] *[A309]*	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] *[A310]*	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] *[A311]*	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] *[A312]*	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] *[A313]*	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] *[A314]*	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] *[A315]*	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] *[A316]*	Leveling Speed	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
VN[ii] *[A317]*	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

Multistep Ref A3 Submenu

Parameter *[Alphanumeric]*	Description	Units	Range	Default	Hidden Item	Run lockout
V1[ii] *[A318]*	Speed Reference 1	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
V2[ii] *[A319]*	Speed Reference 2	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
V3[ii] *[A320]*	Speed Reference 3	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
V4[ii] *[A321]*	Speed Reference 4	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
VI[ii] *[A322]*	Inspection Speed	**ft/min**	**-3000.0 – +3000.0**	**0.0**	N	Y
		m/sec	**-16.000 – +16.000**	**0.000**		
Unlock Spd Level[ii] *[A323]*	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] *[A324]*	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] *[A325]*	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**		
Re-level Spd Hi[ii] *[A326]*	For Magnetek personnel – Used when optimizing final stopping sequence (DCP4 only)	**ft/min**	**0.00 – 60.0**	**10.00**	N	Y
		m/sec	**0.00 – 0.30**	**0.050**		
Re-level Spd Low[ii] *[A327]*	For Magnetek personnel – Used when optimizing final stopping sequence (DCP4 only)	**ft/min**	**0.00 – 60.0**	**01.00**	N	Y
		m/sec	**0.00 – 0.30**	**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 119.*

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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default**		**Hidden Item**	**Run lockout**
				ENGLISH (U3)	**METRIC (U3)**		
Input L-L Volts *[A401]*	(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 *[A402]*	(Undervoltage Alarm Level) The nominal DC bus voltage is equal to 1.414 times the input line-to-line voltage (i.e. 1.414*Input L-L Volts (A4)). This parameter sets the level (as a percentage of the nominal DC bus voltage) at which an undervoltage alarm will be declared.	**%**	**40 – 99**	**90**	**80**	Y	N
UV Fault Level *[A403]*	(Undervoltage Fault Level) The nominal DC bus voltage is equal to 1.414 times the input line-to-line voltage (i.e. 1.414*Input L-L Volts (A4)). This parameter sets the level (as a percentage of the nominal DC bus voltage) at which an undervoltage fault will be declared.	**%**	**40 – 99**	**80**	**70**	Y	N
PWM Frequency *[A404]*	(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 16.*	**kHz**	**2.5 – 16.0**	**10.0**		N	N
Extern Reactance *[A405]*	(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 *[A406]*	(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

Power Convert A4 Submenu

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	**Default** METRIC (U3)	**Hidden Item**	**Run lockout**
Id Reg Prop Gain *[A407]*	(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**	**0.10** [i,iii] ***0.700*** [ii]		Y	N
Id Reg Intg Gain[iii] *[A409]*	*(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 *[A410]*	(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 *[A411]*	(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**	**0.10** [i,iii] **0.700** [ii]		Y	N
Iq Reg Intg Gain[ii] *[A413]*	*(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] *[A424]*	*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.*	***deg***[ii]	***-100.00 – +100.00***[ii]	***0.00***[ii]		*Y*[ii]	*N*[ii]

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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default ENGLISH (U3)**	**Default METRIC (U3)**	**Hidden Item**	**Run lockout**
Id Ref Threshld[ii] *[A426]*	*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.*	***none***[ii]	***0.00 – 0.20***[ii]	***0.00***[ii]		*Y*[ii]	*N*[ii]
Flux Weaken Rate[ii] *[A427]*	*(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 73.*	***none***[ii]	***0.000 – 1.000***[ii]	***0.000***[ii]		*Y*[ii]	*N*[ii]
Flux Weaken Lev[ii] *[A428]*	*(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 73.*	***none***[ii]	***0.70 – 1.00***[ii]	***0.95***[ii]		*Y*[ii]	*N*[ii]
Align Vlt Factor[ii] *[A429]*	*(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] *[A430]*	*(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] *[A414]*	*(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] *[A415]*	*(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]

Power Convert A4 Submenu

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	METRIC (U3)	**Hidden Item**	**Run lockout**
Id Dist Loop Fc[iii] *[A416]*	*(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]
Iq Dist Loop Fc[iiii] *[A417]*	*(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] *[A418]*	*(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] *[A419]*	*(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] *[A420]*	*(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]

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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	**Default** METRIC (U3)	**Hidden Item**	**Run lockout**
Hunt Prev Gain[iii] *[A421]*	*(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] *[A422]*	*(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] *[A423]*	*(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] *[A425]*	*(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]

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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default**		**Hidden Item**	**Run lockout**
				ENGLISH (U3)	**METRIC (U3)**		
Load Sense Time *[A431]*	(Load Sense Time) This is the duration that the drive spends in the Recommended Travel Direction mode to figure out the direction that will require the least amount of current (lightest load).	**sec**	**0.00 – 1.50**	**0.00**		N	N
Travel Dir Spd *[A432]*	(Travel Dir Spd) Used only if Rec Travel Spd (C1) is set to geared. This is the speed the drive will rotate the motor at in both directions to overcome gearbox friction to measure which direction requires the least amount of current.	**%**	**0.0 – 100.0**	**0.0**		N	N
Autoalign Volts[ii] *[A433]*	*(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 *[A434]*	(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 will force the fans to turn on immediately and continuously run all the time	**sec**	**0 – 999**	**20**		N	N

Table 12: Power Convert A4 Submenu

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

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.

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 119.*
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
[Alphanumeric]</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 lockout</th></tr>
<tr><th>ENGLISH (U3)</th><th>METRIC (U3)</th></tr>
<tr><td>Motor ID
[A501]</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 152 or Auto Tune on page ix to Obtain Maximum Motor Performance.</td><td>none</td><td>– 4 pole dflt[i,ii] [1][i]
– 6 pole dflt[i,ii] [2][i]
– PM dflt[ii] [3]</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>

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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	**Default** METRIC (U3)	**Hidden Item**	**Run lockout**
Rated Mtr Pwr *[A502]*	(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 *[A503]*	(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] *[A504]*	(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 *[A505]*	(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 *[A506]*	(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 *[A507]*	(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 152 calculates the amount of slip of the motor. $\left(\begin{array}{c}\text{synchronous}\\ \text{speed of}\\ \text{motor}\end{array}\right)=\dfrac{120*\left(\begin{array}{c}\text{rated}\\ \text{excitation}\\ \text{frequency}\end{array}\right)}{\#\text{ of Poles}}$	**RPM**	**1.0 – 3000.0**	**0.0**		N	Y
% No Load Current[i,iii] *[A508]*	(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 152.*	**%**[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
[ii] Parameter accessibly through ***PM (U9)*** Operation
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

Motor A5 Submenu

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default** ENGLISH (U3)	**Default** METRIC (U3)	**Hidden Item**	**Run lockout**
Stator Leakage X[i,iii] *[A509]*	(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] *[A510]*	(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] *[A515]*	(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] *[A516]*	(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] *[A517]*	(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] *[A511]*	*(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.* $\begin{pmatrix}MOTOR\\MIN\\VOLTS\end{pmatrix} < \begin{pmatrix}MOTOR\\MID\\VOLTS\end{pmatrix} < \begin{pmatrix}RATED\\MTR\\VOLTS\end{pmatrix}$	***Volts***[iii]	***0.1 – 100.0***[iii]	***Per ID***[iii]		*N*[iii]	*Y*[iii]
Motor Min Freq[iii] *[A512]*	*(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.* $\begin{pmatrix}MOTOR\\MIN\\FREQ\end{pmatrix} < \begin{pmatrix}MOTOR\\MID\\FREQ\end{pmatrix} < \begin{pmatrix}RATED\\EXCIT\\FREQ\end{pmatrix}$	***Hz***[iii]	***0.1 – 10.0***[iii]	***1.0***[iii]		*N*[iii]	*Y*[iii]
Motor Mid Volts[iii] *[A513]*	*(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.* $\begin{pmatrix}MOTOR\\MIN\\VOLTS\end{pmatrix} < \begin{pmatrix}MOTOR\\MID\\VOLTS\end{pmatrix} < \begin{pmatrix}RATED\\MTR\\VOLTS\end{pmatrix}$	***Volts***[iii]	***0.1 – 575.0***[iii]	***Per ID***[iii]		*N*[iii]	*Y*[iii]

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

Parameter [Alphanumeric]	Description	Units	Range	Default ENGLISH (U3)	Default METRIC (U3)	Hidden Item	Run lockout
Motor Mid Freq[iii] *[A514]*	*(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.* $\begin{pmatrix} MOTOR \\ MIN \\ FREQ \end{pmatrix} < \begin{pmatrix} MOTOR \\ MID \\ FREQ \end{pmatrix} < \begin{pmatrix} RATED \\ EXCIT \\ FREQ \end{pmatrix}$	***Hz***[iii]	***0.1 – 40.0***[iii]	***3.0***[iii]		*N*[iii]	*Y*[iii]
Ovld Start Level *[A518]*	(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 78.	**%**	**100 – 150**	**110**		Y	Y
Ovld Time Out *[A519]*	(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: $\begin{pmatrix} OVLD \\ START \\ LEVEL: \end{pmatrix} + \begin{pmatrix} 40\% \\ rated \\ motor \\ current \end{pmatrix}$ This is the other parameter used to define the overload curve. For more information, see OVLD START LEVEL on page 78.	**sec**	**5.0 – 120.0**	**60.0**		Y	Y
Stator Resist *[A520]*	(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 *[A521]*	(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 *[A522]*	(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] *[A523]*	*(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 – 150.00***[ii]	***10.00***[ii]	***30.00***[ii]	*N*[ii]	*N*[ii]
Q Axis Inductance[ii] *[A524]*	*(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 – 150.00***[ii]	***10.00***[ii]	***30.00***[ii]	*N*[ii]	*N*[ii]

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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Range**	**Default**		**Hidden Item**	**Run lockout**
				ENGLISH (U3)	**METRIC (U3)**		
OL Align Scale[ii] *[A525]*	*(Open-Loop Alignment 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] *[A526]*	*(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 ix.*	***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.

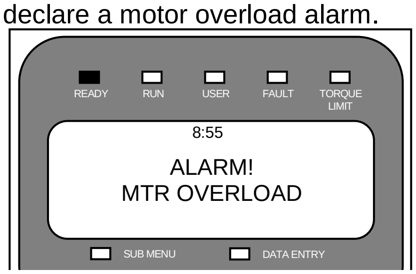
- motor current overload start level (OVLD START LEVEL(A5)) parameter
- motor current time out (OVLD TIME OUT(A5)) parameter

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

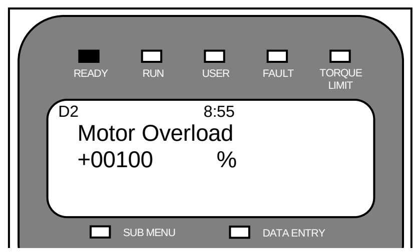
Motor Overload Parameters

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.

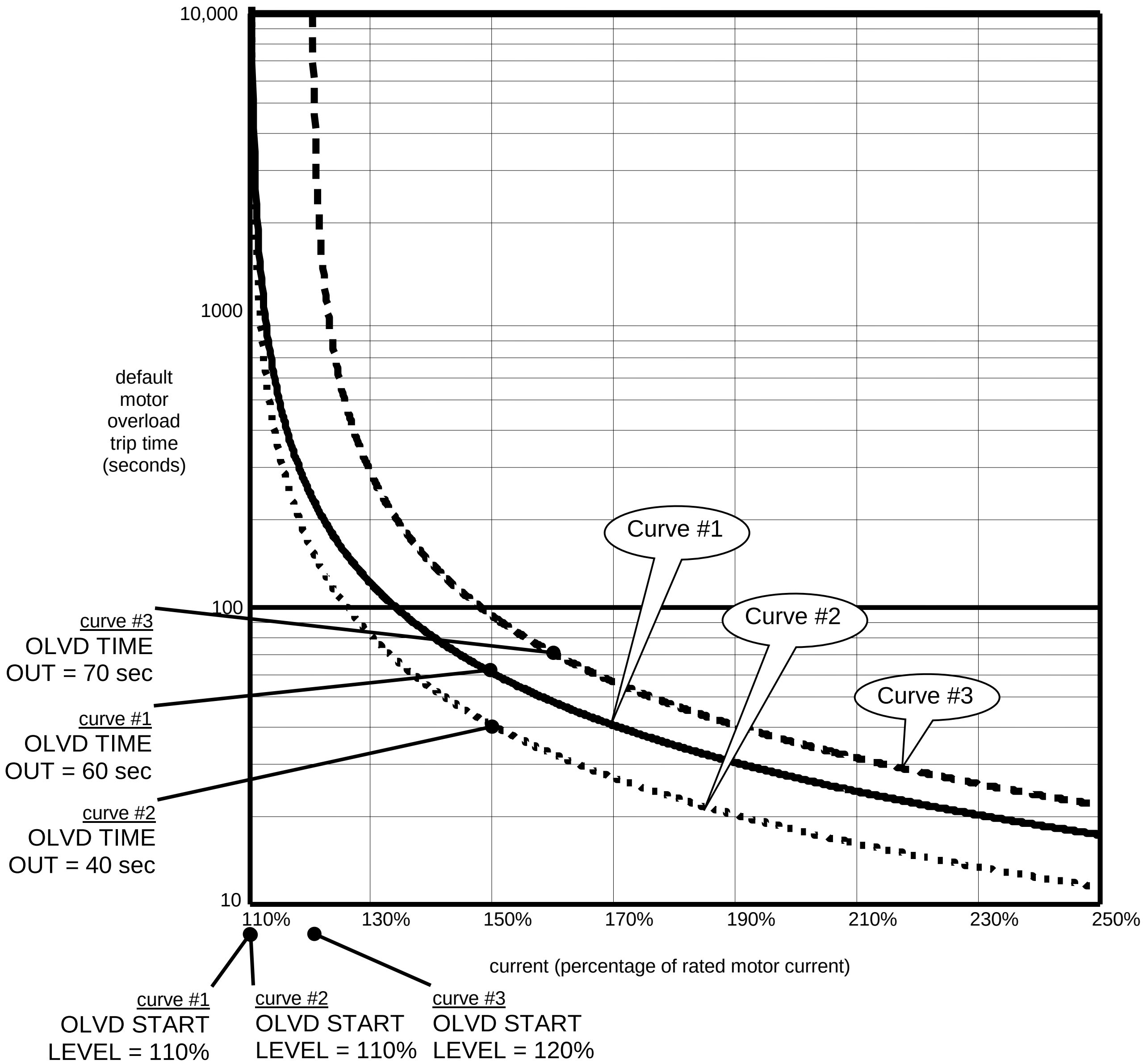
But, if the user wants the drive to declare a fault on a motor overload the following need to be completed:

- 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 Ovrld Sel) C1
This parameter selects the action to be taken by the drive when declareing a Motor Overload.

- 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



Motor Overload Curve

Configure C0 Menu

User Switches C1 Submenu

Parameter *[Alphanumeric]*	Description	Choices	Default ENGLISH (U3)	Default METRIC (U3)	Hidden item	Run lockout
Spd Command Src *[C101]*	(Speed Command Source) This parameter designates the source of the drive's speed command. The four possible choices for the speed command are as follow: • Multi-Step: 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) • Serial Multi-Step: multi-step speed command over the serial communication terminals located on the drive control board • Analog: a bipolar (±10V) signal. Available with the analog channel is a Speed Command Multiplier (SPD COMMAND MULT(A1)) and Speed Command Bias (SPD COMMAND BIAS(A1)). These parameters are used to scale the user's analog speed command to the proper range for use by the drive software. • Serial: speed profile over the serial communication terminals located on the drive control board (NOTE: used in serial Mode 2 and DCP4 ONLY)	– **multi-step** *[1]* – **ser mult step** *[2]* – **analog input** *[3]* – **serial** *[4]*	**MULTI-STEP**		Y	Y
Run Command Src *[C102]*	(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** *[1]* – **serial** *[2]* – **serial+extrn** *[3]*	**EXTERNAL TB**		Y	Y
Motor Rotation *[C103]*	(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** *[1]* – **reverse** *[2]*	**FORWARD**		Y	Y

Parameter [Alphanumeric]	Description	Choices	Default ENGLISH (U3)	Default METRIC (U3)	Hidden item	Run lockout
Encoder Select [ii] *[C104]*	*(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.*	− ***incremental*** [ii] *[1]* − ***endat*** [ii] *[2]*	***INCREMENTAL*** [ii]		*Y* [ii]	*Y* [ii]
Encoder Connect [i,ii] *[C105]*	(Encoder Connection [i,ii]) This parameter allows the user to electronically switch A and /A signals from the encoder without moving any wiring. NOTE: this parameter will be locked in forward in PM if Encoder Select (C1) is set to Endat.	− **forward** [i,ii] *[1]* − **reverse** [i,ii] *[2]*	**FORWARD** [i,ii]		Y [i,ii]	Y [i,ii]
Encoder Fault [i,ii] *[C106]*	(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).	− **enable** [i,ii] *[1]* − **disable** [i,ii] *[0]*	**ENABLE** [i,ii]		Y [i,ii]	Y [i,ii]
Cont Confirm Src *[C107]*	(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** *[0]* − **external tb** *[1]*	**NONE**	**EXTER-NAL TB**	Y	Y
Fast Flux [i] *[C108]*	(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 93.	− **enable** [i,ii] *[1]* − **disable** [i,ii] *[0]*	**DISABLE** [i]		Y [i]	Y [i]
HI/LO Gain Src [i,ii] *[C109]*	(High / Low Gain Source [i,ii]) High / low gain change switch source. For more information, see HI/LO GAIN SRC on page 93.	− **internal** [i] *[1]* − **external tb** [i,ii] *[2]* − **serial** [i,ii,ii] *[3]*	**INTERNAL** [i,ii]		Y [i,ii]	Y [i,ii]

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

User Switches C1 Submenu

Parameter *[Alphanumeric]*	Description	Choices	Default ENGLISH (U3)	Default METRIC (U3)	Hidden item	Run lockout
I-Reg Inner Loop[ii] *[C110]*	*(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]*** *[0]* – ***enabled low[ii]*** *[1]* – ***enabled high[ii]*** *[2]*	***DISABLED[ii]***		*N[ii]*	*N[ii]*
Ramped Stop Sel[i,ii] *[C111]*	(Ramp Stop Select[i,ii]) Chooses between normal stop and torque ramp down stop. For more information, see RAMPED STOP SEL on page 94.	– **none[i,ii]** *[0]* – **ramp on stop[i,ii]** *[1]*	**NONE[i,ii]**		Y[i,ii]	Y[i,ii]
Ramp Down En Src[i,ii] *[C112]*	(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]** *[1]* – **run logic[i,ii]** *[2]* – **serial[i,ii]** *[3]*	**EXTERNAL TB[i,ii]**		Y[i,ii]	Y[i,ii]
S-Curve Abort *[C113]*	(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 95.	– **enable** *[1]* – **disable** *[0]*	**DISABLE**	**ENABLE**	Y	Y
DB Protection *[C114]*	(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** *[1]* – **alarm** *[2]*	**FAULT**		Y	Y
Spd Ref Release *[C115]*	(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** *[1]* – **brake picked** *[2]*	**REG RELEASE**	**BRAKE PICKED**	Y	Y

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

Parameter *[Alphanumeric]*	**Description**	**Choices**	**Default**		**Hidden item**	**Run lockout**
			ENGLISH (U3)	**METRIC (U3)**		
Brake Pick Src *[C116]*	(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** *[1]* − **serial** *[2]*	**INTERNAL**		Y	Y
Brake Pick Cnfm *[C117]*	(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** *[0]* − **external tb** *[1]* − **internal time** *[2]*	**NONE**		Y	Y
Motor Ovrld Sel *[C118]*	(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** *[1]* − **flt immediate** *[2]* − **fault at stop** *[3]*	**ALARM**		Y	Y
Stopping Mode *[C119]*	(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** *[1]* − **ramp to stop** *[2]*	**IMMEDIATE**		Y	Y

Parameter *[Alphanumeric]*	**Description**	**Choices**	**Default**		**Hidden item**	**Run lockout**
			ENGLISH (U3)	**METRIC (U3)**		
Auto Stop *[C120]*	(Auto Stop Function Enable) The Auto Stop function determines how the drive logic will respond to a zero or non-zero speed command. If Speed Command SRC (C1) is set to Analog, then SPD ZERO BND (A1) must be non zero. For more information, see Auto Stop on page 96.	– **enable** *[1]* – **disable** *[0]*	**DISABLE**		Y	Y
Stall Test Ena[iii] *[C121]*	*(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.*	– ***enable***[iii] ***[1]*** – ***disable***[iii] ***[0]***	***ENABLE***[iii]		*N*[iii]	*Y*[iii]
Stall Prev Ena[iii] *[C122]*	*(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.*	– ***enable***[iii] ***[1]*** – ***disable***[iii] ***[0]***	***DISABLE***[iii]		*N*[iii]	*Y*[iii]
Serial Mode *[C123]*	(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 2 Test – test mode used when testing custom protocol serial mode 2. • Mode 3 - selects a Magnetek alternative protocol. • DCP3 – Drive Control Position Protocol 3 . • DCP4 – Drive Control Position Protocol 4	– **None** *[0]* – **mode 1** *[1]* – **mode 2** *[2]* – **mode 3** *[3]* – **DCP4** *[4]* – **DCP3** *[5]* – **mode 2 test** *[6]*	**NONE**		Y	Y

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

Parameter *[Alphanumeric]*	**Description**	**Choices**	**Default**		**Hidden item**	**Run lockout**
			ENGLISH (U3)	**METRIC (U3)**		
Ser2 Flt Mode *[C124]*	(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** *[1]* −**run remove** *[2]* −**rescue** *[3]*	**IMMEDIATE**		Y	Y
Drv Fast Disable *[C125]*	(Drive Fast Disable) Addresses how fast the drive responds to the removal of the DRIVE ENABLE logic input.	−**enable** *[1]* −**disable** *[0]*	**DISABLE**		Y	Y
Speed Reg Type[i,ii] *[C126]*	(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 96.	−**elev spd reg**[i,ii] *[1]* −**pi speed reg**[i,ii] *[2]* −**external reg**[i,ii] *[3]*	**ELEV SPD REG**[i,ii]		Y[i,ii]	Y[i,ii]

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

Parameter *[Alphanumeric]*	Description	Choices	Default ENGLISH (U3)	Default METRIC (U3)	Hidden item	Run lockout
Brake Hold Src *[C127]*	(Brake Hold Source) If set to internal, the drive will command the mechanical brake to hold mode until confirmation of brake picked exists.	– **internal** *[1]* – **serial** *[2]*	**INTERNAL**		Y	Y
Brk Pick Flt Ena *[C128]*	(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.	– **enable** *[1]* – **disable** *[0]* – **active** *[2]*	**DISABLE**		Y	Y
Brk Hold Flt Ena *[C129]*	(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.	– **enable** *[1]* – **disable** *[0]*	**DISABLE**		Y	Y
Ext Torq Cmd Src[i,ii] *[C130]*	(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] *[0]* – **serial**[i,ii] *[1]* – **analog input**[i,ii] *[2]*	**NONE**[i,ii]		Y[i,ii]	Y[i,ii]

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

Parameter *[Alphanumeric]*	Description	Choices	Default ENGLISH (U3)	Default METRIC (U3)	Hidden item	Run lockout
Fault Reset Src *[C131]*	(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. <u>Automatic Fault Reset</u> If the fault reset source is set to automatic, the faults will be reset according to the setting of the FLT RESET DELAY (A1) and FLT RESETS/HOUR (A1) parameters. When a logic input is defined as "fault reset" and this logic input signal is transitioned from false to true: an active fault will be reset and automatic fault reset counter (defined by FLT RESETS/HOUR(A1)) will be reset to zero. **CAUTION** If the run signal is asserted at the time of a fault reset, the drive will immediately go into a run state. Unless using the auto-fault reset function (FAULT RESET SRC (C1)=automatic), then the run command needs to be cycled to be reset automatically, but will reset if initiated by a logic input without cycling the run command.	− **external tb** *[1]* − **serial** *[2]* − **automatic** *[3]*	**EXTERNAL TB**		Y	Y
Overspd Test Src *[C132]*	(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** *[1]* − **serial** *[2]*	**EXTERNAL TB**		Y	Y
PreTorque Src *[C133]*	(Pre-Torque Source) This parameter sets the source of the pre-torque command.	− **none** *[0]* − **analog input** *[1]* − **serial** *[2]*	**None**		Y	Y

User Switches C1 Submenu

Parameter *[Alphanumeric]*	Description	Choices	Default ENGLISH (U3)	Default METRIC (U3)	Hidden item	Run lockout
PreTorque Latch[i,ii] *[C134]*	(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.	− **not latched**[i,ii] *[0]* − **latched**[i,ii] *[1]*	**NOT LATCHED**[i,ii]		Y[i,ii]	Y[i,ii]
PTorq Latch Clck[i,ii] *[C135]*	(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.	− **external tb**[i,ii] *[1]* − **serial**[i,ii] *[2]*	**EXTERNAL TB**[i,ii]		Y[i,ii]	Y[i,ii]

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

Parameter *[Alphanumeric]*	Description	Choices	Default		Hidden item	Run lockout
			ENGLISH (U3)	METRIC (U3)		
Dir Confirm *[C136]*	(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.	– **enabled** *[1]* – **disabled** *[0]*	**DISABLED**		Y	Y
Mains Dip Ena *[C137]*	(Mains Dip Enable) When enabled, the function limit the speed (to the percentage of contract speed defined by the MAINS DIP SPEED parameter). • Low Mains: defined by UV alarm level • EXT TB: Logic Input • Serial: Serial Link	– **Disable** *[0]* – **Low Mains** *[1]* – **Ext TB** *[2]* – **Serial** *[3]*	**DISABLE**		Y	Y

Parameter *[Alphanumeric]*	Description	Choices	Default ENGLISH (U3)	Default METRIC (U3)	Hidden item	Run lockout
Mlt-Spd to Dly 1 *[C138]*	(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 97.	– **mspd 1** *[1]* – **mspd 2** *[2]* – **mspd 3** *[3]* – **mspd 4** *[4]* – **mspd 5** *[5]* – **mspd 6** *[6]* – **mspd 7** *[7]* – **mspd 8** *[8]* – **mspd 9** *[9]* – **mspd 10** *[10]* – **mspd 11** *[11]* – **mspd 12** *[12]* – **mspd 13** *[13]* – **mspd 14** *[14]* – **mspd 15** *[15]* – **none** *[0]*	**NONE**		Y	Y
Mlt-Spd to Dly 2 *[C139]*			**NONE**		Y	Y
Mlt-Spd to Dly 3 *[C140]*			**NONE**		Y	Y
Mlt-Spd to Dly 4 *[C141]*			**NONE**		Y	Y
Priority Msg *[C142]*	(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** *[1]* – **Disable** *[0]*	**ENABLE**		N	N
Arb Select[i,ii] *[C143]*	*(Anti-Rollback Select [i,ii]) With ARB SELECT set to ARB2 or ARB3, the drive will calculate pretorque values when movement is seen on the shaft. For information on how to setup ARB, see on page 57.* *NOTE: ARB feature is disabled when PPT Select (C1) is enabled.*	– ***Disable*** [i,ii] *[0]* – ***ARB2*** [i,ii] *[2]* – ***ARB3*** [i,ii] *[3]*	***DISABLE*** [i,ii]		*N* [i,ii]	*Y* [i,ii]
Endat Interp [ii] *[C144]*	*(EnDat Interpolation [ii]) This parameter sets the feedback interpolation rate mutilpiler for the EnDat board for increased encoder feedback resolution* ***NOTE:****drive has an internal maximum operating frequency explained on page 99*	– ***8*** [ii] – ***32*** [ii] – ***64*** [ii] – ***128*** [ii] – ***256*** [ii] – ***512*** [ii] – ***1024*** [ii]	***128*** [ii]		*N* [ii]	*Y* [ii]

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

Parameter *[Alphanumeric]*	Description	Choices	Default ENGLISH (U3)	Default METRIC (U3)	Hidden item	Run lockout
Endat Out Mult [ii] *[C145]*	*(EnDat Output Multiplier* [ii]*)* *This parameter is the encoder PPR multiplier that sets the pulse rate of the differential quadrature buffered output on the EnDat board*	– ***8*** [ii] – ***1*** [ii] – ***2*** [ii] – ***4*** [ii]	***8*** [ii]		*N* [ii]	*Y* [ii]
Drv Enable Src *[C146]*	(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** *[1]* – **serial** *[2]* – **serial+extrn** *[3]*	**EXTERNAL TB**		N	Y
Rec Travel Dir *[C147]*	(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** *[0]* – **geared** *[1]* – **gearless** *[2]*	**NONE**		N	N
Phase Loss Check *[C148]*	(Phase Loss Check Selection)This parameter allows the user to select the sensitivity of the phase loss detection. Low sens setting phase loss condition must be twice as low as at high sens setting for a phase flt to be declared. If disabled a phase fault will not be declared.	– **high sens** *[1]* – **low sens** *[2]* – **disabled** *[0]*	**HIGH SENS**		N	Y
Overload Select *[C149]*	(Overload Select) This parameter allows the user to select the over load capacity of the drive, 200% for normal duty or 250% for heavy duty. **NOTE:** NOT available on drive models: 2075, 2088, 2098, 4065, 4072, and 4096. When selecting 200%, set PWM Frequency (A4) to 8kHz.	– **200%** *[200%]* – **250%** *[250%]*	**250%**		N	Y
NTSD Mode *[C150]*	(Normal Terminal Stopping Device Mode) Sets the number of threshold checkpoints in the hoistway and threshold speeds for the NTSD function. If set to external, the speed threshold is determined by the controller or if NTSD is not used.	– **1 Threshold** *[1]* – **2 Thresholds** *[2]* – **3 Thresholds** *[3]* – **External** *[4]*	**External**		N	N
Balance Comp *[C151]*	(Balance Compensation) Minimizes fundamental harmonics in the current feedback circuit. Enabling this function can help improve the ride quality, especially for a PM motor.	– **Enable** *[1]* – **Disable** *[0]*	**Disable**		N	Y

Parameter *[Alphanumeric]*	**Description**	**Choices**	**Default**		**Hidden item**	**Run lockout**
			ENGLISH (U3)	**METRIC (U3)**		
Fan PWM Enable *[C152]*	This parameter allows the user to enable and disable soft starting on the fans.	– **Enable** *[1]* – **Disable** *[0]*	**Enable**		N	Y
PPT Select *[C153]*	(Pulse Pre-Torque) Enables the PPT feature. PPT is designed for use with certain brake types to eliminate the bump felt and heard as the brake is released at the start of travel.	– **Enable** *[1]* – **Disable** *[0]*	**Disable**		N	Y

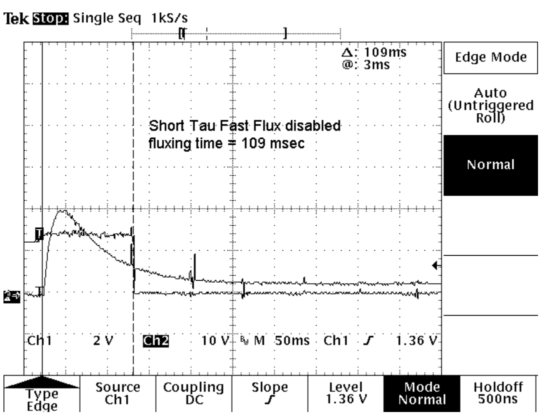
Table 15: User Switches C1 Submenu

Detailed descriptions

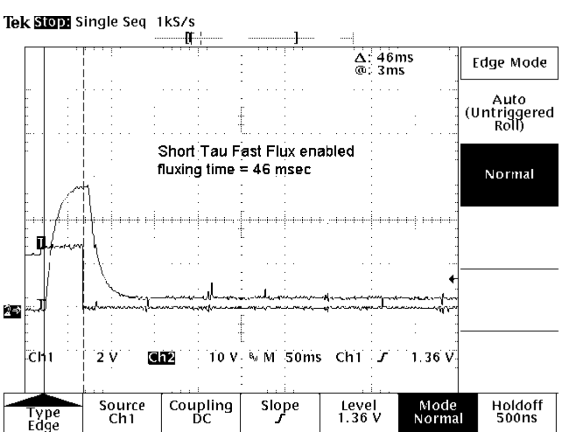
FAST FLUX[i]
(Fast Flux Enable)
This parameter addresses the method the HPV 900 Series 2 uses to build up flux in the motor. Enabling the Fast Flux function can decrease the motor fluxing time significantly. By decreasing the motor's flux time, the starting takeoff time will also be decreased.

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:

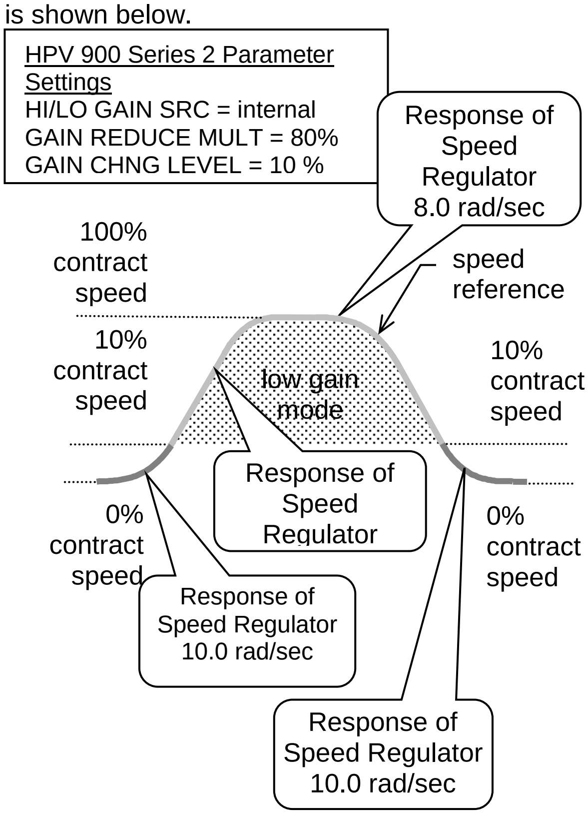
- the gain change level parameter (GAIN CHNG LEVEL), which defines a percentage of contract speed

With the drive set to internal control, the speed regulator will go into 'low gain' mode when the

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

[iii] Parameter accessible through ***OPEN LOOP(U9)***

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,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 36 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 37 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).

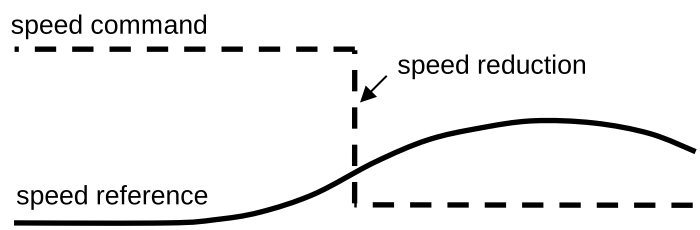


Figure 36: Normal S-curve Abort

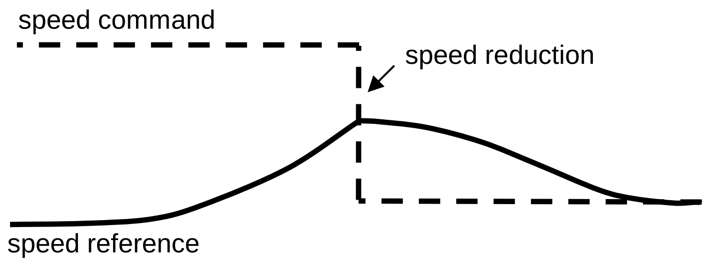


Figure 37: Optional S-curve Abort

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 work with a Multistep/Serial/Analog Speed Command. When Speed Command SRC (C1) is set to Analog, the Auto Stop function can only be used if Speed Zero Bnd (A1) is set to a value greater than 0.

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, 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. When using an Analog Speed Command, the drive will consider the speed command to be zero when it is below the Speed Zero Bnd (A1) threshold.

Remember, when the auto stop function is enabled (AUTO STOP (C1)=enabled) both a non-zero 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:

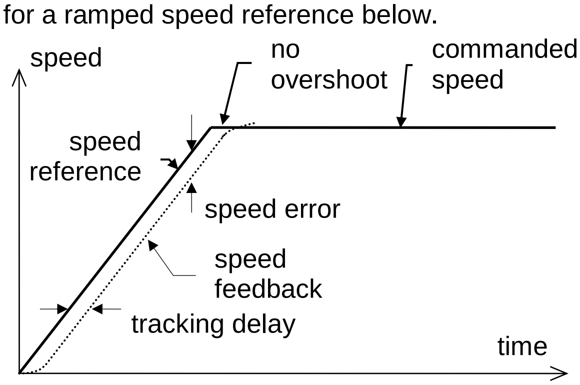
- Elevator Speed Regulator (Ereg)
- PI Speed Regulator
- External Speed Regulator

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)***

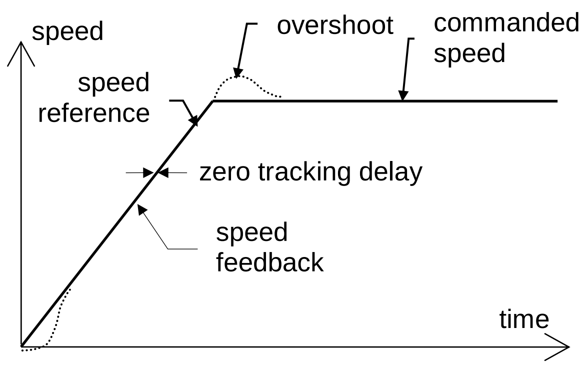
The inner loop crossover parameter (INNER LOOP XOVER(A1)) should not need to be changed. But if the number is changed, it must satisfy the following formula:

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

PI Speed Regulator

When the Proportional plus Integral (PI) speed regulator is used, the response to a speed reference is different. As an example, the PI Speed Regulator's speed response is shown below for a ramped speed reference. With the PI speed regulator, 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

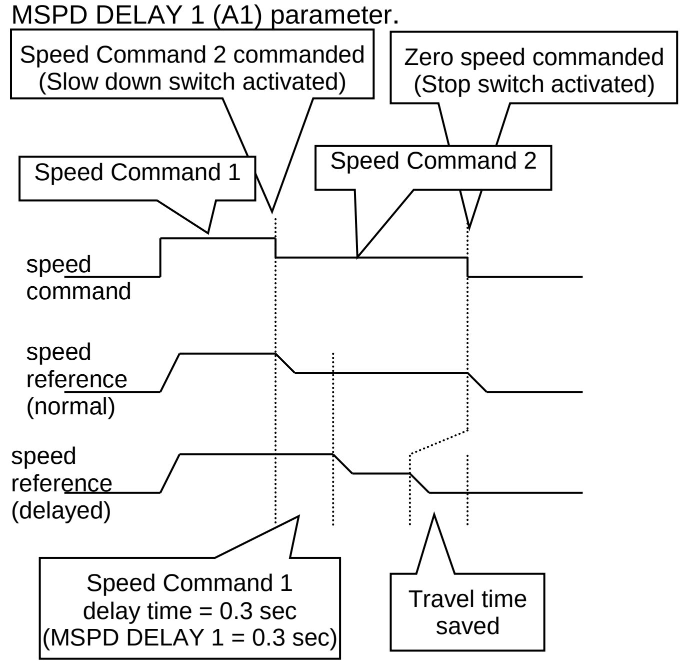
The PI Speed Regulator is tuned by:

- 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.



Phase Loss Check

(Phase Loss Check Selection)

This parameter allows the user to select the sensitivity of the phase loss detection.

- DISABLED: Phase loss checking is completely disabled; an open phase will not be detected. Drive will keep running at single phase but greatly derated.
- LOW SENS: Phase loss detection is done with low sensitivity. The phase loss condition must persist for twice as long as in the HIGH SENS setting. This allows for more bus voltage ripple.
- HIGH SENS: Phase loss detection is done with high sensitivity. Phase loss is declared faster at higher frequency motor current than at lower frequencies. This is the default setting.

RECOMMENDED TRAVEL DIRECTION
(Recommended Travel Direction)
The recommended travel direction feature is designed to allow the drive the ability to determine the lightest loaded travel direction, and communicate this information to the car controller. The car controller can then use this information to decide whether to instruct the drive to run in that direction (drive will not automatically run in the direction of the lightest load, it requires the controller to dictate a directional speed command).

This is intended primarily for use in emergency evacuations runs when the mains power is not available and the drive and controller are running on UPS backup. This should ensure that the running current for the evacuation run is as low as possible, and hence use the least possible power from the UPS.

Geared Machines
1. To activate the Recommended Travel Direction function with Travel Dir (C1) set to geared, the drive will expect a drive enable, run, a directional input, and Rec Travel input signals.
2. The brakes should then lift to allow the drive to determine the direction of the lightest load.
3. The drive will then rotate the the motor in the forward direction at the speed set in Travel Dir Spd (A4) regardless of speed command for the amount of time set in Load Sense Time (A4).
4. Then the drive will start to spin the motor in the reverse direction at the speed set in Travel Dir Spd (A4) regardless of speed command for the amount of time set in Load Sense Time (A4).
5. The drive will then announce with Logic Outputs (C3) Rec Travel On that it has sucessfully determine a direction (if it was not successful, increase the Load Sense Time (A4)).
6. When the Rec Travel On (C4) output is high, the state of Rec Travl Dir (C3) will be the direction that the drive suggests the elevator should go for the lightest load.
   a. If Rec Travl Dir (C3) remains low, the controller should continue running in the same direction.
   b. If Rec Travl Dir (C3) goes high, the controller should immediately drop the original direction input and instead issue the opposite direction.
7. The drive then requires that the controller makes a desion on which direction that the elevator should run at with the drive's recommendation. NOTE: the drive WILL try to run at the speed and direction that the controller tells it to regardless of what the drive thinks the lightest load is.

Gearless Machines
1. To activate the Recommened Travel Direction function with Travel Dir (C1) set to gearless, the drive will expect a drive en, run, a directional input, and Rec Travel input signals.
2. The brakes should then lift to allow the drive to determine the direction of the lightest load.
3. The drive will force the motor to hold 0fpm regardless of speed command for the amount of time set in Load Sense Time (A4) because the motor is direct drive to the sheave.
4. The drive will then announce with Logic Outputs (C3) Rec Travel On that it has successfully determine a direction (if it was not successful, increase the Load Sense Time (A4)).
5. When the Rec Travel On (C4) output is high, the state of Rec Travl Dir (C3) will be the direction that the drive suggests the elevator should go for the lightest load.
   a. If Rec Travl Dir (C3) remains low, the controller shold continue running in the same direction.
   b. If Rec Travl Dir (C3) goes high the controller should immediately drop the original direction input and instead issue the opposite direction.
6. If the controller does not change which inputs it gives to the drive, then the drive will continue to run as normal in the direction requested.

   If the controller changes which run direction it gives the drive as an input, the drive will stop, and then start again with the run commanded in the opposite direction. If the Rec Travel en input is still issued to the drive, it will once again try and determine the lightest direction of travel.

MAINS DIP ENABLE
(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).

ENDAT INTERPOLATION
(EnDat Interpolation)
This parameter determines how precisely the drive is able to sense the angular position of the motor shaft. Higher interpolation values correspond to a more precise sensing of the shaft position. The default setting provides an optimal ride quality for most applications. It may be necessary to lower this parameter for faster motors or to raise it for slower motors.

For any installation the Contract Mtr Spd (A1) should not exceed the value shown in Table 16 for a given EnDat Interpolation setting. The recommended maximum Contract Mtr Spd (A1) settings will allow over-speed test operation up to 150%.

Setting of EnDat Interp (C1)	Maximum Contract Mtr Spd (A1) in RPM
8	1200 RPM
32	1200 RPM
64	580 RPM
128	290 RPM
256	140 RPM
512	70 RPM
1024	30 RPM

Table 16: Maximum acceptable setting of Contract Mtr Spd (A1) for a given EnDat Interp (C1)

PULSE PRETORQUE (PPT)
PPT
The Pulse PreTorque (PPT) function determines the car loading before releasing the brake. This feature is best suited to brakes where there is a small amount of mechanical float as is typical on some MRL applications.

This feature can be used where a traditional Load Weighing device is not available and instead of the existing Anti-Rollback (ARB) function. Where the ARB function is a reactive solution to rollback, PPT function determines the car loading before releasing the brake so as to greatly reduce rollback. This feature will disable ARB when PPT is enabled.

This feature is turned on simply by setting PPT Select in the C1 menu to 'ENABLED'.

UMD Brake Monitoring
Brake Monitoring
This feature is intended to conform as part of an Uncontrolled Movement Detection System. From this release, the drive now has the option to separately monitor the status of two Mechanical Brake switches. In addition, there are now two Brake Pick Faults (One for each switch), to help fault finding in the event that the feedback from the switches isn't as the drive expects.
The way the Brake Pick Faults are declared has also changed, and they will now persist through a power cycle and Fault Reset signal to ensure the fault is cleared by a competent person. To clear a Brake Pick Fault, the parameter Brake Pick Flt Ena (C1) must be changed from 'Active' to 'Enabled'.

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.

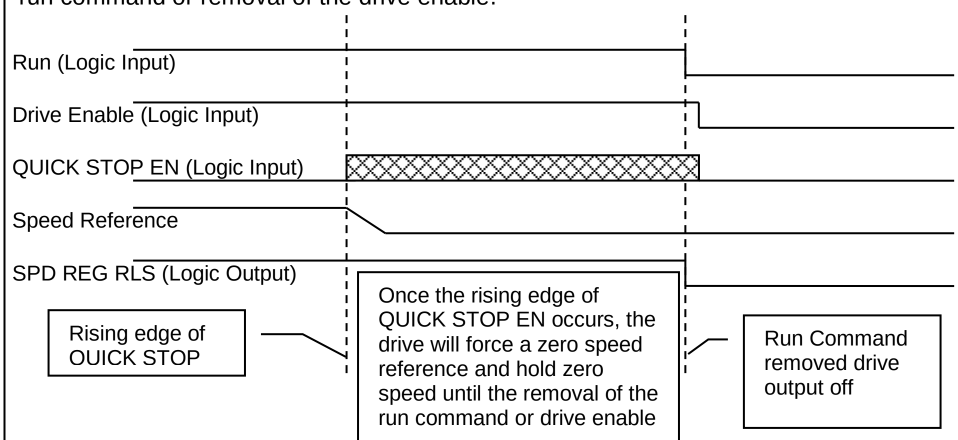
NOTE: When ***Hidden Item*** appears with the parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. See details on page 119.

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 *[Alphanumeric]*	**Description**	**Default**		**Hidden Item**	**Run lock out**
		ENGLISH (U3)	**METRIC (U3)**		
Logic Input 1 *[C201]*	Logic Input 1	**DRIVE ENABLE**		Y	Y
Logic Input 2 *[C202]*	Logic Input 2	**RUN**	**CONTACT CFIRM**	Y	Y
Logic Input 3 *[C203]*	Logic Input 3	**FAULT RESET**	**RUN UP**	Y	Y
Logic Input 4 *[C204]*	Logic Input 4	**UP/DWN**	**RUN DOWN**	Y	Y
Logic Input 5 *[C205]*	Logic Input 5	**S-CURVE SEL 0**		Y	Y
Logic Input 6 *[C206]*	Logic Input 6	**STEP REF B0**		Y	Y
Logic Input 7 *[C207]*	Logic Input 7	**STEP REF B1**		Y	Y
Logic Input 8 *[C208]*	Logic Input 8	**STEP REF B2**		Y	Y
Logic Input 9 *[C209]*	Logic Input 9	**SAFE-OFF**		Y	Y

<table>
<tr><th>choices…</th><th colspan="2">choice descriptions…</th></tr>
<tr><td>contact cfirm
[1]</td><td colspan="2">(Contactor Confirm) Closure of the auxiliary contacts confirming closure of the motor contactor.</td></tr>
<tr><td>drive enable
[2]</td><td colspan="2">(Drive Enable) Must be asserted to permit drive to run. This does not initiate run, just permits initiation.</td></tr>
<tr><td>extrn fault 1
[3]</td><td>(External Fault 1) User input fault #1</td><td rowspan="3">Closure of this contact will cause the drive to declare a fault and perform a fault shutdown.</td></tr>
<tr><td>extrn fault 2
[4]</td><td>(External Fault 2) User input fault #2</td></tr>
<tr><td>extrn fault 3
[5]</td><td>(External Fault 3) User input fault #3</td></tr>
<tr><td>extrn /flt 4
[6]</td><td colspan="2">(External / Fault 4) User input fault #4. Opening of this contact will cause the drive to declare a fault and perform a fault shutdown.</td></tr>
<tr><td>fault reset
[7]</td><td colspan="2">(Fault Reset) If the FAULT RESET SRC (C1) is set to EXTERNAL TB1, the drive’s fault circuit will be reset when this signal is true. If the FAULT RESET SRC switch is set to AUTOMATIC, the drive’s fault circuit will be reset when this signal is true and the automatic fault reset counter, defined by FLT RESETS/HOUR, will be reset to zero. NOTE: this input is edge sensitive and the fault is reset on the transition from false to true.</td></tr>
<tr><td>low gain sel
[8]</td><td colspan="2">(Low Gain Selection) If the HI/LO GAIN SRC switch is set to EXTERNAL TB1, the low gain mode is chosen for the speed regulator when this signal is true.</td></tr>
<tr><td>mains dip
[9]</td><td colspan="2">(Mains Dip Selection) Requests the drive to enter mains dip mode. Only valid when MAINS DIP (C1) = EXTERNAL TB.</td></tr>
<tr><td>mech brake hold
[10]</td><td colspan="2">(Mechanical Brake Hold) Auxiliary contact closures confirming when the mechanical brake is in the hold mode (engaged).</td></tr>
<tr><td>mech brake pick1
[11]</td><td colspan="2">(Mechanical Brake Pick) Auxiliary contacts from mechanical brake switch 1. Asserted when brake is picked (lifted).</td></tr>
</table>

choices…	***choice descriptions…***
mech brake pick2 *[12]*	(Mechanical Brake Pick) Auxiliary contacts from mechanical brake switch 2. Asserted when brake is picked (lifted).
nc ctct cfirm *[13]*	(Normally Closed Contact Confirm) Opening of the auxiliary contacts confirming closure of the motor contactor.
no function *[14]*	(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.
NTSD Input 1 *[15]*	NTSD input #1 for use when the NTSD MODE is set to "1 Threshold", "2 Thresholds" or "3 Thresholds".
NTSD Input 2 *[16]*	NTSD input #2 for use when the NTSD MODE is set to "2 Thresholds" or "3 Thresholds".
ospd test src *[17]*	(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.
pre-trq latch *[18]*	(Pre-Torque Latch) Transition from false to true latches pre torque command.
quick stop *[19]*	(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. 
rec travel en *[20]*	(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).

Logic Inputs C2 Submenu

<table>
<tr><th>choices…</th><th colspan="2">choice descriptions…</th></tr>
<tr><td>run
[21]</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
[22]</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
[23]</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
[24]</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 61</td></tr>
<tr><td>s-curve sel 1
[25]</td><td>(S-Curve Select 1) Bit 1 of S-curve selection</td></tr>
<tr><td>safe off
[26]</td><td colspan="2">Only Logic Input 9 can be used for the “Safe Off” input. Used in conjunction with ‘Safe-Off’ switch on the control card. IGBTs can then only fire when this input is high.</td></tr>
<tr><td>ser2 insp ena
[27]</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
[28]</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 63.</td></tr>
<tr><td>step ref b1
[29]</td><td>(Step Reference Bit 1) Bit 1 of multi-step speed command selection</td></tr>
<tr><td>step ref b2
[30]</td><td>(Step Reference Bit 2) Bit 2 of multi-step speed command selection</td></tr>
<tr><td>step ref b3
[31]</td><td>(Step Reference Bit 3) Bit 3 of multi-step speed command selection</td></tr>
<tr><td>trq ramp down
[32]</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
[33]</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 17: 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 *[Alphanumeric]*	**Description**	**Default**		**Hidden item**	**Run lockout**
		ENGLISH (U3)	**METRIC (U3)**		
Logic Output 1 *[C301]*	logic output #1	**READY TO RUN**		Y	Y
Logic Output 2 *[C302]*	logic output #2	**RUN COMMANDED**		Y	Y
Logic Output 3 *[C303]*	logic output #3	**MTR OVERLOAD**	**ZERO SPEED**	Y	Y
Logic Output 4 *[C304]*	logic output #4	**ENCODER FLT**		Y	Y
Relay Coil 1 *[C305]*	relay output #1	**FAULT**	**READY TO RUN**	Y	Y
Relay Coil 2 *[C306]*	relay output #2	**SPEED REG RLS**	**BRAKE PICK**	Y	Y
User LED *[C307]*	User LED located at the top of the operator	**ALARM**		Y	N

choices…	***choice descriptions…***
alarm *[1]*	(Alarm) The output is true when an alarm is declared by the drive.
alarm+flt *[2]*	(Alarm and/or Fault) The output is true when a fault and/or an alarm is declared by the drive.
at mid speed *[3]*	(At Mid Speed) The output is true when the speed is above the level set by AT MID SPEED (A1) parameter.
auto brake *[4]*	(Auto Brake) The output is controlled by the Auto Brake function and is used to open the mechanical brake.
brake alarm *[5]*	(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 *[6]*	(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 *[7]*	(Brake Pick) The output is true when the speed regulator is released and is used to open the mechanical brake.
brk hold flt *[8]*	(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 *[9]*	(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 *[10]*	(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 *[11]*	(Car Going Down) The output is true when the motor moves in negative direction faster than the user specified speed.
car going up *[12]*	(Car Going Up) The output is true when motor moves in positive direction faster than user specified speed.
charge fault *[13]*	(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 *[14]*	(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 *[15]*	(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 *[16]*	(Current Regulator Fault) The output is true when the actual current measurement does not match commanded current.

Logic Outputs C3 Submenu

choices…	***choice descriptions…***
drv overload *[17]*	(Drive Overload) The output is true when the drive has exceeded the drive overload curve.
encoder flt *[18]*	(Encoder Fault) The output is true when the drive is declaring an encoder fault
ext fan en *[19]*	(External Fan Indicator) The output is true when the drive fan is on and false when the drive fan is off.
fan alarm *[20]*	(Fan Alarm) The output is true when the fan on the drive is not functioning.
fault *[21]*	(Fault) The output is true when a fault is declared by the drive.
flt reset out *[22]*	(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.
flux confirm *[23]*	(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 *[24]*	(Fuse Fault) The output is true when the DC bus fuse has blown.
ground fault *[25]*	(Ground Fault) The output is true when the sum of all phase current exceeds 50% of rated current of the drive.
in low gain *[26]*	(In Low Gain) The output is true when the speed regulator is in "low gain" mode.
motor trq lim *[27]*	(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 *[28]*	(Motor Overload) The output is true when the motor has exceeded the user defined motor overload curve.
no function *[29]*	(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 *[30]*	(Not Alarm) The output is true when an alarm is NOT present.
NTSD Active *[31]*	(NTSD Active) The output is true when NTSD is activated.
over curr flt *[32]*	(Motor overload current fault) The output is true when the phase current has exceeded 300% of rated current.
overspeed flt *[33]*	(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 *[34]*	(Heatsink Over Temperature Fault) The output is true when the drive's heatsink has exceeded 90°C (194°F).
overvolt flt *[35]*	(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 *[36]*	(Drive Over Temperature Alarm) The output is true when the drive's heatsink temperature has exceeded 80°C (176°F).
phase fault *[37]*	(Phase Loss) The output is true when the drive senses an open motor phase.
Probe 1 *[38]*	(Probe 1) Programmable setting to be used with conjuction with U7 HEX MONITOR to monitor internal software variables.
Probe 2 *[39]*	(Probe 2) Programmable setting to be used with conjuction with U7 HEX MONITOR to monitor internal software variables.
ramp down ena *[40]*	(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 *[41]*	(Ready to Run) The output is true when the drive's software has been initialized and no faults are present.
rec travel on *[42]*	(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
rec travl dir *[43]*	(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

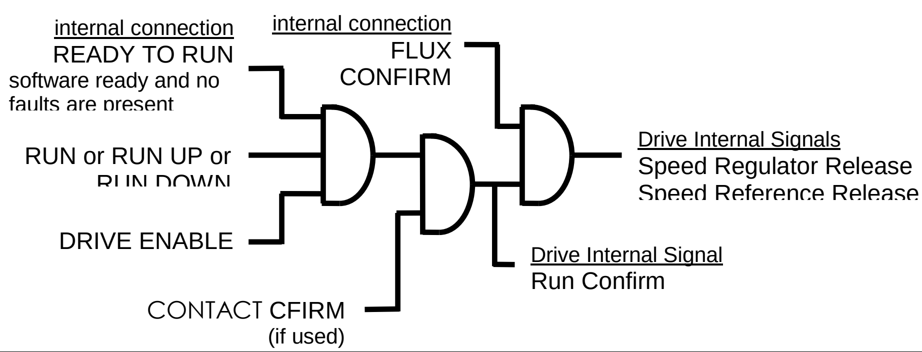
choices…	***choice descriptions…***
regen trq lim *[44]*	(Regeneration Torque Limit) The output is true when the torque limit has been reached while the drive is in the regenerative mode. The regenerative mode is defined as when the motor is returning energy to the drive. When the drive is in regenerative mode, the energy is dissipated via the dynamic brake circuitry (internal brake IGBT and external brake resistor).
run commanded *[45]*	(Run Commanded) The output is true when the drive is being commanded to run.
run confirm *[46]*	(Run Command Confirm) The output is true after the software has initialized, no faults are present, the drive has been commanded to run, the contactor has closed and the IGBTs are firing.
Safe-Off Input *[47]*	This output is high when the drives safe off input is not present and the drive is therefore disabled by the safe off feature. This feature is enabled by the control card's 'Safe Off' switch.
speed dev *[48]*	(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 *[49]*	(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 *[50]*	(Speed Reference Release) The output is true when the flux is confirmed and drive is NOT in DC injection.
spd ref rel2 *[51]*	(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
speed reg rls *[52]*	(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 *[53]*	(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 *[54]*	(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 *[55]*	(Up to Speed) The output is true when the motor speed is above the user specified speed
uv alarm *[56]*	(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 *[57]*	(Zero Speed) The output is true when the motor speed is below the user specified speed for the user specified time.

Table 18: 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 *[Alphanumeric]*	**Description**	**Default**		**Hidden item**	**Run lockout**
		ENGLISH (U3)	**METRIC (U3)**		
Analog Output 1 *[C401]*	analog output #1	**SPEED REF**	**SPEED COMMAND**	Y	N
Analog Output 2 *[C402]*	analog output #2	**SPEED FEEDBACK**		Y	N

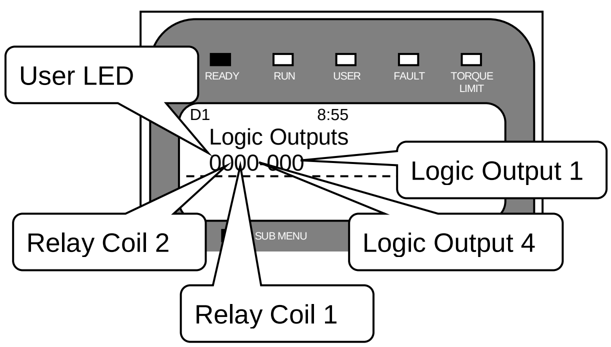
choices…	***choice descriptions…***	***D/A units…***
abs pos bin *[1]*	(Absolute Position Binary) Raw absolute position reading from the absolute encoder.	Counts
aux torq cmd *[2]*	(Auxiliary Torque Command) Additional torque command from auxiliary source, when used.	% rated torque
bus voltage *[3]*	(DC Bus Voltage Output) Measured DC bus voltage.	% of peak in
current out *[4]*	(Current Output) Percent motor current.	% rated current
d-current ref *[5]*	(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 *[6]*	(Drive Overload) Percent of drive overload trip level reached.	% of trip point
flux current *[7]*	(Flux Producing Current) Measured flux producing current.	% rated current
flux output *[8]*	(Flux Output) Measured flux output.	% rated flux
flux ref *[9]*	(Flux Reference) Flux reference used by vector control	% rated flux
flux voltage *[10]*	(Flux Producing Voltage) Flux producing voltage reference.	% rated volts
frequency out *[11]*	(Frequency Output) Electrical frequency.	% rated freq
mtr overload *[12]*	(Motor Overload) Percent of motor overload trip level reached.	% of trip point
no function *[13]*	(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 *[14]*	(Power Output) Calculated power output.	% rated power
pretorque ref *[15]*	(PreTorque Reference) Pre-torque reference.	% base torque
probe 1 *[16]*	(Probe 1) Programmable setting to be used with conjuction with U7 HEX MONITOR to monitor internal software variables.	
probe 2 *[17]*	(Probe 2) Programmable setting to be used with conjuction with U7 HEX MONITOR to monitor internal software variables.	
slip frequency *[18]*	(Motor Slip Frequency) Commanded slip frequency.	% rated frequency

choices…	***choice descriptions…***	***D/A units…***
spd rg tq cmd *[19]*	(Speed Regulator Torque Command) Torque command from speed regulator.	% base torque
Speed command [20]	(Speed Command) Speed Command before S-Curve	% rated speed
speed error *[21]*	(Speed Error) Speed reference minus speed feedback.	% rated speed
speed feedbk *[22]*	(Speed Feedback) Speed feedback used by speed regulator.	% rated speed
speed ref *[23]*	(Speed Reference) Speed reference after S-Curve	% rated speed
tach rate cmd *[24]*	(Tachometer Rate Command) Torque command from tach rate gain function.	% base torque
theta e *[25]*	(Polarity Error Signal) Magnet polarity estimation error signal used for PM motor characterization with respect to quick align.	Internal drive unit
torq current *[26]*	(Torque Producing Current) Measured torque producing current.	% rated current
torque ref *[27]*	(Torque Reference) Torque reference used by vector control.	% base torque
torq voltage *[28]*	(Torque Producing Voltage) Torque producing voltage reference.	% rated volts
torque output *[29]*	(Torque Output) Calculated torque output.	% rated torque
voltage out *[30]*	(Voltage Output) RMS motor terminal voltage.	% rated volts

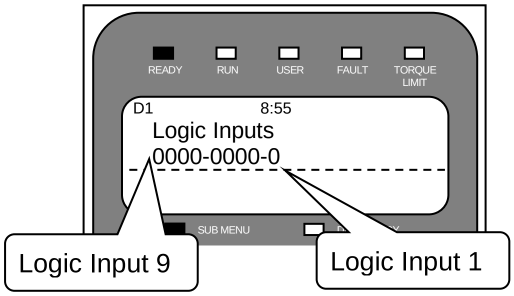
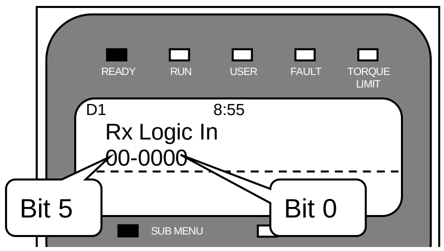
Table 19: Analog Outputs C4 Submenu

Display D0 Menu

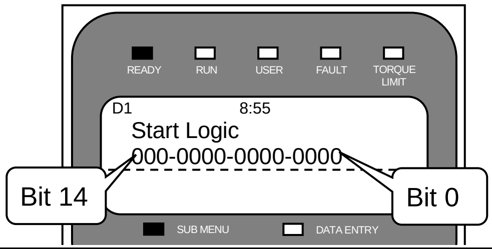
Elevator Data D1 Submenu

Parameter *[Alphanumeric]*	**Description**	**Units**	**Hidden item**
Speed Command *[D101]*	(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 *[D102]*	(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 *[D103]*	(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
Analog Spd Cmd *[D104]*	(Analog Speed Command) - Displays the analog speed command raw voltage before adjusting for SPD COMMAND BIAS, SPD COMMAND MULT, and SPD ZERO BAND.	**volts**	N
Encoder Speed *[D105]*	(Encoder Speed) - Monitors encoder speed in rpm.	**rpm**	N
Speed Error[i,ii] *[D106]*	(Speed Error[i,ii]) - Monitors the speed error between the speed reference and the speed feedback. It is equal to the following equation: $\left\lvert \begin{pmatrix} speed \\ reference \end{pmatrix} - \begin{pmatrix} speed \\ feedback \end{pmatrix} \right\rvert = \begin{matrix} speed \\ error \end{matrix}$	**ft/min or m/s**[i,ii]	N[i,ii]
Est Inertia[i,ii] *[D107]*	(Estimated Inertia[i,ii]) - Estimated elevator system inertia.	**secs**[i,ii]	N[i,ii]
Logic Outputs *[D108]*	(Logic Outputs Status) - This display shows the condition of the logic outputs. (1=true 0=false) 	**1=true 0=false**	N

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

<table>
<tr><th>Parameter
[Alphanumeric]</th><th>Description</th><th>Units</th><th>Hidden item</th></tr>
<tr><td>**Logic Inputs**
[D109]</td><td>(Logic Inputs Status) - This display shows the condition of the logic inputs. (1=true 0=false)

</td><td>**1=true**
0=false</td><td>N</td></tr>
<tr><td>**Rx Logic In**
[D110]</td><td>(Serial Communications Logic Inputs)


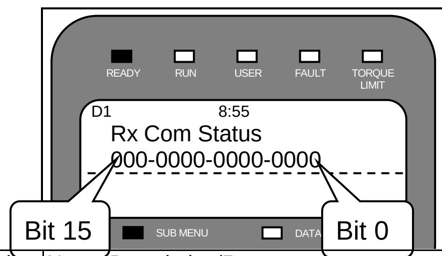
<table>
<tr><td>Bit</td><td>Name Description/Reason</td></tr>
<tr><td>0</td><td>AUX_RUN_BIT Serial Run Command bit from car controller</td></tr>
<tr><td>1</td><td>AUX_FLT_RST_REQ_BIT Serial Fault Reset Request from car controller</td></tr>
<tr><td>2</td><td>AUX_PT_CLK_BIT Serial Pre-Torque Latch Clock 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
[Alphanumeric]</th><th>Description</th><th>Units</th><th>Hidden item</th></tr>
<tr><td>**Start Logic**[i,ii]
[D111]</td><td>(Start Logic Status[i,ii]) - This display shows the condition of certain starting logic bits. (1=true 0=false)


<table>
<tr><td>Bit</td><td>Name Description/Reason</td></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>

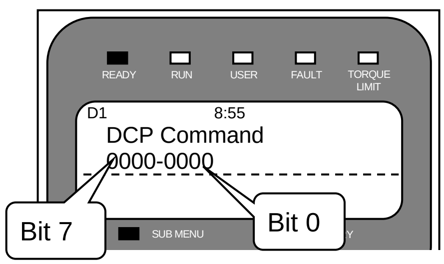
[i] Parameter accessible through **CLOSED LOOP (U9)** Operation
[ii] Parameter accessibly through ***PM (U9)*** Operation
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

<table>
<tr><th>Parameter
[Alphanumeric]</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]**
[D112]</td><td>(Serial Communications Status[i,ii])
Serial communication status display.

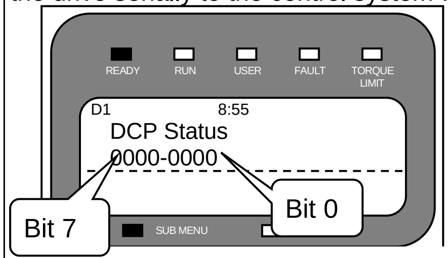


<table>
<tr><th>Bit</th><th>Severity</th><th>Name Description/Reason</th></tr>
<tr><td>0</td><td>Info</td><td>RX_INVALID_SETUP_ID; Invalid setup id on setup msg</td></tr>
<tr><td>1</td><td>Info</td><td>RX_SETUP_IN_RUN; A setup message to write was received while the serial run bit was set.</td></tr>
<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>
<tr><td>15</td><td>Fatal</td><td>RX_COMM_FAULT; COMM FAULT has been declared by the drive</td></tr>
</table>
</td><td>**1=true,
0=false[i,ii]**</td><td>N[i,ii]</td></tr>
<tr><td>**RX Error Count**
[D113]</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>
</table>

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

<table>
<tr><th>Parameter
[Alphanumeric]</th><th>Description</th><th>Units</th><th>Hidden item</th></tr>
<tr><td>**Pre-Torque Ref**[i,ii]
[D114]</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]
[D115]</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]
[D116]</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]
[D117]</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**
[D118]</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**
[D119]</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**
[D120]</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
[ii] Parameter accessibly through ***PM (U9)*** Operation
[iii] Parameter accessible through ***OPEN LOOP(U9)*** Operation

<table>
<tr><th>Parameter
[Alphanumeric]</th><th>Description</th><th>Units</th><th>Hidden item</th></tr>
<tr><td>DCP Status
[D121]</td><td>(DCP Status Monitoring) - Used for monitoring signals given by the drive serially to the control system when using DCP


<table>
<tr><th>Bit</th><th>Name Description/Reason</th></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>
<tr><td>Measured PPR
[D122]</td><td>(Measured Pulses Per Revolution) – Monitors the amount of encoder pulses the drive reads per motor revolution</td><td>PPR</td><td>N</td></tr>
<tr><td>Endat Abs Fdbk
[D123]</td><td>(EnDat Absolute Feedback) – Displays the angular position from the EnDat encoder</td><td>None</td><td>N</td></tr>
<tr><td>Z Edge Count
[D124]</td><td>(Z Edge Count) – Monitors the amount of index pulses from the Z channel of an encoder.</td><td>None</td><td>N</td></tr>
<tr><td>NTSD Spd Fdbk 1
[D125]</td><td>(Normal Terminal Stopping Device Speed Feedback 1) - Monitors the speed feedback coming from the encoder at the first NTSD threshold assertion.</td><td>ft/min or m/s</td><td>N</td></tr>
<tr><td>NTSD Spd Fdbk 2
[D126]</td><td>(Normal Terminal Stopping Device Speed Feedback 2) - Monitors the speed feedback coming from the encoder at the second NTSD threshold assertion.</td><td>ft/min or m/s</td><td>N</td></tr>
<tr><td>NTSD Spd Fdbk 3
[D127]</td><td>(Normal Terminal Stopping Device Speed Feedback 3) - Monitors the speed feedback coming from the encoder at the third NTSD threshold assertion.</td><td>ft/min or m/s</td><td>N</td></tr>
</table>

Table 20: Elevator Data D1 Submenu

Power Data D2 Submenu

Parameter *[Alphanumeric]*	**Description**	**Units**	**Hidden item**
DC Bus Voltage *[D201]*	(DC Bus Voltage) Measured voltage of the DC bus.	**Volts**	N
Motor Current *[D202]*	(RMS Motor Current Output) Monitors the RMS motor output current.	**Amps**	N
Motor Voltage *[D203]*	(Motor Voltage Output) Monitors the RMS motor terminal line-line voltage.	**Volts**	N
Motor Frequency *[D204]*	(Motor Frequency Output) Monitors the electrical frequency of the motor output.	**Hz**	N
Motor Torque *[D205]*	(Motor Torque Output) Calculated motor output torque in terms of percent rated torque.	**% rated torque**	N
Est No Load Curr %[i] *[D206]*	(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] *[D207]*	(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] *[D208]*	(Torque Reference[i,ii]) Monitors the torque reference used by the drive control.	**% rated torque**[i,ii]	N[i,ii]
Flux Reference[i] *[D209]*	(Flux Reference[i]) Flux reference used by the vector control of the drive.	**% rated flux**[i]	N[i]
Flux Output[i] *[D210]*	(Flux Output[i]) Measured value of the flux output.	**% rated flux**[i]	N[i]
% Motor Current *[D211]*	(Percent Motor Current) Monitors the motor current as a percent of rated motor current.	**% rated current**	N
D-Curr Reference[ii] *[D214]*	(*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 *[D212]*	(Power Output) Calculated drive power output.	**KW**	N
Slip Frequency[i,iii] *[D213]*	(Slip Frequency[i,iii]) Displays the commanded slip frequency of the motor	**Hz**[i,iii]	N[i,iii]
Motor Overload *[D215]*	(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 *[D216]*	(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 *[D217]*	(Flux Current) Displays the flux producing current of the motor.	**% rated current**	Y
Torque Current *[D218]*	(Torque Current) Displays the torque producing current of the motor.	**% rated current**	Y
Flux Voltage *[D219]*	(Flux Voltage) Displays the flux voltage reference.	**% rated volts**	Y
Torque Voltage *[D220]*	(Torque Voltage) Displays the torque voltage reference.	**% rated volts**	Y

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

Parameter *[Alphanumeric]*	**Description**	**Units**	**Hidden item**
Base Impedance *[D221]*	(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] *[D222]*	*(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] *[D223]*	(*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 *[D224]*	(Drive Temperature) Displays the value of the drive heatsink.	**deg C**	N
Highest Temp *[D225]*	(Highest Temperature) Displays the highest recorded value of the drive heatsink. May be reset to zero.	**deg C**	N

Table 21: Power Data D2 Submenu

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

Utility U0 Menu

U0	Parameter *[Alphanumeric]*	Description	Default	Choices	Hidden item	Run lockout
U1	**PASSWORD**	*For more information, see PASSWORD on page 119.*				
	ENTER PASSWORD *[U101]*	Allows the user to enter in a password	12345	0 – 65535	N	N
	NEW PASSWORD *[U102]*	Used to change the password			N	N
	PASSWORD LOCKOUT *[U103]*	Used to enable and disable password lockout	DISABLED	enabled *[1]* disabled *[0]*	N	N
U2	**HIDDEN ITEMS**	*For more information, see HIDDEN ITEMS on page 119.*				
	HIDDEN ITEMS *[U201]*	Selects if the “hidden” parameters will be displayed on the Digital Operator.	SHOW ITEMS	show items *[1]* hide items *[0]*	N	N
U3	**UNITS**	*For more information, see UNITS on page 119.*				
	UNITS SELECTION *[U301]*	Choose either Metric units or standard English measurements units	ENGLISH	English *[1]* Metric *[2]*	N	Y
U4	**OVRSPEED TEST**	*For more information, see OVERSPEED TEST on page 120.*				
	OVERSPEED TEST? *[U401]*	Allows for Overspeed Test to be enabled via the digital operator	NO	no *[0]* yes *[1]*	N	Y
U5	**RESTORE DFLTS**	*For more information, see RESTORE DFLTS on page 121.*				
	Rst Drive Dflts *[U501]*	Resets all parameters to default values except parameters in MOTOR A5 and Utility U menus		Idle *[0]* Enter2Rst *[1]*	N	Y
	Rst Mtr Dflts *[U502]*	Resets the parameters in the MOTOR A5 to the defaults defined by the MOTOR ID		Idle *[0]* Enter2Rst *[1]*	N	Y
U6	**DRIVE INFO**	*For more information, see DRIVE INFO on page 121.*				
	DRIVE VERSION *[U601]*	Shows the software version of the drive software			N	N
	BOOT VERSION *[U602]*	Shows the lower level software version of the drive			N	N
	CUBE ID *[U603]*	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 *[U604]*	Displays the drive type as HPV900-Series 2.			N	N
U7	**HEX MONITOR**	*For Magnetek personnel, see HEX MONITOR on page 122.*			N	N
U8	**LANGUAGE SEL**	*For more information, see LANGUAGE SEL on page 122.*				
	LANGUAGE SELECT *[U801]*	Selects language for operator text	ENGLISH	English *[1]* Alpha-Num *[2]*	N	N

U0	Parameter *[Alphanumeric]*	Description	Default	Choices	Hidden item	Run lockout
U9	**BASICS**	*For more information, see BASICS on page 122*				
	Drive Mode *[U901]*	Selects open-loop, closed-loop, or permanent magnet drive operation	CLOSED LOOP	Closed loop *[1]* Open loop *[2]* PM *[3]*	N	Y
U10	***ROTOR ALIGN***[ii]	*For more information, see ROTOR ALIGN on page 122.*				
	ALIGNMENT[ii] *[U1001]*	*Enabling this parameter allows the alignment procedure or value ENCODER ANG OFST (A5) to be changed*	*DISABLE*	*enable [1] disable [0]*	*N*	*Y*
	BEGIN ALIGNMENT[ii] *[U1002]*	*Selecting YES beings the alignment procedure*	*NO*	*no [0] yes [1] on run [2]*	*N*	*Y*
	ALIGNMENT METHOD[ii] *[U1003]*	*Chooses between open loop, auto align, or high frequency*	*OPEN LOOP*	*open loop [1] High Frequency [2] auto align [3]*	*N*	*Y*
U11	**TIME**	*For more information, see TIME on page 122.*				
	Year *[U1101]*	Sets the year for the real time clock			N	N
	Month *[U1102]*	Sets the month for the real time clock			N	N
	Day *[U1103]*	Sets the day for the real time clock			N	N
	Hour *[U1104]*	Sets the hour for the real time clock			N	N
	Minute *[U1105]*	Sets the minute for the real time clock			N	N
	Second *[U1106]*	Sets the second for the real time clock			N	N
U12	***AUTOTUNE SEL***[ii]	*For more information, see AUTOTUNE on page 153.*				
	AUTOTUNE SELECT[ii] *[U1201]*	*Setting this parameter to something other than Disable allows the AutoTune feature to run.*	*No*	*No [0] on run [1] yes [2]*	*N*	*Y*
U13	**PARAMETER UPLOAD/ DOWNLOAD**					
	Drive to Operator Xfer [U1301]	*Allows a user the ability to store parameters in the operator*	*Disable*	*Enable [1] Disable [0]*	*N*	*N*

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

U0	Parameter *[Alphanumeric]*	Description	Default	Choices	Hidden item	Run lockout
	Operator to Drive Xfer [U1302]	*Allows a user the ability to recall parameters from the operator*	*Disable*	*Enable [1] Disable [0]*	*N*	*N*
U14	***Power Meter***	*For more information see Power Meter on page124*				
	Motor Pwr [U1401]	*Displays the power (in kWh) used by the drive since last 'Energy Reset'*			*N*	*N*
	Regen Pwr [U1402]	*Displays the power (in kWh) regenerated (saved) by the drive since last 'Energy Reset'*			*N*	*N*
	Energy Time [U1403]	*Displays the hours of use since last 'Energy Reset'*			*N*	*N*
	Energy Reset [U1404]	*This allows the user to reset all U14 counters to zero*			*N*	*N*
U15	***OVERLOAD TEST***					
	Overload Test *[U1501]*	If set to ON and Overload Select is set to 200%, on the next run the Select is set to 250%. After this run, Select goes to 200% and Test goes to OFF.	*No*	*No [0] Yes [1]*	N	Y

Table 22: Utilities Menu

Detailed Description

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

- ENTER PASSWORD
- NEW PASSWORD
- PASSWORD LOCKOUT

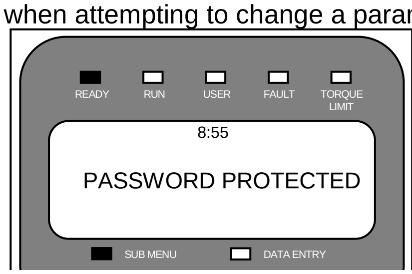
Password Function

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

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

Parameter Protection

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

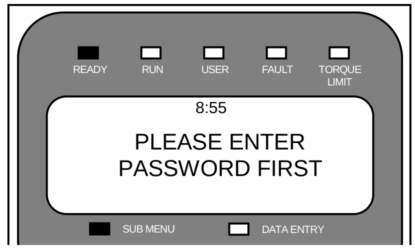


In order to change a parameter after password lockout has been enabled, the following two steps must be followed in the PASSWORD sub-menu:
1) A valid password must be entered in the ENTER PASSWORD screen.
2) The password lockout must be DISABLED in the PASSWORD LOCKOUT screen.

PASSWORD Sub-menu Protection

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

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



ENTER PASSWORD Screen

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

NEW PASSWORD Screen

This screen is used to change the established password.

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

PASSWORD LOCKOUT Screen

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

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

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

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

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

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

Overspeed Test via Logic Input

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

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

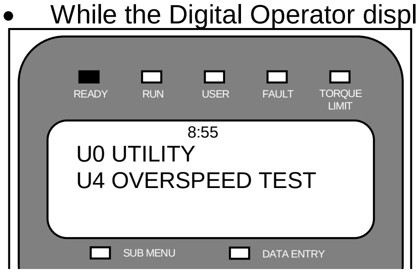
Overspeed Test via Serial Channel

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

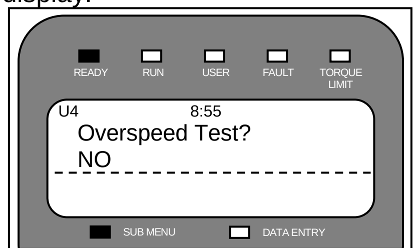
Overspeed Test via Operator

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

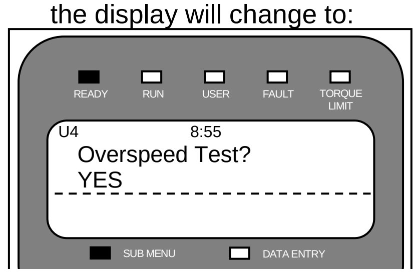
- While the Digital Operator display shows



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



- Press the ENTER key again. The 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.

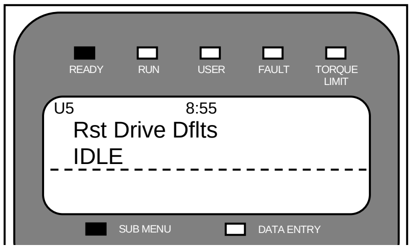
The value in the Overspeed Mult parameter is applied to the speed reference and the overspeed level, so that the elevator can be operated at greater than contract speed and not trip on an Overspeed Fault.
When the Run command is remove after the overspeed test, overspeed test reverts back to its default 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.

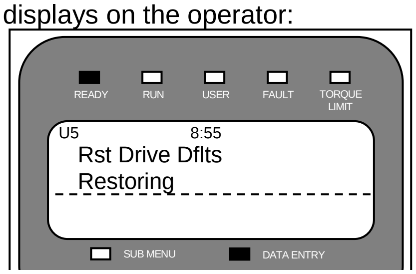
RESTORE DRIVE DEFAULTS

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:

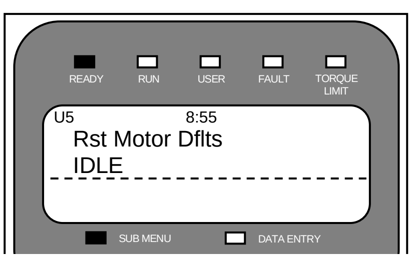


Press the enter key again. If the esc key is pressed, instead the reset action will be aborted.

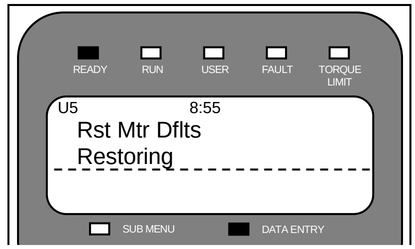
RESTORE MOTOR DEFAULTS

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:

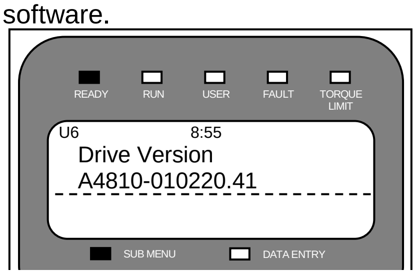


Press the enter key again. If the esc key is pressed, instead the reset action will be aborted.

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

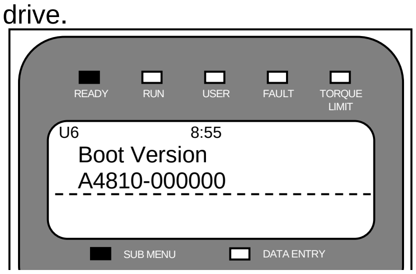
DRIVE VERSION Screen

Shows the software version of the drive software.



BOOT VERSION Screen

Shows the lower level software version of the drive.

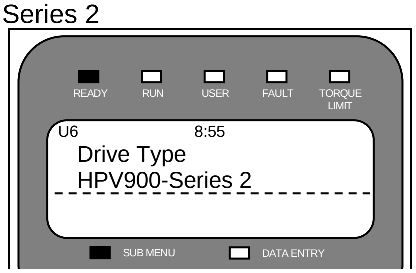


CUBE ID Screen
Displays the cube identification number of the drive.

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

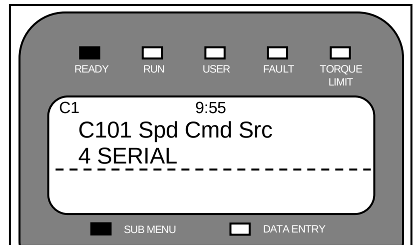
DRIVE TYPE Screen
Shows the drive software type HPV 900 Series 2



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

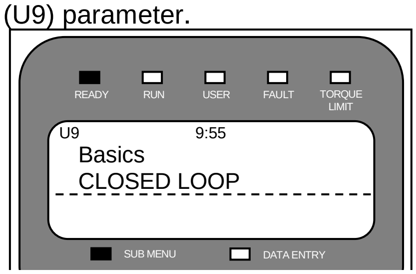
LANGUAGE SEL
(Language Selection Function)
When the Language Selection sub-menu is displayed, the user can choose either English or Alpha-numeric for the operator's text.
With Alpha-numeric selected, each parameter has an alpha-numeric code accompanied by a short English description. If the parameter has multiple selectable settings, the settings will be numbered.

For example, setting Speed Command Source to serial, would mean setting parameter 'C101' to '4'



The Alphanumeric values are provided in the parameter tables above.

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



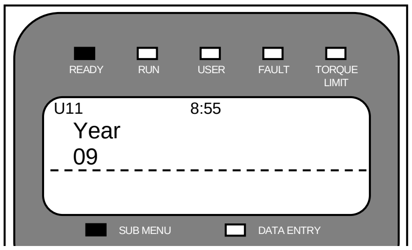
ROTOR ALIGN[ii]
(Rotor Alignment Function)
The Rotor Align submenu is meant for aligning the rotor with the magnets in the motor. For a detailed procedure see PM Start-Up Procedure on page ix.

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

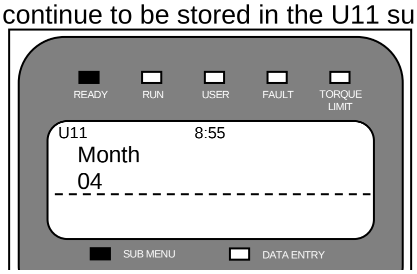
TIME
(Time Setting Function)

The clock located at the top of the operator under the user LED, will set after the SECOND parameter has been enter.

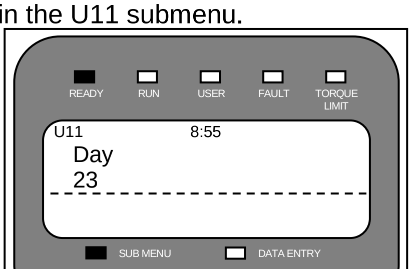
For the year, enter the last two digits corresponding to the current year. This will update and continue to be stored in the U11 submenu.



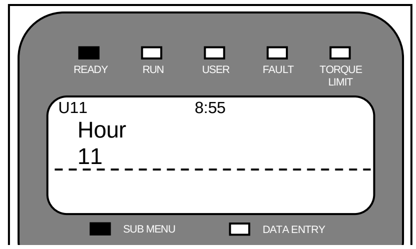
Enter the month based off of a 12 month calendar. This will automatically update and continue to be stored in the U11 submenu.



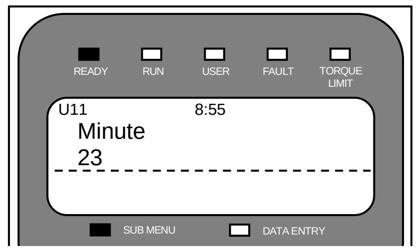
Next, enter the current day. This will automatically update and continue to be stored in the U11 submenu.



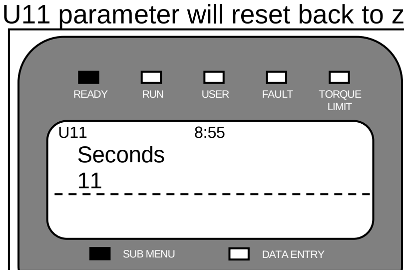
The hour is based off a 24 hour clock. This number will be automatically stored, however, after setting this value in the U11 submenu, it may be viewed on the top of the display and the U11 parameter will reset back to zero.



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.



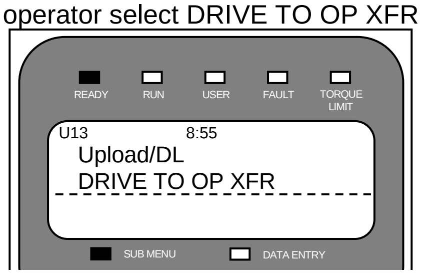
And finally enter the seconds. This number will be automatically stored, however, after setting this value in the U11 submenu, it may be viewed on the top of the display and the U11 parameter will reset back to zero.



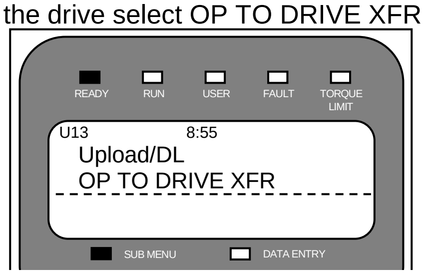
AUTOTUNE SEL[ii]
(AutoTune Selection)
The AutoTune feature allows for the drive to automatically measure the stator resist (A5), D Axis inductance (A5), and Q Axis inductance(A5). The procedure itself may be found in the Appendix on page ix.

UPLOAD/DL
(Upload/Download Parameters)
This enables the parameters to be transferred from the operator to the drive or from the drive to the operator. The software revision must be the same in the drive as in the par file in the operator.

To transfere parameters from the drive to the operator select DRIVE TO OP XFR



To transfere parameters from the operator to the drive select OP TO DRIVE XFR.



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*

Fault F0 Menu

F0	Parameter *[Alphanumeric]*	Description		Hidden item	Run lockout
F1	**ACTIVE FAULTS** *[F101]*	Contains a list of the active faults		N	N
F2	**FAULT HISTORY** *[F201]*	Contains a list of up to the last sixteen faults with time stamps		N	N
F3	**SORTED HISTORY** *[F301]*	Contains a list of all potential faults and the number of times they have occurred		N	N
F4	RESET FAULTS				
	RST ACTIVE FLTS *[F401]*	Clears the active faults listed in F1 submenu	Idle *[S179]* Enter to rst *[S180]*	N	N
	CLR FLT HIST *[F402]*	Clears the Fault History listed in the F2 submenu and the Sorted History listed in the F3 submenu	Idle *[S179]* Enter to clr *[S182]*	N	N

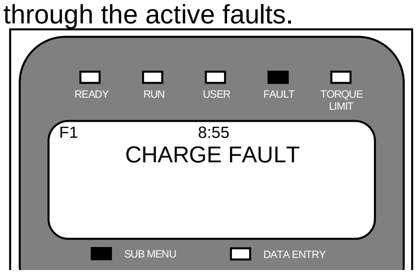
Detailed Descriptions

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)

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.

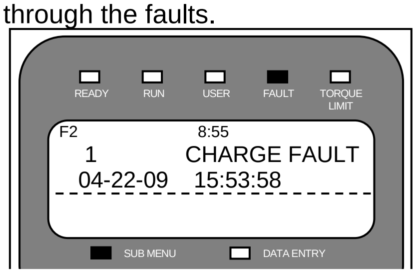


FAULT HISTORY
(Fault History)

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

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.



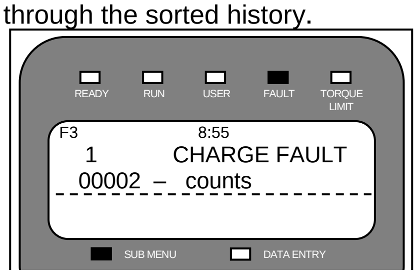
SORTED HISTORY
(Sorted History)

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.

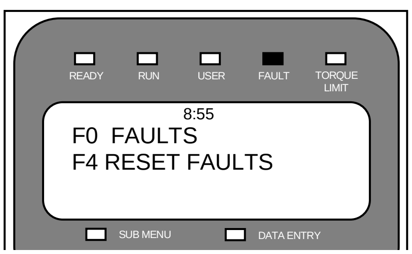


RESET FAULTS
(Reset Faults)

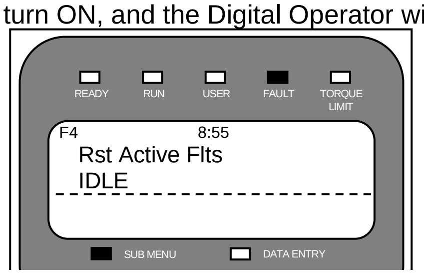
This sub-menu allows the user to reset both the active fault and the fault history.

Rst Active Flts

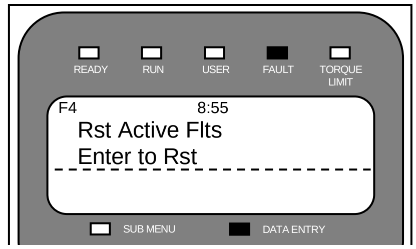
The active faults may be reset by the user function as described below.
While the digital operator display shows:



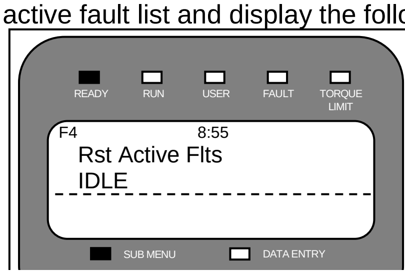
Press the enter key. The submenu LED will turn ON, and the Digital Operator will display:



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:

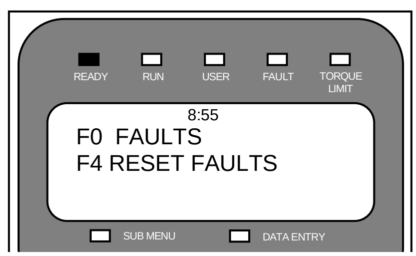


Note: if an active fault still exists on the drive, the FAULT LED will continue to be lit. Clear the condition causing the fault and attempt to reset the faults again.

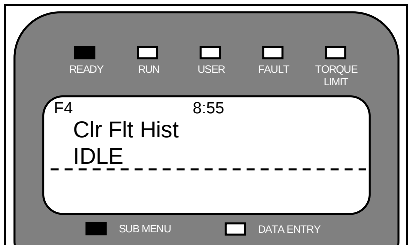
Clr Flt Hist

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

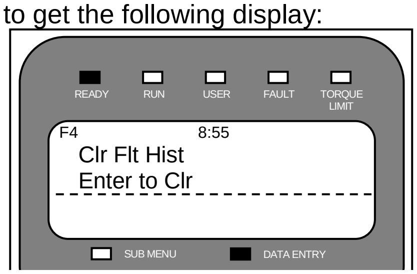
While the digital operator display shows:



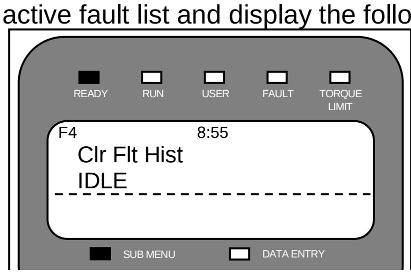
Press the enter key. The submenu LED will turn ON, using the down arrow key, scroll until the following displays on Digital Operator:



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

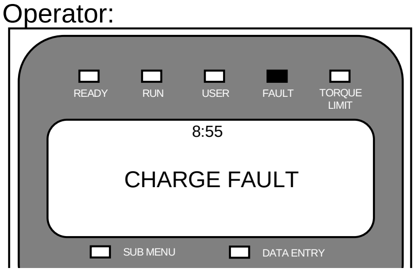
The HPV 900 Series 2 reports two classes of warnings; these are identified as Faults and Alarms.

Faults and Fault Annunciation

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

There are four means of fault annunciation.

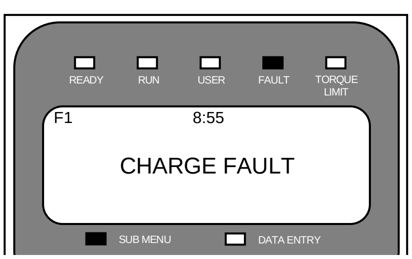
A priority message will be seen on the Digital Operator:



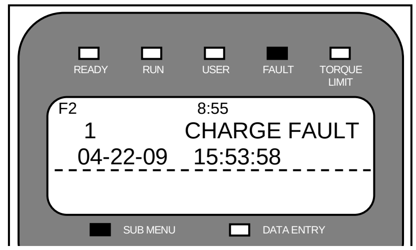
A priority message will overwrite whatever is currently displayed. The user can clear this message by pressing any key on the Digital Operator keypad. If another fault is present, the next fault will appear as a priority message.

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

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



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:

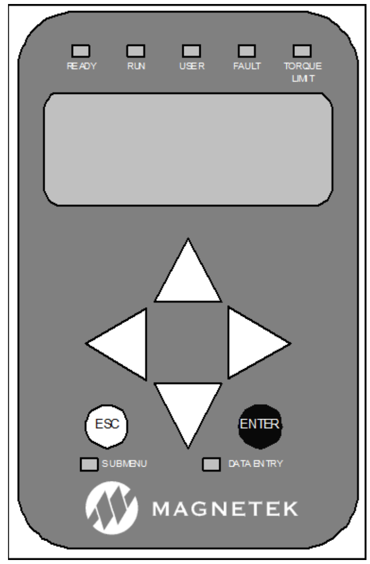
- an external logic input
- the serial channel
- automatically by the drive

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 23: 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)* *[F86]*	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 *[F65]*	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)* *[F84]*	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)* *[F82]*	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 *[F50]*	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 *[F00]*	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 *[F64]*	The drive saw movement during either the Rotor Align (U10) or the Auto-Tune (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 *[F01]*	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.
CF00 OP Comm. Err1	Declared when the operator fails to communicate with the control board.	**Check Power Supplies** ⇩ Check 5v power supply at T9 to T12 on the control board on page 164. ⇩ Check/replace RJ12 connector between drive operator and drive control board ⇩ Replace drive operator ⇩ Replace drive control board ⇩ Replace drive unit
Charge Fault *[F54]*	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 *[F03]*	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 *[F05]*	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 *[F06]*	Actual current does not match the command current. The drive is commanding more motor voltage then is available on the input.	**Current Regulation problem** ⇩ Verify that SW1 (Safe-Off) position is set to I9 (right) position if not using Safe-Off. Refer to SAFE-OFF on page 159. ⇩ Verify that if SW1 (Safe-Off) is set to BE (left) position to enable the SAFE-OFF, logic input 9 should be triggered on when drive is told to RUN. Refer to SAFE-OFF on page 159. ⇩ Check for a low input line ⇩ Check if 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) ⇩ Complete Adaptive Tune and Inertia procedure, *see pages 152-155.* ⇩ 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 152-155.* • As a last step, calculate motor parameters from motor's equivalent circuit. ⇩ Otherwise, replace the drive

Name	Description	Possible Causes & Corrective Action
DB VOLTAGE *(fault)* *[F53]* or **DB VOLTAGE** *(alarm)* *[F83]*	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 *[F07]*	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)* *[F77]*	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 80.*	**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 *[F08]*	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 23 on page 130), 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 152-155.* ⇩ As a last step, calculate motor parameters from motor's equivalent circuit, *see Motor Parameter Calculations.* **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)* *[F75]*	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 *(Fault)* *[F60]* **Encdr Crc Warn** *(Alarm)* *[F87]*	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 73 and 74 for +5V on TB2 of EnDat Option board. 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)* *[F85]*	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 *[F09]*	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 TB1 pins 17 and 18 **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. ⇩ Replace drive TerMag board. ⇩ Replace drive EnDat board.
EncoderFault OFF *(alarm)* *[F78]*	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 *[F11]*	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 *[F12]*	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 *[F13]*	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 *[F14]*	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 /FLT 4 (C2) ⇩ Check external fault is on the correct terminal on TB1.
Fuse Fault *[F15]*	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 *[F51]*	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)* *[F79]*	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
MAX FLT RETRIES *(alarm)* *[F89]*	The drive has reached the maximum allowable automatic drive resets.	**Check Parameter Setting** ⇩ Check that Fault Reset SRC (C1) is set correctly ⇩ Check that the Flt Reset / Hour (A1) and Flt Reset Delay (A1) are set correctly. Increase the amount of allowable Flt Resets / Hour (A1) . **Shut Down Problem** ⇩ Resolve the issue(s) that is /are causing the drive to fault. ⇩ Look in the FAULT HISTORY (F2) to figure out which faults are causing the drive to trip on a fault
MOTOR PHASE FAULT *(PM)* *[F61]*	Speed feedback is backwards during an Open-Loop Alignment	**Phasing Problem** ⇩ If the motor was running smoothly immediately before the drive declared an **MOTOR PHASE FAULT**, 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.* **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 OL Align Scale (A5) to overcome excessive static friction that may exist in the elevator. **Rotor is rotating rough or jerky during Open Loop Alignment** ⇩ Increase the value for OL ALIGN SCALE (A5) until the motor rotates smoothly **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
Motor Ovrload *Fault* *[F48]* *or* **Motor Ovrload** *Alarm* *[F74]*	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 152-155).* ⇩ 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 *[F57]*	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

Name	Description	Possible Causes & Corrective Action
Mtr Data Flt *[F19]*	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)
NTSD LI SETUP *[F71]*	This fault is declared if the selected NTSD Mode (C1) does not match with the correct setting of the Logic Inputs (C2) NTSD Input 1 and NTSD Input 2 • NTSD Input 1 has to be set in Logic Inputs (C2) if NTSD Mode (C1) is 1 Threshold, 2 Thresholds, or 3 Thresholds • NTSD Input 2 has to be set in Logic Inputs (C2) if NTSD Mode (C1) is 2 Thresholds or 3 Thresholds	**Check Parameter Settings:** ⇩ Check that the correct NTSD Mode (C1) is selected ⇩ Check that the correct NTSD Input(s) in Logic Inputs (C1) is set
NTSD SPEED SETUP *[F70]*	This fault is declared if the NTSD Threshold(s) parameters does not satisfy: Contract car speed (A1) ≥ NTSD Threshold 3 > NTSD Threshold 2 > NTSD Threshold 1	**Check Parameter Settings:** ⇩ Check that Contract Car Speed (A1) is greater than or equal to all the NTSD Thresholds ⇩ Check that NTSD Threshold 3 is greater than NTSD Threshold 1 and 2 ⇩ Check that NTSD Threshold 2 is greater than NTSD Threshold 1

Name	Description	Possible Causes & Corrective Action
Overcurr Flt *[F20]*	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 152-155.* ⇩ As a last step, calculate motor parameters from motor's equivalent circuit, *see Motor Parameter Calculations.* **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 *[F40]*	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.
Overtemp Flt *[F41]*	The heatsink on the drive has exceeded 95°C (203°F).	**Excessive Heat** ⇩ Reduce Ambient Temperature ⇩ Clean heat sink ⇩ Check for cooling fan failure

Name	Description	Possible Causes & Corrective Action
Overvolt Flt *[F42]*	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 *[F49]*	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. **Check Parameter Settings** ⇩ Decrease the sensitivity of the Phase Loss Check (C1)
RTR NOT ALIGN *(PM)* *[F59]*	Run command given before a valid rotor alignment number was calculated *(Clears automatically)*	**Initial Setup Not Performed** ⇩ Perform rotor alignment **Alignment Failed** ⇩ Repeat the alignment. If any fault gets posted during the alignment, the setup offset will be set out of the range causing this alignment to fault.
Safe-Off Setup *[F69]*	Safe-Off has been incorrectly set up. Fault will be declared if Logic Input 9 is configured to “Safe-Off”, and control card switch is set to I9 **OR** If the EN81 switch SW1 is set to BE and Logic Input 9 (C2) is NOT set to safe off and THEN the RUN is issued.	**Switch Set Incorrectly** ⇩ Make sure that the SW1 switch on the main control card is set to BE for use with “Safe-Off” ⇩ Make sure that the SW1 switch on the main control board is set to I9 if “Safe-off” isn’t used **Parameter Mismatch** ⇩ Ensure that Logic Input 9 (C2) is set to “Safe-Off”, if safe-off feature is used. ⇩ Ensure that Logic Input 9 (C2) is NOT set to “Safe-Off”, if safe-off feature isn’t used (SW1 is in the right or I9 position) **Incorrect Input Signal** ⇩ Observe the state of Logic Input 9 in the D1 menu – Logic Inputs and verify timing of input

Name	**Description**	**Possible Causes & Corrective Action**
Safe-Off Open *[F66]*	The drive has received a run command, but the "Safe-Off" input is open. • If the "Safe-Off" input is open and the drive is in the ready state, but has a run command active, then "Safe-Off Open" will be declared after 1 second (But the IGBTs will be disabled immediately) • If the "Safe-Off" input becomes open whilst the drive is in a run condition, "Safe-Off Open" will be declared after 50ms (But the IGBTs will be disabled immediately).	**Incorrect Input Signal** ⇩ Observe the state of Logic Input 9 in the D1 menu – Logic Inputs and verify timing of Input 9 **Sudden Stop** ⇩ In the event of a sudden stop, the feed to Logic Input 9 should be dropped, and "Safe-Off Open" will be declared. **Miswiring** ⇩ Ensure Logic Input 9 is being used for the Safe Off input. Logic Input 9 is unique as it is the ONLY Input which can be used for Safe Off.
Ser2 Spd Flt *[F58]*	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 *[F21]*	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
Setup Fault 2 *[F22]*	This fault is declared if the number of poles and encoder pulses per revolution do not satisfy: Incremental Encoder $\dfrac{\begin{pmatrix} encoder \\ pulses \end{pmatrix}}{\begin{pmatrix} \# \\ poles \end{pmatrix}} > 64$ Absolute Encoder with new EnDat board $\dfrac{\left(\begin{pmatrix} Encoder \\ Pulses \end{pmatrix} * \begin{pmatrix} EnDat \\ Interp \end{pmatrix}\right)}{\begin{pmatrix} \# \\ poles \end{pmatrix}} > 64$	**Check Parameters Settings:** ⇩ Check ENCODER PULSES (A1) parameter for correct setting ⇩ Check MOTOR POLES (A5) parameter for correct setting
Setup Fault 3 *[F23]*	This fault is declared if the number of poles is not an even number.	**Check Parameters Settings:** ⇩ Check MOTOR POLES (A5) parameter for correct setting

Name	Description	Possible Causes & Corrective Action
Setup Fault 4 *[F24]*	This fault is declared if the contract motor speed (in rpm) and encoder pulses/revolution do not satisfy: $300{,}000 < \begin{pmatrix} contract \\ motor \\ speed \end{pmatrix} \begin{pmatrix} encoder \\ pulses \end{pmatrix} < 18{,}000{,}000$	**Check Parameters Settings:** ⇩ Check ENCODER PULSES (A1) parameter for correct setting ⇩ Check CONTRACT MTR SPD (A1) parameter for correct setting ⇩ Check ENCODER SELECT (C1) parameter for correct setting in PM mode
Setup Fault 5 *[F25]*	This fault is declared if the rated motor power (in watts) and rated motor voltage do not satisfy: $(0.07184)\left[\frac{\begin{pmatrix} rated \\ motor \\ power(W) \end{pmatrix}}{\begin{pmatrix} rated \\ motor \\ voltage \end{pmatrix}}\right] < \begin{matrix} general \\ purpose \\ current \\ rating \\ of \\ drive \end{matrix}$	**Check Parameters Settings:** ⇩ Check RATED MOTOR PWR (A5) parameter for correct setting ⇩ Check RATED MTR VOLTS (A5) parameter for correct setting
Setup Fault 6 *[F26]*	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 *[F27]*	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 *[F28]*	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 *[F29]*	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 *[F30]*	This fault is declared when a run is issued and the Input L-L Volts (A4) 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 *[F31]*	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 *[F32]*	This fault is declared when one or more parameter values are set outside the acceptable limit when • the U9 Drive Mode is changed from one to another • or the parameters were being loaded from EE to RAM.	**Check Parameters Settings:** ⇩ Verify the setting of ALL parameters ⇩ Default the drive parameters to factory defaults in U5 Restore Defaults ○ reload all the parameters ○ go through all the parameters and set them manually to the correct values
Short Circuit *[F52]*	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)* *[F63]* *&* **Spd Dev Alm** *[F76]*	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.

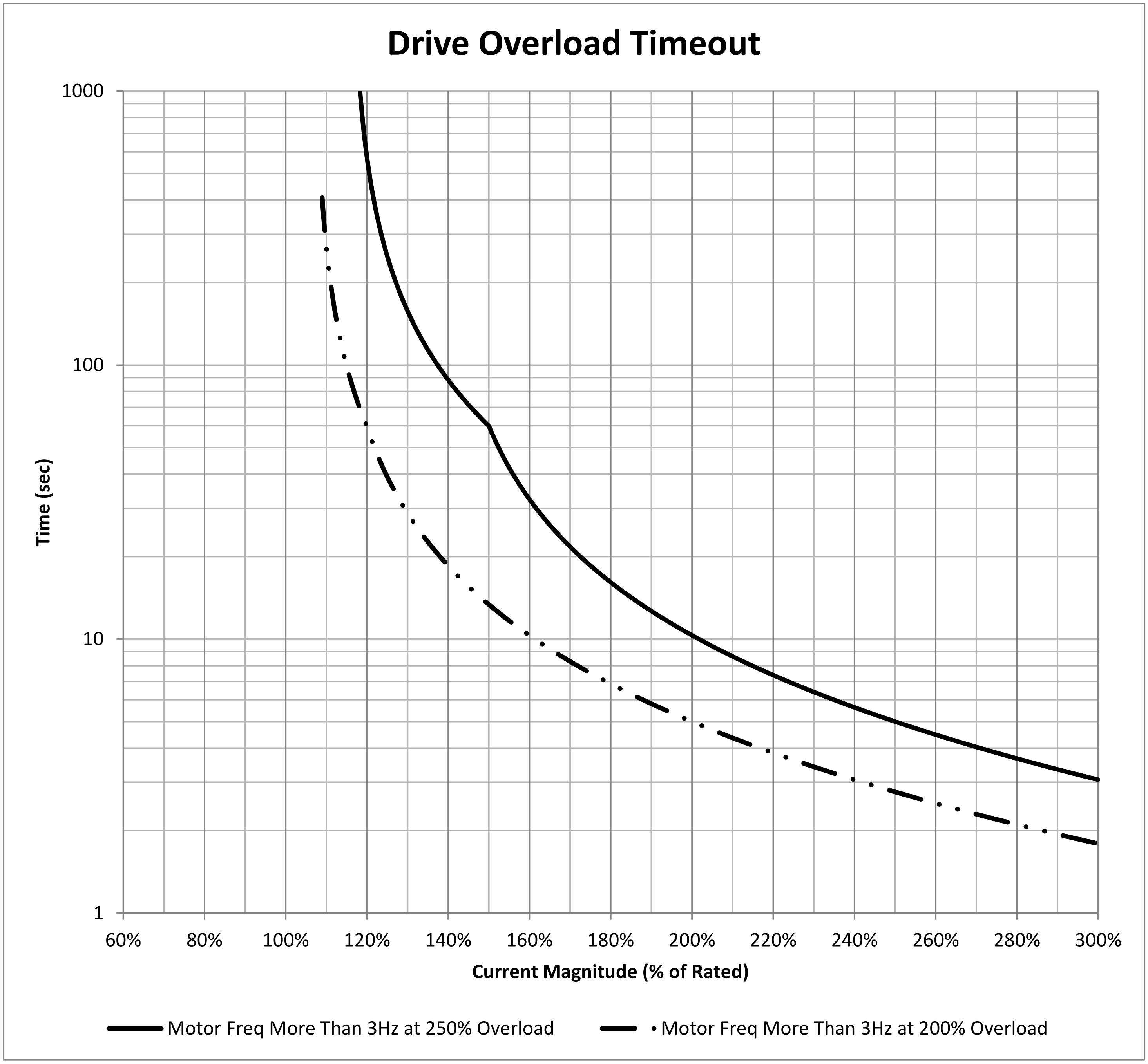
Name	Description	Possible Causes & Corrective Action
Srl Timeout *(Fault)* *[F45]* **Srl Timeout** *(Alarm)* *[F81]*	The drive is being operated by serial communications and one of the following has occurred: • Communication time-out – if the serial run bit is set and the drive does not receive a run-time message for 40 msec • Bad message checksum – drive has detected fifteen 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)* *[F56]*	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
Tach Loss Flt *[F68]*	See ENCODER FLT	See ENCODER FLT
Tq Lim 2Hi 4cube *[F46]*	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 *[F47]*	This fault is generated during a run condition if the DC bus voltage falls below the level that is specified by UV Fault Level (A4). Fault is declared when: $DC\ \ bus\ \ volt\ \langle\ UV\ \ Fault\ \ Level(A4)*$ $\sqrt{2} * Input\ \ L-L\ \ Volts(A4)$	**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)* *[F73]*	This alarm is generated during a run condition if the DC bus voltage falls below the level that is specified by UV Alarm Level (A4). Alarm is declared when: $DC\ \ bus\ \ volt\ \langle\ UV\ \ Alarm\ \ Level(A4)*$ $\sqrt{2} * Input\ \ L-L\ \ Volts(A4)$	**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)* *[F55]*	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

Name	Description	Possible Causes & Corrective Action
Z MARKER LOST *[F62]*	This fault is declared when the drive expects to see a signal from the Z channel of the encoder within a window but it doesn't during an Open-Loop Alignment.	**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

Appendix
Drive Overload Curve

When the drive is running an output frequency of less than or equal to 3 Hertz, the drive will use an adjusted overload curve. See the graph below for current vs. time.



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)

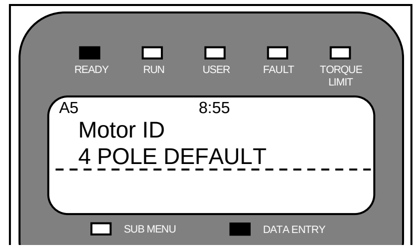
The adaptive tune will estimate:

- 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.

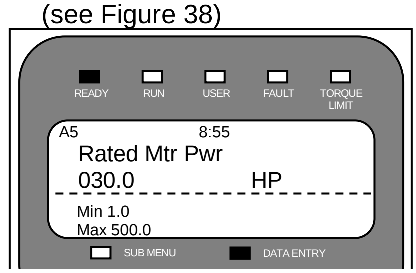
Initial Set-up

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



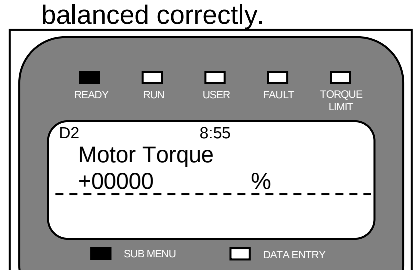
The default motor selections for the motor id will place a zero values in the motor nameplate parameters (see Figure 38). This selection will also load nominal values for the other motor parameters listed in Table 24

- Now, enter the motor nameplate data into the needed motor nameplate parameters (see Figure 38)



Tuning Motor No-Load Current
With a balanced car, run the car at 70% contract speed from top floor to the bottom floor then back to the top floor.

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



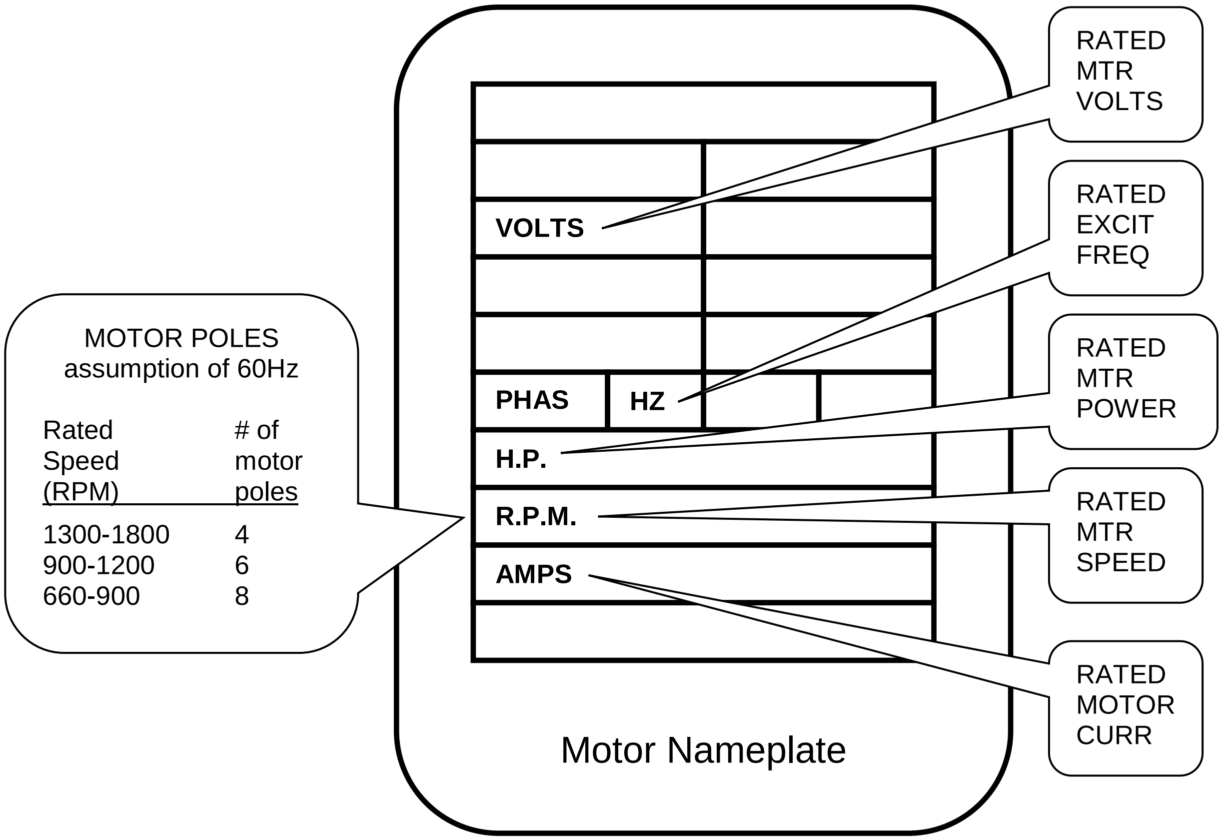


Figure 38: Motor Parameters Entered from Motor Nameplate

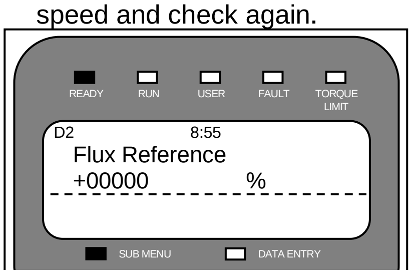
description	*Parameter*	*4 pole dflt*	*6 pole dflt*
percentage no load current	% NO LOAD CURR	35.0 %	45.0 %
stator leakage reactance	STATOR LEAKAGE X	9.0 %	7.5 %
rotor leakage reactance	ROTOR LEAKAGE X	9.0 %	7.5 %
stator resistance	STATOR RESIST	1.5 %	1.5 %
motor loss - motor iron loss	MOTOR IRON LOSS	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 24: Nominal Values for Motor Parameters

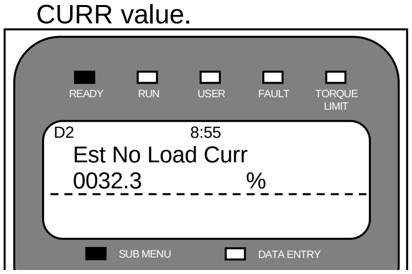
NOTE: If you are having problems getting the motor torque under 15% the cause may be:

- <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, you should look only at the estimated values in the up direction and run the car in the up direction a number of times before changing any parameter settings.

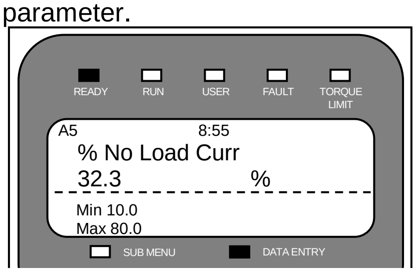
- Also, verify that the FLUX REFERENCE is 100%. If the value is not equal to 100% reduce the speed to less than 70% contract speed and check again.



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



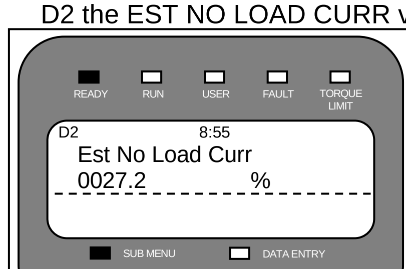
Enter this estimated value into the motor parameter.



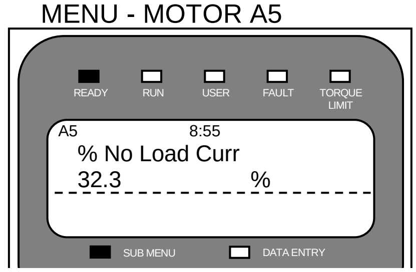
- Continue iterating the above two steps until the two values are within 2%. If the values do not converge after two iterations, verify the information entered in the initial set-up is correct.
- After the values converge, again verify the MOTOR TORQUE < 15% and the FLUX REFERENCE = 100%.

Tuning Motor's Flux Saturation Curve
With a <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.

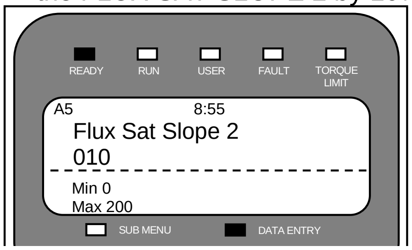


- Compare the displayed value EST NO LOAD CURR with the value entered for % NO LOAD CURR under the ADJUST MENU - MOTOR A5



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.

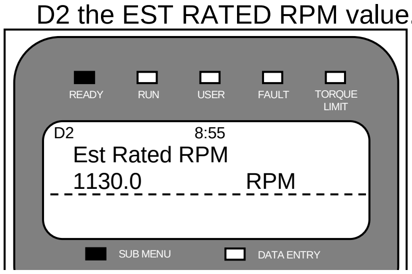
- Continue iterating FLUX SAT SLOPE 2 in 10% increments until the EST NO LOAD CURR and % NO LOAD CURR are within 2% of each other.

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

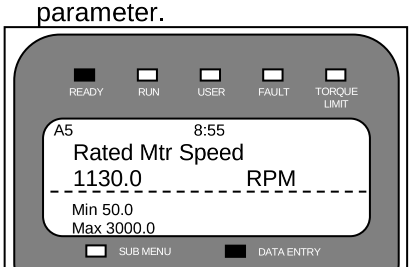
Tuning Rated Motor RPM

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 two steps until the two values are within 3 RPM.

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

Estimating System Inertia

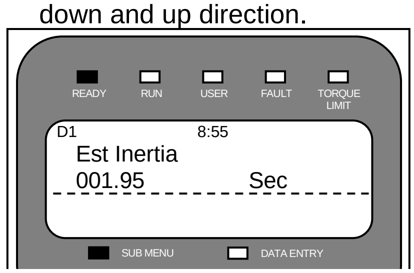
The HPV 900 Series 2 software can be used to calculate the inertia of the entire elevator, which is used for accurate tuning of the speed regulator.

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

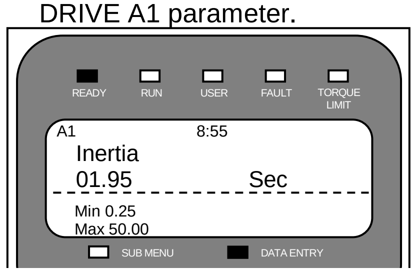
Using the Software to Estimate the System's Inertia

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

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

$$\left(\frac{\begin{pmatrix}\text{Contract} \\ \text{Car Spd}\end{pmatrix}}{\begin{pmatrix}\text{Actual} \\ \text{Travel Spd}\end{pmatrix}}\right) \times \begin{pmatrix}\text{Contract} \\ \text{Motor Spd}\end{pmatrix} = \begin{pmatrix}\text{New Contract} \\ \text{Motor Spd}\end{pmatrix}$$

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:

It is then recommended to repeat the process 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

NTSD
Normal Terminal Stopping Device
Functional Overview:
The drive can be configured to perform a pre-programmed NTSD slowdown by several different methods as outlined below.

EXTERNAL: The car controller or other elevator controls provide all NTSD detection functions and modify the speed command profile to the drive as necessary to perform an NTS slowdown… OR a logic input is sent to the drive from external car controller equipment to tell the drive to disregard other high speed commands and quickly decelerate to a pre-programmed low speed.

INTERNAL: The drive itself monitors 1 or 2 hoistway position logic signals that represent up to 3 separate physical checkpoint locations in the hoistway. When one of these hoistway position logic signals changes state, this implies that the car has crossed one of the physical checkpoint locations. The drive then verifies that the traveling speed at this particular checkpoint (based on the NTSD mode and the state of the hoistway position logic signal(s)) is less than or equal to the pre-programmed NTSD Threshold speed(s) as it approaches terminal landings. The drive will limit the car speed to ensure that it remains at or below the pre-programmed NTSD Target Speed [Position "1" is always the location closest to the landing.] Note that the car controller has exclusive control of the NTSD operation when NTSD MODE is set to External.

In either of the above conditions, the drive may continue to follow an externally supplied speed command if it is less than the NTSD TARGET SPEED as it continues to approach the landing and will stop when commanded to do so. A programmable output may be selected to indicate when an NTS slowdown mode is active. If serial communications are used, bit 7 of byte 4 will also indicate that an NTS slowdown is in progress. All of the settings for the NTSD operating mode, deceleration rate, slow down target speed and NTSD speed thresholds are adjustable. To aid internal NTSD set up, captured speed read-outs are provided to indicate the traveling speed as the car passes the hoist way position markers and changes the status of logic inputs to the drive. When NTSD logic input signal conditions indicate that the car is no longer close to the landing, the drive will return to the original S-Curve control settings and again follow any commanded speed. NTSD adjustments may be used in English or Metric units as programmed in Menu U3.

Set up and adjustment functions for the NTSD features are:
Menu C1 – NTSD MODE: External, 1 threshold, 2 thresholds or 3 thresholds to identify the NTSD operating mode, if any.
Menu C2 – NTSD Input 1 and NTSD Input 2 logic selection identification and location if used.
Menu C3 – NTSD is active output logic selection identification if used.
Menu A1 – NTSD Target Speed, NTSD Threshold 1, NTSD Threshold 2, NTSD Threshold 3 when used.
Menu A2 – S-Curve Set 4, the pre-set NTS slow down profile
Menu D1 – Captured speed feedbacks at NTSD positions 1, 2, and 3, when programmed to be used by the NTSD Mode selected in C1.

Mode C1: External

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

Mode C1: 1 Threshold

NTSD Input 1	NTSD Input 2	Result
1	Not Used	Normal Operation
0		If speed feedback is greater than NTSD Threshold 1, decel using S-Curve 4, and clamp the speed command to be no greater than NTSD Target Speed..

Mode C1: 2 Thresholds

NTSD Input 1	**NTSD Input 2**	**Result**
1	1	Normal Operation
1	0	If speed feedback is greater than NTSD Threshold 2, decel using S-Curve 4 and clamp the speed command to be no greater than NTSD Target Speed.
0	0	If speed feedback is greater than NTSD Threshold 1, decel using S-Curve 4 and clamp the speed command to be no greater than NTSD Target Speed.
0	1	If speed feedback is greater than NTSD Threshold 1, decel using S-Curve 4 and clamp the speed command to be no greater than NTSD Target Speed.

Mode C1: 3 Thresholds

NTSD Input 1	**NTSD Input 2**	**Result**
1	1	Normal Operation
0	1	If speed feedback is greater than NTSD Threshold 3, decel using S-Curve 4 and clamp the speed command to be no greater than NTSD Target Speed.
1	0	If speed feedback is greater than NTSD Threshold 2, decel using S-Curve 4 and clamp the speed command to be no greater than NTSD Target Speed.
0	0	If speed feedback is greater than NTSD Threshold 1, decel using S-Curve 4 and clamp the speed command to be no greater than NTSD Target Speed.

Appendix

SAFE-OFF

Safe-Off Functional Overview

To summarize the feature, the Safe-Off function is yet another way to positively disable the drive so it cannot cause a motor runaway. It uses a switch to change terminal TB1-26 from "Logic input 9" to a base enable (BE) function.

1. The Safe-Off input to the drive uses only hardware to positively turn IGBT gating off. This will only occur when the switch on the control card is set to the BE position.

2. The DRIVE monitors the status of the signal and the menu selection of what the user has established for Logic input 9.

3. If the status of this input does not match the setting for Logic input 9, a "Safe Off Setup Fault" will be declared

4. If the C2 menu selection claims that logic input should be used as Safe-Off, but the logic input status is not what the drive is expecting, then there will be a "Safe Off Setup Fault", a "Current Regulator Fault" may occur on running, or the drive may not run at all

5. If the Safe-Off function is set up correctly and the drive receives other enabling/command logic to start but the Safe-Off signal is not yet in the 'safe to-run' state, the drive will not start.
It will not get to a state where regulators are released unless the Safe-Off input becomes high to match enabling/command signals within 1 second. If the signals do not match after this time, the drive will declare a Safe-Off Fault (As diagnostic information and to avoid remaining indefinitely poised to run) or a Current Regulator Fault. The drive will not be allowed to become engaged with IGBTs disabled. This prevents speed or current integrators from starting that may cause significant 'bumps' when/if IGBT gating should become enabled. During this time Regulator Release will not be indicated, because the drive has not yet started.

6. EN81-1 does not indicate any requirement in timing for the drive to become disabled if safe-off becomes disabled. Since it is an enable/disable function in hardware, it is relatively fast (micro-seconds). However:
   - If the drive is not running and receives a Drive Enable and Run command, but NO Input on logic input 9, it will not begin to fire IGBTs to apply torque to the motor and a fault will be declared after 1s
   - If the drive already has a Drive Enable and Run command present, and Logic Input 9 is opened whilst torque is already being applied to the motor, IGBTs will immediately cease firing and a fault will be declared after 50ms

   In any instance, the drive will disable the IGBTs as soon as Logic Input 9 becomes open.

7. The standard requires that the safe-off function be cycled and verified to be working at least before every reversal of elevator direction. So it is the car controller circuitry, not the drive, which performs the function to interrupt the safe-off circuitry and therefore the car controller which must also verify that the drive has indeed removed gating power when commanded to do so. One of the drive's programmable logic outputs can be used to indicate that the drive recognizes the status of the internal safe-off circuitry in order for the car controller to verify functionality according to the standards requirements.

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

Enabling the safe off feature

The safe off feature is enabled by setting the switch in the center of the control card from I9 (Input 9) to BE (Base Enable) as per figure 1. This allows the IGBTs to be enabled when logic input 9 is closed (Logic high), and disabled when logic input 9 is open (Logic low).

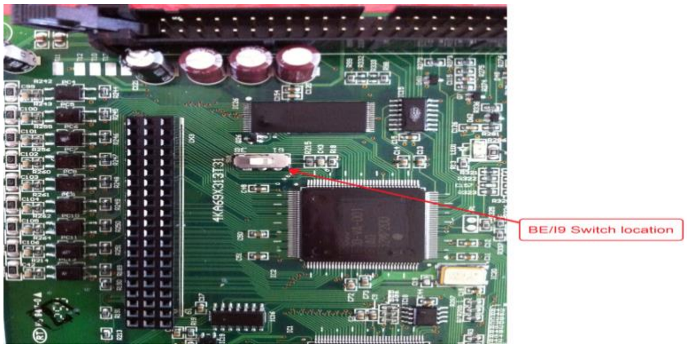


Figure 1. *Switch set to BE on the left (Safe off on) or I9 on the right (Safe off disabled)*

Switch

With the switch set to the left at the "BE" position, the drive will only be able to fire the IGBTs when an input on logic input 9 is high. The car controller will need to supply this feed in the same way that they would usually supply the signal for the contactors to close, the drive will require the usual 24V feed as in the case of the rest of the logic inputs. This input must be fed from a pilot relay switched by the controller.

Input

Regardless of the setting of logic input 9 in the C2 menu of the drive, the IGBTs will not fire unless this feed is present on terminal TB1-26 (Logic Input 9). Although the "Safe Off" function is a purely hardware feature, the drive's software will still monitor the status of logic input 9, and has been designed to give intuitive feedback based on the state of this input. With that in mind, for correct operation the logic input 9 in C2 should be set to "SAFE-OFF". The drive can then give diagnostic information if and when the IGBTs are shut off (in the event of a crash stop for example), much in the same way that it would declare a contactor fault if contactor monitoring were enabled.

Output

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

Parameter Settings

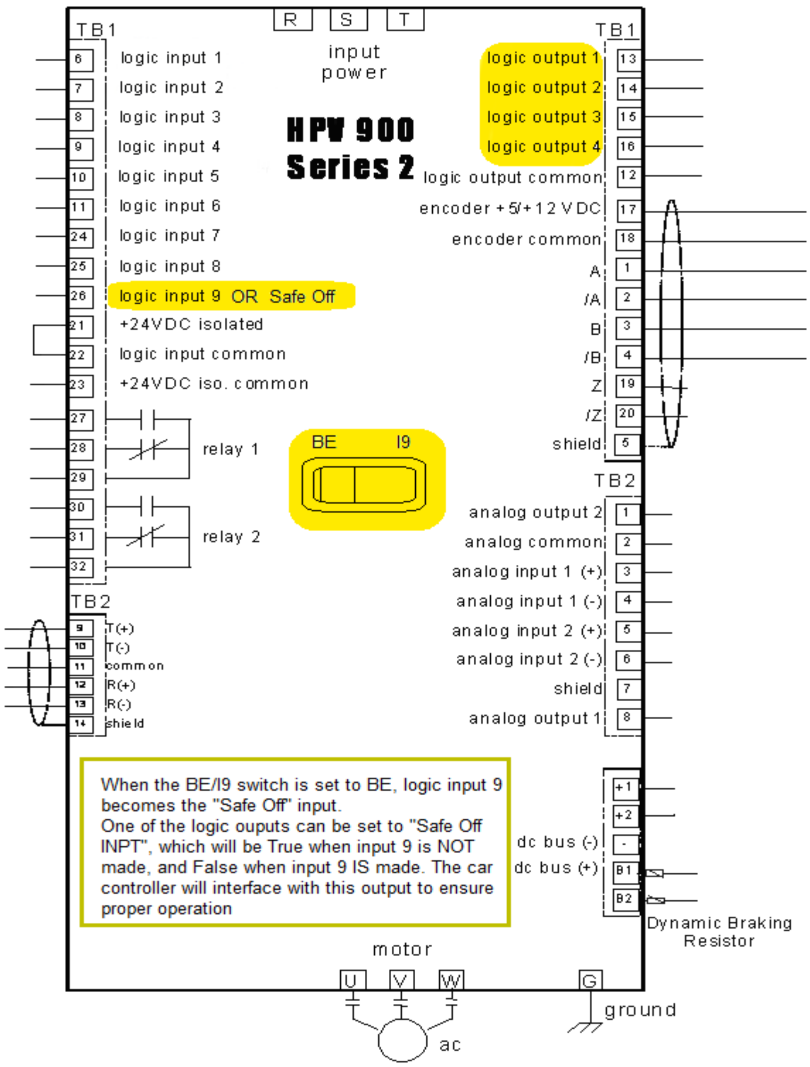
The parameters for the "Safe Off" function should be configured as follows:

Parameter Name	Setting	Function
Logic Input 9 (C2)	SAFE-OFF	Only Logic Input 9 can be used for the "Safe Off" input. This parameter monitors the status of the input and allows the drive to declare diagnostic information in the event of the input not matching the expected status during each drive state (Ready and Run).
Logic Output 4* (C3)	SAFE-OFF INPT	Provides feedback to the car controller of the status of the Safe Off Input, and therefore the status of the IGBTs

		(Enabled or Disabled). Used to determine if the drive has been correctly set for the “Safe Off” function, and provide similar feedback to that of a contactor auxiliary. Can be configured to any free output. This Output will be HIGH when the drive’s IGBTs are disabled by the Safe Off circuitry, and LOW when the drive’s IGBT are enabled by the Safe Off circuitry. The status of this output can be monitored in the D1 menu under Logic Outputs as a 1 or 0 as with any other output.

* Any free Logic Output can be used, however Logic INPUT 9 is the ONLY input which can be used as the “Safe Off” input.

Drive Connections



Appendix

Brake Monitoring

To summarize the feature, the Brake Monitoring feature in the drive is used to monitor up to two brake pick switches, and determine that their operation is as expected.

1. The drive can monitor up to two brake switches with logic inputs and a logic output can be configured to annunciate a Brake Pick Fault
2. In the event of a Brake Pick Fault, ‘Brake Pick Fault Enable’ will change from ‘Enable’ to ‘Active’ and the fault status will latch. The fault can only be reset by adjusting the Brake Pick Fault Enable parameter back to Enable. This is to ensure it can only be reset by a competent person. A power cycle will not reset this fault.
3. If a Brake Pick Fault occurs, and the user tries to disable the Brake Pick Fault Enable function, it will revert back to Active

Enabling the Brake Monitoring feature

This feature is enabled by setting ‘Brake Pick Fault Enable’ in the C1 menu of the drive to ‘Enable’. An output in the C3 menu (Logic output or Relay Output) should be configured to ‘Brake Pick Flt’ to be monitored by the controller. Inputs should be configured in the C2 menu for however many Brake Pick switches are available. Presently there are inputs for up to two brake pick switches. The switches should be normally open, and wired into inputs configured to ‘Mech Brake Pick 1’ and ‘Mech Brake Pick 2’.

Outputs
This guide will assume the brake lift is controlled by the drive with a logic output for ‘Brake Pick’ or ‘Autobrake’, however the timings will still apply if no output is configured to those parameters.
An output will be configured to ‘Brake Pick Flt’ for the controller to monitor the status of the Brake Pick Fault.
This feature will declare a ‘Brake Pick Flt’ output if the Brake Pick Inputs do not change as expected within ‘Brake Pick Time’ after a Brake Pick/Autobrake output.

Inputs
Up to two logic inputs can be configured to monitor normally closed brake switches. One input should be used for each switch.

Parameter Settings

The parameters for the Brake Monitoring function should be configured as follows:

Parameter Name	Setting	Function
Relay Coil 2* (C3)	Brake Pick Or Autobrake	This is the output configured to control the brake. Following the change in this output, the drive will expect a change in the ‘Mech Brake Pick’ Logic inputs.
Logic Output 4* (C3)	Brake Pick Flt	Provides feedback to the car controller of the status of the Brake Pick Fault. This fault persists through fault resets and power cycles, and can only be reset by a competent person using the C1 menu. The status of this output can be monitored in the D1 menu under Logic Outputs as a 1 or 0 as with any other output.
Logic Input 7 † (C2)	Mech Brk Pick 1	Input for a normally open brake switch. The drive monitors this input, and if it doesn’t switch as expected after a change in Brake Pick/Autobrake output, it will declare ‘Brake Pick Fault 1’

Logic Input 8 † (C2)	Mech Brk Pick 2	Input for a normally open brake switch. The drive monitors this input, and if it doesn't switch as expected after a change in Brake Pick/Autobrake output, it will declare 'Brake Pick Fault 2'
Brake Pick Flt Ena (C1)	ENABLE	This parameter should be set to enable. In the event of a Brake Pick Fault occurring, this parameter will change to ACTIVE. The only way to clear the fault is to set this parameter back to Enable and issuing a fault reset. If a Brake Pick Fault occurs, and this parameter has changed to ACTIVE, the only possible change is to ENABLE. If the user tries to select DISABLE, the setting will revert to ACTIVE.
Brake Pick Time (A1)	1 SEC	This parameter sets the window within which the brake pick inputs should switch following a change in Brake Pick Output

* Any free Logic Output or Relay Coil can be used.
† Any free Logic Input can be used

Appendix

Testpoints (Control Board)

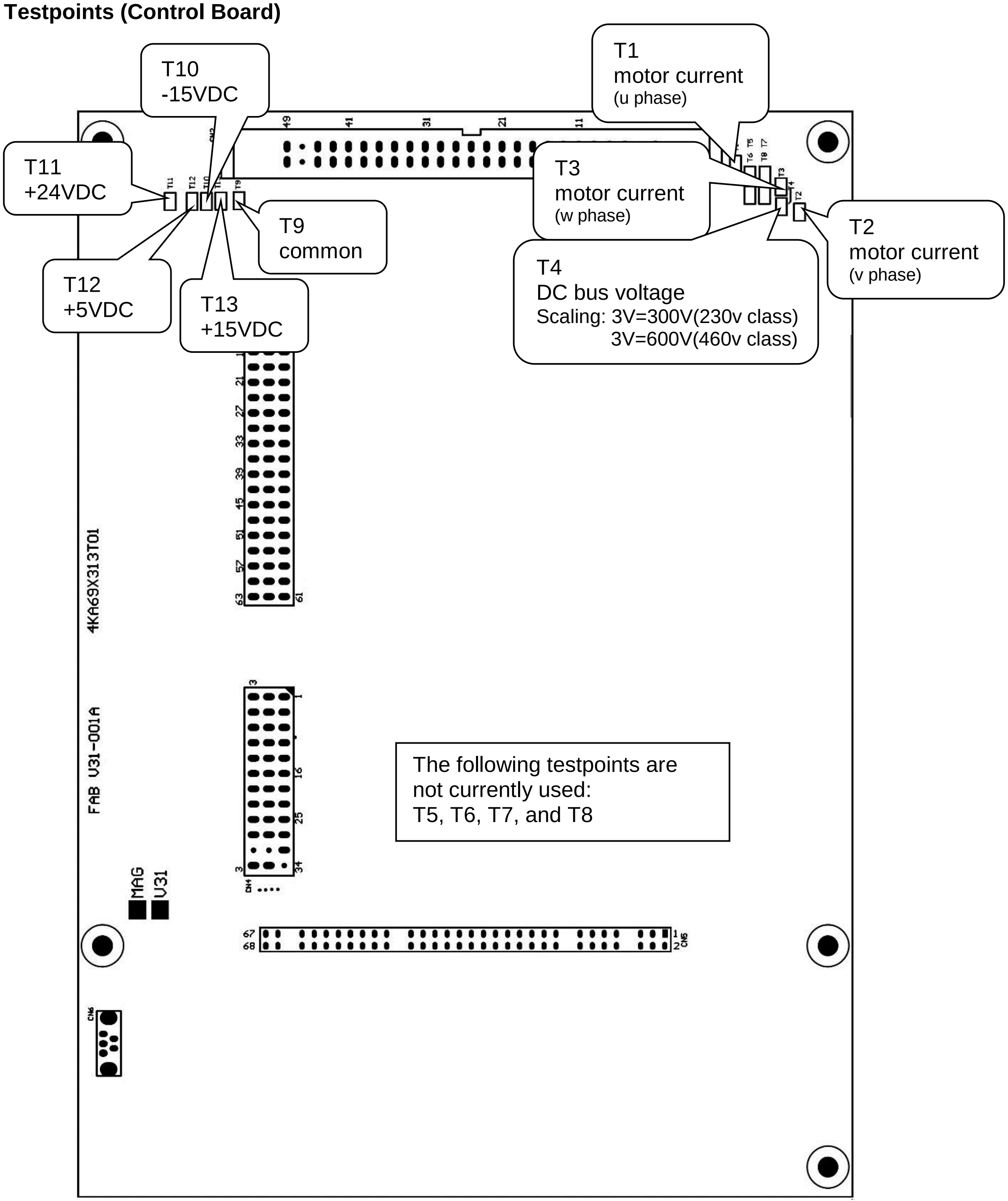


Figure 39: Main Board Testpoints

Appendix

Testpoints (EnDat Option Card part number 46S04327-1030 through 46S04327-1010 - Power Supplies)

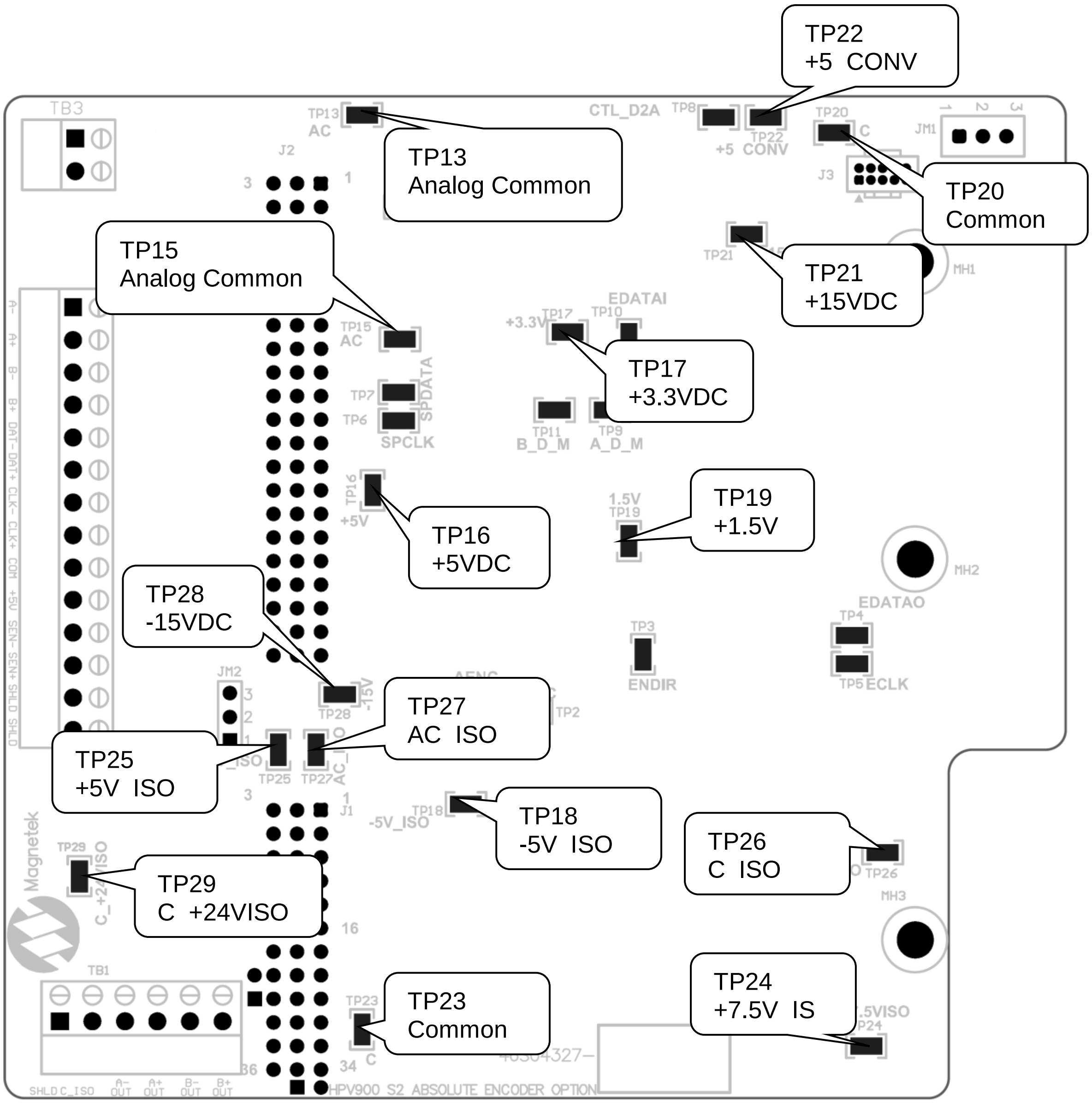


Figure 40: EnDat Option Card Part Number 46S04327-1030 Power Supply Testpoints

Appendix

Testpoints (EnDat Option Card part number 46S04327-1030 through 46S04327-1010 - Other)

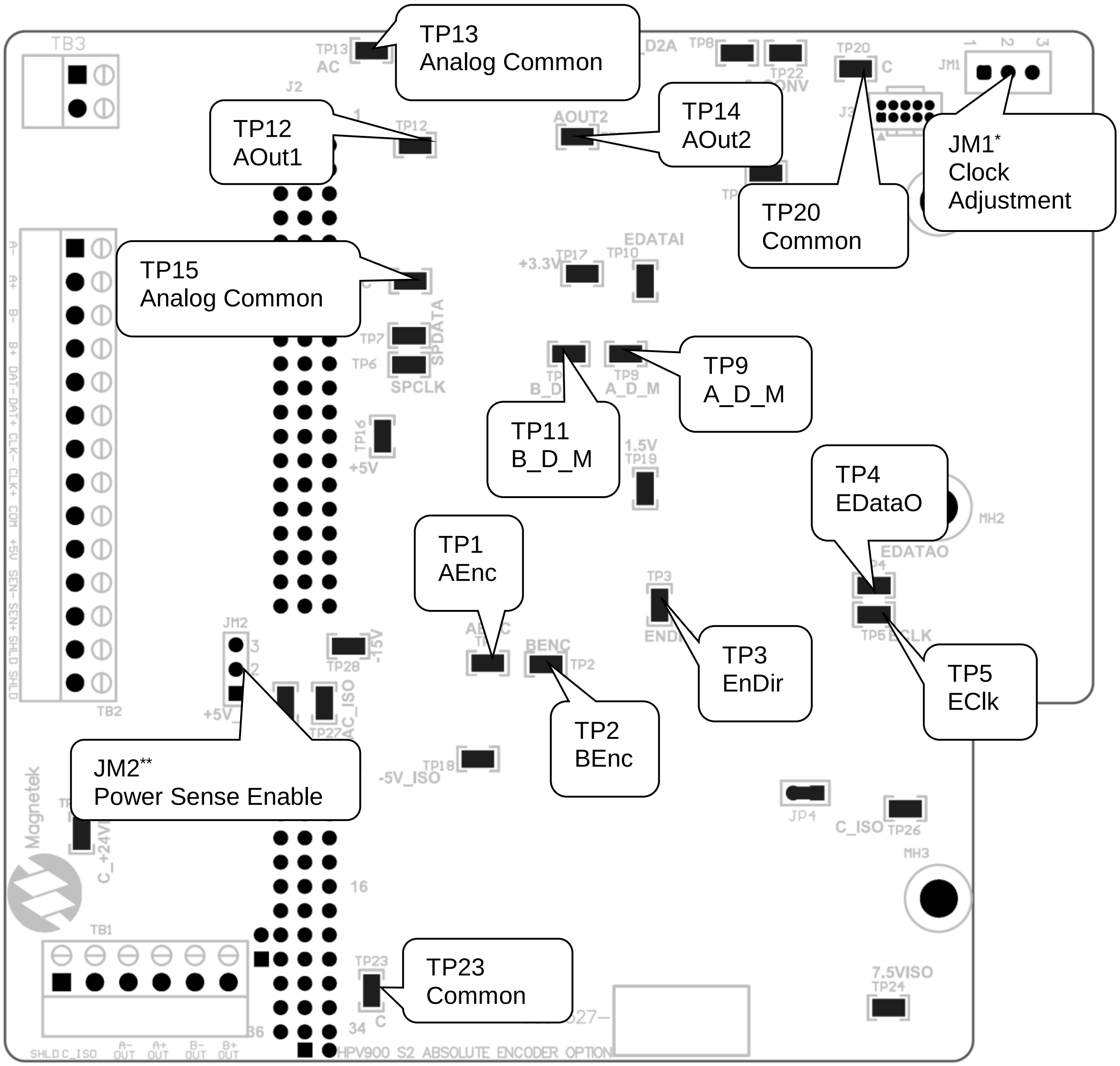


Figure 41: EnDat Option Card Other Testpoints

*For encoder cables longer than 15m/50ft, JM1 should be set to position 2-3 to slow down the serial clock. For shorter cable lengths, JM1 should stay in position 1-2.

** For encoder cables longer than 15m/50ft, it is recommended to connect the –SENSE and +SENSE lines into the terminal block and JM2 set to position 2-3. 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. The maximum cable length is 100m (328ft).

Appendix

Testpoints (EnDat Option Card part number 46S04327-1100 - Power Supplies)

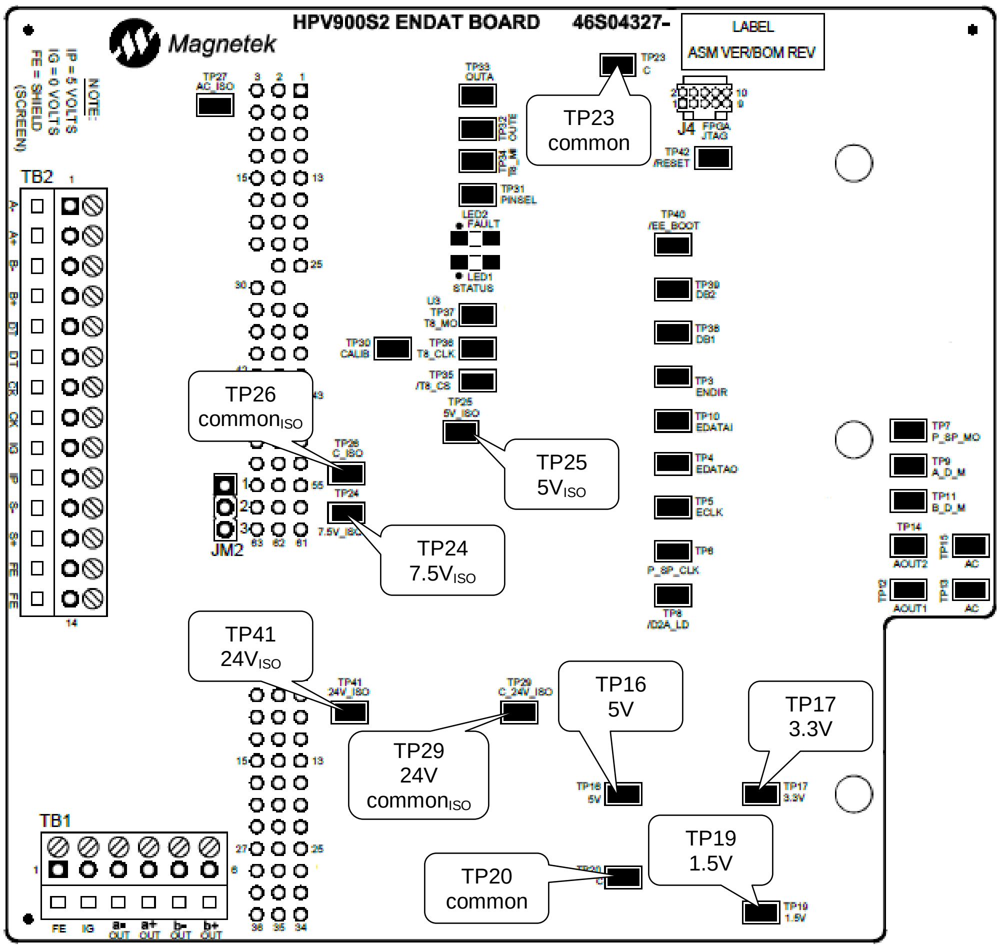


Figure 42: EnDat Optional Card Part Number 46S04327-1100 Power Supply Testponts

Appendix

Testpoints (EnDat Option Card part number 46S04327-1100 - Other)

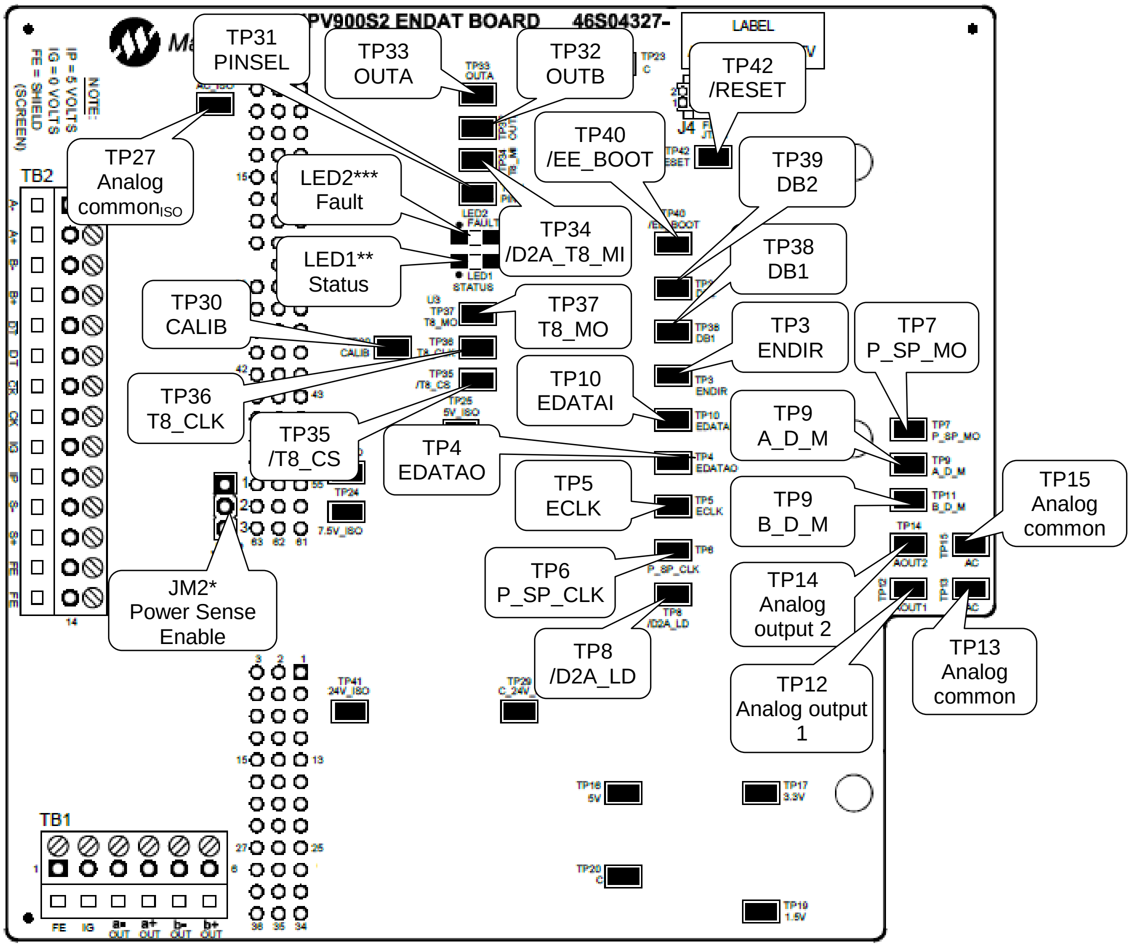


Figure 43 EnDat Optional Card Part Number 46S04327-1100 Other Testpoints

* For encoder cables longer than 15m (50ft), it is recommended to connect the –SENSE and +SENSE lines into the S- and S+ terminal on TB2 and setting JM2 to position 2-3. If JM2 is set to position 2-3, the drive will automatatically boost the encoder power supply to account for voltage drop. If JM2 is set to position 1-2, the remote power sense is disabled and the sense wires do not need to be connected. The maximum cable length is 100m (328ft).

**The status LED will luminate green when the board is powered up

***The fault LED will luminate red when the EnDat board has a problem: EnDat board cannot communicate with the encoder or the sense wires are not connected but the JM2 is set for enable

Appendix

Testpoints (TerMag Board)

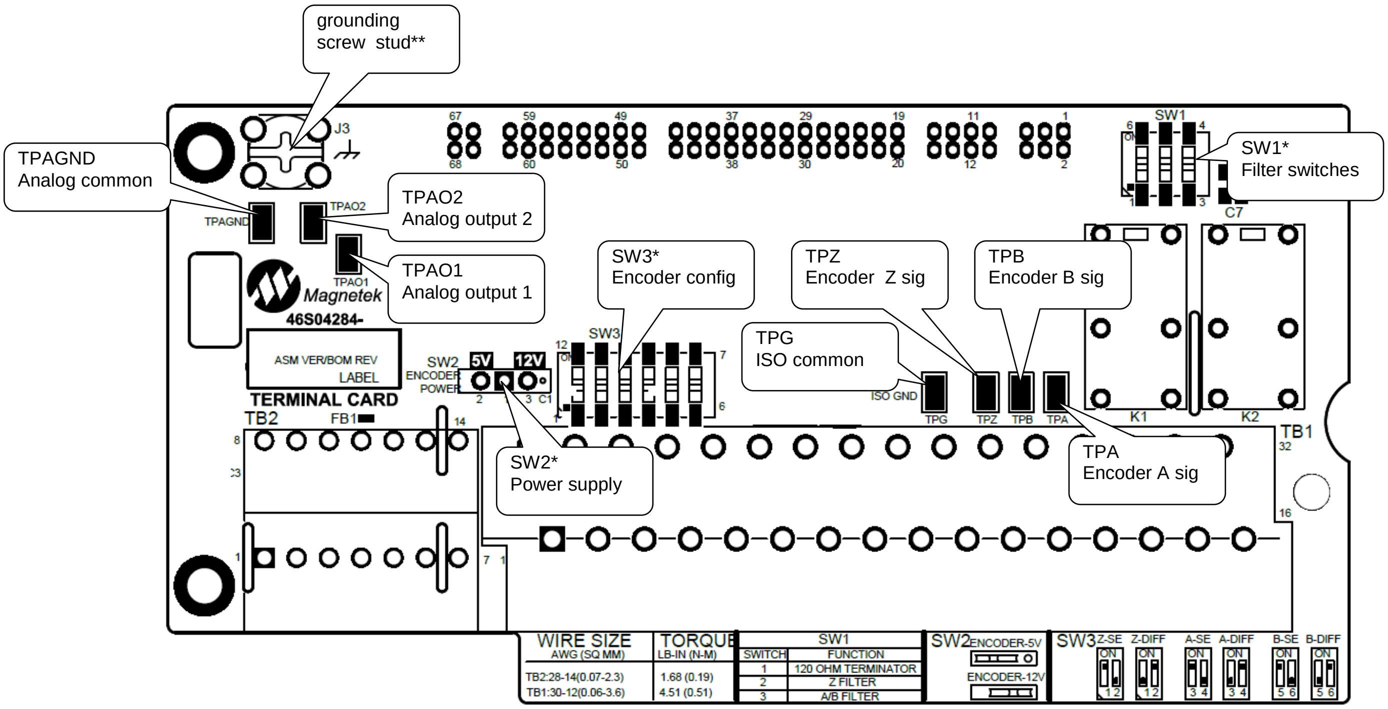


Figure 44: TerMag Board Testpoints

* Refer to pages 29, 31, 190, and 31 for description of the switches and their configuration.
NOTE: on the board below the terminal block mating connector, there is a silk screen on the board that explains the switch various configuration combinations and terminal specs (wire sizes and torque spec)

** This grounding screw should be used to secure and ground the P-clamp when it is used to ground the shield for the encoder cable (specifically with EnDat applications)

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.

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

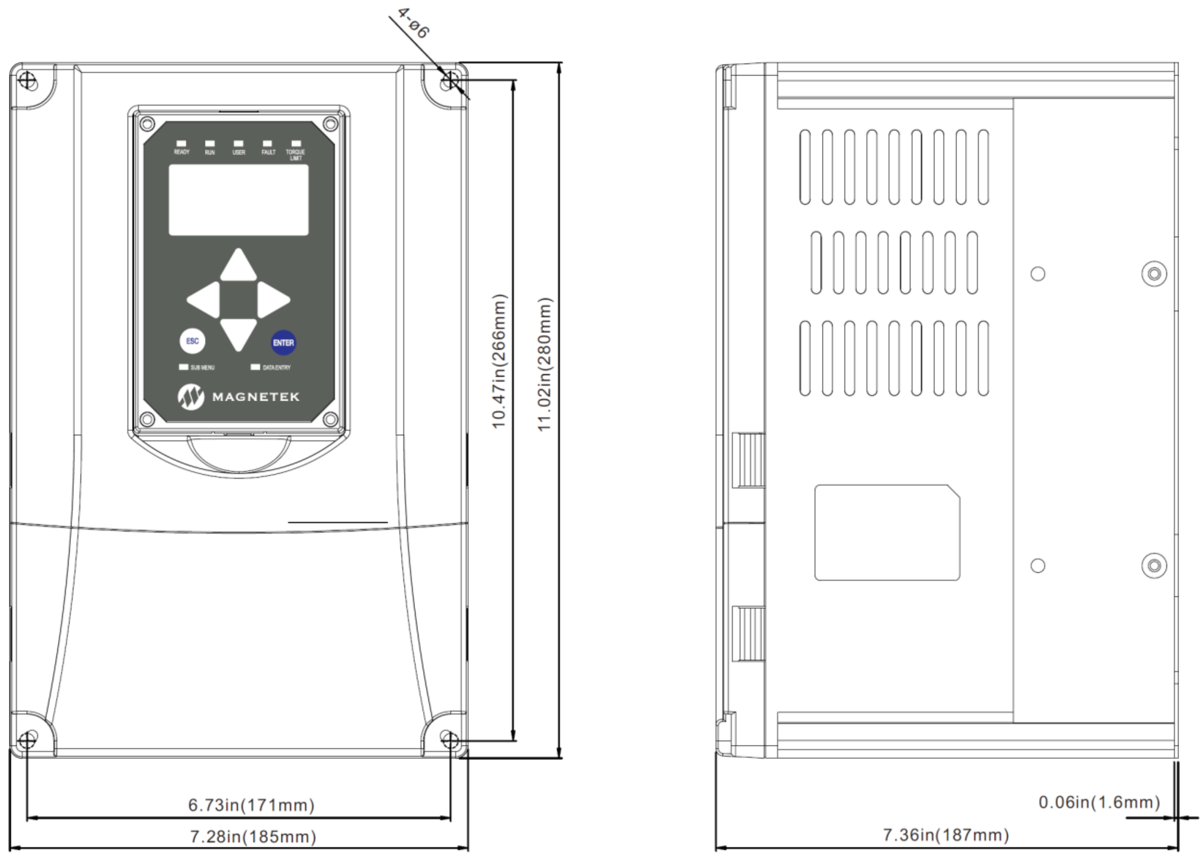
The most effective treatment for cables is shielding. Screened / shielded cable is recommended within the control panel. Use cables with a woven screen. The screen of the cable should be securely grounded using the largest area and shortest distance practical. Shield terminations must be as short as 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 45: Frame 1 Dimensions, Mounting Holes, and Weight

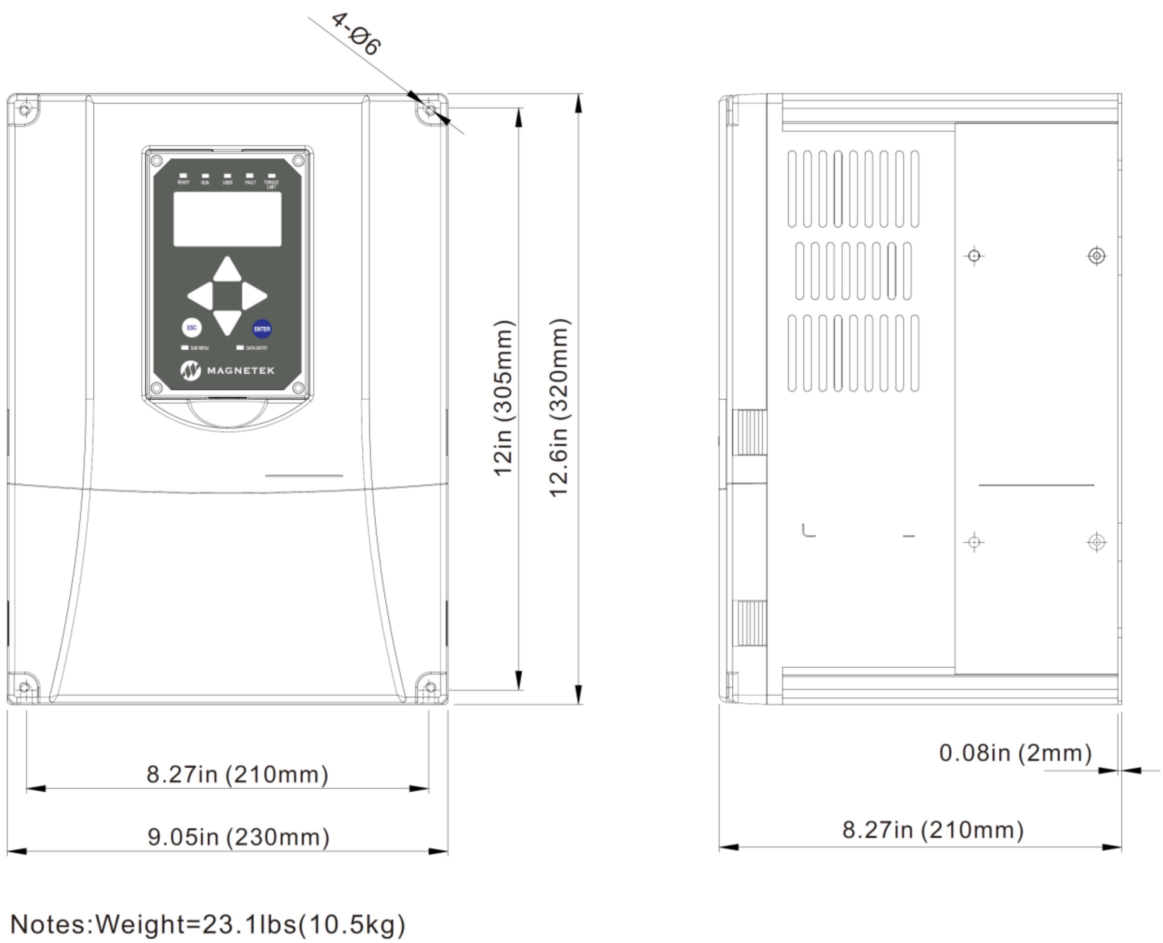


Figure 46: Frame 2 Dimensions, Mounting Holes, and Weight

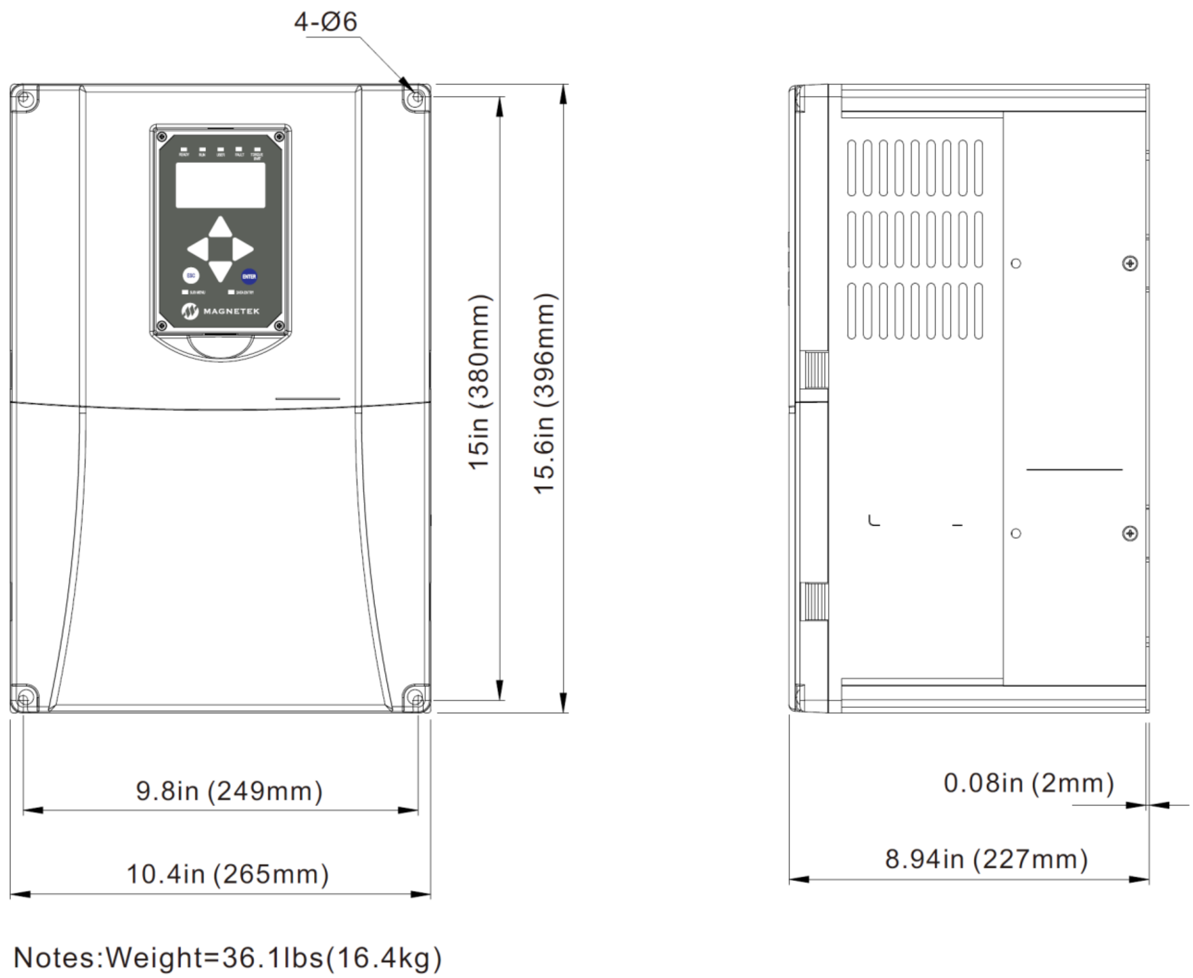
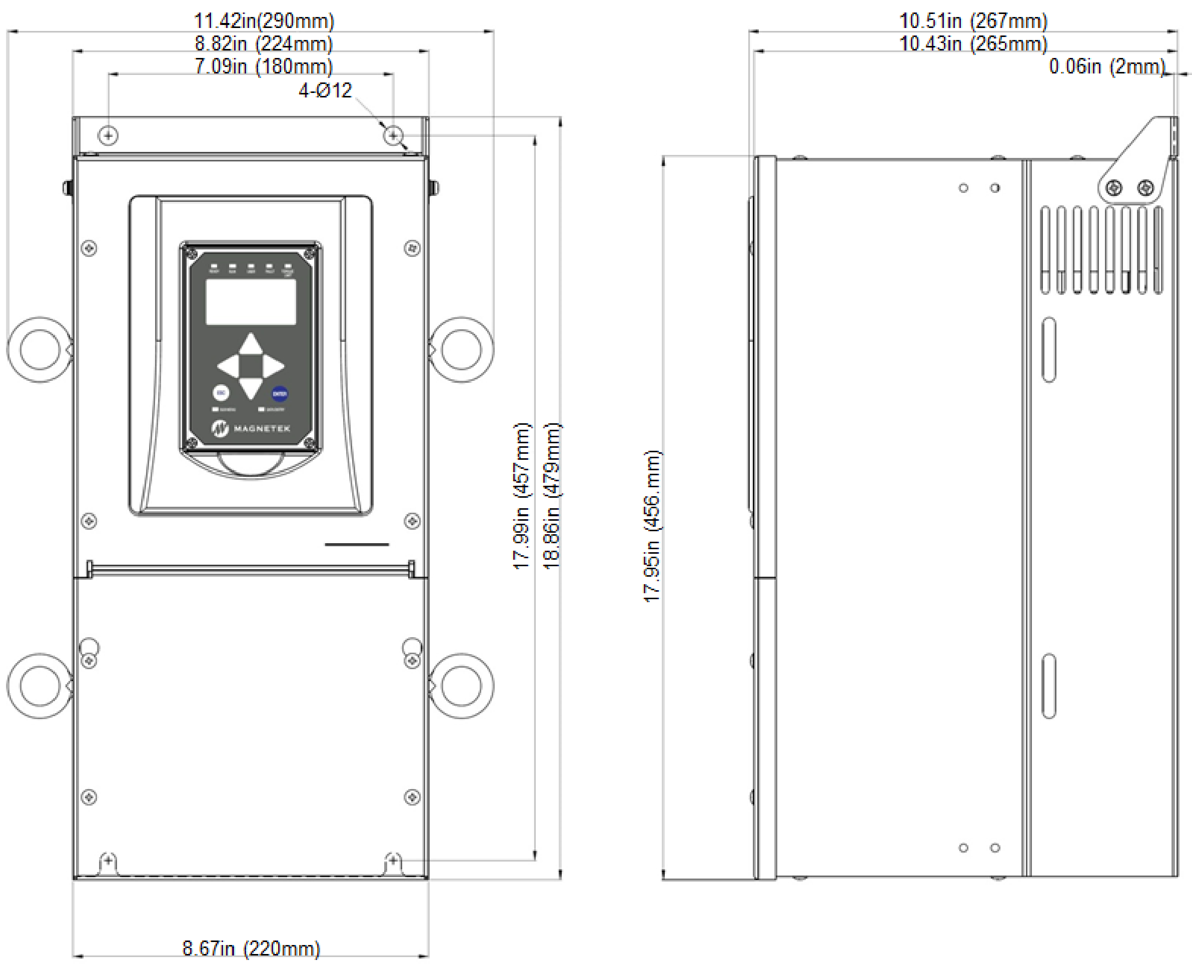
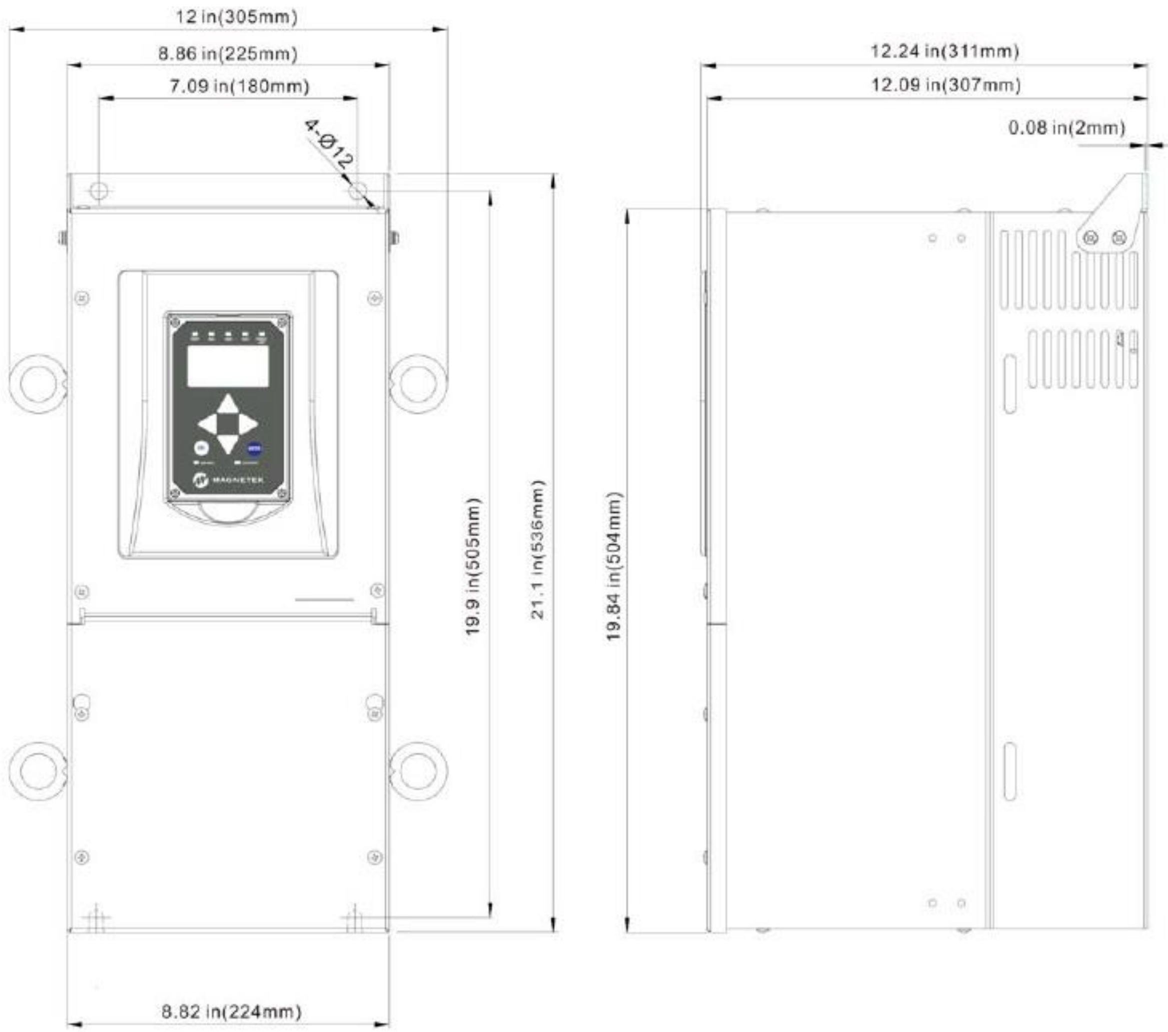


Figure 47: Frame 3 Dimensions, Mounting Holes, and Weight



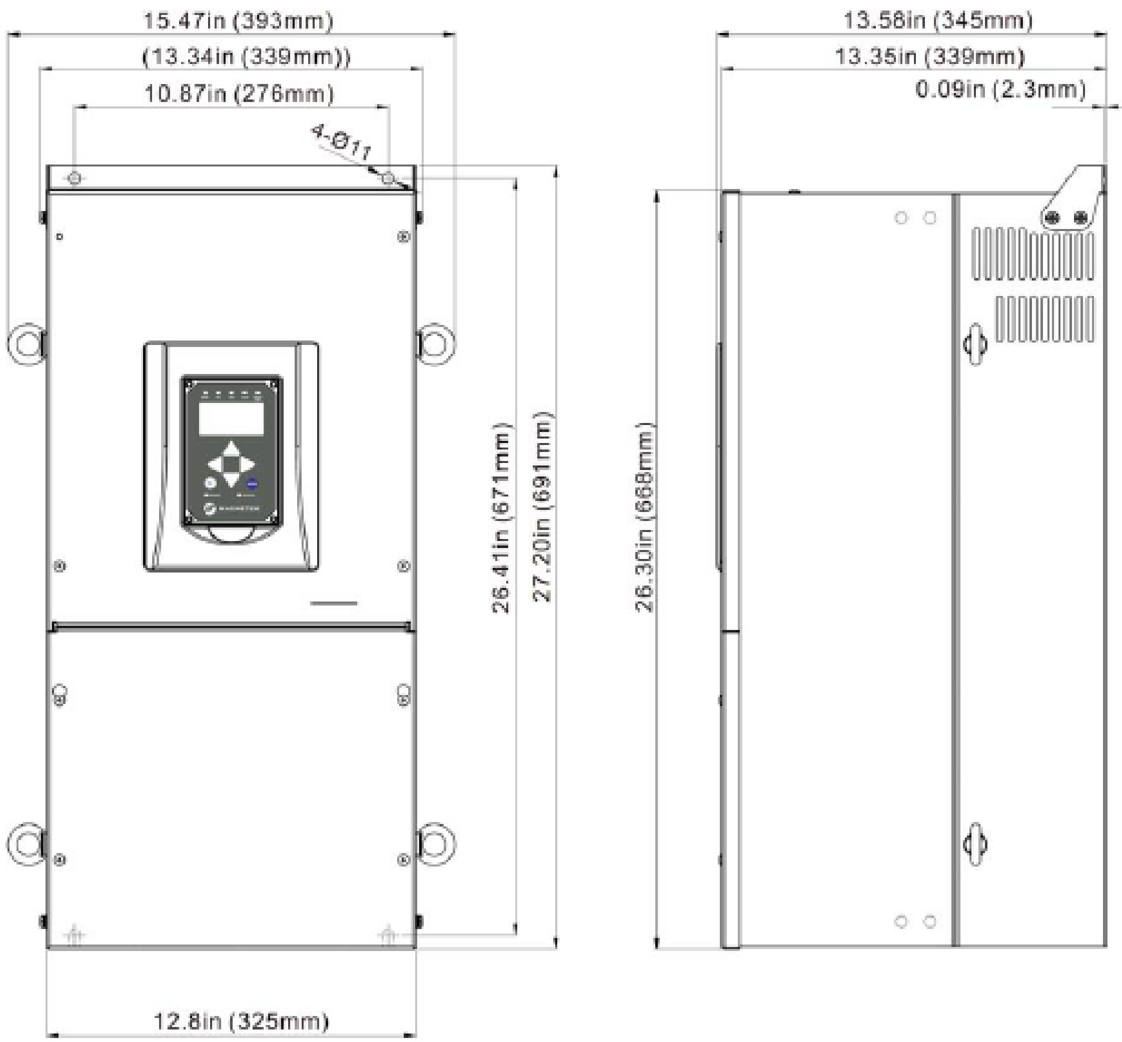
Notes: Weight = 70.6lbs (32kg)

Figure 48: Frame 3.5 Dimensions, Mounting Holes, and Weight



Notes:Weight=71.7lbs(32.5kg)

Figure 49: Frame 4 Dimensions, Mounting Holes, and Weight



Notes : Weight =121lbs (55kg)

Figure 50: Frame 5 Dimensions, Mounting Holes, and Weight

Appendix

Dynamic Braking Resistor Selection

Drive Model	Power Dissipation kW (Worm Gear)	Resistor Value Range (Worm Gear)	Power Dissipation kW (Planetary Gear)	Resistor Value Range (Planetary Gear)
HPV900-4008-2E1-01	0.8	162Ω - 53Ω	1.7	77 Ω - 53 Ω
HPV900-4012-2E1-01	1.2	109Ω - 32Ω	2.5	52 Ω - 32 Ω
HPV900-4016-2E1-01	1.6	80Ω - 32Ω	3.4	38 Ω - 32 Ω
HPV900-4021-2E1-01	2.4	53Ω - 16Ω	5	25 Ω - 16 Ω
HPV900-4027-2E1-01	3.2	40Ω - 16Ω	6.8	19 Ω - 16 Ω
HPV900-4034-2E1-01	4.0	33Ω - 8Ω	8.5	16 Ω - 8 Ω
HPV900-4041-2E1-01	4.8	27Ω - 8Ω	10	13 Ω - 8 Ω
HPV900-4052-2E1-01	6.4	20Ω - 8Ω	14	9 Ω - 8 Ω
HPV900-4065-2E1-01	8.0	16Ω - 5.3Ω	17	7.7Ω - 5.3Ω
HPV900-4072-2E1-01	9.6	13Ω - 5.3Ω	20	6.3Ω - 5.3Ω
HPV900-4096-2E1-01	12.0	11Ω - 4Ω	25	5.2 Ω - 4 Ω

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)	Power Dissipation kW (Planetary Gear)	Resistor Value Range (Planetary Gear)
HPV900-2025-2E1-01	1.2	27Ω - 8Ω	2.5	13 Ω - 8 Ω
HPV900-2031-2E1-01	1.6	20Ω - 8Ω	3.4	9.5 Ω - 8 Ω
HPV900-2041-2E1-01	2.4	14Ω - 4Ω	5	6.4 Ω - 4 Ω
HPV900-2052-2E1-01	3.2	10Ω - 4Ω	6.8	4.7 Ω - 4 Ω
HPV900-2075-2E1-01	4.0	8.3Ω - 2.7Ω	8.5	3.9Ω - 2.7Ω
HPV900-2088-2E1-01	4.8	6.8Ω - 2.7Ω	10	3.2Ω - 2.7Ω
HPV900-2098-2E1-01	6.4	5Ω - 2Ω	14	2.4Ω - 2Ω

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 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 25: 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 26: 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

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

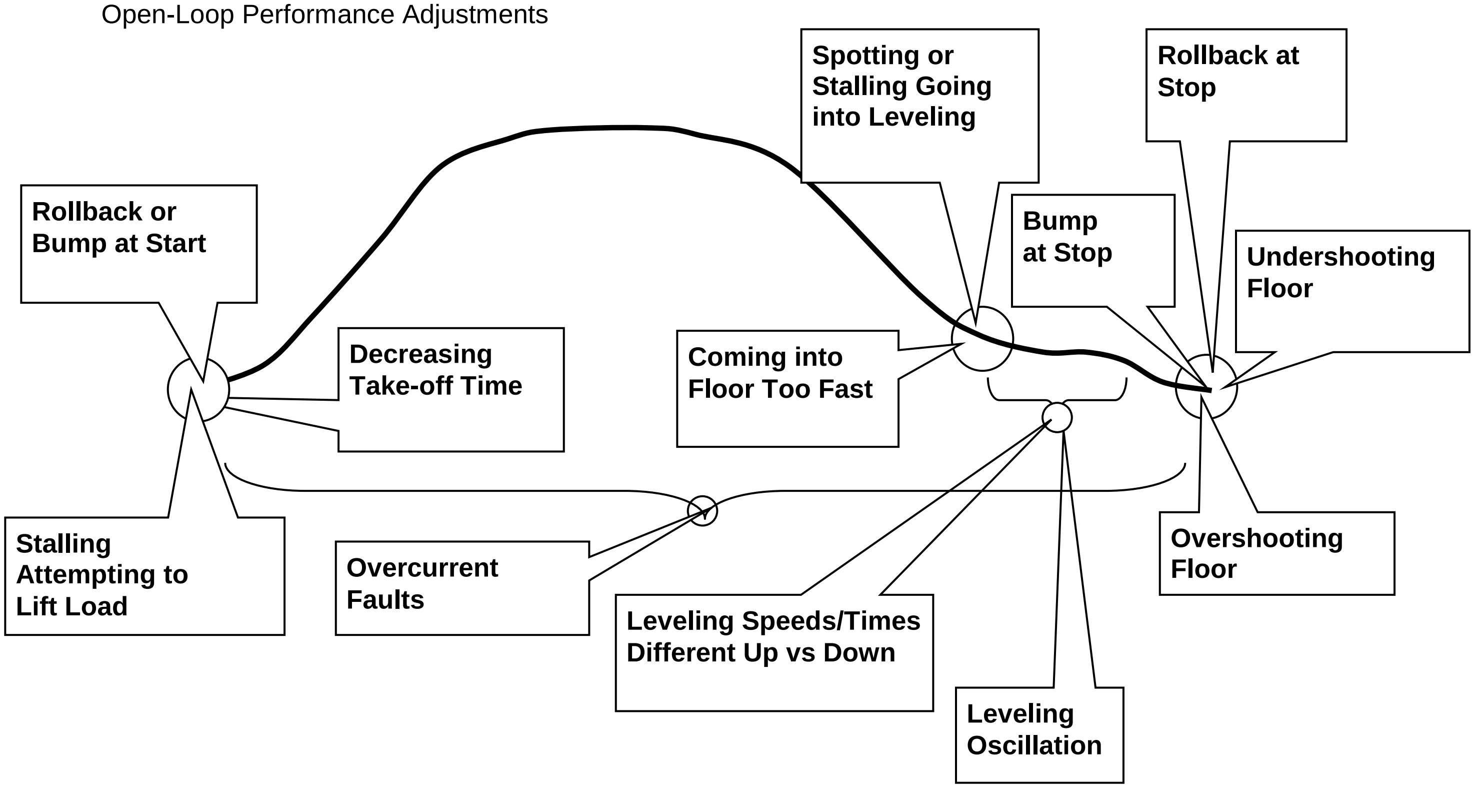
Table 27: 460V Fusing Recommendations

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 28: 230V Fusing Recommendations

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.

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.

Adjust the Motor's Stator Resistance

- Measure the stator resistance.

If still stalling after measuring stator resistance, additionally increase STATOR RESIST (A5) parameter by increments of 0.1 and observe performance

Adjust the Motor Mid Voltage Parameter

- Complete the Mid-volts Adjustment procedure.
- 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.

Verify Mechanical Brake Timing

- The mechanical brake should be picked during the DC injection start time (DC START TIME (A1) parameter), see “Mechanical Brake Timing at Start” .

Increase DC Injection Start Level

- 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.

Increase DC Injection Start Level

- Increase the DC START LEVEL (A1) parameter by increments of 5% and observe performance.

Increase the Accel S-curve parameters

- 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.

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 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.

Verify Mechanical Brake Timing

- 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” .

Verify Torque Limits

- 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

Decrease the S-curve Parameters

- 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)

Verify Motor Min/Mid Voltage Parameters

- MOTOR MID VOLTS (A5) and MOTOR MIN VOLTS (A5) parameters should usually be set at default, see .
- These parameters would only be adjusted slightly with certain issues

(see Stalling Attempting to Lift Load); Spotting or Stalling Going into Leveling ; or Overshooting Floor only with Regen Load).

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.

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 and observe performance.

Adjust the Motor Mid Volts parameter

- Complete the Mid-volts Adjustment Procedure 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 .
- These parameters would only be adjusted slightly with certain issues (see Stalling Attempting to Lift Load ; Spotting or Stalling Going into Leveling; or Overshooting Floor only with Regen Load).
- 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.
- At Full-load, run the drive at 10% of contract speed and complete the Motor RPM Adjustment Procedure.

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.

Increase the Hunt Prevention Time Parameter

- 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

Decrease the Distortion Loop Gain Parameters

- 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.

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".

Decrease Decel Jerk Out Rate

- Decrease jerk rate via DECEL JERK OUT x (A2) parameter and observe performance.

Decrease DC Injection Stop Frequency

- 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.

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".

Increase Leveling Speed

- Increase leveling speed and observe performance

Increase 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

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.

<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".

<u>Decrease Leveling Speed</u>

- Decrease leveling speed and observe performance
- Note: practical minimum for leveling speed is about 2.5 Hz.

<u>Increase Decel Jerk Out and Decel Rates</u>

- 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.

<u>Decrease the Motor Mid Voltage Parameter</u>

- 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.
- 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.

<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".

<u>Decrease Decel Jerk Out Rate</u>

- Decrease jerk rate via DECEL JERK OUT x (A2) parameter and observe performance.

<u>Increase DC Injection Stop Level</u>

- Increase the DC STOP LEVEL (A1) parameter in increments of 5% and observe performance.

<u>Measuring Stator Resistance Procedure</u>

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):

$$= \frac{\textit{stator resistance} - \textit{meter resistance}}{2 \times \text{BASE IMPEDANCE (D2)}} \times 100$$

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

<u>*Mechanical Brake Timing at Start*</u>

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.

<u>*Mechanical Brake Timing at Stop*</u>

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

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 187.
- Use twisted pair cable with shield tied to chassis ground at drive end. For more information, see Encoder Wiring on page 30.
- Use limited slew rate differential line drivers. For more information, see Differential Line Drivers on page 189.
- Do not allow capacitors from internal encoder electronics to case. For more information, see Capacitors from Electronics to Case on page 190.
- Do not exceed the operating specification of the encoder/drive. For more information, see Exceeding Operating Specification on page 191.
- 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 191.

Mechanical Considerations

- Use direct motor mounting without couplings. For more information, see Direct Motor Mounting on page 188.
- Use hub or hollow shaft encoder with concentric motor stub shaft. For more information, see motor stub shaft on page 188.
- If possible, use a mechanical protective cover for exposed encoders. For more information, see Encoder Protective Covers on page 189.

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 54 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.

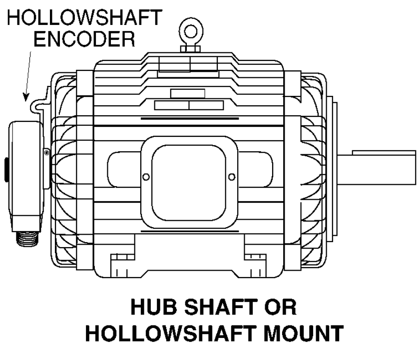


Figure 51: Direct Motor Mount

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.

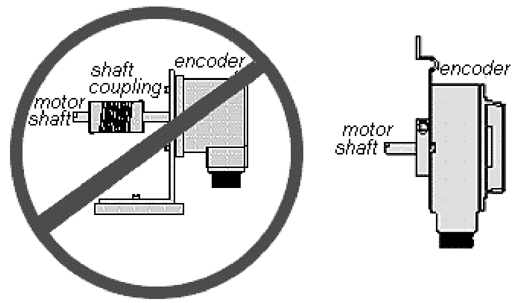


Figure 52: Avoiding Couplings

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.

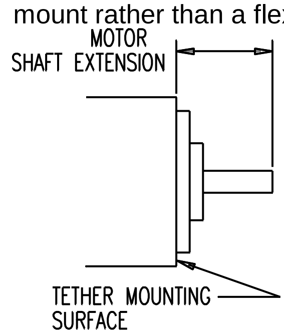


Figure 53: Motor Stub Shaft

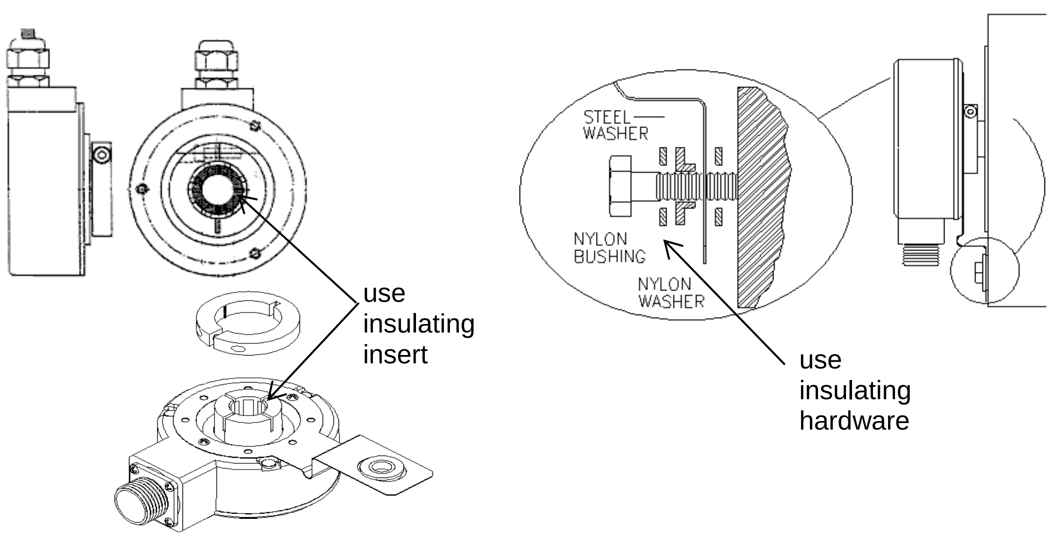


Figure 54: Insulating Encoder from Motor

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.

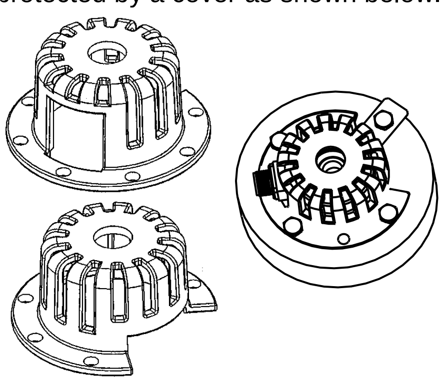


Figure 55: Protective Encoder Covers

Differential Line Drivers

Use limited slew rate differential line drivers, in order to minimize transmission line reflections use type 7272 differential line 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.
Differenetial line drivers are recommended 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 configured to run with singled ended encoders with setting of SW3 on page 190.

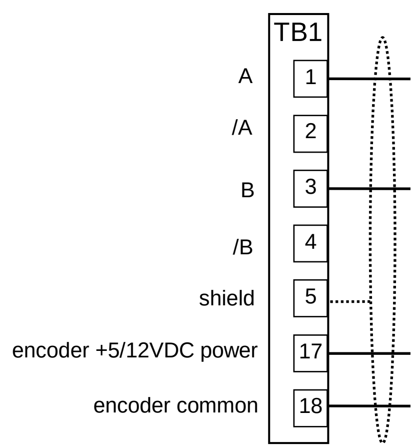


Figure 56: Single-Ended Encoder Connection

Differential / Single-Ended Encoder Configurations

Drives with TerMag boards 46S04284-1020 can be configured to run with either a differential or single-ended encoder with the setting of the SW3 dip switches. Below are examples of how the TerMag can be configured to run with differential or single-ended encoders. NOTE: each encoder channel can be configured individually for differential or single-ended operation.

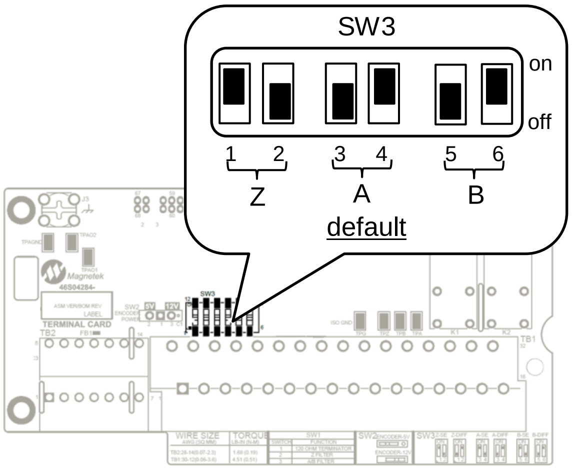


Figure 57: Default setting of SW3 on TerMag Board A & B with Differential and Z with Single-Ended

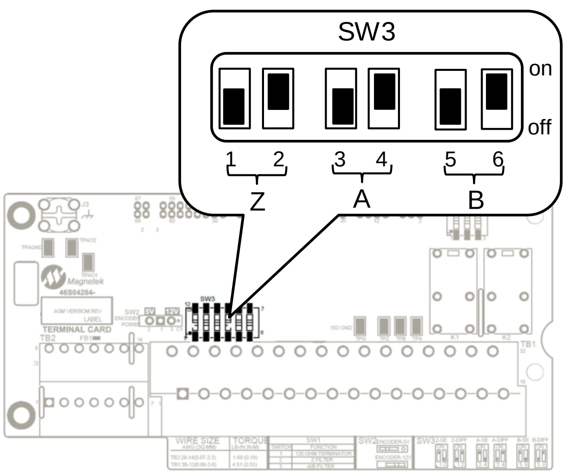


Figure 58: SW3 set for ALL Differential Input for TerMag Board

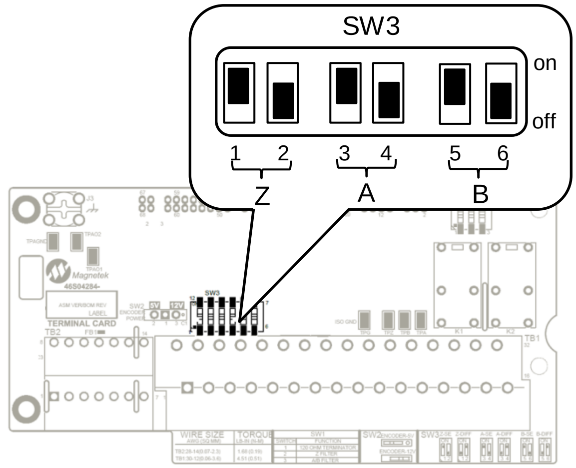


Figure 59: SW3 set for ALL Single-Ended Input for TerMag Board

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 30.*

The scope traces in Figure 60 and Figure 61 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.

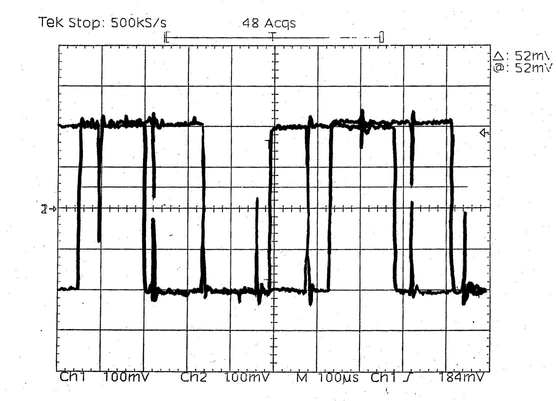


Figure 60: Encoder with a capacitor (common to ground)

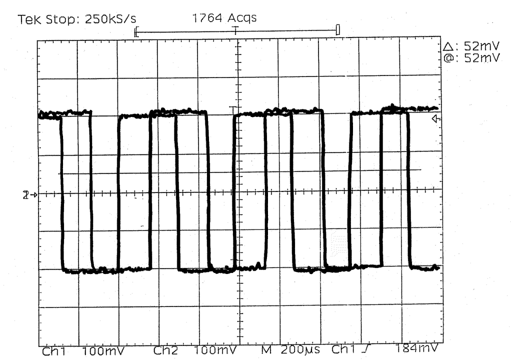


Figure 61: Encoder with no capacitor (common to ground)

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)

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

- 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),		Ground Terminals	
	Wire size range AWG (mm^2) 90°C (194°F) / 105°C (221°F)	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) / 10 (5.3)	15.6 (1.76)[i]	12-10 (3.5-5.5)	15.6 (1.76)
HPV900-2031-2E1-01	8 (8.4) / 8 (8.4)	15.6 (1.76)[i]	8 (8.4)[i]	15.6 (1.76)
HPV900-2041-2E1-01	6 (14) / 8 (8.4)	57.3 (6.47)	8 (8)	57.3 (6.47)
HPV900-2052-2E1-01	6 (14) / 6 (14)	57.3 (6.47)	8 (8)	57.3 (6.47)
HPV900-2075-2E1-01	3 (27) / 4 (22)	57.3 (6.47)	6 (14)	57.3 (6.47)
HPV900-2088-2E1-01	2 (38) / 3 (27)	57.3 (6.47)	4 (22)	57.3 (6.47)
HPV900-2098-2E1-01	1 (42.4) / 2 (38)	104.2 (11.76)	4 (22)	57.3 (6.47)
HPV900-4008-2E1-01	14 (2.1) / 14 (2.1)	15.6 (1.76)	12-10 (3.5-5.5)	15.6 (1.76)
HPV900-4012-2E1-01	12 (3.5) / 14 (2.1)	15.6 (1.76)[i]	12-10 (3.5-5.5)	15.6 (1.76)
HPV900-4016-2E1-01	10 (5.5) / 12 (3.5)	15.6 (1.76)[i]	10 (5.5)	15.6 (1.76)
HPV900-4021-2E1-01	8 (8.4) / 10 (5.5)	26.0 (2.94)	8 (8)	26.0 (2.94)
HPV900-4027-2E1-01	8 (8.4) / 8 (8.4)	26.0 (2.94)	8 (8)	26.0 (2.94)
HPV900-4034-2E1-01	6 (14) / 8 (8.4)	26.0 (2.94)	8 (8)	26.0 (2.94)
HPV900-4041-2E1-01	6 (14) / 8 (8.4)	26.0 (2.94)	8 (8)	26.0 (2.94)
HPV900-4052-2E1-01	6 (14) / 6 (14)	26.0 (2.94)	6 (14)	26.0 (2.94)
HPV900-4065-2E1-01	4 (22) / 4 (22)	57.3 (6.47)	4 (22)	57.3 (6.47)
HPV900-4072-2E1-01	3 (27) / 4 (22)	57.3 (6.47)	4 (22)	57.3 (6.47)
HPV900-4096-2E1-01	1 (42.4) / 2 (38)	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) 90°C (194°F) / 105°C (221°F)	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) / 10 (5.3)	15.6 (1.76)[i]	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-2031-2E1-01	8 (8.4) / 8 (8.4)	15.6 (1.76)[i]	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-2041-2E1-01	6 (14) / 8 (8.4)	26.0 (2.94)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-2052-2E1-01	6 (14) / 6 (14)	26.0 (2.94)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-2075-2E1-01	3 (27) / 4 (22)	26.0 (2.94)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-2088-2E1-01	2 (38) / 3 (27)	26.0 (2.94)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-2098-2E1-01	1 (42.4) / 2 (38)	57.3 (6.47)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-4008-2E1-01	14 (2.1) /14 (2.1)	15.6 (1.76)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-4012-2E1-01	12 (3.5) /14 (2.1)	15.6 (1.76)[i]	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-4016-2E1-01	10 (5.5) /12 (3.5)	15.6 (1.76)[i]	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-4021-2E1-01	8 (8.4) / 10 (5.5)	26.0 (2.94)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-4027-2E1-01	8 (8.4) / 8 (8.4)	26.0 (2.94)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-4034-2E1-01	6 (14) / 8 (8.4)	26.0 (2.94)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-4041-2E1-01	6 (14) / 8 (8.4)	26.0 (2.94)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-4052-2E1-01	6 (14) / 6 (14)	26.0 (2.94)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-4065-2E1-01	4 (22) / 4 (22)	57.3 (6.47)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-4072-2E1-01	3 (27) / 4 (22)	57.3 (6.47)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)
HPV900-4096-2E1-01	1 (42.4) / 2 (38)	57.3 (6.47)	30-12 (0.06-3.6)	4.51 (.51)	28-14 (.07-2.3)	1.68(.19)

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℃ (104℉)) source: CAN/CSA-B44.1-M91*

Table 29: 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 30: 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 31 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 31: Single Phase Ratings

Appendix

Carrier Frequency Ratings (250% Overload)

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 32: 200V Series Drives Carrier Frequency Ratings

Appendix

Carrier Frequency Ratings (250% Overload)

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 33: 400V Series Drives 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 34: 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
Min recommended contact load	100mA, 5Vdc	
Contact material	AgSnO2	
Manuafacturer	Tyco, PCH-124D2H	

<u>Operating Time</u>

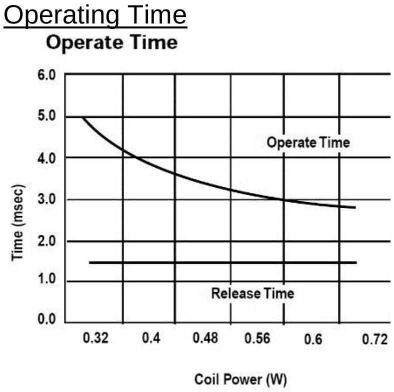


Figure 62: Operate Time

<u>Coil Temperature Rise</u>

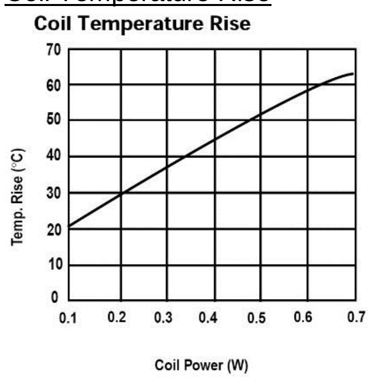


Figure 63: Coil Temperature

<u>Life Expectancy</u>

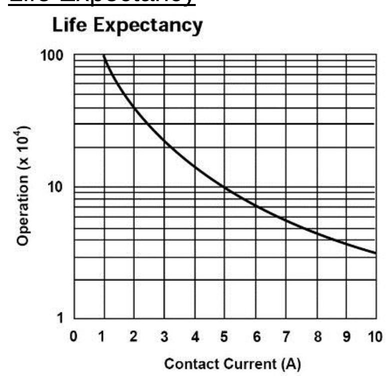


Figure 64: Relay Life Expectancy

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*

HPV9S2-REFLASH	FRU,HPV900S2, ReFlash Kit	*Includes cable, reflash board, instructions for software uploads, and USB flash drive*
46S03543-0020	CABLE,USB A to mini B	*Cable for parameter and software uploads*
46S04413-HP02	ASM,H9S2,SFTR UPDATE KIT	*Includes Tech Manual, software, program used for uploads and manual, and instructions. All on a USB flash drive.*

Table 35: Replacement Parts

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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
Unit 3, Bedford Business Centre Mile Road
Bedford, MK42 9TW UK
+44(0) 1234 349191, FAX +44(0) 1234 268955