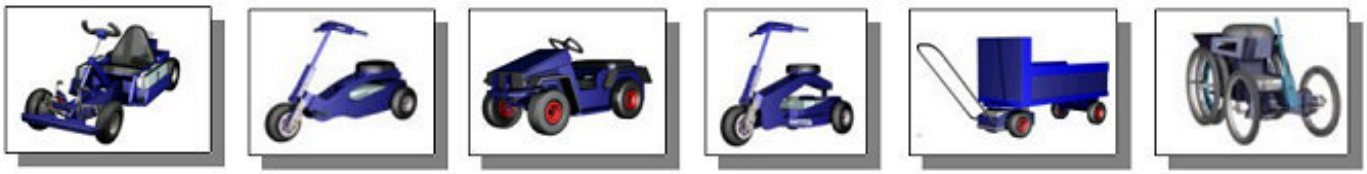
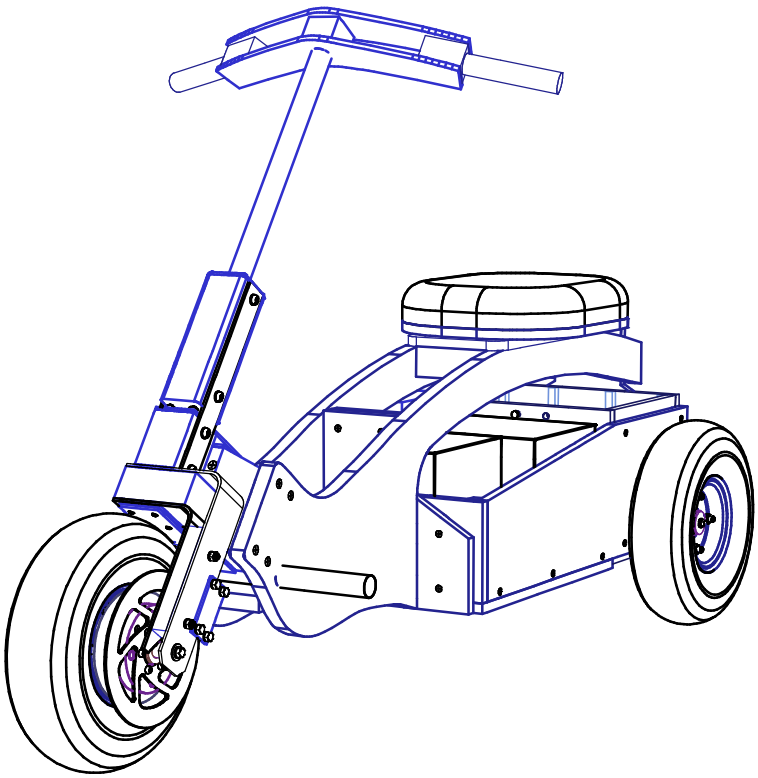


Self-Build Electric Mini Trike

Plans For Single Motor Version



Ian Hopper

WARNING:

OPERATING EVEN SMALL, LOW POWERED VEHICLES CAN BE DANGEROUS. YOU MUST TAKE ALL PRECAUTIONS NECESSARY TO ENSURE SAFE OPERATION OF YOUR VEHICLE, INCLUDING, BUT NOT LIMITED TO, THE GUIDANCE ITEMS GIVEN AT THE END OF THESE NOTES. FURTHER, IF YOU ARE IN ANY WAY UNSURE ABOUT YOUR ABILITY TO CONSTRUCT SUCH A VEHICLE OR OF THE SAFETY OF YOUR VEHICLE BUILD YOU MUST CONSULT A PROFESSIONAL ENGINEER.

DISCLAIMER:

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TRK1 Single Motor Driven Home-Built Electric Trike

Now that you have your trike plans please take a few minutes to read through these introductory notes – you should find them helpful.

The TRK1 is a timber structured electric trike for use on good drive surfaces by lighter riders. It is powered by a single 250 Watt (1/3Hp) DC electric scooter motor fed by on board batteries.

The trike has been designed throughout with the home-builder in mind so that it can be successfully built by competent DIY-ers using commonly available materials and components and the usual range of DIY tools. We have managed to do this by carefully designing and selecting engineering component combinations and developing build methods which remove the need for the usual specialist engineering tools and skills required by many vehicle builds. The essential engineering of the trike has not been compromised.

When fitted with the suggested type of motor controller the vehicle has a simple to use and smooth variable speed control and will be able to run both forwards and in reverse. Dynamic braking by the drive motor, acting through the back-driveable gearbox, slows the vehicle however the principal independent mechanical braking is provided by a front wheel mounted disc brake.

The trike uses our single motor, two stage gearbox GBX1 which is our simplest drive box. It is the easiest and least costly to make. A separate plan set for the gearbox is included with these trike plans. To keep things as simple as possible the GBX1 box drives only one of the two rear axles and is best suited for lighter riders and running on hard and essentially flat drive surfaces – the trike isn't really an off-roader.

You can vary the 2nd stage gearing of the box at the build stage to give different rear axle speeds. If you are sure the vehicle will be used on smooth surfaces with lighter riders and are prepared to keep an engineer's eye on the motor temperature you can use the 18T/54T 2nd stage gear combination to give a vehicle top speed of about 7 mph. If the motor does get too hot – stop the vehicle and let it cool down. For more demanding use, on mowed grass or modest gradients etc, or also to mechanically limit the top speed to about 4 mph (perhaps for younger kids), use the 12T/60T combination. If you feel this isn't good enough for your intended use you should look at the double motor trike TRK2.

What drawings are in the set and how to use them

There are 18 drawings in the Trike set, and 8 for the GBX1 gearbox. All are A3 sheets. The TRK1 drawings are:

- TRK1-A001 (1 Sheet) "*TRIKE OVERVIEW*"
- TRK1-S001 (2 Sheets) "*BATTERY CARRIER*"
- TRK1-S002 (3 Sheets) "*MAIN FRAME*"
- TRK1-S003 (2 Sheets) "*LOWER STEERING COLUMN*"
- TRK1-S004 (2 Sheets) *"UPPER STEERING COLUMN"*
- TRK1-S005 (1 Sheet) *"REAR WHEEL & ATTACHMENT"*
- TRK1-S006 (2 Sheets) *"FRONT WHEEL ASSEMBLY"*
- TRK1-S007 (1 Sheet) *"SEAT ASSEMBLY"*
- TRK1-S008 (1 Sheet) *"ELECTRICAL &*

CONTROL"

- TRK1-S009 (1 Sheet) *"GEARBOX COVERS"*
- TRK1-A002 (2 Sheets) *"TRIKE ASSEMBLY"*

Please look at the separate GBX1 plan set for details of how to make the gearbox.

TRK1-A001 is the place to start. The drawing shows how the trike is broken down into its main sub-assemblies and gives a brief explanation of each. Each of these sub-assemblies has its own drawing; several of these drawings, as you can see above, have more than one A3 sheet.

These sub-assembly drawings are "combined" assembly and part detail drawings – i.e. they have the dual function of showing you what individual components make up the sub-assembly, and, how these parts are to be made. Each contains a list of parts, details of materials and, where it is not obvious how the parts should be put together, detailed assembly notes. You can see there is a lot in them – it is essential to read them through before starting the build; if only to let you see what you've gotten yourself into!

There are nine of these sub-assembly drawings as listed above (each with TRK1-S00X numbers). The first seven detail the mechanical design and S008 describes the electrical and control elements. To an extent, this is not as detailed as the others, simply because there are a number of good motor controllers that can be used for the trike and the details of some components and wiring will vary depending on which controller you chose to use. The main power cabling between the batteries, the controller and the motor is simple enough – it's the wiring of the input devices that usually varies. Things can be further complicated by the use of different types of control devices e.g. finger lever or twist grip for speed control, ignition key switch or no ignition switch etc. Some controllers require separate fuses, some don't. Absolutely the best place to sort this stuff out is by studying the controller manufacturer's instruction manuals. We use 4QD controllers and all their manuals are available for download free from their web site at www.4qd.co.uk – get a copy of the one you are thinking of using and study it before buying the parts.

TRK1-A002 is the final assembly drawing and describes, as you might guess, how the trike is finally put together. By the time you have made all the parts and put together the sub-assemblies it is very likely that you may feel you won't need it though! It does however contain some helpful information and some important notes about what to do before using the trike and do's and don'ts in use.

Some technical guidance

One issue with building your own buggy can be that the sizes of materials you are able to obtain might not exactly match those specified in the plans. We have tried to minimise the chances of this as much as possible by designing around commonly available materials and parts, but it can still happen. In these cases be careful to study the plans and identify whether or not using, say, a piece of plywood slightly thicker than specified will have any knock-on effects for the positioning of other components, or for the positions of drilled holes for bolts etc. If so you will need to figure out what adjustments might need to be made.

In general double checking your sizes before committing to cut or drill is always good advice and one advantage of using mainly timber is that it's usually quite easy to remake bits you made a hash of – it

happens to all of us!

Exceptions to this are your metal parts and especially those precious gears you have bought. These require their pilot bores to be drilled out accurately to provide the right fit on the shafts for adhesive bonding. If possible ask the gear supplier to pre-bore them to the sizes in the drawings, or to as close to the finished size as they can so that you have the least amount to do. If you do need to open out the bores yourself it is quite possible for most of them but do use new, sharp drill bits and a good bench mounted drill and open up the hole in a series of small steps – we suggest 0.5 mm steps. Then finish to the required final size with a size matched sharp drill bit. This might sound pedantic but it is very easy to wreck a gear by drilling the bore squint or off-centre – be patient.

Note that the ø16 mm bore on the 2nd stage gear is too large to drill on most bench drills – you need the supplier to do this one, or ask a favour from a friend with a lathe. ø16mm is a fairly standard drill size and in the UK HPC Gears should be able to do this modification for you without problem on gears they supply. Other gear manufacturers may also.

Finally, much of the timber structure of the gearbox and trike is adhesively bonded. When used properly conventional PVA type wood glues are very strong – the joints are often stronger than the wood itself, but the joint strengths do depend on the faces to be joined being cut straight and flat so that the full contact of the surfaces at the joint is achieved. Make sure then that you identify from the plans which edges are to be bonded and, if you can, use a bench or circular saw to cut these edges dead-straight. Take care also to identify those panels that need to be the same width for an assembly to work – ie when two or more pieces are bonded between two end panels. It is best to cut these pieces from a single length of timber, itself cut to the correct width – this way all the pieces will then have the same width. You will see that most of these kinds of issues, and the parts involved, are identified in the plans to help you.

What tools?

You may by now have leafed through the drawing sheets. If you hadn't already, you will also have realised by now that this is not the kind of project in which you are led by the hand through every detailed step. The plan set is comprehensive and contains detailed descriptions of many important build issues – in fact all the information the competent home-builder needs to make the vehicle. However the success of the project relies, most of all, upon your skill and intelligence in studying, understanding and then implementing the plans. Part of your job is to assess what equipment you need, and the best way to do this is to read the plans, understand all the parts and their shapes and then figure out what tools you need to make them.

What follows is therefore only a general overview of the tools needed.

For the woodwork the usual saws, rasps etc will be needed. A powered jig saw will help greatly with some of the profile cutouts and a circular saw will help in the important job of cutting straight edged lengths of plywood for the gearbox casing and vehicle structure. A good drill is certainly needed for the metal parts (see below) but is also needed for drilling the timber parts, a selection of flat tipped wood drills to match the hole sizes in the parts shown in the drawings is needed.

The metal parts of the trike have been designed to reduce as far as possible the metal working required. However you will

still need a good hacksaw, files and a good powered drill – preferably a proper bench drill (drill-press), but failing that a powered hand drill mounted in a bench drill stand. Get a small vice to hold the workpiece when drilling - drilling accurately positioned and sized holes in steel is simply not a job for a hand held drill! You will need a selection of centre and properly sharpened (best new) HSS twist drill bits for the hole sizes in the parts shown in the drawings. Two of the gearbox shafts need flats ground on them; you could, with effort, do this with a file but far better to use a grinding wheel attachment for your stand mounted drill or, better still, a proper bench mounted grinder – these days they are not expensive.

A good centre punch, scribe and accurate measuring tools will help, buy yourself some decent vernier calipers; you can then check accurately the shaft and hole sizes. Finally, other than the usual screw drivers, spanners etc you will need to be able to drill and tap M6 screw threads.

It should go without saying that the necessary safety precautions should be taken when working with power tools – look after your eyes & fingers especially, they are much more important than any kart you make.

Sources of Parts

Part of the fun and satisfaction of building your own buggy comes from the knowledge that when it's finished you will have done more than snap together a “lego” kit. You will have physically created something that wasn't there before and which works the way intended - This directed creativity is the essence of engineering and you can, in your success (hopefully not your failure), feel part of a long standing human tradition.

Part of the job is to source and buy the required raw materials and components. Some suggested suppliers are given in the drawings but the best place for the most up to date information is our links page at the www.buggies.builtforfun.co.uk web site. Most of the suppliers listed there do mail, telephone or internet ordering in the UK. There is a separate list for US based builders. You may have to find your own local suppliers of course for some of the materials and parts.

Need help?

Don't forget that we can be contacted by e-mail should you need help or advice with your build. Even if you don't, but have some suggestions or would like to share your success you can e-mail us at Ian@builtforfun.co.uk.

And finally!

On sheet 2 of the trike final assembly drawing, TRK1-A002, there are some very important notes about how to use the trike and where and where not to use it – make sure you read and understand them.

We wish you the best with your project – have fun!

SAFETY:

It is very important that, having completed your vehicle build, you take all necessary precautions to ensure its safe use. Read the following safety points carefully. The list is not comprehensive however - above all use your common sense when deciding by whom, where and how your vehicle can be used!

- **Do not allow the use of the vehicle on public roads and paths; use only on private ground with the permission of the landowner - be aware of your local road traffic laws and keep to them.**
- **Never allow the vehicle to be used where it may come into contact with full size vehicular road traffic or with general pedestrian traffic.**
- **Always supervise the vehicle's use and ensure drivers are properly instructed in how to use it, especially in use of the brakes.**
- **Always judge the capabilities of the driver and the vehicle and where you feel necessary ensure the riders wear appropriate protective equipment such as helmet, gloves and protective pads. Ensure there is no trailing clothing or hair etc to get entangled in the moving parts.**
- **Do not allow use of the vehicle in the dark or in other conditions where the driver can not see clearly or be seen clearly.**
- **Regularly check all screws and nuts and tighten/lock as required. Check the structural integrity of bonded joints. Keep tyres inflated to the pressure stated on the tyre. Keep bearings, gears and chains lubricated.**
- **Regularly check the function of the brakes and steering mechanisms and adjust as required.**
- **Ensure all motor and gearbox covers are fitted and secure before vehicle operation. Take great care if making adjustments in or near the motors when the motors are hot - it is best to allow hot motors to cool before working in their vicinity.**
- **Consider carefully the area/track on which the vehicle is to be run. If passes will be made close to solid obstacles consider fitting skid boards, such as at prominent hard edges, gate posts, wall corners etc. Consider the run-off at corners should the vehicle not make the turn - always judge the capabilities of the drivers!**
- **Teach the drivers never to drive at pedestrians, to always slow their vehicle to a stop when pedestrians look as if they may be in the way and to slow the vehicle to make turns.**

Your Notes -