



ARTA - Hardware & Tools

Construction of an automatic turntable

introduction

In ARTA Application Note No. 6 and Application Note No. # The metrological recording of the radiation characteristics and various options for evaluating the measurements are shown.

Those who measure radiation characteristics with high resolution more often know that it is a laborious, stupid activity that still requires concentration by the person performing it, otherwise angles are quickly skipped or measured angles and file names do not match.

A simple, re-buildable, inexpensive automatic turntable that can communicate directly with ARTA was therefore developed especially for multi-knives and self-assemblies. At this point, we would like to thank Wim Huyghe (software) and Ralf Grafe (hardware), who both contributed significantly to the success of the project. My thanks also go to Matthias Sylvester, who provided many pictures of the construction of his very successful turntable.

This construction manual only describes the construction of the turntable. Commissioning, calibration and measurement with ARTA and the turntable are described in Application Note No. # described.

Construction and construction of the turntable

First, an important preliminary remark: The construction shown here focuses on the smallest possible dimensions for transport. Nevertheless, with just a few additions, it is also suitable for large and heavy loudspeakers - for both horizontal and vertical measurements (see picture 1, variant A and annex).

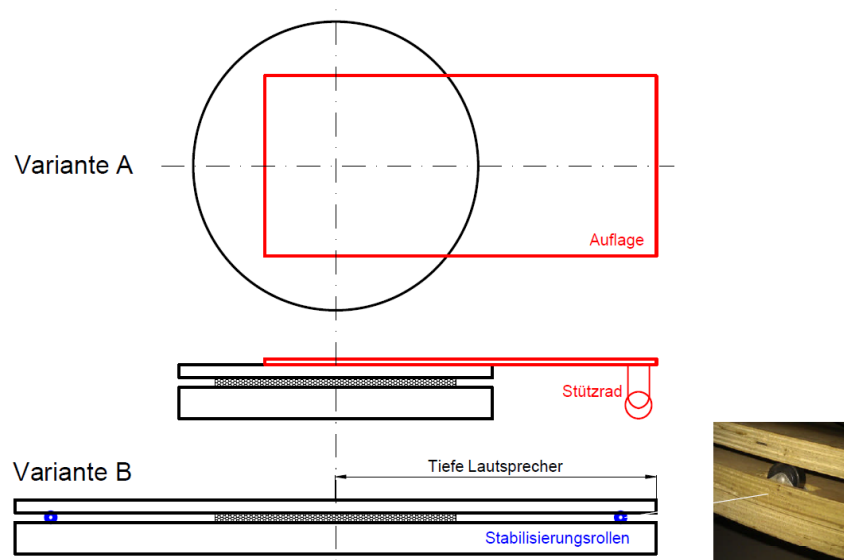


Image 1: Constructional variants

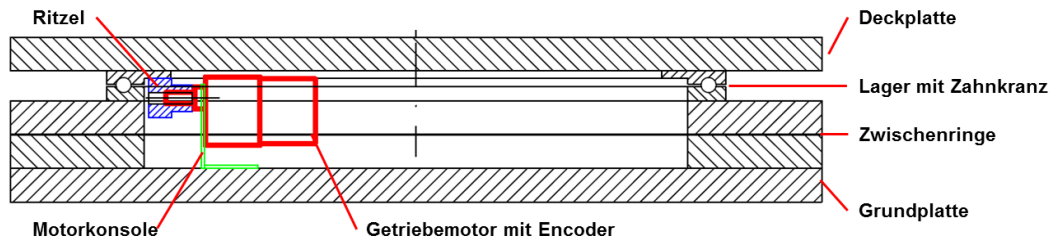
For outdoor measurements with an uneven floor or for measurements in the RAR with a grid floor, it is better to build a larger version on which the test object can be safely positioned without an additional support with a support roller (Figure 1, version B). The large variant has the advantage that no movement takes place outside the footprint of the turntable and thus neither connecting nor speaker cables can hinder the rotating movement. However, the pivot bearing should then be supported by additional stabilizing rollers on the outer edge of the cover plate.



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With the exception of the bearings and the drive concept, the concept can be freely designed, ie the outside diameter and size of the contact surface can be adjusted as required. The basic construction consists of a base plate, two intermediate rings, the thrust bearing with ring gear and pinion, and the cover plate.



Picture 2: Design principle of the turntable

In addition to common tools such as screwdrivers, wrenches and side cutters, the following tools are required to build the rotary table: jigsaw or better router, drill, M6 tap and soldering iron.

18mm multiplex should be used for the wooden construction. It consists of two disks (cover plate, base plate) and two intermediate rings. That is both with a jigsaw and with

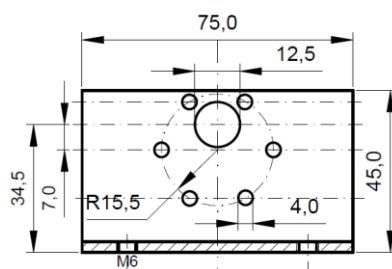


to accomplish a router. The dimensions are shown in Figures A1 and A2 in the Annex, the outer diameter being largely freely selectable. For the integration of the connection panel, it is advisable to provide a breakthrough for power and USB cables in the lower ring. Further details can be found in Figures A3 and A4 in the Annex.



The thrust bearing with ring gear can be attached to the wooden structure using wood screws as well as M6 hexagon screws. The hexagon bolts offer the advantage of limited adjustability, but require additional M6 threads to be cut in the outer ring of the bearing. Since M6 threads have to be cut into the inner ring to fix the cover plate, the additional effort is manageable.

The drive unit consists of the geared motor with encoder and mounting bracket, a pinion and the control unit with USB connection. The basic construction with drive unit is designed so that both geared motors mentioned in the parts list - of course with the matching motor console - can be installed (see parts list and annex).



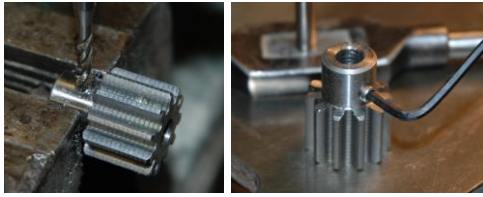
It is important to attach and align the geared motor. The bracket for the motor mounting must be aligned and, if necessary, relined until the pinion - gear rim pair runs without play. Due to the manufacturing tolerances for the ring gear, which is made of die-cast aluminum, and

The thickness tolerances for the 18 mm multiplex plates require individual adjustment. The axis dimension of 34.5 mm must therefore be checked before drilling the console!



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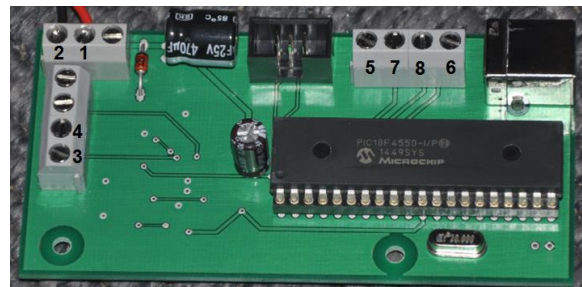
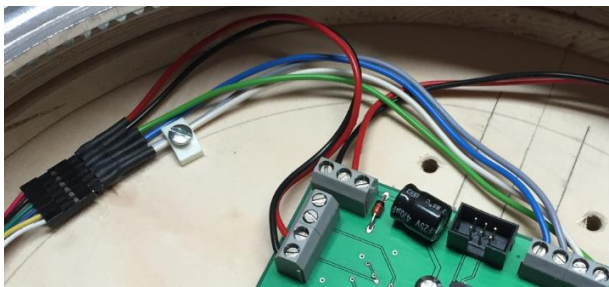
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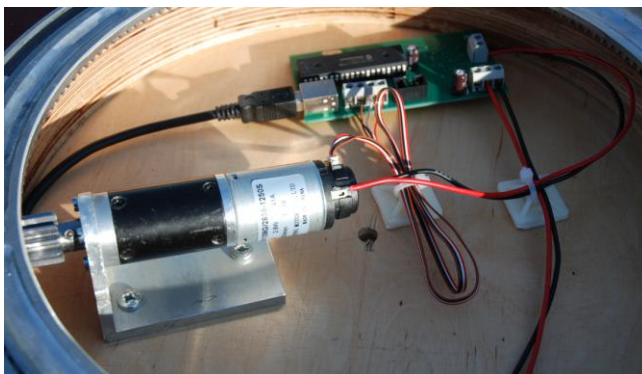
There is another small hurdle to be taken to secure the pinion on the motor axis: First cut a 3.5mm hole and then an M4 thread for the clamping screw on the pinion (see pictures).

The control board with USB connection can be assembled, including the programmed PIC (<http://www.m1n1.de/html/Measurement.html>). The wiring of the motor or the encoder with the control board is done according to the following table or the following pictures.

function	Pololu	Phidgets	Board connector
	Gear motor 12VDC with 64 CPR encoder 80rpm (6mm axis)	3264E_0 - 12V / 8.4Kg-cm / 28RPM 139: 1 DC Gear Motor w / encoder	
Motor power -	black	own choice	3rd
Motor power +	red	own choice	4th
Hall sensor + 5V DC	blue	red	5
Hall sensor GND	green	black	6
Hall sensor output A	yellow	White	7
Hall sensor output B	White	brown	8th
USB board supply +12 V DC	red		1
Supply USB board GND	black		2nd



The finished structure of the interior of the ARTA rotary table can be seen in the following pictures. The right picture shows the construction with additional stabilizing rollers to relieve the bearing ring. A little patience is required to adjust the correct roll height.



A 12V / 3A power supply or a 12V lead gel battery is suitable for the power supply. A fully charged 12V / 2.2Ah battery comfortably lasts for a longer measuring session and makes you independent of the power supply. In addition, you are freed from the annoying laying of long cables for both outdoor measurements and measurements in the RAR.



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Up to approx. 3m to 4m, the turntable works perfectly with passive USB extension cables. That should be enough for measurements in normal living rooms. A USB booster is required for longer distances between the computer and the rotary table. The USB boosters are available from specialist retailers in lengths of up to 25 m for € 10.00 to € 25.00 (e.g. USB repeater DIGITUS, active extension DELOCK).

Finally, the parts list is shown below. Positions 1 to 5 are decisive for the construction, for this reason also the indication of possible sources of supply. The costs for positions 1 to 5 are approximately € 150.00. The other items refer to the variant shown here, they can vary depending on the structure and preferences of the builder!

Pos	designation	Supplier No.
1	Bearings with ring gear Slewing ring 330.01	stapler 1
2a	engine, variant A Gear motor 12VDC with 64 CPR encoder 80rpm (6mm axis), Pololu	noDNA -
2b	engine, variant B Geared motor-12VDC-84Kg-cm-28rpm-139-1-with encoder, phidgets	noDNA 1
3rd	circuit board Printed circuit board (http://www.m1n1.de/html/Measurement.html)	1
4th	Sprocket 11 t Spur gear, 11SMnPb30 with hub module 1.5 11 teeth, width 15mm Mädler	1
5	Aluminum angle Bracket for gear motor	1
6	USB cable USB cable (max. 3 to 4 m, otherwise cable with USB booster)	1
7	USB port WireThinX extension USB 2.0 plug B to built-in socket B, 0.5 m Amazon	1
8th	Hollow plug socket Hollow plug socket, central installation, Øi = 2.5mm	Reichelt 1
9	Button head screw M3 x 6, motor mounting	6
10	hexagon bolts M6 x 16, fastening cover - slewing ring, gear side	6
11	hexagon screw M6 x 35, fastening base / intermediate rings - slewing ring	6
12	M6 x 25 countersunk screws, fastening the engine console to the base plate	2nd
13	Blind rivet nut M6 M6, threaded bushes for attaching components to the lid	4th
14	Wood MPX 18mm	

Table 1: Parts list for the ARTA rotary table



Picture 3: Individual parts of the ARTA turntable by Matthias Sylvester

literature

[01] Floyd Toole, Sound Reproduction - Loudspeakers and Rooms, Focal Press 2008 [02] ARTA

Application Note No. 6: Directivity Measurements

[03] ARTA Application Note No. 8: Repetitive Measurements with Script Language AutoIT [04] ARTA Application

Note No. #: Directivity Measurements with an Automatic Turntable

ANNEX

Part 1: construction details

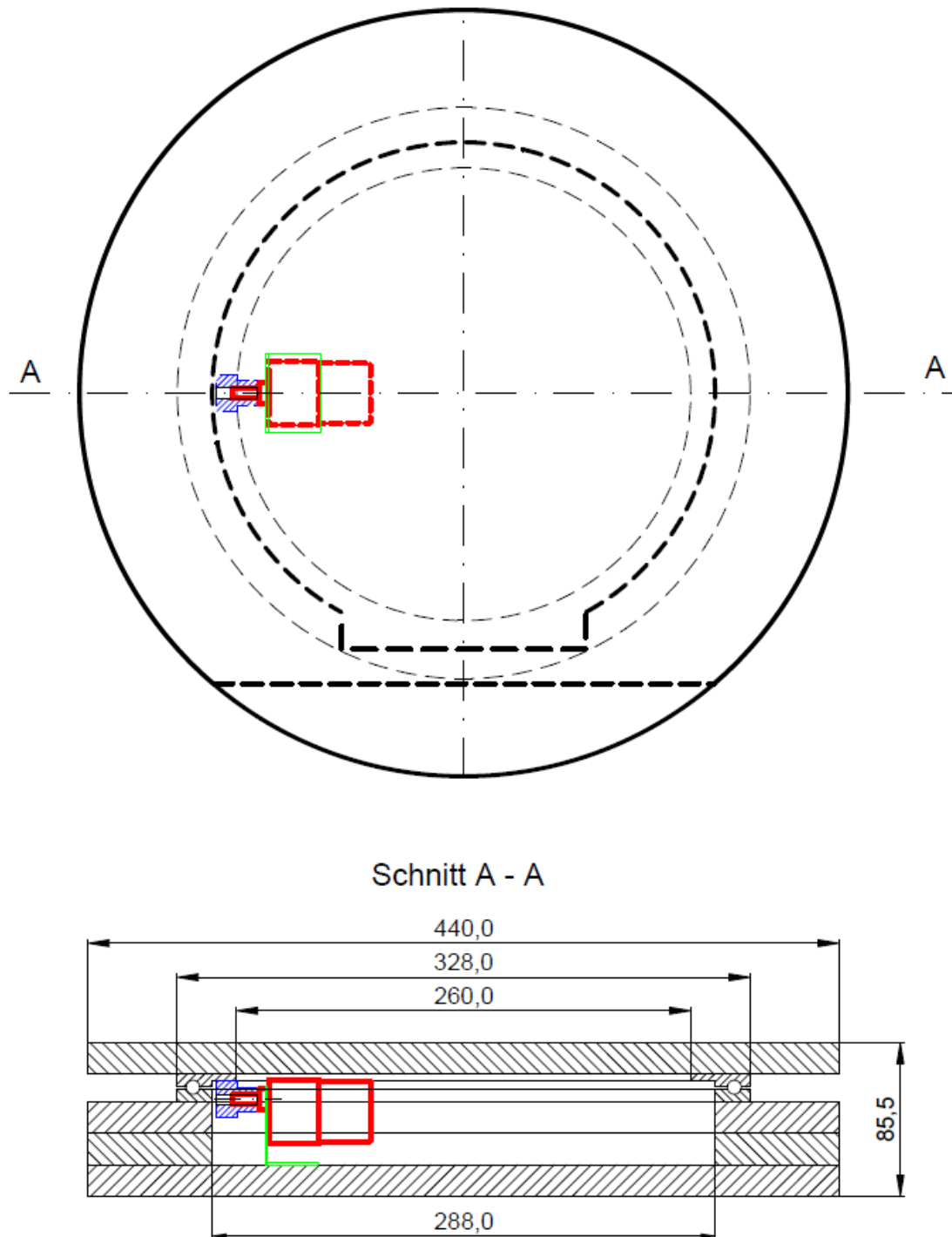
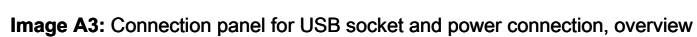
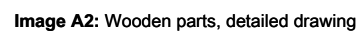


Image A1: Overview drawing: top view and section AA

Base / cover plate 18mm MPX (2x)

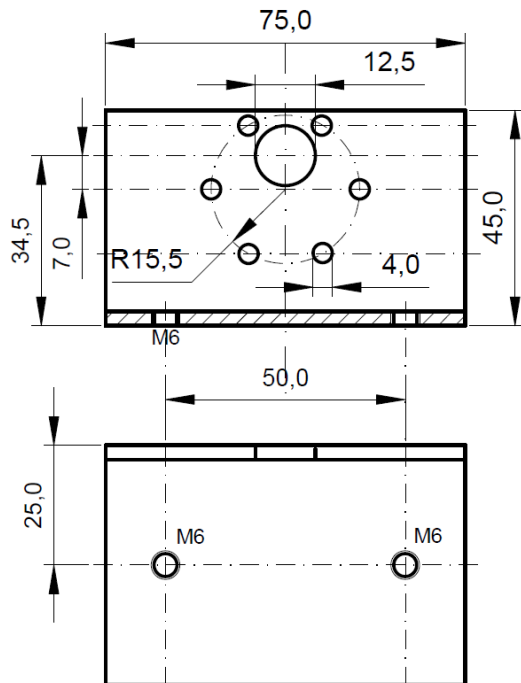




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Engine mounting bracket for Pololu
Gear motor



Motor mounting bracket for phidgets
Gear motor

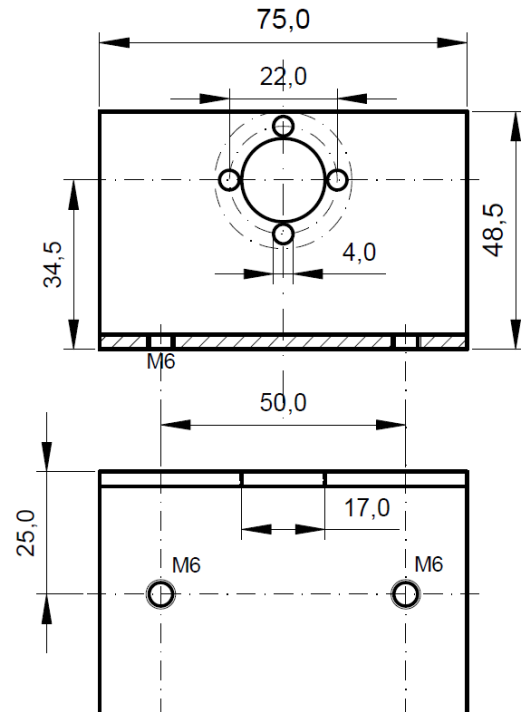


Image A5: Engine consoles



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Part 2: Useful additives for the measurement

The measurements of heavy loudspeakers - especially vertical measurements - in normal rooms or outdoors are not always easy to do.

There are basically two options:

- The turntable remains on the floor, an additional construction on the turntable ensures that the desired measuring height is achieved.
- The turntable is placed on a speaker stand, for example

In both cases, it is important to ensure a safe stand, as it would be annoying and possibly dangerous if the loudspeaker to be measured would damage its builder or itself by falling.

The author prefers the first variant. With a simple attachment (see following picture), floorstanding speakers can be raised to a height of approx. 2.00 to 2.50 m (floor tweeter). If the structure is properly aligned with a spirit level, there is sufficient stability despite the rotary movement. At a measuring distance of 2 m, this results in a measuring window of approx. 10 ms or a lower limit frequency of 100 Hz.

