LACI Pick and Place Ratios, Rates and Signed Numbers

Automated Systems

Jobs of many types have been taken over by machines. Fortunately, the first jobs to go have often been those that are repetitive, boring and demanding in terms of physical strength or precision or both. "Pick and place" operations in manufacturing are one such example, as at right where a small robot works hour after hour, picking up computer chips and placing them correctly in a computer. Robots like this may decrease the number of low-skill workers required, but there are still good, higher-paid job opportunities for people with the ability to design, build, operate, maintain or program the robots.

Robotic Arm Installing a Computer Chip

Tasks:
#1: Correct errors in a CNC (computer numerical control) program so the LACI Smart Cart actually grabs a block, deposits it in a container at the end of the track and returns to the original position.

#2: Optimize the program sequence to complete the same task as quickly as possible while also using the smallest possible number of steps.

Materials: LACI Smart Cart with clamp, plastic block, container

Math Machines Program: *LACI Sequence* for computers with SensorDAQ or myDAQ interface **or** *LACISEQ* for TI-83/84 calculators with CBL2 or LabPro.

Activity File: "Pick-Place-Wrong"

Constraints: In this mode, LACI can move only at set, constant speeds, which can be either forward (positive velocity) or backward (negative velocity). The possible speeds are listed below.

0	mm/s
12.1	mm/s
13.7	mm/s
16.0	mm/s
19.5	mm/s
24.2	mm/s
31.9	mm/s
48.4	mm/s
94.2	Mm/s

Design and Test a Better "Pick and Place" CNC Program

The current (incorrect) CNC program is shown below. Working as a team, watch the current operation and make any desired measurements, then modify the times or velocities (or both) so LACI Smart Cart actually grabs the block, deposits it in the container at the end of the track and returns to the original position. Once you have achieved initial success, try to optimize your program sequence to complete the same task as quickly as possible while also using the smallest possible number of steps. Explain each of the changes you make to the right of the original instructions or on a separate sheet.

Instruction # 0

Time (s)	2.000
Velocity (mm/s)	0
Servo 1 Active	yes
Servo Position (deg)	-30 (R = 0.0011 s)

Instruction # 1

Time (s)	5.000
Velocity (mm/s)	31.9
Servo 1 Active	no
Servo Position (deg)	

Instruction # 2

Time (s)	2.000
Velocity (mm/s)	0
Servo 1 Active	Yes
Servo Position (deg)	62 (R = 0.0016 s)

Instruction # 3

Time (s)	5.000
Velocity (mm/s)	19.5
Servo 1 Active	no
Servo Position (deg)	

Instruction # 4

Time (s)	2.000
Velocity (mm/s)	0
Servo 1 Active	yes
Servo Position (deg)	-30 (R = 0.0011 s)

Instruction # 5

Time (s)	5.000
Velocity (mm/s)	-48.4
Servo 1 Active	no
Servo Position (deg)	