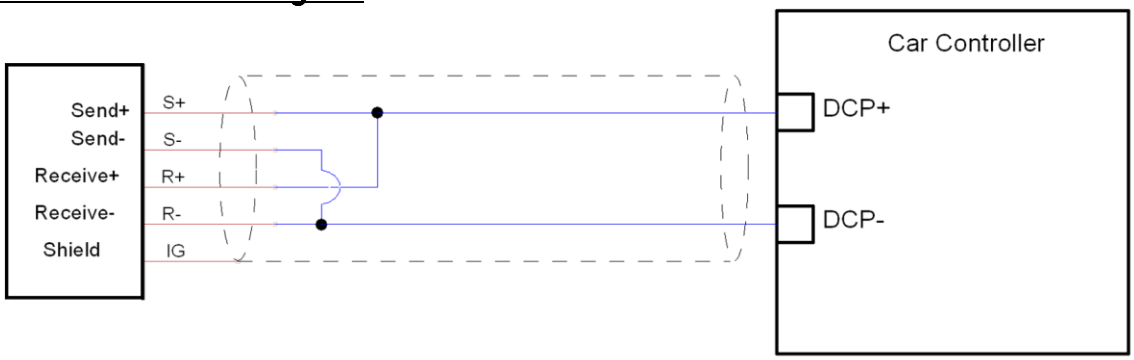
HPV1000-App_Note_33b

DCP Closed Loop Guide

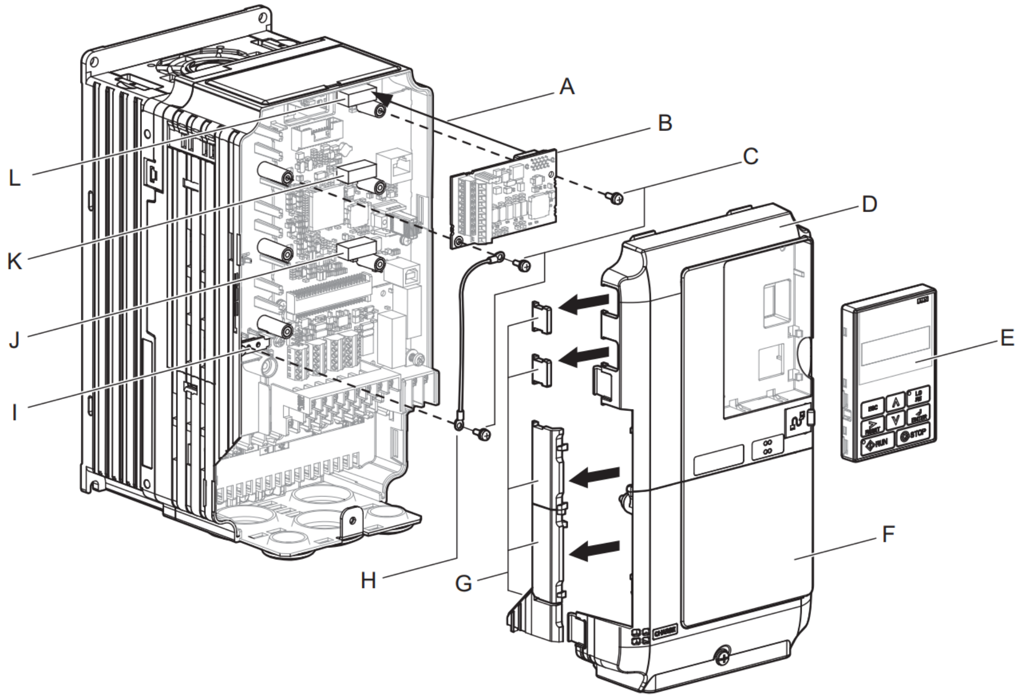
Guide to setting up induction motors using DCP with Yaskawa Firmware

DCP Connection Diagram



Option Card

1) The drive will need a PG-X3 encoder option card to run in Closed Loop mode. Confirm that the encoder board is installed in the drive 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

2) The encoder should be wired to the drive as follows:

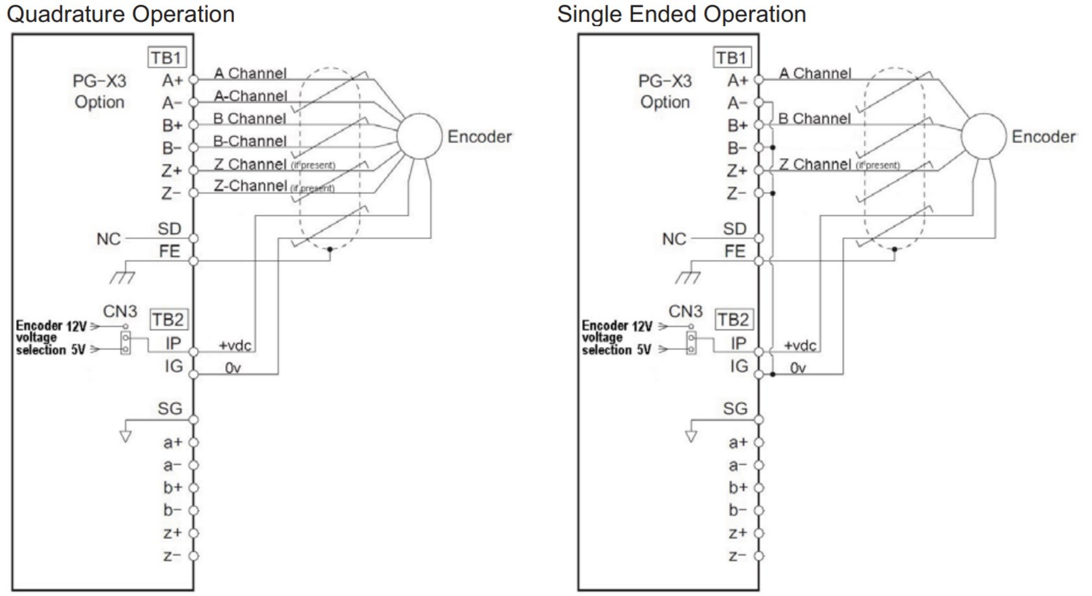


Table 1 CL: PG-X3 Encoder connections

- *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 (F1-20) must be Disabled*

Encoder Set-up

3) 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.

Power up and parameterisation

- Enter / verify that the drive is set to run in 'PM Closed Loop Vector' in the Drive Mode menu (A1-02)

Autotune

Controller Setup

For some car controllers it is necessary for the control system to allow extra time to complete an autotune:

Kollmorgen	Böhnke & Partner

For Kollmorgen MPK411 controllers use the "Synchronous Motor Phasing" option in the "Completion Testing" menu.
 	
• First the completion testing input must be closed:
  ○ Either by linking X1-200 to terminal 4 on the MPK411
  ○ Or on later controllers using the XDP-DP switchable link
  Sheet two of the drawings will show which option with terminal 4 connected to either a dotted line for option 1, or the switchable link for option 2.
• Then the synchronous motor phasing test must be activated on the MPK411
  ○ Go to :
  Commissioning and testing ➔ Testing ➔ Test Mode and select "Synchronous Motor Phasing"
  ○ Then go to Commissioning and testing ➔ Testing ➔ Completion Testing and select "Activate" to change the state from "Test is ready" to "Test is running"
  NOTE: You must select Activate each time you do an Autotune.
	For B+P controllers use the "Drive Tuning Operation" option in the "Maintenance Function" menu:
	• Go to:
	Service Menu ➔ Maintenance ➔ Maintenance Functions ➔ Drive Tuning Operation and select "On"

4) The autotune can now be performed. we recommend the 'Tune-No Rotate1' (Static) method is used.

First, ensure parameter S1-12 is set to 2.

Navigate to the Autotune menu and enter the following information:

- 'Tune-No Rotate1' (T1-01 TUNING MODE SEL)
- Motor Rated Power in kW (T1-02 MTR RATED POWER)
- Rated Voltage in V (T1-03 RATED VOLTAGE)
- Rated Current in A (T1-04 RATED CURRENT)
- Rated Frequency in Hz (T1-05 RATED FREQUENCY)
- Number of Poles (T1-06 NUMBER OF POLES)
- Rated Motor Speed* (T1-07 RATED SPEED) - *This is after slip, so NOT synchronous speed.*
- Encoder Pulses (T1-08 ENCODER PPR)
- No Load Current (T1-09 NO-LOAD CURRENT) - *Enter 35% of the RATED MOTOR CURRENT entered above for 4 pole motors or 45% for a 6 pole motor*

Stop at this point in the menu and begin running your lift UP on test control (note: the lift will not run, it is purely to initiate the autotune). The drive will ignore the run input until you press the up arrow on the keypad once more, and then press the run key on the keypad. At this point the drive will begin the autotune. During this process the drive will display motor current on the right hand side of the screen for reference. Maintain the test run until the drive displays "END Tune Successful". The test run UP button can then be released.

***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

Inspection Run

5) Run the drive in low speed inspection mode and…
   - Ensure Motor Contactors are closing, Brake is lifting, and the car can move freely in the shaft
   - Verify encoder polarity. The motor phasing should match the encoder phasing. If you experience Speed Dev Flt/HIT TRQ LIM alarm the phasing may be incorrect –the most likely cause is incorrect motor phasing. Change Motor Rotation (B1-14).
   - Verify proper hoistway direction. If this is running with correct speed and control, but in the incorrect direction, swap both Encoder Connect (F1-05) and Motor Rotation (B1-14).

Equalizing speeds between car controller and drive

Enter sheave diameter (o1-20) eg. 330 = 330mm
Enter roping arrangement (o1-21) eg. 1 = 1:1, 2 = 2:1
Ensure Gear ratio (o1-22) = 1

For correct DCP4 operation good speed calibration is critical. Speed calibration can take place after the learn run on the car controller has been completed.

In the drive, monitor the speed feedback in U1-05 and note the constant running speed.
In the car controller, navigate to the display which shows actual car speed from the absolute position system.
Take the lift to the top floor and then run the lift to the bottom floor, make a note of the speed displayed on the car controller during travel (Vreal).

If this speed is not exactly the same as the speed displayed in the drive, increase or reduce the o1-20 parameter until the speeds match using the following formula:-

new o1-20 = Vreal / U1-05 x current o1-20

Final Stop Position Adjustment

After the above steps, the final stopping position should be very accurate however, if the final floor level position is out by a consistent amount then the drive has the ability to fine tune the floor level further by +/- 10mm using parameter S7-30. Adjustment examples are below:-

If the lift has travelled through floor by 5mm – set S7-30 to -5mm
If the lift has stopped short of floor by 3mm – set S7-30 to 3mm

Drive Parameter Checklist for DCP4: (Parameters specific to DCP operation)

Parameter Name	Default Value and Range	Required Setting	Function
Serial Mode (H5-13)	3 DCP3 – 4 DCP4	4 (DCP4)	Sets the type of DCP used. DCP3 is a traditional multistep speed profile with levelling DCP4 allows direct to floor travel **NOTE: Power must be cycled after changing this setting**
Speed Reference Source (b1-01)	6	6 (DCP)	Instructs the drive to follow the serial DCP speed command
Operation Method Source (b1-02)	6	6 (DCP)	Instructs the drive to follow the serial DCP run command
Traction Sheave Diameter (o1-20)	400mm	Measure Sheave	Sets the sheave diameter. Adjust this setting to calibrate speed between drive and controller to ensure accurate floor levels.
Roping Ratio (o1-21)	2	1 = 1:1 2 = 2:1	Roping arrangement
Gear Ratio (o1-22)	1.00	gearless = 1.00	Gearbox ration from dataplate
C1 Distance Prolongation Type (S7-40)	0-1	0	Controller Distance Change Method Selection. 0: Prolongation (for MPK400c, bp30x) 1: Shortening (for LiSA20, SLC4-20)
Level Offset (S7-30)	0-1000mm	0mm	Adds a fixed offset to the level position. Used to trim the final few mm of floor level.

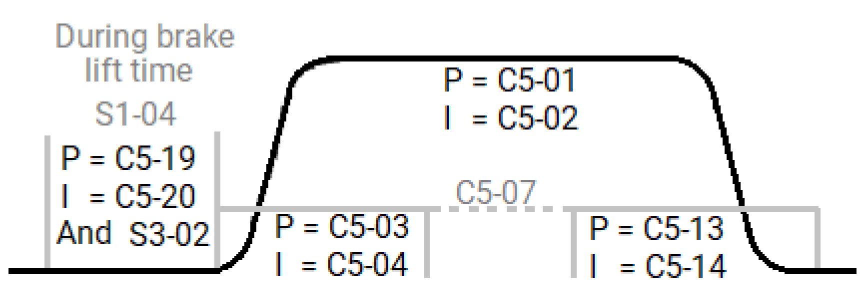
Speed Settings for DCP4:

V0 (D1-26)	0-3000m/s	0.08m/s	Low Speed
VN (D1-23)	0-3000m/s	0.03m/s	Relevelling Speed
V1 (D1-04)	0-3000m/s	0.00m/s	Optional DCP3 Speed
V2 (D1-03)	0-3000m/s	0.00m/s	Optional DCP3 Speed
V3 (D1-02)	0-3000m/s	0.5m/s (e.g)	Mid Speed (Only V3 and V4 are used with DCP4)
V4 (D1-01)	0-3000m/s	2.0m/s (e.g)	High Speed (Only V3 and V4 are used with DCP4)
VI (D1-24)	0-3000m/s	0.30m/s	Inspection Speed
Border Speed (D1-30)	0-200%	120%	When the lift Is travelling at or below this speed the drive will advise the control system. Used for speed monitoring when approaching terminal floors

Over Speed (D1-31)	0-200%	120%	When the lift Is travelling at or below this speed the drive will advise the control system. Used for overspeed detection.

ASR Regulator Settings:

Parameter Name	Default Value and Range	Required Setting	Function
Brake Time Start (S1-04)	0.4s (0.00 – 10.00s)	1.0	Sets the time the drive will hold zero speed at start while the brake lifts
Brake Time Stop (S1-05)	0.6s (0.00 – 10.00s)	1.0	Sets the time the drive will hold zero speed at stop while the brake drops
ASR Prop Gain 1 (C5-01)	0 - 300	20	Sets the proportional gain 1 of the speed control loop (ASR). High Speed P Gain
ASR Int Gain 1 (C5-02)	0.00 – 300.00s	0.5	Sets the Integral gain 1 of the speed control loop (ASR). High Speed I Time
ASR Prop Gain 2 (C5-03)	0 - 300	20	Sets the proportional gain 2 of the speed control loop (ASR). Low Speed P Gain for Accel
ASR Int Gain 2 (C5-04)	0.00 – 300.00s	0.5	Sets the Integral gain 2 of the speed control loop (ASR). Low Speed I Time for Accel
ASR Gain Change Level (C5-07)	0.0% ~ 100.0%	2.0%	Sets the frequency for switching between high speed and low speed gains
ASR Prop Gain 3 (C5-13)	0 - 300	20	Sets the proportional gain 3 of the speed control loop (ASR). Low Speed P Gain for Decel
ASR Int Gain 3 (C5-14)	0.00 – 300.00s	0.3	Sets the Integral gain 3 of the speed control loop (ASR). Low Speed I Time for Decel
P Gain at Pos Loc (C5-19)	0 - 300	20	Sets the proportional gain of the speed control loop (ASR) During Pos Loc
I Time at Pos Loc (C5-20)	0.00 – 300.00s	0.3	Sets the Integral gain of the speed control loop (ASR) during Pos Loc



Accel and Decel Settings Settings:

Parameter Name	Default Value and Range	Required Setting	Function
Accel Rate (C1-01)	3.00s	3.00s	Defined as the time to accelerate/decelerate the lift between zero and full speed. Increase to soften and decrease to sharpen accel and decel.
Decel Rate (C1-02)	3.00s	3.00s	
Acceleration Jerk at Start (C2-01)	3.00s	0.5s	Accel Jerk in parameter. Increase to soften, decrease to sharpen Accel Jerk In
Acceleration Jerk at End (C2-02)	3.00s	0.5s	Accel Jerk out parameter. Increase to soften, decrease to sharpen Accel Jerk In
Deceleration Jerk at Start (C2-03)	0.5s	0.5s	Decel Jerk in parameter. Increase to soften, decrease to sharpen Decel Jerk In
Deceleration Jerk at End (C2-04)	0.5s	2.5s	Decel Jerk out parameter. Increase to soften, decrease to sharpen Decel Jerk out

Misc Direct To Floor Settings:

Parameter Name	Default Value and Range	Required Setting	Function
Manufacturer Code (S7-50)	0-1	0 (Yask EU)	Sets the manufacturer string sent in the I0 message. **NOTE: Power must be cycled after changing this setting**

Display Paramters:

Parameter Name	Unit	Function
Motor Speed (U1-05)	m/s	Display the car speed in m/s
Command Byte (U4-82)	Bin	First byte of DCP frame (Controller à Drive) B0: Drive Controller Enable B1: Travel Command B2: Stop Switch B3: Travel command transfer in data bytes B4: Travel Direction B5: Speed Change B6: Remaining Distance B7: Error in last reply message
Status Byte (U4-83)	Bin	First byte of DCP frame (Drive à Controller) S0: Drive Controller Ready S1: Travel active S2: Alarm active S3: Fault active S4: Motor speed below 0.3 m/s S5: Distance accepted S6: Brake open S7: Error in last reply message
Remaining Distance (U4-50)	0.001m	Shows the remaining distance until the commanded distance is reached (value originating

<table>
<tr><td></td><td></td><td>from lift controller, contains distance prolongations)</td></tr>
<tr><td>Braking Distance
(U4-51)</td><td>0.001m</td><td>Shows the braking distance for a currently driven speed (matches the remaining distance at the time of deceleration)</td></tr>
<tr><td>Internal Distance Command
(U4-52)</td><td>0.01m</td><td>Shows the total commanded distance including prolongations (calculated from remaining distance)</td></tr>
<tr><td>Absolute Remaining Distance
(U4-58)</td><td>0.001m</td><td>For controllers using Distance Shortening, the absolute initial distance when starting a travel is memorized internally and shown here</td></tr>
<tr><td>V Speed Deceleration Distance
(U4-71 – U4-79)</td><td>0.001m</td><td>Shows the braking distance occurring when decelerating from corresponding d1-xx speed:
<table>
<tr><td></td><td>d1-xx</td><td>U4-7x</td></tr>
<tr><td>V0</td><td>d1-26</td><td>U4-71</td></tr>
<tr><td>V1</td><td>d1-04</td><td>U4-73</td></tr>
<tr><td>V2</td><td>d1-03</td><td>U4-74</td></tr>
<tr><td>V3</td><td>d1-02</td><td>U4-75</td></tr>
<tr><td>V4</td><td>d1-01</td><td>U4-76</td></tr>
<tr><td>V5</td><td>d1-07</td><td>U4-77</td></tr>
<tr><td>V6</td><td>d1-06</td><td>U4-78</td></tr>
<tr><td>V7</td><td>d1-05</td><td>U4-79</td></tr>
<tr><td>VN</td><td>d1-23</td><td>U4-72</td></tr>
</table></td></tr>
<tr><td>I7 Received V4 Distance
(U4-90)</td><td>0.001m</td><td>Distance transmitted before travel commenced from the controller</td></tr>
<tr><td>I7 Transmitted Distance
(U4-92)</td><td>0.001m</td><td>Distance the drive responds with during the I7 exchange.</td></tr>
<tr><td>I7 Transmitted Decel Distance
(U4-92)</td><td>0.001m</td><td>Distance the drive requires to decelerate from the commanded V speed.</td></tr>
</table>