# Racetrack Flashlight Assembly Instruction Manual

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# **Racetrack Assembly**



Figure(1) Racetrack Assembly

It is a modular assembly that can be easily and rapidly reconfigured to support different operations. This system is more simple than most, because the carts require no modification and are universal. All the all complexity is contain within the individual stations.

This is the 2<sup>nd</sup> year that the racetrack assembly has been used in this class and the entire project was redesigned from scratch, little of last year's tooling survived.

The stations consist of an X, Y and Z axis that can be operated with stepper motors. Each station is run off of Linux CNC and its own computer. This allows the system to continue to run in an old configuration while a new station is added. The system is powered my Pneumatic cylinders and rams as well as a voltage converter that allows for a computer interface.

## Instructions

## Starting

In order to get the system powered up and running two things need to be started. First the pneumatics need to be pressurized and second the computers need to be powered up and booted with Linux and Linux CNC.

To prepare the pneumatics you must first plug the orange hose into the wall until you hear a faint hissing noise. This means that the lines and cylinders are charged and ready to rock. However make sure that the pressure in the lines is around 32 psi. This can be adjusted by turning the valves located in the solenoids located at the base of the tables.

Next the three computers need to be booted and you need to ensure that the voltage converters are plugged in and turned one. The voltage converters power the stepper motors and allow for conversion of the signals that will be read by the computers for Linux CNC. Then boot up Linux CNC on all the computers and make sure the three programs are loaded. Each station must be run by a separate computer so make sure that they are all powered on.

#### Nose

This station feeds a nose piece from factory supply. It has a two jaw gripper on a YZ robot. The gripper can move to pick up the nose piece and insert it into the nose piece holder. The holder is designed to prevent rotation for the threading operation.



Figure(2) Nose Assembly station, view 1

- (1) Supply tube for nose pieces. Supplied by factory.
- (2) Double action air cylinder to push nose piece out into work area.
- (3) Double action air cylinder to hold next piece in tube

Operation: Ready position – (3) extended, (2) retracted. – Retract (3) Team Bernet - Manufacturing Project - Spring 2012

- Extend (3) extend (2)

- Retract (2)



figure (3) Nose Assembly station, view 2

- (1) Double action, two jaw gripper on YZ axis robot.
- (2) Spring loaded nose piece holder.

#### Operation:

- (1) Open jaws.
- (1) Move to part.
- (1) Close jaws.
- (1) Move to holder.
- (1) Press part into holder.
- (1) Open jaws.
- (1) Retract.

## Lens Assembly and Nose O-ring

The dual action ram pushes both the o-ring and the lens assembly forward to drop through the predesigned hole in the tray and fall into place on top of the nose piece.



figure(4) Lens and Nose O-ring assembly station.

- (1) Double action air cylinder
- (2) Two layer slide for lens assembly (top slide) and Nose O-ring (bottom slide)

Operation:

- Ready Position: (1) Retracted
- (1) Extend
- (1) Retract

## Washer and Magnetic Ring

The precision machined jaws of the robot assembly moves into position and picks up the places the magnetic ring on to the nose of the flashlight. Then the vacuum moves into position and pics up the washer off of the spring loaded platform then places it on the nose piece.



figure(5) Washer and Magnetic ring assembly station (view 1).

- (1) Double action, two jaw gripper.
- (2) Spring loaded washer supply.
- (3) Magnetic ring holder.



figure(6) Washer and Magnetic ring assembly station (view 2).

- (1) Vacuum washer lifter
- (2) Spring loaded washer supply

#### Operation:

- (1) Open jaws
- (1) Move to part
- (1) Close jaws
- (1) Move to assembly
- (1) Open jaws
- (4) Move to part
- (4) Vacuum on
- (4) Move to assembly
- (4) Vacuum off
- (4) Retract

## Main O-Ring

The duel actio ram pushes the o-ring forward until it drops through the hole onto the waiting assembly below.



figure(7) Main O-Ring assembly station

(1) - Double action air cylinder(2) - O-ring slide

Operation: Ready position: (1) retracted - (1) Extend - (1) Retract

### **Battery and Body-Tube**

The battery drops from the acrilic tube onto the waiting tray and is then pushed forward until it is in position under the tube containing the body. The body is then dropped on top of it and then pushed over to drop on too the waiting nose piece. Then the tree jaw gripper grabs it and screws the flashlight together.



figure(8) Battery and Body-Tube assembly station (view 1)

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- (1) Battery supply tube (clear)
- (2) Double action air cylinder, battery supply stop.
- (3) Double action air cylinder, pushes battery into work area
- (4) Body-tube supply tube
- (5) Double action air cylinder, Body-tube supply stop.



figure(9) Battery and Body-Tube assembly station (view 2)

- (6) Stepper motor for threading attached to YZ robot
- (7) Double action, 3 jaw gripper
- (8) Friction grips.

Operation:

Ready Position: (2) Extend (3) Retract (5) Extend

- (2) retarct
- (2) extend, (3) extend
- (5) retract
- (3) retract
- (5) extend: During this cycle a body-tube should fall from (4) and land over top of the battery.
- (7) Open jaws
- (6,7) Move to part
- (7) Close jaws
- (6,7) Slide to assembly
- (6) threading operation. Clearance is allowed in this assembly to accomodate linear travel as a result of threading.
- (7) open jaws

# **Known Problems:**

- At station 2 the o-rings sometimes stick in the whole in the lens and o-ring tray and the cylinder leaks.
- Station 3 the magnetic sensor is misallined, the ring holder and washer holder have limited capaticy, the y,z robot does not have a belt clamp and so has nomotion in the y direction.
- Station 4 the o-ring sticks in the tray while dropping through to the top of the nose piece.
- station 5 the rods for the x/y robot the rods are slipping, missing a belt clamp like station 3, the hoses for the three jaw gripper get caught was it spins, and sometimes the o-ring gets nocked while the jaws spin.

# **Future Improvements**

- Station 2 create a better tray, get a new air clynder and new end for the ram, better way to reload o-rings in the tray.
- Station 3 align the magnetic probe, larger capacity holders, and add a belt, grab the washer and ring in a single movement.
- Station 4 new tray and new end for the ram.
- Station 5 needs a coplete make over to make it function more effiecntly, also hold the O-ring on the nose piece.

# Linux CNC Code

Station 1	
M64 P1	Hold Part in tube
M64 P0	Push out lowest part
M65 P0	Retract Cylinder
M65 P1	Allow next part to fall
M64 p2	Open Grabber (to make sure its open)
G01 Y3.77 F60	
G01 Z-1.0 F60	
M65 p2	Close Grabber
G01 Z10.0 F60	
GUI 25.0 F60	Open Crabber
	Open Grabber
GUI ZZ.0 FOU	
Station 2	
m64 p3	
m65 p3	
Station 3	

#### Station 4

m64 p2 m65 p2

# Station 5

# gcode program	
# setup G64 p2 an	d G64 p3 close tubes holding battery and tube
m65 p2	Drop Battery
m64 p1	Push Battery
m65 p3	Drop Tube
m65 p1	retract battery pusher ( order on purpose ^)
m64 p2	try to force p1 to retract

g01 z-4.7 f60

m65 p0	Make sure grabber is open
g01 y222 f60.0	Move to grab tube (set place)
g01 z0.0 f60.0	
m64 p0	Grab tube
g01 y22 f20.0	move tube over nose (set place)
g01 z1.25 f40	
g01 x2.0 f40	
m65 p0	release tube
g01 x0.0 f40	unwind pneumatic tubes
g01 z-4.86.0 y0.0 f40	move to home
m64 p2	
m64 p3	