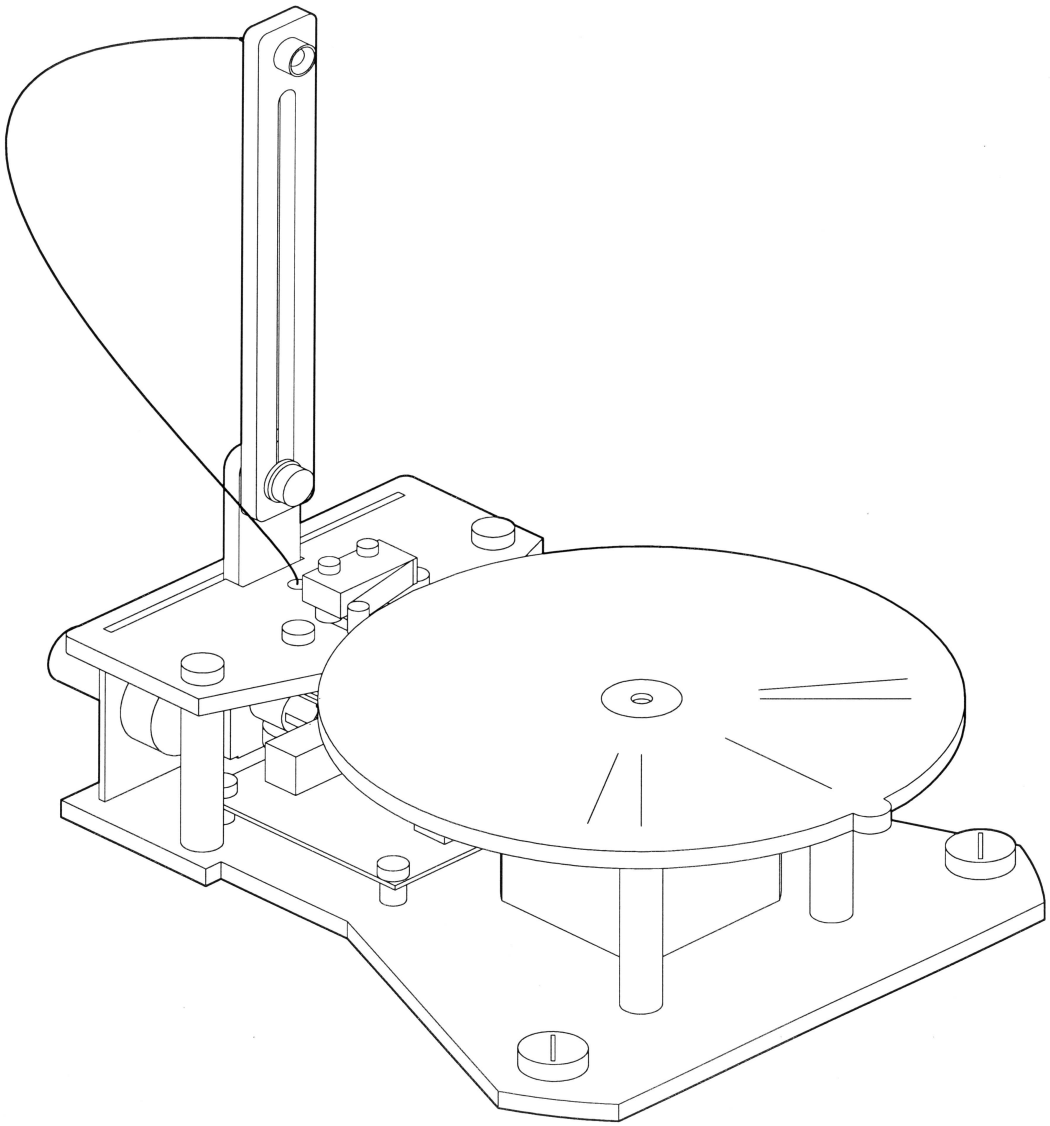
TriAngles™ 3D Scanner
Turn Table Assembly Instructions V1



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TriAngles 3D Scanner Turn Table Version 1 PUBLICATION
TriAngles 3D Scanner Turn Table Version 1 DESIGN

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TriAngles 3D Scanner, Version 1 IntriCAD
TriAngles; 3D Scanner, 3D Builder and 3D Viewer IntriCAD

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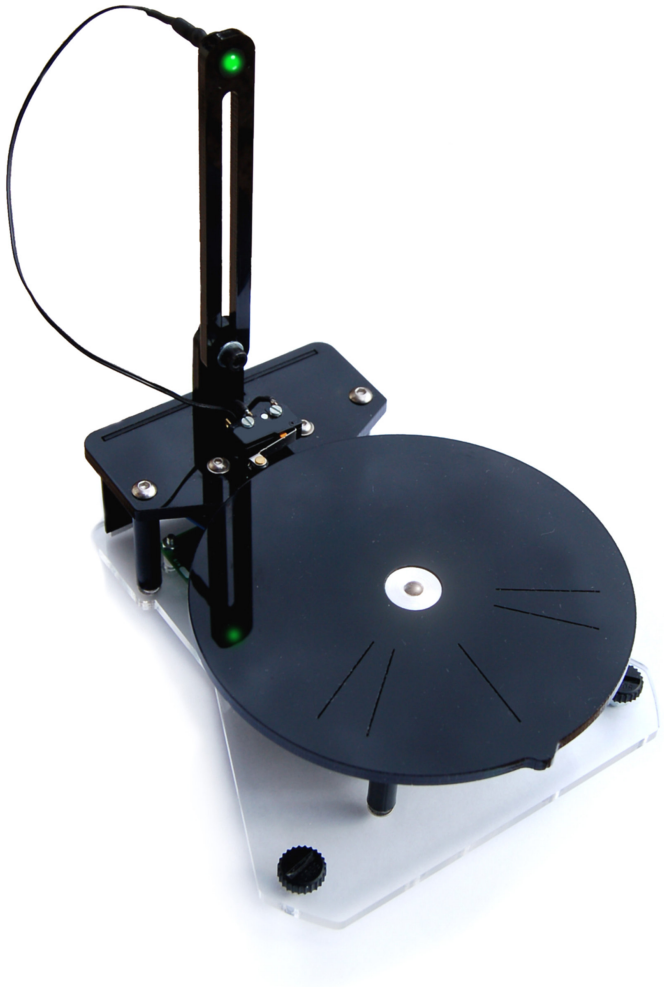
1. Introduction

The Scan Turn Table was developed in order to turn an object around in a controlled and consistent fashion during scanning. More precisely, the turn table disc must rotate at a very smooth and consistent speed with minimal wobble. This is important as inconsistent speeds will warp the resulting scan. The unit employs a high quality microstepper driver in order to attain the highest possible turning accuracy.

The Turn Table includes an indicator LED. The LED functions to indicate to the user when the Turn Table disc has completed a full 360 degree rotation. It does this by switching OFF at 0 degrees and switching back ON exactly after the disc has rotated 360 degrees. The LED is controlled via the motor driver. The driver counts the amount of steps incremented after the LED switches OFF. When the amount of steps is equivalent to a full turn is switches the LED back ON.

The Turn Table disc has 5 radial engraved stripes on its surface which serve to align projectors/lasers and camera. The middle line represents the camera position facing the turntable. The 4 other lines are the projector/laser angle positions.

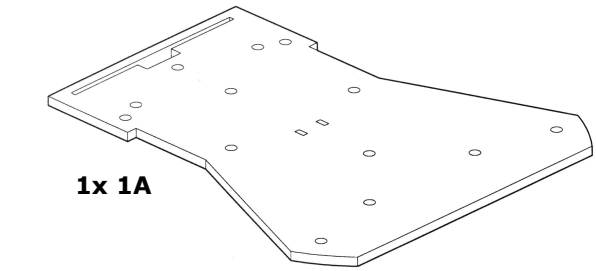
The table was designed for small lightweight objects. However due to the design simplicity it should not be much problem to build a larger scaled Turn Table to better suit your scanning needs.



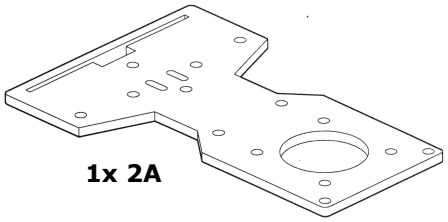
2. Tools

1. Screw Driver (flat)
2. Small Pliers
3. Glue (contact or super glue)
4. Multimeter
5. Soldering iron with solder

3. Parts List

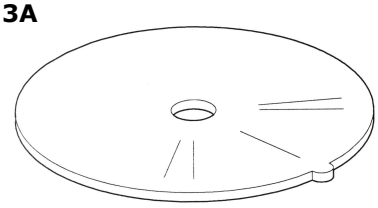


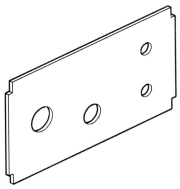
1x 1A



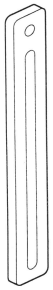
1x 2A

1x 3A



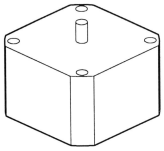


1x 4A

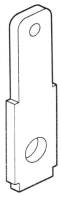


1x 5A

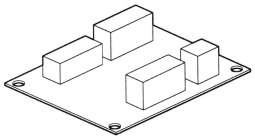
1x 7A



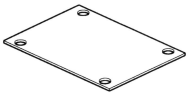
1x E1



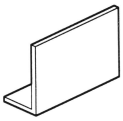
1x 6A



1x E2

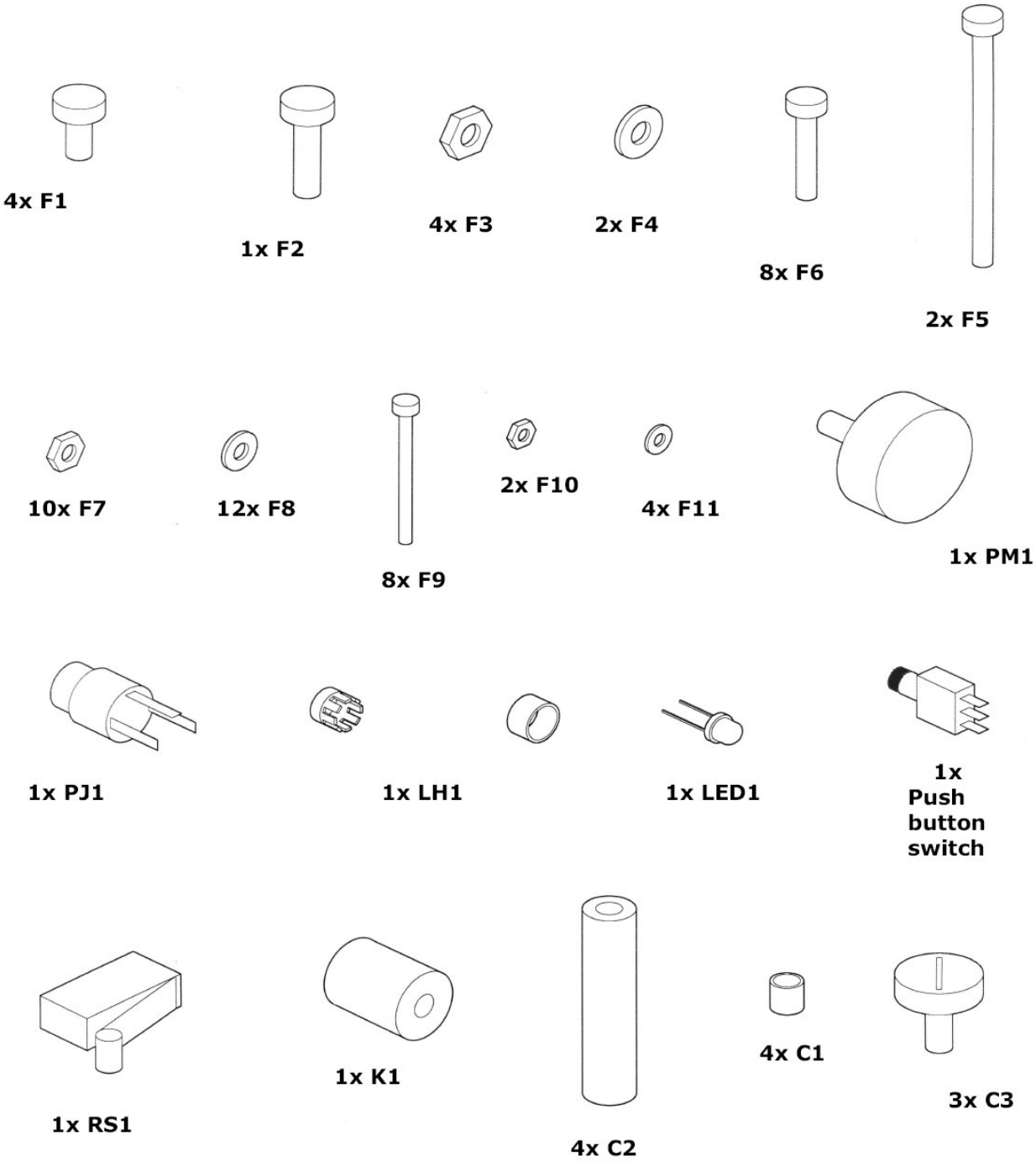


1x E3



1x O1

AC Wall Adapter not Drawn. Part E3 (Latch Switch Circuit) no longer required



Parts drawing may differ from actual parts supplied. RS1, F9-F11 no longer required

Qty.	Part	Name	Size	Remarks
1	1A	Base Plate		
1	2A	Support Plate		
1	3A	Disc		
1	4A	Control Panel		
1	5A	LED Bracket		
1	6A	Bracket Plate		
1	7A	Hub		
1	E1	Stepper Motor		
1	E2	Micro Stepper Motor Driver		
1	E3	Latch Switch Circuit		No longer required
1	O1	Calibrator		
8	F1	Bolt	M4x12	
1	F2	Bolt	6-32 3/4	
2	F3	Nut	6-32	
2	F4	Washer	6-32	
8	F5	Bolt	6-32 1/2	May differ depending on supplied motor
8	F6	Bolt	4-40 3/4	
8	F7	Nut	4-40	
8	F8	Washer	4-40	
0	F9	Bolt	2-56 3/4	No longer required
0	F10	Nut	2-56	No longer required
0	F11	Washer	2-56	No longer required
4	C1	Stand Off	5x5	PCB stand off
4	C2	Threaded Spacer (Stand Off)	40x8xM4	
3	C3	Knurled Adjustment Screw		
1	PJ1	Power Jack		
1	PM1	Potentiometer		
1	LH1	LED Holder		
1	LED1	LED (green)		
1	PBS1	Push Button Switch		
1	SW1	Toggle Switch		**Not Required**
1	RS1	Roller Switch (snap action)		**Not Required**
1	K1	Knob		
2	F12	FHMS Flat head Machine Screws		Not drawn

4. General Guidelines

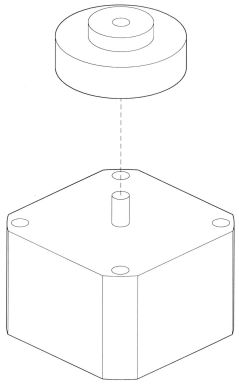
5 main aspects must be observed during assembly:

1. The panel material is supplied with a protective layer. This should be removed only when necessary. The base material is not scratch-resistant.
2. Caution should be taken when handling the micro stepping motor driver. The driver is electro-static sensitive. The acrylic panels are an ideal material to induce static electricity, which can damage the driver in case a discharge occurs.
3. The micro stepping motor should never be disconnected from the driver while it is running. This will permanently damage the driver.
4. Before assembly it is advised to first read through the instructions carefully as well as lay out all major parts in position. **In particular the wiring lengths in section 6.**
5. The control panel may be a bit sticky due to the manufacturing process used. Panels should be cleaned with citrus.

5. Placing the Hub over the Motor Shaft

The stepper motor (E1) may have a shaft on both ends. The aluminum hub (7A) needs to be placed over the larger shaft (5mm) of the stepper motor. *Note:* ***The hub may have already been placed and fixed over the motor shaft by the product distributor. If this is the case do not remove the hub.*** Before sliding the hub over shaft clean the shaft and hub bore of any burrs or debris. Place the hub's bore over the shaft and press it firmly in controlled fashion until it slides down. Try and prevent the hub from being pushed

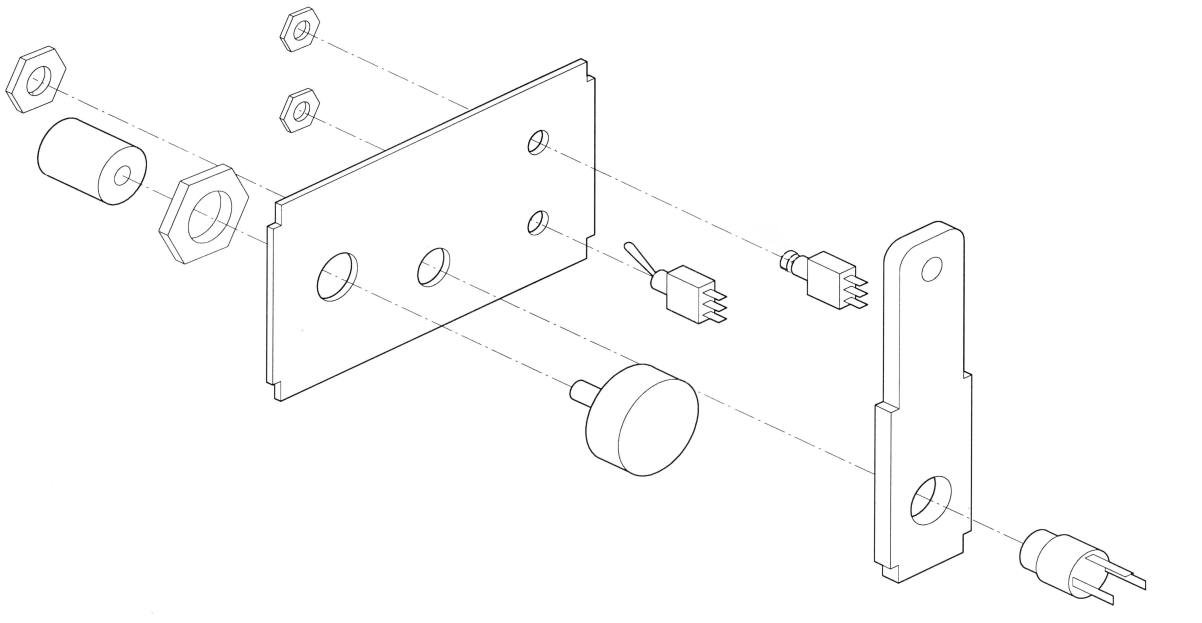
slanted over the shaft. The hub should have a tight fit and not slip over the shaft when turned. The hub should turn easily with no obstruction.



Note: some motors may have different dimensions and/or fastening points.

6. Solder Leads to Components

Peel off the protective layer on the control panel (4A). Determine the required length that the potentiometer (PM1) shaft should have to accommodate the knob (K1). Cut the potentiometer shaft to length. Insert all components as depicted in drawing. Place the potentiometer (PM1) shaft through the designated control panel hole and screw on the flat nut lightly.



Note: Top switch is push button switch PBS1, Bottom Switch Not Required.

The power jack (PJ1) has 3 pins. **One is for the middle pin which is the positive pole. Another is for the negative pole (outer)** and the last is for the chassis (not relevant). Solder an 80mm length of Red wire to the terminal on the control panel power jack connector (PJ1) center pin. Solder an 80 mm length of Black wire to the adjacent terminal on the power jack connector (PJ1). Verify with an ohm meter that the center terminal is indeed connected to the center terminal. **A mistake here will otherwise burn out the driver board**. Place a piece of heat shrink tuning over these solder joint. Shrink the tubing.

Two MTA connectors are provided with wires already inserted. One is a 3 pin connector and the other is a 5 pin connector.

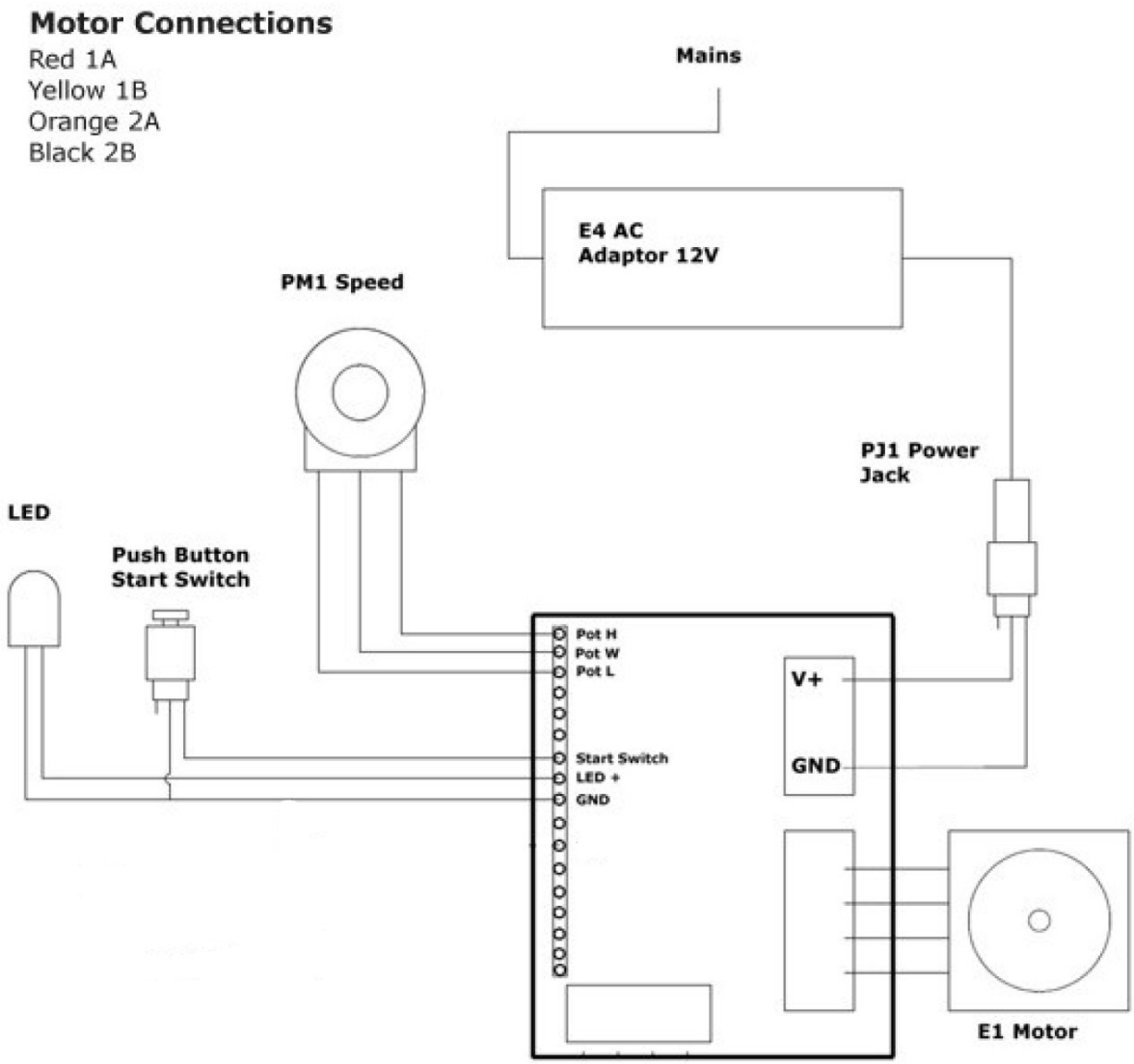
Take the MTA connector with the 3 wires and prep the ends by stripping 4mm from the exposed ends. Slide a piece of heat shrink tubing over the Yellow wire and solder to the middle terminal of the potentiometer (PM1). Shrink the tubing .Slide a piece of heat shrink tubing over the White wire and solder to the (PM1) pot H side terminal and slide a piece of heat shrink tubing over the Blue wire to the remaining terminal. Shrink the tubing. Bend back at a 90 degree angle all 3 of the potentiometer (PM1) pins. This is necessary make enough clearance for the control panel to fit in

Take the MTA 5 terminal connector and prep the ends of the exposed wires by stripping 4mm from the ends. Slide a piece of heat shrink tubing over the White wire. Solder the White wire to the side terminal of the push button switch (PBS1). Shrink the tubing.

A GND junction needs to be made as the LED and PBS1 share the same GND. Slide a piece of heat shrink tubing over a Black wire of the MTA connector as well as a loose Black wire. The loose Black wire is for the LED cathode and may be soldered to it after the wire has been extended through a hole that is located towards the end of the support plate (2A). The wire must be long enough to extend to the LED bracket (5A) for subsequent insertion of the LED.

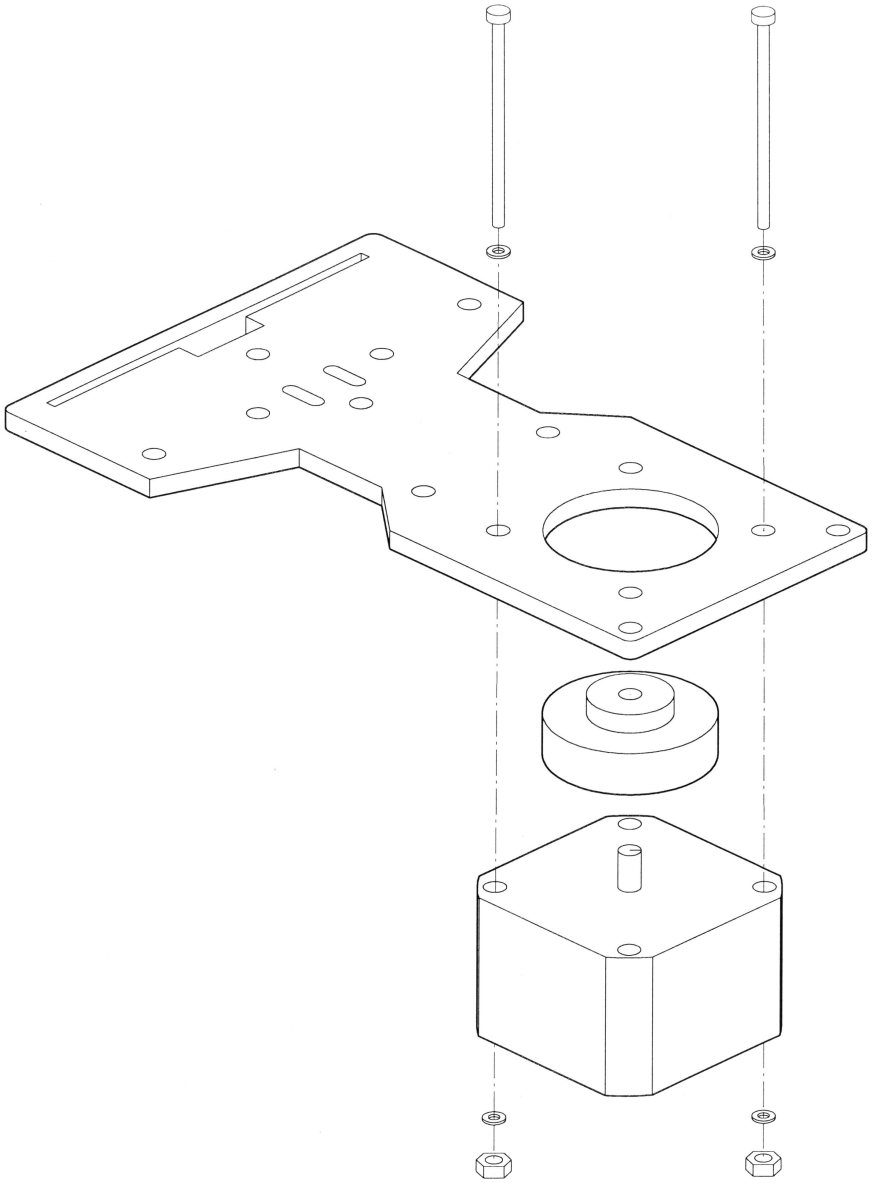
Solder this Black wire combination to the center terminal of the push button switch (PBS1). Shrink the tubing.

The micro stepper driver is supplied pre-programmed. The driver is supplied in 8^{th} step micro stepping mode. While this will result in low motor step torque it will run smoothest.



7. Attaching the Motor to the Support Plate

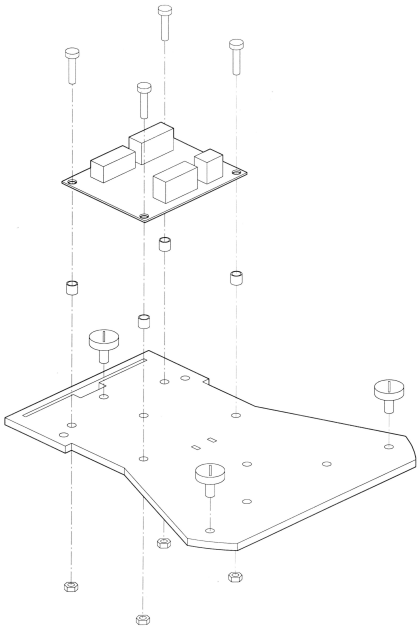
Remove the protective layers of the support plate (2A). Use 2 (F5) bolts, washers (F8) and nuts (F7) to attach the motor to the support plate with the leads of the motor facing towards the back side of the support plate. Make sure that the hub (7A) freely rotates and looks centered in the support plate.

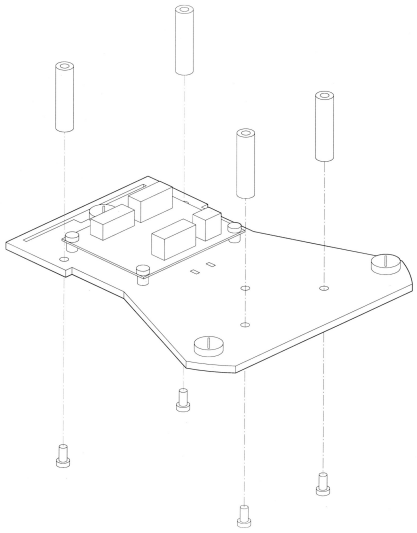


Note: Installation fasteners may differ depending on motor supplied

8. Populating the Base Plate

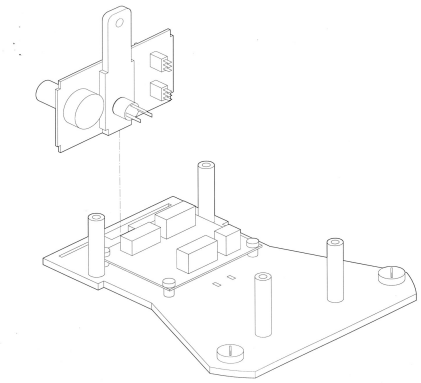
Peel off the protective layers of the Base Plate (1A). Insert the 3 black knurled screw stand off's (C3) into the base plate and fasten using (F3) nuts. The microstepper driver PCB (E2) includes a thin long jumper row (J4). Attach the microstepper driver PCB (E2) with J4 of the driver board facing the control panel to the base plate using bolts (F6), washers (F8), nuts (F7) and white nylon stand off's (C2).





Note: driver illustration differs from supplied driver

Install the 4 stand offs (C2) using (F1) screws from the bottom of the base. Remove the protective layers of the bracket plate (6A). This is the small finger shaped plate with a large hole at one side and a smaller at the other. Insert the power jack (PJ1) and lead wires through the bracket plate. Place the control panel plus bracket together in the rear slot of the base plate.



Plug the 3 pin MTA connector from the pot onto terminals 1, 2 and 3 of J4. These are the first three pins marked Pot. Make sure that this is correct. Plug the 5 pin MTA connector with the White wire onto J4 with the terminal marked 1/06, the Red wire to pin marked I/07, the Black wire to the pin marked GND.

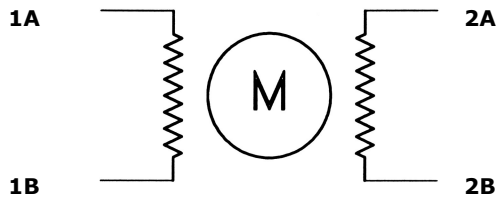
Cut to length the power jack leads. Connect the Red wire lead from the power jack (PJ1) to the connection labeled +VB on the driver PCB. Connect the Black lead of the power jack to the GND connection of the same connector.

Make sure that no debris such a copper from the wire cutting has fallen on the PCB. Turn the PCB upside down to make sure. Using bolts (F1) screw on the 4 35mm black stand off's (C1).

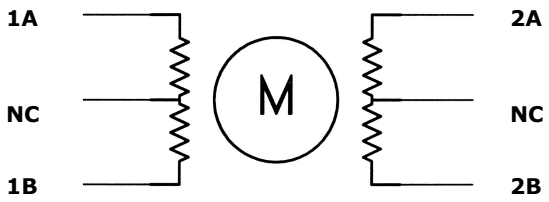
The supplied bipolar stepper motor (E1) has either 4 or 6 leads. Check which leads are "pairs". Pairs can be found using a multimeter. Set the multimeter to read resistance at a low Ohm setting. For 4-Wire Motors pairs should read very low Ohm resistance while non pairs should read infinite resistance. 6-Wire Motors have an extra line for each of its two coils. First find which lines a related by measuring their resistance. Infinite resistance means not related. Once the 2 groups of 3 lines are found find out which line has the least resistance. This is the Not Connected (NC) line.

Connector J3 is for the stepper motor connection. The labels are 01A, 01B this is one pair. 02A and 02B is another pair. Connect one pair of leads from the motor to 01A and 01B. Connect the other pair to 02A and 02B.

The current motor uses a Red wire connected to 01A, Yellow to 01B, Orange to 02A and Black to 02B.



4-Wire Motor

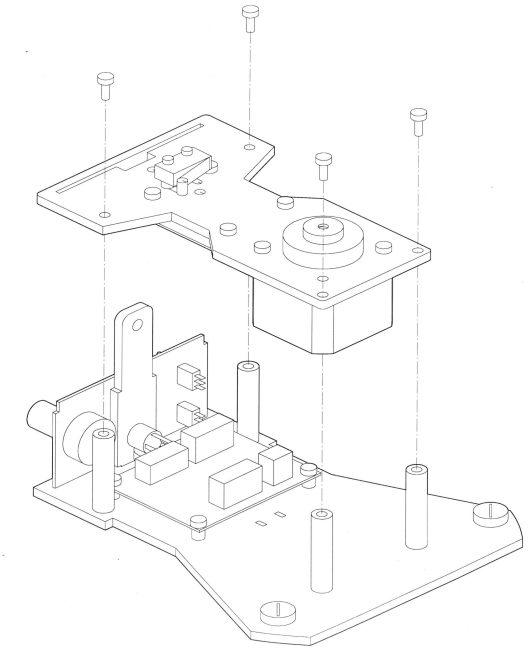


6-Wire Motor

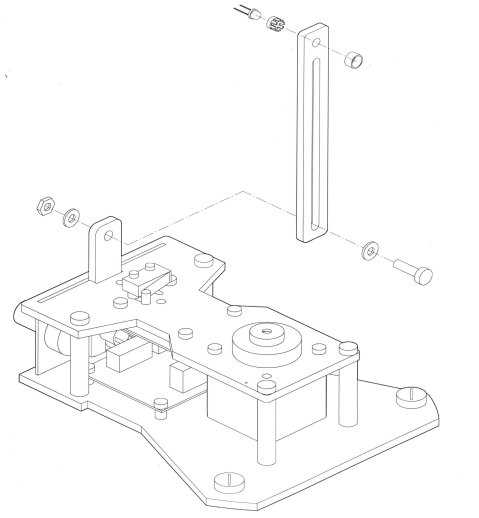
9. Finishing Up

Attach the support plate assembly to the base plate assembly using 4 bolts (F1). Remove the protective layers from the LED bracket (5A). Insert the LED clip into the hole and use a small drop of super glue to secure. Careful, too much super glue will result in a frost like deposit around the glue site. Attach the bracket to the LED support plate using a bolt (F2), washers (F3) and nut (F4). Solder the leads that were inserted through the support plate to the LED (LED1). Make sure that the LED connections are correct. The LED only works if it connected correctly. The LED pins differ in length. The longer pin represents the positive connection (+) and the other for the negative connection.

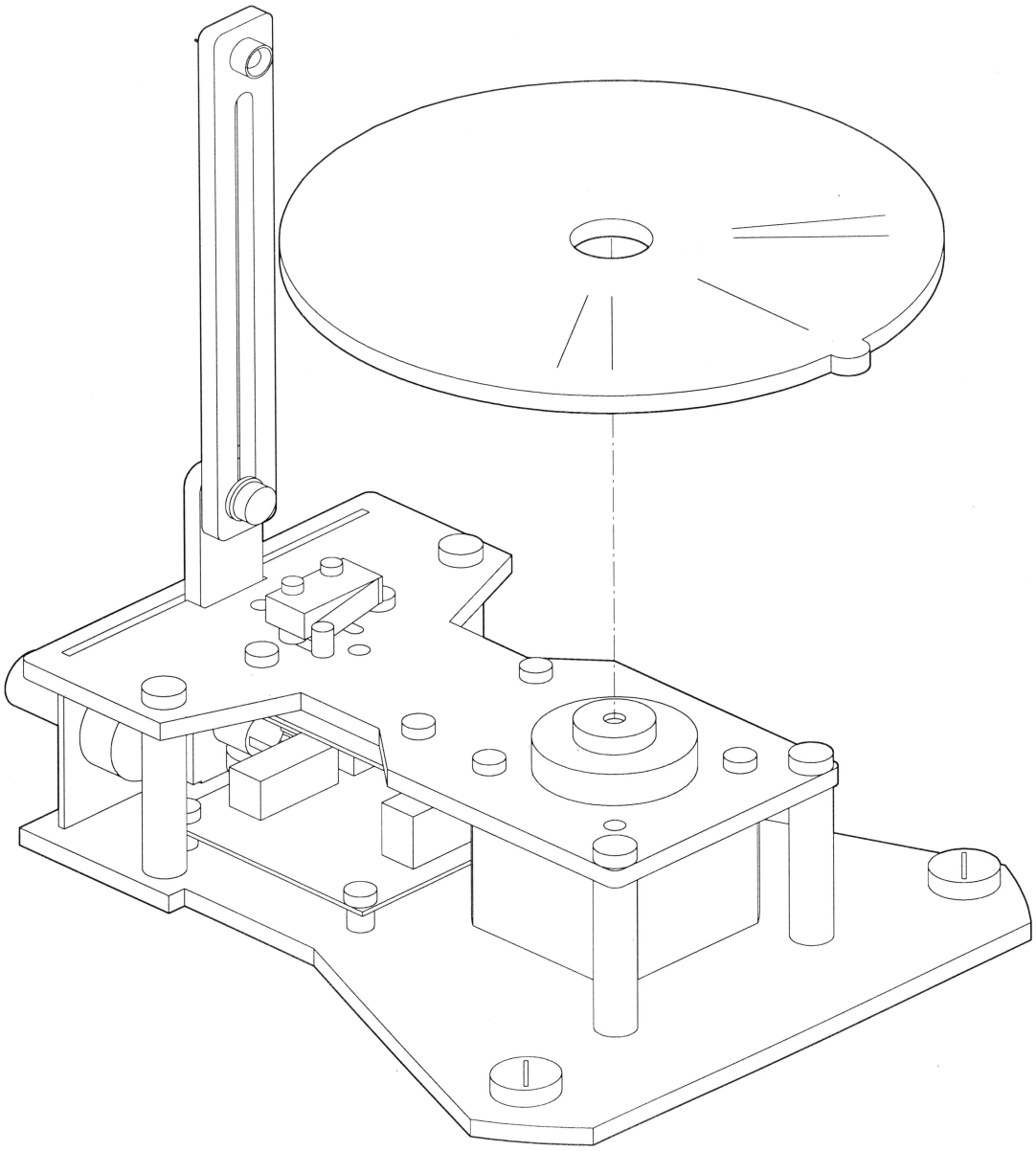
The Red wire from the J4 MTA header connects to the + and the Black wire from the junction of the Black wires attaches to the shorter – pin of the LED.



After making a thorough check of all connections hook up the power supply. Push the start button. The motor should run and the LED should switch ON then switch OFF after a brief period. The LED will then switch ON again after a full turn is achieved. The motor should then auto stop. From above the turn table looking down at it the rotation direction should be Counter Clockwise. If not, cut the power and unplug the power supply. Swap one of the wire pairs of the motor to driver connection. This will reverse the run direction of the motor. Run the cycle again, with the motor running turn the potentiometer knob. The rotation speed should change. Find a speed that is about 45 seconds for a full revolution. Usually if something does not work it is due to a loose connection. If so, unplug the power supply and localize using a multimeter.



Only when the unit fully functions should the disc (3A) be attached to the hub. First remove the protective layers of the Disc. Place the disc on the hub a check that it evenly rests on it. Use the FHMS Flat head Machine Screws (F12) to fasten the disc onto the hub. Do not over tighten. Make sure that the disc does not wobble when it is turning. Wobble will lead to swirls in the scan. Plug in the power supply and turn on the motor. Set to a high speed and look at the disc from its side. Inspect for wobble. If this is found investigate why and correct.



Note: sink nuts not drawn