

Laser Scarecrow Parts List

For 2017 version

Most of the electrical and electronic components can be purchased through eBay, Amazon, or Adafruit. Sources are noted for hard-to-find components. These are suggestions, not endorsements – other sources may be equally good.

Special Electronics and Electrical Parts

Part	Quantity	Specifications	Approx. Cost	Notes
Arduino Microcontroller	1	Pro Micro ATmega32U4 5V 16MHz	\$5	Micro, not mini; must be 5V/16MHz not 3V/8MHz
Laser Module	1	3.6-4.2V 532nm 50mW green wide beam	\$21	might be marketed as "DJ" lighting
Micro 9g Servo	1	Futaba S3107	\$17	the super cheap (<\$10) servos do not last; Tower Hobbies is a good source
Infrared Optical Sensor	1	TCRT5000	\$1	not needed if you won't be limiting rotation of beam
CdS Photoresistor	1	We used a cheap unbranded ~5mm part	\$1	others should work, but you might need to change the sense-ground resistor
Stepper Motor	1	NEMA 17 bipolar, 200 steps/rev, 4-wire	\$13	
Stepper Motor Driver	1	A4988 carrier module with heatsink	\$5	Pololu Electronics item 1182 ^a
DC-DC Buck Regulators	2	Need <1A output, but don't go too cheap	\$4 for 2	Could use a fixed 5V output ^b ;
Adafruit Perma-Proto Breadboard PCB	1	Full size 6.2" x 2.0", 830 Tie	\$7	Don't even think about using a solderless breadboard in the field!
Slip Ring	1	12.5mm 6-circuit, 2A 240V	\$3	
Trim Potentiometer	3	10K Ohm, with breadboard pins	\$3.75 for 3	The style with knobs for your fingers is nice
Logic-level MOSFET	1	RFP30N06LE for example	\$2	Used to switch the laser on/off
Heat Sink (probably unnecessary)	1	clip-on TO220, aluminum	\$0.25	We put one on the MOSFET even though it's controlling only ~0.1A @3.3V
Electrolytic Capacitor	1	100µF, 20V or better (radial mounts easier)	\$0.20	to filter stepper driver
Diode	1	Schottky 1A 20V 1N5817, for example	\$0.80	protection against reversed polarity
100Ω Resistor	1	1/4W, 5% tolerance	\$0.10	to limit IR LED emitter current in TCRT5000
220Ω Resistor	1	1/4W, 5% tolerance	\$0.10	to limit gate current in MOSFET
10kΩ Resistor	3	1/4W, 5% tolerance	\$0.30	CdS sense (maybe 8.2k depending on part), IR sense, MOSFET gate-to-ground

^a Pololu driver includes instructions for setting current with just a voltmeter; cheap alternates from eBay you'll need to put an ammeter inline with one of the motor coils and run a special program to set the current

^b probably could make 3.3V work for the laser diode, but it's nice to be able to tune that for maximum brightness without going too high and wasting current

Parts-Box Electronics and Electrical

Stuff you likely have on hand if you are not new to electronics making.

Part	Quantity	Specifications	Approx. Cost	Notes
Screw Terminal Block	1	2-position, 0.1" pitch, side entry	\$2.50	For 12 battery power to distribution board. Price is for 4-pack
Header connector kit	1	Dupont M/F 2.54mm pitch; require special crimp tool (\$25)	\$20 kit	Used for connections in arm and hookup option 2
Optional: female headers	2@1x12, 2@1x8	0.1" (2.54mm) spacing, straight (not stacking)	\$3	If you wish to remove/replace arduino, A4988 modules. ^c
male headers	1@1x4, 1@1x2	0.1" (2.54mm) spacing, straight (not stacking)	\$1	For stepper and CdS hookup. Typically sold in longer breakaway strips
Hookup Option 1a: male headers	3@1x2, 1@1x6	0.1" (2.54mm) spacing, straight (not stacking)	\$1	Cheapest option for power hookups and arm, but not polarized so misconnection is a risk
Hookup Option 1b:	3@1x2, 1@1x6	0.1" (2.54mm) crimp connector housing ("DuPont")		You can take these from the kit you buy to wire up the arm
Hookup Option 1c:	16	Female crimp pins for 0.1" housings		Crimp tool required
Hookup Option 2: JST (our final choice)	5@1x2, 1@1x6	Headers: 3@ B2B-XH-A, 1@ B6B-XH-A	\$10 kit	Polarized: Can't plug in backwards. 2.50mm is close enough that it still fits the board
Hookup Option 2b	5@1x2, 1@1x6	Housings: 3@ XHP-2, 1@ XHP-6		We found some 2-pin ones with red/black lead already attached; very convenient. Used for radio-controlled vehicle batteries, I think.
Hookup Option 2c	16	Contacts: SXH-001T-P.06		Different crimp tool required (\$40)- not the same as for the "DuPont" style
Hookup Option 3:	8	Screw terminal block, 2-position, 0.1" pitch, side entry	\$5	Only a screwdriver required. Not polarized; watch for stray "whiskers"; typically sold 1x2 but with slots to connect end-to-end
<i>Hookup general note: you can mix/match as convenient, for example using JST on the main board and screw terminals for the 12V distribution board.</i>				
Hookup wire	1 kit	Solid 22AWG or 24AWG, multicolor insulation	\$30	Stranded wire is less expensive, but much easier to use solid conductor to wire up the board; can also form the wires to go exactly where you want

Recommended: heat-shrink tubing	bag	2mm dia, typical	\$4	for organizing wires in cable assemblies (don't necessarily have to shrink it)
Optional: expandable braided sleeving	6inches?	1/8" size	\$9 for 16'	to protect the delicate wires of the slip ring
silver-bearing rosin-core solder	1 spool	Lead-free is good but harder to use	\$10	

^c Can also be cut from longer headers; you lose one pin each cut, so you'll need >40 pins total

Specialized Mechanical Parts

We purchase these from Servocity.com.

Part	Quantity	Specifications	Approximate Cost	Notes
clamping hub	1	0.85" bore to fit 1/2" PVC	\$8	part 545504
Set Screw Hub	1	5mm bore; 0.770" pattern	\$5	part 545572
Plastic gear chain	1	0.250" pitch, 48 links	\$7	part Actobiotics 615150
Hub Sprocket	2	1/2" bore, 0.250" pitch, 20-tooth, acetyl	\$6	part THS-250-20
1/4" Pan Head Machine Screws	8	6-32 pitch ^d	\$1.50	part 91772A144
3/8" Pan Head Machine Screws	2	6-32 pitch	\$0.34	part 91772A146
5/16" Pan Head Machine Screw	1	6-32 pitch	\$0.17	part 91772A145
hex nut	2	6-32 pitch	\$0.10	part 90480A007

^d 6-32 is a smaller pitch than standard hardware store machine screws

From the Hardware Store

Part	Quantity	Specifications	Approx. Cost	Notes
5-gallon bucket with lid	1	white preferred, lid should fit tightly	\$4	does not need to be new; should be clean
1/2" sch40 PVC pipe	4" piece		\$1.50 for 2ft	
1/2" PVC T fitting	1		\$0.50	
3/4" copper coupling	1	without stop	\$2	
3/4" PEX clamp	1	suspension clamp for pipe	\$1	
3/8" plywood	12"x12" piece	cut into circle or hexagon 10" diameter		
16 gauge 2-strand power cord	~15 ft	low voltage landscape lighting wire	\$13	
battery terminal connectors	1 pair	depends on battery post type		alligator clamps are not recommended
1/2" wood screws	2	#10	\$0.20	

3/8" wood screws	3	#8	\$0.25	
fender washers	3	3/16" x 3/4"	\$0.25	
outdoor mounting tape	~1 ft		<\$1	
1" sch40 PVC piece	6" piece			
1" u-bolts	2	1/4"x1"x1-3/16"	\$2	
1/2" split ring pipe hanger	1		\$1.57	
1/2" metal pipe	10 ft	sch40 threaded on both ends; not conduit	\$11	for mounting scarecrow
12 volt deep-cycle battery	1	35 amp hour minimum	≥\$60	35 ah runs scarecrow for ~5 days on a charge
irrigation sprinkler tripod	1	easy-move base for mounting pipe	\$40	bigsprinkler.com sells tripods without sprinklers
waterproof box for battery	1	Plastic storage bins are good; to protect battery from rain	<\$10	
3/8" dowel	1 ft	cut into 6 2" pieces		
elastic bands	handful	#64 size (3 1/2" x 1.4")	\$5	to tension the stepper chain
hotmelt glue				