ECD-HPV1000-App_Note_Rev_0

Closed Loop Start Guide

Guide to set up HPV1000 drive with ECD controller in Closed Loop

May 2024

CLOSED-LOOP QUICK START-UP GUIDE

NOTE: This quick start-up guide just outlines the general wiring and parameters that should be changed / verified when a drive is installed with an ECD 100-1xx controller. Most parameters are factory set prior to shipping; however, motor data, speeds and acceleration/deceleration curves must be set by the installer. For more information and safety warnings please refer to the supplied ECD 100-1xx manual and Magnetek HPV1000 manual.

Controller Installation

Before disconnecting the old controller measure the actual lift speed, motor RPM and brake voltage as the data plates are not always accurate.
Nb: Use a hand-held tacho for accurate speed measurement.

Controller cabinet must be installed in a location free from;

- Dust and dirt.
- Excessive heat and humidity.
- Internal controller temperature not to exceed 40°C /104°F
- Excessive vibrations.
- Mist or water

When mounting controller cabinet, ensure it is suitably supported.
Weight of controllers can range from approx. 60-120kg.
Wall mounted controllers may need to be supplemented with a stand under the cabinet.
All internal components of the controller must be protected against contamination from dirt, dust, metal filings etc resulting from the mounting process and general operation.
A 100mm square open top duct mounted directly under the controller cabinet access panels is recommended for cable entry to the controller.
Ensure controller cabinet and the controller cabinet doors (use earth studs on doors) are grounded. Keep doors closed to minimize electrical noise.

Controller-Motor Wiring

It is recommended that all existing motors be re-wound to Class F specifications for variable frequency control.
Connect motor windings to terminals U, V, W and PE

- Motor cable must be shielded and grounded **BOTH** controller and motor ends. Cable should be suitably sized for the KW rating of the motor. Ensure the inverter and motor housing are grounded.
- Install the motor cable in separate conduit/duct from other wiring.
- The motor cable shield must be connected to the inverter PE terminal and the motor ground terminal.
- If an existing motor is being re-connected ensure motor is wired in a configuration which will provide full speed operation. Eg, Connect a 2 speed motor to the fast speed winding. Slow speed winding will not be used.
- Wire hoist motor over temp thermistor to terminals marked on circuit diagrams.

Brake

To prevent voltage spikes and back emf/noise affecting the microprocessor;
Brakes **MUST** be suppressed **AT THE BRAKE COIL** with supplied reverse biased diode or, a reverse biased diode with appropriate series resistor (100 Ohm, 5W) recommended.

Connect brake coils to terminals marked on circuit diagrams.

If using ECD brake board, set up VMAX and V1 according to brake coil voltage

Braking Resistor

The braking resistor should be mounted externally to the controller to and as close as possible to the controller cabinet. The braking resistor may be mounted on top of controller cabinet. (Nb. If drilling holes in cabinet protect against metal filings entering the cabinet).

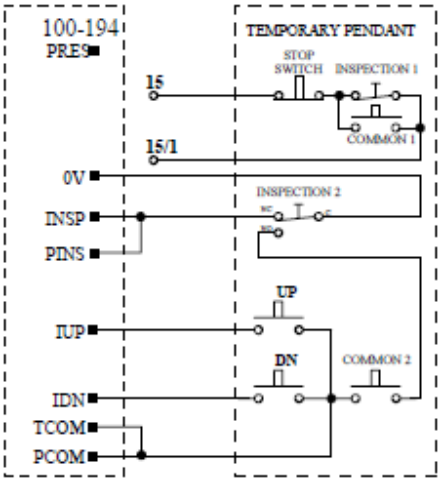
If mounting resistor to the wall, do not mount vertically with the terminals towards the top. Rising heat from resistor can damage the terminals in this position.

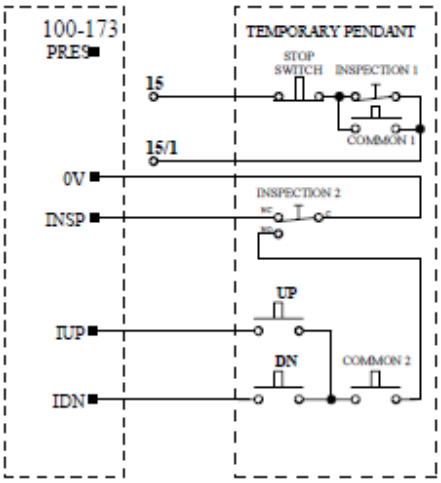
- Ensure that ventilation air can move freely around and through the resistor unit.
- Ensure the brake resistor metal enclosure is grounded.
- Wire the braking resistor terminals B1 and B2 to the HPV1000 terminals using 4 mm shielded cable and ring lugs. Ground the shield at the inverter.
- Keep the brake wiring segregated from other control wiring and the run as short as possible.
- Ensure the braking resistor temperature is monitored to avoid the brake resistor overheating. Connect the brake resistor temp switch sensor terminals on the braking resistor to terminals 61 and 62 (or 63 and 64) – Thermistor Relay trip with manual reset.
- If the braking resistor temp switch opens due to an overheating brake resistor, the circuit will drop C1 contactor, removing power from the drive. This shall also prevent a faulty brake IGBT from overheating the brake resistor to dangerous levels.

Preparation for Power Up

To prepare for **controller inspection operation**, check the following;

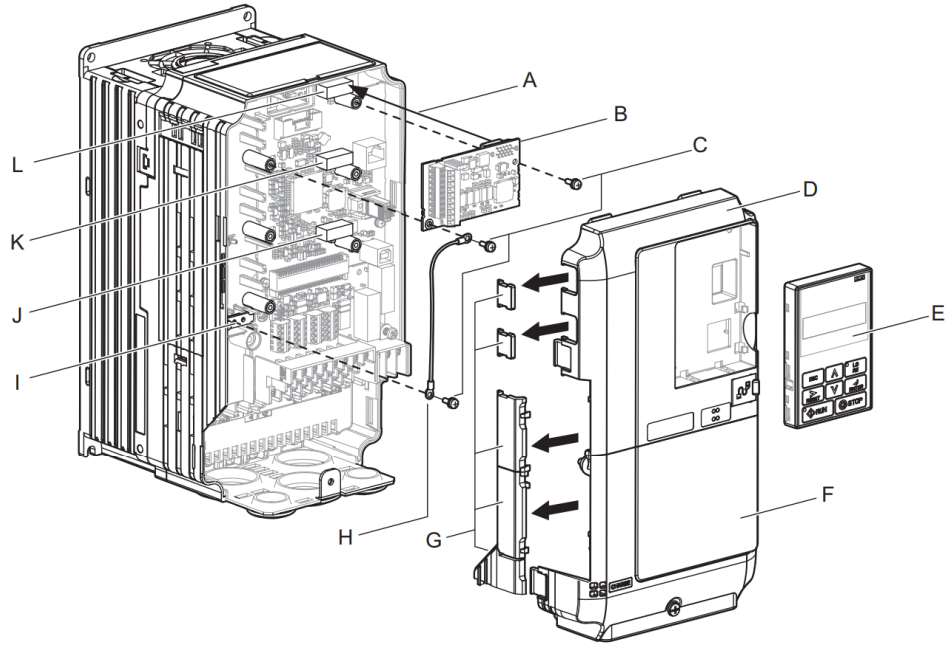
- Check controller is mounted securely.
- Wire 3 Ph. supply from main circuit breaker to controller terminals R, S, T, N, GRD.
- Ensure all connections are tight.
- Check all existing connections on controller, paying particular attention to all motor terminal and contactor connections. These may have loosened due to transport etc.
- Check braking resistor is installed, wired and grounded correctly.
- Check hoist motor is wired and grounded correctly; shield grounded both ends.
- Correct encoder card installed (PG-X3) for incremental Nb. Elevator can be run open loop (no encoder) for asynchronous motor if encoder has not been mounted. See Open Loop start up guide.
- Ensure brake has been wired correctly and diode installed.
- Ensure final limits and direction limits are in circuit and operational.
- Safety circuit and door locks to be wired in as per page 2 of circuit diagrams.
- Switch “INSP controller” on main circuit board to ON. This should be left on until the lift is ready for automatic operation. Top of car and Pit inspection can be used and take priority while on board inspection is on.
- Top of car inspection must on NORMAL (INSP ON) to allow controller inspection operation and to complete the safety circuit (common breaks the safety line). See circuit diagrams.
- For 100-194 EN81 controller, PINS and SIN1 input must also be ON to allow on board inspection. If board powers up with PINS input open, a pit reset is necessary. Pit reset is achieved by activating “PRES” for 3 seconds. Cycling power will not reset pit inspection.
- If connecting a pendant for construction operation, please see below examples





Option Card

The drive will need an option card to run in closed loop mode. Confirm that the encoder board is installed in the drive. For Asynchronous geared machine with ECD supplied LIKA incremental encoder, a PG-X3 card should be used. The card should be installed as follows;

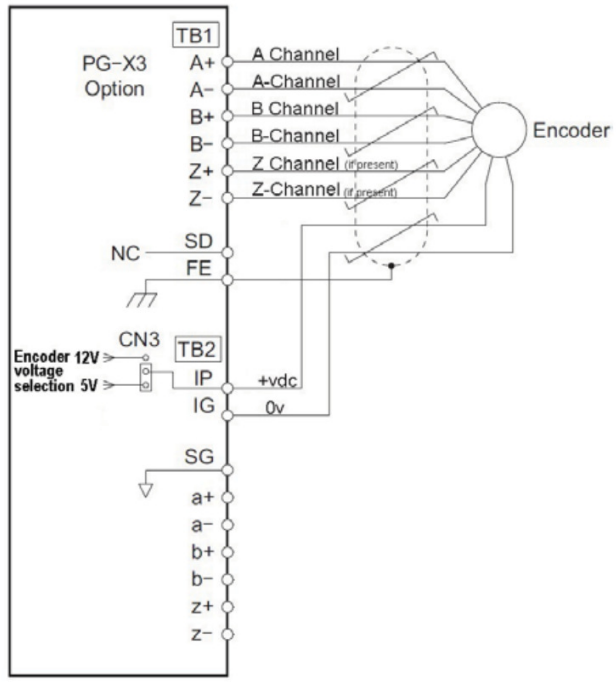


A – Insertion point for CN5
B – Option card
C – Included screws
D – Front cover
E – Keypad
F – Terminal cover
G – Removable tabs for wire routing
H – Ground wire
I – Drive grounding terminal (FE)
J – Connector CN5-A
(Not available for PG option installation.)
K – Connector CN5-B
L – Connector CN5-C

Encoder Wiring

The encoder should be wired to the drive as follows:

Quadrature Operation



Single Ended Operation

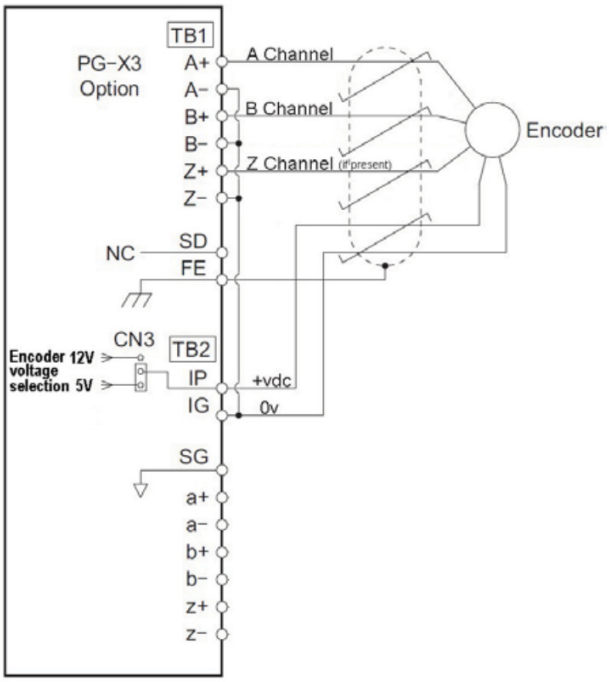


Table 1 CL: PG-X3 Encoder connections

- *IP is the +VDC, and IG as the common.*
- *The encoder voltage is selected via the jumper CN3 as either 5.5V or 12V*
- *Note that the encoder is wired in to the upper case terminals. The lower case terminals are an output from the drive and won't necessarily be used.*
- *If wired single ended, PG Card Detect (C1) must be Disabled*
- *Please refer to circuit diagrams for specific wiring schematic*

Power Up of Controller and Drive

- Turn circuit breakers on.
- Red led under LCD display on circuit board will flash. Yellow led will be on.
- Nb. When re-powering; ensure the lift is off for 10 seconds before turning back on.
- 110VAC safety circuit inputs. LR, SAF, LRX red led's on circuit board must be on.
- The INSP led must be OFF.

Controller LCD will show controller on inspection or pit inspection, IDL.
If SAF appears, safety circuit is open.
Also refer LCD section in ECD manual.

- The controller is ready to run on controller inspection operation.
- Before attempting to run the elevator, the VF Drive parameters must be entered into the drive.

Closed-Loop Operation Set-up

Enter / verify that the drive is set to run in Closed Loop Vector in the Drive Mode menu (U8)

Hoistway Parameter Set-up

Enter / verify the following parameters:

- CONTRACT CAR SPD (A1) *parameter should be the lift contract speed in m/s. This can be verified with a hand tachometer if required and adjusted if required.*
- CONTRACT MTR SPD (A1) *parameter should be set to the RPM that is required to make the lift travel at contract car speed*

NOTE: The above two parameters are utilised by the drive for many purposes regarding speed control of the lift, therefore its important these are set correctly prior to continuing any further.

Input Voltage

1) Enter the Line Voltage in the A4 menu:
    - INPUT VOLTAGE (A4) parameter should be set to the measured incoming phase to phase voltage.

Encoder Set-up

2) 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.

Autotune

3) The autotune can now be performed by navigating to the U9 menu. The drive has several options for autotuning the motor, however usually the motor will be roped, and so the 'Tune-No Rotate1' (Static) method will be used.
If the ropes are off, and the motor can turn freely, the 'Standard Tune' (Rotating) method can be used.

Navigate to the U9 menu and enter the following information:

- 'Tune-No Rotate1' (TUNING MODE SEL(U9))
- Motor Rated Power in kW (MTR RATED POWER(U9))
- Rated Voltage in V (RATED VOLTAGE(U9))
- Rated Current in A (RATED CURRENT(U9))
- Rated Frequency in Hz (RATED FREQUENCY (U9))
- Number of Poles (NUMBER OF POLES(U9))- *120 x frequency(Hz)/motor speed(rpm) if not shown on data plate.* $\frac{120 \times \text{Rated Motor Frequency}}{\text{Rated Motor Speed}}$
- Rated Motor Speed* (RATED SPEED (U9)) - *This is after slip, so NOT synchronous speed.*
- Encoder Pulses (ENCODER PPR (U9))
- No Load Current (NO-LOAD CURRENT(U9) - *Enter 35% of the RATED MOTOR CURRENT entered above for 4 pole motors or 45% for a 6 pole motor*

***Note** The rated motor rpm entered must equal what it can achieve at rated frequency, at full load and full speed. If synchronous speed is given on the dataplate, a lower RPM must be entered. Table 2 gives an indication of typical motor rated rpm for lift applications.

Synchronous speed (50hz)	Rated motor Speed (rpm)	Number of motor poles	Typical No Load Current
1500	1480 - 1340	4	35%
1000	980 - 840	6	45%

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

Once the above information has been entered and the bottom of the menu is reached the screen will display: 'Auto-tuning. Waiting for command – Tune Ready? Give Run/Hit Enter'.
At this point **DO NOT** press any keypad buttons.

Using your inspection controls, **PRESS AND HOLD** the buttons to run the lift in the **UP DIRECTION** (the lift will not move, however the tune will begin) If the drive has control of the motor contactors they will now pull in and the tune will begin.
During this process the drive will display motor speed and motor current for reference.
Once complete the drive will display "END Tune Successful". The test run UP button can now be released.

The drive will then automatically populate the following parameters in the A1 and A5 menus:

- Encoder Pulses (A1)
- Rated Mtr Power (A5)
- Rated Mtr Volts (A5)
- Rated Motor Freq (A5)
- Rated Motor Curr (A5)
- Number of Poles (A5)
- Motor Rated Slip (A5) – calculated from autotune
- No-Load Current (A5)
- Leak Inductance (A5) – calculated from autotune
- Term Resistance (A5) – calculated from autotune

Low speed inspection mode

4) Run the drive in low speed inspection mode and…
   - Start with default value of 2 for INERTIA (A1)
   - Verify encoder polarity. The motor phasing should match the encoder phasing. If you experience Speed Dev Flt/ PGO Fault the phasing may be incorrect -this can be reversed changing ENCODER CONNECT (C1) between Forwards and Reverse
   - Verify proper hoistway direction. This can be reversed by changing both the MOTOR ROTATION and ENCODER CONNECT (C1) parameters.

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	2.0	m/s	Adjust to speed the installation is rated to run at.
CONTRACT MTR SPD	Motor speed at elevator contract speed	1450.0	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.
RESPONSE	Sensitivity of the speed regulator	10.0	rad/sec	Set to 20 to improve the drive response to changes in speed reference. If the motor current and speed becomes unstable, reduce however if the value is too small, the response will be sluggish.
INERTIA	System inertia	2.00	sec	Determines the system inertia in terms of the time it takes the elevator to accelerate to contract speed. If the car is light, the value will be smaller than the default and vice versa if the car is heavy.
ENCODER PULSES	Encoder counts per revolution	1024	PPR	Obtain the Encoder PPR from the encoder nameplate and enter in this parameter.
MTR TORQUE LIMIT	This parameter sets the maximum motoring torque the drive will produce in the motor	200.0	%	Determines the maximum torque allowed when in the motoring direction. This is generally left at the default setting. If the drive intermittently gives 'Hit Torque Limit' messages, this can be increased. 250% would be a recommended value.
REGEN TORQUE LIMIT	This parameter sets the maximum regenerating torque the drive will produce in the motor	200	%	Determines the maximum torque allowed when in the regenerating direction. This is generally left at the default setting. If the drive intermittently gives 'Hit Torque Limit' messages, this can be increased. 250% would be a recommended value.

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 VOLTAGE	Nominal line-line AC input Voltage, RMS	0	Volts AC	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 DETECT LEVEL	DC Bus Voltage level for undervoltage fault	500	Volts DC	Usually set to around 70% of the DC Bus voltage while idle (Can be monitored in the D2 menu)
PWM FREQUENCY	Carrier frequency	8	kHz	Setting this parameter to 8kHz is a good starting value to ensure low motor noise. Increasing this value will derate the drive.

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
MTR RATED POWER	Rated motor output power	0	kW	Set to motor kW rating as per the motor nameplate (Should be set in U9 during autotune)
RATED MTR VOLTS	Rated Motor Voltage	0	VAC	Set to motor Voltage rating as per the motor nameplate (Should be set in U9 during autotune)
RATED MOTOR FREQ	Rated excitation frequency	0	Hz	Set to motor frequency rating as per the motor nameplate (Should be set in U9 during autotune)
RATED MOTOR CURR	Rated motor current	0	Amps	Set to motor nameplate rated current (Should be set in U9 during autotune)
NUMBER OF POLES	Motor poles	4	none	Adjust to set number of motor poles (Should be set in U9 during autotune)
MOTOR RATED SLIP	The slip frequency of the motor	0	Hz	Set to the slip frequency of the motor (Should be set in U9 during autotune)
NO-LOAD CURRENT	No Load Current	0	A	If it is not known, use the default value in the U9 menu (Should be set in U9 during autotune)
LEAK INDUCTANCE	Leakage Inductance	0	%	These parameters should be set during the autotune (U9)
TERM RESISTANCE	Phase to phase resistance of motor	0	%	

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

Basics U8

Parameter	Description	Default	Choices	Suggested Adjustment
DRIVE MODE	Drive operation	Closed Loop Vect	V/f Control Open Loop Vector Closed Loop Vector PM ClosedLoop Vct	Set to Closed Loop Vect (Note: not “PM ClosedLoop Vct”!) to run in Closed Loop mode. Can be set to Open Loop Vect to run without encoder feedback for diagnosis purposes

Table 6 CL: Important parameter in U8 menu to set/check when setting up a drive in closed-loop

Autotune U9

Parameter	Description	Default	Choices	Suggested Adjustment
Autotune	Autotune menu	Standard Tune	Standard Tune Tune-No Rotate1 Tune-No Rotate2 Term Resistance	'Tune-No Rotate1' is the method to use if the motor is already roped. If the motor is not roped then the 'Standard Tune' method can be used to learn the No Load Current value. Note that when performing the autotune, the drive will also ask for the following parameters: • Rated Motor Power in kW • Rated Motor Voltage in V • Rated Motor Current in A • Rated Motor Frequency in Hz • Number of Motor Poles • Rated Motor Speed • Encoder Pulses • No Load Current

Table 7 CL: Important parameters in U9 menu to set/check when setting up a drive in closed-loop