

# When Seconds Count

## CANbus facilitates info & control for EMTs

An ambulance is a medical center on wheels, expected to more than just make runs to and from the critical care scene. Current technology has created a vehicle that is as responsive as the EMTs that drive it. Made possible by the Command Zone electronics system, first responder professionals have at their fingertips crucial information about the vehicle, plus the means to make on-the-fly adjustments to a variety of functions throughout the ambulance using a newly introduced compact color graphics display.

Collaborating with HED Inc, Hartford, WI, a developer of multiplexing technology, Medtec Ambulance Corp., Goshen IN, added this system to handle multiple electrical signals emanating from all over the vehicle, passing through a single data link cable to a central processor. This activity is trafficked by a CAN network, which brings computer controlled, multiplexed electronics to operate these vehicles with a continual diagnosis of internal systems. The display translates system information into a fully accessible and interpretable readout to the humans that have to run, service, design and upgrade the equipment. .

With the introduction of the J1939 protocol in the late 1990s, Medtec and Oshkosh Truck Corp., its parent company, has worked closely with HED in developing this product. The Command Zone system has been installed on thousands of Pierce fire trucks, and is now moving into the military market, starting with the Medium Tactical Vehicle Replacement (MTVR) wrecker. Oshkosh has other military truck models using the Command Zone concept that are ready to go into production.



**Driver's display.**



**Patient cabin display.**

The J1939 standard is a high-speed 250 kbs protocol that provides registered addresses and architecture, enabling vehicle components such as the anti-lock braking system, the engine, transmission modules and the various electronic and hydraulic systems to essentially talk to one another. The CAN serial, asynchronous, multi-master protocol uses the HED CANLink family of electronic control modules positioned throughout the vehicle to monitor and manage any component or system that can generate an electrical signal or has a sensor. This

system provides data integrity and data rates up to 1 Mbit/sec offering, among other things, constant self-diagnosis.

CAN technology facilitates the development of customized vehicles for the needs of specific departments and EMTs. To maximize the advantages of these features, a console-mounted control with a 480 x 234 size VGA screen is the window into the system. "From a design standpoint," notes Jacob Fischer the lead engineer for the Medtec ambulance up-grade, "we have the capability of putting onto the screen anything the Command Zone sees." Vehicle status is within an easy glance. The driver no longer has to scan the expanse of the dashboard with its many gauges to stay on top of vehicle operation. Real-time data can include alternator voltage, amperage and other readings presented in a trend format rather than simply static digital data. Other data not necessarily part of the vehicle itself such as oxygen tank pressure are presented as animations, which have been coded into the system by Fischer and the Medtec designers. The screen module design also allows the ambulance drivers to make changes to the layout and other graphics.

Additionally, the screen carries a pictorial of the ambulance doors. For example, the instant an EMT charges out of the rear, the open door appears on the screen. The screen tracks the many compartment, rear, side and cab doors (the number varies) on the vehicle to make sure all of them are shut when the ambulance speeds off to the next location.

Vehicle designers and owners can configure the module's push buttons to handle whatever desired functions lie within the scope of the CAN system's control. "With a simple push of a button the driver can turn the cabin climate control system off or on," points out Fischer. "We have worked up an algorithm to keep the environment within the ambulance stable." Buttons have an electrical interlock to prevent them from being accidentally activated or de-activated. "This is something you cannot do with toggle switches on a standard electrical system," says Fischer.

As the ambulance is on route to its destination, up-to-the-second patient status information is used by the driver in making decisions on whether to switch on the siren

and lights and start barreling through traffic. For ease of processing, a simple color code keeps the driver informed.

Camera images also expand the driver's view around the outside of the ambulance. Flip on the left turn signal and a view of the driver side automatically comes on the screen, eliminating those blind spots for the driver. Put the transmission into reverse and there is a view of the rear of the vehicle. Additionally, the floodlights can be programmed to light up at night or any time the compartment door opens. In short, the prime benefit of the panel is that it enables the driver to focus attention on just two fields of vision — the road ahead and the screen — giving all that is needed to respond to patient condition and what's going on outside the ambulance.

Various features can be controlled and changed from the display module. Operators can select the wigwag pattern and flashing speed for the lights. The driver can also program the horn to honk the siren. To ensure the unit is operating properly, configurable load shedding capabilities are built into the electronic system using the software. The driver has the option of determining which group of outputs can be turned on or off depending upon a certain voltage condition. For example, if the alternator fails, the crew wants to have every bit of electrical juice left on the battery. The system takes over and blocks out lower priority functions from coming on. Function-set priorities (such as lights vs. heating/cooling) are selected by the operator.

On the ambulance, Fischer and his engineers have strategically positioned modules throughout the unit be near the components and systems the CAN system monitor and control. The twisted pair of wires that comprise the CANbus circuitry hook the module up to a central processing module. Altogether, the modules currently on the Medtec ambulance have 64 inputs and 88 outputs. Many undedicated slots are available for future additions to the system. Fischer notes the chassis has room for additional modules. This simplified wiring enables easy installation and servicing of the graphic display module, along with the other components. "This smart panel replaces a lot of switches and relays," says Fischer. "All the wiring harnesses necessary for the features this display gives us would end up looking like a rat's nest."

With the large role the software plays in operating the Medtec ambulance, the toolset needed for configuration and maintenance switch from wrenches and screwdrivers to computers and the internet. Using a laptop with standard programs developed by HED, a technician can configure contact points and diagnose problems that may lie with the hardware, software or sub-systems on the vehicle. For a vehicle that must spend time out on the road rather than the shop, the Command Zone allows system options and other reprogramming to be completed remotely using a modem.

Fischer notes that the Command Zone system gives Medtec the ability to produce an ambulance with a many more benefits than are found in standard units. "For the past 30 to 40 years you had few components that were electronic and now you have technology that rises to the point where you can offer unlimited features."