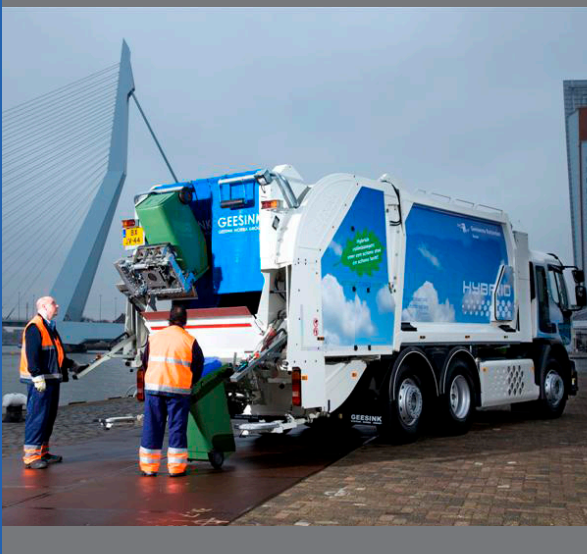




## VEHICLE CONTROLS



# THE CONTROLS COMPANY

The complete HED Product Portfolio offers a wide variety of control, display and operator input devices, as well as software tools for programming and diagnostics.

HED specializes in electronic control systems for mobile vehicles. Located in Hartford, Wisconsin, we provide all your electronic control requirements from single components through complete networked control systems. HT operates as an extension of HED's engineering department, providing support as needed to make your vision a reality.

What this Applications Guide is about.

Increasingly, mobile vehicles are designed to task-specific requirements involving complex functionality of transmissions and specialized tools.

Electronic control systems can help those applications perform better, at lower cost, by eliminating complex wiring, mechanical linkages and hydraulic conduit and aiding the vehicle operator with automation, information systems and diagnostics. Helping engineers understand the promise and the potential of this technology is our core competency!

This guide is a quick look at what's available, what's possible, and how HED can make it happen.



## Features & Benefits:

- **Simplicity**

By utilizing the HED/HT multiplex system you can enhance your vehicles performance along with increasing the simplicity of the electrical and hydraulic systems. Instead of routing hydraulic conduit to the operator station and then to the tool, hydraulics only need to go from the power source to the tool. This allows for a smaller, easier-to-use operator station and cost savings, especially when the operator is located some distance from the tool.

- **Reliability/Ergonomics**

Leak-prone hydraulics are minimized and replaced with shock-resistant, ruggedized electronics. Electronic input devices are smaller, easier to mount, require less operator effort and generate less heat, increasing cab space and comfort and reducing operator fatigue.

- **Intelligence/Safety**

You can prevent dangerous situations with safety interlock logic, activate alarms and involve multiple vehicle systems simultaneously to perform a specialized task. Solid state electronics eliminate unreliable relay logic plus provide additional current protection, while enhancing safety and performance by optimizing simultaneous operation of multiple vehicle functions.

- **Extended Component Life**

By controlling transmission shift patterns, component duty cycles and programming "soft limits" when components near their maximum range, electronic control minimizes wear and tear and abusive vehicle operation, thus maximizing service life.

- **Programmable**

HED offers customers the option to use Windows-based software to create, adjust or completely re-engineer the control programming. This gives the customer ultimate control over vehicle function and allows infinite opportunities for differentiation of a single basic design.

- **Faster New Product Development (NPD) Timelines**

Engineers can move from drawing board to prototype and production more quickly when electronics are involved. Hardware components can be tested and validated along with overall vehicle design, with control systems moving on a parallel path. That allows engineers to quickly exploit windows of opportunity and use a basic vehicle design for multiple purposes with different add-ons.

- **Ruggedized**

All components are military grade and typically protected according IP-67, vibration-proof up to 50G, immune up to emission levels up to 200V/m.

# VEHICLE CONTROL

## Realize Your Vision with Intelligent Control

Complex machines require complex controls. Control systems that use traditional hydraulic conduit and mechanical linkages can quickly get out-of-hand.

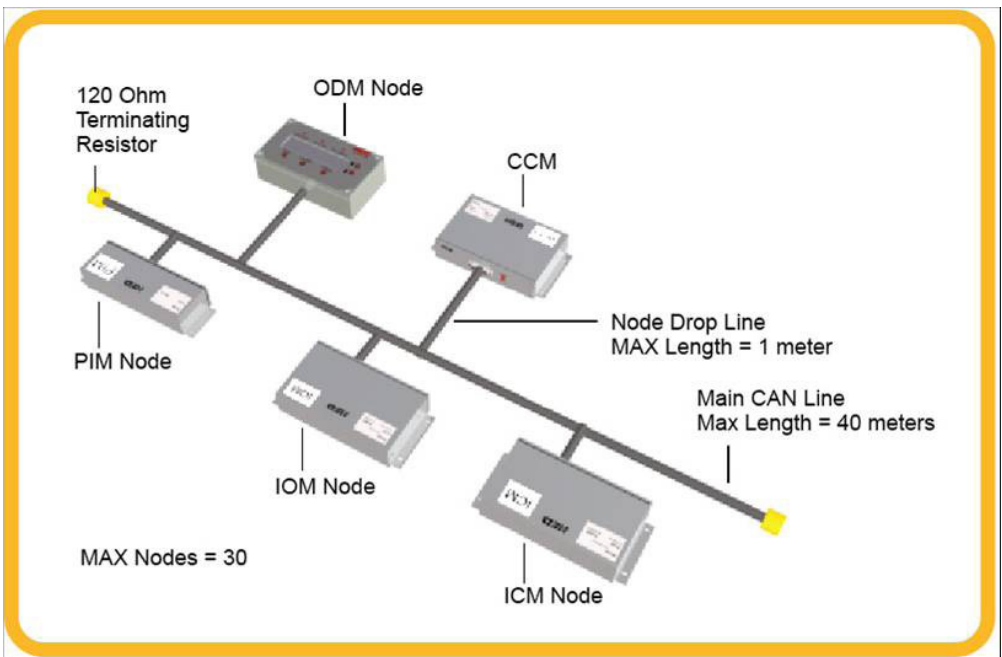
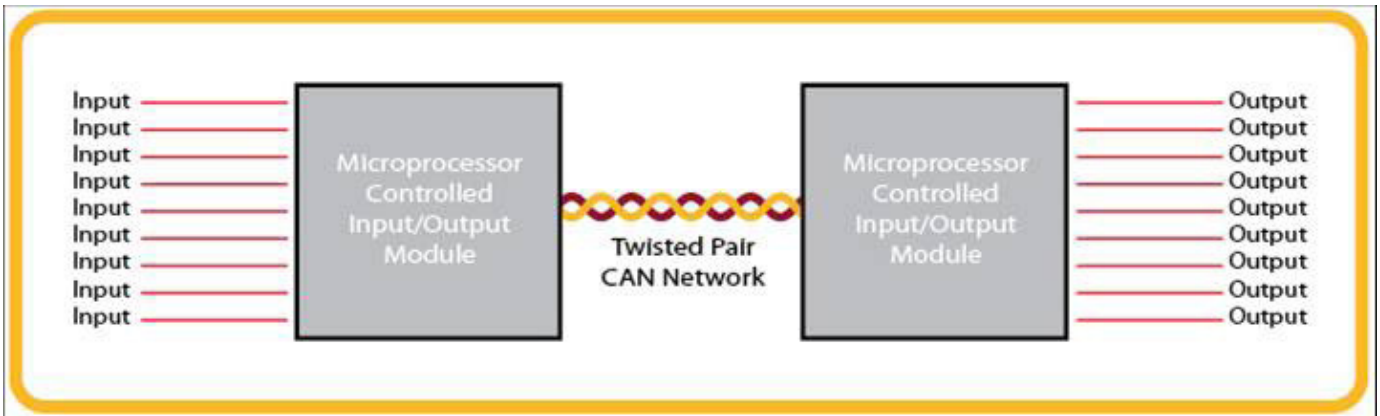
Electronics offer a way to simplify control, while actually offering greater precision for specific tasks.

### Benefits include:

## Multiplexing

Even though electronic controls tend to be simpler than hydraulic or mechanical linkage controls, the number of wires involved can quickly add up. Multiplexing allows control of multiple functions through a single pair of wires, eliminating the need for complex wiring harnesses.

Multiplexing allows you to distribute electronic control judiciously to various quadrants or input/output concentration areas on your vehicle, coordinating electronic sensors and operator inputs with output devices and actuators using computer logic.



HED is experienced at designing control systems that make use of multiplexing. The firm offers its own line of components, CANLink®, which is fully compatible with the J-1939, CANopen, J-1708, or customer-specific communications protocols, to name just a few.

Systems with 2, 22, or more nodes can dramatically reduce wiring complexity by placing control modules close to sensor inputs and control devices, connecting modules through the CAN bus.

# VEHICLE CONTROL

## Engine Control

Communications with Engine Control Modules (ECM or ECU), enables task-based control of engine operating/idle speed. In addition, you can monitor engine conditions (overheating, transmission status, etc.) from the operator station and automatically control vehicle load conditions to prevent engine stall.

## Multi-Station Control

Multiplexing simplifies control of vehicle or tool operation from multiple points on the vehicle: from the operator's cab, from a station near the tool, or even remotely (off-vehicle) through a wired or wireless connection.

## Self-Diagnosis and Reporting

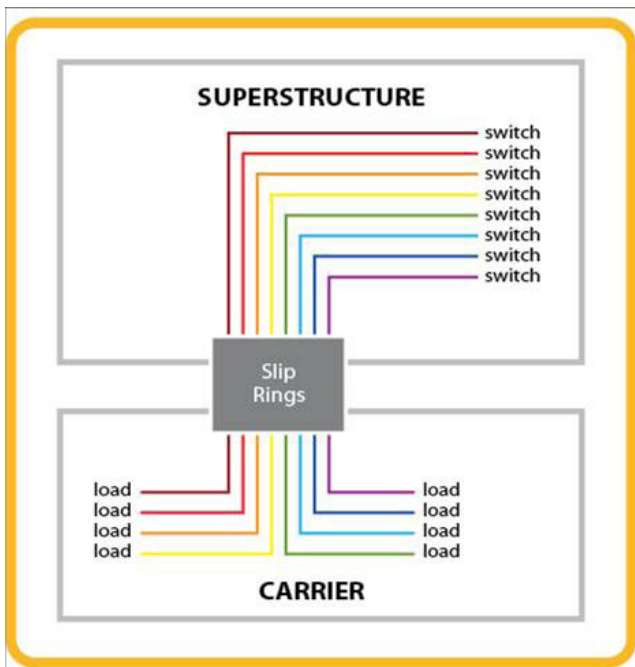
Multiplexing simplifies the hardware/software interface and makes it easier to locate problems and alert operators. In addition to built-in diagnostic capabilities, HED Windows-based software tools can check the entire network from a single module for a multitude of conditions, including short and open circuits, over current, loss of communications and prognostics, which means advanced detection of component wear, either through sensing fatigue or through monitoring hours of operation.

## The Bottom Line

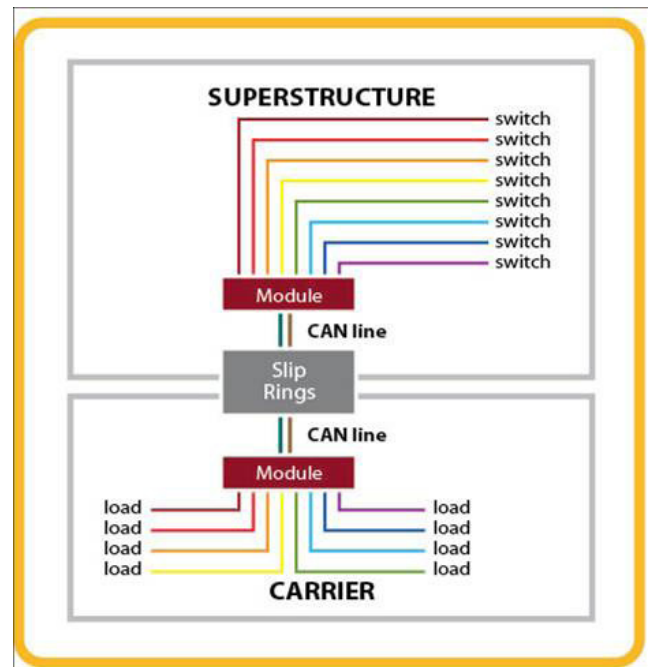
HED multiplexing, the CANLink® system, is designed for survivability under extreme and hostile environments. Multiplexing means lower costs, fewer wires to break, faster time-to-market and simplified troubleshooting in the field. Plus, the HED CANLink® products offer maximum protection from high EMI/RFI exposure, extreme vibration and temperatures, dirt, dust, moisture and hard equipment wash-downs.

## Aerial or Crane Swing Drive

Traditional Wiring



Multiplexing



Multiplexing allows for complex vehicle design while minimizing the need for slip rings.



More and easier to read information is available to operators through graphical displays and cab display and instrument cluster wiring is reduced by multiplexing.

# TYPICAL MULTIPLEXING APPLICATIONS ON A MOBILE VEHICLE

## Power System

Typical inputs: pressure and temperature sensors, speed pickups and electronic engine or transmission communications via CAN.

Typical outputs: servo valve pump control, starter solenoids, throttle-, power-management and electronic engine or transmission communications.

Benefits:

- Access vehicle ECM.
- Log data for maintenance and troubleshooting.
- Match power curve to specific vocational requirements.

## Valve Banks

Typical inputs: pressure and temperature sensors.

Typical outputs: servo valve pump control, proportional valves, on/off valves.

Benefits:

- Reduce leak-prone hydraulic connections, cut costs.
- Add proportional PWM controls for improved performance.

## Remotes and Communication

Typical inputs: modem connections, GPS inputs and remote controls.

Benefits:

- Allows remote control of any multiplexed function.
- Wired or wireless operation, on-vehicle or off-vehicle.
- Allows fast and even remote access to vehicle diagnostics and maintenance records for simplified fleet management.

## Console/Dash

Typical inputs: joysticks, dash switches, potentiometers, operator presence switches.

Typical outputs: gauges, displays, indicator lights or/and LED's, alarms.

Benefits:

- Simplify operator controls, eliminate hydraulics, linkages.
- Centralize vehicle data and controls.

## Booms and Lifts

Typical inputs: angle sensors, pressure sensors and position sensors.

Typical outputs: displays, alarms, limit -, & envelop-controls

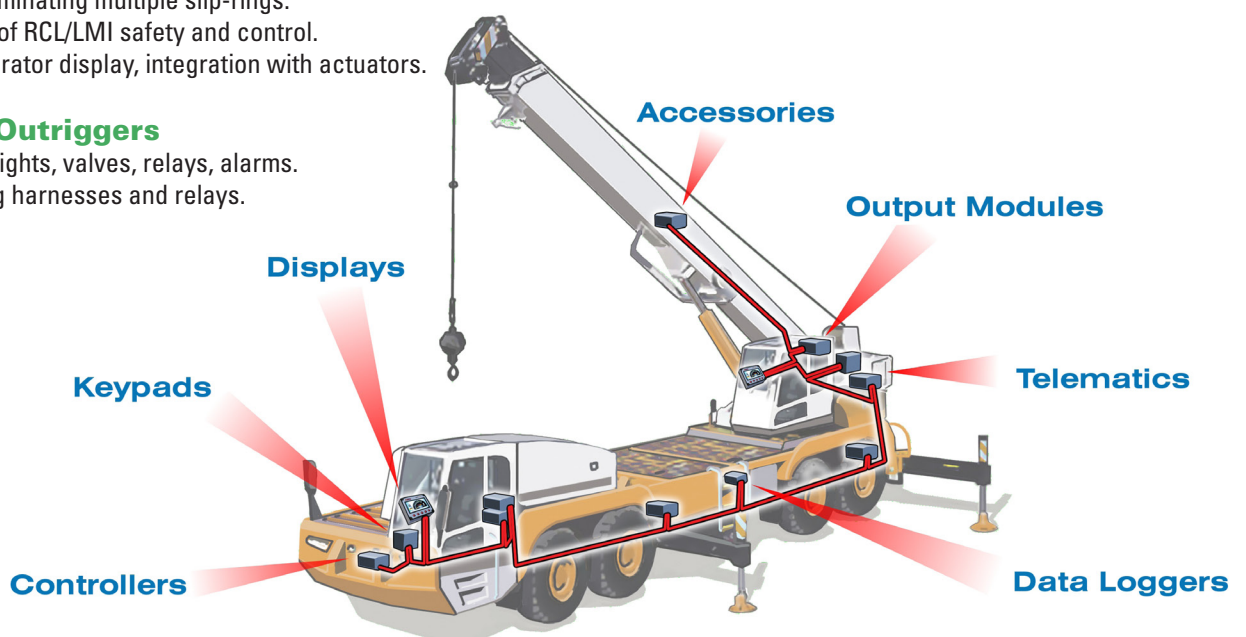
Benefits:

- Cut costs by eliminating multiple slip-rings.
- Multiple levels of RCL/LMI safety and control.
- Centralized operator display, integration with actuators.

## Lights and Outriggers

Typical outputs: lights, valves, relays, alarms.

- Eliminate wiring harnesses and relays.



# VEHICLE APPLICATIONS

**Graphical displays in the cab provide operating data, diagnostics, and even video input from cameras used for vehicle positioning. CAN multiplexing offers increased performance, added flexibility, reduced development time and lower lifetime vehicle ownership cost.**

- Reduce wiring complexity and cost.
- Easily add production or aftermarket options, while keeping base unit cost low.
- Quickly introduce new vehicle features with little or no hardware modifications.
- Locate I/O modules close to the source.
- Simplify vehicle troubleshooting.

## Fire Aerial Ladder Application

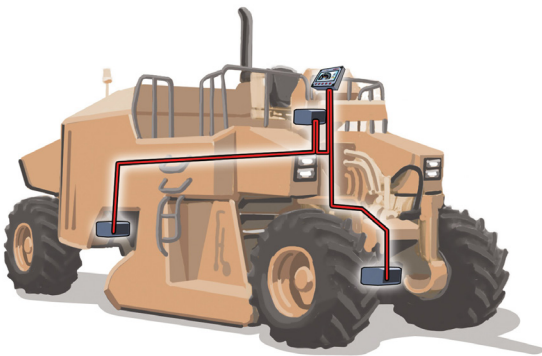
The number of wires exiting a fire truck cab can number in the hundreds without the use of CAN multiplexing technology. The reduction in vehicle wiring cost and field service troubleshooting time alone can easily pay for the cost of the multiplexing system.

## Aerial Work Platform Application

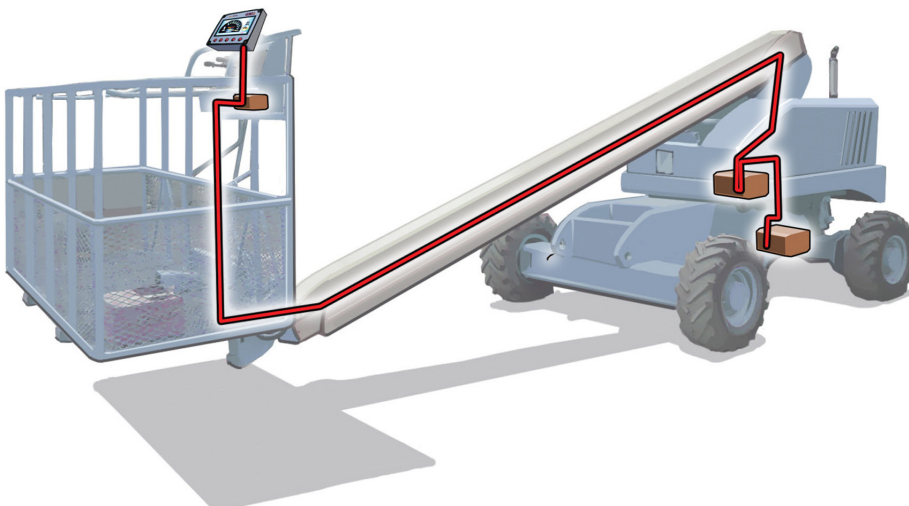
For aerial work platform applications, multiplexing can easily accommodate multiple operator stations in the platform or on the ground, using wired or wireless remote controls. The system could control platform rotation and hydrostatic transmission, as well as outrigger operation, including safety interlock logic to prevent dangerous operating conditions, while providing smooth, precise work platform positioning. Simplified wiring can also reduce the amount of slip rings required to route control circuitry through the swing drive.

## Road Building Machine

Road building vehicles such as reclaimers and skid-steer loaders are often offered with a multitude of variations or attachments. Multiplexing systems allow the pre-wiring for these options for addition of control module hardware only as needed to implement the options. The software for additional options can be included on the base unit and options or attachments can be automatically recognized when added on the production line or by the dealer or end user. The use of identification pins in the wiring harness can also allow identical control modules to function completely differently depending on where it is mounted on the vehicle and what job it is required to do in that location.



**Graphical displays in the cab provide operating data, diagnostics, and even video input from cameras used for vehicle positioning.**



**Platform control can be accomplished easily using multiplex wiring through the boom or wireless control modules.**

## Windows-Based Programming Expands the Capabilities of CANLink®

CANLink® modules can be programmed at HED and shipped ready for your single application, or they may be programmed by your own design team. This allows designers to give vehicles different performance characteristics for different applications without changing the basic production hardware components. The benefits include simplified design, reduced inventory and the ability to quickly deliver customer-specific products.

## Do-It-Yourself Windows-Based Software Programming Tool CANLink® Composer™

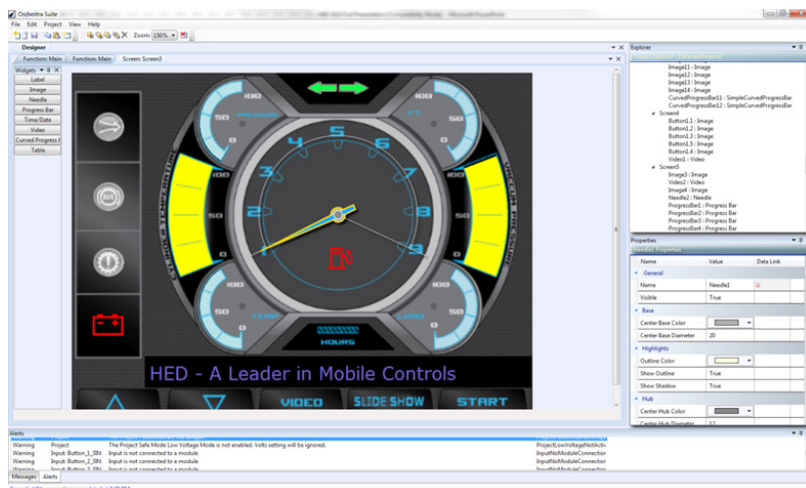
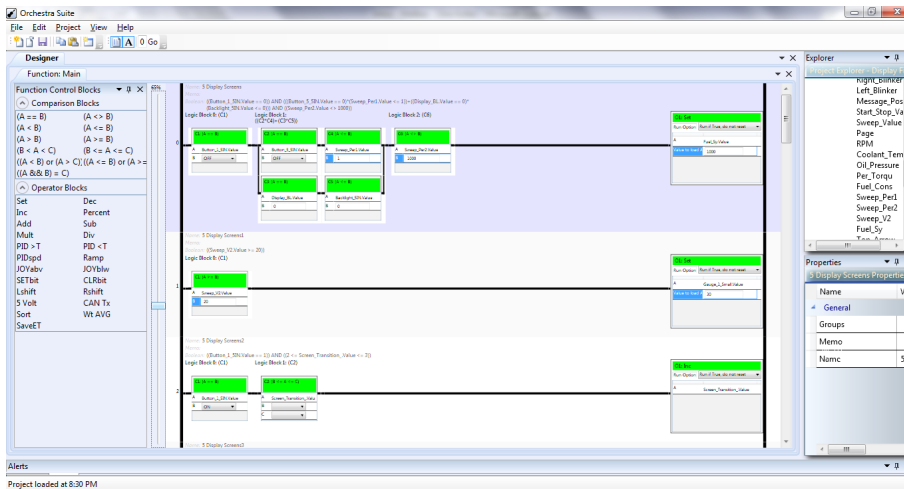
This easy-to-use software requires no programming language knowledge to generate complete vehicle control programs. Whether your system uses a single stand alone module or a multiplex system, you can create new or modify existing control programming as dictated by your customer requirements, providing you with greater control, flexibility and responsiveness. The program uses either simple ladder logic, or C based language, to construct even the most complex functions and a complete contextual help function is available at every step.

## Diagnostic Tool for On-Board or Remote Troubleshooting CANLink® Conductor™

This is a powerful tool to identify and troubleshoot vehicle performance issues or electrical circuit faults. It pinpoints errors and dramatically reduces troubleshooting and wire tracing time for fast, reliable customer service. A unique real-time “debug” feature allows service technicians to bypass normal control logic and force operation of inputs and outputs to help identify the source of system faults. It is available in read-only and full functional versions.

## GUI Interface to Develop Displays CANLink® Arranger™

This powerful software development tool allows even a novice user to quickly assemble details screens by simply dragging-and-dropping widgets, such as custom images, text boxes, gauges, progress bars, curved progress bars, tables and video feeds. Arranger is contained within the Orchestra® Programming Suite along with Composer, so a programmer can define inputs, output, variables and EEPROMs in a single program and use them in Composer to define the vehicle logic or in Arranger to drive gauges and readouts



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