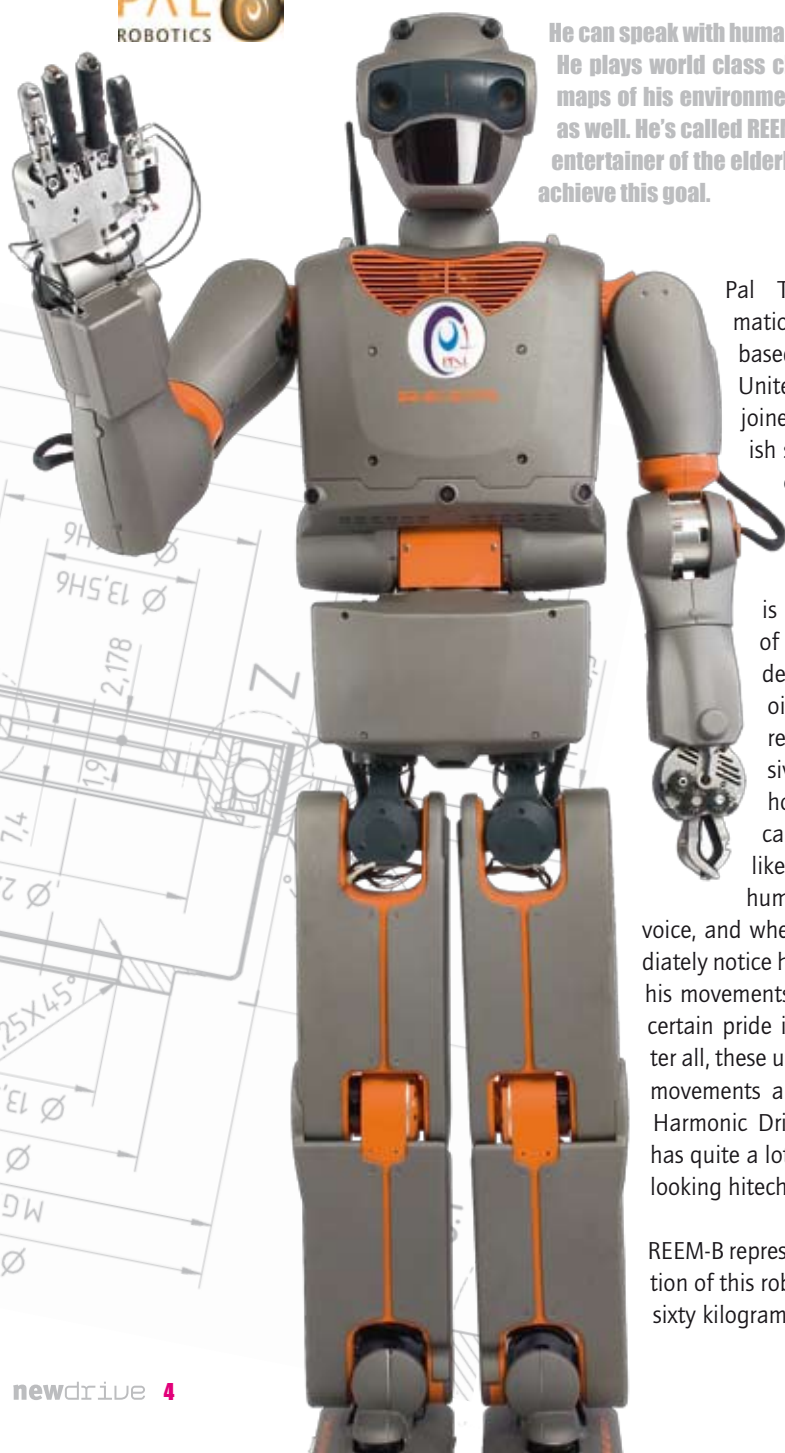


"i am reem-b – how may i be of assistance?"



He can speak with humans and take their instructions. He can recognise faces and follow a schedule. He plays world class chess. He can find his way in any building in the world and even generates maps of his environment. He can move objects, carry loads, and soon he'll be able to climb stairs as well. He's called REEM-B and was developed by PAL Technology Robotics as a future assistant and entertainer of the elderly or needy in their everyday environment. Harmonic Drive gears help him to achieve this goal.

Pal Technology, an automation technology maker based in Abu Dhabi of the United Arab Emirates, has joined forces with its Spanish subsidiary PAL Technology Robotics to set new standards in humanoid robots. Their joint development REEM-B is an incredible example of the great progress the development of humanoid robots has made in recent years, an impressive demonstration of how "human" a machine can now seem. He walks like a human, listens like a human, has eyes and a voice, and when he moves you immediately notice how flowing and smooth his movements are. We must admit a certain pride in this achievement: after all, these ultra precise, harmonious movements are the hallmark of our Harmonic Drive gears. And REEM-B has quite a lot of them in his delicate looking hitech body.

REEM-B represents the second generation of this robot type. Weighing in at sixty kilograms, he is 1.47 metres tall

and if desired can march 1.5 kilometres an hour. He is actually able to transport loads equalling 20 to 25% of his own body weight – making him the strongest humanoid robot in the world. Also, a multitude of sensors allow him to react to his environment and act in it, and an integrated gyroscopic instrument helps him to keep his balance. Ultrasonic sensors and laser scanners help him up and down the stairs, and when his batteries are charged he can move about freely for two hours. It is really incredible to see him in action.

Like every other component, the parts making up REEM-B must of course fulfil the very high demands of PAL Technology Robotics, in particular the gears of the REEM-B which, after all, are responsible for getting the robot going. Alone his four fingered hands are each fitted with ten motors that have to interoperate with perfect precision when for instance REEM-B is refilling a coffee cup.

All precision axes feature Harmonic Drive gears – without exception

The minimum requirements these components must fulfil without fail extend to the optimal synchronism, highest precision, and greatest torsional rigidity in the smallest of spaces with the minimum of weight, or precisely those product properties that our Harmonic Drive gears have been presenting to such acclaim for a long time now. And for this reason, also every single precision axis



REEM-B

- 60 kg _WEIGHT
- 1.47 m _HEIGHT
- 120 min _BATTERY CAPACITY
- 51° _ARTICULATION ANGLE
- 12 kg _LOAD BEARING
- 1,5 km/h _SPEED
- Core 2 Duo (1.66 Ghz) _MAIN CPU
- Geode (500 Mhz)
- microphone, stereo camera, _SENSORS
- six axis force sensors,
- accelerometer & gyro,
- ultrasonic sensor,
- laser range finder



| HFUC units

| HDUC units

| CPL units

| CSG units

| CSD units

in REEM-B's locomotor system features without exception Harmonic Drive gear units of the HFUC, HDUC, CPL, CSG, and CSD Series – and for good reasons too.

Compared with standard gears the HFUC Series features a shorter flexspline, ultimately leading to a considerably shorter axial length. Moreover, compared with traditional involute toothing, the patented IH toothing profile in this gear type exhibits a considerably higher torque capacity.

The lightweight CPL installation units are based on the tried and tested HFUC units whose low weights are already a characteristic feature of the standard designs. Owing to a series of cross sectional reductions and additional optimisations to the hole patterns for the same performance data

the CPL units have shed yet another 50% of their weight. We could also reduce the mass moment of inertia by a further 40% compared with the HFUC standard. Moreover the CPL units feature a modified wave generator and flexspline for a larger hollow diameter than comparable HFUC units. For applications with particularly high power to weight demands relatively small screws are used on the flexspline in conjunction with the established EKagrip® washers for the benefit of the hollow diameter.

An ultra precise and harmonious sequence of movements is just one of our hallmarks

The Harmonic Drive installation units from our CSG Series can take considerably greater loads for a far longer service life than the HFUC Series

– a result of the optimisations to the flexspline, circular spline, and the wave generator ball bearing. Moreover the CSD units are characterised by an overall length almost 50% shorter than the present HFUC Series, facilitating the design of extremely flat precision drives and subtables. Also, the CSD Series allows designs with a hollow shaft.

All of these product features have served to sway the decision of PAL Technology Robotics in favour of Harmonic Drive gear units that are to realise the ambitious goals of REEM-B. If you want to gain an impression of how excellently this works visit www.pal-robotics.com/media.html.