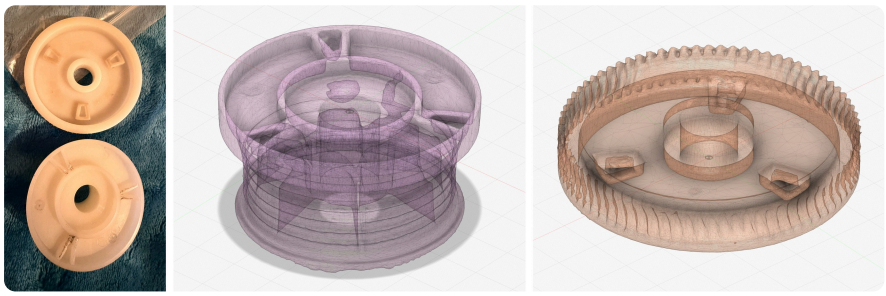
CASE STUDY

A new torque plug for the Lotus Elan M100 window winder

> The M100's window winder torque plugs are no longer made, and the originals have perished. With nothing left to measure, we designed a new one from the gears it sits between.

In the Lotus Elan M100, built from 1989, each electric window is driven by a motor through a worm gear and a cable drum. Between them sits a rubber torque plug: dogs on the gear and drum push against it, so when the window reaches the top or bottom of its travel, the plug takes up the shock rather than the gears and cable. The plugs are no longer made, and after more than 30 years the rubber has degraded and no longer does its job.



Left: the worm gear (top) and cable drum, each with three dogs. Centre and right: the drum and gear captured with a 3D scanner.

The challenge

The original plug was too badly perished to take any measurements from, so the new one had to be designed from the parts it works with. It had to:

- fit between the three dogs on the drum and the three on the gear, with no play;
- be firm enough not to crush when the gears are turned by hand, yet give a slight cushion;
- leave room for the material to bulge as it is squeezed;
- fit the 4.3 mm space between the drum and the gear.

Our approach

01 **Scan the dogs.** We 3D-scanned the gear and drum and lined the scans up as they sit in the motor, then measured the width, spacing and height of every dog.

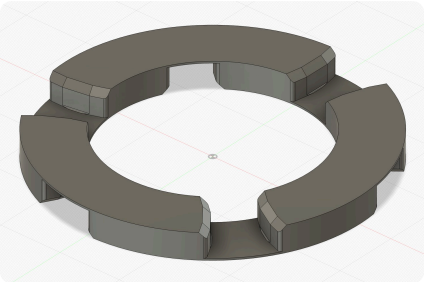
02 **Design between the dogs.** In professional CAD, we modelled six pads, one for each gap between the dogs, joined by thin webs. Each face is matched to the dog it meets.

03 **Choose the right material.** We print the plug in TPU 95A, a firm, flexible material, with the pads trimmed back from the drum walls so it has room to bulge.

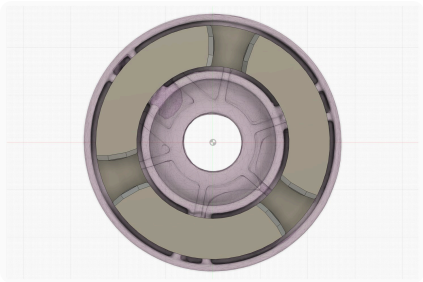
We use AI alongside our own engineering judgement to align the scans, measure the dogs and check the fit. It handles the slow number-crunching, so each round of changes takes minutes, not days and you get your part sooner.

Designed around the dogs

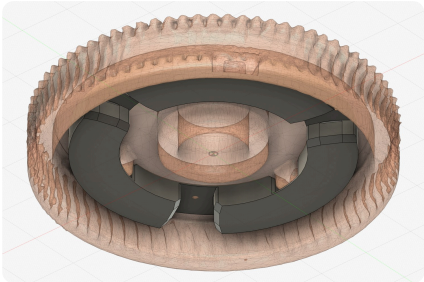
The original plug filled the drum's channel from wall to wall, but TPU barely changes volume when squeezed, so a part with nowhere to bulge can't compress. The new plug leaves about 1 mm at each wall, and meets the dogs with under a tenth of a millimetre of clearance, so there is no backlash.



The new model: six pads joined by thin webs.

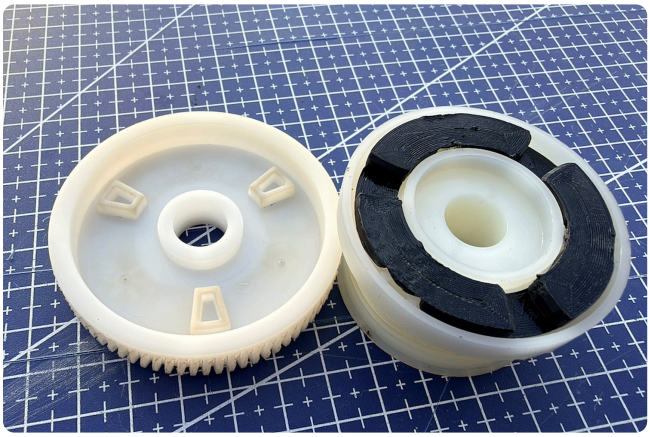


The new model (grey) in the drum scan (purple).



The gear scan (orange) over the new model.

	MEASURED FROM THE SCANS	NEW DESIGN
Drum channel	15.1 to 25.7 mm radius	16.1 to 24.7 mm, room to bulge
Space between drum and gear	4.3 mm	4.2 mm thick
Dog width	18.2° drum, 19.5° gear	0.25° clearance per side



The printed plug seated in the original drum, beside the gear.

The result

A replacement torque plug for the Elan M100 window winder, printed in TPU 95A and designed from the dogs it works between. It fits the original gear and drum in the winder assembly, ready to go back into the car. Every key size is a named setting, so the fit can be tuned in seconds.

Now available on eBay: ebay.co.uk/itm/198771975801

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