MAGNETEK
ELEVATOR

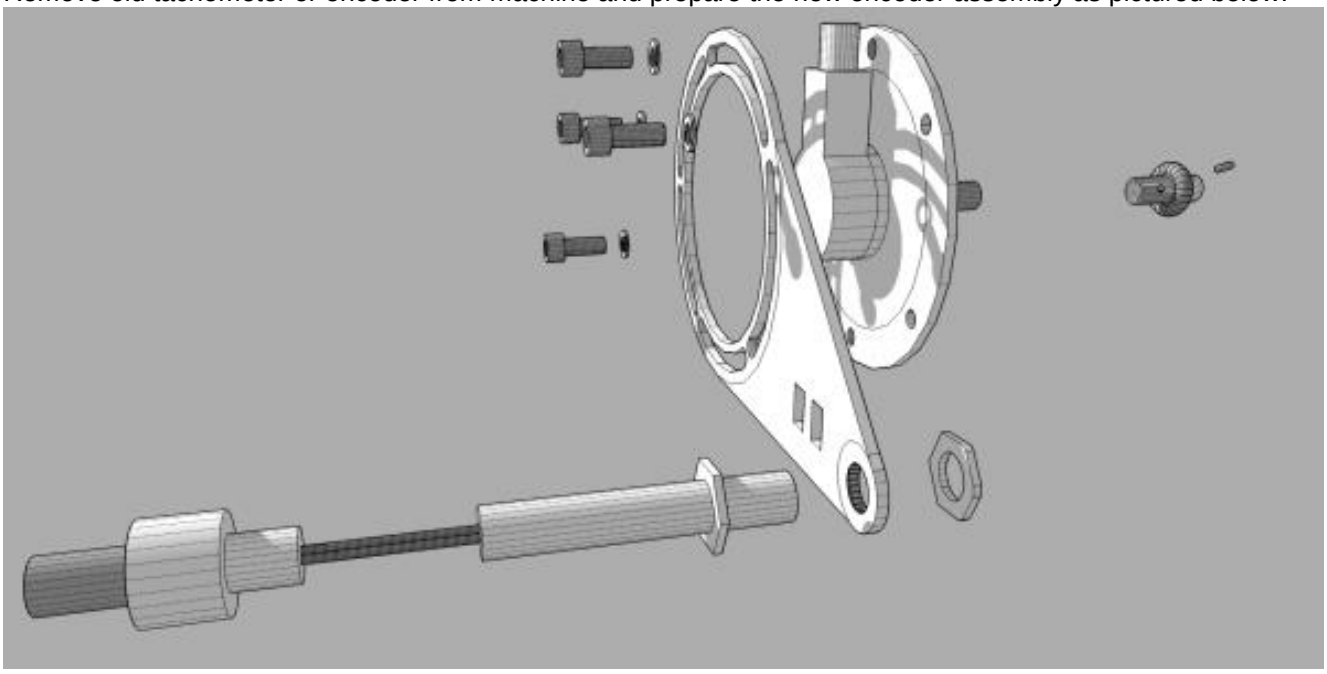
Axial Flux Start Guide

Guide to set up 900S2 Axial Flux drive

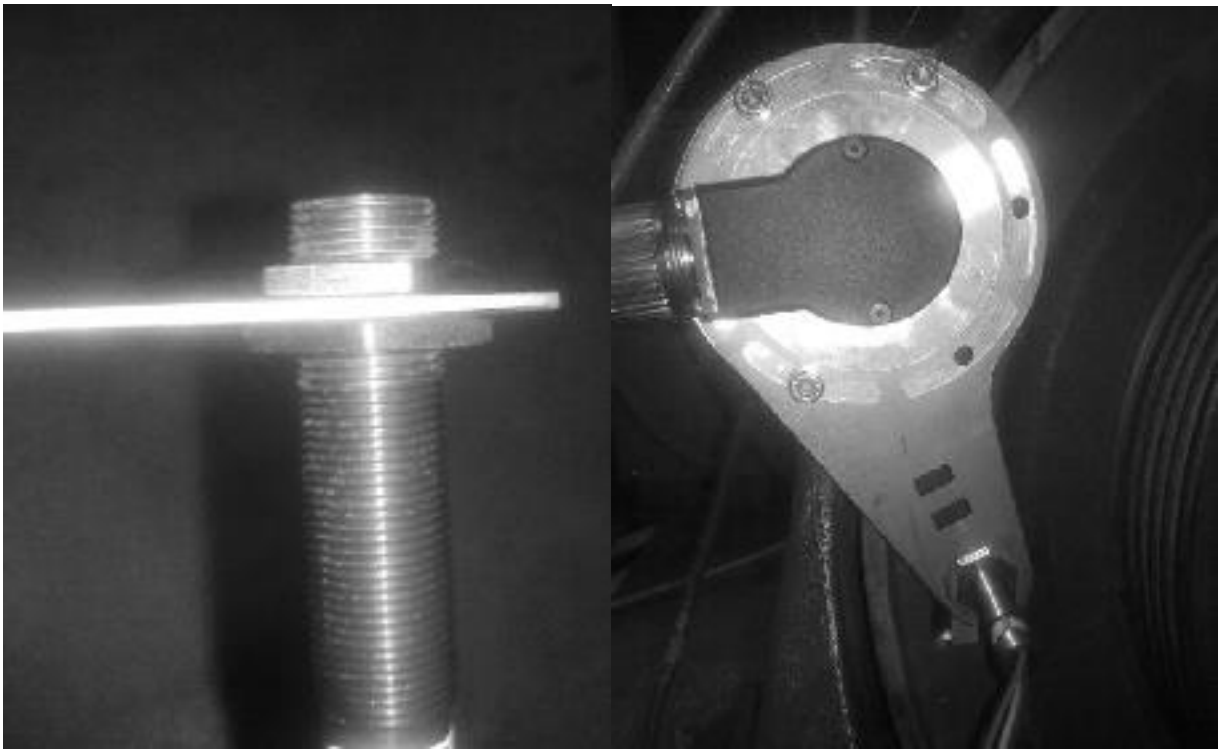
This is a quick setup guide to commission the HPV900 Series 2 Axial Flux drive.

Step 1 – Mechanical Mounting

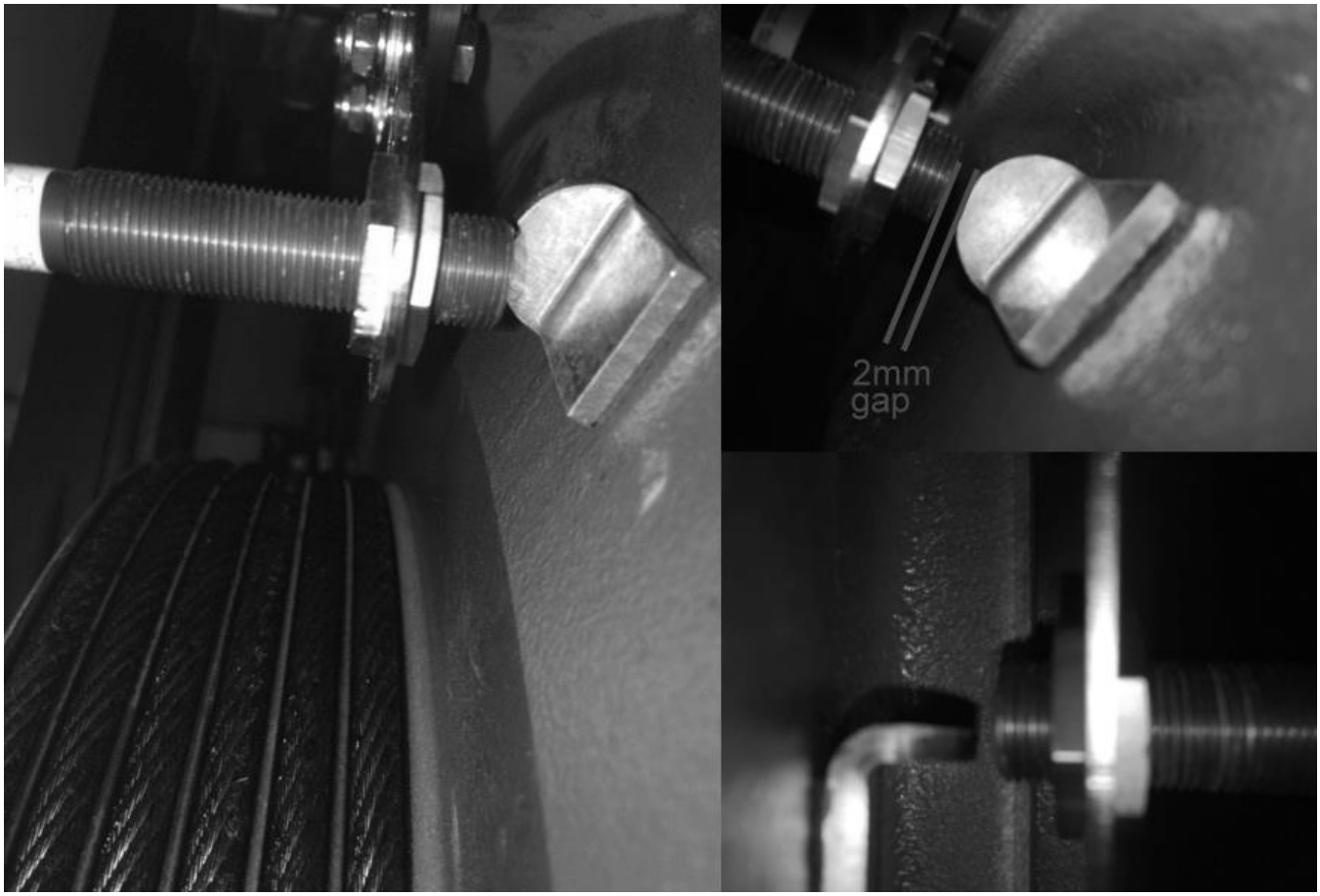
1. Remove old tachometer or encoder from machine and prepare the new encoder assembly as pictured below.



2. The Rider Wheel (supplied as part of the kit) should be attached to the encoder shaft using the grub screws provided. the proximity switch should be fitted to the proximity bracket as pictured below using the supplied nuts.

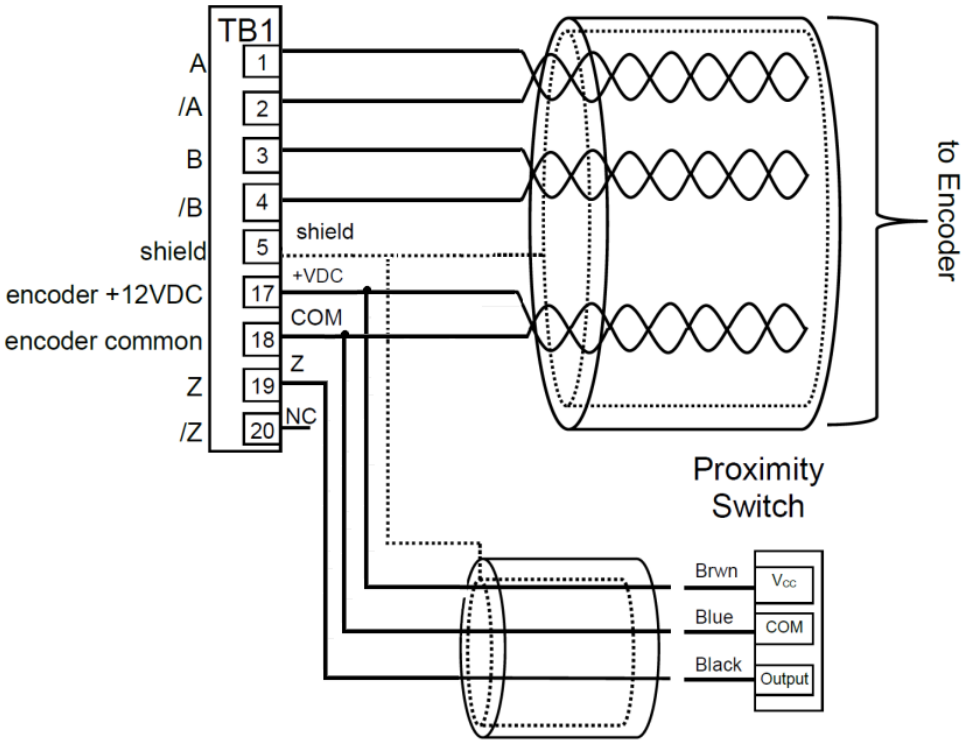


3. The target flag should be positioned on the sheave so that the short rounded edge will face the proximity sensor. Use the supplied alcohol wipe to clean the surface, then peel the backing from the adhesive backing on the flag, orient as pictures below and stick to the sheave. The proximity distance should be adjusted to 2mm using the supplied gap tool.



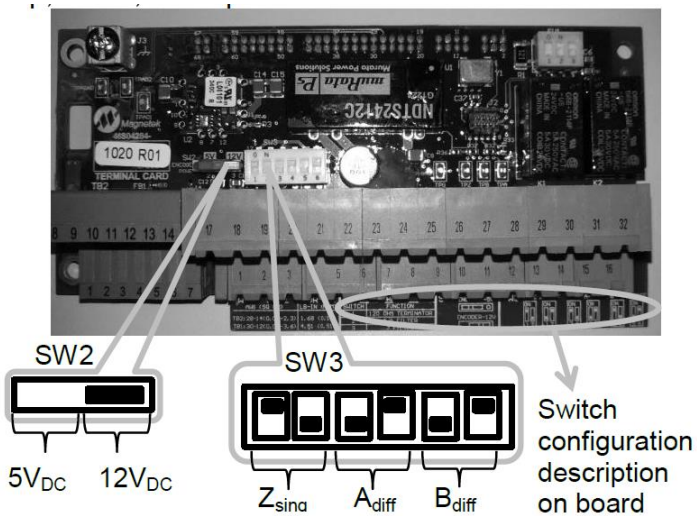
Step 2 – Electrical Connection

Connect the encoder and proximity sensor wires to the drive as follows:



Each of the wires are labelled and should be connected into the TB1 terminals (long connectors). Under no circumstance should any wires be 'switched' away from the labelled order.

Each Axial Flux drive is factory configured as per below to match the encoder and proximity sensor supplied with the kit.



For best performance, it is also recommended that the existing load sensor from the elevator is retained, and connected to the drive as shown on page 9. Instructions on calibration are also included.

Step 3 – Drive Parameters

The following drive parameters should be entered for the Axial Flux drive:

Menu	Parameter	Correct Setting
U9	Drive Mode	*"PM" (Factory Locked)*
C1	Motor Rotation	*See table below*
	Wear Adapt Ena	*See Step 5 below*
A4	Input L-L Volts	*Enter Line to Line Voltage*
A5	Rated Motor Power	*From Motor Dataplate*
	Rated Motor Voltage	*From Motor Dataplate*
	Rated Motor Current	*From Motor Dataplate*
	Motor Poles	**From Motor Dataplate**
	Rated Motor Speed	*From Motor Dataplate*
A1	Encoder Pulses	*See table below*
	Enc PPR Low	*See Step 5 below*
D1	PPR Adapt	*See Step 5 below*

*Motor poles are not always stamped on the dataplate. Please refer to calculation below if pole count is not stamped.

Motor Poles (A5)

If motor pole count is not stamped on the motor dataplate, please use the following calculation to determine the value to enter in the A5 menu:

$$Motor\ Poles = \frac{120 * Motor\ Frequency\ (Hz)}{Rated\ Motor\ Speed\ (Rpm)}$$

Motor Rotation (C1)

Ensure the motor is wired to the drive with U to U, V to V and W to W

If the motor sheave will rotate in a **Clockwise** direction for the car to travel up, set Motor Rotation (C1) to **FORWARDS**
If the motor sheave will rotate in an **Anti-clockwise** direction for the car to travel up, set Motor Rotation (C1) to **REVERSE**

Logic Input 9 (C2)

If the 'Safe Off' function is NOT being used, ensure the switch in the centre of the control board should be set to I9, and Logic Input 9 is NOT set to Safe Off.

Encoder Pulses (A1)

The encoder pulses in the A1 menu should be picked from the table below:

PM Motor Frame Types	Encoder Pulse (A1)
MX05/10	14395 PPR
MX05/16	14452 PPR
MX06/05	17067 PPR
MX06/10	17067 PPR
MX06/16	17067 PPR
MX10/05	19819 PPR
MX10/08	19735 PPR
MX10/10	19819 PPR
MX10/15	19680 PPR
MX18	26050 PPR
MX20	12950 PPR (75mm Rider Wheel)

These values are simply a starting point. The final encoder PPR value will be entered once the motor can be run at full speed as detailed in step 5.
If the motor does not conform to any of the types listed above, the PPR can be calculated using the diameter of the sheave where the encoder rider wheel is running (This may differ from the sheave diameter on the motor dataplate), and the diameter of the rider wheel supplied (37.3mm or 75mm).

$$Entered\ PPR = \frac{Motor\ sheave\ diameter}{Encoder\ Rider\ Wheel\ diameter} * 1024$$

Step 4 – Alignment and Autotune

The drive must determine its start position relative to the encoder on each power cycle.

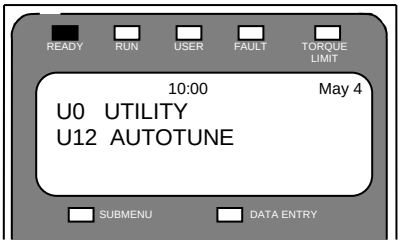
Using default settings, the drive will automatically perform a HF inject alignment when it is given the first run command and all parameters are entered with no active faults.

During Alignment, a slight buzzing noise should come from the motor for approximately half a second before the brake lifts and the motor attempts to move.

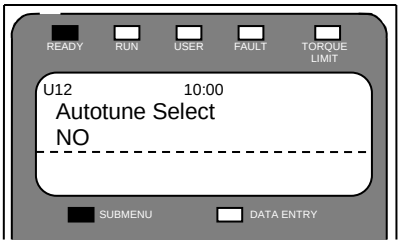
- If the fault **AT CONTACT FLT** is displayed, verify the motor contactor closes during this process
- If the fault **BRAKE IS OPEN** is displayed, the drive has detected motion - verify the brake does NOT lift. If brake doesn't lift and minimal movement has occurred, increase BRK FLT LEVEL (A4).

Assuming no faults were displayed the lift should be able to be driven in both directions, however for best performance an AutoTune should also be performed as follows:

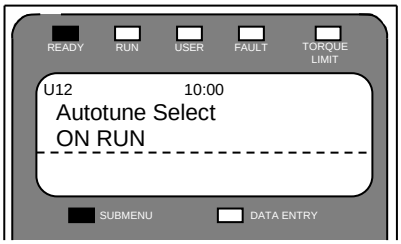
1. Move to the (U12) menu.



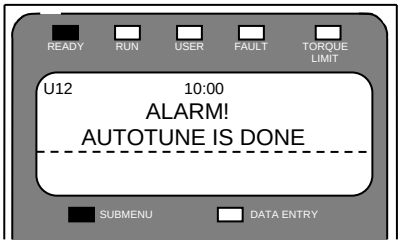
2. Press Enter to display:



3. Press Enter, and change Autotune select to ***ON RUN***. ("Yes" would begin the alignment immediately which would require motor contactors to be bypassed)



4. Attempt to run the lift on test by pressing the inspection run/direction buttons and keep them depressed whilst the autotune is carried out. During Autotune, a slight buzzing noise should come from the motor for approximately half a second and the RUN light will be lit for the duration of the procedure.



- If the fault **AT CONTACT FLT** is displayed, verify the motor contactor closes during this process
- If the fault **BRAKE IS OPEN** is displayed, the drive has detected motion, verify the brake does NOT lift. If brake doesn't lift and minimal movement has occurred, increase BRK FLT LEVEL (A4).

Step 5 – Running

When the above steps have been completed, the drive should be ready to run the motor.
If any faults are displayed whilst running, refer to the troubleshooting section at the end of this guide.

Otherwise:-

- If the motor turns, but is running in the wrong direction, change MOTOR ROTATION parameter in C1.
- If the motor turns halfway, then stops, check encoder ENCODER PULSES in the A1 menu. This should match the value in the table shown in Step 3 above (14,000 to 26,050PPR).

Once running on inspection control 'MEASURED PPR' in the D1 menu should be monitored. An average reading should be noted and then entered in 'Encoder PPR Low' (A1)

When the installation is nearing completion the above 'MEASURED PPR' should be monitored again (whilst traveling at contract speed) and an average reading entered in 'Encoder PPR' (A1)

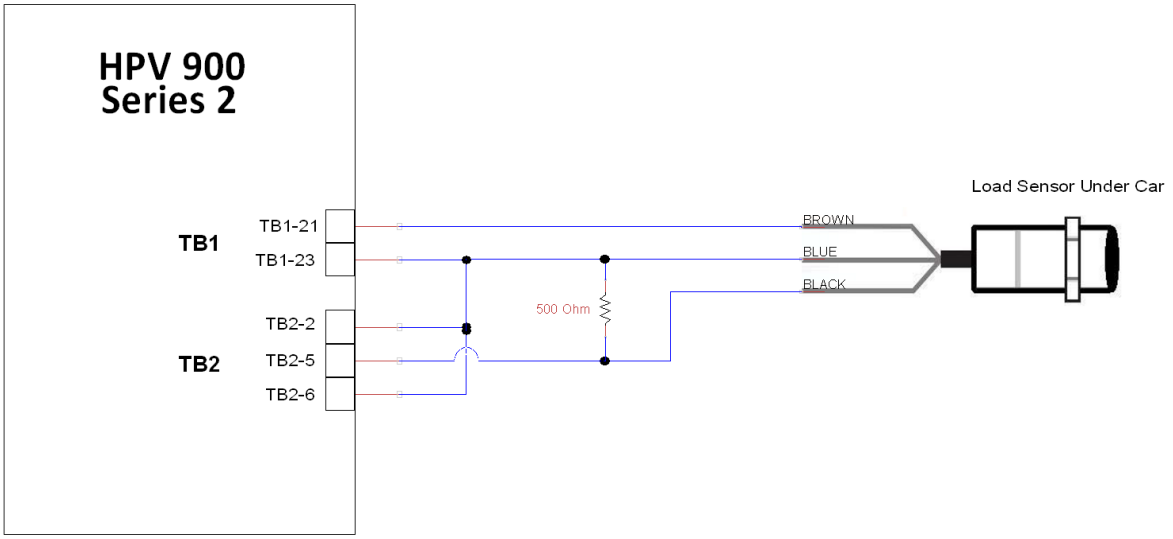
Any final adjustments or drive tuning should be conducted if required at this stage such as setting INERTIA (A1) or RESPONSE (A1) to optimize ride quality.

The rider wheel will wear over time which will affect the number of encoder pulses per revolution. The drive has a feature that will automatically compensate for this and so therefore, as a last step, enable the 'Wear Adapt Ena' parameter in the C1 Menu. The drive will then automatically adjust Encoder PPR internally by the value displayed in the 'PPR Adapt' D1 Display.

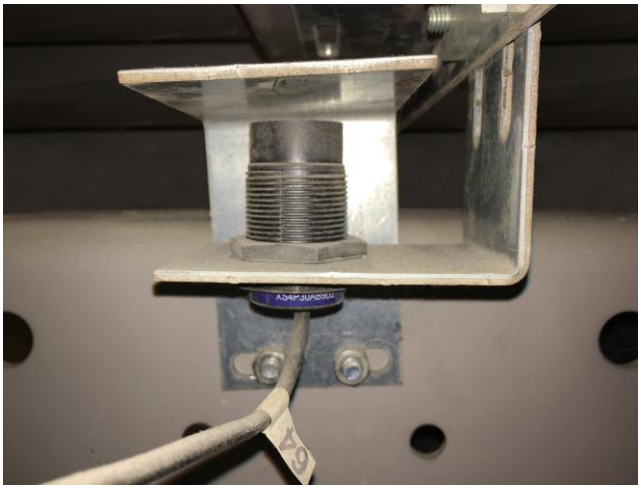
LOAD SENSOR GUIDE

Step 1 – Connect the Load Sensor

The load sensor needs to be connected with the use of an external 500Ohm resistor to convert the analogue current signal to a voltage reference.



The 900S2 drive uses a -10 to +10VDC voltage analogue input. The resistor is simply to convert a 4-20mA signal to a 3-10V signal which the drive can use.
The load sensor should appear as per the image on the right, and should be retained when modernising the elevator:



Step 2 – Drive Parameters

Once the load sensor is connected, the drive's Pre-Torque Bias parameter (A156) should be set to 6V to centre the signal. The pretorque value is then scaled simply by using the Pre-Torque Multiplier (A157) parameter:

The start settings are as follows:
A1
Pre-Torque Bias (A156) - 6V
Pre-Torque Time (A158) - 0.2s
C1
Pre-Torque SRC (C133) - Analog Input

"Pre-Torque Ref" (D114) can then be monitored, and the value should change when weight is added/removed to the car. With the settings above, the value should be roughly -50% for pretorque reference with empty car, 0% for balanced load, and +50% for full load. This is the amount of motor torque the drive will use to hold the car when the brake lifts.

The Pre-Torque Multiplier (A157) parameter can then be adjusted higher to give more pretorque, or lower to give less pretorque. You can see the effect of this parameter in D114.

The easiest way to calibrate this setting is by setting the Test/Inspection speed of the elevator to 0m/s, and with an empty car:
If the car moves down when the brake lifts, reduce A157
If the car moves up when the brake lifts, increase A157

Troubleshooting

If any issues are experienced which are not covered by this guide, please refer to the technical manual (TM7354) which is available on the Magnetek website.

Faults/ Alarms/ Difficulties	Description	Solutions
Encoder Flt	The drive is in a run condition and the encoder is: not functioning or not connected or phasing is not proper with motor phasing	**Incorrect Encoder Phasing** ⇩ Verify that the encoder phasing is correct ⇩ Swap encoder A and /A channel on TB1-1 and TB1-2 **Encoder Power Supply** ⇩ Check that the encoder power supply on TB1-17 and TB1-18 is $12V_{DC}$ ⇩ Verify that SW2 is switched to the 12V position (at right). Verify that the voltage between TB1-17 and TB1-18 is 12 volts DC **Parameter Settings** ⇩ Verify that the Encoder Connect (C1) is set to axial flux ⇩ Verify that the Encoder Pulses (A1) is set to a reasonable number **Encoder Mechanical Setup** ⇩ Verify that the rider wheel is firmly on the rotor and that the encoder spins as the rotor is spinning
Encoder PPR Fault	The number of encoder pulses the drive has counted when the Z marker is observed is outside the expected window	**Incorrect Encoder PPR** ⇩ Verify the encoder PPR setting in the A1 menu. This value should match the 'Measured PPR' displayed in the D1 menu when travelling at high speed. **Z Marker Flag Mount** ⇩ Ensure the Z marker flag is correctly mounted on the rotor. The distance between the flag and proximity sensor should be as per the gap tool, and the flag orientation should be as shown in the photo on page 3 of this guide. **Encoder Feedback Filters** ⇩ Verify that filter switches on SW1 of the Termag board are set as follows: 

Faults/ Alarms/ Difficulties	Description	Solutions
HIT TORQUE LIMIT *(alarm)*	The drive has reached its torque limit as defined in the A1 menu.	**Incorrect Encoder Phasing** ⇩ Verify that the encoder phasing is correct. ⇩ Swap the A and /A wires in TB1-1 and TB1-2 **Proximity Switch** ⇩ Verify that the target sensor is being seen by the proximity switch every time the target is lined up with the proximity switch using the Z Edge Count (D1) ⇩ Verify that there is no noise on the proximity switch channel by verifying that the Z Edge Count (D1) isn't incrementing/decrementing more than once per motor rotation ⇩ Check that the proximity switch power supply on TB1-17 and TB1-18 is $12V_{DC}$ ⇩ Verify that SW2 is switched to the 12V position (at right). Verify that the voltage between TB1-17 and TB1-18 is 12 volts DC **Parameter Settings** ⇩ Verify that the Encoder Connect (C1) is set to axial flux incremental ⇩ Verify that the Encoder Pulses (A1) is set to a reasonable number **Rotor Alignment** ⇩ Perform a rotor alignment in the U10
Once Per Revolution Bump	The motor would jerk every time the target sensor goes pass the proximity switch NOTE: for MRL setup, use the Z Edge Count (D1) to see when the target is being seen by the drive if you can't see the motor	**Parameter Setting** ⇩ Verify that the Encoder Pulses (A1) matches the number for Measured PPR (D1) while the motor is rotating at high speed ⇩ If they don't match, enter measured PPR in Encoder Pulses (A1).
RTR NOT ALIGN	*Run command given before aligning the rotor.* The drive does not have a good fix on the motor's magnets.	**Alignment Failed** ⇩ Perform a Rotor Align (U10) ⇩ Verify the motor is connected properly ⇩ Verify that the motor isn't bad ⇩ Verify that the contactor is picked while the drive is performing the alignment

Faults/ Alarms/ Difficulties	Description	Solutions
Spd Dev Flt **or** **Spd Dev Alm**	The speed feedback is failing to properly track the speed reference	**Encoder Cable not properly grounded** ⇩ Verify encoder cable is properly grounded **Motor Runaway Condition – (PM)** ⇩ Verify that the rider wheel is firmly connected to the rotor and that the encoder spins as the rotor is spinning **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 S2 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!
Z Marker Loss	The drive is expecting a signal back from the proximity switch but doesn't see any within the expected window.	**Proximity Switch** ⇩ Verify that the target sensor is being seen by the proximity switch every time the target is lined up with the proximity switch using the Z Edge Count (D1) ⇩ Verify that there is no noise on the proximity switch channel by verifying that the Z Edge Count (D1) isn't incrementing/decrementing more than once per motor rotation ⇩ Check that the proximity switch power supply on TB1-17 and TB1-18 is $12V_{DC}$ ⇩ Verify that SW2 is switched to the 12V position (at right). Verify that the voltage between TB1-17 and TB1-18 is 12 volts DC