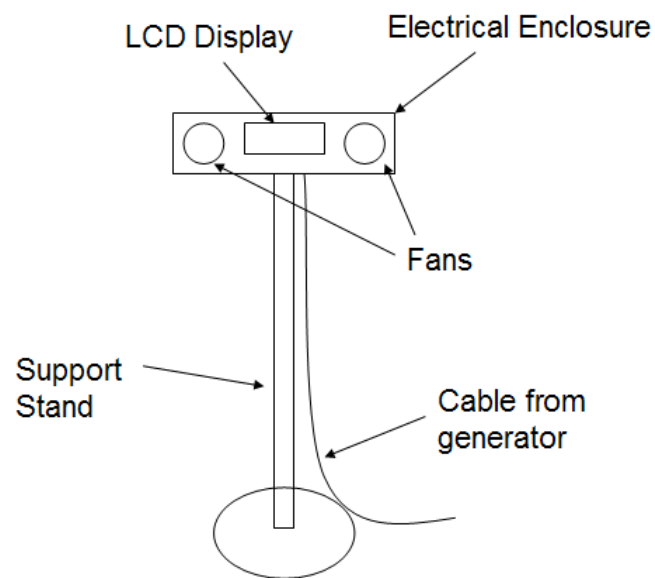


# Case/Stand Design

## General Concepts

- Electrical enclosure securely mounted on stand
- Enclosure modified for mounting of fans, LCD display, Ipod dock



### System Functions

#### Stand

- Support electrical enclosure
- Adjust to suit biker's eye level and arm reach

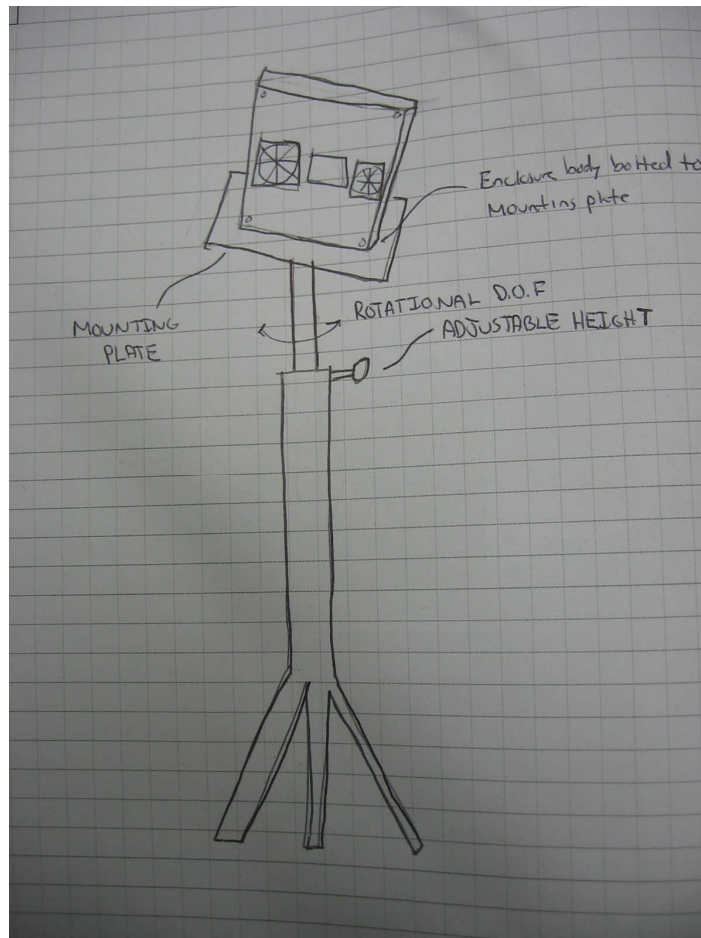
#### Enclosure

- House electrical components safely
- Protect/isolate biker from accidental incidents inside (surge etc)
- Provide mounting space for fans/LCD/Ipod dock
- Easy access for repair/testing of electrical components

# Stand/Enclosure Specifications

Revision #	Engr. Spec. #	Importance	Source	Specification (description)	Unit of Measure	Marginal Value	Ideal Value	Comments/Status
				<b>Stand</b>				
	ES1			Height Range	Ft		4-4.5	
	ES2			Supported Weight	Lbs	25	50	
	ES3			Adjustable for different users	# of operations to adjust	3	1	
	ES4			Versatile for different placements	Degrees of Freedom for mounting plate	2	3	Ideal: Vertical (same as ES3), Rotational, Tilting;
	ES5			Stability	Span of Base/Legs (ft)			Marginal: Vertical, Rotational
				<b>Enclosure</b>				
	ES6			Protection from gym environment	NEMA Rating	4	4X	
	ES7			Accessible for repair	# of operations to open	3	1	
	ES8			Mounting area for fans/LCD/Ipod	in <sup>2</sup>	84	112	Ideal value comes from commercial product available
	ES9			Depth for mounting electrical components	in	3	5	

## General Concept



# Electrical Enclosure Selection

## NEMA Ratings

- Describes protection offered from each enclosure

	NEMA 1	NEMA 3R	NEMA 4	NEMA 4X	NEMA 5	NEMA 6	NEMA 6P	NEMA 7	NEMA 9	NEMA 12	NEMA 13
<b>Environments:</b>											
Indoor use only	✓										
Indoor and outdoor use		✓	✓	✓	✓	✓	✓				
Falling liquids and light splashing		✓	✓	✓	✓	✓	✓				
Nonhazardous dust, lint, fibers			✓	✓	✓	✓	✓				
Washdowns and splashing water			✓	✓	✓	✓	✓				
Oil and coolant seepage									✓	✓	
Oil and coolant spraying and splashing									✓	✓	
Corrosive agents				✓			✓				
Occasional temporary submersion						✓	✓				
Occasional prolonged submersion							✓				
Prevention of external hazard from internal explosion								✓			
Prevention of combustible dust ignition									✓		

**IP Ratings**—The IEC (International Electrotechnical Commission) developed their own IP (Ingress Protection) Standards, IEC 60529, for the degree of protection provided by enclosures. IEC designations consist of the letters "IP" followed by a two-digit number:

**First Digit**—Protection from entry of solid foreign objects:

- 1—Protection from solid objects greater than 50 mm dia.
- 2—Protection from solid objects greater than 12.5 mm dia.
- 4—Protection from solid objects greater than 1 mm dia.
- 5—Protection from dust that would interfere with equipment operation
- 6—Dust tight

**Second Digit**—Protection from harmful entry of water:

- 0—No protection
- 2—Protection from vertically dripping water
- 4—Protection from splashed water
- 5—Protection from water projected from a nozzle
- 6—Protection from heavy seas or power jets of water
- 7—Protection from temporary submersion
- 8—Protection from continuous submersion

## NEMA Ratings for Electrical Enclosures (Image from McMaster Carr)

### Protection needed in typical gym environment

- Small impact (bumping etc)
- Airborn particles
- Moisture (splash from water bottle, sweat)

Conclusion: NEMA 4 or 4X will probably be a cost-efficient solution

With Lift-Off Cover				Enclosures				Panels					
Overall Size, Ht.xWd.xDp.	Enclosures	Each	Ht.xWd.	Enclosures	Each	Ht.xWd.	Panels	Each	Enclosures	Each	Ht.xWd.	Panels	Each
<b>Style 1</b>													
2" x 2" x 1.6"	69945K91	\$15.51	1" x 1.7"	69945K94	\$2.07								
2" x 2.6" x 1.8"	69945K92	18.21	1" x 2.2"	69945K95	2.35								
3.1" x 3.2" x 2.6"	69945K93	28.04	2.2" x 2.7"	69945K96	2.64								
3.1" x 3.2" x 3.7"	69945K1	29.12	2.2" x 2.7"	69945K96	2.64								
3.8" x 2.5" x 1.6"	69945K2	20.82											
3.9" x 3.9" x 1.4"	69945K3	16.63	3.1" x 2.5"	69945K114	2.53								
3.9" x 3.9" x 3"	69945K4	18.35	3.1" x 2.5"	69945K114	2.53								
5.1" x 3.1" x 1.4"	69945K5	18.05	3.8" x 1.8"	69945K21	2.18								
5.1" x 3.1" x 3"	69945K107	19.70	3.8" x 1.8"	69945K21	2.18								
5.1" x 5.1" x 1.4"	69945K6	21.58	3.8" x 3.8"	69945K22	2.69								
5.1" x 5.1" x 3"	69945K108	24.05	3.8" x 3.8"	69945K22	2.69								
6.7" x 3.1" x 3.3"	69945K87	35.07	5.5" x 2.1"	69945K111	3.77								
7.1" x 5.1" x 1.4"	69945K7	26.02	5.8" x 3.8"	69945K23	3.20								
7.1" x 5.1" x 3"	69945K8	26.96	5.8" x 3.8"	69945K23	3.20								
7.1" x 7.1" x 2.4"	69945K9	33.98	5.8" x 5.8"	69945K24	3.77								
9.1" x 3.1" x 3.3"	69945K119	39.69	7.8" x 2.1"	69945K112	5.63								
9.1" x 5.5" x 3.7"	69945K89	50.44	7.2" x 3.7"	69945K113	10.10								
9.1" x 5.5" x 4.9"	69945K59	54.96	7.2" x 3.7"	69945K113	10.10								
<b>Style 2</b>													
5.1" x 3.1" x 4.9"	69945K126	\$20.78	3.8" x 1.8"	69945K21	\$2.18								
5.1" x 5.1" x 4.9"	69945K127	24.89	3.8" x 3.8"	69945K22	2.69								
7.1" x 5.1" x 3.9"	69945K109	28.74	5.8" x 3.8"	69945K23	3.20								
7.1" x 5.1" x 5.9"	69945K128	31.72	5.8" x 3.8"	69945K23	3.20								
7.1" x 7.1" x 3.9"	69945K115	36.12	5.8" x 5.8"	69945K24	3.77								
7.1" x 7.1" x 5.9"	69945K129	42.07	5.8" x 5.8"	69945K24	3.77								
<b>Style 3</b>													
7.4" x 7.4" x 5.1"	69945K116	55.88	5.8" x 5.8"	69945K53	4.14								
7.4" x 7.4" x 7.1"	69945K131	62.70	5.8" x 5.8"	69945K53	4.14								
10.9" x 7.4" x 5.1"	69945K121	70.74	9.3" x 5.8"	69945K54	6.32								
10.9" x 7.4" x 7.1"	69945K132	74.49	9.3" x 5.8"	69945K54	6.32								
10.9" x 10.9" x 5.1"	69945K122	81.39	9.3" x 9.3"	69945K56	9.38								
10.9" x 10.9" x 7.1"	69945K133	86.67	9.3" x 9.3"	69945K56	9.38								
14.9" x 7.4" x 5.1"	69945K123	78.96	13.3" x 5.8"	69945K55	8.10								
14.9" x 7.4" x 7.1"	69945K134	88.81	13.3" x 5.8"	69945K55	8.10								
14.9" x 10.9" x 5.1"	69945K124	93.98	13.3" x 9.3"	69945K57	11.94								
14.9" x 10.9" x 7.1"	69945K135	99.74	13.3" x 9.3"	69945K57	11.94								
22" x 10.9" x 5.1"	69945K125	126.28	20.3" x 9.3"	69945K58	29.94								
22" x 14.9" x 7.1"	69945K136	170.98	20.3" x 13.3"	69945K98	33.41								

## Polycarbonate NEMA 4X Enclosures

## **Electrical Enclosure Selection (cont)**

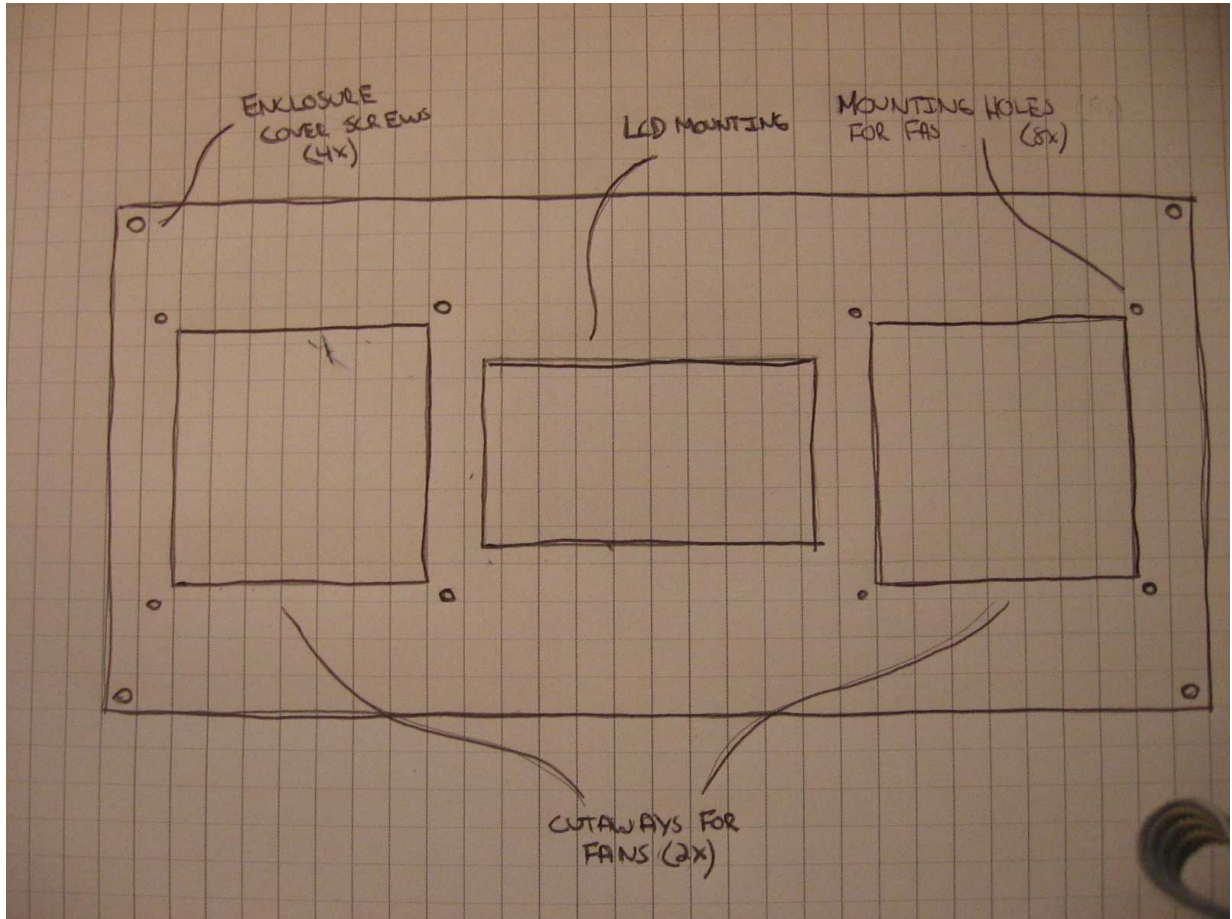
PN #69945K123

- NEMA Rating: 4X
- Dimensions: 14.9" x 7.4" x 5.1" (actual mounting depth ~4.5")
- Polycarbonate

Pros

- Modifiable (slots/holes) for mounting fans/LCD
- Cover screws for easy access for repair
- Cost efficient

## Concept for Fan/LCD Mounting



Approximate Space needed for mounting

Fans: 3.15" x 3.15"

LCD: 5.5" x 4"

## Stand Concept

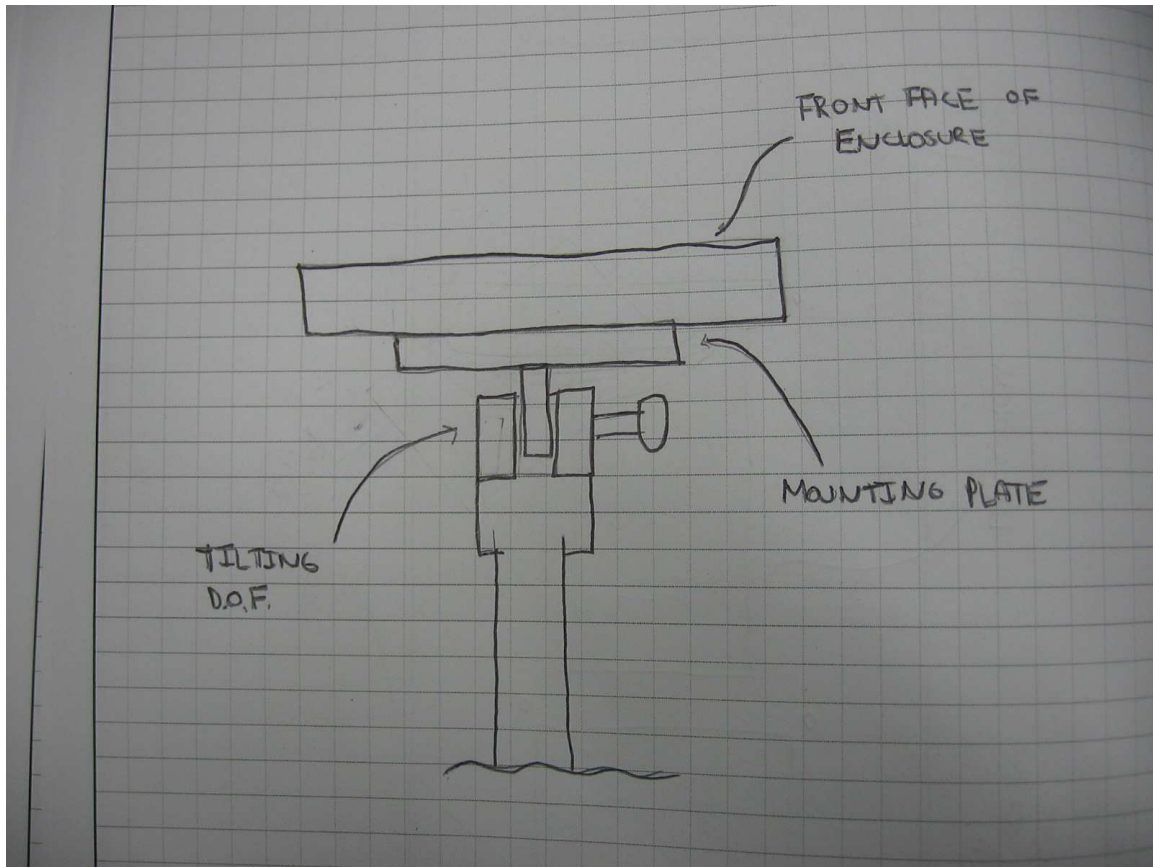
“On-Stage” Monitor Stand (or similar product)

- 34”-61” Adjustable Height
- 100 lb rated load capacity
- Welded Steel
- 9” square mounting plate
- Mounting plate can be modified to bolt enclosure
- No tilting DOF
- May make cover difficult to take off (bottom may be flush against mounting plate)
- Center of Mass remains centered on stand



Image from MusiciansFriend.com

## Alternate Stand Concept



- Has tilting DOF
- Removable cover faces out, so easier to remove
- May lose some stability since center of mass can move with tilting

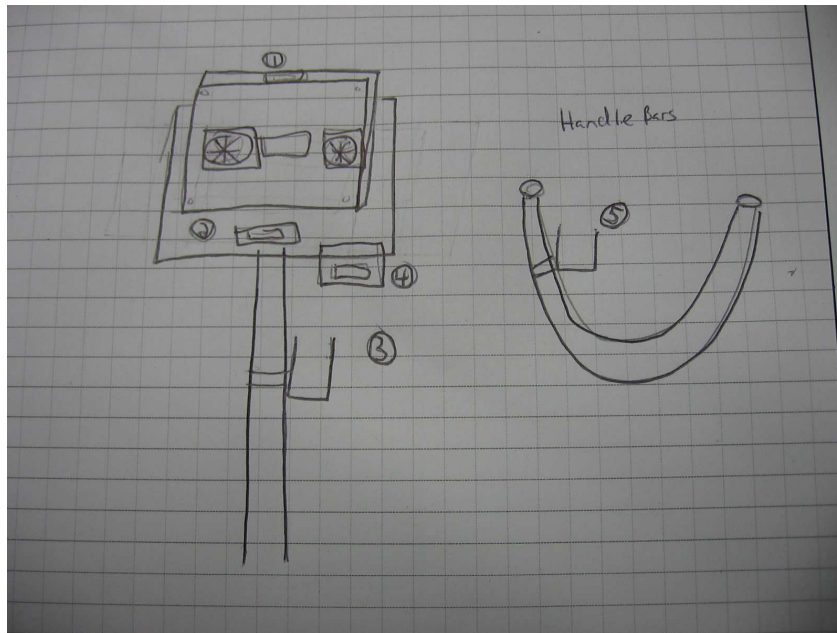
# Ipod Dock Mounting

## Design Challenge

Ipod dock needs to be mounted within arm's reach of biker, but stand needs to be far enough away from bike to stay clear of mechanical system and spinning front wheel.

Mounting Concepts (see diagram below)

- 1) Top of enclosure
- 2) On mounting plate in front of enclosure
- 3) On Stand Pole
- 4) Tray bolted to mounting plate
- 5) On handle bars





## Near-Term Action Items For Stand/Enclosure Design

- 1) Concept selection matrix for ipod mounting dock/locations
- 2) Continue product research for stands/enclosure/dock
- 3) Refine design based on Design Review Feedback
- 4) Final Selection of Concepts/Parts
- 5) Begin ordering parts
- 6) Start needed modification of arrived parts