Case Study

A new rail-based parcel delivery system is being developed by an innovative start-up with the help of advanced DQ axis analysis from Tektronix



Tektronix supports Magway's mission to develop a zero emissions delivery system

Based in Wembley, London, Magway is developing a system to deliver parcels and goods through a network of underground pipes across the UK, using a series of small carriages running on rails. The system uses technologies such as conventional HDPE pipe and linear synchronous motors.

CHALLENGE

Magway is developing a revolutionary new distribution system based on magnetic rails. Magway envisages that its pipeline-based delivery systems could revolutionise the delivery of parcels and goods between distribution centres, potentially taking up to 90% of online delivery vehicles off the roads, reducing pollution and congestion.

The company's demonstrator track is in the form of a 65-meter loop, with 106 discontinuous stator linear synchronous motor motors installed along it. These motors interact with permanent magnets on the carriages, propelling them forward at average speeds of up to 15 meters per second. Currently, up to three carriages can be run simultaneously.

During measurements on the system, the company discovered there was a lot of electrical noise present.

THE SOLUTION

To find the root cause of this noise, Magway purchased a Tektronix 8 channel 5 Series MSO Mixed Signal Oscilloscope (MSO58) along with three TCP0030A current probes and three TDP0200 differential voltage probes.

Each of the MSO58's eight inputs provides one analog signal that can be displayed as a waveform view, a spectral view or both simultaneously, as well as eight digital logic inputs.

Many applications, such as three-phase power electronics and power supply design, require the observation of more than four analog channels to verify and characterise device performance and debug complex issues such as Magway's noise problem. The eight channels of the 5 Series MSO offer better visibility into these complex systems, with waveforms presented on a large 15.6-inch high definition (1,920 x 1,080) touch screen display.

One of the application options chosen by Magway was Tektronix' Inverter Motor Drive Analysis (IMDA) software. Available for the 5 Series, 6 Series B MSO, the IMDA solution offers rapid, accurate and repeatable results for electrical measurements on industrial motors and drive systems for AC induction motors, permanent magnet synchronous motors and brushless DC motors.

It can also be configured to measure DC to three-phase AC converters, such as those used in electric vehicles.

The IMDA solution gives Magway an easier way of correlating control systems and power electronics with the performance of the overall system.

Aanchal Mittal, an Innovation Engineer at Magway, says: *"Every time we run the track, we're collecting thousands of lines of data from currents and voltages, positions, speeds and torques – we get pretty much any data you can think of. That's really helpful for us, because then we can analyze all that data pretty much straight way and see any problems we're getting."*

"With the Tektronix scope we can apply a very systematic, methodical approach and find where these problems are and then find a solution to them. At Magway, everything we do is driven by data, so if we have the right tools to collect that data, it makes our job so much easier."

Initially Tektronix provided in-depth support to ensure Magway staff were able to use the oscilloscope to its full advantage. *"Working with Tektronix has been really useful, and their technology support has been great,"* added Mittal. *"They spent many hours helping us to set everything up and we've all got a pretty good idea of how to use the 'scope now. We got the assistance we needed to set it up, and now we can take all the measurements we need."*

"There are parts of the electrical system that we need to figure out. Our head project engineer and some of the other engineers have been using the Tektronix oscilloscope on every one of the motors and drives on the track and it has been an incredibly useful tool for this."

With drive systems, an important challenge is to tune the drive system control logic based on the three-phase AC signals. Analysing a system in the AC domain is inherently difficult, so converting from the AC to the DC domain makes it easier to measure parameters.

The IMDA solution features direct-quadrature-zero (DQZ or DQ0) transformation, which rotates the reference frames of the three-phase waveforms, so they become DC signals. Calculations can be conducted more easily on these DC quantities before inverting them and getting to the actual three-phase AC results.

Mittal says: *"Our entire control system revolves around measuring our currents and voltages in the DQ axis, converting them from three-phase currents to DQ axis currents. That's something that Tektronix, I think have just patented maybe six months or so ago, so we're really using this technology to help us measure those DQ axis currents - it's just a method we hadn't even thought of. This will help us build up the robustness of our electrical system."*



"'The 5 Series oscilloscope together with the IMDA software solution and probes really help us measure our currents and voltages in the DQ axis, converting them from three-phase currents - it's just a method we hadn't even thought of."

Aanchal Mittal, an Innovation Engineer at Magway

For Magway, working with Tektronix is a chance to partner with likeminded companies. *"We are looking for companies we can work well with,"* says Mittal, *"companies who are excited about what they do and share the same passion for engineering that we do, the same passion for making the world a better place."*

Innovation is at the heart of everything Magway does. This is reflected in the job titles of its engineers, many of whom are designated as Innovation Engineers. This also means that working with partners that support its innovative approach is vital to Magway.

Mittal comments: *"What's important in an R&D partnership is a company who's willing to work with us to innovate quickly, in the best way possible."*

"It is through innovation that we are going to see the changes in the world that we want to see."

MAGWAY

PRODUCTS AND SOFTWARE PROVIDED

Bench Configuration	
Product	Description
	**5 Series MSO, 8 channel mixed signal oscilloscope (MSO58) ›› View On Tek.com**
	**3-Phase Inverter, Motor and Drive Analysis software with DQ0 measurements ›› View On Tek.com**
	**TCP0030A 30 A AC/DC Current Probe ›› View On Tek.com**
	**THDP0200 probes, High-voltage Differential Probes ›› View On Tek.com**

For detailed information on the solutions presented please visit 5 Series MSO and 3-Phase Inverter Motor Drive Analysis (IMDA) or contact us at 1-800-833-9200.

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