

## 3-Axes Pick and Place

Associated files:

- Basic Pick and Place – C.qcp
- Basic Pick and Place – X.qcp
- Basic Pick and Place – Y.qcp
- Intermediate Pick and Place – Master.qcp
- Intermediate Pick and Place – Slave 1.qcp
- Intermediate Pick and Place – Slave 2.qcp
- XY Coord.txt

## Required Software

QuickControl

Rev 4.6 or higher

## Overview

This document describes a Pick and Place application. This particular application is a precision system for filling a carton with golf balls. The system places golf balls at 18 predetermined points in a carton and then moves a new carton in place when complete. The 3-axes communicate with each other to move the hose to a predetermined point and remove a locking pin to drop a golf ball then move the full carton to make room for an empty carton.

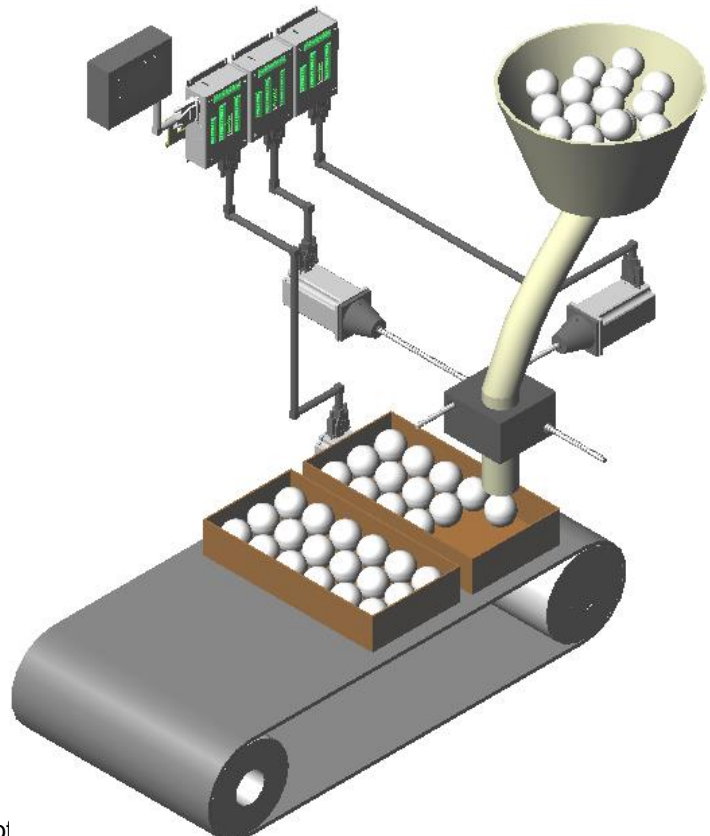
The application notes contains two example:

- Basic: Uses I/O to communicate between controllers.
- Intermediate: Uses CANopen® to communicate between controllers.

The user should have an understanding of the following topics:

- Homing Techniques (QCI-AN001)
- Register Files (QCI-AN048)
- CANopen® (CANopen User Manual)-required for intermediate example only.

This application note means to provide an understanding of a basic 3-axes system using QuickSilver controllers and motors.



## System Parameters

This example requires:

- 3 x Controllers, Motors and Associated Cables
- 1 x Conveyer Belt
- 1 x Actuator
- 1 x Ball Hopper
- Multiple Sensors, Balls and Cartons
- Optional HMI or PC controller

## Basic Pick and Place Example

This example uses I/O to communicate between the controllers.

### Basic Pick and Place - C.qcp

#### Pick and Place Homing

This program moves positive to find a sensor home position.

Line# Oper	Label	Command
1:REM		Pick and Place Basic: Carton  The most basic Pick and Place program.
2:REM		Homing Routine
3:MRV		Move 999999 counts @ acc=20000.67 cps/s vel=8000 cps Stop when "I/O #1" is LOW/FALSE
4:REM		Run Movement Program
5:LRP		Load And Run Program: Program = "Pick and Place Basic"

#### Pick and Place Basic

The first operation sets the controller to a ready state and waits for the other controllers to finish filling the carton with balls.

Once ready, the filled carton moves down the conveyer while an empty carton moves into place for filling.

The process repeats for the next carton.

Line# Oper	Label	Command
1:REM		Pick and Place Basic: Carton  The most basic Pick and Place program.
2:REM		Controller is Ready
3:COB		Clear "I/O #4"
4:REM		Wait for Other Axes to be Ready
5:WBS		Wait On Bit State Until "I/O #5" is LOW/FALSE
6:REM		Controller is Busy
7:SOB		Set "I/O #4"
8:REM		Move out of range
9:MRV		Move 999999 counts @ acc=20000.67 cps/s vel=4000 cps Stop when "I/O #1" is HIGH/TRUE
10:REM		Move next carton in place
11:MRV		Move 999999 counts @ acc=20000.67 cps/s vel=4000 cps Stop when "I/O #1" is LOW/FALSE
12:REM		Restart Process for Next Carton
13:JMP		Jump to "READY"

## Basic Pick and Place – X.qcp and Basic Pick and Place – Y.qcp

### Pick and Place Homing

This homing sequence uses the Hard Stop home sequence to determine the minimum and maximum travel. This requires some initialization steps:

- 1) Disable Kill Motor Conditions – needed to keep controller from ending the program when hitting a Hard Stop.
- 2) Set Error Limits – needed to let the motor register sense a Hard Stop quickly.
- 3) Set Torque Limits – needed to prevent the motor from damaging the equipment.

The first move command is in a negative direction. This finds the upper limit then moves away a small amount away before setting the actual position.

The next move is in a positive direction. This finds the lower limit. This works the same as the far positive move.

The next operation sets the normal Torque Limits then runs the movement program.

Both X-axis and Y-axis use the homing routine. Line 32 loads either the X or Y Pick and Place program.

Refer to the Application Note “QCI-AN001 Homing Techniques” for further explanation.

After homing, the program load and runs “Pick and Place Basic – X” and begins the movement sequence.

Line# Oper	Label	Command
1:REM		Pick and Place Basic: X Axis The most basic Pick and Place program.
2:REM		Begin Homing Routine
3:REM		Disable Kill Motor Conditions
4:KMC		Kill Motor Conditions:
5:REM		Set Error Limits
6:ERL		Error Limits: Moving Limit = 500 counts Holding Limit = 200 counts Delay to Holding = 120 mSec
7:REM		Set Homing Torque Limits
8:TQL		Torque Limits: Closed Loop Holding = 50 % Closed Loop Moving = 50 % Open Loop Holding = 30 % Open Loop Moving = 30 %
9:REM		Move Far Negative
10:MRV		Move -999999 counts @ acc=20696.06 cps/s vel=4000 cps Stop when "Moving Error" is HIGH/TRUE
11:REM		Clear Error
12:CIS		Clear Internal Status
13:REM		Move off Wall a small amount
14:MRT		Move 250 counts @ ramp time=99.96 mSec total time=200.04 mSec
15:REM		Set Negative Wall
16:ZTP		Zero Target and Position
17:REM		Move Far Positive
18:MRV		Move 999999 counts @ acc=20696.06 cps/s vel=4000 cps Stop when "Moving Error" is HIGH/TRUE
19:REM		Clear Error
20:CIS		Clear Internal Status
21:REM		Move off Wall a small amount
22:MRT		Move -250 counts @ ramp time=99.96 mSec total time=200.04 mSec
23:REM		Set Positive Wall
24:CLX		Max Limit[29] = Actual Position[1]
25:REM		Move to Home
26:MAV		Move to 0 counts @ acc=20000.67 cps/s vel=8000 cps
27:REM		Set Normal Torque Limits
28:TQL		Torque Limits: Closed Loop Holding = 75 % Closed Loop Moving = 100 % Open Loop Holding = 30 % Open Loop Moving = 30 %
29:REM		Run Movement Program
30:LRP		Load And Run Program: Program = "Pick and Place Basic - X Axis"

## Basic Pick and Place – X.qcp

### Pick and Place Basic – X Axis

This program uses a For-Next loop to control the amount of balls per carton based on the Register File Array, XY Coord.

The next command clears I/O #4 to signal a Ready Status to the other axes. Then this axis waits for the other axes to be ready.

The next command loads data from the Register File Array, "XY Coord.txt". The file contains the drop locations.

The axis sets I/O #4 to signal a Busy Status to the other axes. Then this axis begins a move command to the location loaded from XY Coord.

The axis waits for the Y-axis to be finished moving before beginning the ball drop procedure. This procedure triggers an actuator to retract a stop pin and replace the pin 200 milliseconds later.

After the ball drop, the loop repeats. This will continue until the end of the XY Coord file. At the end of the file, the axis moves back to the home position and then clears I/O #7. This tells the C axis to load the next carton.

The program then jumps back to the beginning to fill the next carton.

Line# Oper	Label	Command
1:REM		Pick and Place Basic: X Axis The most basic Pick and Place program.
2:REM		Placement Loop
3:FOR	READY	FOR "Accumulator[10]" = each row in Register File Array "XY Coord"
4:REM		Controller is Ready
5:COB		Clear "I/O #4"
6:REM		Wait for Other Axes to be Ready
7:WBS		Wait On Bit State Until "I/O #5" is LOW/FALSE
8:WBS		Wait On Bit State Until "I/O #6" is LOW/FALSE
9:REM		Load the current Ball and Position
10:RLM		Register Load Multiple: Load 1 row of Register File Array "XY Coord" starting with "Ball[30]" from NV address in Accumulator[10]
11:REM		Controller is Busy
12:SOB		Set "I/O #4"
13:REM		Move to Placement Position
14:RAT		Move to location stored in "X Coordinate[31]" Register @ ramp time=99.96 mSec total time=200.04 mSec
15:REM		Wait for Y Axis to be Ready
16:WBS		Wait On Bit State Until "I/O #5" is LOW/FALSE
17:REM		Retract Ball Stop Pin
18:SOB		Set "I/O #101"
19:REM		Wait for Ball to Pass
20:DLY		Delay for 200 mSec
21:REM		Insert Ball Stop Pin
22:COB		Clear "I/O #101"
23:REM		Continue Loop
24:NXT		Next (FOR line 3)
25:REM		Move to Home Position
26:MAT		Move to 0 counts @ ramp time=999.96 mSec total time=5000.04 mSec
27:REM		Load new Carton
28:COB		Clear "I/O #7"
29:REM		Wait for signal to register
30:DLY		Delay for 200 mSec
31:REM		Reset output
32:SOB		Set "I/O #7"
33:REM		Continue with New Carton
34:JMP		Jump to "READY"

## Basic Pick and Place – Y.qcp

### Pick and Place Basic – Y Axis

This program uses a For-Next loop to control the amount of balls per carton based on the Register File Array, XY Coord.

The next command clears I/O #4 to signal a Ready Status to the other axes. Then this axis waits for the other axes to be ready.

The next command loads data from the Register File Array, "XY Coord.txt". The file contains the drop locations.

The axis sets I/O #4 to signal a Busy Status to the other axes. Then this axis begins a move command to the location loaded from XY Coord.

After the ball drop, the loop repeats. This will continue until the end of the XY Coord file.

The program then jumps back to the beginning to fill the next carton.

Line# Oper	Label	Command
1:REM		Pick and Place Basic: Y Axis The most basic Pick and Place program.
2:REM		Placement Loop
3:FOR	READY	FOR "Accumulator[10]" = each row in Register File Array "XY Coord"
4:REM		Controller is Ready
5:COB		Clear "I/O #4"
6:REM		Wait for Other Controller to be Ready
7:WBS		Wait On Bit State Until "I/O #5" is LOW/FALSE
8:WBS		Wait On Bit State Until "I/O #6" is LOW/FALSE
9:REM		Load the current Ball and Position
10:RLM		Register Load Multiple: Load 1 row of Register File Array "XY Coord" starting with "Ball[30]" from NV address in Accumulator[10]
11:REM		Controller is Busy
12:SOB		Set "I/O #4"
13:REM		Move to Placement Position
14:RAT		Move to location stored in "Y Coordinate[32]" Register @ ramp time=99.96 mSec total time=200.04 mSec
15:REM		Continue Loop
16:NXT		Next (FOR line 3)
17:REM		Move to Home Position
18:MAT		Move to 0 counts @ ramp time=999.96 mSec total time=5000.04 mSec
19:REM		Continue with New Carton
20:JMP		Jump to "READY"

## Intermediate Pick and Place

This example uses CANopen® to communicate between controllers.

### Intermediate Pick and Place - Master.qcp

#### Initialization

This program will initialize the Master controller for control of the whole system.

The first command establishes a Kill Motor Recovery routine, Error. The Kill Motor triggers with an emergency stop switch, a Temperature/Driver Enable Fault, a Moving Error or Holding Error.

The next set of commands sets up the CANopen Protocol, which allows the controller to transmit and receive registers from the Slave controllers. The Master transmits All Status[39], Slave 1 Position[46] and Slave 2 Position[47] while receiving the Slave 1 Status[42] and Slave 2 Status[43]. All of the register numbers in the Master program are local.

After initializing CANopen and Kill Motor Conditions, the Master waits for the Slaves to transmit a Ready Status before loading the Carton program.

Line# Oper	Label	Command
1:REM		Pick and Place Intermediate: Master Intermediate Level Program  I/O #1 = Emergency Stop I/O #2 = Clear for Restart I/O #101 = Pin Activation I/O #102 = Ball Drop Check I/O #103 = Carton Placement Point
2:REM		Set up Motor Recovery routine
3:KMR		Kill Motor Recovery: Program = "Error"
4:REM		Set Kill Motor Conditions
5:KMC		Kill Motor Conditions: If "I/O #1" LOW or Temp/Driver Enable Fault or Moving Error TRUE or Holding Error TRUE
6:REM		CAN Protocol
7: CBD		CAN Baud Rate = 1 Mb/Sec
8: CNL		CAN NMT State = Operational
9: CTRL		CTRL: CAN Transmit Register, Local Tx Channel: #1 Lower 16 Bits of Local Register: All Status[39] Lower 16 Bits of Local Register: Slave 1 Position[46] Lower 16 Bits of Local Register: Slave 2 Position[47]
24: CRML		CRML: CAN Register Map, Local Remote Unit ID: 17 Remote Tx Channel: #1 Local Rx Channel: #2 Local Register: Slave 1 Status[42]
34: CRML		CRML: CAN Register Map, Local Remote Unit ID: 18 Remote Tx Channel: #1 Local Rx Channel: #3 Local Register: Slave 2 Status[43]
44: REM	WAIT	Wait for other controllers to be Ready
45: JNE		Jump to "0" When "Slave 1 Status[42]" != 1
46: JNE		Jump to "0" When "Slave 2 Status[43]" != 1
47: REM		Begin Movement Program
48: LRP	RUN	Load And Run Program: Program = "Carton"

## Intermediate Pick and Place - Master.qcp

### Carton

This program loads data from the file "XY Coord" into the registers Ball[45], Slave 1 Position[46] and Slave 2 Position[47] for transmission to the Slaves. Once all 18 balls have been loaded, this program executes a move, which runs the conveyer belt to remove a full carton and load an empty carton.

The first command establishes a loop, which will run until the end of the Register File Array, XY Coord.

The program checks the Status of the Slaves to confirm their movements are complete before retracting the holding pin, dropping a golf ball and then replacing the holding pin.

After running through all of the data in XY Coord, the controller moves the next carton in place then restarts the sequence.

Line# Oper	Label	Command
1:REM		Pick and Place Intermediate: Master Intermediate Level Program  I/O #1 = Emergency Stop I/O #2 = Clear for Restart I/O #101 = Pin Activation I/O #102 = Ball Drop Check I/O #103 = Carton Placement Point
2:REM	READY	Controller is Ready
3:FOR		FOR "Accumulator[10]" = each row in Register File Array "XY Coord"
4:RLM		Register Load Multiple: Load 1 row of Register File Array "XY Coord" starting with "Ball[45]" from NV address in Accumulator[10]
5:CLX	CHECK	Slave Status[41] = Slave 1 Status[42] * Slave 2 Status[43]
6:WRP		Write 1 to "Master Status[40]" Register
7:CLX		All Status[39] = Master Status[40] * Slave Status[41]
8:REM		Wait for All Other Controllers to be Ready
9:JNE		Jump to "CHECK" When "All Status[39]" != 1
10:REM		Controller is Busy
11:WRP		Write 0 to "Master Status[40]" Register
12:REM		Retract Ball Stop Pin
13:COB		Clear "I/O #101"
14:REM		Wait for Ball to Pass
15:WRP		Write 200.04 mSec to "Delay Counter[5]" Register
16:JOI	DELAY	Jump On Input to "DROPPED" When "I/O #102" is LOW/FALSE
17:WDL		Wait Delay
18:JMP		Jump to "DELAY"
19:REM		Insert Ball Stop Pin
20:SOB	DROPPED	Set "I/O #101"
21:REM		Continue Loop Until Carton is Filled
22:NXT		Next (FOR line 3)
23:REM		Load New Carton
24:MRV		Move 999999 counts @ acc=20000.67 cps/s vel=4000 cps Stop when "I/O #103" is HIGH/TRUE
25:MRV		Move 999999 counts @ acc=20000.67 cps/s vel=4000 cps Stop when "I/O #103" is LOW/FALSE
26:REM		Restart Process for Next Carton
27:JMP		Jump to "READY"

## Intermediate Pick and Place - Master.qcp

### Error

This program recovers the controller and motor from a Kill Motor event.

The first command sets the Status to an Error state and then waits for 500 milliseconds before beginning recovery.

The Target to Position command sets the current actual position as the current target position. The motor then Clears Internal Status which clears the Kill Motor error.

The Kill Motor Conditions reset and the Motor Driver re-enables before waiting for an All Clear command from the user.

The last command returns operation at the movement program.

Line# Oper	Label	Command
1:REM		Pick and Place Advanced: Master  Advanced Level Program  Error Mode  Status[27] Register Codes 0 = Ready 1 = Busy 2 = Kill Motor Error
2:WRP		Write 2 to "Master Status[40]" Register
3:REM		Give the motor time to stop
4:DLY		Delay for 500 mSec
5:REM		Target to Position will effectively zero the position error
6:TTP		Target to Position
7:REM		Reset Internal Status Word to clear any latched bits
8:CIS		Clear Internal Status
9:REM		Reset the Kill Motor Conditions
10:KMC		Kill Motor Conditions: If "I/O #1" LOW or Temp/Driver Enable Fault or Moving Error TRUE or Holding Error TRUE
11:REM		Enable Motor Driver again. Give power to the rotor
12:EMD		Enable Motor Driver
13:REM		Waits for the User to Clear the System for a Restart
14:WBS		Wait On Bit State Until "I/O #2" is LOW/FALSE
15:REM		Restart Controller
16:LRP		Load And Run Program: Program = "Carton"



## Intermediate Pick and Place - Master.qcp

### Error

This program recovers the controller and motor from a Kill Motor event.

The first command sets the Status to an Error state and then waits for 500 milliseconds before beginning recovery.

The Target to Position command sets the current actual position as the current target position. The motor then Clears Internal Status which clears the Kill Motor error.

The Kill Motor Conditions reset and the Motor Driver re-enables before waiting for an All Clear command from the user.

The last command returns operation at the movement program.

Line# Oper	Label	Command
1:REM		Pick and Place Intermediate: Master  Intermediate Level Program  Error Mode Status[40] Register Codes 0 = Ready 1 = Busy 2 = Kill Motor Error
2:WRP		Write 2 to "Master Status[40]" Register
3:REM		Give the motor time to stop
4:DLY		Delay for 500 mSec
5:REM		Target to Position will effectively zero the position error
6:TTP		Target to Position
7:REM		Reset Internal Status Word to clear any latched bits
8:CIS		Clear Internal Status
9:REM		Reset the Kill Motor Conditions
10:KMC		Kill Motor Conditions: If "I/O #1" LOW or Temp/Driver Enable Fault or Moving Error TRUE or Holding Error TRUE
11:REM		Enable Motor Driver again. Give power to the rotor
12:EMD		Enable Motor Driver
13:REM		Waits for the User to Clear the System for a Restart
14:WBS		Wait On Bit State Until "I/O #2" is LOW/FALSE
15:REM		Restart Controller
16:LRP		Load And Run Program: Program = "Carton"

## Intermediate Pick and Place – Slave 1.qcp and Intermediate Pick and Place – Slave 2.qcp

### Initialization

This program will initialize the Slave controllers.

The first command establishes a Kill Motor Recovery routine, Error.

The next set of commands sets up the CANopen® Protocol, which allows the controller to transmit and receive registers from the Master controller. The Slave controllers receive register All Status[25], X Position[26] and Y Position[27] from the Master controller while transmitting Status[28].

After initializing CANopen, the Slave begins the Homing routine.

There is no difference between Slave 1 and Slave 2.

Line# Oper	Label	Command
1:REM		Pick and Place Intermediate: Slave 1
2:REM		Intermediate User Level I/O #1 = Emergency Stop I/O #2 = Clear for Restart
3:KMR		Set up Motor Recovery routine
4:REM		Kill Motor Recovery: Program = "Error"
5: CBD		CAN Protocol Setup
6:CNL		CAN Baud Rate = 1 Mb/Sec
7:REM		CAN NMT State = Operational
8:CRML		Set up Receiver
18:REM		CRML:CAN Register Map, Local Remote Unit ID: 16 Remote Tx Channel: #1 Local Rx Channel: #1 Lower 16 Bits of Local Register: All Status[25] Lower 16 Bits of Local Register: X Position[26] Lower 16 Bits of Local Register: Y Position[27]
19:CTRL		Set up Transmitter
34:REM		CTRL:CAN Transmit Register, Local Tx Channel: #1 Local Register: Status[28]
35:LRP		Run Homing Program
		Load And Run Program: Program = "Homing"

## Intermediate Pick and Place – Slave 1.qcp and Intermediate Pick and Place – Slave 2.qcp

### Homing

This program will home the Slave controllers to the minimum and maximum points.

This homing sequence uses the Hard Stop sequence to locate to the minimum and maximum travel. This requires some initialization steps:

- 1) Disable Kill Motor Conditions – needed to keep controller from ending the program when hitting a Hard Stop.
- 2) Set Error Limits – needed to let the motor register sense a Hard Stop quickly.
- 3) Set Torque Limits – needed to prevent the motor from damaging the equipment.

The first move command is in a negative direction. This finds the upper limit then moves away a small amount away before setting the actual position.

The next move is in a positive direction. This finds the lower limit. This works the same as the far positive move.

The next operation sets the normal Torque Limits then runs the movement program.

Both Slave axes use the homing routine. Line 33 loads either the Slave 1 or 2 Movement program.

Refer to the QCI-AN001\_HomingTechniques application note for further explanation.

There is no difference between Slave 1 and Slave 2.

Line# Oper	Label	Command
1:REM		Homing Routine
2:REM		Set Kill Motor Conditions
3:KMC		Kill Motor Conditions: If "I/O #1" LOW
4:REM		Set Error Limits
5:ERL		Error Limits: Moving Limit = 500 counts Holding Limit = 200 counts Delay to Holding = 120 mSec
6:REM		Set Homing Torque Limits
7:TQL		Torque Limits: Closed Loop Holding = 50 % Closed Loop Moving = 50 % Open Loop Holding = 30 % Open Loop Moving = 30 %
8:REM		Move Far Negative
9:MRV		Move -999999 counts @ acc=20696.06 cps/s vel=4000 cps Stop when "Moving Error" is HIGH/TRUE
10:REM		Clear Error
11:CIS		Clear Internal Status
12:REM		Move off Wall a small amount
13:MRT		Move 250 counts @ ramp time=99.96 mSec total time=200.04 mSec
14:REM		Set Negative Wall
15:ZTP		Zero Target and Position
16:REM		Set Negative Wall
17:CLX		Minimum Position[29] = Actual Position[1]
18:REM		Move Far Positive
19:MRV		Move 999999 counts @ acc=20696.06 cps/s vel=4000 cps Stop when "Moving Error" is HIGH/TRUE
20:REM		Clear Error
21:CIS		Clear Internal Status
22:REM		Move off Wall a small amount
23:MRT		Move -250 counts @ ramp time=99.96 mSec total time=200.04 mSec
24:REM		Set Positive Wall
25:CLX		Maximum Position[30] = Actual Position[1]
26:REM		Set the Soft Stop Limits
27:SSL		Soft Stop Limits: "Minimum Position[29]" Register for Minimum "Maximum Position[30]" Register for Maximum
28:REM		Move to Home
29:MAV		Move to 0 counts @ acc=20000.67 cps/s vel=8000 cps
30:REM		Set Normal Torque Limits
31:TQL		Torque Limits: Closed Loop Holding = 75 % Closed Loop Moving = 100 % Open Loop Holding = 30 % Open Loop Moving = 30 %
32:REM		Run Movement Program
33:LRP		Load And Run Program: Program = "Movement"

## Intermediate Pick and Place – Slave 1.qcp and Intermediate Pick and Place – Slave 2.qcp

### Movement

This program will process the movement sequence.

The first command sets the Kill Motor Conditions to the I/O #1, an emergency stop control, Temperature/Driver Enable Fault, Moving Error, or Holding Error.

The next command begins the movement loop and sets the ready status. It then waits for the Master controller to transmit the ready status.

Once this ready status is received, the controller decides if the target position is out of range of motion. The target must be between the minimum and maximum points found in the homing sequence or the controller goes into an error state.

After checking, the motor moves the point transmitted from the Master controller and then the loop restarts.

The difference between Slave 1 and Slave 2 in this program is between Lines 11 and 16. X Position[26] is switched with Y Position[27].

Line# Oper	Label	Command
1:REM		Placement Loop
2:REM		Set the Kill Motor Conditions
3:KMC		Kill Motor Conditions: If "I/O #1" LOW or Temp/Driver Enable Fault or Moving Error TRUE or Holding Error TRUE
4:REM	READY	Controller is Ready
5:WRP		Write 1 to "Status[28]" Register
6:REM		Wait for Other Controllers to Be Ready
7:JNE		Jump to "0" When "All Status[25]" != 1
8:REM		Controller is Busy
9:WRP		Write 0 to "Status[28]" Register
10:REM		Check Maximum and Minimum for Out of Range Target
11:CLX		Check Max[31] = Maximum Position[30] - X Position[26]
12:CLX		Check Min[32] = Minimum Position[29] - X Position[26]
13:JLE		Jump to "MAX0" When "Check Max[31]" <= 0
14:JGE		Jump to "MIN0" When "Check Min[32]" >= 0
15:REM		Move to Placement Position
16:RAT		Move to location stored in "X Position[26]" Register @ ramp time=99.96 mSec total time=200.04 mSec
17:REM		Restart Loop
18:JMP		Jump to "READY"
19:REM	MAX0	Target is more than Maximum
20:REM	MIN0	Target is less than Minimum
21:LRP		Load And Run Program: Program = "Error"

## Intermediate Pick and Place – Slave 1.qcp and Intermediate Pick and Place – Slave 2.qcp

### Error

This program recovers the controller and motor from a Kill Motor event.

The first command sets the Status to an Error state and then waits for 500 milliseconds before beginning recovery.

The Target to Position command sets the current actual position as the current target position. The motor then Clears Internal Status which clears the Kill Motor error.

The Kill Motor Conditions reset and the Motor Driver re-enables before waiting for an All Clear command from the user.

The last command returns operation at the homing program.

There is no difference between Slave 1 and Slave 2.

Line# Oper	Label	Command
		Error Mode
1:REM		Status[28] Register Codes 0 = Ready 1 = Busy 2 = Kill Motor Error Check Max[31] Error Negative Number = Out of Range High Check Min[32] Error Positive Number = Out of Range Low
2:WRP		Write 2 to "Status[28]" Register
3:REM		Give the motor time to stop
4:DLY		Delay for 500 mSec
5:REM		Target to Position will effectively zero the position error
6:TTP		Target to Position
7:REM		Reset Internal Status Word to clear any latched bits
8:CIS		Clear Internal Status
9:REM		Reset the Kill Motor Conditions
10:KMC		Kill Motor Conditions: If "I/O #1" LOW or Temp/Driver Enable Fault or Moving Error TRUE or Holding Error TRUE
11:REM		Enable Motor Driver again. Give power to the rotor
12:EMD		Enable Motor Driver
13:REM		Waits for the User to Clear the System for a Restart
14:WBS		Wait On Bit State Until "I/O #2" is LOW/FALSE
15:REM		Restart Controller
16:LRP		Load And Run Program: Program = "Homing"

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