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a to b

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A to B magazine

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If you're lucky enough to own any of the later Folder magazines or early A to Bs, we hope you'll agree that they really were rather good. In those far-off days - before the two-monthly A to B cycle became a bit of a production line - we spent a lot more time over the writing and artwork. The photos were scratchy black and white, and - pre-internet of course - the audience was small, but the results could be quite entertaining. To mark our fast approaching 100th edition we're dragging some of these classics out of the archives and remastering them... where possible in glorious technicolour. Do send in your requests... we have most of the original photos, so pretty well anything is possible. DAVID HENSHAW

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The Trial

Momentum Model T & Upstart

The Model T is a simple, elegant step-thru roadster, with the bonus of power-assist

If we were going to specify a Chinese bike ourselves, we'd go for a light responsive frame with a reasonable size battery mounted low down in the middle of it, a light, efficient motor in the front wheel, a two- or three-speed hub in the back wheel, and very little else.

"...testing 200 bikes gave a clear idea of what worked and what didn't..."

A few months ago, we had a visit from two young engineers: Ying-Tsao Tan and Andreas Törpsch, who - it turned out - had designed a bike that more or less fitted the bill. If you wanted to design an electric bike from scratch, you couldn't do much better than employ these two: Ying-Tsao graduated from the Glasgow School of Art with a degree in Product Design, then worked as an engineering team leader at Hoover, and Andreas left the Technical University of Chemnitz with a degree in Sports Engineering, then spent some time at Extra Energy as head of testing. For those who don't know, ExtraEnergy is the bigger and much more expensive German version of *A to B*, testing and appraising electric bikes. Andreas was involved in the testing of over 200 bikes while he was there, giving him a clear idea of what worked and what didn't, and a picture of what he wanted from an electric bike.

Ying-Tsao discovered electric bikes while on business in China, and found himself wondering why this exciting new technology was growing so slowly in Europe. Andreas, meanwhile, was testing bikes that were either too expensive or badly made, and wondering why no-one had yet produced a workable yet affordable bike. They were to meet quite by chance, when Ying-Tsao approached a friend working at ExtraEnergy to join the electric bike project, but found he was busy with his PhD. He suggested Andreas, who turned out to be the perfect match, bringing good solid hands-on electric bike experience and a great deal of knowledge about the European market.

By early 2012, the pair had a working prototype. It had a few power-control issues, and the frame was a bit small, but it looked good and it worked well. By March, they had developed a much slicker machine, and the project really began to take off.

"...there's no need to stop pedalling, no fiddling with levers, and no nasty noises..."

The bike is now in production, or at least, it will be in a few weeks, and we have finally had a chance to give a pre-production machine a proper test. The eventual aim is to develop all sorts of innovations, but for now, they've wisely gone for the two most marketable prospects: the 'Model T', a well-equipped step-thru aimed, one assumes, at urban ladies, and the 'Upstart', a stripped down, sporty roadster, more likely to appeal to men. To keep things simple, both frames come in a single size, and the sizing has been chosen with care, such that just about everyone could live with either bike, although the ladies frame is pretty small and the gents quite large.

The Momentum USPs are SRAM's new 'Automatix' self-changing two-speed hub, and a simple, but reliable torque sensor on the crank. There are no gear levers, no twist grips, and thus no safety issues. And with twistgrip throttles outlawed in many places, the bikes should be future-proofed for most world markets without adaptation.

Only two gears? Really? Yes really. One thing electric bikes don't need is hundreds of gears, and we've been very impressed with some three- and four-speed machines in the past. In urban conditions, the Automatix hub is absolutely superb. You start pedalling, and when road speed hits anything up to 11.3mph (depending on wheel size), the bike shifts up to top gear. There's no need to stop pedalling, no fiddling with levers, and no nasty noises. Changing down, the shift takes place below 10mph, and it is not quite so automatic, because you need to stop pedalling briefly for the gears to engage. At the moment, the gear range (from direct drive in first, to a 124% overdrive in top) is a bit limited, but SRAM is introducing a 136% model for 2013, which should help matters no end.

The Automatix is presumably designed for the enormous Dutch and German roadster market, and as far as we know, Momentum are the first people to try this gear system on an electric bike. The power from the motor doesn't run through the hub, because it's in the front wheel, but the oomph from the motor, allied to the smooth step-less gear change results in some very effective acceleration.

Although the Upstart and Model T share the same motor and battery, they have very different characteristics, so we'll deal with them separately.

At the heart of the Momentum concept is SRAM's new Automatix hub. It works well and should find many applications

The Upstart is best described as minimalist. You'll have to add a few extras to ride in all weathers

The Upstart

After riding the Tonaro (see page 20), the Upstart seems incredibly light, and at 19.8kg with battery, it just scrapes in below the magic 20kg barrier. That it doesn't break any records is largely down to the chunky Bafang motor, but everything else is pretty light. Electrics aside, this is a really well sorted machine. You can ride for miles hands free, which is unusual for an electric bike, and the handling is safe and precise. The brakes are neat Tektro calipers, and the tyres are big 700x32C, 28-inch semi-slick jobs, which make this relatively small bike look all wheel, and rather sexy. There isn't much else to tell you about, because the Upstart has no stand, no rack, no mudguards, no nothing except tyres to grip the road, motor and pedals to make it go, and brakes to stop. But what there is has been chosen with infinite care.

The Autorq torque sensor on the bottom bracket is a good example. We've never seen one before, because it's made in the Far East for the Japanese market. The boys from Momentum don't want to take the credit for designing it, because they didn't, but they sourced it, and it's exactly the right component for the job. Unlike many torque sensors, it doesn't dart off the minute you press on the pedals, which is a nice safety feature, but can be

a problem starting on a really steep hill, because the pedals have to go a quarter turn or so before the motor picks up. Power does come in very quickly though, and once you're away, you're really away, racing up through the 11mph gear shift, and topping out at 17mph, at which pace pedal cadence is very comfortable.

With only two gears to play with, the ratios are obviously going to be something of a compromise, but Momentum has gone for 66" and 82", which is perfect: low enough to give rocket-booster acceleration, but high enough to spin up to 17mph with ease, and on to 24mph or more without assistance if the conditions are right.

Pedal torque sensors are generally limited to top-end electric bikes. The Autorq works very well

In town, the bike is a real point-and-squirt machine. At the lights, it leaves all the clunky derailleur bikes searching for gears, and will outpace most electric bikes too, because the Upstart is damned efficient: you put human and electric power in at one end, and road speed comes out the other. For our money, the upward gear change comes a little early, but surprisingly, the Automatix is non-adjustable, changing gear at a set wheel speed, so the change is fixed at just over 11mph with this big-wheeler, but it would be less than 7mph on a small-wheeled folder. This fixed change speed rather dictates the gear ratios a manufacturer can offer, because if - for example - Dahon was to specify high gearing to give a 16-inch bike a reasonable top speed, first gear would be a bit of a struggle and the bike would change up before your legs had really got going. The hub is ideal for the relatively slow Dutch big-wheelers it's designed for, and it's OK on the Upstart, but because it's quite high geared, your legs never really get up to speed in first gear. This should all be sorted when the wide-range hubs arrive in 2013.

As you ride faster, the motor continues to pull nice and cleanly, before running very gently out of steam at around 17mph, giving a perfect top speed: high enough to add a bit of excitement to your daily commute, but more or less legal (there will always be a few percent of leeway). Compared to the Tonaro, which hunts in and out of engagement at cruising speed, the Upstart never surges or jumps, and on such a free-running bike, it's easy to leave the motor behind on the very gentlest of downgrades, and pedal on up into the low twenties mph at a surprisingly comfortable cadence.

Range, Battery & Charging

Urban use is all well and good, but what about the open road? On our flat commuter route, the Upstart felt quite at home, knocking off the more or less flat, near ten-mile ride in 31 minutes. That's blindingly fast for a 'legal' bike, and it's beaten only by the CVT-equipped Raleigh Dover - which has a very high top gear, and thus cuts along at quite a rate

on the flat - and the Cytronex Trek, which is similar in concept to the Upstart, proving once again that the best electric bikes are the best riding machines, and not necessarily the most powerful, or indeed the fastest. We've ridden eight bikes that were faster, including the Tonaro tested elsewhere in this issue, but in terms of efficiency, bikes like the Cytronex and Momentum Upstart are in a class of their own, using about 8 watt/hours a mile at these fairly high speeds. They're efficient because they roll well, have gentle, but powerful motors, low wind resistance, and are pleasant to ride.

"...we restarted on a 1:6 gradient without standing out of the saddle... surely a first for a 66" gear?"

On our longer hillier course, the Upstart didn't feel quite so at home, but for a two-speed machine it was very impressive. The top gear of 82" allows you to pedal at a fair old pace, but as the hills close in, the bike is soon grinding along at 15mph or less, and at this speed the pedal cadence is low, and thus relatively ineffective. If the hill gets steeper, you need first gear, but the bike won't change down until you're down to 9.5mph, and by this time, the motor (which of course, hasn't changed gear) is grumbling along rather slowly. Despite all these compromises, the Upstart does surprisingly well. Gradients as steep as 1:10 can just about be tackled in top gear, while the limit in first gear is about 1:6, or steeper if you have chunky calf muscles. Believe it or not, the Upstart restarted on our 1:6 test hill, and we climbed a further 200 feet without standing out of the saddle - surely a first with a 66" gear?

There are three power settings, but to be honest we could barely tell the difference, and restarting on the hill was the only time we came out of 'Low', which suggests there's far more power being delivered than the bike really needs. Momentum says the Low setting will be recalibrated, which makes sense, and should help to increase the range. The impressive power in Low resulted in a healthy average speed of 16.5mph for the first hour or so, but it later fell back to 15.8mph - still more than a match for

many sportier, more powerful bikes.

Range was a little bit disappointing for a machine that had proved so efficient on the flat, thanks to all that grinding up hills at low motor speed, which is bound to take a toll on the battery. The fuel gauge is a simple voltage-sensing array of four LEDs, and they aren't terribly helpful. The first LED was permanently out by six miles, and the second at 19.5 miles, suggesting a range of some 40 miles. Not the case unfortunately, because the bike momentarily cut out on a hill at 22.7 miles, losing the third LED at about the same time, and the motor began to baulk at steep gradients at 25.8 miles, and on gradients of any kind at 27 miles. You can go further, but an electric motor obviously serves little purpose if it won't climb hills.

The speed controller shows three assistance levels on the left, with the rather ineffective fuel gauge on the right. This is the Upstart console - the Model T has a light switch at top right

Fuel consumption came out at 10.8Wh/mile, which is respectable, but not ground-breaking, and could clearly be improved with a spot of recalibration.

The battery is a neat little device with a claimed capacity of 324Wh, which sounds the right sort of ball-park, because we got 292Wh out of one, and 322Wh out of the other. Charging takes about five hours at 70 to 80 watts, which used to be considered quite fast, but is now only average. The charger, incidentally, is the same unit that came with the Tonaro, but at this slightly lower charge rate it only gets warmish, rather than hot.

Model T

Although technically very similar, the Model T has a completely different character to the Upstart. It's a small step-thru bike with wide, swept back, almost cruiser-style handlebars, a big chunky rack, mudguards, Spanninga LED lights powered from the traction battery and smaller 26-inch tyres. Were we in the habit of using outmoded, gender stereotypical terminology, we might call it a ladies bike, but it's suitable for anyone who does a bit of shopping and doesn't fancy getting their leg over a top tube. Interestingly though, the yummy-mummy panel from the Manor Park First School reception class were very keen on the look of the bike, from the leatherette saddle to the classic 26x1 3/8" whitewall tyres, which should please Momentum, although there was one proviso that we shall come to.

The most important difference to the Upstart is markedly lower gearing of 55" and 68". The bike uses the same automatic hub, so the smaller wheels mean the upchange point drops very slightly to about 10mph. You'd expect the downshift to drop accordingly but it's still 9.5mph, with a more audible click, which suggests there may be some variability in the Automatix hubs.

With much lower gearing, pedal cadence is of course, much higher, so you can get up to

a reasonable pedal speed in first gear, although your legs will be going round in a bit of a blur above 15mph in top. If you're in a hurry you can pedal on up to 17mph or more, because the motor keeps pulling for a bit longer. Momentum claims that the motor cuts out at the legal speed limit, but we're fairly sure it keeps spinning at higher speeds when you push hard on the pedals, as most other systems do.

"...the younger, racier yummy-mummies expect a bit more than 15mph from their urban roadsters..."

Once again, ratios are a difficult compromise, and although we thought a 68" top gear was rather low, it proved exactly right for our friend Mary from up the road, who offered to buy the Model T after the briefest of rides. It did however prove a disappointment to the younger, racier yummy-mummies who expect a bit more than 15mph from their urban cruisers. Fortunately, with a hub gear, ratio fine-tuning is easy and cheap. The bike starts life with a middle of the road 18-tooth rear sprocket, which can be swopped for something bigger or smaller to give a top gear anywhere between 50-something inches and 90 inches.

We assumed that Momentum has restricted peak power on the Model T, but this is apparently not the case. Odd, because hill climbing is certainly inferior to the Upstart, despite the Model T's lower pedal gearing, and slightly lower motor gearing thanks to the smaller wheels. Our 1:6 restart proved a bit of a struggle on the Model T, presumably because the riding position makes it difficult to put power into the system with your legs.

As the Model T struggles a bit keeping up with urban traffic, it's not surprising that it soon looks a bit out of its depth on a long hilly-cross-country ride. With a maximum pedalling speed of 15 to 16mph, you end up freewheeling quite a bit on the flat. Hills should be easy, but as we've said, hill-climbing is nothing special, although the higher pedal cadence in the low ratio is very welcome.

After a dozen or so miles, the handlebars feel a bit uncomfortable on the

The Model T is well equipped for a mid-priced electric bike, with LED lights, mudguards, a full chainguard and a big chunky rack

wrists, but the sprung saddle, and extra bounce in the 1 3/8" tyres give a very comfortable ride. Handling is good, but not on a par with the Upstart, and the brakes are merely good (front V-brake) and adequate (rear band brake). On a faster bike we'd consider this device alarmingly weak and lacking in feel, but for the rear end of an urban potterer like the Model T, it's fine.

The discrete battery is modelled on the Panasonic crank-drive battery, but in this case the motor is in the front wheel

The laws of physics being what they are, there has to be a bonus from the lower gearing and modest top speed. On our long hilly circuit, the first LED lasted until 12 miles, the second until 24.8 miles, which once again suggested a lot more to come, although yet again the gauge proved over-optimistic: the bike cut out on a hill at 29 miles, and failed very quickly thereafter, refusing its first hill at 30.6 miles, and more or less running out of steam at 31.7 miles. At 10.2 Wh/mile, consumption is very good, and you'd be hard pressed to find anything better under these testing conditions. Speed fell marginally over the ride, from a modest 14.8mph at 14 miles, to 14.5mph at the end.

Surprisingly, considering how much time the bike spends freewheeling, it used nearly as much power on our shorter, flatter commuter route, but these things happen. The Model T again made surprisingly good time: 36 minutes for a shade under ten miles, which comes out at 14.9mph - comparable to the more leisurely sort of electric bike and about the same as the very fastest non-assisted folders. Two gears are more than adequate for a ten-mile commute if you aren't in a searing hurry, and the bonus is fuel consumption of only 9.9Wh/mile. It could be even lower, with some gentle recalibration. The Model T would probably benefit from slightly higher gearing and reduced power in Low, because once again, we did almost everything on the lowest power setting.

The lights are a real bonus on a bike at this level. They're relatively cheap, single LED jobs, and the output and focus is obviously not up to Busch & Muller standards, but they work well enough (especially the neat rear light) and they are powered from the battery, with a convenient little switch on the handlebar nacelle, so there are no fiddly batteries, no dynamo, and lights whenever you need them. It's the sort of equipment every electric bike should have, but very few do.

Looking elsewhere, the rack is really big and substantial, there's a full chainguard and full mudguards. Being secured only at the front and back, the rear guard gets into a proper old shimmy on bumpy roads, and really needs either another pair of stays midway, or a bracket to

the rack - something that should be sorted by the time the bikes hit the shops.
Missing from both models is a stand. We're in two minds about this - stands are heavy and unreliable, but without one, you have to look for a convenient wall every time you stop. An accessory we would certainly like to see is a rear wheel lock. They don't weigh much, and will deter an opportunist thief from 'alf-inching your wheels.

"...value for money bikes offering similar spec and performance to those costing £1,500 plus..."

The accessories add a fair bit of weight to the Model T, but at 24kg overall (21.4kg without the battery), it's lighter than most comparable bikes costing a great deal more, which will be good news for the design team. Obviously it would be nice if it was lighter, but taking more weight out of a bike begins to add a great deal of cost, and most people should be able to lug 24kg up at least a couple of steps.

Conclusion

We have yet to mention price. Both bikes are expected to cost £1,095, which sounds a lot, but is mid-range these days. It's a shame Momentum couldn't squeeze in below the £1,000 barrier, but it's a pretty good price point all the same. These are attractive, efficient and practical bikes, with five-year frame warranties, and - much more importantly - two years on the electrical parts, including the battery. Most electric bikes at this price are trashy MTB-style beasts with fail-as-you-watch batteries, dicey gears and other dubious components from the Chinese export bin.

The Momentum bikes really are a breath of fresh air, and the only opposition worthy of the name comes from Raleigh's budget range, which now apparently starts at only £1,000. Like the Momentum, these bikes have been sourced from Far Eastern factories by people who know what they are looking for in a bike, and they are also pretty good for the price. Crucially though, we don't think they're a match for these simple, elegant, effective machines. They're less well equipped than the Model T, and less peppy than the Upstart, which just goes to show that a small manufacturer can still beat the multi-nationals if if it knows its market really well (and let's face it - that's why we're still here).

Momentum has got off to a flying start with a pair of bikes that are well sorted, carefully specced and great fun to ride. We think, however, that there should be two distinct step-thru models: the sedate one we've tried here, and something very nearly as sporty as the Upstart for younger customers. Fortunately, recalibration is even easier than changing sprockets these days, so making these sort of changes should be neither time-consuming nor expensive.

Barring any disasters, the bikes should walk off the shelves at £1,095, because they are far superior to anything else at the price, and it's not often we get to say that. Momentum's stated mission was to produce bikes that were both desirable and value for money, with similar spec and performance to those retailing for £1,500 plus. From what we can see, the mission has been accomplished.

Specification

Momentum Upstart £1,095 . Weight *Bike* **17.3kg** *Battery* **2.5kg** *Total* **19.8kg** *(44lbs)* **. Battery Li-ion Capacity** *(As measured)* **292Wh . Replacement Cost £345 . Maximum Range 27 miles Gears 66-inch & 82-inch . Full Charge five hours . Consumption 10.8 Watthours/Mile**

Momentum Model T £1,095 . Weight *Bike* **21.4kg** *Battery* **2.5kg** *Total* **23.9kg** *(53lbs)* **. Battery Li-ion Capacity** *(As measured)* **322Wh . Replacement Cost £345 . Maximum Range 31.7 miles Gears 55-inch & 68-inch . Full Charge five hours . Consumption 10.2 Watt-hours/Mile**
Manufacturer Momentum Electric *tel* **0207 254 8751** *web* **www.momentumelectric.com** *email* **hello@momentumelectric.com**