

# RESPONSE ABILITY

Exceptional connectivity between instrumentation and motor-speed controllers has had a positive effect on electric vehicle design – better programmability, economy and ease of mounting

Improving the responsiveness of industrial electric vehicles (EVs) to the operator is often a matter of making different components in those vehicles more responsive to one another. For such applications, the new enGage IV from Curtis Instruments has special appeal.

This innovative gauge/panel allows powerful flexibility and advanced functionality. Using a dot-matrix display, operators can select each display element and its location on the gauge. Display options include bar graph, numeric display, needle display and message center – all custom-configured to the designer's choice. It has four gauge functions plus on/off indicators. The panel can be further customized with the OEM's logo, the end-user's logo, or virtually any other desired graphic. Even the display icons themselves can be custom designed. Evaluate it how you will – function, flexibility, aesthetics, or price performance – the enGage IV trumps earlier technology.

The series is built with solid-state electronics, void of moving parts, so there is nothing to break or wear out, and they will not pick up dust and moisture because they are protected to IP 65. Batteries are not required because they rely on EEPROM non-volatile memory to retain vital user information. Importantly, enGage IV only needs a minimum of wires to connect to the rest of the vehicle.

In addition, the gauge/panel is manufactured under an ISO 9001-certified quality management system and is UL-recognized and CE-certified. It also provides as many as four gauge functions and a bevy of warning icons, a message center and a clock.

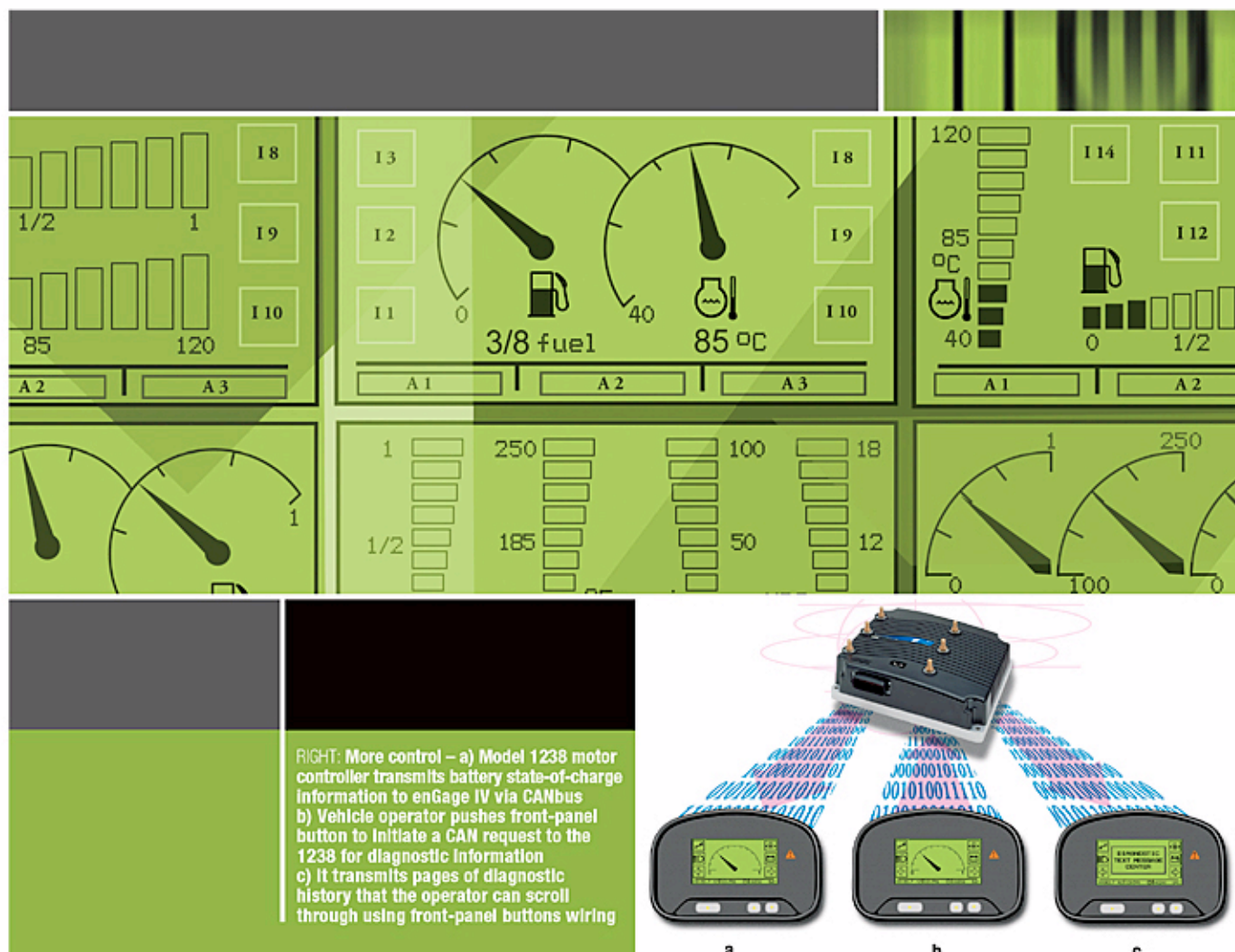
This product is virtually all things to all companies, and includes a temperature and pressure gauge, speedometer, maintenance monitor, tachometer, hour meter, or battery-discharge indicator – or a combination of the functions.

The reason this panel boosts vehicle responsiveness lies with its ability to

communicate. By working in harmony with a Curtis motor-speed controller, enGage IV is always in touch with what the vehicle is doing or what it needs. Similarly to other Curtis electric vehicle products, enGage IV relies on industry-standard CAN communications. This capability helps give the gauge amazing versatility. If, for example, operating a vehicle requires the brake to be activated, the keyswitch to be in neutral and an operator in the seat, the gauge can be programmed to send a signal to the controller – 'unless all these things happen, do not turn on the motor'.

## Major advantages

Flexibility is an obvious advantage of enGage IV, as OEMs can program all of these functions themselves. This is even better than it seems at first glance, because it can be shipped as a blank unit to be customized by users. The production economies that this brings to Curtis are passed on to OEMs in the form of competitive pricing, and because



the product is always the same (regardless of how it will be used), OEMs which need more than one type of gauge can still order just one product. For the OEM, the benefit here is a simpler purchasing procedure and bulk-purchase savings.

From the standpoint of pure economy, the enGage IV is also attractive in other ways. Due to the integration of simple wiring, installation for the OEM is also claimed to be straightforward and easy. The instrument – complete with integrated connector – snaps into the panel cutout without hardware. This contrasts with older-style gauges that require every measurement indicator to be accompanied by a hardware kit. As the conventional hardware mounting kits of traditional gauges are also eliminated, the simplified production process reduces labor and inventory costs.

#### Integrated connectivity is the key

A number of components interface with the microprocessor-based enGage IV. Many are associated with sensors, such

as those that measure pressure and temperature. Although a number of functions can be incorporated into the panel, it is possible to program it in such a way that all of the readings are viewable simultaneously. A backlit LCD makes the contents visible in full sun, total darkness and dim-indoor conditions. Vehicle status – and especially warning signals to the operator – are easy to see and of high impact. Warnings can be displayed as LCD icons, LCD bar graphs, or bi-color front-panel LEDs.

In the four classes of electric vehicles, the first two – counterbalanced forklift trucks and reach trucks – are perfect candidates for Curtis enGage IV.

As good as they are by themselves, one of the greatest strengths of these gauges is their connection to an integrated system of complementary platforms, linked by CAN communication. These offerings include vehicle management systems, motor-speed controllers, battery chargers, DC/DC converters, throttles, DC contactors,

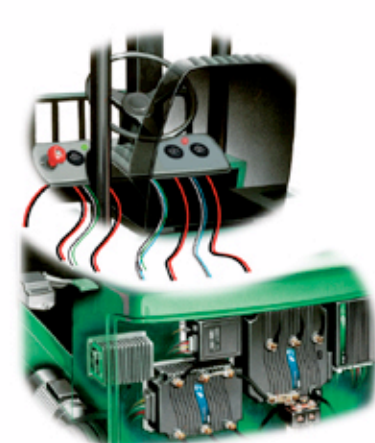
disconnect switches, alarms and more. In offering such systems, this ensures that customers can purchase a package of components that are guaranteed to integrate smoothly, and the one that works closest with the enGage IV are motor controllers. Curtis motor-speed controllers enhance vehicle responsiveness and efficiency, and can be tailored to a variety of special applications – due in part to communications.

#### CAN and vehicle control provide the pathway

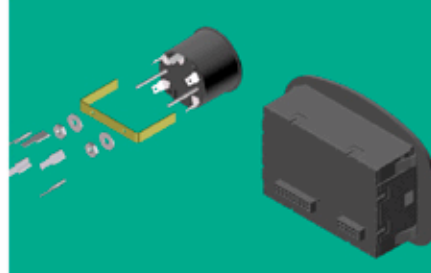
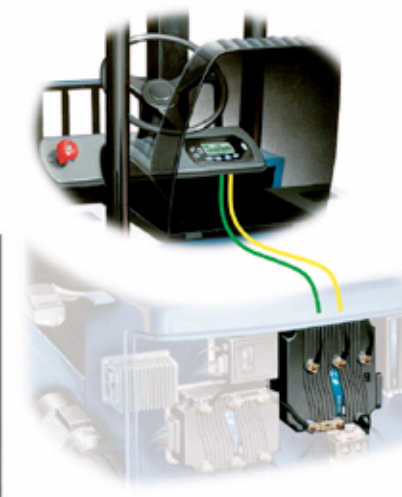
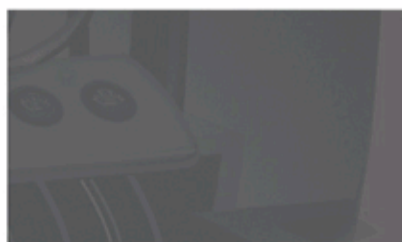
CAN technology has become a special area of expertise and Curtis is one of the companies at the forefront of development in this area. The company's know-how also includes advanced system integration and motor-speed controllers, including AC and separately excited SepEx models.

VCL (Vehicle Control Language) software – written by Curtis – hugely advances vehicle control. VCL combines the power of a motor controller with the flexibility of a programmable logic





**ABOVE: Less clutter – distributed processing allows simplified vehicle design and wiring by using the two-wire CANbus to communicate all vehicle information between the two data-processing hubs, enGage IV and Model 1238 motor controller**



**ABOVE: Installation is made easy with snap-fit mounting which eliminates messy mounting hardware while integrated connectors simplify wiring**

controller to provide a highly adaptable motor-speed drive. VCL commands are communicated via CAN and include input/output (I/O) functions, feedback-loop blocks and software development tools. This combination enables almost limitless customization. The CANbus physically connects the vehicle system and allows a virtual network of I/O devices, while also reducing expenses associated with wiring and maintenance. Distributed logic and I/O unify the vehicle's resources, making them available to the entire system. VCL works with Flash programmable memory to allow instant modifications at any phase of development, from prototyping to final field testing. This all translates to easier vehicle upgrades for the OEM.

VCL allows features such as traction, lift, steering, display, diagnostics, fault handling and maintenance to be combined smoothly. Efficiencies made possible by VCL also let engineers eliminate or incorporate components, combine or share features, add functionality and mix and match system resources.

For OEM designers, the customization made possible through the

implementation of VCL is vital. They can develop an individual feel for their vehicles, creating functions based on their own intellectual property. VCL can also govern the way a vehicle accelerates, turns and brakes, or how these functions are displayed to the operator in the form of messages, warning lights, measurements and so forth.

Due to the VCL's easy-to-program nature, the OEM's design cycle can be shortened and made more responsive to changing market conditions. Through software codes alone, it is possible to provide improvements to a product that previously required multiple hardware configurations. Curtis has developed a VCL 'library' comprising blocks of software codes that provide commonplace functions such as steering and acceleration. Not having to create such functions from scratch promises to ease an OEM programmer's workload. These include input debouncing, proportional integrator differentiator loop, pulse-width modulation and CAN messaging.

## Coupling with advanced AC controllers

Curtis AC induction motor-speed controllers represent the next level for

materials handling and industrial vehicles. They offer lower maintenance, higher performance, greater flexibility and deliver an exceptional level of sophistication and adaptability.

These AC controllers can be supplied in compact, fully sealed housings with advanced thermal management, and they are taking on an increasing number of responsibilities beyond the operational basics. Functions including temperature, speed and battery level are also monitored by motor controllers that seamlessly pass on the data to Curtis gauges. The key to successful integration is distributed processing, which allows connection of key system components to smart processing hubs. Previously, all items connected to the motor-speed controller only, requiring a lot of wiring to run throughout the vehicle. Now, enGage IV is the second hub, allowing connection to either the panel or the controller, depending on which is shortest and most convenient. This greatly reduces the vehicle's wiring network, simplifies installation and maximizes space.

Prospective customers can order a sample of the gauge they require at [www.curtisinstruments.com](http://www.curtisinstruments.com) by picking the appropriate enGage model for their application, and configuring it interactively by choosing the desired icons and gauge indicators. **IVT**

*Michael Miller is director of product management, Curtis Instruments, New York, USA*