TURNTABLE INDEXER #617

for use with BOWSER and other, turntables by

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OVERVIEW

The TURNTABLE INDEXER unit has been made with simplicity of installation and use in mind. The unit consists of a printed circuit board with an infra-red optical reflective sensor attached. A 14 to 18 volt fixed AC, 15 to 18 vDC input source is required to power the electronics and a variable DC source is required to power the turntable motor. The turntable motor is operated by merely turning on and off the power via the optical alignment. When the turntable motor is set for "off" the indexer places a shunt resistor across the motor for a faster stop. Fabrication of brackets for stop positions is required by the user.

Operation of the turntable to the next position merely requires pressing the momentary push button and releasing when the present stop is cleared. The turntable will proceed (assuming that power is being applied to the motor) to the next stop. If you desire to continue, merely hold the pushbutton until that stop position is cleared and release. You can also use a toggle switch to accomplish this function. Then you would merely turn the toggle switch on and set it to the off position when past the stop before the desired stop.

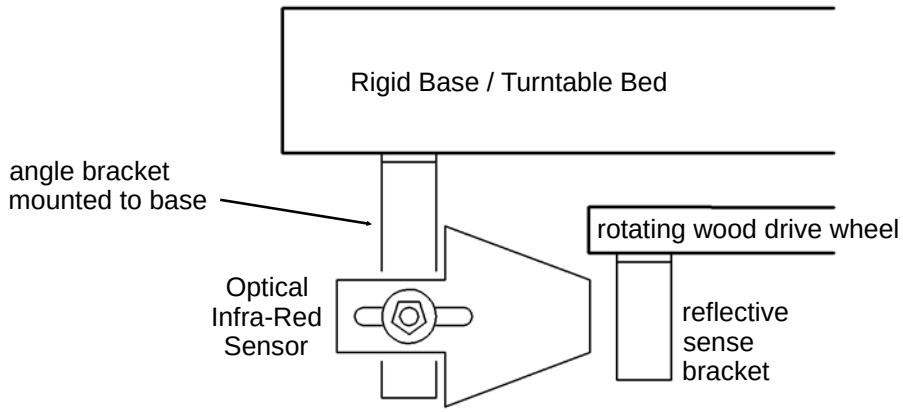
For use with other type turntable mechanisms it is suggested to study the BOWSER installation and try to apply that operation to your type turntable. As an example, the optics could be mounted on top of the turntable and with a solid rotating bed (as some have) you could read small vertical wires.

INSTALLATION INSTRUCTIONS

Read all instructions first, then decide on the best method for your installation. When using this unit with a BOWSER turntable, you will need to bend the motor support bracket (Bowser #79334) at the spring end so that the spring / tension wire clears the brackets mounted to the underside. You will also need to use a longer nail / screw to extend the tension wire further below the wood drive wheel base. We would also suggest placing two large washers (one on either side of the motor support bracket) so that the motor is held closer to parallel of the lower wood drive wheel. You may find it necessary to add a few washers to bring the motor drive's "O" ring drive drum closer to centered with the wood drive wheel.

Since the optical alignment is controlled from the lower wood drive wheel it is neccessary to secure the drive wheel to the vertical shaft and the vertical shaft to the upper table. This can be done by either glueing or driving a pin through holes drilled in the upper and lower parts. If you elect to pin the upper and lower parts to the drive shaft, please be careful, first drill a small hole for accuracy followed by the size hole appropriate for the pin used. It is suggested to always leave the outer collar hole a slight bit undersized. As a side note, if you are concerned about warpage of the lower wood drive wheel, you might want to seal it before use.

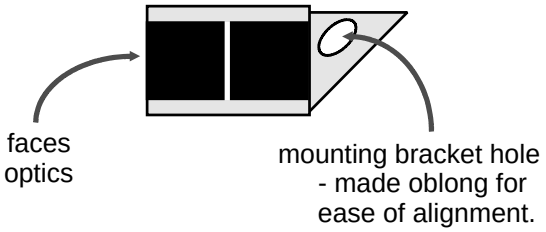
The optics and printed circuit provided need to be secured near the main turntable base. The optics need to be secured at the edge of the wood drive wheel on the turntable base. This can be done by using a standard angle bracket or with a wood block. The point of focus from the optical end to the sensed object ranges from an 1/8" to 1/4". Mount the optics so that the focal point is at least 1/4" below the wood drive wheel and a slight bit back from the edge of the drive wheel (see diagram below). Although the optics are shown to be mounted perpendicular, they can also be mounted horizontally.



Exploded side view of bottom rotating wood drive wheel, showing optics aligned to stop bracket.

Stop indicators can be fabricated from shim stock, thin paper clips (easiest for O gauge & larger type operators), laser printed stripe, or just about any other reflective surface. The accuracy of stopping in either direction is directly related to the thickness of material (when using edge of fabricated bracket, paper clip thickness) or line on the indicator. When using a 300 dot per inch printer, the smallest useable resolution has been found to be 0.015" (at 300 dpi = 0.0033"/dot, 600 dpi = 0.001667, the included stripes are printed at 600 dpi. To use these simply cut out and press the self stick label or glue (with "Glue Stic" or a similar type paper cement) to the flat face of any type of support (a picture is shown on page 4). If using this type of sense, the sense brackets would be rotated 90 degrees from shown in all edge sense diagrams and the stop position would be the white line (perpendicular to the drive wheel). As the drive wheel turns to stop position the sensor will first see black. The black is sensed the same as not being there. When the white stripe appears, the sensor detects the reflection and stops the motor (assuming that all is aligned correctly). In all of the following text, whatever you are using to sense position will be referred to as a sense bracket. The accuracy of the stop from a clockwise rotation versus a counter-clockwise rotation is shown on page 2.

LASER PRINTED STRIPE SENSOR



The optics do not sense black or the lack of focus, they do however sense any reflection of light striking the optical pickup. This light is generally the infra-red light generated by the internal infra-red led. It will however also sense ambient light striking the sensor, since that also contains infra-red light as well.. So care must be taken when alignment is done so that ambient light does not strike the sensor.

Fabrication of this type of sensor can be done by placing patterns included on the preprinted labels on the front of angle brackets. The pattern can be copied with a laser printer type copier utilizing toner, inkjet printers and paint will generally not work. A sheet is also available from our web site to download and print more on your own laser printer. Each pre-printed label consists of 3 patterns on each and must be cut from each other. The brackets can be either commercial brackets since the thickness is not important in this application or they can be fabricated from 3/8" (or larger) Plastruct molded plastic right angle extrusions which are available from most hobby stores. Cut the strip into small lengths, make an oblong hole for mounting, and with a clean surface to place the pattern on, remove the backing from the labels and place the optical patterns on the face. If more glue is necessary, use "Glue Stic" for reattachment. Other glues may seep into the toner and close the gap so that the optics cannot read it properly. The optics should read the center pass of the printed line. It is not important to have an exact amount of black on either side of the center white stripe. What is important is to have the bracket covered on either side of the center white stripe. Otherwise the optics will read the exposed bracket and stop on those spots as well. The black area is equivalent to having nothing in front of the optics.

If you are operating as an "O" gauge or larger type operator, then paper clips bent and cut to position will work just fine.

The bracket must be made to clear the tension spring and wire. A longer screw to secure this wire may be used.

PAINTED STRIPE SENSOR

The optics do not sense black or the lack of focus. A painted sensor can be made two different ways.

The first method is done by placing a fine line on the bracket, painting brackets flat black, after the paint has dried peel open the reflective stripe. The shiny metal will reflect just fine.

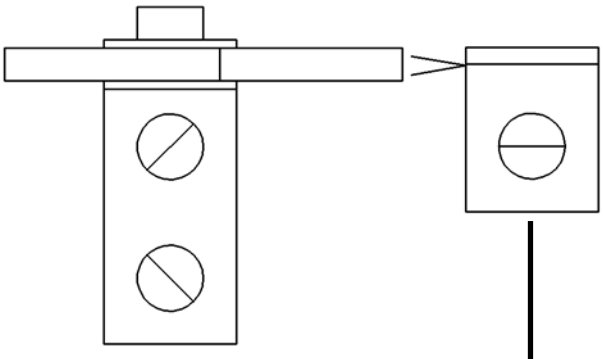
The other method is to again paint the face of the bracket flat black. Then place a fine white line on the face of the bracket.

The main problem with painting the bracket flat black is that some types of paint still reflect infra-red light. To be sure that yours does not, simply paint a bracket. After it dries hold it in front of the optical pickup (at a proper focal distance - the optics will detect your finger nail). If the relay does not activate there is no reflection detected and the paint is OK to use.

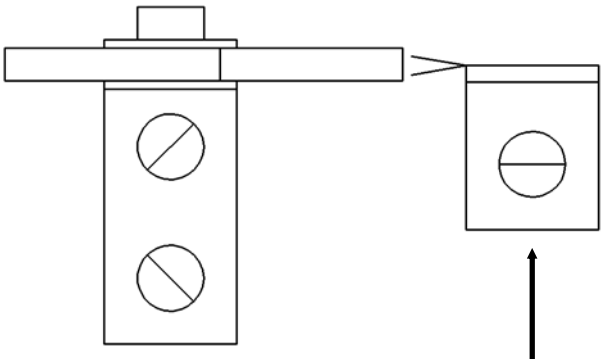
ANGLE BRACKET SENSOR

The side of a narrow angle bracket or paper clip can be used to operate the indexer. The thickness of the bracket or paper clip will effect the accuracy of clockwise and counter-clockwise operation (see Sensor Accuracy drawing below). This accuracy is however OK for use in larger gauges, beginning with "O" gauge and possibly "S" gauge as well.

Sensor Accuracy



Clockwise rotation - sensor stops turntable operation slightly after reflection detected.

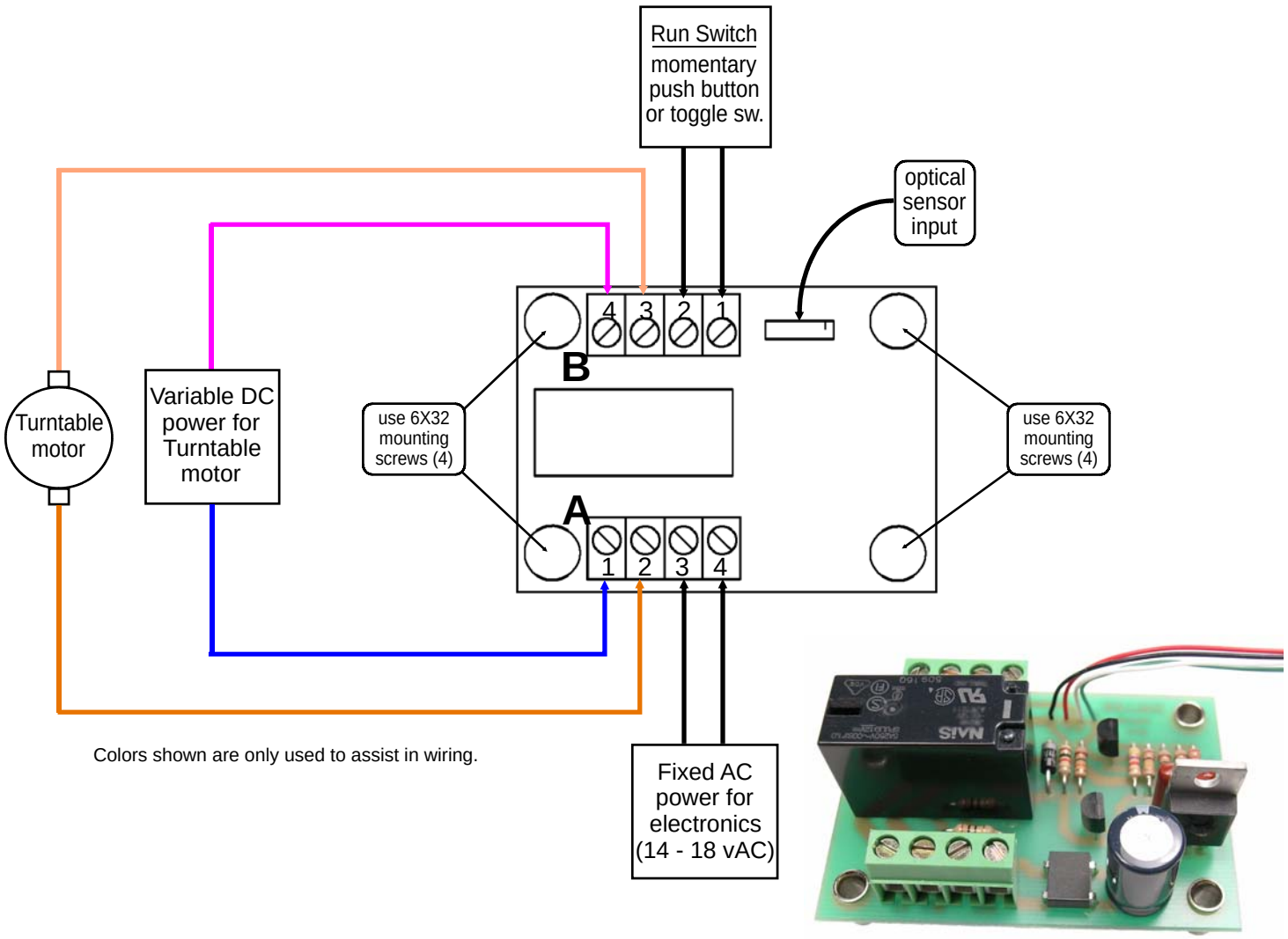


Counter-clockwise rotation - sensor stops turntable operation slightly after reflection detected.

Sensor accuracy determined by thickness of sense bracket. If the bracket is located closer to center of the turntable bed, the error of stop position for clockwise versus counter-clockwise becomes greater. In some cases it may be necessary / desirable to overshoot the stop position and reverse the table for accuracy in one direction only.

TURNTABLE INDEXER
wiring diagram

DO NOT leave any electrical wire come in contact with the Run Switch wires, this will damage the optical sensor and is not covered as a warranty repair!



ELECTRICAL CONNECTIONS:

All wires to be connected to the barrier strips should be stranded, not solid, and stripped approximatly 1/4" for placement in the barrier strip. Place the wires into the appropriate rectangular opening, and when all wires necessary are in the opening turn the appropriate screw clockwise until the wires are secure. DO NOT overtighten. There is NO SOLDERING required.

Without power on, connect an appropriate AC source (14 to 18 volts AC, this can be the "accessory" output from the power pack you are using for the turntable) to the AC input terminals on the printed circuit board (as shown below and labeled - refer to this drawing for all further connections). Connect the motor wires to the terminal strip marked for the turntable motor. Connect the variable DC control wires to the power supply used to provide the 0 to 12 volts variable DC motor power (usually marked "CAB" on power packs). If the turntable operates opposite the direction desired, simply reverse these wires at the power pack or turntable motor but NOT BOTH.

Connect the switch wires to the momentary push button switch but DO NOT mount this switch at the present, it is easier to do the alignment with this switch in close proximity to the bottom of the turntable when aligning the stops. You might also elect to do the run / stop operation with a panel mounted toggle switch (SPST) instead of the push button supplied. If so, you can connect the toggle switch in parallel to the momentary push button switch but be sure that it is in the "OPEN" position. DO NOT allow the switch wires to contact any other electrical power or you will damage the optics and possibly more!

ALIGNMENT:

For alignment, you will need to hear that the relay activation / de-activation. If you feel that you cannot, one of two things can be done. The simplest is to slightly apply motor power so that you can hear it buzz / hum without rotating the turntable (if you disengage the drive wheel, as an alternative discussed below, more power can be applied to the motor since it does not matter if it operates). Another alternative is to use a lamp for indication - if so disconnect the turntable motor power temporarily from the pc board, connect a 12 to 18 volt lamp across the turntable motor terminals on the pc board, apply turntable motor power from the "CAB" variable DC. This way the light bulb will illuminate when you are NOT in alignment.

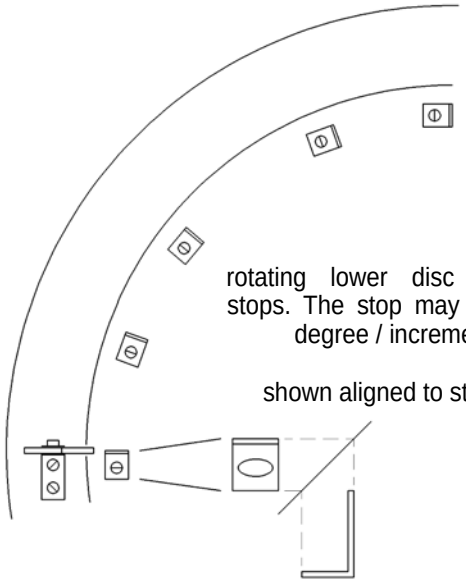
To properly perform alignment, you MUST NOT have any external light entering the front of the optical sensor. Bright light entering the sensor will disable it from properly reading the infra-red light emitted from it's own source. Some light, of course, is neccessary to see what you are doing!

Alignment is done by having power to the indexer turned on and power to the motor off (unless it is easily accessible). Rotate the turntable manually to an appropriate stop position (either release spring tension for all of alignment proceedure or pull back on tension drum to free the turntable for manual rotation). Take the fabricated sense bracket and slide it in front of the optics. When in a proper position you will hear the relay activate. At this rough position, lightly secure the sense bracket leaving it slightly adjustable. Press the push button, you will hear the relay instantly drop out. When you release the push button the relay will pull back in only if precise alignment is present! If you do not hear the relay pull back in, lightly nudge the sense bracket until it does. Repeat pressing and releasing the pushbutton until precise alignment occurs. The sensor circuit has a large hysteresis window. Once activated, it stays pulled in until a definite deactivation occurs. This is to prevent random hunting of the stop position when vibrations occur from operating a locomotive on and off the turntable. If you removed the turntable motor power temporarily, reconnect it.

Underside of turntable showing multiple stops of rotating lower disc. The lower disc directly correlates to the upper transit.

Note the ease of stop placement. An undersized wood screw with a washer works best for bracket securement.

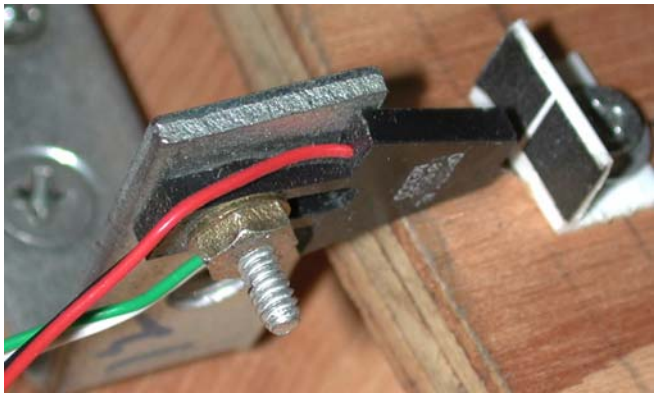
shown reading a paper clip or other rigid fine wire. Rember, the clockwise and counter clockwise stop resolution depends on the thickness of this metal (as discussed on page2).



rotating lower disc with multiple stops. The stop may be set at any degree / increment!

shown aligned to stop position.

Side view of fabricated angle bracket. Note the oblong hole made for ease of adjustment. The bracket needs only to be high enough for optical sensing.



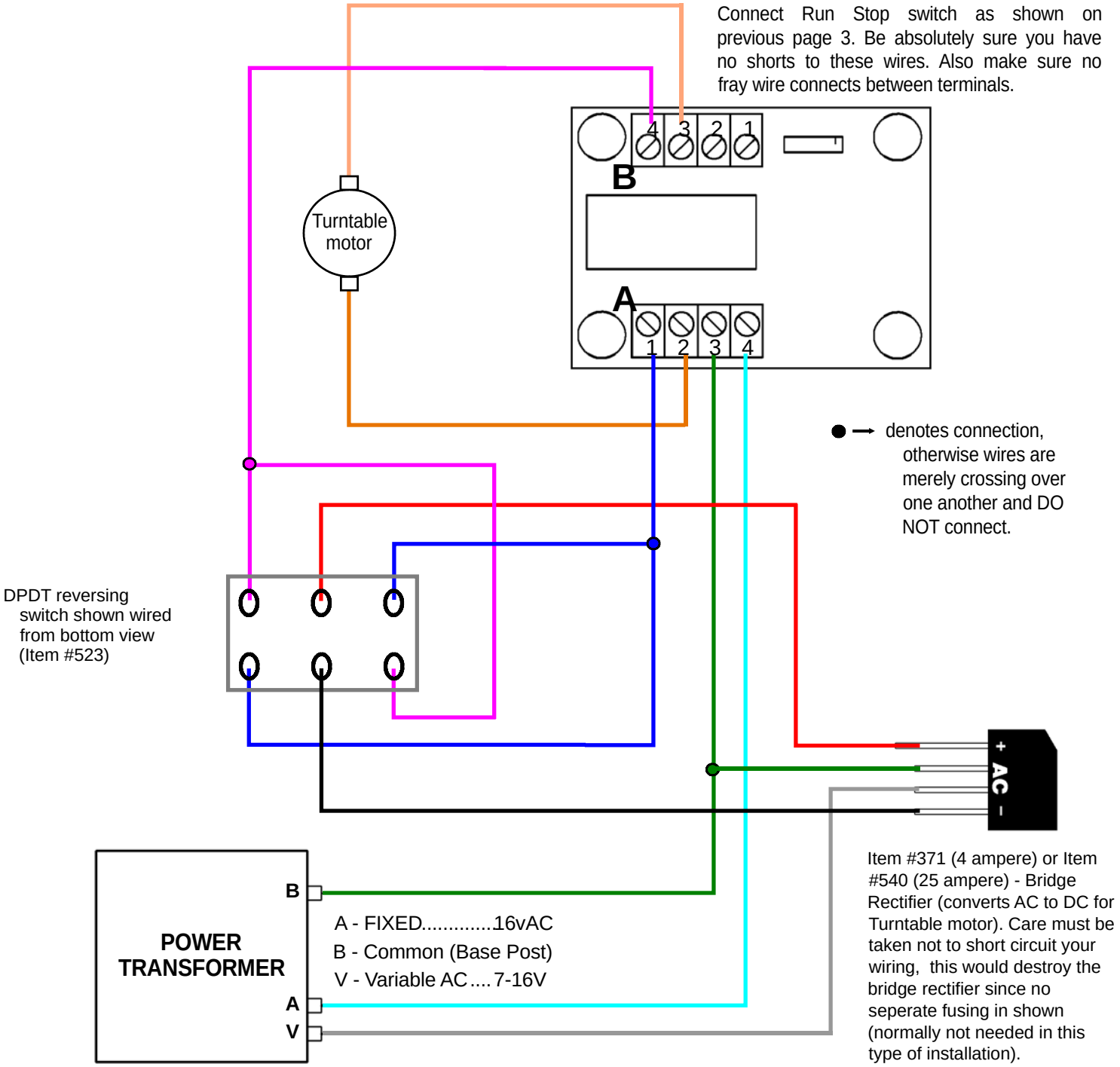
If you choose to use the laser printed laser stripes, the brackets would be mounted as shown above. In this picture plastruct plastic angle brackets used. First they were cut to size. Then large, or oval, mounting holes were drilled. Last, the laser printed stops were placed on the brackets face.

FINAL OPERATION:

At this point you should mount the pushbutton (or toggle switch if that's what you selected to use) on the panel at a desired location. Re-connect the switch wires and verify all alignments / operation. If any stop is out of alignment re-adjust it. You should now be ready for full operation.

Connecting Turntable Indexer to a variable AC type transformer as most Hi-Rail AC train operators already have.

Since the BOWSER turntable uses a DC motor it is necessary to convert the AC to DC. For AC operators this merely neccessitates the addition of a bridge rectifier. If direction control is desired a Double Pole Double Throw switch is also necessary.

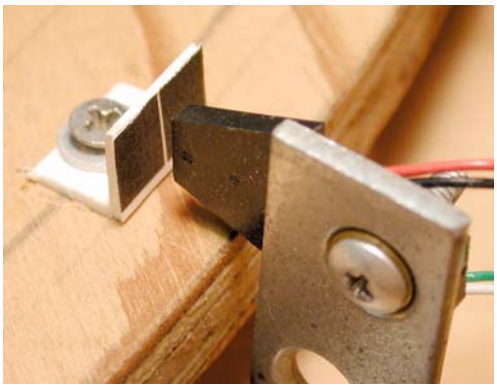


If a direction switch is not desired, wire the bridge rectifier "+" to barrier strip "B" #4 and the bridge rectifier "-" to barrier strip "A" #1. If the turntable rotates in the opposite direction desired merely reverse the wires on the motor.

If you choose to use a separate transformer or small transformer (40 watt or more) to power the turntable you might also consider placing a toggle switch on the variable output of the transformer. In the first position the variable AC would power the turntable operation. The second position would power the tracks in the yard area. This way a small power transformer can be utilized quite well in the yard area. Don't forget to insulate the yard feeder from the main line. By doing so you can shift locomotives in the yard area without interfering with the main line operation.

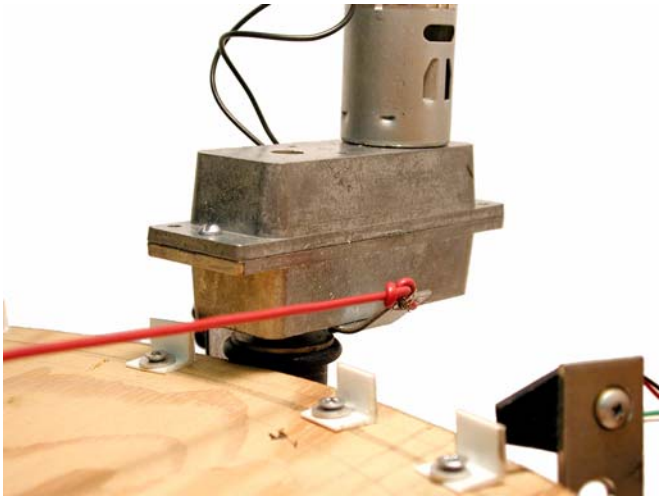
Optical Alignment - another view

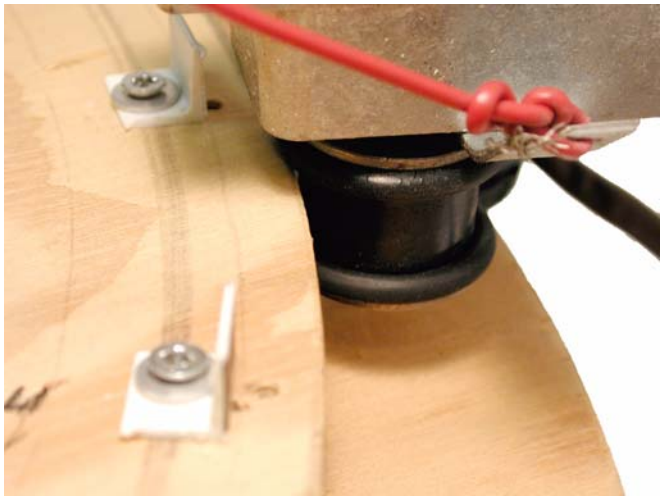
Paper Target mounted on angle bracket



Easy adjustment when using a large flat head screw or a screw with a flat washer.

Motor Drive & Optics





By applying drive O rings top and bottom of the drive wheel the turntable bottom maintains a proper elevation for the optics to read. A wandering disc prevents the optics from proper reading.

Another method to hold the lower disc is to use angle brackets to trap the rotating disc or captive roller balls.

In this picture, tubing was added to the drive wheel before the O rings were placed. This assists in drive traction although not required.