



WITHOUT A RIVAL



iServo HVC.45 by PowerBox Systems

First impression

The servo arrives in a hard case. A sturdy metal arm (Secraft arm) is included as an accessory. The high-strength, 40 mm aluminium arm can be secured to the servo's spline on both sides using grub screws and, in this configuration, withstands the highest forces. The HVC.45 is exceptionally well manufactured. The three-piece aluminium housing not only looks premium, it also serves the purpose of efficiently dissipating heat from the electronics and motor. There's no servo lead, as the servo features a recessed JR connector in the housing. A patch lead is supplied with the servo for connection. The JR plug on the lead disappears completely into the housing connector and is secured with a screwable GRP retaining tab.

The HVC.45 has the classic dimensions of a standard servo: 20 mm wide, 41 mm long and 42 mm high (excluding mounting flanges). It weighs 95 g. The output shaft has a diameter of 8 mm and 25 T splines. This makes a very solid impression and is well matched to the forces involved. This makes the servo perfectly equipped for virtually all model applications.

PowerBox is continuously expanding its product range. With the iServo HVC.45, they are now offering a new servo that aims to combine the highest specifications in terms of power, precision and control with a commitment to maximum quality and longevity. In short – a new servo in the high-end class. This servo is designed for large RC models where high performance, positioning accuracy and long-term stability are crucial. This test examines whether these high expectations are met.

Contents: The HVC.45 servo comes supplied with a sturdy aluminium arm, a patch lead and a strain relief.





The servo connector is recessed into the housing. A GRP strain relief component is included with the servo, which can be screwed on if required.

Inner values

To access the internals, four screws need to be removed. The housing parts are milled very precisely to match each other, so a certain degree of basic sealing is already present. The servo doesn't have additional rubber rings or O-rings on the screws. A look inside reveals absolute top quality. There's the carefully greased and extremely robust all-metal gearbox. The gears are

hardened and run virtually free of play - I'm even inclined to say completely free of play. The gear output is equipped with two large ball bearings (the upper one is sealed). A high-resolution Hall sensor serves as the position sensor - completely wear-free and correspondingly long-lasting. What I particularly appreciate is that the external components (motor, cables, Hall sensor, etc.) aren't connected to the electronics board

via cables. The servo's layout is designed so that everything makes direct contact with the board. Such construction guarantees maximum reliability even under harsh conditions, for example strong vibrations. The lower cover has a large thermal pad to the electronic components, ensuring a balanced temperature on the board even in warmer environments.



Once opened, high industrial quality is revealed. The extremely robust gears, the large sealed ball bearing and the very tidy control board. There are no connecting wires to be found; everything is permanently connected to the board.

A word about my test methodology

For measuring torque, I use an HP-100 Digital Torque Meter. This enables me to accurately and reproducibly record the servos' torque in both directions of rotation up to 1,000 Ncm (10 Nm), both average and peak values. I determine speed using a storage oscilloscope. This allows me to display the acceleration and braking current peaks of the servo motor in the millisecond range. The principle is that every motor generates one or more current spikes during acceleration and deceleration. A DeltaElektronika laboratory power supply provides stable voltage. The wiring is short and uses 0.5 mm² cable.

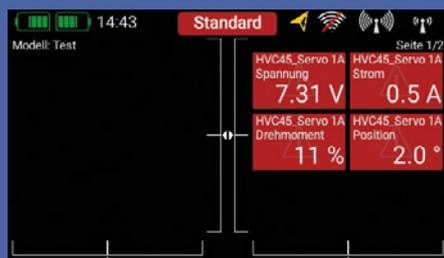
Excellent test results

In what follows, I'll explain my measurement data where necessary and highlight any special features: Due to its digital control, the HVC.45 should preferably be driven at 100 Hz (or higher). Throughout the entire test, it became apparent that the HVC.45 shows no unrest or even buzzing (rapid micro-servo arm tremor) at the target position, either at rest or under load. Whatever I tried, the test samples behaved absolutely calmly and confidently during operation. What was particularly striking was their stubborn consistency when multiple, rapidly repeating extreme torque demands were made. Previously,

it had been standard for other tested servos to noticeably deteriorate after the second or third torque test. The electronics and especially the motor would heat up considerably, leading to this loss of performance. The HVC.45 didn't show this effect. They're designed to be able to deliver extremely high forces over an extended period. What's also worth mentioning is that with strongly impulsive control commands, the servo arm doesn't overshoot in any way – not even the slightest movement, which many servos do to a greater or lesser extent. The target position is reached "crisply" and held, regardless of whether under positive or negative load. To that, I can only say: Bravo PowerBox!



▲▲ The list of transmitted telemetry data comprises seven values.



I've shown four of these telemetry values here as an example.



The programming options are comprehensive. The first page shows the firmware, the neutral pulse and the servo channel – important for the P2-BUS for channel assignment.

► If you prefer to program using the Powerbox Terminal, four pages are available (only the first is shown here as an example).



The neutral position can be set directly in the servo programming, as can the throw range. Up to 1,800° is possible within the pulse width from the transmitter, which corresponds to five rotations per side (relevant for large winches or undercarriage spindles, for example). If you prefer slower operation, you can activate and redefine the speed limiter – for undercarriage servos, for instance. The torque limit and maximum current can also be restricted. Should the servo become blocked, the current is reduced after 0.6 s (adjustable) to protect the entire system. Soft start is also selectable.

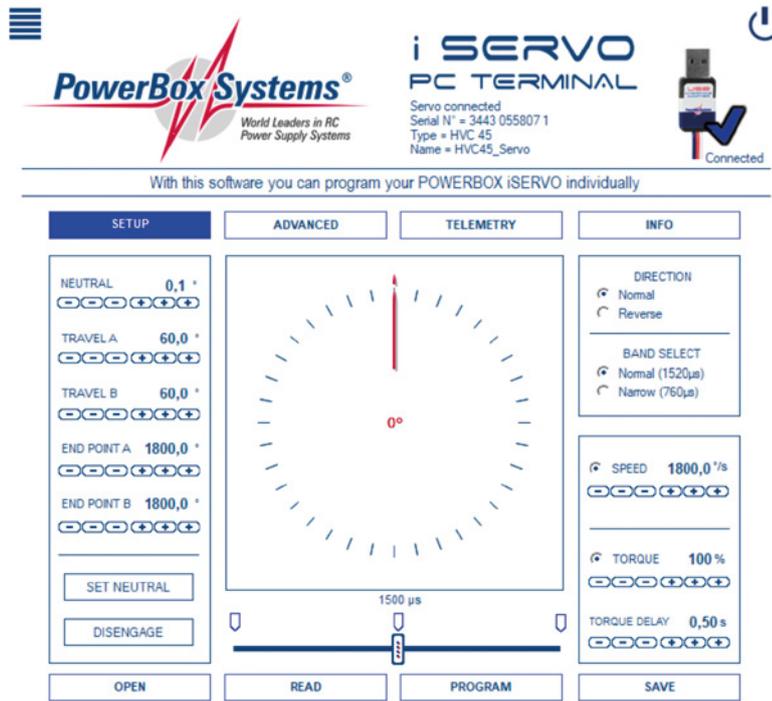


HVC.45 test results

Housing dimensions (L×W×H):	41×20×42 mm
Weight including cable:	95 g
Position sensor:	Hall effect sensor
Drive motor:	DC coreless
Ball bearings:	two
Operating frequency:	up to 333 Hz
Centre position (+/- 5 µs) / frequency:	1,520 (760) / 100 Hz
Idle current 6 V / 8.4 V:	62 mA / 50 mA
Minimum operating voltage:	4 V
Speed 60° at 6 V:	165 ms
Pulse current (<20ms) start / stop:	4 A / <0,6 A*
Speed 60° at 8.4 V:	120 ms
Pulse current (<20ms) start / stop:	5,5 A / <0,8 A*
Maximum torque at 6 V:	390 Ncm
Stall current:	4,8 A
Maximum torque at 8.4 V:	500 Ncm
Stall current:	6,5 A
Drift between 8.4 V and 6 V:	0 µs
Resolution:	2 µs
Soft start:	Yes
Programmable:	Yes, extensively!
Cable length:	JR pin connectors integrated
Output gear (thickness / tooth count):	8 mm / 25 T

*Reverse current is electronically suppressed!

One special feature deserves mention: The HVC.45 has no mechanical stop in its rotational movement. Its rotation radius extends up to 1,800° in each direction. That corresponds to five complete revolutions. Telemetry data is fully output to the ATOM or CORE when the HVC.45 is controlled via the P²-BUS. Programming with the transmitter is likewise assured. The problem so far: the P²-BUS cannot supply enough cur-



With the PC programme (PC Terminal, downloadable from the PowerBox website), the settings and all the related information extend over four pages. Here, just the first page as an example, where the servo is configured and moved using the slider.

rent to operate multiple servos. PowerBox is working on a power adapter to change this. The PowerBox Royal SR2 is currently the only unit that addresses this issue, allowing multiple servos with telemetry to be operated.

Convincing across the board

The positioning accuracy is superb and shows no deviations whatsoever. PowerBox uses a Hall sensor as the position sensor. It detects the servo arm angles with high precision and without wear. A coreless motor serves as the drive motor. These are characterised by their very fast response and high performance capability. The centre position is very precisely defined and doesn't deviate from the nominal value of 1,520 µs. As the servo is programmable, the centre position can be changed

directly in the servo if required. The idle current is somewhat higher than normal. Typical would be 30 to 40 mA. In this class, an external BEC (dual) power supply is recommended (BEC = Battery Eliminator Circuit). Anyone working with multiple servos (for example, two per flap) should be aware of their total pulse currents. As a recommendation, I'd like to note that the sum of the maximum servo currents, halved, should equal the target current rating of a BEC. The HVC.45 shows clear reserves at the minimum operating voltage. They work 100% flawlessly between 4 V (PowerBox specifies 6 V) and 8.4 V. The transit time or speed fully met the manufacturer's specifications. The pulse currents occurring in the process (lasting up to 20 ms) are, at 5 A, well within the normal range. They could be up to twice the stall current. What's outstanding, however, is the deceleration current (braking current). This normally generates high vol-

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tage spikes that feed back into the receiver system and aren't without risk. Here, PowerBox has done an excellent job and electronically suppressed the voltage spikes to the minimum – exactly as one would want. After measuring the stall torque, I can only pay PowerBox another compliment, as it's not a given that manufacturer specifications are exceeded with positive margin! Just one example: at 8.4 V, the HVC.45 reliably delivers 500 Ncm; the specification is 450 Ncm. What's special is that this servo delivers this repeatedly. Other servos already drop off noticeably after the third attempt.

No voltage drift is detectable. The test voltage range was from 8.4 V (2s LiPo, fully charged) down to 6 V (2s LiPo, empty). The servo shows no movement whatsoever on

the control arm, either at idle or under load. The resolution is extremely high at 0.002 ms – typical is around 0.004 ms. The fine line between very high resolution (risk of slight servo unrest – they often buzz under load in the rest position) and high resolution has been superbly implemented here from a technical standpoint. The servo arm position is absolutely precise and steady, with or without load. Conclusion: convincing across the board.

No brushless motor?

Yet it's supposed to be the be-all and end-all, one keeps hearing. But PowerBox has three clear reasons against it:

1: With a brushless motor, the rotor is comparatively heavy and requires more time and energy just to start up. Whilst the torque is high, the starting torque is significantly lower. PowerBox sets clear priorities here, as the torque should always be consistently available. This specially designed coreless DC motor ensures this optimally.

2: Four-pole motors are usually used as brushless motors in servos. Exact precision is therefore only possible within these "detents" per revolution of the rotor. The coreless motor has finer resolution in positioning because it positions at any angle. But the greatest thing is that it doesn't have to rotate first to develop full torque. One must understand: the starting torque of a brush-

less motor is comparatively low compared to a coreless motor, because the latter has its highest torque at standstill, whilst the brushless only achieves it when rotating!

3: Precision in holding torque. Here too, the coreless drive has clear advantages, because it can make the finest corrections to counterforces in the holding moment to maintain the target position.

All these circumstances mean that the PowerBox servo achieves a fantastic 0.1° resolution within specification. Nevertheless, there are of course advantages that justify a brushless drive. It's more compact for the same forces, positions almost as accurately and is very durable because it has few wearing parts. Anyone wanting to achieve this with a coreless DC motor must invest considerably more effort in terms of technology and cost.

Programming options

Anyone who owns the PowerBox Mobile Terminal should use it to configure the servo individually if necessary. A firmware update is also possible with it. After the update, version FW3.30 was installed on my test samples. The menu navigation is in German and overall (almost) self-explanatory. PowerBox doesn't supply instructions. Anyone wanting to delve deeper should seek help in the PowerBox forum. Alternatively, the PC programme iServo-Terminal can also be used (the PowerBox USB Interface Adapter is required for this). It offers the same controls and setting options for the HVC.45 in a very clear layout. Updating, should new servo firmware be available, is likewise provided for.

Final Verdict

I must try not just to express my enthusiasm but to remain objective. Yet it is what it is – the HVC.45 is simply a servo that's in a class of its own and unlike anything I've had on my test bench to date. It runs so precisely and powerfully that I initially didn't trust my measurements. But I was repeatedly proven wrong. Anyone who only considers the bare price is judging the HVC.45 too one-dimensionally, because the qualities acquired with it are left out of the equation! There can therefore be only one verdict: this servo represents the absolute pinnacle in the premium class and meets the highest requirements and demands, as defined by the model and its pilot!



EXPLANATORY NOTES ON THE DIAGRAM

Servo at 6 V, measuring shunt 0.15 ohms: 5.3 A starting current peak [1], fully accelerated after 25 ms [2]. After 125 ms, -0.7 A braking current [3] (deceleration) followed by a micro-soft run at 0.8 A to the target position [4], reached after 150 ms (no overshoot in movement!) [5]. The braking current (return current to the receiver) is normally almost as high as the acceleration peak, but here it is excellently suppressed due to the internal electronics. This should not be underestimated, for example, in an F3A-X model where two servos operate a control surface in parallel. In such cases, pulse return currents accumulate, easily reaching over 12 A per control surface.



HVC.45

Operating voltage:	6.0 to 8.4 V DC Volt
Protocols:	PWM, P ² -BUS and S.BUS
Telemetry:	yes, via P ² -BUS
Torque at 8.4 V	45 kg*cm
Speed at 8.4 V	0.12 s at 60°
Case:	Aluminium
Motor:	Coreless DC-Motor
Gears:	Metal
Ball bearings:	2x ball bearings
Dimensions:	40x20x38.8 mm
Weight:	94 g
RRP:	€179
Purchase and information:	Specialist retailers and directly from: PowerBox Systems, www.powerbox-systems.com, Tel.: +49 906 99999-200