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MOTARD ARX 540

BY DEZ CHAND



TRACK AND FIELD



Motard riders just can't wait to get it sideways!

ARX 540 1/4th off road MX Bike developments

We reviewed the first ARX540 1/5th MX bike from AR Racing, back in October 2007 (RRCi issue 287), a Pro level kit with all alloy components, a CNC swing arm and everything to offer you extreme off road thrills. But since then AR Racing have been tirelessly improving the product and adding a whole new range. If you need a more economic way to get into 1/4 scale MX bikes then the new ARX540 base kit is right up your alley, with a serious attempt to get the cost down without sacrificing quality, AR Racing have done a marvellous job.

Are you tired of wearing out your knobbies on the street? Then go get the Super Motard conversion kit complete with smaller front wheel and slick racing tyres.

If you want more noise and longer run times, get yourself the Nitro conversion kit and bolt in the screaming two-stroke to play tunes on your ear drums.

Need more stability over rough ground? Well the new electric gyro is for you, amazingly efficient and offering increased top speed and longer run times at a stroke.

All these are now available as kits or factory assembled models as well as conversion kits if you already have one, and there's the choice of two power packs so the choice is literally yours.

Let's dive into this huge box and see what AR have been up to, how it all works, and how it goes together!

BASE KIT – OUT THE BOX, ON TRACK

The ARX540 has been on a diet, not just to reduce weight but also to bring the price of the base kit more within reach and give the off road bike scene even more chance to grab the imagination of more and more bike fans.

The front forks of the new base version use a circlip retained seal cassette instead of a threaded collar, but I think the circlip gives a better fit with less chance to over tighten and crimp the seals within.



Pro Gyro above, Base Gyro below. Four idler gears on ball races are definitely the better option



Geared Pro Gyro built, note I have chamfered the alloy gear carrier and put flats on each ring gear mounting boss for extra clearance

The top caps that retain the fork springs are now threaded plastic mouldings so you must be a little more careful not to cross thread it, but a plastic bolt is a natural thread retainer so there's no need to thread lock them in. The forks have a 75 mm stroke to give plenty of droop to encourage it to hold a line over ruts and plenty of travel to absorb heavy landings. There is no internal oil or grease recommended as you need as smooth and light action as possible, so just keep them clean and dry, though I confess I added just a drop of shock oil to each fork seal on assembly which gave a smoother action but will attract dust and grit, so I'll have to keep an eye on it and clean it out regularly.

The rear mono shock has a threaded alloy body and comes with a plastic rod end fitted as standard but fortunately the kit includes a metal rod end which needs installing before the shock is fitted in order to survive the extreme loads placed upon it. The wheel to shock ratio is such that the piston will move very little over the full range of rear suspension so the spring and oil grades are pretty extreme, just like the real thing. Don't throw the removed plastic rod end away as you will need it for the steering linkage later!

TOP SHOCK TIPS – I added a drop of stud lock to the metal rod end so it's there for good, and I removed the threaded spring collar to add a drop of shock oil to the 'O' ring that keeps it in the required position, so that when I wind the preload on it doesn't grab the thread and try to unscrew the shock body from its cap.

The spring preload ring has a range of 12 mm adjustment on the threaded shock body, though the first 2 mm simply takes up the slack created by the shorter metal shock rod end, but at least you can now wind it off far enough to be able to flick off the shock-retaining collar when you need to. Aiming for 5 mm of droop meant I had to wind it almost all the way to the bottom of the shock but there is just a little left so I can still fine tune it either way.

The twin vertical steering linkage arrangement is retained from the



E-Gyro is stunningly simple and effective, with the ESC mounting to the axle, the flywheel is the outrunner motor

New two-piece insulated swing arm carries positive and negative power transmission to the two-piece rear axle



MOTARD ARX 540



Above: Motard conversion set includes front wheel, both slick tyres, steel scratch bars and stiffer forks springs with spacers

Above right: New fork seal design is neat and simple. The forks have reduced droop with the Motard spacer fitted here on the lower leg

Left: MX front 124 mm diameter rim, compared to the slick shod Motard 102 mm rim

BELOW: Chamfered sprocket teeth will help the chain roll better. Also Dremel the swing arm to get better access to the chain tensioner with a ball ended driver



original ARX540, but the pivots now turn on bushes rather than bearings. This is easily upgraded with eight 10 x 5 x 4 bearings if you desire but arguably bushes take the knocks better than bearings and stay in reasonable shape longer whereas a ball race can literally disintegrate, so think carefully before upgrading immediately!

The twin springs on the steering link rod allows the steering to slap around without damaging the servo. The amount of preload you put on these springs determines how much steering response you get and how much work the servo has to do. In this new kit you get a servo horn extension piece, which is a smart move, so the linkage can work in an almost straight line to put minimum side thrust on the linkage sliders for the best possible action.

TOP TIP – A drop of shock oil often works wonders on the sliding link, and thread lock the spring collet grub screws too!

As the head stock and triple clamps are now all plastic, you have to work carefully in order to get a free moving assembly, tighten them all down then back them off slightly until you get a good feel. Fortunately the moulded triple clamps have nyloc nuts behind the through bolts so you can pinch them up and really secure the fork legs.

The main chassis plates have been redesigned to allow more clearance to the steering linkage which is a good thing, but the 'L' shaped steering arm itself is now plastic instead of alloy. As I have bent the alloy piece on the previous model a few times, I welcome this not just as a cost and weight saving idea but because plastic will bounce back from an impact whereas alloy takes a kink and stays there.

The twin alloy plate frame goes together as before with alloy spacers on the long fixings, but the new battery retaining plate now has two positions to suit small LiPo and NiMH users in the horizontal plane, or for larger capacity LiPo batteries it goes vertical between the motor and LiPo pack. Getting between the motor and battery is a good thing, keeping the heat from the soft LiPo casings, and allowing more airflow to the motor's cooling fins, so a good move by the AR Racing designers!

The new rear mudguard guard now offers a shock protector and receiver mounting, while also incorporating the rear seat mount post, a great new addition to the ARX540 design. With a thick tail flip protruding from the rear, it offers the painted lexan tailpiece some protection when the ultimate wheelie goes ultimately wrong!

IN A SPIN

While on road R/C racing bikes run heavier alloy rims at high speed they have all the gyro effect they can handle already, whereas MX bikes typically travel slower over rougher ground, so need the extra stability a gyro has to offer. The new base model that has just two planetary gears in the mechanical gyro, to reduce weight and cost at a stroke, so obvious improvements are available like the new pro spec ball raced gyro with a quad gear train, bringing a new level of efficiency and reliability to the mechanical gyro. Even this can be upgraded if you prefer, superseded by the new electric gyro where a brushless motor uses the rotating flywheel weight like a huge 'out-runner' motor, but more on that later.

The standard gyro uses planetary gears to increase the revs of the gyro



Various motor and battery combinations are available, but don't make it so fast that you have to glue the tyres on!

flywheel to increase its effect. Running a 15-tooth central gear against a 75-tooth out ring via twin idler gears on either side means the flywheel will reach five times the wheel speed, amplifying the gyroscopic effect as a ratio thereof. The ball raced gear train of the pro version is available as a spare part so you could always upgrade your base kit by ordering part number X-031, though you'll need a couple more gear mounting posts into the bargain. As the geared flywheel will usually be running at a speed in a ratio with the actual wheel speed it will rarely get up to full speed, so it needs to be heavier than the constantly spinning E-Gyro.

The base kit gyro wheel weighs in at 320 grams and the balance of that is more crucial, bearing in mind that at 35 mph the wheel will be doing 2,000 rpm which means the flywheel will be doing nearer 10,000 rpm by virtue of the gear train calculations. The flywheel clutch shoes have removable grub screws to alter their weight and hence bite point. All the grub screws in for a heavy clutch shoe gives an early bite, while all grub screws out results in lightweight clutch shoes and a later bite point further up the rev range. These ballast grub screws might not be attaching anything important but they need thread locking anyway, because if they should migrate out of position they can drag on the wheel and slow the gyro effect. I left them all out for a later bite point, more steering response at low speeds and less chance of the grub screws shaking loose and causing any problems in the future.

I cleaned up some moulding pips on the planetary gears and from the face of the central gear where the clutch shoes slide across. A couple of minutes spent with a sharp knife well spent for a smoother action. I also took a Dremel to the outer ring gear and ground a small flat on each screw location boss to afford the flywheel just a little extra clearance to the wheel rim as I could hear it rubbing and see a witness mark in the plastic already. I also ground an extra chamfer onto the extents of the alloy planetary gear holder so that it gave extra clearance to the wheel inner and my geared gyro was running super sweet.

E-GYRO

The new E-Gyro is an outrunner motor design, features 12 armature poles with wire wrapped around the static armature, while 14 magnets arranged side-by-side with alternating poles rotate around the rotor in the flywheel inner housing. Hence outrunner as the magnets move while the armature forms the wheel axle and remains static!

On the bench I measured nearly 3 Amps as the weight accelerated but then it was sipping just 1.5 Amps once it reached top speed. By driving the gyro weight independently instead of taking its energy from the gears inside the wheel, you take a load off the main drive motor allowing it to reach a higher top speed and increasing the acceleration by reducing mechanical drag. All the power from the main motor is now driving the rear wheel alone and none is wasted spinning up the 295 g flywheel from rest out of every slow corner. Genius. I measured the motor at around 1,000 kV by rating it at different voltages and measuring the revs with a data logger set-up. On 2s LiPo supplied with 8.07 V it made 8750 rpm, and with 3s LiPo and 11.2 V it produced 12020 rpm so it's comparable with the mechanical gyro in effect, but as it's always at top speed maybe it will be too stable at low speeds and reduce the steering response, hence the E-Gyro flywheel has been reduced in weight to compensate.

The clever part of the electric gyroscope is that it's entirely enclosed within the rear wheel, with no fiddly wires to route past rotating parts or drive chain. The power is carried down the cast alloy swing arm and into the axle where positive and negative are picked up from separate halves of the axle and carried to the ESC within. To accomplish this first a rear axle had to be made in two pieces to keep the two poles apart all the way to the ESC, and a new swing arm had to be developed so the positive and negatively charged arms never met in the middle, now that's clever stuff!

When you have assembled your E-Gyro be sure to test it before bolting it into the wheel and covering with the rear tyre, and to track the positive and negative cables to the gyro so you always get your wiring the correct way round. The black wire should end up chain side of the swing arm.

Before fitting the E-Gyro into my rear wheel I had to cut away the moulded lugs for the gear gyro ring mount, from the inside of the wheel shell, and for good measure I took away the rib that runs around the same surface as it got too near the black wire running up the back of the ESC. Built into a rear wheel with sprocket etc., with an off road tyre fitted ready to bolt into a bike, the E-Gyro assembly weighed in at 653 grams. That's pretty substantial!

Power is taken to the two halves of the swing arm by a cable designed to plug into an ESC fan socket but you can simply wire it directly to the



Alloy rear shock has threaded body and needs the supplied metal rod end fitting



The Base ARX540 built as the proper MX bike. A simple paint job is completed by the excellent graphics package supplied in red, blue, green and yellow



A multi jointed rider figure just can't wait to pose for stunts! Weighing in at 3 kg the ARX540 is a big bike and needs lots of room to use to its full potential



Converted to a Motard bike the first thing you notice is those big, fat, sexy slick tyres, but note the steel crash bars relocated rearwards too



New rear seat moulding has a shock protector, seat mount and rear mudguard saver built-in



Base ARX540 headstock is all moulded and runs on bushes. Twin spring steering linkage benefits from long servo horn adaptor



The M.troniks G2 Ride installed neatly, with a data logger built into a waterproof ESC, it's priceless, and British! Note new receiver location on seat unit, up out of the blast zone

power leads so it starts spinning as soon as you plug in. This is fine for anyone running 7.2 V NiMH or 7.4 V LiPo packs, but an 11.1 V 3s LiPo will over speed the gyro by half that speed again to make the bike super stable, demanding stronger steering springs to encourage it to run corners. A 6 V 3 A BEC supply to feed the gyro with constant stable power would be nice, with maybe an adjustable voltage selector so I could vary the speed of the gyro and decide just how stable I need my bike to be. Something I'm sure AR Racing is working on as we speak!

GO ON ROAD, SIDEWAYS!

We have run an ARX540 as an off road MX bike already so were keen to try the on road Motard conversion kit, which includes not just the gorgeous slick tyres and smaller front wheel, but also steel crash bars to cope with hard road surfaces, and a new scratch bar mount post to relocate the front mount just behind the shock absorber. Plus, and perhaps most importantly, you get a pair of shorter, stiffer, dual rate fork springs and some fork travel limiters. These 16 mm alloy spacers pull the front end lower to the floor, reducing ride height for a steeper rake angle and better steering response by reducing trailing castor. Dropping the rear shock to its lowest ride height position brings the whole machine lower for higher speed corners while the spring pre-load collar allows you to dial in the amount of droop you need to keep it stable on the brakes.

With the base Motocross bike complete I set about converting it to the Motard version, and having built the new front wheel assembly it took me less than 20 minutes to have a slick shod tarmac burner in my hands, ready to wheelie up the street, so that's just what I did! It's nice to know

that in just 20 minutes I can convert it back to a proper off road bike with long travel forks and knobby tyres when the need arises.

The shorter steel scratch bars allow an extreme amount of lean angle, a typical road racing 32 degrees from horizontal, but the shorter forks and slick rubber tyres bite hard so the ARX Motard lifts out of slow turns with the back wheel realistically out of line and spinning wildly. What bliss!

WIRED

Two power packs are on offer from AR Racing, with a speed controller, a choice of motors and LiPo batteries specific to your requirements, B-001 (7.4 V 6000 mAh) or B-002 (11.1 V 4000 mAh).

Both LiPo batteries are the same dimension, 76 mm x 54 mm x 42 mm and weigh an identical 315 g but the performance and endurance will differ massively by virtue of their different voltages and capacities. The choice of motor should be considered, but the 4400 kV motor (X-4400) and 2s 7.4 V battery would be my choice to give extended run times while reducing wear and tear on the chassis. You could go for the faster 5000 kV (M-5000) or the 5900 kV (M-5900) on a 3s 11.1 V battery but besides your run time being reduced you will find the tyres literally rip themselves from the rims as the bike will be travelling too fast, necessitating gluing the tyres on which makes access to the gyro impossible. If you are a speed freak and built your gyro right with plenty of thread lock there's no reason not to glue the tyres on, apart from making tyre changes impossible.



Only use a good quality high torque metal geared steering servo, and thread lock the collet grub screws to avoid disappointment

For our test we fitted the excellent M.troniks G2 Ride ESC, whose integral data logger gives feedback like no other, and graphs on your PC to boot. On top of all this it's waterproof, multi programmable and British made! What more could you want? Oh yeah, and it fits perfectly in the ARX540 chassis like it was made for the job!

A quick test up the road showed the motor revving to 34,000 rpm on 2s LiPo which confirms the 4400 kV motor rating and equates to a reasonable road speed of around 31.5 kph, just under 20 mph, and we'll be looking at half that again on a 3s LiPo.

The E-Gyro kicked in as soon as I plugged the battery into the G2 ESC as I had it wired direct, and the speed of the E-Gyro and weight of the flywheel within made the ARX540 Motard supremely stable, almost like a trials bike as you could drive it as slowly as you wanted and point it literally anywhere your heart desired without worrying about falling over or starting to wobble at low speed, amazing!

Pulling power wheelies from the slowest corners is great fun, as is drifting the rear end into bends in proper Motard style, using the drag brake facility of the M.troniks G2 ESC to good effect. Turned down to just 15% drag brake and limiting overall brake to just 50% made it usable and not too aggressive. Having a little drag brake dialled in also helped save me from terminal wheelies and I have yet to go beyond touching the rear mudguard on the floor so the bike looks as good as new and the riders head is still on. Bonus!

We had all the other programmable features of the G2 wound up to 100%, like power, acceleration and current limiter, but even so the G2 built in data logger showed just 60 Amp spikes with a typical 20 Amp constant drain, so run time should be pretty awesome as both the battery and speed controller were laughing it off. The 6000 mAh 2s LiPo ran for over half an hour, doing laps of the Bedworth 1/10th tarmac circuit and pulling fat wheelies to cut across the grass and rejoin the circuit whenever we felt the need. Because we could!

We found that if you let the bike stop the lean angle was so extreme that it wouldn't pick itself back up again and needed to be hand launched, but so long as you kept just a little corner speed it would lift back up no problem.

3S TEST

A quick run with a 3s LiPo for the extra grunt that 11.1 V can offer saw a marked improvement in top speed. The E-Gyro revved to an even higher top speed as expected, making the bike even more stable than before. Running like this you would need much stiffer steering springs than the kit ones to overcome the extra gyro effect, or fit a voltage regulator to limit the revs of the E-Gyro to make it easier to turn a sharp corner at speed.

The 4400 kV motor saw 43,000 rpm on the G2 Ride ESC data logger, which equates to a road speed of around 40 kph as expected which was far more like the speed we were expecting so the 4400 kV motor is definitely better suited to 3s LiPo power. I'll have to fit a 5400 kV motor or similar to get the best out of a 2s LiPo.

DRIVE RATIO CALCULATIONS

8:1 (7/56) primary drive gears
 3.5:1 (9/32) chain final drive
 28.4:1 overall drive ratio
 140 mm diameter slick rear tyre
 440 mm circumference
 = 15.4 mm/rev



Getting down in the corners on the racing line, the steel scratch bars let it get 32 degrees from horizontal!

SEE YOU TRACKSIDE

Transforming the ARX540 into a wild tarmac shredder was a revelation and opened up so many more places to enjoy an R/C bike, as even a quick trip up the street would damage a pair of knobbly off road tyres and limit their use once you wanted to take on the rough stuff again, so slicks are the perfect answer. Being able to wheelie at will is superb fun and tackling a 1/10th tarmac track was exhilarating. Being such a large model meant that rough tarmac, grit gravel and other obstacles that would upset a 1/5th or 1/8th road bike are of no consequence and I can leave the broom at home when I take my ARX540 out for the day.

Coming soon we have the Nitro conversion kit so watch this space as we get noisy to see what two – stroke power has to offer the keen off road biker and whether the E-Gyro can make the ARX540 capable of taking on a proper rallycross track. Who knows, a 1/4th Motocross GP could be on the cards. Oh I hope so! **RRCi**

QUICK SPEC

Class: 1/4th Electric Motocross Bike
Type: Chassis kit
Manufacturer: AR Racing
Prices:
 ARX540 Base Kit – €99
 Motard Conversion – €109
 E-Gyro Conversion – €60
 Power Pack LiPo, Motor, ESC – €30

REQUIRED TO COMPLETE

Radio: Tx & Rx: Spektrum DX3R
Steering Servo: XP1313
Drive Cell: 7.4 V LiPo AR
Motor: AR X-4400
ESC: M.troniks G2 Ride
Battery Charger: CellPro Multi 4S
Lexan Paint: FTX

DISLIKES

E – Gyro not speed adjustable

LIKES

Performance and robust construction
 On and off road abilities
 E-Gyro stability and performance boost
 Available as a kit or factory assembled
 Motard conversion and slicks
 Four colour graphics supplied – R/B/Y/G

CONTACT

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