System Customization-Quick and easy

Reprinted from Industrial Vehicle Technology 2000
Lift Truck and Materials Handling

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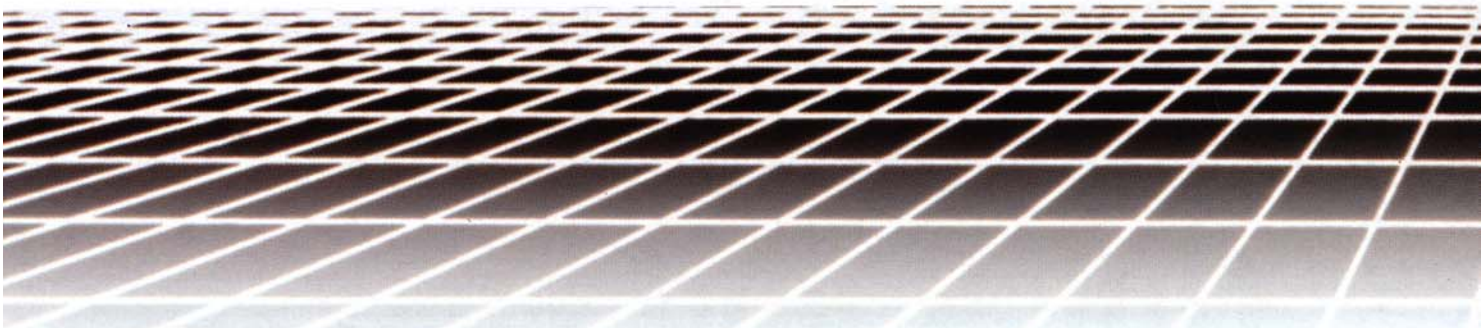

System customization
– quick and easy

CANbus and vehicle control language technologies are changing the future of industrial electric vehicle design. This industry is about to take a giant leap forward

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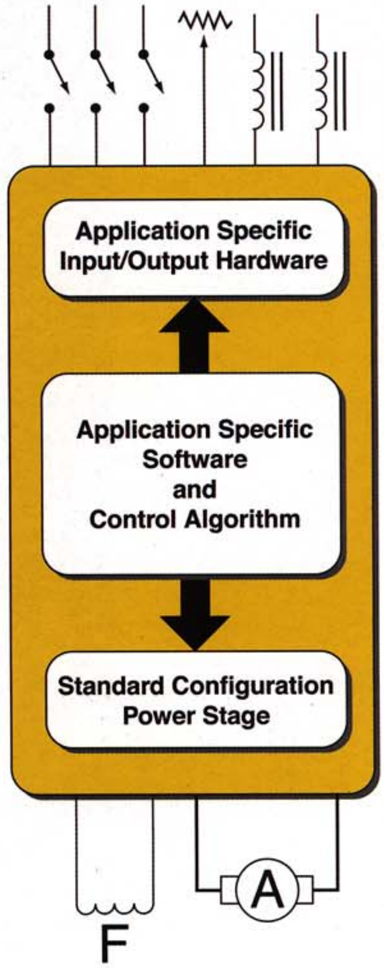
By its very nature, the traditional approach to industrial vehicle design creates two opposing forces in the industry. OEMs demand low-cost, reliable components that are customized to meet the unique requirements of a system, whereas suppliers need to produce proven generic modules in high volume in order to make them cost-effective. With the advent of the microprocessor, suppliers such as Curtis Instruments, Inc have been able to successfully meet customer needs by providing time-tested modules with software that allows some flexibility and programmability.

However, traditional module design falls short of meeting the growing needs of the marketplace. Manufacturers continuously demand more customization on vehicles that are becoming increasingly sophisticated, requiring hardware and software additions to the system or its components. For example, in a complex system of hydraulics, motor control, battery management, steering systems, displays and multifunction control handles, there is a limit to the number of wires that can be included in a wiring harness. Adding software parameters is also problematic because of the thousands of permutations and interactions, and it increases integration difficulty and the likelihood of error.

Today, there are new technologies that address current design issues and greatly expand the opportunities in the industrial electric vehicle (EV) industry. Curtis is at the forefront of this movement with a unique system solution including communications, reprogrammability and software development tools. This combination of tools works in conjunction with CAN to significantly simplify wiring and link system resources. The Curtis solution ultimately enables OEMs to have the best of both worlds – cost-effective, time-tested generic modules and custom solutions.

Current design limitations

Generic components of traction, pump and steering controllers provide OEMs with cost-effective products, but their adaptation can be costly, or in some cases, not even feasible. This is especially so with devices that are not programmable, but even programmable devices have limitations (e.g. a throttle input is a throttle input – even if used as a voltage throttle or a resistive throttle, it remains a throttle input). A Curtis option called multimode allows



Traditional design – customization adds development complexity since software is inter-related

About Curtis

Curtis Instruments, Inc, a supplier of instrumentation and motor speed controllers for battery-powered vehicles and equipment, is headquartered in Mount Kisco, New York. The company has global sales, support and distribution that enhance its ability to serve customers in markets around the world.

The mission of the industrial vehicle group at Curtis PMC in Dublin, California, is to build reliable, cost-effective generic modules that offer increased flexibility. The company has made significant headway in this direction. Curtis has four product lines that are CAN-compatible, and is currently converting its entire modern product line. Efforts are underway to further develop the company's core competency products and design them around the new technologies available to the industry. The latest product introduction is Model 1310, a generic software module that houses VCL and Flash. Also under development are a new line of CAN-ready displays and AC controllers.

some functions to have up to four features, but this also is limiting.

Vehicle customization presents a number of challenges, whether it involves adding wires and/or changing system software. This process is usually long, arduous and complex, and the resulting system is often difficult to maintain. Also, the customization process can be too revealing for OEMs who prefer to protect their distinctiveness from industry suppliers.

Complex systems create additional difficulties. As the electronic content of vehicles increases, the complexity of the interaction of systems also expands. Initially, components were built to have one function, but with the advent of the microprocessor these units could be designed to accommodate numerous parameters and hundreds of permutations. Now, in order to meet the needs of complex systems, these same products must be configured with hundreds of parameters and hundreds of thousands of permutations. Subsequently, task-specific components become costly, unmanageable and more difficult to integrate.

Get on the CANbus

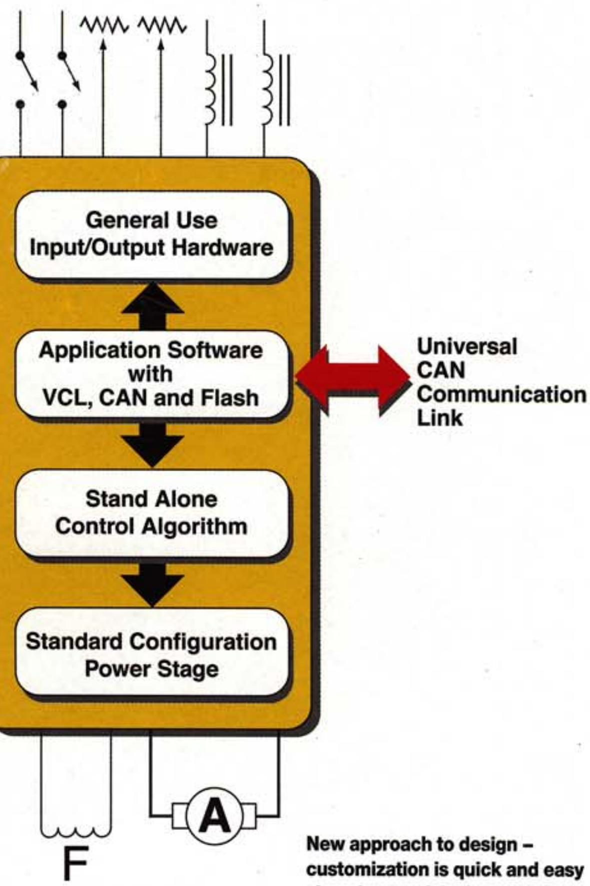
In recent years, industrial EV designers have come to recognize the benefits of central bus architectures such as CAN. The immediate advantage to implementing a CAN-based system is a reduction in wiring harness size, since only a simple two-wire bus is required for communication of digital information. With complex applications, the reduction in wiring alone can justify the costs of implementing CAN interfaces on a system.

Initially, a CAN-based system may add complexity because of the need for additional software. Yet, from a systems perspective, a CAN network ensures higher systems integrity, reduces overall complexity and facilitates maintenance on the entire vehicle as well as individual components. More importantly, CAN enables vehicle designers to meet the increasing demands of the marketplace; it is therefore quickly becoming the industry-accepted standard.

Already an adopted standard is the Open Systems Interconnection (OSI) model. Defined by the International Organization for Standardization (ISO), the model describes how communications should occur on a network. The OSI model defines seven independent 'layers' of a protocol stack. The bottom layers, which specify physical and electrical characteristics and how data is handled, are implemented with commercially available CAN microcontrollers. Curtis has incorporated the CANbus chipsets into several of its product lines. Since information going onto and coming off of the bus is now a function of qualified hardware, this lessens the burden on the software that drives the module.

The seventh layer of the OSI model – the application layer – defines the protocols for communicating with other nodes on the system. While the industry awaits an accepted standard for a communications protocol, companies have been using proprietary protocols – this poses a problem when it comes to interconnectivity. As vehicles become increasingly complex, it becomes more difficult for a single supplier to develop every functional module. A standard communications protocol will allow suppliers to focus their expertise on task-specific modules. It also will help establish the groundwork needed to drive the industry forward.

Over the last few years, Curtis has been working with the Industrial Truck Association (ITA), an industry association based in the USA, to determine the common baseline protocol that would best meet the needs of the industrial EV industry.



New approach to design – customization is quick and easy since interactivity is controlled

With ITA, Curtis and other industry players, including Atlas Copco, Raymond Corporation and Sevcon, were instrumental in the technical direction of the committee that evaluated the top known protocols – from the physical layer, to the application layer and a layer above, which defines device profiles. The committee has selected CANOpen as the standard communications protocol, with the use of the device profiles as specified by the CAN in Automation (CiA) Group based in Germany. In 2000, a formal recommendation will be made to ITA that specifies CANOpen as the communications protocol standard to be used by companies leading this industry.

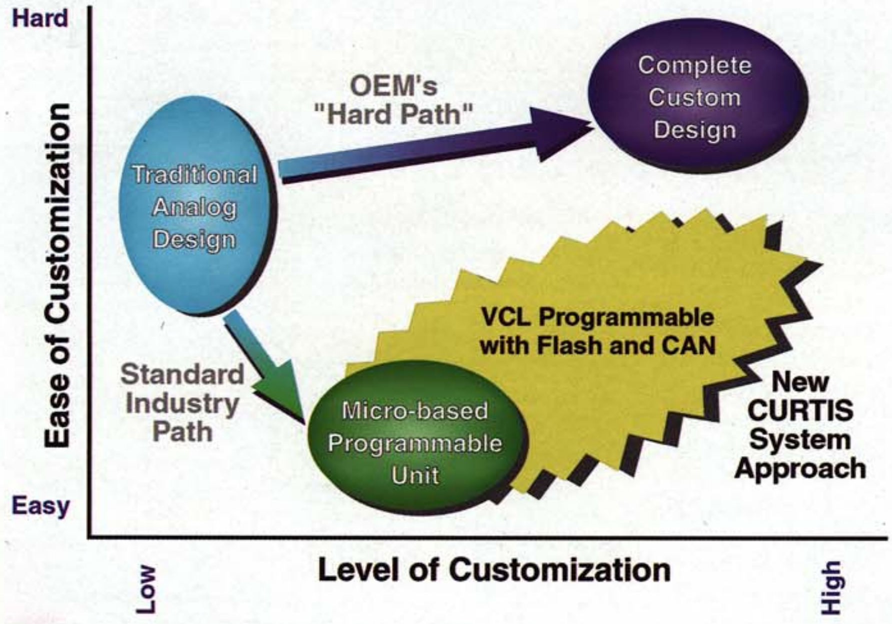
VCL ties it together

In addition to its list of core competencies in power electronics, battery management, industrial packaging and motor control, Curtis now includes a generic software module that works with reconfigurable memory and extended I/O. Called the Vehicle Control Language (VCL), this new software provides the interface to configure functionality of the individual components and their interconnectivity, and ultimately controls the vehicle. With VCL loaded into a motor controller, for example, OEMs can customize systems to their unique specifications.

VCL is a basic language created for the specific needs of industrial EVs. Easy to learn, VCL will feel familiar and comfortable to first time users. Non-software engineers and high-level technicians will be able to immediately make modifications to the vehicle control system.

The VCL software module comes with an extensive library of program samples that demonstrate how to solve common problems. It also comes loaded with predefined functions that are common to the industry to help the user develop programs easily and quickly. Standard functions such as throttle type, mapping, filters, delays and CAN message send and receive, all add to the ease and speed of developing custom vehicle control functions with VCL. OEMs can both use and customize the sample programs, or can ask Curtis to develop a program for their particular application.

Overall, VCL allows for a highly integrated system, maximizing the capability of each component. For example, with CAN, inputs near the operator compartment can be accessed and utilized by the traction controller and remote display. Then, resources throughout the vehicle can be scanned, logically combined and controlled by VCL software and new commands can be issued to motors, solenoids and relays over a simple two-wire bus.



The system solution from Curtis offers increased flexibility

VCL flexes its muscles with Flash

The combination of VCL with Flash programmable memory gives OEMs the flexibility to dynamically configure systems. Since Flash is rewritable ROM that is electrically erasable, quick system changes can be made electronically via VCL commands. This provides a level of accessibility never experienced before in vehicle design – it allows OEMs to modify systems quickly and easily. Now, system updates can be implemented at any stage, from the initial configuration of a prototype, to the final modification of the vehicle out in the field.

A key benefit of VCL and Flash is rapid prototyping. In the time it takes a vehicle manufacturer to wire up a prototype system, a VCL program can be created to test it. This VCL program can then be rapidly modified as a result of the experience with the prototype, drastically reducing time-to-market for new designs. In addition, since it is easy to configure and modify a system with VCL, OEMs can defer the vehicle interconnects until late in the development phase.

VCL gives vehicle manufacturers the capability to download software into generic components. Although industry suppliers have been reluctant to do this in the past, this level of flexibility can be made available to OEMs for two reasons: VCL has protected boundaries (it is structured to protect the core of the components); and Flash programmable memory has become readily available to this industry.

A leap to new design

Many CANbus connected systems already exist throughout the industrial EV industry. The addition of CANOpen and VCL expand design opportunities even further. The Curtis solution gives companies access to new technologies. It fosters synergy between industry players and allows each company to focus on its core competencies. It enables the effective integration of complex systems and gives OEMs tools to efficiently customize systems. In the end, this translates to significant time and cost savings and increased reliability. Yet, more importantly, it gives OEMs what they want – the unique feel and differentiation they desire. ●