Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.
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1 Introduction

This supplement instruction manual provides help on how to integrate the MotoPick package to the other hardware to configure a complete high speed picking solution.

Before working with this product, read this manual and all other documents carefully to ensure knowledge about the product and safety, including all cautions.

MotoPick provides a user friendly, a high speed picking solution to empower Motoman integrators to quickly develop custom applications to achieve high-speed picking solutions. The package provides building blocks to create an optimal solutions for up to 10 robots and 11 conveyors. The powerful MotoPick software will synchronize multiple robots with vision to pick fast moving product off a conveyor, and place it into an organized arrangement on an outfeed tray or box. MotoPick provides pattern-based distribution of product and dynamic load balancing among multiple robots.

Fig. 1-1: MotoPick Cell

MotoPick was designed as a modular kit of parts. The integration needs to be done completely by the integrator or customer. This document will help guide the integrator on how to perform this final assembly using the supplied standard drawings.

The drawing package includes guidelines for wiring any configuration of MotoPick. The basic drawings include interface wiring for one robot with a camera and two conveyors. It also includes instructions on how to connect l/O power and cameras to multiple robots, and how to share a conveyor encoder signal with multiple robots using a splitter board.

There are different versions of the MotoPick Robot Interface Board that are used by Yaskawa groups in America, Europe, and Asia. If there is a discrepancy in the pinout connections between drawings supplied and the main manual, PC-Less MotoPick Conveyor Tracking System (172532-1), the information on the drawings is correct.
2 MotoPick Features

• Conveyor tracking speeds of up to 1m/sec
• 10 robots can be synchronized to one infeed and one camera
• Multi-picking of up to four parts with multiple placements per cycle
• Different part types can be picked and sorted (five max)
• Parts can be stacked on an outfeed tray located on the outfeed conveyor
• Pick zones can be dedicated or shared between robots
• Unacceptable parts can be moved to a reject bin
• Infeed/outfeed conveyors can be configured in any orientation
  – Parallel (same or opposite direction)
  – Perpendicular
• Wizard provided to step through the setup process

*Fig. 2-1: Conveyor Speed Adjustments*
3 System Design Notes

- Each robot can track two conveyors max
- Only one camera can be used on each conveyor
- Each FS100 can master one camera, but all robots can share the vision data
- The number of cameras cannot exceed the number of robots
- Standard I/O interfacing is PNP, but NPN is an option
- Ethernet switch provided can connect up to six robot controllers
- Package includes a 24V, 2.5A power supply for robot I/O, encoder and camera power
- As robots, cameras and encoders are added to the system, the total power requirements must be calculated, and the power supply re-sized appropriately

Fig. 3-1: Two Shared Conveyor Example
Fig. 3-2: Three Conveyors and One Shared Example

Fig. 3-3: Three Conveyors Shared Example
4 MotoPick Drawing Package (174335-1)

Refer to the actual drawings included with the package.

4.1 Main Components (Sheet 1)

The package will include the following items:

1. Terminal strip, which includes a 24V power supply, fusing, terminals and an 8 port Ethernet switch.
2. Camera
3. Miscellaneous cables and connection plates
4. Robot interface board for each robot with four 5m cables
5. Encoder splitter board for each shared conveyor

A robot interface board, developed specifically for MotoPick, greatly reduces the integration wiring and panel size requirements for a multiple robot cell. The robot interface board replaces the three standard breakout boards required for each robot to interface safety I/O, dedicated I/O and standard I/O. The board also provides connections for a camera and two encoders. For each conveyor that is shared with multiple robots, an encoder splitter board will be supplied.

Fig. 4-1: Robot Interface Board

Fig. 4-2: Encoder Splitter Board
4.2 Power Connections (Sheet 2)

This sheet shows the incoming AC power connections to the main terminal strip TB10.

The package includes a 24V, 2.5 amp power supply, which will be used for all FS100s I/O and accessories. As additional cameras, encoders, and grippers are added, a second power supply or larger power supply might be required. It is up to the integrator to calculate total power requirements and re-size the power supply, if required.

Estimated power requirements:

- Camera Power = 700mA without lights
- Encoder = 150mA
- Encoder Buffer Board Power = 40mA

An 8 port Ethernet Switch is provided with the package. Note that each robot and each camera requires a port for connection. An additional port should be reserved for a laptop during setup. If the switch does not have enough ports for the number of robots and cameras in the system, it should be replaced with a larger Ethernet Switch.

For each robot, a 1 amp fuse will be provided for external I/O DC power. The fused 24VDC needs to be connected to the CN3 connector of each robot I/O board.

4.3 MotoPick I/O Connections (Sheet 3)

This sheet shows the camera, tray sensor and gripper connections to one of the robots.

The camera and tray sensor is connected to only one robot, which is designated as the cameras master. The camera and tray sensor feedback can be shared with other robots.

The MotoPick package will support a maximum of one camera on the infeed (included) and one camera on each outfeed conveyor. However, the number of cameras cannot exceed the number of robots. Each robot can only master one camera. This camera data can be shared between robots, which is shown on the next sheet.

The default jumper settings are for PNP camera and robot I/O. If NPN connections are needed, the jumpers can be changed to NPN settings as explained in the drawing notes.

4.4 Multiple Robots Connected to Same Camera and Tray Sensor (Sheet 4)

This sheet shows how to connect the camera and tray sensor signals to other robots in the cell. (LS1 - Camera Detect, LS2 - Tray Detect) The two signals can be daisy chained to each robot interface board that requires the feedback.
4.5 Encoder Connections (Sheet 5)

This sheet shows how to connect two encoders to a single robot interface board. If multiple robots will be tracking the same conveyor, the encoder signals need to be shared with an encoder splitter board. For this case, use sheet 6 instead of sheet 5.

All encoder cabling should be twisted pair and shielded to minimize noise. The encoder cable might need to be routed into an enclosure with a connector, which is not shown.

4.6 Multiple Robots Sharing a Conveyor (Sheet 6)

When multiple robots track the same conveyor, use this sheet to wire the signal through a splitter board. The example shows four robots, but the maximum for a splitter board is eight robots. If more than eight robots track the same conveyor, two encoder splitter boards can be cascaded using an optional flat ribbon cable. There are two versions of the encoder splitter board (4 channel and 8 channel). The encoder splitter boards can be installed on a DIN rail.
5 MotoPick Robot Interface Board Drawing (174354-1)

Refer to the actual drawings included with the package.

This drawing package is a supplement to the drawing package discussed in chapter 4 "MotoPick Drawing Package (174335-1)". This drawing package is used to show all the schematic details for each robot interface board. The information from chapter 4 can also be copied into this drawing package.

The robot interface board provides additional connections for external E- Stops, safety gates, dedicated I/O, and user I/O. All of the standard FS100 control signals can be connected to this board, instead of the multiple small breakout boards. Space is provided to draw all input and output interface connections (16 inputs and 16 outputs). The board also provides connections for the camera and two encoders.

The default jumper settings are for PNP I/O connections to the FS100 and camera. If NPN connections are needed, the jumpers can be changed to NPN settings as explained in the drawing notes. Refer to the description block on sheet 1 to determine which sheets to use. (PNP: sheets 2-7, NPN: sheets 2, 6-10)
6 Verification on Functional I/O

This section will provide some tips on how to verify correct data is being received from the encoder and camera. Refer to the MotoPick manual for complete information on the hardware/software setup and checkout.

6.1 Test Counter Card

1. Connect an encoder
2. Create a job with two commands, as shown below:
   - SYEND CV#(1)
   - SYEND CV#(2)
3. Run the job by pressing [Interlock], and [Test Start]
5. Turn the encoder, and verify the speed display changes
6. Toggle Output 11 two times and Output 12 three times
7. Verify on the CV Tracking screen that there are two tracking positions for CV#01 and there are three tracking positions for CV#02.

6.2 Test Camera I/O

1. With the camera online, Toggle Output 10, and verify the camera triggers.
2. With the camera offline, select [Sensor] -> [Discrete I/O Settings] -> [Output Settings].
3. Set Line 0 type to "Online/Offline."
4. Set the camera from Offline to Online, and verify Input 10 changes from OFF to ON.
5. Set Line 0 type back to "Job Completed".
6. Set Line 1 type to "Online/Offline".
7. Set the camera from Offline to Online, and verify Input 11 changes from OFF to ON.
8. Set Line 1 type back to "Job Load OK".

6.3 Verify System Job

1. On the pendant, press [Job] -> [Ctrl System Job].
2. Verify the Line No. is changing to validate the system job is executing.
7  MPP3 Robot Work Envelope

The overhead MPP3 robot mounting structure needs to be designed so that the robot work envelope covers the infeed and outfeed conveyor surfaces.

**NOTE**

Adjusting the conveyor heights is another way to bring the product into the optimal work envelope of the robot. Refer to Figure 6.1 for the work envelope dimensions of the MPP3S robot.

Fig. 7-1: MPP3S Work Envelope

- **The MPP3S has two choices for the range of motion that can be used for the work envelope:**
  - 800mm Diameter x 200mm Height
  - 580mm Diameter x 300mm Height

The top of the two cylinders are 789mm from the top mounting plate of the robot.

- **The MPP3H has two choices for the range of motion that can be used for the work envelope:**
  - 1300mm Diameter x 300mm Height
  - 1040mm Diameter x 400mm Height

The top of the two cylinders are 1075mm from the top mounting plate of the robot.
MotoPick Design
SUPPLEMENT MANUAL

For FS100 Robots

Specifications are subject to change without notice
for ongoing product modifications and improvements.