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PRODUCTS & SERVICES

Yes CAN do!

COMMUNICATION STANDARDISATION FOR LIFT-TRUCK CONTROL CAN SEEM LIKE WISHFUL THINKING. BUT THERE IS A WAY FOR SAVVY ENGINEERS TO ACHIEVE ONE COMMON CONTROL LANGUAGE FOR ALL DEVICES

Capability versus cost is the formula that drives industrial vehicle development. So in order to build a marketable product, today's industrial vehicle designers use multiple CAN devices on their creations to obtain the required system functionality for an acceptable cost. They can choose from a huge range of CAN devices from different manufacturers and, for a required system specification, it may often be the case that the 'best' CAN device for each particular function can come from different sources.

Although each individual choice may be a smart solution, the resulting mix of devices can create a terrible cacophony of conflicting CAN 'languages'. Unfortunately there is not just one CAN standard that enables out-of-the-box communication between the various devices – instead there are several different 11-bit CANopen profiles such as ds401 or ds402, and there are devices that use entirely different 29-bit CAN protocols such as SAE J1939. To complicate issues even further, some CAN device manufacturers have implemented slightly different versions of these 11-bit or 29-bit profiles to create their own semi-proprietary CAN standards.

The standard mix: incommunicado

Engineers are often frustrated that, having selected their 'ideal' set of CAN devices, some of them may not communicate with other CAN devices due to these different CAN implementations. This means the designer has to approach each device manufacturer and ask for some modification to be performed. But such customisation is typically expensive – not only are extra fees charged for the modification, but the non-standard part created often commands a higher purchase price, which negatively impacts the new vehicle's profitability.

What's more, customisation can lead to big delays in the development process. Being late to market, and allowing competing manufacturers to get there first, can be disastrous for any new vehicle launch.

With this in mind, some of the more thoughtful engineers might well complain that having many standards, instead of just one, is not useful at all, and that some disciplined standardisation is seriously lacking. Vehicle designers with a more easygoing nature may recall the old joke: the great thing about standards is that everyone can have their own.

Thankfully, there is a technical solution to the problem of converting different protocols into one common language, and it's rather simple: just select a VCL-equipped Curtis AC motor controller as the electric traction or hydraulic pump motor controller.

These controllers can be configured to enable a network of CAN devices from different manufacturers – which 'speak' different versions of the language – to successfully communicate with each other. Therefore, the Curtis controller acts as an interpreter for each device on the bus, so there is no need for the vehicle developer to request costly modifications from all the other CAN device vendors. Instead, all other devices on the CANbus remain standard.

With VCL onboard, the vehicle developer can make allowances for the differences of each CAN device. A common language brings the whole system together and provides the desired functionality. It also allows the use of the vehicle designer's 'first choice' for every CAN device. To further streamline the process, the task of writing software functions to configure the CAN data is very simple and can be done without assistance from Curtis. Nevertheless, the company's customer support engineers are on call for advice and assistance with customisation.

The vehicle designer can make use of VCL in two ways: either rely on the proven VCL functions Curtis has predefined, or quickly and easily write proprietary functions and algorithms. Choosing the latter will differentiate the control system from the competition (and in consequence, the functions of the vehicle), with the goal of creating a marketplace advantage.

Cab control

A brief application example illustrates the advantages that VCL can offer. One vehicle developer was in the process of designing a special electric forklift truck for handling long loads. The design required a remote seating position within a rotating cab that would provide the operator with a clear view of un/loading operations, and also face the direction of travel to offer a safe, clear field of vision. Mechanical linkages or hydraulic hoses would be very problematic in such a configuration, hence the need for electronic fly-by-wire CAN control of all vehicle functions.

The vehicle developer was very specific that the steering had to simulate the feel of a hydrostatic steering system. The selection of devices at the man-machine interface was therefore limited and the developer had to choose a device that only ran a custom version of 29-bit CAN. Hydraulic control and vehicle direction inputs were handled by a dual-axis joystick running a 'proper' SAE J1939 CAN protocol.

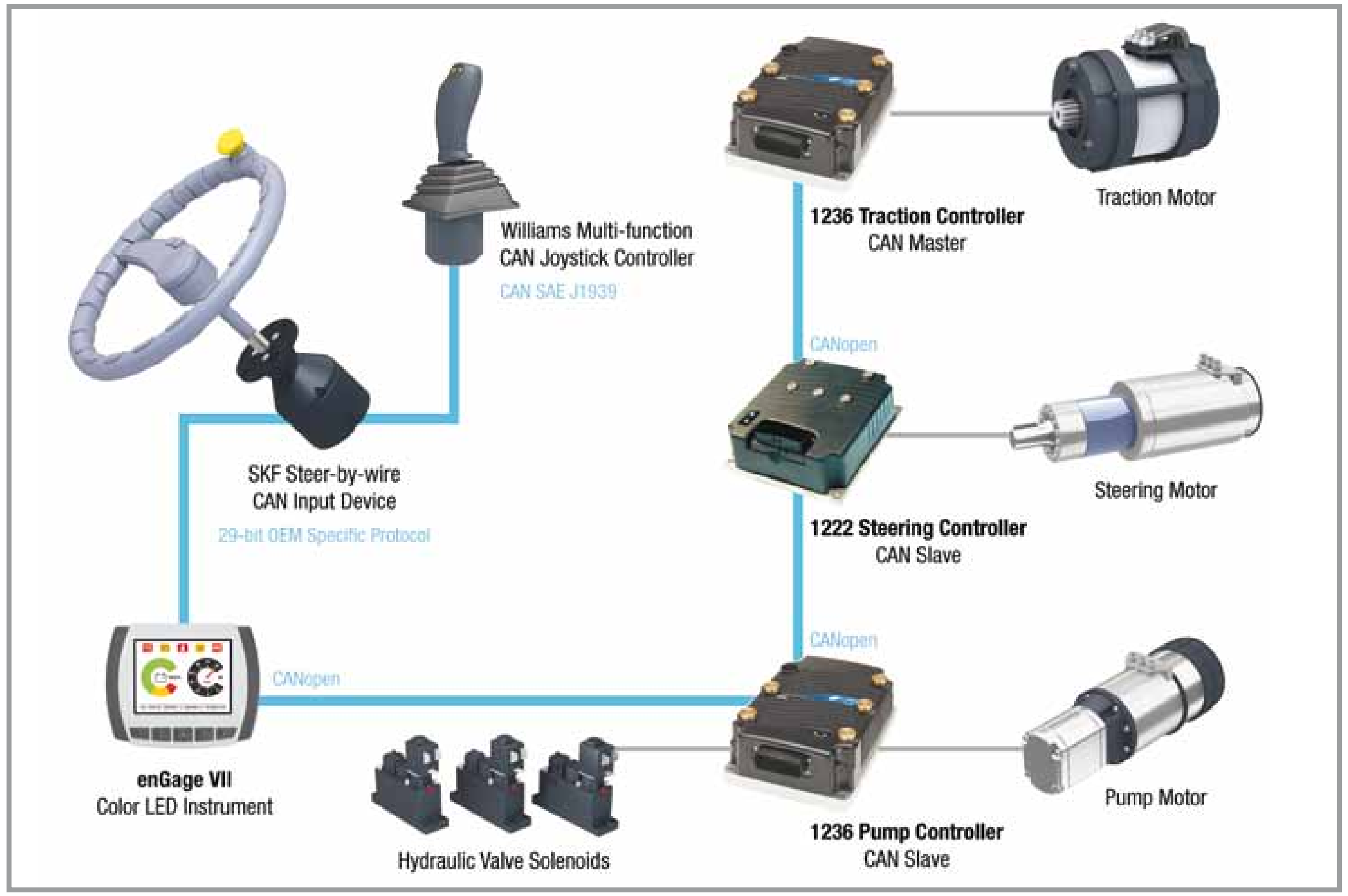
A Curtis enGage VII colour LCD instrument was chosen to provide battery status and steered wheel position indication, together with comprehensive on-vehicle diagnostics and real-time monitoring of all critical vehicle information and vehicle speed. This product, together with the Curtis Model 1222 EPS AC steering motor controller and two Curtis Model 1236 AC motor controllers – one driving the truck's electric traction motor, the other the hydraulic pump – ran 11-bit CANopen.

The selection of man-machine and control devices ultimately required that three different protocol types had to be matched. The vehicle developer thought that an additional (and expensive) separate CAN system master module would be required to pull the system together and these three protocols into line, and reached out to its local Curtis customer support engineer for help.

Within an hour of arriving on-site, the Curtis engineer had set up the Model 1236 AC traction motor controller as the system CAN Master, and let the Curtis VCL software flex its technical muscle. The individual 'mailboxes' in the Model 1236's software were configured to handle the 11-bit CANopen, 29-bit J1939 and 29-bit OEM-specific protocols. This configuration, easily implemented in the standard AC motor controller, allowed multiprotocol data to flow seamlessly across the network while maintaining the minimal two-wire twisted-pair CAN cabling.

The mailbox data format that adjusts the system to individual needs is fully flexible and may be configured for the transmission of 8-, 16- or 32-bit data by adding the +UseHB (Use High Byte) function. In this way, 16-bit data words sent across the CANbus as two 8-bit bytes are automatically combined back into a 16-bit word by the mailbox.

Importantly, the use of the Curtis Model 1236 AC traction controller as the CAN Master completely eliminated the need to add an additional 'vehicle manager' device. This functionality was effectively embedded in the traction motor controller's VCL software, an approach that ultimately provided the vehicle developer with a considerable reduction in system cost and complexity.



ABOVE: **VCL-equipped Curtis AC motor controllers are able to 'translate' different protocols into one common language**

Flexible and reliable

VCL is just one of several interesting functions that characterise the Curtis AC motor controllers. They utilise an advanced indirect field orientation (IFO) vector control algorithm that provides the maximum possible torque and efficiency across all loads and all speeds. Curtis's evolutionary approach to controller design and 25 years of MOSFET controller know-how ensure class-leading reliability.

The comprehensive logic I/O allocation is enough to handle the requirements of almost any application. And the vehicle designer can choose virtually any operator command/control and MMI devices, regardless of the communication standards they use.

Controllers such as the Curtis 1236 can be employed as master or slave modules; models such as the Curtis 1222 may be included in the control system as slave. In this way the designer is able to build a complete control system that includes all necessary functions such as – for instance – driving, steering and lifting.

As electric and hydraulic drives can be included in the control system, it can be easily adapted to vehicles with hybrid drives too. And as SAE J1939 is on the list of the 'spoken languages', combustion engines and transmission components can be included in the vehicle control system as well. This methodology allows lower-cost, standard components to be used, and eliminates the great expense of customisation. It also eliminates the considerable risk of delay to the project caused by several different CAN device vendors all modifying their products at the same time in an attempt to make them talk to each other.

In summary, Curtis AC motor controllers with VCL offer the possibility to create a virtual system controller by integrating all control devices for hydraulic and electric drives and man-machine interfaces into one system that accommodates differing CAN protocols. Even an IC engine or a transmission can be integrated into that control system, enabling vehicle designers to make use of new vehicle configurations, or optimise the energy efficiency of their vehicle. Furthermore, choosing Curtis AC motor controllers with VCL allows vehicle developers to choose from a broader range of CAN devices and reduce the overall complexity of the control system. They can explore the benefits of custom functionality that can be easily implemented within the VCL environment, safe in the knowledge that expert Curtis customer support engineers are ready and waiting to help out if needed. **ALT**

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